OPERATING AND MAINTENANCE PLAN
MEMBRANE BIO-REACTOR
WASTEWATER TREATMENT SYSTEM

Hayes Camp, Nunavut

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February 2011

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1.0 INTRODUCTION

North Country Gold Corp. (NCG) has completed the following Membrane Bio-Reactor Wastewater Treatment System Operating and Maintenance Plan, in consultation with Sanitherm Inc, for the 100 person Hayes Camp located at Latitude 66˚ 39' 30" and Longitude 91˚ 33' 11", north of Rankin Inlet, Nunavut.

2.0 PLANT CERTIFICATION

The Hayes Camp wastewater treatment plant will be reviewed and approved by the Nunavut Water Board (NWB). The NWB will be notified prior to any proposed modifications to the plant. An annual report describing the quantity of usage will also be submitted with the NWB annual report.

3.0 OPERATOR TRAINING

A primary operator, employed NCG, will be stationed at the site at all times when the system is running. The primary operator will be trained onsite, by Sanitherm technicians.

4.0 OPERATION AND MAINTENANCE

Sanitherm Inc. (Sanitherm) is the authorized service agent and provider of authorized parts for the subject Membrane Bio-Reactor wastewater treatment system. The plant processes and components are described below. The monitoring and maintenance steps will be reviewed on an annual basis and at such time that modifications are made to the treatment system, if any, in order to ensure continual improvement of the operation and maintenance of the plant.

4.1 Process Overview

4.1.1 Mechanical and Biological Process

Sewage is collected in above ground transfer stations, which pump the raw wastewater (influent) to the treatment system. lnfluent enters through Primary Settling Tank #1, where air can be injected to accelerate the bacterial treatment process and eliminate most odours from the influent. The sewage then runs to Settling Tank #2 where Fats, Oil & Grease (FOG) float to the top to form a "scum" layer, and most of the solids separate and settle to the bottom to form a "sludge" layer. Anaerobic bacterial digestion of the wastewater occurs at this stage. Gravity allows effluent flow from tank #2 through a fine screen to the flow equalization tank. Floats monitor the fluid level in this tank and a pump moves the fluid to the de-nitrification tank, where the aeration process continues and the BOD; is further reduced by aerobic bacteria. Floats again monitor the level of this tank, and it is finally pumped to the membrane tank where it is filtered to produce treated effluent. Refer to Appendix A for the detailed Membrane Bio-Reactor Operations, Maintenance and Training Manual and schematic diagrams.

4.1.2 Membrane System

The membrane tank is where the final treatment occurs on the discharged effluent. In this tank the mixed liquor suspended solids (MLSS) are built up to between 10,000 & 20,000mg/1. This thick "chocolate shake" looking liquid consists of the bacteria that drive the digestion of the wastewater, and the partially treated fluid from the settling tanks and de- nitrification process. The bacteria can be cycled back through the system to continue consuming the sewage. The membrane, which is best compared to a Reverse Osmosis filter, is fine enough to remove 98% of all suspended solids and biological organisms from the treated wastewater (effluent). This is achieved by connecting the suction of an effluent pump to as many as 50-100 membranes through a manifold system, which is connected to the membrane nozzles, and drawing water through the membrane fabric and out the nozzle. The pore size of the membrane is fine enough to act as a physical barrier to suspended solids, bacteria, parasites, and most

viruses, ensuring that the effluent is of the highest quality and represents no health risk. Each 100 man membrane consists of 50 individual plates, each about 6mm thick and together totalling 72mZ of area. When in operation, the membrane system is completely submerged in the "chocolate shake" liquid. Turbulent air is pumped across the membranes by an air diffuser mounted beneath the membranes. This eliminates any plugging of the pores by scouring the membrane surface and preventing solids from settling on the membrane itself. By filtering out the solids from the effluent, the concentration of bacteria in the membrane tank is rapidly increased, leaving a remnant "bug" population to digest any organic matter that enters the membrane tank, creating a Membrane Bio-reactor (MBR). The result is a clear, treated effluent that resembles tap water or watery apple juice (slightly yellow), with no visible solid particles or odour. The Membrane Bioreactor effectively eliminates virtually all of the biological components of the wastewater.

4.2 Maintenance Requirements

4.2.1 Pre-Treatment

Pre-treatment in the system occurs through settling tanks. Monitoring conditions in these tanks is very important to maintain the treatment process. An inlet baffle slows down incoming fluid, to minimize disturbance in the tank. Fluid is turned downwards into the tank, where heavier solids settle to the bottom (sludge), and lighter materials (grease, hair, etc.) float to the top (scum). Anaerobic biological digestion of the wastewater occurs, partially treating the wastewater. The middle of the tank becomes clarified and the partially treated fluid proceeds to the next stage of the system through the outlet baffle, which prevents the scum from leaving the tank.

4.2.2 Battle Monitoring

Ensure the scum layer has not built up enough to leak into the bottom of the outlet baffle. Do this by poking an “L"- shaped rod through the scum and feeling the bottom. Then feel for the bottom of the baffle. If the scum is within l0cm of the baffle, a vac truck is needed to remove the contents of the tank. Check that the scum has not built up as high as the top of either baffle, as grease falling into the baffle both defeats the purpose and could cause a blockage. Make sure the baffles do not become plugged by chunks of paper or grease. If there is a blockage, clean it out and throw the "stuff" in the garbage. Don’t throw it back in the tank, if it got through once, it might do it again.

4.2.3 Flow Equalization

The fluid from the settling tanks flows through a fine-mesh screen before entering the equalization (EQ) tank. This screen must be checked often to ensure fluid still moves freely through it. If it is plugged up, it must be pulled out and cleaned. This can be done with a gloved hand, or in a pail of water with a soft bristled brush. Fluid entering the EQ tank should be relatively clear. Look where it pours through the strainer. If the fluid looks brown or has suspended material, something is wrong with the pre-treatment. Check for obstructions in the piping, make sure the scum layer has not built thick enough to allow scum solids to enter the outlet baffle, and re-evaluate the flow into the system. ls it more than the system is designed for? If the flow is too high, proper settling will not occur. Fluid from the EQ tank is transferred into the de-nitrification tank by a progressing cavity—type feed pump. These pumps usually don’t require maintenance; Periodically check that the pipe union fittings are tight, and that the drain plug is not leaking. Never over—tighten the drain plug, as they strip very easily and can be difficult to remove. TO DRAIN THIS PUMP, loosen the pipe unions to let water out of the pipes, and remove the drain plug to allow the pump to drain. Turn the pump shaft by hand or by turning the control switch to "hand" for a moment to push water from inside the pump cavity to be pushed out.

4.2.4 De-Nitrification

De-nitrification is the removal of organic nitrogen from the wastewater. Nitrogen in wastewater is often in the form of ammonia (NH4) and, untreated, can be toxic to animals and plants. Aerating sewage treats ammonia by converting it to nitrate (O2 binds to the H4 to form water, H20, leaving behind nitrate, N Os), which can then be broken down by bacteria seeking oxygen, releasing gaseous (and harmless) nitrogen to the atmosphere. This bacterial action requires anoxic (oxygen-free) conditions, which we create by cycling the de-nitrification blower on and off. The amount of nitrogen removal can be controlled by adjusting the blower cycles.

4.2.5 Aeration Monitoring

Aeration is the only component of de-nitrification that requires monitoring. It is possible for the galvanized blower line to vibrate loose, especially after a location move. Check that the threaded union is tight, and air is being delivered to the tank. Also check that the blower is delivering the appropriate amount of air to the de-nit tank. Ensure that the air delivery valve is adjusted correctly. If no air is being delivered, the valve may be shut, or there may be a problem with the blower itself.

4.2.6 Membrane Bio-Reactor Monitoring

It is vital to keep the membrane Bio-Reactor (MBR) tank functioning properly. This is the "make or break" point for these systems. If the membranes clog and flow through them is not adequate to keep up with the output from the camp, filtration will be reduced and the plant will overflow and cause a spill. Check the performance of the membranes by observing the pressure/vacuum gauge on the pump suction line. Acceptable range is 12"Hg to 2 psi (-12 to +2). Readings below -12 indicate that the pump is sucking hard to draw water through the membrane, indicating fouling. At this point, a chemical cleaning should be performed with 5-8L of bleach and approximately 140L water. The detailed chemical cleaning procedures are outlined in Appendix A (page 13). Visually check that the scouring blower is delivering air uniformly over the entire membrane unit. This is extremely important, as a lack of proper scouring will cause excessive membrane fouling. There should be a turbulent area approximately 60cm x 80cm in the centre of the membrane tank. If all the bubbles seem to come from one spot, it is likely that a fitting has come loose somewhere. Foaming: small amounts of crisp, white foam can indicate a high Food: Micro-organism (F:M) ratio. This means there’s lots of food (wastewater), but not many bugs. Measures can be taken to increase MLSS concentration. Thick, brown foam indicates old sludge or a low F:M Ratio (too many bugs, not enough food). Sludge wasting is recommended. Estimate the MLSS concentration. This can be estimated visually by filling a measuring cup, letting it settle for 15-30 minutes, and estimating what percentage of the total volume is occupied by settled solids. lf the solids occupy <20%, the membranes will likely need cleaning more often. If >90%, sludge should be wasted to the Sludge tank. Observe the colour and thickness of the MLSS. It should be light to medium brown in colour, and have the consistency of chocolate milk. Dark brown colour indicates old sludge that may need to be wasted. Chocolate "milkshake" thickness indicates a very high MLSS concentration (>30,000mg/L), indicating the need to waste large amounts of sludge.

4.2.7 Blower, Pump and Float Monitoring

The Equalization tank contains three floats. Ensure they are not tangled, and that the float weights are still attached to the float cables. The lowest one tells Pump 1 when to stop pumping, and the second float tells it when to start (As the level in the tank increases, float switch #2 (FS 2) activates Pump l, sending fluid forward into the de-nit tank. As the level falls, FS l tells the pump to quit the tank is empty). The third, top float (FS 3) activates a high level alarm, indicating to the cellular alarm unit that an overflow is imminent. Pump #1 (located between the EQ and de-nit tanks). This is a progressing cavity pump. Confirm that this pump is actually pumping water when the PLC says it is. If it is not, the motor

shaft coupling may have come loose (rare). Listen for rattling noises in the pump itself, and for unusual noises from the motor. Check the flange where the two halves of the pump meet. Ensure that the seal does not leak. Also ensure that the pump drain plug is tight and not leaking. The electric motor that drives Pump l does not require greasing.

TO DRAIN THIS PUMP, loosen the pipe unions to let water out of the pipes, and remove the drain plug to allow the pump to drain. Turn the pump shaft by hand or by turning the control switch to "hand" for a moment to push water from inside the pump cavity to be pushed out.

Blowers: Regularly check the air filter. If it is dirty, replace it. The common method for determining whether a filter is acceptable is to hold it up to a light and look through the filter element. If you can see light, the filter is good. Check that the belt is in good condition. lf it is not, replace it. Signs of cracking, splitting, or delaminating indicate replacement is needed. Check the oil level in the blower regularly. There are two hex-plugs on the front of the blower. The lower one is the oil level plug (H). To top up, remove the level plug, take out the fill plug on the top of the blower (B), and slowly add until oil flows out the level plug. A complete oil change should be done yearly. Blower 1 has a flow gauge connected to the air line. It should read approximately 20 lf/m. If the flow is substantially lower than this, it will not adequately scour the membrane surfaces. This could be caused by an incorrect air supply valve setting, a dirty air filter, or a slipping or thrown belt. Inspect all components to ensure proper functioning. Blower 2 should supply enough air to Tank l and the de-nit tank to make the fluid surfaces bubble. As long as there is some visible agitation, there is enough air supply to these tanks. The supply valve to the De-nit tank should be no more than 1/4 open, since tank is always full, and has more back pressure to overcome, requiring the bulk of Blower 2 air. The De—nitrification process does not require excessive amounts of air. The Electric Motor that drives the blower has a grease nipple, and should be greased lightly every few months with AEON synthetic grease. Do not over grease these motors, as it will shorten the motor life. The De-nit tank contains floats that determine how the MBR tank is fed. Ensure they are not tangled, and that the float weights are still attached to the float cables. FS 4, the lowest of these three floats, tells Pump 2 that the de-nit tank is empty and it can stop pumping. FS 5, the middle float, has two controls. When raised, it activates Pump 2. When lowered, it activates Pump l (unless FS l is also lowered, which indicates an empty EQ tank). FS 6, the top float, stops Pump l and prevents an overflow of the de-nit/membrane tank. The De-nit tank also contains a circulation pump, which transfers fluid from the de-nit tank to the MBR tank. This is a submersible, centrifugal pump controlled by a timer in the PLC. Occasionally, these pumps can fail. Confirm that the pump is running when the PLC says it should be. Be aware that there is a safety float on this pump to turn it off if the fluid level is below the top of the pump housing. This is the lowest of four floats in the De-nit tank, and its purpose is to prevent the pump from running dry and burning out. At a low level situation, the pump may not be running, even when the PLC light says it is. This is normal, and is caused by the safety float bypassing the PLC. Pump 2, the Permeate Pump, pumps permeate (fluid that has gone through the membrane) out of the plant and into the drain field. It is a centrifugal pump run by an electric motor mounted on top of the pump housing. The electric motor does not require grease. The drain plug has two parts; the main, outer plug, and a smaller plug in the middle of the main plug. This smaller plug is for recirculation within the pump, and for our purposes must always be tightened in. D0 not over tighten, as there is a delicate washer-like end on the small plug, which fits into an orifice inside the pump to form a seal. There is an air bleeder valve near the top of the pump that should be used to release air from the pump lines when priming the pump. This is often necessary on a new startup, or after a chemical cleaning. There is a mechanical seal on Pump 2 that couples the pump to the motor. It is prone to leaking, especially if chemical cleaning is not done when required (the pump runs dry). Look for signs of water leaking on top of the pump; if the seal is shot, you will see water leaking out from the seal whenever the pump is

running. If there is leakage, the seal is worn out and needs to be replaced. A Flow Restrictor Valve located downstream from the permeate pump limits the flow through the membranes by restricting the pump discharge. This prevents Pump 2 from sucking too hard on the membranes, causing excessive fouling. There is a sticker on the valve handle listing the flow allowed through the valve (typically 3.50Gal/min, = 15.9L/min). lf the flow is higher than this value, something is wrong, check the chemical cleaning return valve and ensure that it's closed. It is possible that the valve is worn out and needs replacement. Repair and replacement of components are detailed in Appendix A.

4.2.8 Chlorination

Chlorination using a 12% sodium hypochlorite solution will be used to disinfect water. Sodium hypochlorite is a strong irritant and proper handling and storage requires the use of personal protective equipment and use in a ventilated area. Detailed safety and first aid information is provided in Appendix C. The metering and dosing pumps used in the chlorination system include the Alldos Model 208 and Plus3 System supplied by Grundfos Alldos.

5.0 QUALITY MANAGEMENT PLAN

The operational, as well as quality control and assurance activities that NCG conducts to ensure compliance with the regulated effluent quality standards and environmental protection incorporate many of the elements of the ISO 9001 quality management system as outlined in NCG's Health, Safety and Environment policy are outlined below.

5.1 System Set-up

Before the plant is sent to location, Sanitherm works with the wastewater supervisor to meet the customer's needs, in terms of expected sewage flows and site configuration. Once the system is transported to a remote location, it is rigged up by a team of system installers, and tested for normal operation.

5.2 Plant Monitoring

The Operations and Maintenance Checklists are provided in Appendix A.

5.2.1 Daily System Inspection

The installers orient on—site personnel to the components of the system (power source and requirements, treatment plant, collection piping, transfer stations, at-grade discharge field). In addition, system requirements are discussed with site residents in terms of the influent stream (i.e. what can and can't be put down toilets and sink drains). On-site personnel are instructed to report any sewage spills or extraordinary observations to NCG so that corrections can be made.

5.2.2 Weekly System Inspection and Service

After rig-up, each system is physically inspected by wastewater personnel on a weekly basis. During this time, all equipment is inspected and serviced for normal operation following written procedures and best practice sheets. This includes any control panel alarms that may have been triggered since the previous service call. lf there are any anomalies, the wastewater service technicians go through a series of checks to find the source of the problem and troubleshoot/fix the problem through adjustment or parts replacement (e. g. pump, blower motor, etc).

5.2.3 Third Party Inspection Process

NCG will use a third party company to inspect a representative portion of its systems while in operation to ensure compliance with all applicable codes.

5.2.4 Effluent Sampling

To verify efficient operation of the system, the effluent stream is sampled on a regular basis (described below), and the sample analyzed by an accredited laboratory. The flow is monitored twice weekly and the following parameters are analyzed:

• BOD5 — biochemical oxygen demand (expected concentration: <45mg/L): Weekly
• TSS — total suspended solids (expected concentration: <45mg/L): Daily
• pH (expected range: 6 - 9): Weekly
• FCC - fecal coliform count (expected concentration: < 200/ lO()mL): Weekly

If any of these parameters are significantly outside the expected range, the following steps are followed:

• Service sheet from time of sample is examined for reports of any abnormal plant operation or site anomaly (e. g. temporary increase in camp population).
• The service technician is interviewed for a report of any plant or site abnormality.
• An analysis is conducted of the sample handling by both NCG and laboratory personnel.
• The plant may be resampled ASAP or at the next service opportunity.

The detailed sampling procedures are outlined in Appendix A.

6.0 EMERGENCY PROCEDURES

6.1.1 Sewage Spill/Overflow

Vigilant efforts are made to discourage disposal of foreign objects (such as dish rags, mop strings, geological samples, and excessive grease) not fit for the influent being discharged from the wellsite trailers into the system on the part of the camp residents and staff to prevent fouling of the pumps. In addition, the wastewater treatment plant is inspected daily by on-site personnel, who are trained to recognize leaks and overflows. The monitoring and maintenance procedures described in Section 4.0 above outline the measures to prevent emergency conditions from occurring. In the event a leak or overflow is detected, it is reported to the Project Manager and the NWB :

Jo Price
Project Manager, NCG
Camp Telephone 1 604-759-0628
Cellular 1-780-953-5575
Office 1-780-439-6624
jop@northcountrygold.com

From there, the wastewater supervisor calls the individual for more information and to assess the opportunity for troubleshooting the system over the phone. If this is not possible or is unsuccessful, a wastewater technician or crew is dispatched to investigate the source of the trouble call and make the necessary repairs

6.1.2 Sample Results Failure

In the event of a failed result from the wastewater treatment plant that is discharging, the following steps are followed:

• Service sheet from time of sample is examined for reports of any abnormal plant operation or site anomaly (e.g. temporary increase in camp population). In many cases, we have little or no control over the composition of the influent entering the plant.
• The service technician is interviewed for a report of any plant or site abnormality.

• An analysis is conducted of the sample handling by both NCG and laboratory personnel.
• The plant may be resampled ASAP or at the next service opportunity. If a second sample result fails, the following actions may take place:
• Effluent is contained on site until the problem can be rectified.
• The entire contents of the wastewater treatment plant are vacuumed out and transported to a suitable treatment facility.
• Individual membrane plates or the entire membrane bank may be replaced.
• The wastewater treatment plant may be removed from site and replaced with another plant.

7.0 STAFF COMPETENCY

Facility staff that operate and maintain the wastewater treatment system will either be trained by Sanitherm staff or by trained NCG staff. Operator training will be provided in accordance with requirements from the operating plan and examinations will be prepared to ensure operator's knowledge in relation to the operating plan and prior to any facility modifications. Any deficiencies will be corrected and re—examined through the training program, along with ongoing educational upgrading resources

Appendix A: Peak Membrane Bio-Reactor Operations, Maintenance and Training Manual

Membrane Bioreactor Wastewater Treatment System

Operations, Maintenance, and Training Manual

v. October 2008

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PROCESS OVERVIEW

Mechanical and Biological Process:

Sewage is collected in above ground transfer stations, which pump the raw wastewater (influent) to the treatment system. Influent enters through Primary Settling Tank #1, where air can be injected to accelerate the bacterial treatment process and eliminate most odors from the influent. The sewage then runs to Settling Tank #2 where Fats, Oil & Grease (FOG) float to the top to form a "scum" layer, and most of the solids separate and settle to the bottom to form a "sludge" layer. Anaerobic bacterial digestion of the wastewater occurs at this stage. Gravity allows effluent flow from tank #2 through a fine screen to the flow equalization tank. Floats monitor the fluid level in this tank and a pump moves the fluid to the de-nitrification tank, where the aeration process continues and the BOD_5 is further reduced by aerobic bacteria. Floats again monitor the level of this tank, and it is finally pumped to the membrane tank where it is filtered to produce treated effluent.

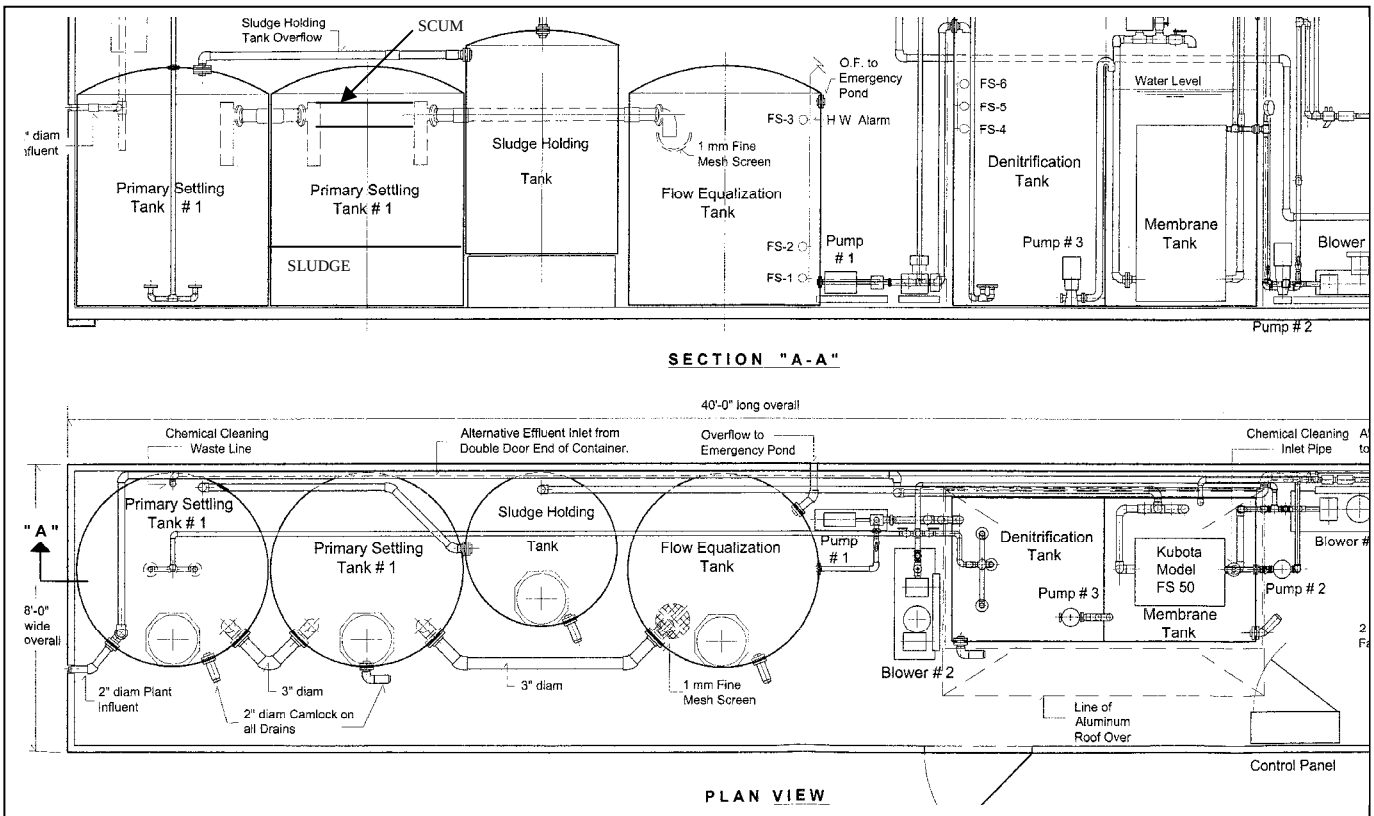


Figure 1. Schematic diagram illustrating the system layout. Note the vertical baffles in the settling tanks, which prevent the majority of solids and FOG's from continuing through the system.

The Membrane System:

The membrane tank is where the final touches are put on the discharged effluent. In this tank the mixed liquor suspended solids (MLSS) are built up to between 10,000 & 20,000mg/l. This thick "chocolate shake" looking liquid consists of the bacteria that drive the digestion of the wastewater, and the partially treated fluid from the settling tanks and de-nitrification process. The bacteria can be cycled back through the system to continue consuming the sewage.

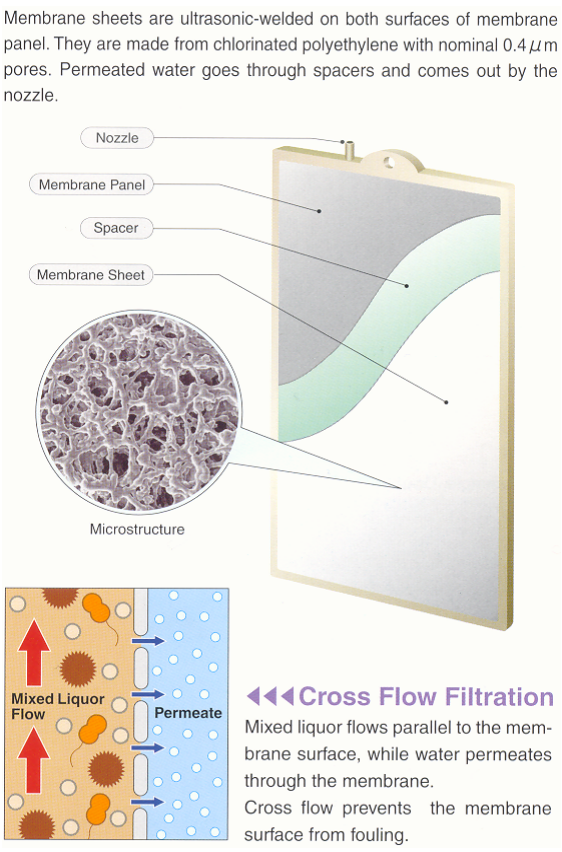


Figure 2. Membrane structure with illustration demonstrating filtration.

The membrane, which is best compared to a Reverse Osmosis filter, is fine enough to remove 98% of all suspended solids and biological organisms from the treated wastewater (effluent). This is achieved by connecting the suction of an effluent pump to as many as 50-100 membranes through a manifold system, which is connected to the membrane nozzles (see figure at left), and drawing water through the membrane fabric and out the nozzle (figure 2).

The pore size of the membrane is fine enough to act as a physical barrier to suspended solids, bacteria, parasites, and most viruses (figure 3), ensuring that the effluent is of the highest quality and represents no health risk.

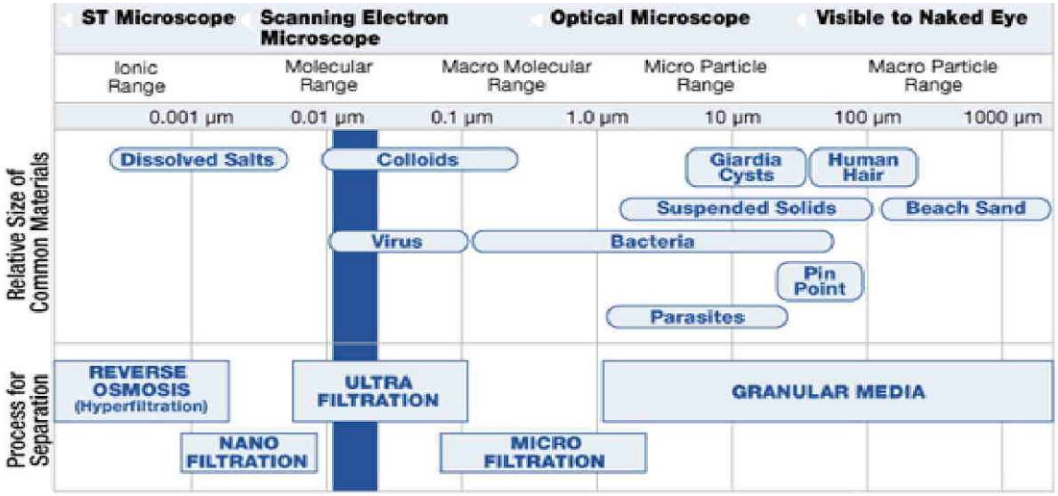


Figure 3. Relative sizes of various components of wastewater, compared to the membrane pore size, represented by the thick blue line.

Figure 4 below shows a membrane installed in a Sewer Treatment System in a similar application to how our system is set up. Each 100 man membrane consists of 50 individual plates, each about 6mm thick and together totaling 72m^2 of area. When in operation, the membrane system is completely submerged in the "chocolate shake" liquid. Turbulent air is pumped across the membranes by an air diffuser mounted beneath the membranes. This eliminates any plugging of the pores by scouring the membrane surface and preventing solids from settling on the membrane itself.

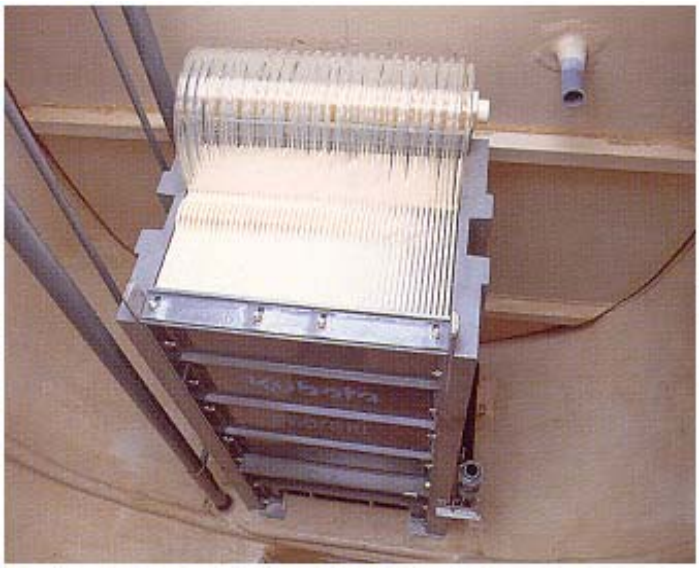


Figure 4. Photo of a membrane module, composed of approximately 100 membranes, connected to a collection manifold by rubber tubes.

By filtering out the solids from the effluent, the concentration of bacteria in the membrane tank is rapidly increased, leaving a remnant "bug" population to digest any organic matter that enters the membrane tank, creating a Membrane Bio-reactor (MBR).

The result is a clear, treated effluent that resembles tap water or watery apple juice (slightly yellow), with no visible solid particles or odour. The Membrane Bio-reactor effectively eliminates virtually all of the biological components of the wastewater.

Figure 5. Effluent Samples.

MAINTENANCE REQUIREMENTS:

Pre-Treatment:

Pre-treatment in the system occurs through settling tanks. Depending on the model and size of system you are in, there could be 1, 2, or more settling tanks. Monitoring conditions in these tanks is very important to maintain the treatment process. An inlet baffle slows down incoming fluid, to minimize disturbance in the tank. Fluid is turned downwards into the tank, where heavier solids settle to the bottom (sludge), and lighter materials (grease, hair, etc.) float to the top (scum). Anaerobic biological digestion of the wastewater occurs, partially treating the wastewater. The middle of the tank becomes clarified and the partially treated fluid proceeds to the next stage of the system through the outlet baffle, which prevents the scum from leaving the tank.

Maintenance & Monitoring

- Ensure the scum layer has not built up enough to leak into the bottom of the outlet baffle. Do this by poking an "L"-shaped rod through the scum and feeling the bottom. Then feel for the bottom of the baffle. If the scum is within 10cm of the baffle, a vac truck is needed to remove the contents of the tank.

- Check that the scum has not built up as high as the top of either baffle, as grease falling into the baffle both defeats the purpose and could cause a blockage.

- Make sure the baffles do not become plugged by chunks of paper or grease. If there is a blockage, clean it out and throw the "stuff" in the garbage. Don't throw it back in the tank….if it got through once, it might do it again.

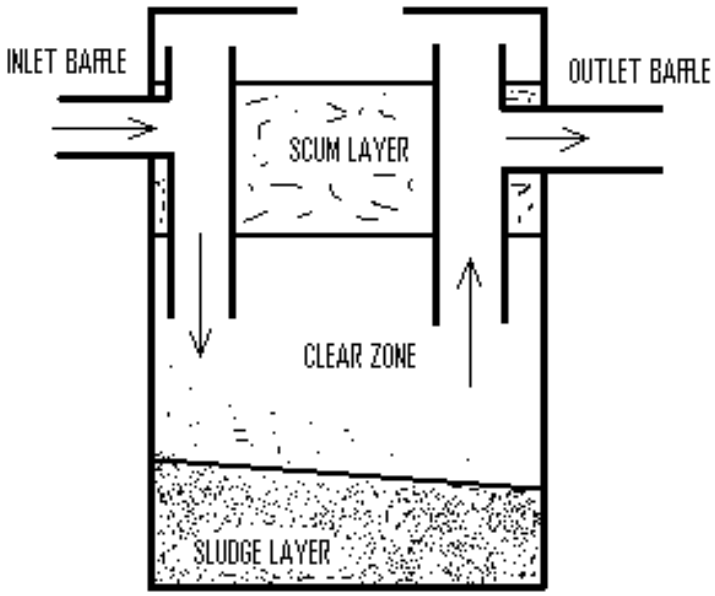


Figure 6. Diagram of a septic settling tank.

Flow Equalization

- The fluid from the settling tanks flows through a fine-mesh screen before entering the equalization (EQ) tank. This screen must be checked often to ensure fluid still moves freely through it. If it is plugged up, it must be pulled out and cleaned. This can be done with a gloved hand, or in a pail of water with a soft-bristled brush.

- Fluid entering the EQ tank should be relatively clear. Look where it pours through the strainer. If the fluid looks brown or has suspended material, something is wrong with the pre-treatment. Check for obstructions in the piping, make sure the scum layer has not built thick enough to allow scum solids to enter the outlet baffle, and re-evaluate the flow into the system…..Is it more than the system is designed for? If the flow is too high, proper settling will not occur.

- Fluid from the EQ tank is transferred into the de-nitrification tank by a progressing cavity-type feed pump. These pumps usually don't require maintenance. Periodically check that the pipe union fittings are tight, and that the drain plug is not leaking. Never over–tighten the drain plug, as they strip very easily and can be difficult to remove.

- **TO DRAIN THIS PUMP**, loosen the pipe unions to let water out of the pipes, and remove the drain plug to allow the pump to drain. Turn the pump shaft by hand or by turning the control switch to "hand" for a moment to push water from inside the pump cavity to be pushed out.

De-nitrification:

De-nitrification is the removal of organic nitrogen from the wastewater. Nitrogen in wastewater is often in the form of ammonia (NH_4) and, untreated, can be toxic to animals and plants. Aerating sewage treats ammonia by converting it to nitrate (O_2 binds to the H_4 to form water, H_20, leaving behind nitrate, NO_3), which can then be broken down by bacteria seeking oxygen, releasing gaseous (and harmless) nitrogen to the atmosphere. This bacterial action requires anoxic (oxygen-free) conditions, which we create by cycling the de-nitrification blower (Blower 2) on and off. The amount of nitrogen removal can be controlled by adjusting the blower cycles.

Maintenance & Monitoring

- Aeration is the only component of de-nitrification that requires monitoring. It is possible for the galvanized blower line (from blower 2) to vibrate loose, especially after a location move. Check that the threaded union is tight, and air is being delivered to the tank.

- Also check that Blower 2 is delivering the appropriate amount of air to the de-nit tank. Ensure that the air delivery valve is adjusted correctly. If no air is being delivered, the valve may be shut, or there may be a problem with the blower itself (see section on blowers, p.7)

- Also see ***Blowers, Pumps and Floats*** (p.7) for information regarding maintenance of blower and motor.

Membrane Bio-Reactor:

The membrane tank contains a concentrated bacterial population suspended in the partially treated wastewater, referred to as Mixed Liquor Suspended Solids (MLSS). When fully operational, the MLSS concentration should be from 10,000–30,000 mg/L. These bacteria are essential for consuming the remaining organic components of the wastewater and, along with air pumped from Blower 1, ensuring that the membranes function correctly.

It is vital to keep the MBR tank functioning properly. This is the "make or break" point for these systems. If the membranes clog and flow through them is not adequate to keep up with the output from the camp, filtration will be reduced and the plant will overflow and cause a spill.

Maintenance & Monitoring

- Check the performance of the membranes by observing the pressure/vacuum gauge on the Pump 2 suction line. Acceptable range is 12"Hg to 2 psi (-12 to +2). Readings below -12 indicate that Pump 2 is sucking hard to draw water through the membrane, indicating fouling. At this point, a chemical cleaning should be performed with 5-8L of bleach and approximately 140L water (see *Chemical Cleaning Procedures, p.)*

- Visually check that the scouring blower is delivering air uniformly over the entire membrane unit. This is extremely important, as a lack of proper scouring will cause excessive membrane fouling. There should be a turbulent area approximately 60cm X 80cm in the centre of the membrane tank. If all the bubbles seem to come from one spot, it is likely that a fitting has come loose somewhere.

- Foaming: small amounts of crisp, white foam can indicate a high Food: Micro-organism (F:M) ratio. This means there's lots of food (wastewater), but not many bugs. Measures can be taken to increase MLSS concentration. Thick, brown foam indicates old sludge or a low F:M Ratio (too many bugs, not enough food). Sludge wasting is recommended.

- Estimate the MLSS concentration. This can be estimated visually by filling a measuring cup, letting it settle for 15-30 minutes, and estimating what percentage of the total volume is occupied by settled solids. If the solids occupy <20%, the membranes will likely need cleaning more often. If >90%, sludge should be wasted to the Sludge tank.

- Observe the colour and thickness of the MLSS. It should be light to medium brown in colour, and have the consistency of chocolate milk. Dark brown colour indicates old sludge that may need to be wasted. Chocolate "milkshake" thickness indicates a very high MLSS concentration (>30,000mg/L), indicating the need to waste large amounts of sludge.

Blowers, Pumps and Floats:

The mechanical components of the system must be kept in good working order. Regularly perform maintenance on pumps, floats, and blowers to avoid failures.

Maintenance & Monitoring

- The Equalization tank contains three floats. **Ensure they are not tangled, and that the float weights are still attached to the float cables.** The lowest one tells Pump 1 when to stop pumping, and the second float tells it when to start (As the level in the tank increases, float switch #2 (FS 2) activates Pump 1, sending fluid forward into the de-nit tank. As the level falls, FS 1 tells the pump to quit….the tank is empty). The third, top float (FS 3) activates a high level alarm, indicating to the cellular alarm unit that an overflow is imminent.

- Pump #1 (located between the EQ and de-nit tanks). This is a progressing cavity pump.
    - Confirm that this pump is actually pumping water when the PLC says it is. If it is not, the motor shaft coupling may have come loose (rare).
    - Listen for rattling noises in the pump itself, and for unusual noises from the motor.

- Check the flange where the two halves of the pump meet. Ensure that the seal does not leak. Also ensure that the pump drain plug is tight and not leaking.
- The electric motor that drives Pump 1 does not require greasing.
- **TO DRAIN THIS PUMP**, loosen the pipe unions to let water out of the pipes, and remove the drain plug to allow the pump to drain. Turn the pump shaft by hand or by turning the control switch to "hand" for a moment to push water from inside the pump cavity to be pushed out.

- Blowers 1&2 :
  - **Regularly check the air filter!!!** If it is dirty, replace it. The common method for determining whether a filter is acceptable is to hold it up to a light and look through the filter element. If you can see light, the filter is good.
  - **Check that the belt is in good condition.** If it is not, replace it. Signs of cracking, splitting, or delaminating indicate replacement is needed.
  - **Check the oil level in the blower regularly**. There are two hex-plugs on the front of the blower. The lower one is the oil level plug (H). To top up, remove the level plug, take out the fill plug on the top of the blower (B), and slowly add until oil flows out the level plug (figure 6). A complete oil change should be done yearly.

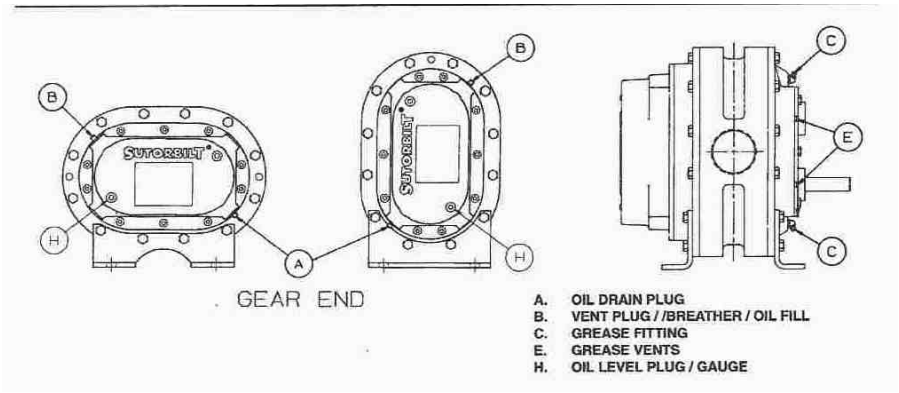


Figure 7. Diagram of blower showing vents and level plug.

- **Blower 1** has a flow gauge connected to the air line. It should read approximately 20 lf/m. If the flow is substantially lower than this, it will not adequately scour the membrane surfaces. This could be caused by an incorrect air supply valve setting, a dirty air filter, or a slipping or thrown belt. Inspect all components to ensure proper functioning.
- **Blower 2** should supply enough air to Tank 1 and the de-nit tank to make the fluid surfaces bubble. As long as there is some visible agitation, there is enough air supply to these tanks. The supply valve to the De-nit tank should be no more than ¼ open, since tank 1 is always full, and has more back pressure to overcome, requiring the bulk of Blower 2 air. The De-nitrification process does not require excessive amounts of air.
- **The Electric Motor** that drives the blower has a grease nipple, and should be greased lightly every few months with AEON synthetic grease. Do not over grease these motors, as it will shorten the motor life.

- The De-nit tank contains floats that determine how the MBR tank is fed. **Ensure they are not tangled, and that the float weights are still attached to the float cables.** FS 4, the lowest of these three floats, tells Pump 2 that the de-nit tank is empty and it can stop pumping. FS 5, the middle float, has two controls. When raised, it activates Pump 2. When lowered, it activates Pump 1 (unless FS 1 is also lowered, which indicates an empty EQ tank). FS 6, the top float, stops Pump 1 and prevents an overflow of the de-nit/membrane tank.

- **The De-nit tank also contains a circulation pump** (**Pump 3**), which transfers fluid from the de-nit tank to the MBR tank. This is a submersible, centrifugal pump controlled by a timer in the PLC. Occasionally, these pumps can fail. Confirm that the pump is running when the PLC says it should be. **Be aware that there is a safety float (FS 8) on this pump to turn it off if the fluid level is below the top of the pump housing**. This is the lowest of four floats in the De-nit tank, and its purpose is to prevent the pump from running dry and burning out. At a low level situation, the pump may not be running, even when the PLC light says it is. This is normal, and is caused by the safety float bypassing the PLC.

- **Pump 2, the Permeate Pump,** pumps permeate (fluid that has gone through the membrane) out of the plant and into the drain field. It is a centrifugal pump run by an electric motor mounted on top of the pump housing. The electric motor does not require grease.

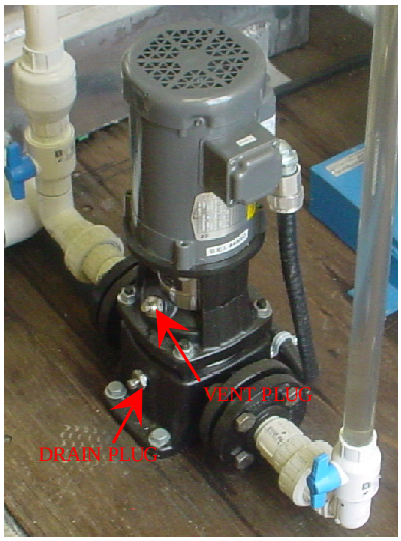


Figure 8. Pump 2

- **The drain plug** is as shown in the picture to left. Note that there are two parts to this plug; the main, outer plug, and a smaller plug in the middle of the main plug. This smaller plug is for recirculation within the pump, and for our purposes must always be tightened in. **Do not over-tighten**, as there is a delicate washer-like end on the small plug, which fits into an orifice inside the pump to form a seal.

- **There is an air bleeder valve** near the top of the pump that should be used to release air from the pump lines when priming the pump. This is often necessary on a new start-up, or after a chemical cleaning.

- **There is a mechanical seal** on Pump 2 that couples the pump to the motor. It is prone to leaking, especially if chemical cleaning is not done when required (the pump runs dry). Look for signs of water leaking on top of the pump; if the seal is shot, you will see water leaking out from the seal whenever the pump is running. If there is leakage, the seal is worn out and needs to be replaced (See *Procedure for Changing Pump 2 Shaft Seal, p.)*

Miscellaneous:

- A Flow Restrictor Valve located downstream from the permeate pump limits the flow through the membranes by restricting the pump discharge. This prevents Pump 2 from sucking too hard on the membranes, causing excessive fouling. There is a sticker on the valve handle listing the flow allowed through the valve (typically 3.50Gal/min, = 15.9L/min). If the flow is higher than this

value, something is wrong- check the chemical cleaning return valve and ensure that it's closed. It is possible that the valve is worn out and needs replacement.

UV Trojan System

Ultraviolet (UV) light is at the invisible, violet end of the light spectrum. The water treatment industry uses a high-powered form of UV light called UV-C or "germicidal UV" to disinfect water. The UV-C rays penetrate microorganisms and destroy their ability to reproduce, effectively rendering them harmless. It's a simple but effective process, with Trojan's system destroying a minimum of 99.9% of harmful microorganisms, including E. coli, Cryp osporidium, and Giardia

Looking after the UVMax system is easy. All you have to do is periodically clean the lamp sleeve and replace your lamp once a year, a simple process that can be complete in minutes.

Operations & Maintenance Checklists:

Daily Checklist- The following items must be checked every time the maintenance provider visits the site:

Y	N	ITEM TO CHECK
		EQ screen is clean
		Pressure/Vacuum gauge reading >-12”Hg (If vacuum is below 12”Hg, perform Chem. Wash)
		Pump 2 Flow meter in acceptable range, according to design flow
		General cleanliness of STS is acceptable
		All motors run when manually activated
		Verify Air delivery to aeration tanks
		All fittings, piping, valves are watertight, no leaks
		All exterior plumbing, equipment, heat trace functioning correctly
		All motors, pumps functioning correctly, no strange noises, etc.
		Heaters functioning correctly, temperature in building is acceptable
		All Control Panel switches left on “Auto”

Weekly Checklist- The following items must be checked weekly:

Y	N	ITEMS TO CHECK
		Blower Air Filters are clean (if not, replace)
		Blower Belts in acceptable condition (if excessively worn, replace)
		Blower oil levels acceptable (if low, add lubricant) (see *Figure 6*, p.8)
		MLSS concentration acceptable (if thick, waste sludge) (see *membrane Bio-reactor*, pp.6-7)
		Scum layer in settling tanks is acceptable (see *Pre-Treatment*, p.5)

Monthly Checklist- The following items must be checked monthly:

Y	N	ITEMS TO CHECK
		Grease Blowers and record date in book and on blower
		Lightly grease blower motors and record date in book and on blower

Yearly Checklist

Y	N	ITEMS TO CHECK
		Do complete oil change in both blowers and record date in book and on blower
		Pressure wash the inside of all tanks and remove fluid with a vac truck

NOTE: Record all maintenance in maintenance record book

In the event of any irregularities or problems with the system, immediately contact Peak staff on site and inform the office @ 1-866-785-8500.

Sampling Procedures

It is very important to follow proper sampling procedures to ensure quality results. ***The slightest contamination from a dirty hand or glove can taint the samples and cause an unacceptable result***. Follow the following procedures for sampling:

- Use a fresh pair of nitrile or latex gloves for each sampling location to avoid contamination
- Run water through the sample valve for a few minutes before sampling, to flush out impurities
- If the rubber hose on the fitting is removable, remove it to eliminate the possibility of contamination
- Do not allow the mouth of the sampling bottle to contact any surface in the plant, including the sample valve or your hands
- Do not touch the underside of the bottle lids
- Make sure lids are on **TIGHT**
- **Clearly label each bottle** with the **STS #**, **Rig #**, and **Date**. Date is extremely important, as we will be sampling nearly every day. It is often easiest to do this before you fill the bottles, when the labels are dry. It is also helpful to label the top of the lid with the STS#, so samples can be identified without removing them from the cooler.
- Fill out the Chain of Custody clearly, neatly, and completely
- Samples go to the lab depot or Greyhound station, Collect, Delivery, to Enviro-test labs in Grande Prairie. If it is a weekend, specify that you need it delivered ASAP, or they will leave it until Monday.
- Remember that biological samples can degrade with time, so we need to get them to the lab ASAP!
- To preserve samples, they should be packed with ice packs in a cooler. This will ensure the best possible lab results.

1 L Polyethylene – ***BOD, TSS*** **no air space**
1 L Amber glass – ***FOG*** **no air space**
500ml Amber glass – ***COD*** **also need acid vials for this sample****no air space**
500ml clear plastic – ***Fecal coliforms*** **with white powder preservative****top of label**

Chemical Cleaning Procedures

The membranes in these plants occasionally require a bleach solution chemical wash to clean organic debris out of the membrane "pores." There are 50 membranes, each of which holds 3L of water, so we need 150L of chemical solution to completely fill the membranes. We use 12% bleach for doing this:

Supplies Required:
1. two CLEAN garbage pails (each holds approx. 70L)
2. a small submersible pump with garden hose or similar attachment
3. 20L pail of bleach

Procedure:
1. **Pour a total of 6-8L of bleach into the pails** (approx 3-4L per pail). It's not rocket science, so we don't need to be exact. Usually, 1/3 of the pail or slightly more is sufficient. (By putting the bleach in first, you don't need to stir the solution)

2. **Use the sample port on the effluent line to fill your pails with clean water**. Fill them to within about 4" of the top. This creates approx. 2% bleach solution (ie. household bleach is usually 5%).

3. **Shut down blower 1 and pump 2**

4. **Open the chemical cleaning injection valve** (the valve inside the membrane tank) **and insert the hose**. You may want to partially close the valve on your hose just to hold it in place.

5. **Drop your pump into your pails and plug it in.** It should take 5-8 minutes to pump the entire chem wash into the membranes. Monitor the chem. wash injection port to ensure your bleach is not overflowing directly into the membrane tank, where it will kill some of the bugs. If you get an overflow, shut down your pump, wait a minute, and try to pump some more. The membranes will usually take it all, but it is not unusual to have 2-6" extra left in your pails. (This comes in handy for cleaning, etc. while you wait)

6. **Leave the solution sit for 2 hours** (rule of thumb). It is preferable to leave the chem. injection valve open during this time to allow gases to escape.

7. **After two hours, open the bleeder valve on pump 2 and let any air out.**

8. **Close the chemical injection valve**. If you leave it open, pump 2 will suck air.

9. **Start blower 1 and pump 2**. Remember it is normal for pump 2 to be delayed a minute before it starts. If the levels in the plant are too low for pump 2 to start, run it on hand for 10 minutes or so to remove the bleach from the membranes. A good trick is to manually toggle the pump 2 start float in the de-nit tank to put the plant on auto. This way, you can let pump 2 run a few cycles on auto. The vacuum gauge and the flow meter basically monitor the rate at which water is moving through the membranes, not the pump performance (ie. We are measuring membrane refill rate). Therefore, right after you've pumped the membranes full, the performance is not indicative of how well the membranes are working. **Monitor the plant until at least 3 cycles have pumped**. You should see a vacuum gauge reading between +2 and -5, and flow of 12-15L/min.

10. ENSURE THAT EVERYTHING IS LEFT ON "AUTO" BEFORE YOU LEAVE THE PLANT!!!!

Chemical Cleaning Procedures for 10-Man Systems

The 10-man systems can be cleaned in the same manner as the 50-man systems, described on page 12, or they can be immersed in cleaning fluid according to the following procedure. This procedure is recommended only if severe fouling is suspected, as it takes a lot more work and time to complete.

The best time to perform the following procedure is during a move, when the plant is sucked out, but if necessary we can do it while on a job. Ideally, the maintenance provider should have a 200+ gallon tank to hold the membrane tank contents, so that most of the sludge can be replaced into the plant after cleaning.

Procedure:

1. Arrange to have the membrane tank sucked out and rinsed with clean water to remove sludge clinging to the tank walls. Also suck out half of the 3rd settling tank to allow for some fluid intake during the cleaning period.

2. Fill the membrane tank with clean water until the membranes are covered with at least 15cm of water (warm water out of the rig tanks would be ideal, as long as it is "clean.")

3. Pour 8L of bleach into the membrane tank and operate the scouring blower.

4. Re-route the effluent hose so that it dumps back into the membrane tank.

5. Start filtration, to draw the cleaning solution through the membranes. Continue cleaning for 2 hours.

6. Stop filtration.

7. Re-route the effluent hose back into the drain field.

8. Have the cleaning fluid sucked from the plant (it can be put back into the rig tank, or the membrane tank drain can be connected to the drain field, and the tank emptied into the disposal area- remember, it is chlorinated water, and presents no health or environmental issues.).

9. Replace the sludge into the membrane tank.

10. Resume normal operation.

STS Installation and Start-up Procedures:

1. Upon arriving, check the power supply for the camp or rig. The plant requires a 100-Amp "Arctite" 4 wire, 4 pole outlet, exactly the same as what the camp requires (ie. there must be **TWO** of these in the gen set, one for us and one for the camp). Sometimes spare outlets are on the outside of the gen set. If there is no second 100-amp outlet, immediately contact the engineer and Robert or Ryan in the office. We may need to arrange for an electrician to wire in an outlet or for another generator.

2. As soon as the plant is spotted, or while you're waiting for the bed truck etc, do an inspection of the plant. Make sure that:

- all drain valves are closed and no fittings are cracked, including the effluent sample valve (hose tap).
- all pipe unions are done up tight (around pumps 1 and 2, as well as in the membrane tank (the union inside the membrane tank and downstream from the membrane unit often jiggles loose),
- the drain plug on pump 2 is closed and the drain in pump 1 is installed and has not jiggled loose,
- all EQ and de-nit tank floats are untied, taken out of the EQ strainer and ready to work,
- a visual inspection of the membrane unit- check to make sure that all clear tubes coming out of the top are not loose from their connections, and that the plastic union downstream from the membrane is tight, and the chem wash valve is closed
- check the metal blower lines in settling tank 1 and the de-nit tank- often the de-nit blower line loosens off during transport and falls into the de-nit tank

3. When you connect the hoses outside, **MAKE SURE** the "in" hose is connected to the right fitting! If you look inside the cam-lock on the outside of the plant, the "in" line is 2" diameter, and the "out" line is only 1 ¼ ". Also double check that the effluent line selector valves are in the right position for the "out" fitting you chose to use.

4. When you hook up your power, make sure the main switch in the plant is **OFF**, make sure the 100-Amp breaker in the gen set is **OFF**, and then connect the main power cord. Turn on the Gen Set 100-amp breaker and check the voltage as per Mike's instruction sheet **BEFORE YOU TURN ON OUR MAIN POWER SWITCH.** When the power is turned on, "bump" test all blowers and pumps (turn them to hand for a second or so and make sure they turn on). Remember that pump 2 will not activate unless blower 1 is on and the membrane tank float is activated manually. Once everything is checked out, leave everything on "auto," with the exception of pump 3. **IF** pump 3 has the new float installed (there will be 4 floats in the de-nit tank instead of three), it can also be left on auto.

STS Shut-Down and De-Mob Procedures

1. The plant holds about 12-14m^3 when full. It must be sucked out before moving. A vac truck is not necessary for this, as they usually only hold 8-10m^3. A tanker truck will do the job fine by hooking up to the drain valves on each tank. We may have to supply them with a female-female cam-lock crossover, as the valves are male and the hose end is male. Ideally, the plant will be sucked low enough that the valves can be left open without spilling (when the plant is stationary), but this is often not possible due to vac truck capacity. It is acceptable to leave up to 2 ft of fluids in the tanks**, AS LONG AS THE TEMPERATURE IS MILD AND THERE IS NO DANGER OF FROZEN VALVES.**

2. Pumps 1 and 2 will **ALWAYS** be drained right after the plant is sucked out, no matter how short the move….plans often change! **There is no excuse for frozen pumps.** The plastic unions on the pump lines should also be opened and drained, and it is good practice to re-assemble these when they are drained to prevent breakage.

3. When you store the 100-amp cord, please connect the two ends and tighten the nut to prevent thread damage.

4. The plumbing and electrical gear from the camp can be stored in the plant for transport, but take care that it is stored in such a way that it will not slide around or fall over and break fittings. Do not store excessive amounts of equipment in the plant.

5. If you have time, throw the ladder up on the side of the plant and visually check that the hood is bolted on. There have been instances where we've lost a lid because the bolts had loosened off.

6. Before transporting the plant, put the EQ floats in the EQ strainer so they won't swing around, and secure the de-nit floats in a similar way (tape, zip-ties, etc)

7. Don't forget to lower the phone antenna.

Procedure for Changing Pump 2 Shaft Seal

Tools Needed:
Phillips head screwdriver
Metric Allen Key
Flat screwdriver or similar prying device
New shaft seal
1/2" wrench or socket
Channel-lock pliers

1. Ensure the pump is turned off on the control panel. Close the isolation valves on either side of the pump to prevent excess water draining on the floor when the old seal is removed.

2. Remove the shaft coupling guards with a Phillips head screwdriver. Use the allen wrench to loosen the four coupling screws and remove the coupling.

3. Remove the four "upside down" 9/16" bolts that connect the motor to the pump housing, and carefully lay the motor to the side, out of the way.

4. Use the smaller allen key to loosen the shaft lock screws on the seal. Then use the channel-lock pliers to unthread the seal from the pump housing.

5. Thread the new seal into place and tighten with the channel-lock pliers. Do not over-tighten.

6. Replace motor on pump and tighten motor mounting bolts in a diagonal pattern.

7. Replace shaft coupling and thread coupling bolts hand-tight. Make sure shaft pin is locate in pump shaft.

8. Using the flat screwdriver, raise the pump shaft by placing the tip of the screwdriver under the coupling and carefully elevating the coupling to its highest point. Now lower the shaft halfway back down and tighten the coupling screws with the allen wrench in a diagonal pattern.

9. Tighten the set screws on the top of the seal. Replace the coupler guards.

10. Turn the power back on and bump test the pump by turning the control switch to "hand." Remember, the membrane tank must be full, and Blower 1 must be running for Pump 2 to activate, even on hand mode.

11. Observe the pump working, and make sure that the new seal is not leaking. Ensure the pump doesn't make any strange noises, etc.

12. Make sure the control switches are all left on "Auto" before you leave the plant.

Procedure for Changing Pump 3 (Circulating Pump)

Tools Needed:
24" pipe wrench
Pipe thread anti-seize compound
Spare Pump 3 (2" submersible "Tsurimi" pump)

1. Turn off the power to Pump 3 by turning the control panel switch to OFF.

2. Using a ladder to access the top of the de-nitrification tank, locate the pump 3 discharge line (white PVC pipe) and the threaded union near the top of the line. Undo the threaded pipe union to free pump 3.

3. Using the wire rope that is attached to the pump, haul the pump up and out of the tank. If the wire rope is not present, use the PVC pipe as a handle, but be very careful.

4. Use the pipe wrench to disconnect the PVC pipe from the pump, and re-install the old pipe on the new pump.

5. Locate the electrical junction box that the pump 3 cord goes into. Using screwdriver, remove the lid from this box. **MAKE SURE THE POWER IS TURNED OFF BEFORE OPENING THE JUNCTION BOX.**

6. Disconnect the two wire nuts that connect the pump to the power supply. Remove the old pump wire.

7. Cut the plug end off the new pump's power cord. Strip an appropriate amount of insulation of the cord, and reconnect exactly how the old wiring was connected. Re-tighten the wire nuts, and replace the junction box lid.

8. Lower the new pump into the de-nitrification tank and re-connect the threaded PVC union. Turn the control switch to HAND to verify that the new pump works.

9. Make sure the control switches are all left on "Auto" before you leave the plant.

Procedure for Wiring Electrical Cords for Pumps & Floats

Occasionally, electrical components in the plant can fail. If this has happened, make sure you have the correct replacement parts before performing the following work. In many cases, the component may be in proper working order, but not functioning due to some other component. Check to make sure all floats are positioned properly and their motion is not impeded by foreign objects. Do not jump to a conclusion that a pump or float has failed. **Changing out a component should be the last resort.**

Whenever possible, a qualified electrician should perform this work. An electrician can perform tests to determine the exact cause of a problem, often eliminating unnecessary and potentially harmful or costly work.

Tools needed:
Screwdriver
Wire strippers

1. **ALWAYS TURN OFF THE POWER BEFORE PROCEEDING WITH ANY ELECTRICAL WORK.** If available, a qualified electrician should perform this work. However, it is quite simple, and can be performed by most technicians if necessary.

2. Follow the cord of the float or pump you wish to replace and locate the junction box which contains the electrical connections.

3. Remove the lid from the junction box and locate the wires from the device you wish to replace. Be aware that several devices may be wired into the same junction box.

4. Remove the appropriate wire nuts, and remove the wires connecting the old device. Remove the wire from the junction box by loosening the retaining nut and pulling the wire out.

5. Using the wire strippers, strip an appropriate amount of insulation from the new wire, insert it through the retaining nut, and connect it to the power supply. Reconnect the wire nuts.

6. Replace the lid on the junction box.

7. Turn on the power and test the component you just installed to ensure it is functioning correctly.

8. Ensure all control switches are on AUTO before you leave the plant.

Useful Conversions and Information

$1m^3$ = 1000L = 220 Gal (Imp) = 264 Gal (US)
4.54L = 1 Gal (Imp)
3.78L = 1 Gal (US)
1000 Gal = 4545L = $4.5m^3$
1 barrel (US Oil) = 42 Gal (US) = 159L
1 Kilogram (kg) = 2.2 pounds (lbs)
1 tonne (metric) = 1000kg = 2200lbs
1 ton = 2000 lbs
1 metre = 1,000,000 micrometres (µm)
1 metre = 1,000,000,000 nanometres (nm)
1 micrometer = 1000 nanometers
(A membrane pore is 0.4 µm (or 400nm) in diameter. This means 4000 pores would be 1cm long!)

8' C-Can holds approximately 1500 Gal/ $6.8m^3$
10' C-Can holds approximately 2800 Gal/ $12.8m^3$
50 man STS holds approx. 4100 Gal/ $18m^3$ when full, 3500 Gal/ $15m^3$ average capacity
Approx. weight of 50-Man STS (empty) = 17,000lbs/ 8000kg

PEAK

SUPERIOR EQUIPMENT
EXCEPTIONAL SERVICE

NOTICE

THIS GENERATOR POWERS A WASTEWATER TREATMENT SYSTEM.

TRANSFER STATIONS REQUIRE POWER TO FUNCTION.

BEFORE SHUTTING DOWN POWER FOR SERVICE, NOTIFY CAMP OCCUPANTS THAT DRAINS CANNOT BE USED. THIS WILL PREVENT A RAW SEWAGE SPILL.

AFTER RESTORING POWER, VERIFY THAT LIFT STATIONS ARE FUNCTIONING CORRECTLY.

PEAK
SUPERIOR EQUIPMENT
EXCEPTIONAL SERVICE

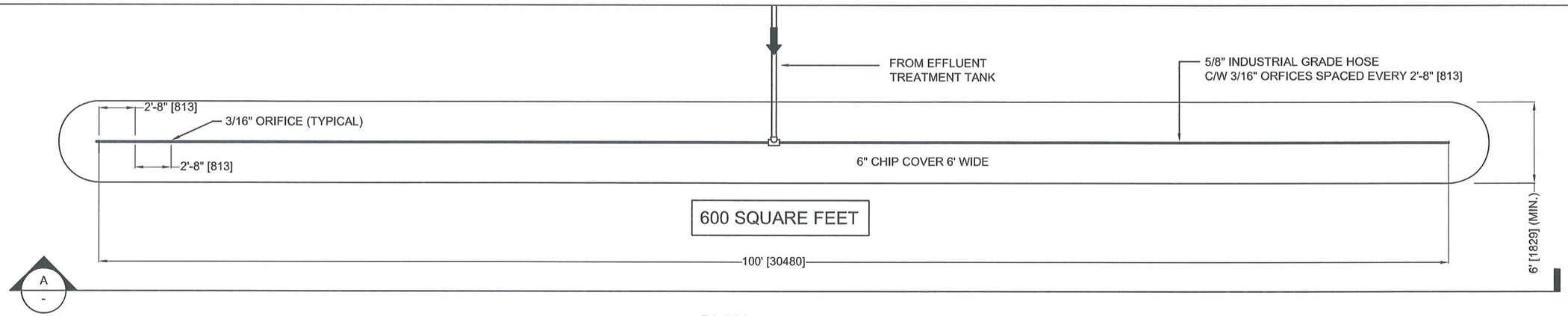
NOTICE

THIS CAMP UTILIZES A WASTEWATER TREATMENT SYSTEM. TO ENSURE THE INTEGRITY OF THE BIOLOGICAL PROCESS, PLEASE OBSERVE THE FOLLOWING CRITERIA:

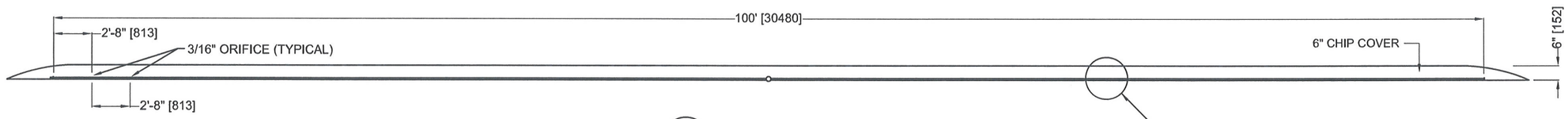
- ***Daily additions of enzymes/ bacterial stimulants are not necessary with Wellco's Membrane Systems.***
- ***Do <u>not</u> use excessive amounts of detergents or cleaners. They can contain toxic substances that may harm the bacteria in the system. Excessive amounts of laundry detergent causes severe foaming problems in the plant.***
- ***Do <u>not</u> dump cooking grease down the drains.***
- ***Do <u>not</u> flush paper towel, sanitary pads, mop strings, dental floss, Q-tips, rubber products, cigarettes, or harsh chemicals. These items can plug plumbing and /or harm the biological components of the system.***

IF YOU NOTICE A PROBLEM WITH THE SYSTEM OR HAVE ANY CONCERNS, PLEASE ADVISE PEAK STAFF ON SITE, AND/OR CALL 1-866-785-8500.

Appendix B: Facility Schematics and Worksheets for Pressure Distribution System Design



PLAN
SCALE: 1/8" = 1'-0"



A / - SECTION
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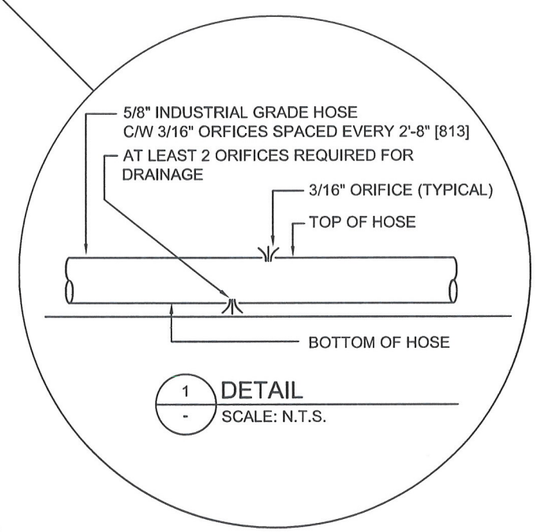


1 / - DETAIL
SCALE: N.T.S.

GENERAL NOTES:

1) MAXIMUM LOADING RATE: 68 L/m2 DAY.
2) EFFLUENT QUALITY PARAMETERS: BOD <10 mg/L, TSS < 10 mg/L (TYPE 2 10-10).
3) LATERAL SPECS: 3/16" HOLE SIZE EVERY 2'-8" [813]. LATERAL SEPARATION: 6'-6" [2000].
4) DOSING RATE 15 MAN: 140 L/hr.
5) SITE REQUIREMENTS: 3/4" [20] VEGETATION LAYER. NOT TO BE USED ON BARE SOIL.
6) SET BACK DIFFERENCES: AS PER SSR SPM (DISTANCE FROM THE EDGE OF THE DISTRIBUTION FIELD).

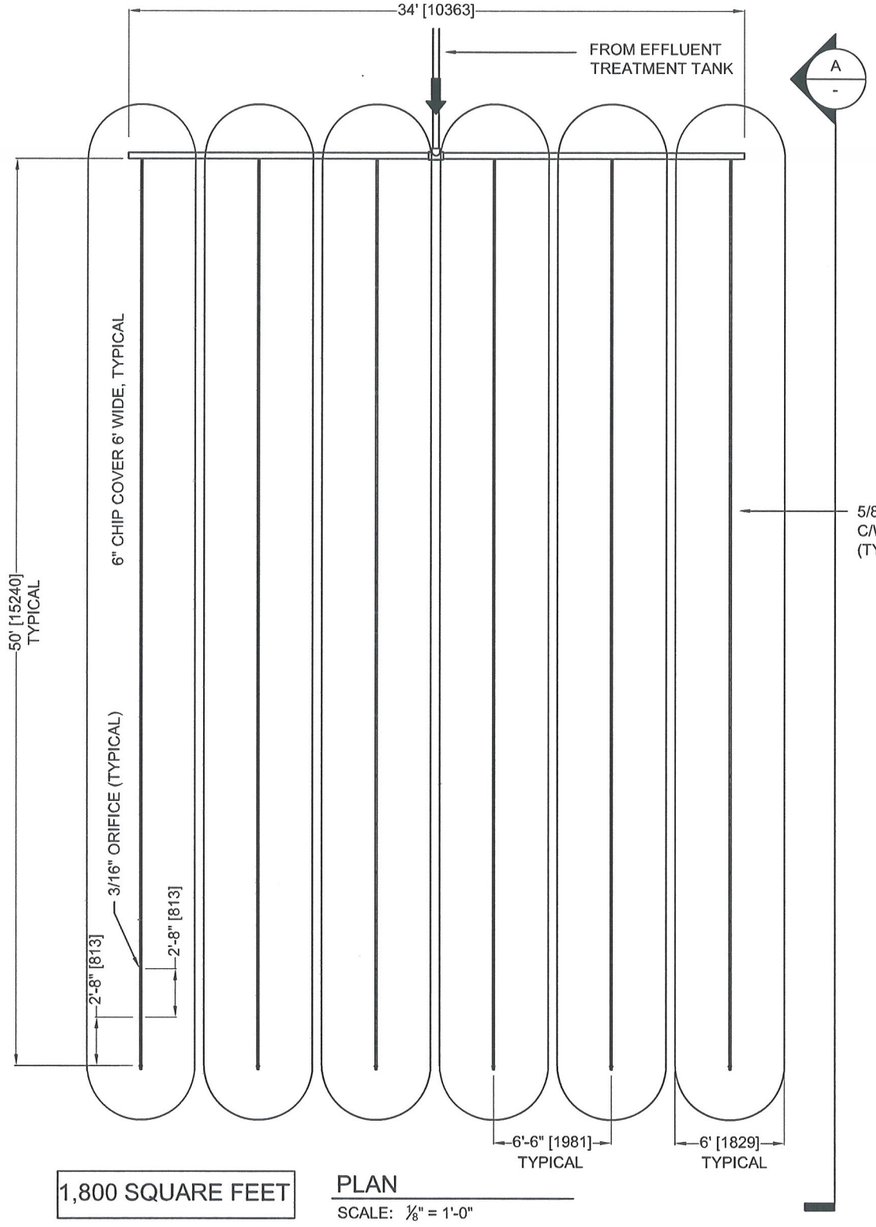
PROPERTY LINES: 10'-0" [3000].
SOURCE OF DRINKING WATER, WELL, OR WATER SUCTION LINES: 98'-6" [30000].
WATER LINES PRESSURE: 10'-0" [3000].
DRAINAGE OR BUILDING PERIMETER DRAIN: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 50'-0" [15000].
BUILDING NON DWELLING: 5'-0" [1500].
BUILDING DWELLING: 10'-0" [3000].
WITH BASEMENT: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 29'-6" [9000].
BREAK-OUT POINT: 25'-6" [7500].
UNTILITY SERVICES: 5'-0" [1500].
FRESH WATER: 98'-6" [30000].
MARINE WATER: 50'-0" [15000].

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
Z. MA
32578

REVISION	DATE	DESCRIPTION
-	-	-
-	-	-
0	17-SEP-10	INITIAL RELEASE

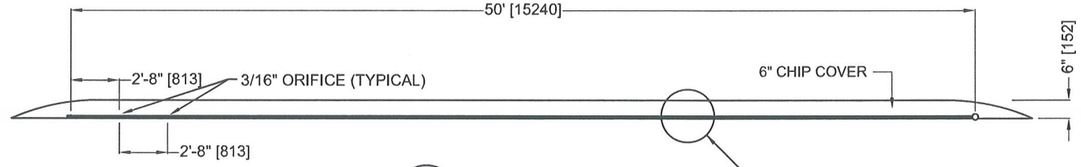
SANITHERM INC.
A SUBSIDIARY OF PEAK ENERGY TRUST
SUITE 100 - 340 BROOKSBANK AVENUE, NORTH VANCOUVER, BC, V7J 2C1, CANADA
TEL: (604) 986 - 9168
FAX: (604) 986 - 5377
E-MAIL: saneng@sanitherm.com
WEBSITE: www.sanitherm.com

PROJECT: -					PROJ. NO.: SEL-100061
CLIENT: PEAK ENERGY SERVICES					REV. NO.: 0
TITLE: 15 MAN EFFLUENT PRESSURE DISTRIBUTION SYSTEM					
DRAWN BY: M.R.	CHECKED BY: J.M.	DATE CREATED: 10-SEP-10	SCALE: 1/8"=1'-0"	DRAWING NO.: SEL-100061-GA1	

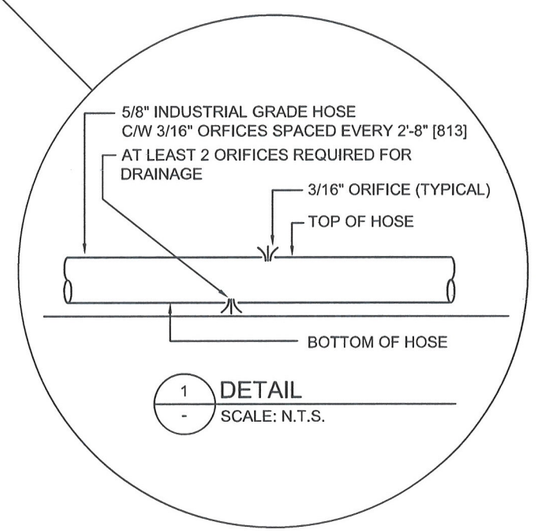


1,800 SQUARE FEET

PLAN
SCALE: 1/8" = 1'-0"



A - SECTION
SCALE: 1/8" = 1'-0"



1 - DETAIL
SCALE: N.T.S.

GENERAL NOTES:

1) MAXIMUM LOADING RATE: 68 L/m2 DAY.
2) EFFLUENT QUALITY PARAMETERS: BOD <10 mg/L, TSS < 10 mg/L (TYPE 2 10-10).
3) LATERAL SPECS: 3/16" HOLE SIZE EVERY 2'-8" [813]. LATERAL SEPARATION: 6'-6" [2000].
4) DOSING RATE 50 MAN: 470 L/hr.
5) SITE REQUIREMENTS: 3/4" [20] VEGETATION LAYER. NOT TO BE USED ON BARE SOIL.
6) SET BACK DIFFERENCES: AS PER SSR SPM (DISTANCE FROM THE EDGE OF THE DISTRIBUTION FIELD).

PROPERTY LINES: 10'-0" [3000].
SOURCE OF DRINKING WATER, WELL, OR WATER SUCTION LINES: 98'-6" [30000].
WATER LINES PRESSURE: 10'-0" [3000].
DRAINAGE OR BUILDING PERIMETER DRAIN: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 50'-0" [15000].
BUILDING NON DWELLING: 5'-0" [1500].
BUILDING DWELLING: 10'-0" [3000].
WITH BASEMENT: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 29'-6" [9000].
BREAK-OUT POINT: 25'-6" [7500].
UNTILITY SERVICES: 5'-0" [1500].
FRESH WATER: 98'-6" [30000].
MARINE WATER: 50'-0" [15000].

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REVISION	DATE	DESCRIPTION
-	-	-
-	-	-
0	17-SEP-10	INITIAL RELEASE

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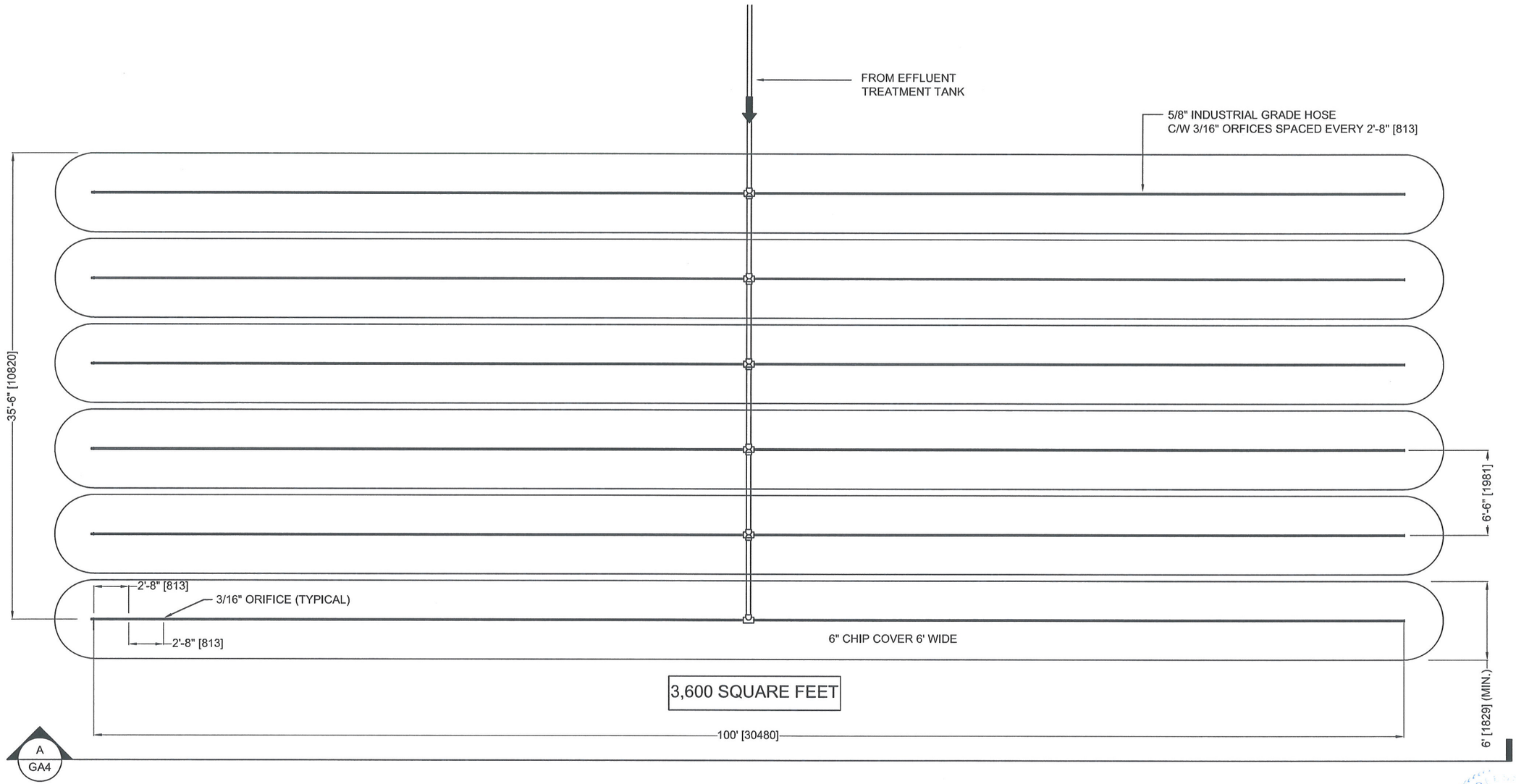
FAX: (604) 986 - 5377
E-MAIL: saneng@sanitherm.com
WEBSITE: www.sanitherm.com

PROJECT	-
PROJ. NO.	SEL-100061
CLIENT	PEAK ENERGY SERVICES
REV. NO.	0
TITLE	50 MAN EFFLUENT PRESSURE DISTRIBUTION SYSTEM
DRAWN BY	M.R.
CHECKED BY	J.M.
DATE CREATED	10-SEP-10
SCALE	1/8"=1'-0"
DRAWING NO.	SEL-100061-GA2



PLAN

SCALE: 1/8" = 1'-0"

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REVISION	DATE	DESCRIPTION
-	-	-
-	-	-
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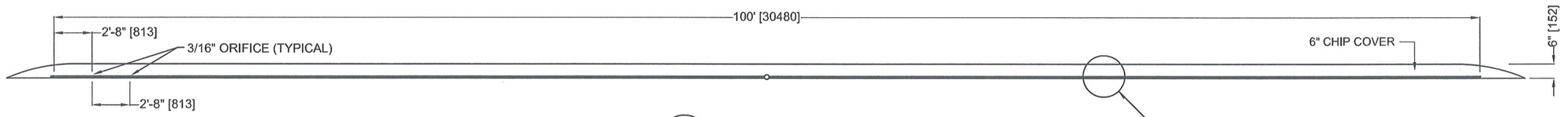
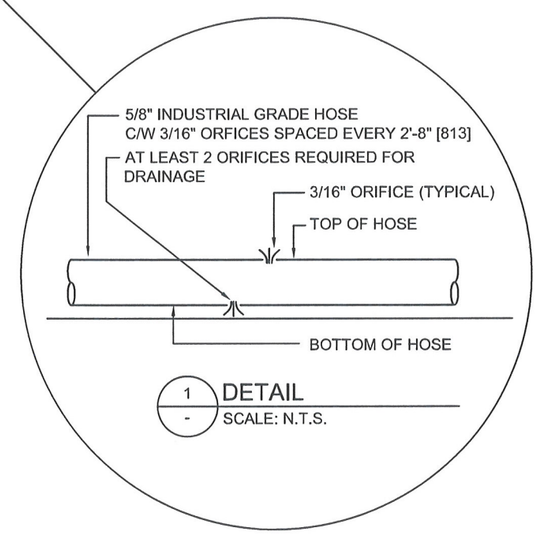
E-MAIL: saneng@sanitherm.com
WEBSITE: www.sanitherm.com

PROJECT	-
PROJ. NO.	SEL-100061
CLIENT	PEAK ENERGY SERVICES
REV. NO.	0
TITLE	100 MAN EFFLUENT PRESSURE DISTRIBUTION SYSTEM
DRAWN BY	M.R.
CHECKED BY	J.M.
DATE CREATED	10-SEP-10
SCALE	1/8"=1'-0"
DRAWING NO.	SEL-100061-GA3



A / GA3 SECTION
SCALE: ⅛" = 1'-0"



1 / - DETAIL
SCALE: N.T.S.

GENERAL NOTES:

1) MAXIMUM LOADING RATE: 68 L/m2 DAY.
2) EFFLUENT QUALITY PARAMETERS: BOD <10 mg/L, TSS < 10 mg/L (TYPE 2 10-10).
3) LATERAL SPECS: 3/16" HOLE SIZE EVERY 2'-8" [813]. LATERAL SEPARATION: 6'-6" [2000].
4) DOSING RATE 100 MAN: 950 L/hr.
5) SITE REQUIREMENTS: ¾" [20] VEGETATION LAYER. NOT TO BE USED ON BARE SOIL.
6) SET BACK DIFFERENCES: AS PER SSR SPM (DISTANCE FROM THE EDGE OF THE DISTRIBUTION FIELD).

PROPERTY LINES: 10'-0" [3000].
SOURCE OF DRINKING WATER, WELL, OR WATER SUCTION LINES: 98'-6" [30000].
WATER LINES PRESSURE: 10'-0" [3000].
DRAINAGE OR BUILDING PERIMETER DRAIN: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 50'-0" [15000].
BUILDING NON DWELLING: 5'-0" [1500].
BUILDING DWELLING: 10'-0" [3000].
WITH BASEMENT: UP GRADIENT 10'-0" [3000], DOWN GRADIENT 29'-6" [9000].
BREAK-OUT POINT: 25'-6" [7500].
UNTILITY SERVICES: 5'-0" [1500].
FRESH WATER: 98'-6" [30000].
MARINE WATER: 50'-0" [15000].

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PROVINCE OF BRITISH COLUMBIA
Z. MA
32578

REVISION	DATE	DESCRIPTION
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-	-	-
0	17-SEP-10	INITIAL RELEASE

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E-MAIL: saneng@sanitherm.com
WEBSITE: www.sanitherm.com

PROJECT	-
PROJ. NO.	SEL-100061
CLIENT	PEAK ENERGY SERVICES
REV. NO.	0
TITLE	100 MAN EFFLUENT PRESSURE DISTRIBUTION SYSTEM
DRAWN BY	M.R.
CHECKED BY	J.M.
DATE CREATED	10-SEP-10
SCALE	1/8"=1'-0"
DRAWING NO.	SEL-100061-GA4

Because MBR wastewater treatment systems are applied, the treated water that will be discharged by the designed distribution systems meets Type 2 10/10 effluent. According to Sewerage System Standard Practice Manual and Sewerage System Standard Practice Manual Appendices, the design parameters are selected or determined as follows:

Hydraulic loading rate = 1.68 gal/ft^2 · day (68 L/m^2· day)

Orifice size and spacing:

Determine orifice size and spacing based on the maximum infiltrative surface per orifice and minimum orifice diameter for Type 2

Orifice size = 3/16 inches
Orifice spacing = 32 inches

Lateral length and diameter:

Lateral length = 50 ft
Lateral diameter = 5/8 inches

Number of orifice per lateral:

Orifices per lateral = 50 ft ÷ 32 inches = 18

At least two 6 o'clock orifices are intalled for drainage. These could be installed approximately 1/3 of the lateral length from each end of the lateral.

Lateral discharge rate:

Distal pressure = 3 ft
Orifice discharge = 0.74 gpm
Lateral dischare = 0.74 gpm × 18 = 13.3 gpm

15 man camp:

Daily design flow = 50 gal/c · day × 15 man = 750 gal/day
Dosing time = 20 hrs/day
Dosing flow rate = 750 gal/day ÷ 20 hrs × 24 hrs = 900 gal/day
Surface area required = 900 gal/day ÷ 1.68 gal/ft^2 · day = 536 ft^2
Actual surface area = 600 ft^2
Width of bed = 6 ft
Number of lateral = 2

50 man camp:

Daily design flow = 50 gal/c · day × 50 man = 2,500 gal/day
Dosing time = 20 hrs/day
Dosing flow rate = 2,500 gal/day ÷ 20 hrs × 24 hrs = 3,000 gal/day
Surface area required = 3,000 gal/day ÷ 1.68 gal/ft^2 · day = 1,786 ft^2
Actual surface area = 1,800 ft^2
Width of bed = 6 ft
Number of lateral = 6

100 man camp:

Daily design flow = 50 gal/c · day × 100 man = 5,000 gal/day
Dosing time = 20 hrs/day
Dosing flow rate = 5,000 gal/day ÷ 20 hrs × 24 hrs = 6,000 gal/day
Surface area required = 6,000 gal/day ÷ 1.68 gal/ft^2 · day = 3,571 ft^2
Actual surface area = 3,600 ft^2
Width of bed = 6 ft
Number of lateral = 12

Appendix C: Sodium Hypochlorite MSDS

MATERIAL SAFETY DATA SHEET

Sodium Hypochlorite 5-20%

Section 01 - Chemical And Product And Company Information

Product Identifier ..... Sodium Hypochlorite (5-20%)

Product Use ..... Disinfectant, bleaching agent, source of available chlorine, deodorizer.

Supplier Name..... ClearTech Industries Inc.
2302 Hanselman Avenue
Saskatoon, SK. Canada
S7L 5Z3

Prepared By..... ClearTech Industries Inc. Technical Department
Phone: (306)664-2522

Preparation Date..... November 26, 2009

24-Hour Emergency Phone..... 306-664-2522

Section 02 - Composition / Information on Ingredients

Hazardous Ingredients.....	Sodium Hypochlorite	4.9-16.5%
CAS Number.....	Sodium Hypochlorite	7681-52-9

Synonym (s).....Industrial bleach, hypo, bleach, Javel water, household bleach

Section 03 - Hazard Identification

Inhalation..... Irritant of the nose and throat, causing coughing, difficulty breathing, and pulmonary edema.

Skin Contact / Absorption…….... Causes severe skin irritation with blistering and ulceration.

Eye Contact.....…….... Causes severe irritation of the mucous membranes of the eyes. May cause severe eye damage.

Ingestion.....……. Burning of the mouth and throat, abdominal cramps, nausea, vomiting, diarrhea, shock. May lead to convulsions, coma, and even death.

Exposure Limits…….. None established.
ACGIH/TLV-TWA= 1ppm (chlorine)

Section 04 - First Aid Measures

Inhalation.....…….. Remove victim to fresh air. Give artificial respiration only if breathing has stopped. If breathing is difficult, give oxygen. Seek immediate medical attention.

Skin Contact / Absorption…….. Remove contaminated clothing. Wash affected area with soap and water. Seek medical attention if irritation occurs or persists.

Eye Contact.....…….... Flush immediately with water for at least 20 minutes. Forcibly hold eyelids apart to ensure complete irrigation of eye tissue. Seek immediate medical attention.

Ingestion.....……. Do not induce vomiting. If vomiting occurs, lean victim forward to prevent breathing in vomitus. Give large amounts of water. Do not give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.

Additional Information.....…….... Not available

Section 05 - Fire Fighting

Conditions of Flammability……..... Non-flammable

Means of Extinction.....…….... Product does not burn. Use appropriate extinguishing media for material that is supplying the fuel to the fire.

Flash Point.....……. Not applicable

Auto-ignition Temperature……. Not applicable

Upper Flammable Limit …….. Not applicable

Lower Flammable Limit..... Not applicable

Hazardous Combustible Products... Decomposition may produce chlorine gas and/or hydrogen chloride gas.

Special Fire Fighting Procedures..... Wear NIOSH-approved self-contained breathing apparatus and protective clothing.

Explosion Hazards..... Pressure buildup in containers could result in an explosion when heated or in contact with acidic fumes. Vigorous reaction with oxidizable organic materials may result in a fire.

Section 06 - Accidental Release Measures

Leak / Spill..... Wear appropriate personal protective equipment. Ventilate area. Stop or reduce leak if safe to do so. Prevent material from entering sewers. Flush with water to remove any residue.

Deactivating Materials..... Neutralize first with sodium sulphite, sodium metabisulphite or other dechlorination agent for no chlorine residual, then with hydrochloric acid until the pH is 7.

Section 07 - Handling and Storage

Handling Procedures..... Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene and housekeeping practices. Wash thoroughly after handling. Avoid all situations that could lead to harmful exposure.

Storage Requirements..... Store in a cool, dry, well-ventilated place. Keep container tightly closed, and away from incompatible materials. Venting of containers is advisable.

Section 08 - Personal Protection and Exposure Controls

Protective Equipment

Eyes..... Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.

Respiratory..... A NIOSH-approved respirator suitable for chlorine is recommended. Where a higher level of protection is required, use a self-contained breathing apparatus.

Gloves..... Impervious gloves of chemically resistant material (rubber or PVC) should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Clothing…….…….... Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Footwear……..... Impervious boots of chemically resistant material should be worn at all times.

Engineering Controls

Ventilation Requirements……..... Mechanical ventilation (dilution or local exhaust), process or personnel enclosure and control of process conditions should be provided. Supply sufficient replacement air to make up for air removed by exhaust systems.

Other……..... Emergency shower and eyewash should be in close proximity.

Section 09 - Physical and Chemical Properties

Physical State.....……...…….... Liquid

Odor and Appearance…..…….... Strong chlorine odour. Clear, greenish-yellow solution.

Odor Threshold...……..... Not available

Specific Gravity (Water=1)…….. 1.17 at 20°C (12% trade)

Vapor Pressure (mm Hg, 20C)…..... 12.1mm Hg at 20°C (12.5 wt %)

Vapor Density (Air=1)..……..... Not available

Evaporation Rate.....…….…….…. Not available

Boiling Point.....…….…….... Slowly decomposes above 40°C.

Freeze/Melting Point....…….... ~ -15°C (12% trade)

pH.....…….…….. < 12

Water/Oil Distribution Coefficient.... Not available

Bulk Density.....…….…. Not available

% Volatiles by Volume……..…….... Not available

Solubility in Water...……..... Complete

Molecular Formula.....……..... NaOCl

Molecular Weight..... 74.44

Section 10 - Stability and Reactivity

Stability..... Unstable at temperatures above 40°C, in sunlight, and in contact with acid.

Incompatibility..... Incompatible with strong acids, ammonia, oxidizable materials, nickel, copper, tin, manganese, and iron.

Hazardous Products of Decomposition.. Chlorine (by reaction with acids), oxygen (by reaction with nickel, copper, tin, manganese, iron), sodium chloride, sodium chlorate, with increased temperature.

Polymerization..... Will not occur

Section 11 - Toxicological Information

Irritancy..... Strong irritant

Sensitization..... Not available

Chronic/Acute Effects..... If over-exposed to the solution, there will be constant irritation of the eyes, nose, and throat.

Synergistic Materials..... Not available

Animal Toxicity Data..... LD_{50}(oral,rat) = 8910mg/kg (100% sodium hypochlorite)

Carcinogenicity..... Not considered to be carcinogenic (IARC and ACGIH).

Reproductive Toxicity..... Not available

Teratogenicity..... Not available

Mutagenicity..... Not available

Section 12 - Ecological Information

Fish Toxicity..... Not available

Biodegradability..... Not available

Environmental Effects..... Not available

Section 13 - Disposal Consideration

Waste Disposal..... Dispose in accordance with all federal, provincial, and/or local regulations including the Canadian Environmental Protection Act.

Section 14 - Transportation Information

TDG Classification

Class..... 8

Group..... III

PIN Number..... UN 1791

Other..... Secure containers (full and/or empty) with suitable hold down devises during shipment.

Section 15 - Regulatory Information

WHMIS Classification.....E

NOTE: THE PRODUCT LISTED ON THIS MSDS HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CANADIAN CONTROLLED PRODUCTS REGULATIONS. THIS MSDS CONTAINS ALL INFORMATION REQUIRED BY THOSE REGULATIONS.

NSF Certification.....Product is certified under NSF/ANSI Standard 60 for disinfection and oxidation at a maximum dosage for the following:

sodium hypochlorite 5%: 200mg/L
sodium hypochlorite 6%: 175mg/L
sodium hypochlorite 7%: 161mg/L
sodium hypochlorite 8%: 146mg/L
sodium hypochlorite 9%: 131mg/L
sodium hypochlorite 10%: 116mg/L
sodium hypochlorite 11%: 101mg/L
sodium hypochlorite 12%: 87mg/L
sodium hypochlorite 13%: 82mg/L
sodium hypochlorite 14%: 76mg/L
sodium hypochlorite 15%: 70mg/L
sodium hypochlorite 16%: 66mg/L
sodium hypochlorite 17%: 62mg/L
sodium hypochlorite 18%: 58mg/L
sodium hypochlorite 19%: 54mg/L
sodium hypochlorite 20%: 50mg/L

Sanitizer Use: to obtain 10 liters of a 200 mg/L solution as available chlorine, use 16.7 mL of Hypochlor-12 for each 10 liters of clean, potable water.

Section 16 - Other Information

Note: The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations.

Attention: Receiver of the chemical goods / MSDS coordinator

As part of our commitment to the Canadian Association of Chemical Distributors (CACD) Responsible Distribution® initiative, ClearTech Industries Inc. and its associated companies require, as a condition of sale, that you forward the attached Material Safety Data Sheet(s) to all affected employees, customers, and end-users. ClearTech will send any available supplementary handling, health, and safety information to you at your request.

If you have any questions or concerns please call our customer service or technical service department.

ClearTech Industries Inc. - Locations

Corporate Head Office: 2302 Hanselman Avenue, Saskatoon, SK, S7L 5Z3
Phone: 306-664-2522
Fax: 306-665-6216

www.ClearTech.ca

Location	Address	Postal Code	Phone Number	Fax Number
Richmond, B.C.	12431 Horseshoe Way	V7A 4X6	604-272-4000	604-272-4596
Calgary, AB.	5516E - 40th St. S.E.	T2C 2A1	403-279-1096	403-236-0989
Edmonton, AB.	11750 - 180th Street	T5S 1N7	780-452-6000	780-452-4600
Saskatoon, SK.	2302 Hanselman Avenue	S7L 5Z3	306-933-0177	306-933-3282
Regina, SK.	555 Henderson Drive	S42 5X2	306-721-7737	306-721-8611
Winnipeg, MB.	340 Saulteaux Crescent	R3J 3T2	204-987-9777	204-987-9770
Mississauga, ON.	7480 Bath Road	L4T 1L2	905-612-0566	905-612-0575

24 Hour Emergency Number - All Locations - 306-664-2522