WASTE WATER TREATMENT FACILITY OPERATION & MAINTENANCE MANUAL

For

Boston Camp Waste Water Treatment Facility

&

Windy Lake Camp Waste Water Treatment Facility

NWB Water License

2BB-BOS0712

2BE-HOP0712

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1.0 INTRODUCTION

1.1 Overview

This Waste Water Treatment Facility Operations and Maintenance Manual (Manual) provides information on how greywater and sewage is to be collected and treated in a safe and environmentally sound manner at the Miramar Hope Bay Ltd. (MHBL) Boston Advanced Exploration Project (Boston) and at the Hope Bay Regional Exploration Project (Windy Lake) in Nunavut.

In the past, sewage from mining and mineral exploration sites was often not treated, and either released separately to the receiving environment or co-disposed in an untreated condition with the mill tailings. More recently, sewage from human activities is typically treated at northern mine and mine exploration sites through the use of sewage lagoons or through packaged sewage treatment plants that use biological activity to digest the sewage. This reduces its biological oxygen demand (i.e., its ability to consume oxygen).

Sewage sludges typically consume oxygen from the water column if they are placed into areas where they ultimately will end up on the bottom of a lake. In northern lakes, this can have adverse effects in lakes that are shallow and are covered by a relatively thick ice cover over an extended winter period. In these lakes, dissolved oxygen within the water column will decrease naturally over the winter months, as oxygen is used up by biological activity within the remaining unfrozen portion of the water column; however, generally sufficient oxygen remains to sustain aquatic life. Any additional oxygen consumer (such as untreated sewage sludge) can result in there being insufficient oxygen in the water column under the ice cover to sustain life within the lake, which would lead to the death of the over-wintering fish populations within these lakes.

The release of sewage water and sludge into water bodies also adds nutrients to the receiving lakes which, under certain conditions, can lead to increase rates of algal growth. When the algal matter decays, oxygen is consumed within the water column, again reducing the available oxygen in the water column to sustain aquatic life.

Consequently, the release of untreated sewage wastewater and sludge into receiving water bodies can affect the ability of these water bodies to sustain aquatic life.

For both the Boston Advanced Exploration Project (Boston) and the Hope Bay Regional Exploration Project (Windy Camp) the Doris North Project, MHBL has installed and operates a packaged sewage treatment plant to treat all sewage and grey waters produced on site. The treated wastewater is then land applied onto the tundra for further treatment (natural attenuation by the vegetation and soil). The sludge is removed, placed in drums and stored for off site disposal or for controlled incineration. In this way the sewage sludge is kept out of the lakes adjacent to the two camps and thus will not be available to consume oxygen in the overlying water column. At both camps sewage treatment is achieved through the use of a modular packaged aerobic biological treatment plant(s).

1.2 Purpose and Scope of the Waste Water Treatment Facility Operations and Maintenance Manual

The purpose of this document is to provide a consolidated summary of information on the operation and maintenance of the Waste Water Treatment Facilities (sewage treatment plants) located at both the Boston and Windy exploration camps to treat all greywater and sewage generated by MHBL's exploration activities. These procedures will be periodically reviewed and updated.

This operations and maintenance manual is a component of the Miramar Environmental Management System and will be reviewed annually during the first quarter of each calendar year by the site's environmental staff and updated as needed to reflect changes in operating and maintenance procedures. The revised Waste Water Treatment Facility Operations and Maintenance Manual will be made available to the appropriate exploration staff with appropriate refresher training and sent to the Nunavut Water Board for inclusion in the public registry.

The Waste Water Treatment Facility Operations and Maintenance Manual is intended to provide the mine's operating staff with a summary of the handling and management procedures for the treatment of greywater and sewage. It similarly provides a summary of the same to the regulatory agencies and to the land owner who have regulatory interest over the exploration camp facilities.

This Manual is not intended to be a design document for the Waste Water Treatment facilities at the Boston or Windy Lake camps. The reader is referred to the following sources for design information:

- Seprotech ROTORDISK® Aerobic Treatment Plant Model Clementine Installation and Operators Manual, Windy Camp. Miramar Hope Bay Limited, prepared for Miramar Hope Bay Limited by Seprotech Systems Inc. dated March 2004;

- Operation and Maintenance Manual for Two (2) 2-40 ROTORDISK® Full Steel Packaged sewage treatment plants c/w 5,421 sq. ft. of combined bio-support media for 28,000 litres/day, prepared for BHP Minerals Canada Ltd. CMS Group Inc. un-dated. (included as Appendix A)

1.3 Responsibility

- Exploration Manager – The Exploration Manager has overall responsibility for this management plan and will be the party to provide the resources to operate and maintain the two Waste Water Treatment facilities.

- Exploration Site Superintendent – The Exploration Site Superintendent will have site responsibility at both the Boston and Windy Lake camps for the implementation of this operations and maintenance manual and will provide the on-site resources to operate, manage and maintain the Waste Water Treatment facilities in accordance with the manual; conduct regular inspections of the two Waste Water Treatment facilities; and provide input on modifications in design and operational procedures to improve operational performance of these two facilities. The Exploration Site Superintendent, through his foremen, will provide daily supervision to site operational personnel on the operation of these two Waste Water Treatment facilities.

- Environmental Coordinator – The site Environmental Coordinator has responsibility to: keep this Waste Water Treatment Facility Operations and Maintenance Manual updated; provide technical expertise to the site operational personnel on the operation and maintenance of both Waste Water Treatment Facilities; sampling of the treated waste water, reporting on the performance of the waste water treatment facilities and assessment of whether the treated waste water has met applicable regulatory standards; provide operational personnel with direction as to when and where sewage sludge should be moved; conduct annual audits of the two facilities; and provide an audit report to the Exploration Site Superintendent and Exploration Manager.

2.0 APPLICABLE LEGISLATION

The operation and maintenance of the waste water treatment facilities at both the Boston and Windy Lake exploration camps is regulated under the following two Type A water licenses issued by the Nunavut Water Board pursuant to its authority under Article 13 of the *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada* and the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*:

Boston Advanced Exploration Project – License 2BB-BOS0712
Hope Bay Regional Exploration Project – License 2BE-HOP0712

Copies of relevant legal documents will be kept on file at the Windy Lake exploration camp site. Management and safety personnel will provide an overview of the applicable regulations to all employees as part of their orientation training and through ongoing training.

The water license referenced above set a discharge standard that must be met as follows:

Boston Camp – Water License 2BB-BOS0712 Part D Item 17
All Sewage discharged from the Sewage Disposal Facility at Monitoring Station BOS-3 shall not exceed the following quality standards:

Parameter	Maximum Average Concentration
BOD_5	80 mg/L
Total Suspended Solids	100 mg/L
Faecal Coliform	10,000 CFU/100 mL
Oil and Grease	No visible sheen
pH	Between 6.0 and 9.5

Monitoring Station BOS-3 (formerly 1652-3) is defined as the Sewage Disposal Facility final discharge.

Windy Camp – Water License 2BE-HOP0712 Part D Item 10
All effluent being discharged from the WWTF, monitoring station HOP-2 shall meet the following effluent quality standards:

Parameter	Maximum Average Concentration
BOD_5	80 mg/L
Total Suspended Solids	100 mg/L
Faecal Coliform	10×10^4 CFU/100 mL (100,000 CFU/100 mL)
Oil and Grease	No visible sheen
pH	Between 6.0 and 9.5

Monitoring Station HOP-2 is defined as the WWTF effluent discharge at the surge tank prior to being pumped over the ridge east of the Windy Camp facilities.

Other acts, regulations, guidelines and general guidance pertinent to the Waste Water Treatment Facilities are as follows:

- Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, NWT Municipal and Community Affairs - Community Development, dated October 1996 by Diep Duong and Ron Kent

Nunavut

- Consolidation of Environmental Protection Act (RSNWT 1988c E.7)
- Consolidation of the Environmental Rights Act RSNWT 1988 c83 2^{nd} Supp)
- Consolidation of Camp Sanitation Regulations
- Environmental Guideline for General Management of Hazardous Waste

3.0 LOCATION AND CONSTRUCTION OF FACILITIES

There are three packaged ROTORDISK® aerobic treatment plants installed at the Boston and Windy Lake exploration camps (one unit at Boston and two at Windy Lake). The three units are as follows:

- Boston
    a. 1 x Model S-40 ROTORDISK® aerobic treatment plant (28 m^3/day capacity)
- Windy
    a. 1 x Model S-40 ROTORDISK® aerobic treatment plant (28 m^3/day capacity);
    b. 1 x Model Clementine ROTORDISK® aerobic treatment plant (28 m^3/day capacity);

All three units are currently serviced (parts and technical support) by Seprotech Systems of Ottawa. All three units were shipped to site fully assembled.

It appears that the two Model S-40 units were initially shipped to BHP Minerals and set up at the Boston Camp. One unit was subsequently relocated by BHP Minerals to the Windy Camp. In 2004 MHBL purchased the Clementine unit and set it up at Windy Camp in 2007.

3.1 BOSTON CAMP WASTE WATER TREATMENT FACILITY

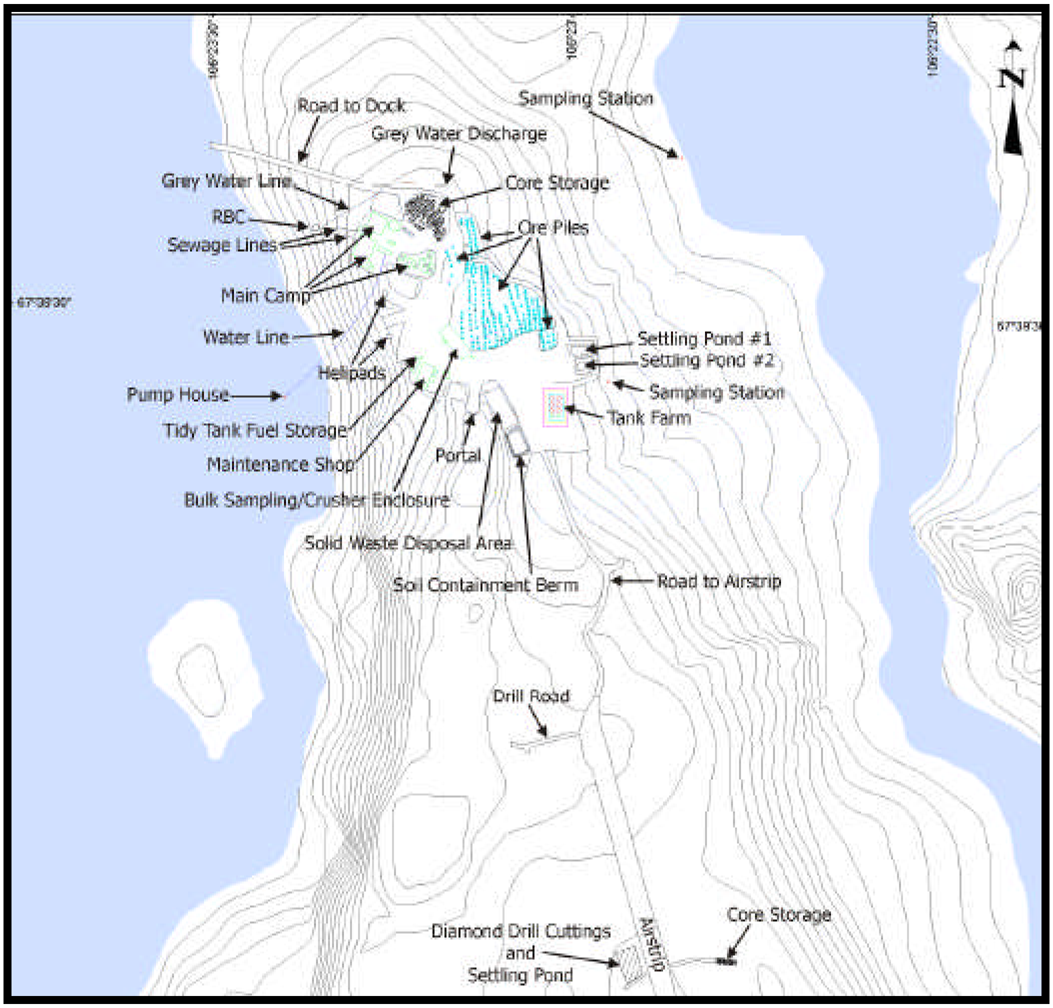
The sewage treatment facility at the Boston Camp consists of an S-40 ROTORDISK® Full Steel Packaged sewage treatment plant c/w 5,421 sq. ft. of combined bio-support media with a rated capacity of 28,000 litres/day.

The sewage treatment plant is located to the northwest and down slope of the camp near the shore of Spyder Lake as shown in Figure 3-1 and 3-2 and on the site map in Figure 3-3. The facility is set approximately 30 meters back from the lake and the discharge of treated effluent is onto the tundra towards the centre of the peninsula immediately to the north of the camp pad. The drainage from this point is towards Spyder Lake downstream of the camp.

Figure 3-1: Photograph of the Boston Advanced Exploration Camp – RBC is located in the middle left edge of the photo.

Figure 3-2: Aerial Photo of the Boston Camp – RBC and Associated Feed and Effluent Pipelines are shown in the lower left section of the photo

Figure 3-3: Site Map of the Boston Advanced Exploration Project Camp



3.2 WINDY LAKE CAMP WASTE WATER TREATMENT FACILITY

The sewage treatment facilities at the Windy Camp consist of two ROTORDISK® aerobic treatment plants that were brought to site fully assembled and subsequently installed in parallel.

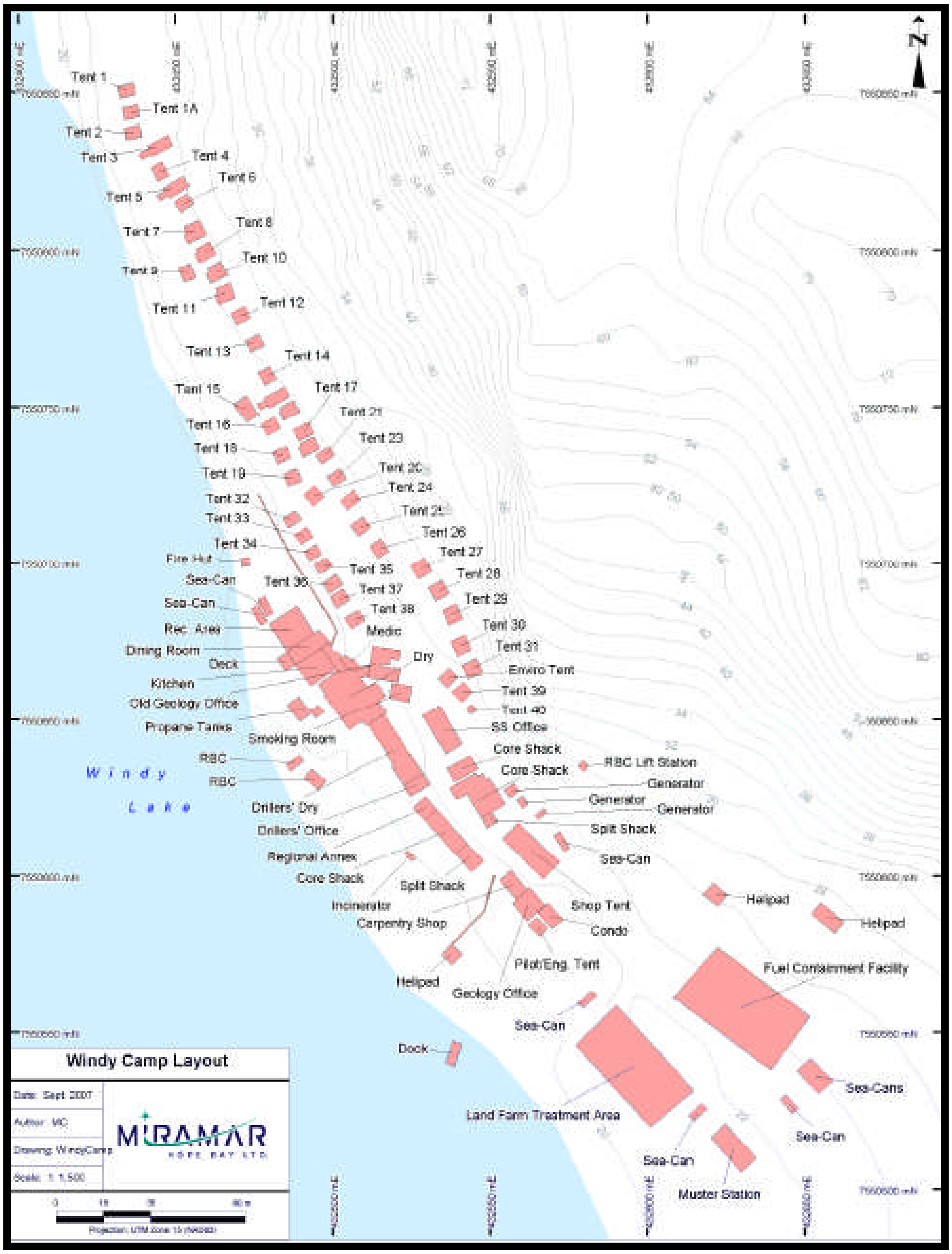
- 1 x Model S-40 ROTORDISK® aerobic treatment plant (28 m^3/day capacity);
- 1 x Model Clementine ROTORDISK® aerobic treatment plant (28 m^3/day capacity);

The two plants are located down slope of the camp on the shore of Windy Lake as shown in Figure 3-4, 3-5 and 3-6 (site map). The treated effluent is transferred to a lift station pump box located to the east of the camp. The treated effluent is then pumped over the ridge to the north east of the camp where it is land applied to the tundra. The drainage from the discharge area is to the north towards Windy Lake to the north of the camp (downstream of the camp).

Figure 3-4: Aerial View of the Windy Lake Exploration Camp – RBC Units are in the centre left on the right side of the small pond

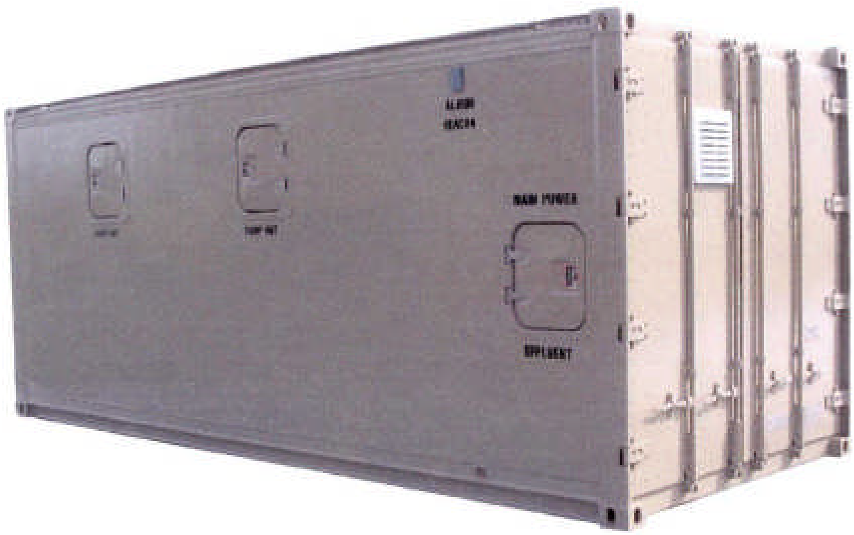
Figure 3-5: Photograph of the Two RBC units at the Windy Lake Camp

Figure 3-6: Site Map of the Windy Lake Exploration Camp showing Location of RBC Units and RBC Lift Station



The newer of the two packaged treatment plants (contained in a grey shipping container) is Model Clementine ROTORDISK® aerobic treatment plant supplied by Seprotech Systems Inc. in Ottawa (see Figure 3-7).

Figure 3-7: ROTORDISK® aerobic treatment plant supplied by Seprotech Systems



The older unit (green tank) is an S-40 ROTORDISK® Full Steel Packaged sewage treatment plants c/w 5,421 sq. ft. of combined bio-support media with a rated capacity of 28,000 litres/day.

4.0 WASTE WATER TREATMENT FACILITY OPERATION & MAINTENANCE

The waste water treatment facilities at both the Windy Lake and Boston exploration camps are aerobic sewage treatment plants. All three units (one at Boston and two at Windy Lake) are high-efficiency packaged sewage treatment plants that use the process of rotating biological contactors (RBCs) to remove pollutants from wastewater. This process utilizes a fixed growth bacteria process, whereby bacteria are grown on a media surface that is rotated into and out of the wastewater. The treated wastewater flows through four zones, each with a progressively higher standard of treatment.

4.1 Summary of Operation

The sewage treatment plant is comprised of the primary settlement tank, the RBC tank and the secondary tank (see general arrangement in Figure 4-1).

The RBC tank is the aerobic section of the treatment plant divided into four stages (see Plan View in Figure 4-2). Raw sewage gravity flows into the primary settlement tank. Settling separates heavy solids and the supernatant enters the aerobic section through the inlet slot located at the front section of the RBC tank.

The aerobic section is made up of four stages. The 1st stage is mounted on one common shaft. The first stage is comprised of one or two disk banks, representing 40% of the surface area of the RBC. The normal colour of the bacteria in the first stage is dark brown. This is the stage where most of the BOD reduction occurs. The succeeding second, third and fourth stages are mounted on the rest of the shaft or another common shaft. Each stage has one disk bank each. It is the second stage that further BOD is reduced, and that nitrifying bacteria start to predominate in the third and fourth stages. The fourth disk bank or last stage has recycle buckets that introduce both fresh dissolved oxygen into the primary settlement tank and nitrifying bacteria present in the recycled water.

Partially treated water from the RBC now enters the secondary settling tank. Sloughed off biomass from the disks and other suspended solids is further settled in this chamber. A scum weir prevents the floating scum from leaving the chamber through the effluent pipe

<u>Routine Visual Checks on RBC</u>
ROTORDISK® sewage treatment plants have three major steps in the purification process. In the primary settlement chamber, gross solids separate from the flow by either sinking or floating. In the Rotorzone, dissolved pollutants are broken down to simple, non-pollutive compounds by the biological growth (biomass) which grows on the rotating disks. The final settlement chamber permits gravity separation of spent biological growth, which continually sloughs off the disks in the Rotorzone preceding it.

Figure 4-1: General Arrangement of Sewage Treatment Plants in Use at the Boston and Windy Lake Camps

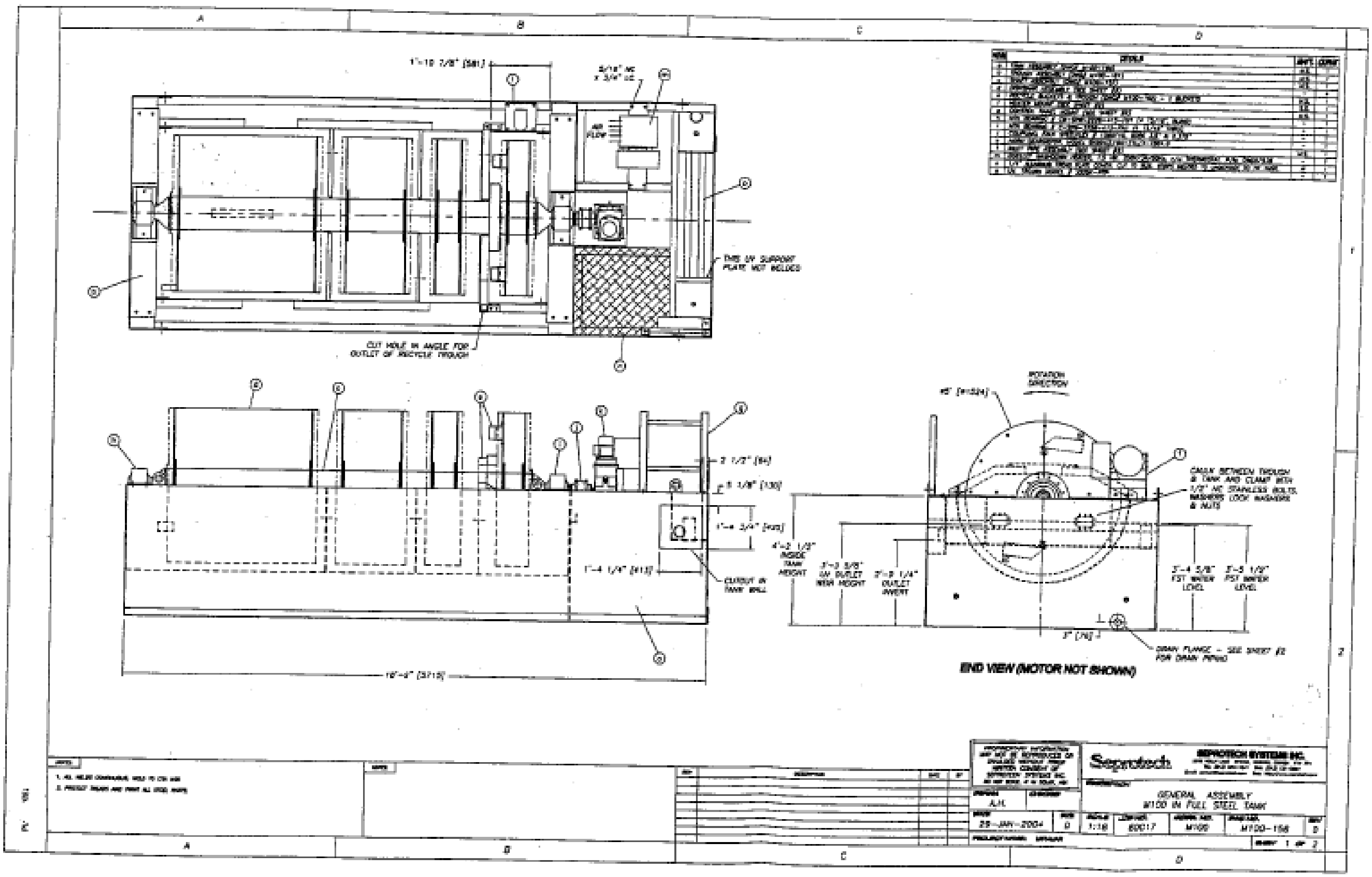
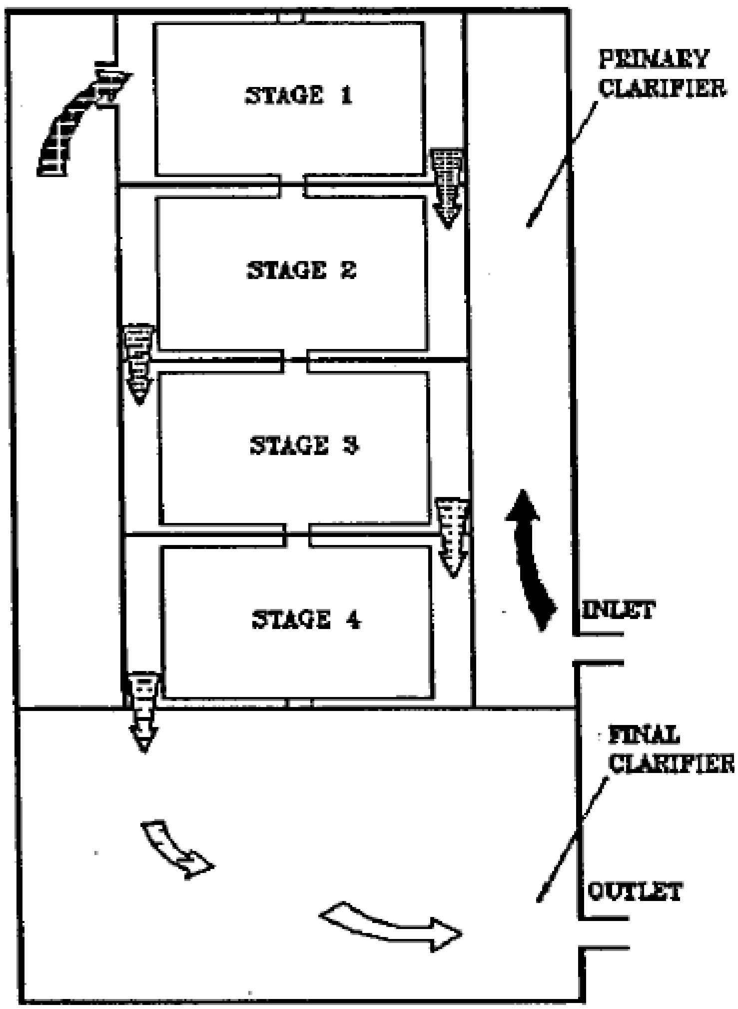


Figure 4-2: Schematic Plan View of a ROTORDISK® sewage treatment plant



Primary Settlement Chamber (Primary Clarifier)

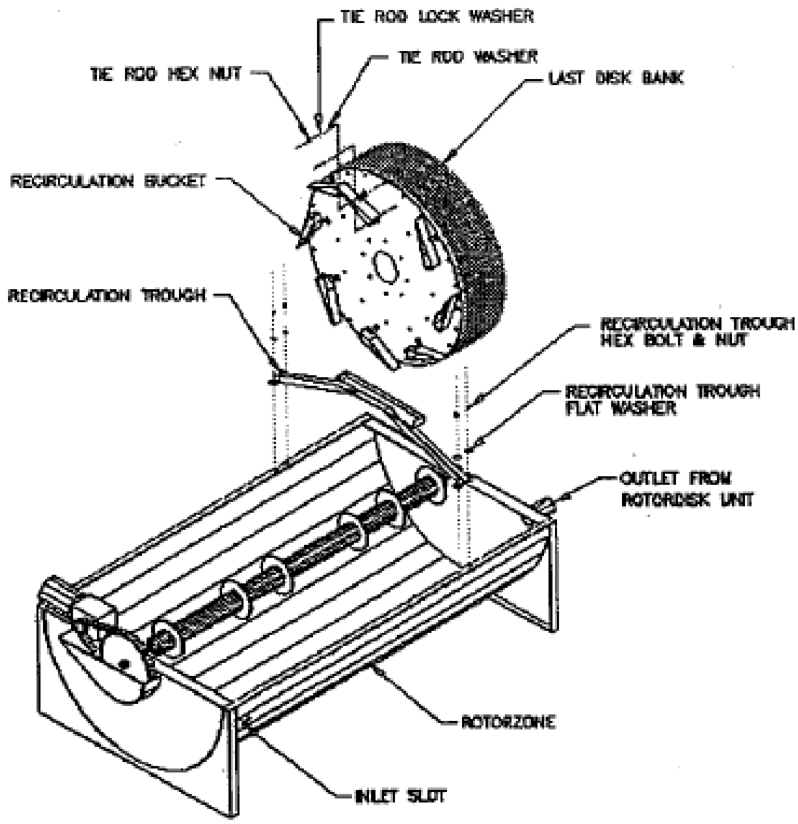
The accumulation of floating scum on the surface of the primary clarifier is normal. It is proportional to the accumulation of settle-able solids at the bottom of the tank. Periodic removal of sludge (9 to 12 month intervals) at the bottom of the tank is required for proper operation of the unit.

If no sludge measuring device is available, the accumulation of 9" to 12" depth of scum on the surface is a good indication that it is time to remove the accumulated deposits of sludge from the bottom of the tank(s).

Rotorzone

The Rotorzone is subdivided into four sections, with a bank of disks in each (see Figure 4-3). The waste water first enters the Rotorzone in the section marked "1" in Figure 4-1 (furthest away from the inlet to the plant). The flow then proceeds through section 2, 3 and 4 before entering the final settlement chamber.

Figure 4-3: Schematic Exploded View of the RBC Rotorzone



The accumulations of biological growth will be greatest in section 1, and gradually decrease through subsequent sections. Generally the growth will be thick, and often filamentous (stringy) in section 1, becoming thinner and more compact through sections 2 – 4.

The colour of the growth will typically be dark brown to black in section 1. Some grey growth may also be noticed, depending on the relative load and type of waste water being treated. Growth in sections 2 – 4 will typically vary from medium brown to a light brown or tan growth in section 4.

In a well functioning unit with the appropriate feed of waste water, there will be an earthy, humus-like (musty) smell inside the unit. A substantial sour, “sewage” smell may be an indication of sub-optimal conditions in the treatment process.

Final Settlement Chamber (Final “Clarifier”)

The effluent near the outlet at the backside of the final clarifier should be relatively clear and colourless and relatively free of suspended matter. Clarity can best be judged by scooping a small volume of the final effluent into a clear glass container. This is particularly true of larger units where the depth and dark colour of the tank walls may make clarity hard to determine. (Note: Although the risk of infection is very small, the wearing of rubber gloves is a rational safety precaution when hand scooping the effluent for a clarity check. This is particularly true if there are open cuts on the hands.)

Although the final effluent itself should be relatively clear, some floating matter may accumulate on the surface of the final clarifier. This is normal, and will typically be much less than the accumulation of floating scum in the primary clarifier.

"Bathtub Ring"

The flow of waste water within a ROTORDISK® plant is strictly by gravity and the water level relatively constant. Changes in water level of 1" to 2" are not unusual due to surge flows entering the unit. The evidence of this is a "bathtub ring" 1" – 2" above the normal level. A "bathtub ring" higher than this suggests that partial or complete flooding of the unit has occurred since the last check. If so, the (gravity or pump) discharge system should be checked for blockages or mechanical malfunction.

Frequency of Inspection

The waste water treatment facilities should be visually inspected every day using a daily a daily visual and audible (look and listen) walk through.

4.2 Sludge Removal Procedures

A design feature of ROTORDISK®, which contributes greatly to overall simplicity of the process, is the sizing of clarifiers to accommodate static internal sludge storage for extended periods. Depending on such factors as raw waste water solids concentrations, and design organic loading in a given application, maximum sludge storage levels will typically be reached in 6 – 9 months of operation.

This period is based on Seprotech's calculated rates of initial decomposition of raw and biological solids, and, upon operating experience, indicating the degree of auto-digestion/compacting, which proceeds during the storage period. The 6-9 month period will be shortened to the extent that design hydraulic and waste loads are exceeded. It will be lengthened to the extent that flows ad waste load are less than those designed for.

Determination of Accumulated Sludge Volumes

The accumulation of maximum storage capacities can be indirectly monitored through visual observation of the thickness of the scum blanket on the surface of the primary clarifier. When the scum blanket has matured to a height of approximately 7" to 10", this is a good indication that sludge accumulations at the bottom of both clarifiers are at or near maximum levels, and that sludge withdrawal is indicated.

The sludge is not a firm solid substance making direct measurement of the sludge volume difficult. Domestic waste water sludge is mostly trapped water and other liquids. The settled sludge is far more liquid than the surface scum, which is a perhaps 30% to 40% solid by volume. A variety of sludge measuring devices are commercially available. The two most common are the weighted hollow tube type, and the (electronic) turbidity change detector type. The former is less costly, relatively easy to use, and more appropriate because of the low frequency with which sludge measurements need to be made.

Irrespective of the type of device used, sludge levels should be measured at several locations in each settlement tank to ensure a reasonably accurate calculation of accumulated volumes. This is required since sludge accumulation levels are not uniform; being highest at the inlet ends of both clarifiers, and, below the slot at the bottom of the first section of the Rotorzone trough.

Once an average sludge height has been determined, multiply by the surface area of the clarifier in question to determine the existing volume of stored sludge. Compare to maximum design capacity listed on the general arrangement drawing. If the accumulated levels equal or exceed design values, it is time to remove the sludge from the unit.

At both the Boston and Windy camps sludge volumes should be checked at a two month interval as a minimum. The sludge volumes measured should be recorded in an operating log for the waste water treatment facility.

Sludge Removal

In accessible southern locations a pump-out truck of the same type that pumps out septic tanks normally does the sludge removal. However the remote location of the Boston and Windy Lake exploration camps makes this approach problematic. Consequently the sludge accumulations in the smaller ROTORDISK® units used at the Boston and Windy Lake camps are typically removed prior to the annual camp shut down (typically late Fall before winter). This represents an annual operating season of approximately 6 months out of each year. The procedure used is as follows:

- During the annual shut down the site crew starts washing down the RBC units three days in advance of the final shutdown to wash the greywater and sewage through the four sections of the plant;
- Once this three days of flushing are complete then all waste water sources are shut down to facilitate the clean out process;
- The liquid content of the treatment plant is withdrawn by pumping out the liquid to expose the sludge. This process starts by pumping out the supernatant from the primary settlement tank until the sludge begins to show up. The supernatant is pumped into section one of the Rotorzone. The pumping of supernatant is then halted;
- The sludge is then pumped into 205 litre drums which are set on pallets for latter ease of movement by fork equipped mobile equipment. The sludge pumping suction hose should be placed down at a multiple number of points to help ensure complete removal of accumulated sludge deposits;
- Once the primary settlement tank is emptied the pumping of sludge is halted;
- The liquid content of section one of the Rotorzone is withdrawn by pumping out the liquid to expose the sludge. The supernatant from section 1 is pumped into section 2 of the Rotorzone until the sludge is exposed. The pumping of supernatant is then halted;
- The sludge is then pumped from section 1 into 205 litre drums. Once the section 1 tank is emptied the pumping of sludge is halted;
- The process is then repeated for sections 2, 3 and 4 and for the final settlement chamber.

Typically this sludge clean out occurs at the end of the exploration season (October) which then facilitates shut down and winterization of the plant until the start of the next years exploration season (typically February. If sludge clean out is occurring outside of the end of season shutdown of the camp, it should be noted that the biological growth on the disks should not be washed off, but left in place. The exception to this is if the disks have accumulated excess biomass due to sludge pump out being delayed past the indicated intervals.

Sludge Disposal

For the Boston Advanced Exploration Project, Part D Item 12 of the Water License (2BB-BOS0712) states: "The licensee shall dispose of sludge removed from the Sewage Disposal Facility in a sump located a minimum of thirty (30) meters from the normal high water mark and such that they do not enter any water body".

In the same license Part D Item 13 and 14 states:

13) "If a Licensee contemplates the disposal and treatment of sludge on land, it shall submit to the Board for approval at least (4) four months prior to the disposal of Sludge a proposal which shall address, but not limited to:

a. Location of disposal area;
b. Quantities and composition of sludge;
c. Mitigation measures to control run-off and restrict access;
d. A program for water quality monitoring;
e. An implementation schedule; and
f. An executive summary of the proposal in English and Inuktitut.

14) The Licensee shall implement the proposal specified in this Part as and when approved by the Board."

In the absence of an approved sludge disposal system at the Boston camp, all sludge is to be placed into drums, sealed and held in storage pending an alternative approved sludge disposal method.

For the Hope Bay Regional Exploration Project (Windy Lake camp), Part D Item 11 of the Water License (2BE-HOP0712) states:

11) The Licensee shall collect as required all sludges generated by the ROTORDISK® in 45 gallon drums and transport to the Boston Camp for proper disposal unless otherwise approved by the Board."

Part D, Item 12 and 13 states:

13) "The Licensee shall provide to the Board for approval, at least (4) four months prior to any alternative means of sludge disposal, a proposal which shall address, but not limited to:

a. Location of disposal area;

b. Quantities and composition of sludge;
c. Mitigation measures to control run-off and restrict access;
d. A program for water quality monitoring;
e. An implementation schedule;
f. An executive summary of the proposal in English and Inuktitut.

14) The Licensee shall implement the proposal specified in this Part as and when approved by the Board."

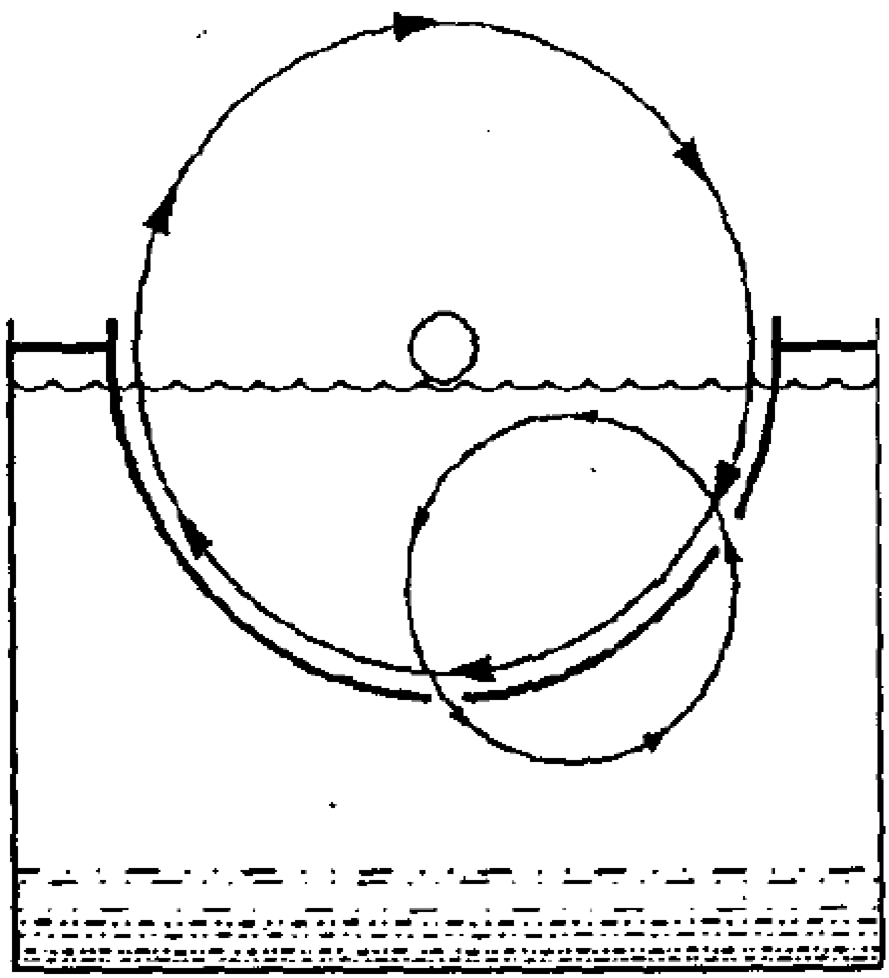
In the absence of an approved alternate sludge disposal system at the Windy Lake camp, all sludge is to be placed into drums, sealed and transported to Boston Camp to be held in storage pending an alternative approved sludge disposal method.

4.3 Potential Consequences of Operating Past Designated Maximum Sludge Storage Levels

Sludge accumulations should be removed once they reach indicated maximum storage levels, because failure to do so could result in lowered treatment efficiency, and possibly cause serious damage to the structure of the rotating assembly and drive unit. The potential for problems is as described below:

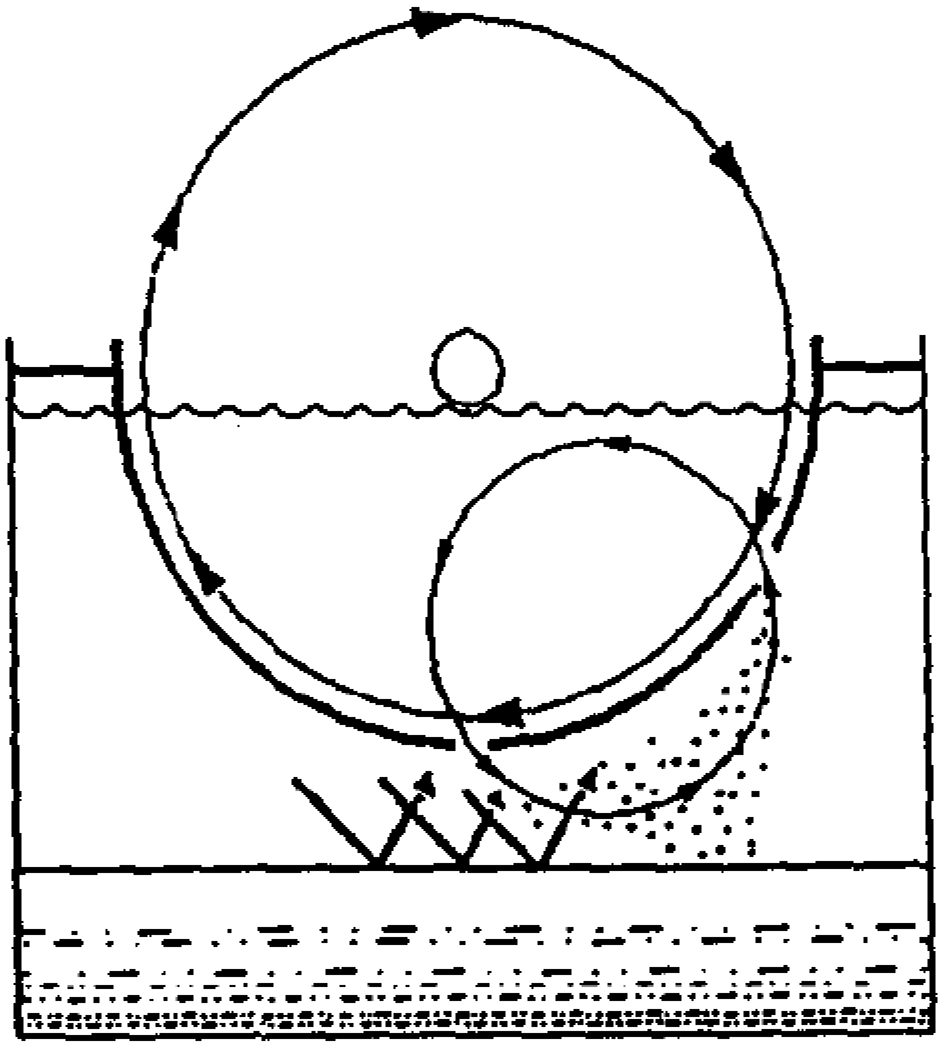
Figure 4-4 shows a unit operating with a sludge build up at or near maximum storage levels. This will cause no problem since the storage heights are designated so that flows through the primary clarifier will not disturb the sludge layer. Characteristics of waste water reaching the Rotorzone at this time (and since start up) will be in the range of 100-200 mg/L BOD and 50-250 mg/L suspended solids. The supporting structure of the rotating assembly is over designed for the amount of biological build-up which will occur on the disks under this operating condition, and the shear force of the rotation through the trough water will limit the thickness of growth.

Figure 4-4: Unit operating at maximum sludge storage levels. Neither influent flows, nor re-circulating flows, disturb sludge blanket



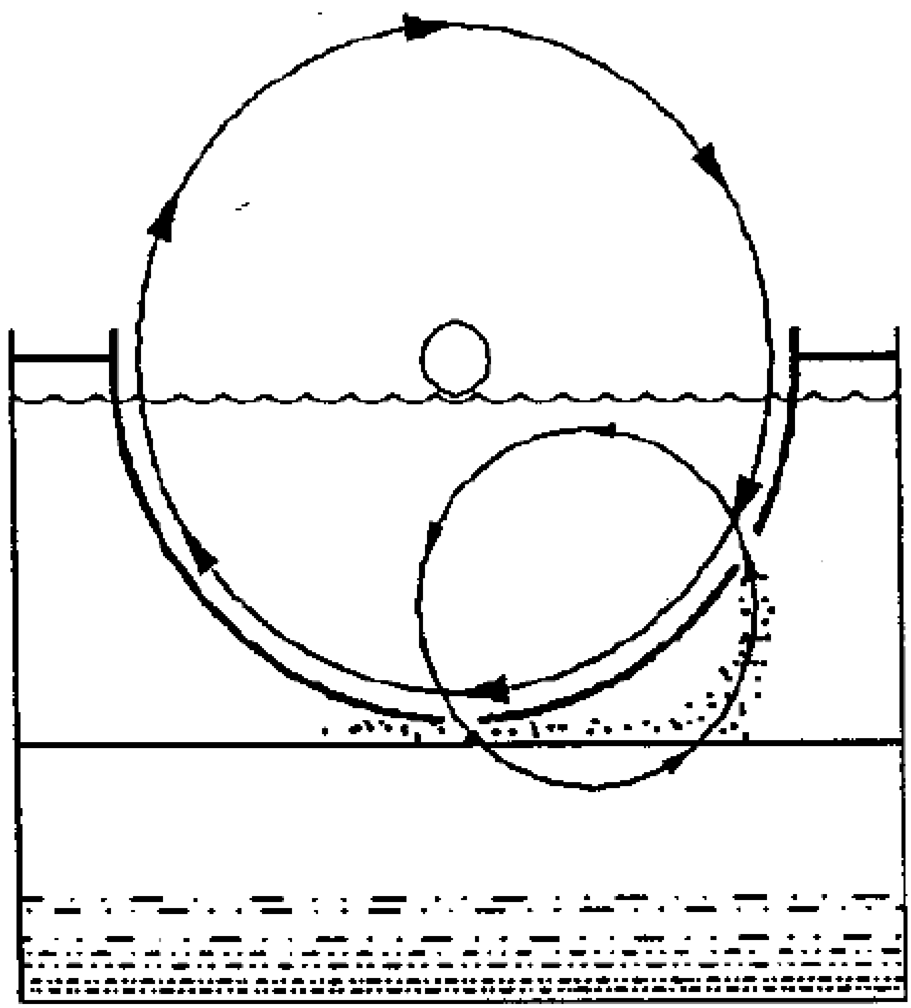
However, if sludge is allowed to accumulate past designated storage heights, flow through the primary clarifier will begin to disturb the sludge blanket, and thus carry loads of solids and dissolved organic matter into the Rotorzone which are not anticipated in the design of the unit (see Figure 4-5). The pollutant load reaching the biomass on the first stage of disks will overload that biomass (in terms of F:M ratio), and force a change in its activity and growth. The biomass becomes more gelatinous, and does not shear off as well with disk rotation. Additionally, the biomass will readily adsorb and entrap the extra solids with the sum effect being an increase in weight on the rotating assembly that considerably exceeds that which its design is based on.

Figure 4-5: Unit operating with excess accumulations of sludge. Influent flows may disturb sludge blanket and increase BOD and solids loads to Rotorzone to levels above treatment design



This tendency reaches its extreme if sludge is allowed to accumulate to the point where it will be disturbed by, and caught up in, the recirculation pattern created by the two slots in the trough on the first section of the Rotorzone (see Figure 4-6).

Figure 4-6: Unit operating with excess sludge accumulated to base of Rotorzone. Both influent flows and re-circulation flows will disturb and carry sludge solids. Increase in BOD and solids loads entering Rotorzone will be substantially above design treatment levels, increase accumulated masses on rotating assembly, produce potential for damage to structure and drive unit



The sludge will have characteristics in the order of 20,000 mg/L total suspended solids and 10,000 mg/L BOD, so it is obvious that even a minor amount of this material caught up in the re-circulation flow will significantly increase the concentration of the waste stream entering the Rotorzone. If, for example, the sludge was caught up in the recycle flow at a ratio of as little as 1:10 or 1:15, the resulting concentration would be sufficient to produce considerable first-stage overload on an amount of disk area selected as compared to normal concentrations.

The resulting build-up of poorly-shearing gelatinous biomass and trapped solids would pose a serious potential for strain on the drive unit, and for structural damage to disk band assemblies and shaft, in spite of these being considerably over designed for loads anticipated in normal operation.

Clearly these potential problems should be avoided by the removal of sludge once they reach the levels specified as maximum for the ROTORDISK® unit in question.

4.4 Start Up Procedures for Waste Water Treatment Facilities

The ROTORDISK® sewage treatment plant is based on a fixed film treatment process referred to as the Rotating Biological Contactor (RBC). In this process, micro-organisms or bugs are attached and grown on the surface of a media, the quantity of bugs being directly proportional to the amount of food in the waste water. When starting up a system (either new or after a winter shutdown), it will normally take about two weeks to get organic removal from the waste water and three to four weeks to establish the nitrification process at normal domestic sewage temperatures.

Under Part D, Item 16 of the Boston Advanced Exploration Project Water License (2BB-BOS0712) MHBL is required to give advance notice of the planned start up of the sewage treatment plant, specifically as follows:

> 16) The Licensee shall, for initial seasonal commissioning of the camp, notify an Inspector at least ten (10) days prior to start-up of the Sewage Disposal Facility and subsequent discharge from the facility

The Hope Bay Regional Exploration Project (Windy Camp) Water License (2BE-HOP0712) does not contain a similar requirement however it is MHBL intent to provide the same 10 day advance notice of the planned start up of the sewage treatment plant at Windy Camp.

The primary sedimentation tank and RBC of the system should, preferably, be filled with fresh water before admitting waste water to the system. A flow less than design is not a problem. The biomass will develop themselves on the media. If there is a small flow only a portion of the disk will have biomass. As the flow increases the amount of biomass will increase.

Seeding a ROTORDISK® sewage treatment plant with activated sludge (sludge from the previous season's operation), although not required, can be one way of building biomass more quickly at the start of a season. The activated sludge should be at the same temperature as the influent. Sudden change in waste water temperature has caused biomass sloughing at other plants. In most cases the use of domestic waste as a seed culture has provided the required biomass for continuous operation. When seeding the ROTORDISK® sewage treatment plant with activated sludge, the primary sedimentation tank and RBC of the system should first be filled with fresh water (preferably) and the activated sludge added to the RBC. The RBC should be rotating at all times. The waste water introduced to the tank needs to have only 20% of the disks covered with waste water. This provides the needed wetting and time to reach normal operating levels when source flow is introduced. The final clarifier does not need to be filled before start-up.

The preferred start-up is the introduction of source waste water at design or less than design loading. The disks need to be rotating at all times. When the disks are rotating and waste water is introduced the biomass will develop and the pollutants will be removed.

Seprotech reports that studies have shown that the natural start-up time for a ROTORDISK® sewage treatment plant without seeding is 2.5 to 3 weeks (normal temperatures and BOD reduction only), and that it has already developed sufficient biomass for 50% removals in only 1 week.

At both the Boston and Windy Lake exploration camps the sewage treatment plants are checked on a daily basis by the site operational crew. The bearings require frequent greasing. Each of the three RBC units is equipped with an alarm indicator light located on the exterior of the plant. This light will illuminate whenever a fault is detected by the RBC electronics to indicate to the operator that attention is required. These alarm lights are inspected frequently by the site operational crew.

4.5 Erosion Protection at Discharge point

Under the Water License for both the Boston and Windy Camps the discharge from the sewage treatment plant must be in a manner to minimize surface erosion at the discharge point. Specifically the licenses address this as follows:

Boston Advance Exploration Project – Water License 2BB-BOS0712 – Part D, Item 19

> 19) The Licensee shall discharge waste in such a manner to minimize surface erosion.

Hope Bay Regional Exploration Project – Water License 2BE-HOP0712 – Part D, Item 9

> 9) The Licensee shall discharge the effluent in Part D, Item 8 in such a manner to prevent surface erosion

To comply, erosion protection should be provided at the discharge point of the treated waste water onto the tundra or a diffuser system used to reduce the discharge energy to the point where erosion is prevented. Erosion protection can consist of a rock outcrop, a bed of armour rock placed at the discharge or a timber mat set to reduce the energy at the point of discharge onto the tundra.

4.6 Trouble Shooting Guide

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
1. Slime on media appears shaggy with a brown colour	PROPER OPERATION	NO PROBLEM NORMAL CONDITION
2. Black slime growing on disks	Solids and/or BOD overloading	a. Pre-aerate RBC influent b. For severe organic overloads, increase recycle rate c. De-sludge unit d. Place another RBC unit in parallel
3. Rotten egg or other obnoxious odors	Solids or BOD overloading	See Problem 2, solutions a, b, c and d, above
4. Development of odors and white biomass over most of the media surface	1. Septic influent wastewater or high hydrogen sulfide or sulfate concentration	e. Determine the cause of the problem and correct it at source. For example, aerate equalization tank f. Pre-aerate influent wastewater g. Determine the cause of the problem, possibly with the addition of chlorine or hydrogen peroxide; potassium permanganate has also been used
	2. Overload first stage	a. Check dissolved oxygen levels to confirm overload problem b. Provide a larger amount of surface area for the first stage treatment by removing baffle c. Increase number of recycle buckets
5. White slime	1. Bacteria that feed on sulfur compounds. Also, industrial discharges containing sulfur compounds may cause an overload	▪ See Problem 2, solutions a, b, and c above
	2. Grease on the disks	a. Remove grease at source b. Install grease traps
6. Sloughing or loss of slime (biomass)	1. Toxic or inhibitory substances in influent, including abrupt pH changes	a. Eliminate source of toxic or inhibitory substances b. Reduce peaks of toxic or inhibitory substances by carefully regulating inflow to plant c. Dilute influent using plant effluent or any other source of water d. See Problem 7.4
	2. Variation in flow or organic loading	a. - During low flow or loading periods, pump from secondary clarifier or 4th stage RBC unit effluent to recycle water with food and dissolved oxygen through the RBC unit b. - During high flow or loading conditions, attempt to throttle plant inflow during peak periods c. - For severe organic overloads, remove bulkhead or baffle between stages 1 and 2

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
7. Decrease in process efficiency	1. Reduced wastewater temperature	a. Decrease air opening in RBC building b. Heat air inside RBC unit cover or building
	2. Unusual variations in flow or organic loading	▪ See Problem 6, cause 2, solutions a, b, and c above
	3. Sustained flows or loads above design levels	▪ Install additional treatment units
	4. High or low pH values	▪ Adjust pH to near neutral
	5. Improper rotation of media	▪ Inspect chain tension and adjust
8. Accumulation of solids and clogging in the RBC system	Solids removal in pre-treatment steps is not adequate	a. Improve pre-treatment efficiencies b. Provide supplemental aeration to help prevent solids from settling c. Move baffles to change flow patterns to reduce settling (if the problem is serious, the RBC wastewater tank may have to be pumped or cleaned out) d. De-sludge primary tank
9. Floating or rising sludge in the secondary clarifier	Removal of sludge from the clarifier is inadequate	a. Increase the duration of pumping sludge from the clarifier b. Remove sludge from the clarifier more often
10. Excess shaft weight or biomass thickness	1. Organic loading too high	▪ Decrease organic loading
	2. Stage loading too high	a. Remove baffles between units to increase size of treatment stages b. Increase number of recycle buckets
	3. Shaft speed too low	▪ Increase the shaft rotational speed by adjusting drive ratio
	4. Inorganic solids accumulation because of inadequate pre-treatment	▪ Check primary treatment and grit removal equipment for proper operation
	5. Accumulation of minerals	▪ Use chemical pre-treatment to eliminate minerals
	6. Digester supernatant adding excessive BOD or sulfides	▪ Modify supernatant pumping frequency
11. Shaft rotation non-uniform or "jerky"	1. Normal variations in balance	▪ Time rotation by quarters. A difference of less than 3 seconds in quarter rotation time is normal
	2. Uneven biomass weight due to power outage	a. If severe, shut unit down and wash down disks b. Turn off the unit temporarily and rotate manually to uniformly wet biomass growth before restarting c. Decrease or stop flow of wastewater to affected units d. contact manufacturer for assistance

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
12. Effluent quality apparently below requirements	1. Organic loading too high	a. Add additional operating RBCs b. Identify cause of additional loading and eliminate at source c. Add supplemental air to RBC trough
	2. Sampling or testing procedures inaccurate	a. In nitrification is occurring, analyze for carbon BOD only by using nitrification inhibitor b. Check for contaminated dilution water, sampler lines, or improper sampling storage
	3. Inadequate secondary clarifier operation	a. Clean and de-sludge clarifier b. Modify sludge removal procedures to eliminate BOD kickback c. Install BUGS filter after clarifier
	4. Anaerobic solids in the RBC tanks producing BOD kickback	* Flush or drain tanks
13. Snails or other nuisance organisms in RBC tanks	Nutritional and conducive environment for reproduction of hard-bodied shell snails ($^1/_8$" - $^1/_2$" in size)	a. Addition of controlled dosages of chlorine. Physical removal may be required with taking units out of service temporarily b. Contact manufacturer

4.7 Recommended Do's and Don'ts

Do's and Don'ts

DO'S

1. Do use biodegradable soap if at all possible. The system will however handle a certain amount of normal soap. When laundering clothes, please follow manufacturer's instructions regarding quantity of detergent. Excessive use of detergent can cause odour in the system.

2. Do put large amounts of grease in a container and dump in garbage. The system will handle a certain amount of fat and grease. If fats and grease get into the tile bed, they may plug the pores of the soil and seal up the bed. Never put large amounts of grease (i.e. old grease from deep fryer) into the sewer lines.

3. Have your system pumped out a minimum of once a year to remove sludge and scum to maintain top operating treatment in your system and filter bed.

4. Do keep service hatch above ground. Do not let run-off water enter system, as this will cause hydraulic overload.

5. Do keep traffic such as cars, snowmobiles, etc., from around the system bed areas as they will break pipes and seal the soil over the bed.

6. Do leave the raised filter in place without disturbing it. The filter is specifically designed to provide maximum dispersal of the water. Altering it by adding fill, covering it up or changing in any way may destroy its water dispersal characteristics and result in bed failure.

7. Do encourage a growth of ground cover over the filter bed as it helps disperse water by evaporation and transpiration.

DONTs

1. Do not put non-biodegradable materials downs the drain, put them in the garbage, these include any plastics, rubber, disposable diapers, sanitary napkins, rubber goods, cigarettes, children's toys, cellophane, etc. They will plug the system, and a pump out will be needed.

2. Do not put harsh chemicals down the drain. They will kill the bacteria necessary for efficient treatment. These include acid or caustic cleaners, gasoline, oil, turpentine, photographic chemicals, etc. Disinfectant and chlorine bleaches should be kept to domestic uses.

3. Do not leave taps running or faulty toilets. The excess water may overload the system and tile field causing breakout and poor treatment.

4. Do not attempt to fix the mechanical parts yourself. Your dealer is trained to repair your plant and work safely with electrical and mechanical components. Call him if you have a problem or concerns.

5. Do not connect any other electrical load to the fuse or breaker feeding the plant as it will cause damage to the controls.

6. Never put large amounts of grease (i.e. old grease from deep fryer) into the sewer lines.

YOUR CO-OPERATION WITH RESPECT TO THE ABOVE POINTS SHOULD ENSURE TROUBLE-FREE OPERATION OF YOUR TREATMENT PLANT AND WILL BE GREATLY APPRECIATED.

4.8 Maintenance Recommendations

Regular maintenance schedules should be allowed for all chain drives. Each drive should be inspected every six months. At each inspection period the following points should be checked:

- Check lubrication – If chain is covered with grit or chips, it should be cleaned in kerosene and re-lubricated before re-installing. With bath lubrication, oil should be maintained at the proper level, as shown in the manufacturer's lubrication instructions. Add oil if necessary. At each inspection oil should be checked for contamination, such as chips, dirt or grit.
- Check sprocket alignment – If the chain is properly aligned, no wear will show on the inner surfaces of the chain roller link-plates. If wear is apparent, this is evidence that sprockets are misaligned and should be realigned as outlined in the manufacturer's installation instructions to prevent further chain and sprocket wear.
- Check sprocket tooth wear – If sprocket shows evidence of wear high on the sprocket teeth, this is evidence of excessive wear in the chain; the chain should be replaced. If the sprocket teeth are severely worn, the sprocket should be replaced. Do not run a new chain on a worn sprocket.

- Check chain tension – At each inspection period, the chain tension should be adjusted. If excessive slack has accumulated which cannot be removed by available shaft centre adjustment (i.e. by moving reducer away from large sprocket using tensioning bolts), two or more chain links should be removed and the chain reconnected.

Motor

If motor is equipped with grease fittings and relief plugs, it should be re-lubricated using a low pressure lubrication hand pump once a year. (Do Not Over Lubricate). There is no lubrication required for motors without grease fittings and relief plugs.

Reducer

The reduction gear on ROTORDISK® units is filled with synthetic long life lubricant. No inspection or maintenance outside of periodic visual inspection is normally required. There should be no evidence of oil leaks on the seals. The synthetic lubricant in the reduction gear should be changed every five years for a unit running 24 hours per day.

Mechanical Trouble Shooting

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Noisy chain	1. Loose chain 2. Faulty lubrication 3. Misalignment 4. Worn Parts 5. Moving parts rubbing stationary parts	1. Tighten chain 2. Lubricate properly 3. Correct sprocket alignment 4. Replace worn chain 5. Align & tighten chain to clear oil bath
Rapid wear on chain	1. Faulty lubrication 2. Loose or misalign parts	1. Lubricate properly 2. Align & tighten entire drive
Chain climbing sprockets	1. Worn out chain and sprockets 2. Loose chain	1. Replace worn out parts 2. Tighten chain
Stiff chain	1. Misalignment 2. Worn out chain or sprockets 3. Faulty lubrication 4. Rust corrosion	1. Correct alignment 2. Replace worn out parts 3. Lubricate properly 4. Clean and lubricate
Noisy Bearing	Rollers or bearings damaged	Replace bearing cartridge
Bearing grease discoloured or mixed with water	Insufficient grease in the bearings	Purge bearing with grease and increase lubrication interval
Hot bearing	1. Improper lubrication 2. Rollers or bearing race damaged	1. Purge bearing with grease and decrease lubrication interval 2. Replace bearing cartridge
Reducer temperature rises above 200 degrees Fahrenheit.	Oil level too high or too low	Maintain proper oil level
Oil leakage from reducer	1. Oil seals need to be replaced 2. Ventilators/breather plugged causing pressure build-up inside the reducer. 3. Oil level too high	1. Replace oil seals 2. Clean Ventilators 3. Correct oil level
Noisy reducer	1. Bearing failure 2. Misalignment in worm gear inside 3. Coupling between motor and reducer worn out and misalign	1. Check bearings and replace if necessary 2. Align worm gear shafts. 3. Replace coupling between motor and reducer. Align coupling hub vertically
Noisy Motor	Bearing damage	Replace damaged bearings
Motor overheating	1. Reducer overheating 2. Cooling fins on motor are clogged 3. Overload 4. Rotor rubbing on stator 5. Over greasing or lubrication	1. Check reducer 2. Clean fins 3. Check for excess friction or imbalance 4. Replace bearings 5. Avoid packing grease too tightly
Motor won't start	1. Power trouble 2. Single phasing at station 3. Fuse blown	1. Check source of power supply 2. Do not try to make it go and "fry" motor. Check starter windings 3. Replace fuse
Knocking/rumbling on motor bearings	1. Bearing worn due to lack of lubrication or excessive mechanical overload 2. bearings slack in housing	1. Replace baring and put new grease of recommended grade. 2. Fir new end shields
Rotordisk® shaft	1. Power failure 2. Motor failure 3. Reducer failure 4. chain drive failure	1. Check power supply 2. Check and replace motor and bearings. 3. Check teeth worn gears and bearings. Replace necessary parts 4. Replace chain

5.0 PERFORMANCE AND ENVIRONMENTAL MONITORING PROGRAM

MHBL will implement a monitoring program around the Waste Water Treatment Facility as required under the Boston Advanced Exploration Project and the Hope Bay Regional water licenses.

The objective is to measure the performance of the waste water treatment facilities, ensure that treated water from the Waste Water Treatment Facility meets the appropriate discharge standards and assess water quality in the receiving water environment.

The water license referenced above set a discharge standard that must be met as follows:

<u>Boston Camp – Water License 2BB-BOS0712 Part D Item 17</u>
All Sewage discharged from the Sewage Disposal Facility at Monitoring Station BOS-3 shall not exceed the following quality standards:

Parameter	**Maximum Average Concentration**
BOD_5	80 mg/L
Total Suspended Solids	100 mg/L
Faecal Coliform	10,000 CFU/100 mL
Oil and Grease	No visible sheen
pH	Between 6.0 and 9.5

Monitoring Station BOS-3 (formerly 1652-3) is defined as the Sewage Disposal Facility final discharge.

<u>Windy Camp – Walter License 2BE-HOP0712 Part D Item 10</u>
All effluent being discharged from the WWTF, monitoring station HOP-2 shall meet the following effluent quality standards:

Parameter	**Maximum Average Concentration**
BOD_5	80 mg/L
Total Suspended Solids	100 mg/L
Faecal Coliform	10×10^4 CFU/100 mL (100,000 CFU/100 mL)
Oil and Grease	No visible sheen
pH	Between 6.0 and 9.5

Monitoring Station HOP-2 is defined as the WWTF effluent discharge at the surge tank prior to being pumped over the ridge east of the Windy Camp facilities.

The monitoring program is broken down as follows:

5.1 Boston Advanced Exploration Camp

The water license requires the following water quality monitoring:

1. Monthly samples are to be taken during periods of discharge from the sewage treatment plant (i.e. monthly in the months when the sewage treatment plant is in operation) to be taken from the following two sampling points:

- Sample Station BOS-3 (formerly SNP station 1652-3) Sewage Treatment Plant final discharge; and
- Sample Station BOS-4 (formerly SNP station 1652-4) Treated sewage effluent prior to entry into Aimaokatuk (Spyder) Lake.

The samples should be analyzed at an accredited external lab for the following parameters:

Biochemical Oxygen Demand (BOD)
Total Suspended Solids
Faecal Coliforms
pH

Each sample should also be visually assessed for visible oil and grease sheen.

2. Once annually during the open water season a sample of treated sewage effluent should be taken at Sample Station BOS-4 (formerly SNP station 1652-4) prior to entry into Aimaoktatuk (Spyder) Lake. The sample should be sent for acute lethality toxicity testing at an accredited lab in the south using the following two procedures:
   - Acute Lethality to Rainbow Trout, Oncorhynchus mykiss (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13); and
   - Acute Lethality to Daphnia magna (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14).

   These tests can only be run at an accredited toxicity testing laboratory most likely in Edmonton. The samples must get to the laboratory within 24 hours of sampling so special planning is required as to how and when the samples are shipped to ensure that they arrive at the lab in a timely manner. It is recommended that the lab be contacted ahead of the planned annual sampling so that they can provide guidance as to shipping procedures, volume of sample required and appropriate sample shipping containers. A volume of greater than 25 litres may be required to conduct these analyses. No preservatives may be used on these samples as this would negate the test validity.

3. The daily volume in cubic meters of treated sewage effluent at Sample Station BOS-3 (Sewage Treatment Plant final discharge) must be measured, recorded and reported to the Nunavut Water Board with the monthly and annual reports.

4. The annual quantity of sludge in cubic meters removed from the sewage treatment plants must be measured, recorded and reported to the Nunavut Water Board with the monthly and annual reports.

   A monitoring program summary report is required to be submitted to the Nunavut Water Board for review within thirty (30) days following the month being reported.

5.2 Windy Lake Regional Expoloration Camp

The water license requires the following water quality monitoring:

5. Monthly samples are to be taken during periods of discharge from the sewage treatment plant (i.e. monthly in the months when the sewage treatment plant is in operation) to be taken from the following two sampling points:
   - Sample Station HOP-2 Sewage Treatment Plant final discharge at the surge tank prior to being pumped over the ridge east of the Windy Camp facilities; and
   - Sample Station HOP-3 Treated sewage effluent at a point of entry into Windy Lake.

   The samples should be analyzed at an accredited external lab for the following parameters:

   Biochemical Oxygen Demand (BOD)
   Total Suspended Solids
   Faecal Coliforms
   pH

   Each sample should also be visually assessed for visible oil and grease sheen.

6. Once annually during the open water season a sample of treated sewage effluent should be taken at Sample Station HOP-3 prior to entry into Windy Lake. The sample should be sent for acute lethality toxicity testing at an accredited lab in the south using the following two procedures:
   - Acute Lethality to Rainbow Trout, Oncorhynchus mykiss (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13); and
   - Acute Lethality to Daphnia magna (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14).

These tests can only be run at an accredited toxicity testing laboratory most likely in Edmonton. The samples must get to the laboratory within 24 hours of sampling so special planning is required as to how and when the samples are shipped to ensure that they arrive at the lab in a timely manner. It is recommended that the lab be contacted ahead of the planned annual sampling so that they can provide guidance as to shipping procedures, volume of sample required and appropriate sample shipping containers. A volume of greater than 25 litres may be required to conduct these analyses. No preservatives may be used on these samples as this would negate the test validity.

7. The daily volume in cubic meters of treated sewage effluent at Sample Station HOP-3 (Sewage Treatment Plant final discharge at the surge tank prior to being pumped over the ridge east of the Windy Camp facilities) must be measured, recorded and reported to the Nunavut Water Board with the monthly and annual reports.

8. The annual quantity of sludge in cubic meters removed from the sewage treatment plants must be measured, recorded and reported to the Nunavut Water Board with the monthly and annual reports.

A monitoring program summary report is required to be submitted to the Nunavut Water Board for review within thirty (30) days following the month being reported.

5.3 Sampling Containers

Sample containers vary in size and material of construction, depending on the analysis to be conducted. The method used to analyze for a particular parameter dictates the minimum size of the sample bottle. MHBL will use clean chemically resistant polyethylene bottles and closures with inert liners supplied by the accredited external laboratory analyzing the samples. Typically these will be 1 litre sample bottles (for pH, BOD and TSS).

Samples to be analyzed for Oil & Grease must be collected in glass containers as hydrocarbons are attracted to the walls of plastic bottles and may not be released when sample aliquots are transferred from the bottle.

Monthly samples collected for analysis of faecal Coliform must be shipped in sterilized sample bottles provided by the external lab. Bottles to be used for bacterial testing must be autoclaved (sterilized). These samples must get to the laboratory within 24 hours of sampling so special planning is required as to how and when the samples are shipped to ensure that they arrive at the lab in a timely manner. It is recommended that the lab be contacted ahead of the planned sampling so that they can provide guidance as to shipping procedures, volume of sample required and appropriate sample shipping containers. No preservatives may be used on these samples as this would negate the test validity.

5.4 Data Collection during Sampling

Details of all sampling are to be recorded in a field logbook. The individual collecting the samples should record the date and time that sampling was conducted, the sampling stations visited, the samples taken at each station and the name of the person who performed the sampling or took the measurements. The results of any field measurements should be recorded. The sampler should indicate whether the sample was preserved and should initial each entry. Additional information can be useful when inquiries are made into the meaning of sample data at a later date. The sampler should record any information that may have a bearing on water quality, such as weather conditions, stream flow rates and unusual conditions at the site. Any necessary deviations from standard procedures or sampling location must be recorded.

When sampling and sample preservation is completed, the bottles should be clearly marked with all information that the laboratory analyst will need to report the result. As a minimum, the following information should be included:

- Sample location (or SNP station number)
- Date of sampling
- Parameters to be analyzed
- Preservation method used
- Name or initials of sampler

- Temperature and pH where applicable

As the samples are to be sent to an external laboratory, the company and property name must also be included.

In some cases permanent markers can be used to identify sample bottles, however these markings can be erased with wear and may not be clearly legible. Whenever possible, and always when sending samples to external laboratories, mark the bottles with pre-printed gummed labels. Labels should only be applied to dry surfaces.

A major objective of the field sampler is to minimize any chemical changes to the sample between the time of sample collection and delivery to the laboratory, and which may alter the concentration of the parameter of interest. Heat, light, and agitation can all impact the water chemistry and the samples should be protected from these effects.

Samples should be delivered to the analytical laboratory as soon as possible after collection. All samples should be stored and transported at a temperature <10 degrees Celsius. Coolers and ice packs are to be used for field transportation and samples should be refrigerated as soon as possible following arrival at the laboratory.

A chain of custody form should be completed for each sampling shipment. The original should be sent to the external laboratory while a copy should be filed on-site accordingly. A follow-up call should be made to the external environmental laboratory ensuring that samples were received as scheduled.

5.5 Quality Assurance/Quality Control Procedures during Sampling

The following QA/QC procedures are to be implemented during sampling:

- Use of field blanks: Field blanks are samples of pure water that are subjected to exactly the same procedures as routine samples, following which they are analyzed for the same parameters as the field samples. Any measurement of the parameter of interest, above method detection limits, will indicate any analytical error, impurities in the laboratory distilled water supply, contaminated sample preservatives, or contamination of the sample during the handling process. Combined with the results of other quality control procedures, analysis of field blanks can help identification of sources of contamination. New sample bottles will be used and prepared using distilled water from the normal laboratory water supply. This set will represent all of the parameters routinely analyzed. They will be preserved in the field and submitted to the laboratory identified as field blanks.

- Duplicate sampling – Replicate sampling (or sometimes referred to as duplicate sampling) is the collection of more than one sample for a given analysis at a given location. The replicate samples are collected, handled, and analyzed using the standard procedures applied to routine samples. Replicate sampling, combined with the results of other quality control procedures, can help indicate sources of error and are particularly useful in identifying problems with accuracy and sampling methods. Once per operating season, for each active water license sampling station, a set of duplicate samples will be taken, representing as many of the routine analyses as possible. Where possible, this should be carried out in conjunction with audit sampling conducted by the designated inspector. Replicate sampling should alternate between the prescribed sampling stations.

These results will be included in the reports provided to the NWB.

6.0 WASTE WATER TREATMENT FACILITY MANAGEMENT

6.1 General

The focus of management of the Waste Water Treatment Facility will be safety and environmental responsibility. Employees working in the Waste Water Treatment Facility will be trained prior to commencement of work so that they are aware of the health and safety risks associated with the Waste Water Treatment Facility.

6.2 Health and Safety

There are four primary exposure pathways to chemicals within the Waste Water Treatment Facility:

1. Inhalation;
2. Ingestion;
3. Skin contact; and
4. Eye contact.

Skin contact will be prevented by issuing suitable personal protective equipment to employees working in the Waste Water Treatment Facility. Personal protective equipment is summarized in Table 6-1.

Eye contact is unlikely under normal circumstances. Where hand work is to be carried out in the Waste Water Treatment Facility with the risk of eye contact, protective goggles will be required.

Table 6-1: Guidelines for Personal Safety in Waste Water Treatment Facilities

Personal Protection	
Ventilation	Use adequate ventilation. Check that the plant's ventilation fans are operating before entering.
Respiratory protection	Use organic cartridge respirator.
Eye protection	For splash protection, use chemical goggles and face shield
Skin protection	Use gloves resistant to the material being used, i.e., neoprene or nitrile rubber. Use protective garments to prevent excessive skin contact.
Health Hazard Data	
Acute effects of overexposure	Eye: May cause mild irritation, with stinging and redness of eyes.
	Skin: May cause infection especially if cuts are present.
	Inhalation: May cause irritation to nose, throat or lungs. Headache, nausea, may occur.
	Ingestion: Swallowing may produce abdominal pail, nausea and vomiting.
First Aid and Emergency Procedures	
Eye	Flush eyes with running water for at least 15 minutes. If irritation or adverse symptoms develop, seek medical attention.
Skin	Immediately wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.
Inhalation	Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.
Ingestion	Seek medical attention.
Fire	
Fire extinguishing media	Dry chemical, foam, or carbon dioxide.

This report, “Waste Water Treatment Facility Operations and Maintenance Manual, Boston Advanced Exploration Project and Hope Bay Regional Exploration Project, Nunavut, October 2007”, has been prepared by Miramar Hope Bay Ltd.

Prepared By

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Appendix A

Operation and Maintenance Manual for Two (2) S-40 ROTORDISK® Full Steel Packaged sewage treatment plants c/w 5,421 sq. ft. of combined bio-support media for 28,000 litres/day, prepared for BHP Minerals Canada Ltd. CMS Group Inc. un-dated.