

**Hamlet of Paulatuk, NT
Sewage Treatment Facility
Operation and
Maintenance Manual**

Hamlet of Paulatuk

July 2015

Sewage Treatment Facility – Operation and
Maintenance Manual

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Submitted by

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TABLE OF CONTENTS

	<u>Page No.</u>
1 INTRODUCTION	1
1.1 Purpose	1
1.2 Site Setting.....	1
1.3 Contact Information	2
2 BACKGROUND.....	2
3 OPERATIONAL AND MAINTENANCE PROCEDURES.....	4
3.1 Sewage Lagoon and Wetland System	4
3.2 Yearly Operation and Maintenance.....	4
3.2.1 Operation from Freeze-up to Break-up	4
3.2.2 Operation from Break-up to Freeze-up	4
3.3 Sewage Sludge Management Plan	5
3.3.1 Characterization of Sludge	5
3.3.2 Storage, Treatment and Disposal of Sludge	5
3.3.3 Methods for Performing Sludge Depth Measurements.....	5
3.4 Lagoon and Wetland Monitoring Program (Surveillance Monitoring Network).....	10
3.4.1 Program Description	10
3.4.2 Program Schedule.....	10
3.4.3 Record of Sampling Events	12
3.5 Quality Assurance/Quality Control Plan for Lagoon and Wetland Monitoring Program.	12
3.5.1 Sample Collection.....	13
3.6 Managing Insects and Weeds.....	16
3.6.1 Insect Management	16
3.6.2 Weed Management	16
3.7 Measures to Prevent Short-Circuiting	16
3.8 Measures to Prevent Stagnation and Excessive Odour.....	16
3.9 Site Records	17
3.10 Safety Procedures	17
3.11 Site Access Control	18
3.12 Contact Numbers.....	18
4 EMERGENCY RESPONSE.....	18
4.1 Emergency Contact Numbers	18
4.2 Contingency Planning	18
4.3 Spill Contingency Plan	19
4.4 Fire Response Plan	19
5 REFERENCES	20

LIST OF FIGURES

Figure 1.1 Hamlet of Paulatuk Municipal Boundaries	1
Figure 3.1. Photo of Sludge Judge®	5
Figure 3.2. Sketch of Tube After Retrieving Lagoon Effluent Depth Measurement (Not to Scale)	7
Figure 3.3. Sketch of Lagoon Cross-Section and Total Depth Measurement (Not to Scale).....	7

LIST OF TABLES

Table 3.1. Quality Standards for Effluent Discharged from Sewage Lagoon (Station Num. 1619-2)	10
Table 3.2. Sampling Program Schedule.....	11

LIST OF APPENDICES

APPENDIX A: Hamlet of Paulatuk Site Layout	
APPENDIX B: Annual Report Forms	
APPENDIX C: SNP Sample Locations	
APPENDIX D: Example of Sampling Instructions from Taiga Environmental Laboratory	

1 INTRODUCTION

1.1 Purpose

The purpose of this manual is to assist the Hamlet of Paulatuk personnel with the operation and maintenance of their sewage treatment system. The manual has been developed according to the requirements of the Inuvialuit Water Board and is based on the *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories* (Duong and Kent, 1996).

1.2 Site Setting

The Hamlet of Paulatuk is located at 69°21'N and 124°04'W, along the southern coast of Darnley Bay. The hamlet is approximately 400 km by air east from Inuvik and 855 km by air northwest from Yellowknife. Located in an area of continuous permafrost, the Hamlet of Paulatuk is dominated by glacial till, and marine sands and silt. The daily mean temperature in July is 10.1°C while the daily mean temperature in January is -25.6°C, based on Environment Canada Climate Normals (1981-2010). Average yearly rainfall is 92.9 mm and average yearly snowfall is 131.8 cm. The climate is characteristic subarctic.

The Hamlet has an airport, but no road access. Therefore, supplies are shipped in annually via barge or by plane. Figure 1.1 outlines the municipal boundaries for Paulatuk.



**Image Retrieved from the Department of Municipal and Community Affairs, GNWT, July 2015*

Figure 1.1 Hamlet of Paulatuk Municipal Boundaries

1.3 Contact Information

The individuals responsible for the operation and maintenance of the Paulatuk sewage lagoon are the following:

Name	Role	Phone
Greg Morash	Supervisor	867-580-3531
Keith Dodge	Director of Public Services	867-580-3039

2 BACKGROUND

The community sewage lagoon, known as ‘Dead Lake’ or ‘Lake A,’ is located approximately 2 km from the hamlet, in the southwest corner of the solid waste facility, as shown in Appendix A. It is a facultative lagoon providing primary treatment to municipal sewage, and is not connected to the drainage basin of New Water Lake, which supplies the Hamlet’s water.

The community has used the lake as a municipal sewage lagoon since early 1990. It is approximately 250 m by 350 m, with an unknown depth. The natural lake shoreline has not been developed (no berms have been constructed to surround the lake); therefore the lagoon has no freeboard.

Sewage is collected from the community by vacuum truck five days a week. Pick up is scheduled three times a week for larger residences, and two times a week for smaller residences. The vacuum trucks discharge into the lagoon from a gravel pad, using one of two discharge chutes located on the northeast side of the lagoon, as seen in Figure 2.1.

From the lagoon, sewage effluent continuously discharges at natural flow rates into a vegetated wetland, before migrating into Darnley Bay. The wetland is approximately 300 m by 50 m. Discharge is continuous throughout the year, though it does freeze over in winter months. Some overland flow can occur during spring thaw, or during major and prolonged precipitation events.



Figure 2.1 Paulatuk Discharge Chute

3 OPERATIONAL AND MAINTENANCE PROCEDURES

3.1 Sewage Lagoon and Wetland System

Sewage collection will be carried out in the same manner as in previous years. Collected sewage will be discharged into the lagoon via the effluent discharge chute. Any effluent spilling onto the truck gravel pad must be cleaned up to prevent accumulation of ice during the winter. Effluent from the lagoon is discharged continuously into the wetland at natural rates. Final discharge will be into Darnley Bay after effluent migration through the wetland. It is imperative that the requirements of the Surveillance Network Program (SNP) are completed to ensure the lagoon and wetland is providing adequate treatment.

3.2 Yearly Operation and Maintenance

Operation of the lagoon has been broken down into two sections; operation during the winter months and operation during the summer months. The following dates are estimates as operational changeovers are weather dependent and may occur earlier or later than the anticipated dates.

3.2.1 Operation from Freeze-up to Break-up

Operation of the lagoon during this time is for winter operations. Changeover to winter operations should occur when effluent in the lagoon begins to freeze. Sewage will be collected using the Hamlet's vacuum truck and will be discharged into the lagoon via the sewage discharge chute. Any sewage spilled onto the truck turn around pad must be cleaned up immediately to prevent the accumulation of ice. Also, any accumulation of ice on the discharge chute should be cleared away to keep the chute clean and free of blockages. Prior to freeze-up, the Hamlet must implement the SNP monitoring program at Station Number 1619-2, and the two new potential SNP monitoring stations (WM-1 and WE-1) tentatively scheduled in the wetland. It is the Hamlet's responsibility to ensure that the SNP is carried out at this time to ensure compliance with the water licence.

3.2.2 Operation from Break-up to Freeze-up

Operation of the lagoon during this time is for summer operations. Changeover to summer operations should occur when stored effluent in the lagoon has thawed. Sewage will be collected and discharged into the lagoon as described for winter operations. Should the need arise (ie: severe risk of sewage overflow) the lagoon will also be decanted during this time using a pump and hose to decant effluent into the adjacent wetland. Prior to decanting any effluent into the wetland, the Hamlet must provide notice to an AANDC Inspector at least 10 days before decanting occurs. Once the decantation period is over the pump and hose system will be disconnected and sewage will be stored in the lagoon during the winter months.

Immediately after ice break-up, implementation of the SNP monitoring program will begin at Station Number 1619-2, and the two potential new monitoring stations (WM-1 and WE-1) mentioned above. It is the Hamlet's responsibility to ensure that this program is carried out each summer to remain in compliance with the Hamlet's water licence. Please refer to Section 3.3 for further details.

3.3 Sewage Sludge Management Plan

3.3.1 Characterization of Sludge

Collected sewage will mostly come from residential buildings in the hamlet as there are few industrial or commercial sources. The sludge will generally be a mixture of fecal matter, organic and inorganic material. However, contaminants such as heavy metals, solvents and petroleum products may enter the lagoon due to municipal activities.

3.3.2 Storage, Treatment and Disposal of Sludge

During the treatment process, heavier solids in the lagoon liquid will sink to the bottom of the lagoon and collect over time as a sludge blanket. If the depth of the sludge blanket becomes thick enough to decrease the volume of the lagoon cell significantly or contaminant concentrations become too high, the sludge must be collected from the lagoon and treated according to CCME standards.

3.3.3 Methods for Performing Sludge Depth Measurements

According to the National Guide to Sustainable Municipal Infrastructure (2004), sludge depth measurements should be performed each year to determine the depth of sludge and rate of sludge accumulation within the lagoon. This will help Hamlet staff to plan and prepare for lagoon desludging operations. There are a number of methods available for measuring the depth of the sludge blanket; however one of the more economical tools is called a Sludge Judge®. The Sludge Judge® is a clear plastic tube with a check valve on the bottom and measured increment markings on the tube. It comes in 5-foot sections that can be screwed together as necessary. The number of sections required for sampling will be dependent on the depth of the water level in the lagoon

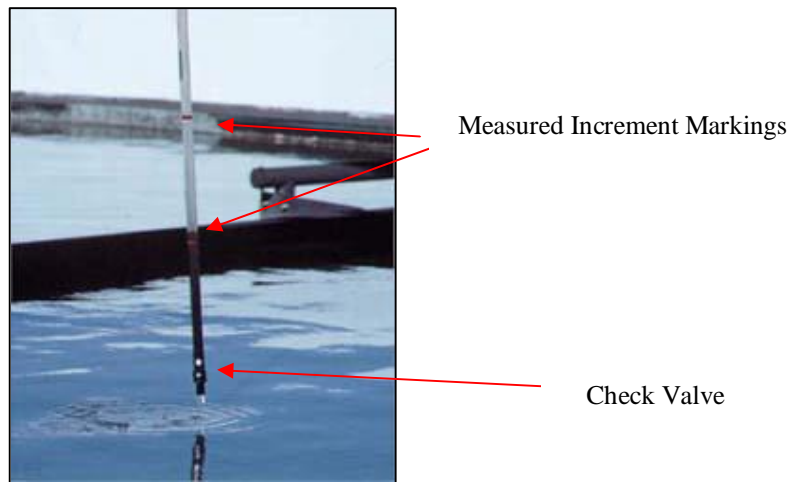


Figure 3.1. Photo of Sludge Judge®

Source: http://www.geneq.com/catalog/en/sludge_judge.htm

Retrieved March 29, 2010

Sludge depth measurements should be taken based on a grid format, and should be taken in the same locations each year. Based on the document *Sludge Survey Methods for Anaerobic Lagoons* (Westerman, Shaffer & Rice, 2008), 6 depths measurements per acre should be collected.

The bottom surface area of the lagoon in Paulatuk must be measured, and an estimate of acreage produced. Then, the number of required sludge depth sampling locations can be determined. Samples should be collected from the bottom of the lagoon using a grid formation. According to Westerman *et al.*(2008), sampling locations on-site should be marked by survey flags or landmarks (sewage truck discharge chute, boulders, outlet pipe, etc.). Hamlet staff can place markers on the side of the lagoon to indicate sampling point locations at intersecting junctures.

To prepare for sludge depth measuring, the follow items must first be obtained:

- A boat (a flat bottom boat should be used as they are more stable than a canoe or V-bottom boat, Westerman *et al.*, 2008)
- Appropriate floatation devices for each sampling team member
- Sludge Judge[®] or a similar measuring device (ensure that the check valve is operating properly)
- Measuring rod to measure total depth from top of water level to bottom of the lagoon
- Appropriate Personal Protective Equipment (PPE) such as latex or nitrile gloves, CSA certified rubber boots, coveralls, safety goggles, etc.
- Notebook and pen to record measurements

Choose to take depth measurements during the summer, after the lagoon has completely thawed. Take measurements on a calm day when weather conditions (wind, rain, etc.) will not interfere with the process. According to Westerman *et al.* (2008), always have a team of three people to take measurements. One person will stay on shore to monitor and act as a rescuer should the need arise. The other two team members will be in the boat, one person will help to anchor the boat and record depth measurements while the second person uses the Sludge Judge[®] and measuring rod to obtain the measurements. All team members, including those on the shore, are to wear appropriate floatation devices (Westerman *et al.*, 2008).

To take the depth measurements, follow these steps provided by Westerman *et al.* (2008):

1. Paddle to the first sampling location. Be sure to mark down which location it is (ie. depth sampling point #1).
2. Slowly lower the Sludge Judge[®] into the lagoon being careful not to move the tube up and down. To determine when the tube has reached the top of the sludge layer, watch the liquid level inside the tube as it is lowered into the lagoon. When the tube has reached the sludge layer, the water level inside the tube will drop slightly.
3. As soon as the tube has reached the sludge layer, tug on the rope to secure the check valve and pull the tube up slowly.
4. Using the increment markings on the tube, measure the depth of the liquid layer (this is the layer of water that sits above the sludge layer). There should be 1 to 2 inches of sludge at the bottom of the tube, indicating that the tube did reach the sludge layer. The depth of the liquid layer in the tube is measured from the top of the sludge to the top of the liquid (Refer to Figure 3.2 below). Record the measurement.

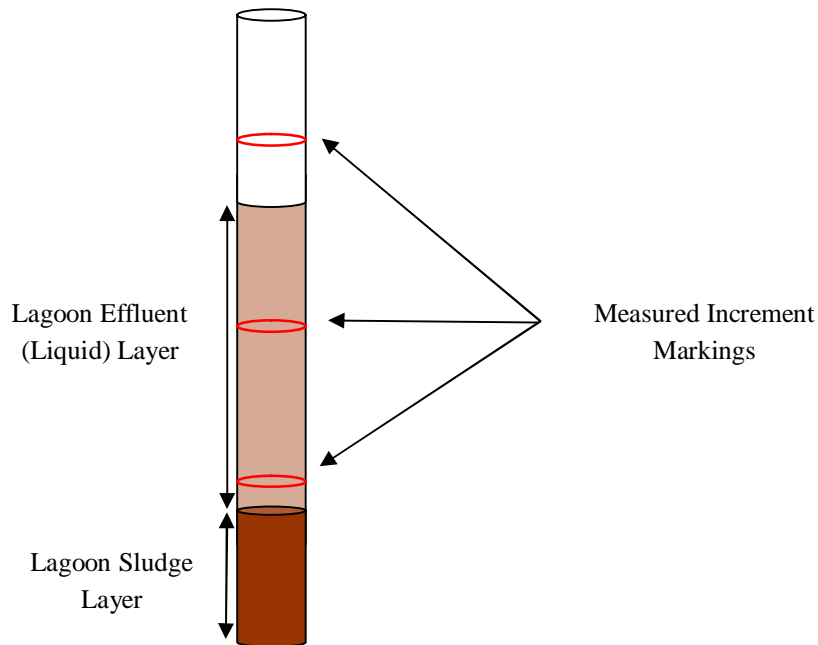


Figure 3.2. Sketch of Tube After Retrieving Lagoon Effluent Depth Measurement (Not to Scale)

5. Empty the contents of the Sludge Judge[®] back into the lagoon.
6. Take the measuring rod, place it in the lagoon with the zero end pointing downwards. Lower the rod all the way down until the bottom of the rod touches the lagoon floor. Read the water level measurement. This is the total depth of the effluent plus the sludge layer (Refer to Figure 3.3 below). Record the measurement.

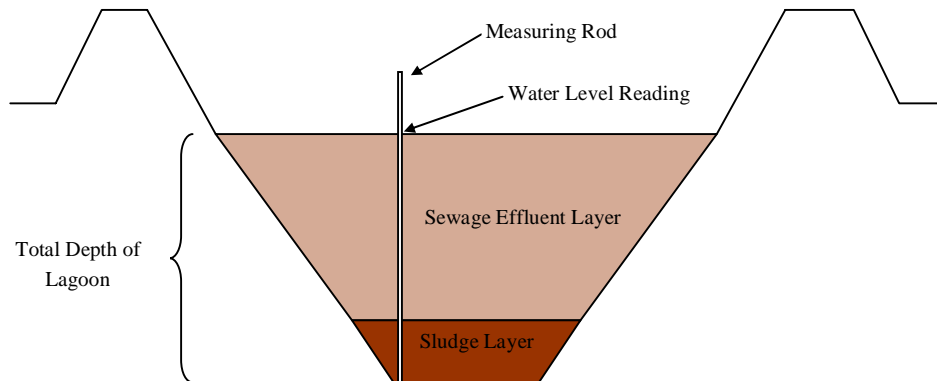


Figure 3.3. Sketch of Lagoon Cross-Section and Total Depth Measurement (Not to Scale)

7. To find the thickness of the sludge layer, subtract the depth of the liquid layer from the total depth.

8. Repeat steps 2 through 7 for the rest of the sampling locations. Be sure to record all measurements and the corresponding sample locations.

An alternative method to measure the depth of the sludge blanket is to lower the Sludge Judge® all the way to the bottom of the lagoon. Sludge and effluent will enter the tube through the check valve. When the tube is lifted out of the water, a distinct layer of sludge will be visible at the bottom of the tube. The distance from the bottom of the tube to the top of the sludge layer in the tube is the estimated thickness of the sludge blanket. Unfortunately this method can provide inaccurate results as the sludge does not enter the tube as easily as the effluent. This may cause the sludge depth measurement to be less than the actual depth of the sludge blanket (Westerman *et al.*, 2008).

When the sludge layer has become thick enough to affect the operation of the lagoon, the sludge should be removed, treated and disposed. As a guide, if the height of the sludge is thicker than 0.5m from the bottom of the lagoon floor and has reached the bottom of the decant screen structure, the sludge should be removed from the lagoon. At this point, in consultation with the Government of the Northwest Territories, the Hamlet should retain the services of an Engineer for the design of appropriate sludge removal, treatment and disposal options. The design will need to be submitted and approved by the Inuvialuit Water Board prior to implementing the sludge removal process. Prior to any lagoon draining or sludge removal, an AANDC Inspector must be informed at least ten days in advance.

3.3.3.1 *Methods for Sampling Sludge*

Although there are no specific guidelines with regards to the frequency of sludge sampling, sampling of sludge once per year should be sufficient to monitor the contaminant concentrations. Therefore sludge samples can be collected during the sludge depth measurements.

As well, parameters to be analyzed in the sludge have not been stated in the Hamlet's water licence. Therefore, prior to initiating the sludge sampling program, the Hamlet must contact the Inuvialuit Water Board to determine which parameters (ie. microbiological, nutrients, physical, metals, etc.) to test for during the program.

Sludge samples should be collected as a composite sample. This means that sludge samples are taken from various points in the lagoon and mixed together before bottling and sending to a laboratory for analysis (Westerman *et al.*, 2008). To collect sludge samples, gather all items listed in Section 3.3.3 for sludge depth measurements as well as the following:

- Sample bottles
- Preservatives (if required)
- Clean 5 gallon bucket
- Cooler
- Ice packs to keep samples cool
- Chain of custody forms (also called COCs)
- Permanent marker to mark on bottles

- Pen to fill out chain of custody forms
- Packing tape
- Shipping label to send samples back to the lab
- Clean stir-stick to mix sludge samples in 5 gallon bucket (must be clean as an unclean mixer may contaminate the sample, leading to inaccurate results).
- Sealable freezer bag

Samples must be collected shortly before they are sent to the lab for analysis. For example, if the samples must be at the airport by 2:00pm, the samples should be collected that morning. Make sure that there is enough time to collect and package all samples for transport. This is important because the samples must be at the lab within 24 hours from the time they are collected, otherwise some of the samples will no longer be acceptable for analysis. Be sure to contact the airport and ask what time the samples must be there to make the flight. Contact the lab to let them know that samples will be arriving and ask if they are able to pick them up at the airport.

To collect a composite sludge sample, follow the procedure below (adapted from Westerman *et al.*, 2008):

1. Prior to beginning sampling, label the sample bottles with the date, time of collection, your name and description of sample (ie. sludge from Paulatuk sewage lagoon).
2. After taking the sludge depth measurement using the Sludge Judge[®], dip the Sludge Judge[®] into the lagoon to collect a sample of sludge in the tube. Pull the tube out and release the valve at the bottom to discharge sludge into the 5 gallon bucket. Be careful not to empty any of the effluent (liquid) into the bucket.
3. Continue this step until a sample of sludge has been collected from each sampling location.
4. Mix the sludge samples together in the 5 gallon bucket. Collect samples by dipping sample bottles carefully into the bucket. Do not allow any of the preservatives in the bottles to spill out of the bottle while filling it. Cap bottles and place in cooler.
5. Once all bottles have been filled, pack bottles in cooler with ice packs for shipping. Fill out chain of custody forms, place in a sealable freezer bag and place in the cooler with the samples. Close cooler and secure with packing tape and place shipping label on top of the cooler.
6. Take cooler to the airport and ship to the laboratory immediately. Some sample parameters must be analyzed within 24 hours of collection; otherwise they will not be acceptable for analysis. Call the lab and give them the shipping number of the cooler.

Samples should contain only sludge and include as little effluent as possible. This is because of the desludging procedure for the lagoon. When it is time to desludge the lagoon, the lagoon effluent will first be discharged to the wetland treatment area leaving mostly sludge (Westerman *et al.*, 2008). Once the sludge is removed, it will most likely require further treatment prior to disposal. Sampling only the sludge will give a more accurate analysis of the amount of contaminants within the sludge to be treated. Results are to be reported once analysis has been completed and are to be included in the Annual Report.

3.4 Lagoon and Wetland Monitoring Program (Surveillance Monitoring Network)

As per the conditions set out in the Hamlet of Paulatuk’s water licence, the effluent discharged from the lagoon into the wetlands must be sampled twice per year (once before freeze-up, and once after ice break-up). The following sections describe in detail how the program must be completed.

3.4.1 Program Description

The lagoon is the main storage and primary treatment facility for municipal sewage. Solids will settle to the bottom and the remaining effluent will be stored and continuously discharged, or decanted, into the adjacent wetland. The wetland area provides the final natural treatment step before discharge into the ocean, removing residual organic and inorganic contaminants. The Hamlet of Paulatuk’s water licence (N7L3-1619) has set the following effluent quality standards for effluent discharged from the sewage lagoon to the wetland as illustrated in Table 3.1.

Table 3.1. Quality Standards for Effluent Discharged from Sewage Lagoon (Station Num. 1619-2)

Parameter	Maximum Average Concentration
Fecal Coliforms	1 x10 ⁴ CFU/100 mL
Biological Oxygen Demand (BOD ₅)	100 mg/L
Oil and Grease	5 mg/L
Total Suspended Solids (TSS)	120 mg/L
pH	6-9

In addition to these samples, the lagoon surface must be inspected monthly for the presence of oil or grease sheens. If a surface sheen is identified, a sample must be taken at the sheen location, analyzed for the presence of oil and grease, and meet the Maximum Average Concentration parameter highlighted in Table 3.1

Note that there are proposed changes to the SNP Monitoring Program that may be updated during the renewal of the Paulatuk water licence. These changes include the addition of two new sampling locations; one mid-way through the wetland and another immediately before the water is discharged into Darnley Bay.

3.4.2 Program Schedule

Appendix C shows the location for Station Number 1619-2, Station WM-1, and Station WE-1.

The following table is a sampling schedule for the lagoon and wetland treatment area during the summer months. Note that parameters may change, check the current water licence for updates.

Table 3.2. Sampling Program Schedule

Sampling Point	Description	Parameters to be Tested	Sampling Dates
Station Number 1619-2	Outflow of Sewage Lagoon before entering adjacent wetland	Biological Oxygen Demand (BOD ₅) Carbonaceous Biological Oxygen Demand (CBOD ₅) Oil and Grease Total Suspended Solids (TSS) pH	Twice annually; once before freeze-up and once after ice break-up
Station WM-1	Middle of Wetland	Biological Oxygen Demand (BOD ₅) Carbonaceous Biological Oxygen Demand (CBOD ₅) Oil and Grease Total Suspended Solids (TSS) pH	Twice annually; once before freeze-up and once after ice break-up

Station WE-1	End of Wetland, just before discharge into ocean	Biological Oxygen Demand (BOD ₅) Carbonaceous Biological Oxygen Demand (CBOD ₅) Oil and Grease Total Suspended Solids (TSS) pH	Twice annually; once before freeze-up and once after ice break-up
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All sampling, sample preservation and analysis is to be performed in accordance with methods approved by the Inuvialuit Water Board. All analysis must be completed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Certified Laboratory. Note that an example of Taiga Environmental Laboratory’s sampling instructions is provided in Appendix D.

3.4.3 Record of Sampling Events

It is the responsibility of the Hamlet to file an Annual Report to the Inuvialuit Water Board following the reported year. Appendix B contains the template for the Annual Report, on which sample forms and results must be attached when submitting. The amount of raw water pumped from SNP Station Number 1619-1 to the community, and the amount of sewage discharged to the lagoon must be documented monthly and annually. As well, the amount of solids removed from the sewage lagoon each year (if this has proven to be necessary due to excessive sludge accumulation) must be recorded.

3.5 Quality Assurance/Quality Control Plan for Lagoon and Wetland Monitoring Program

Section 3.5.1 to Section 3.5.2 describes the Quality Assurance/Quality Control (QA/QC) Plan for sampling of the Sewage Lagoon. This plan outlines general QA/QC procedures, however, the Hamlet should obtain more specific instructions on sample collection and handling from Taiga Environmental Laboratory. They must also obtain a certificate from the lab stating that the lab is certified as a CAEAL Laboratory. Information in developing this plan was taken from *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class “B” Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan* (Department of Indian and Northern Affairs Canada, Water Resource Division and the Northwest Territories Water Board, July 1996) and *Wastewater Sampling Instructions, Kitikmeot Region* (IEG Environmental, July 2005).

3.5.1 Sample Collection

3.5.1.1 Preparing for Sample Collection

Samples are to be collected from the marked Surveillance Network Program (SNP) locations. Each location should be marked with a sign and location number as well as located with GPS coordinates. Please refer to Appendix C for a map of the SNP locations. It is the responsibility of the Hamlet to maintain these markers in good condition.

Before collecting samples, follow the list of instructions below:

1. Contact the lab and ask where their lab is located. Tell them you need enough sampling bottles and equipment to test for the list of parameters in Table 3.4. As well, you will need travel blanks and field blanks. Travel blanks are jars of deionized water that are filled in the laboratory and travel in the coolers with the field samples to determine if there is any possible contamination from traveling and handling methods. Never open the Travel Blanks. Field blanks are also filled with deionized water, but must be filled in the field by the sampler during the sample collection process. Also ask the laboratory for an instruction sheet for collecting the samples. An example of an instruction sheet can be found in Appendix D.
2. Contact the airport and find out what time the samples must be dropped off in order to make the flight to the city where you are sending them. The samples should be collected shortly before they are shipped. For example, if the samples must be at the airport by 2:00pm, the samples should be collected that morning. Make sure that you have enough time to collect and package all samples for transport. This is important because the samples must be at the lab within 24 hours from the time they are collected, otherwise they are no longer good for analysis.
3. Go to the sampling locations and familiarize yourself with the area. Walk to each location so you know where each sample must be taken.

Once you have received the sampling bottles and equipment from the lab, make sure you have the following things with you before you begin collecting samples:

1. Sample bottles;
2. Preservatives;
3. Coolers that the bottles and preservatives were sent in;
4. Field blanks;
5. Chain of custody forms (also called COCs);
6. Permanent marker to mark on bottles;
7. Pen to fill out chain of custody forms;
8. Nitrile gloves;
9. Packing tape;
10. Ice packs;

11. Shipping label to send samples back to the lab.

Once you have gathered the supplies above, determine which day you will collect the samples. Be sure to check the flight schedule for that day and call the lab to ask if they are able to pick up the samples at the airport when they arrive.

3.5.1.2 Instructions for Sample Collection

Follow these instructions to collect samples from the sewage lagoon and wetland:

1. Place ice packs in freezer the night before sampling.
2. In the morning, place ice packs and other equipment into coolers and load into vehicle. Make sure that the Travel Blanks and Field Blanks are in the cooler as well.
3. Drive to site and park in a safe spot. DO NOT park on the truck turn around pad for the sewage lagoon.
4. Take coolers and equipment to the first sampling location (Station WE-1). Samples should be collected in the order of least contaminated to most contaminated. Start at the end of the wetland, where effluent flows into Darnley Bay. Then sample at Station WM-1 and finally Station 1619-2. Put cooler and bottles in a safe and accessible area.
5. Put on a pair of nitrile gloves.
6. Fill the field blanks with deionized water.
7. Take out bottles needed to sample at this location and place beside the cooler. DO NOT OPEN THE BOTTLES.
8. Select the bottles NOT requiring or containing preservatives and put aside.
9. Take the bottles requiring or containing preservatives and sample these first.
10. Please note that some bottles MUST be rinsed and some bottles MUST NOT be rinsed. Please refer to the water sampling instructions provided by the laboratory that sent the sample bottles to determine if the bottle requires rinsing. If rinsing is required, discard rinse water downstream and away from the sampling location. Rinse the bottle three times. If the bottle must not be rinsed, carefully unscrew the cover and place bottle slowly into the water open end up and slightly tilted to allow water to slowly fill the bottle. If the bottle contains preservatives already, be sure not to tip or overfill the bottle as the preservatives will be washed out. Fill as directed by the water sampling instructions provided by the laboratory that sent the sample bottles. To add preservatives (if not already in the bottle) refer to the water sampling instructions provided by the laboratory that sent the sample bottles to determine which preservative to add to the sample. Carefully pour contents into the sample bottle. Screw the cover on tightly and mix by gently tipping the bottle back and forth.
11. Label the bottle with the Station Number (WE-1, WM-1 or 1619-2), your name, date, time of collection and preservative added. Make sure to use a waterproof/permanent marker to label the bottles. Place filled sample jar in cooler.
12. Continue until all preserved samples have been taken.
13. Now fill the bottles not requiring preservatives. Refer to the water sampling instructions provided by the laboratory that sent the sample bottles to determine which bottles need to be rinsed.

14. Fill bottle as directed in the water sampling instructions provided by the laboratory that sent the sample bottles and screw cover on tightly. Label and place in cooler.
15. Continue until the rest of the bottles have been filled.
16. Take off nitrile gloves and dispose in garbage bag.
17. Collect cooler and move to the next sampling location (Station WM-1). Repeat steps 5 to 16.
18. Collect cooler and move to the next sampling location (Station 1619-2). Repeat steps 5 to 16.
19. Once all samples have been collected and labelled, put on a new pair of nitrile gloves and pack samples into coolers tightly with ice packs to limit movement during shipping. Remove gloves and wash hands thoroughly.
20. Fill out the chain of custody form.
21. Place form in a sealable freezer bag, seal and put in the cooler with samples. Tape up the cooler with packing tape. Tape shipping label to top of cooler and bring to the airport. Always wash hands thoroughly after handling the cooler.
22. Fill out the shipping forms for sending the cooler to the lab and check that the plane will be on time.
23. Call the lab and tell them that the samples are on the way and give them the flight information.

As part of QA/QC testing, a second set of samples should be taken from one of the sampling points. This means filling two sets of sampling bottles from the same location. This second set of samples is to verify that sample results are accurate and that sampling methods are consistent. The second set of samples should be taken from a different sampling point during each sampling period, if possible.

Lab Analysis

Once the lab has received the samples, they will begin processing them. A report stating all results as well as the detection limits will be produced and sent to the Hamlet Office. The report will also state any problems that may have occurred during analysis of the samples.

Laboratory Contact Information

Taiga Environmental Laboratory
Judy Mah
GNWT, 4601 52nd Avenue
Yellowknife NT, X1A 2L9
Phone: (867)-765-6645
Facsimile: (867)-920-8740

3.6 Managing Insects and Weeds

3.6.1 Insect Management

In order to discourage attracting insects, the wetland surrounding the lagoon should be inspected regularly for areas of ponding water. Hamlet staff must cover up any puddles or potholes by filling them with soil (Municipal and Community Affairs, Small Wastewater Treatment Systems Operator Student Manual). Weeds growing in and around the lagoon surface may also attract insects. For information about weed management, please refer to Section 3.6.2.

3.6.2 Weed Management

Weeds growing in and around the lagoon may cause a number of problems such as attracting unwanted insects, causing excessive odours, and impeding photosynthesis. Surface weeds block sunlight from entering the lagoon that is required for photosynthesis to occur. Photosynthesis is the reaction that provides energy for algae and that in turn allows algae to provide oxygen to bacteria in the lagoon. Bacteria require oxygen in order to break down wastes within the lagoon (Municipal and Community Affairs, Small Wastewater Treatment Systems Operator Student Manual). Wastes that are not breaking down may result in excessive odour.

Weeds/plants on the surface and edges of the lagoon must be removed promptly. Hamlet staff should skim weeds off the top of the lagoon and trim them at their edges. Any weeds that have been removed must be buried in the landfill immediately to prevent odours and insects.

3.7 Measures to Prevent Short-Circuiting

The lagoon is a rough circular shape where sewage is dumped in at one end of the circle (the point furthest from the outfall) and discharged from the other end (at the outfall). Sewage effluent is therefore forced to pass through the longer length of the lagoon. As long as effluent is discharged in and out in these locations, short-circuiting should be minimized (Municipal and Community Affairs, Small Wastewater Treatment Systems Operator Student Manual). However, should a breach of the lagoon occur, effluent may discharge from the breach potentially causing a short-circuiting effect. The Hamlet should consider having an annual inspection of the lagoon conducted by a Geotechnical Engineer. This should help to identify problems with the lagoon structure and bring awareness to areas of the lagoon that need to be repaired prior to formation of a short-circuit.

3.8 Measures to Prevent Stagnation and Excessive Odour

Continuous flow provided by a lengthy discharge period should help to prevent stagnation of effluent in the lagoon. If stagnation does become a problem, the Hamlet may want to consider a mechanical option such as installation of an aeration pump to aerate the lagoon.

Excessive odour may result from one of the following (Municipal and Community Affairs, Small Wastewater Treatment Systems Operator Student Manual):

- Shortly after the spring melt;

- During periods of extensive cloud cover;
- Stagnation;
- Excessive presence of weeds in and around the lagoon; and
- Presence of sludge mats, floating scum or algae mats on the surface of the lagoon.

Continuous discharge should help prevent stagnation of effluent in the lagoon and reduce excessive odour resulting from the spring melt. As well, natural wind on the surface of the lagoon should act to aerate the lagoon and prevent stagnation. Any mats and/or scum that accumulate on the surface of the lagoon must be promptly broken up and dispersed by Hamlet staff. For weed management methods please refer to Section 3.6.2.

3.9 Site Records

Copies of records pertaining to operation and maintenance of the sewage lagoon should be kept at both the Hamlet Office and the Hamlet's Maintenance Garage. Information that must be included in these records are:

- Volumes of any effluent discharged to the environment through an accidental spill;
- Sewage volume collected (both monthly and annually);
- Details of any maintenance undertaken at site;
- Record sheets;
- Copies of annual reports submitted to the Inuvialuit Water Board;
- Copy of the Hamlet's water licence;
- Copies of all manuals pertaining to the operation and maintenance of the Sewage Lagoon and Wetland Treatment Facility (i.e. Operation and Maintenance Manual, QA/QC Plan, Spill Contingency Plan, Abandonment and Restoration Plan, Sludge Management Plan); and
- Copies of spill reports and related regulations.

3.10 Safety Procedures

The following safety procedures should be obeyed in order to minimize health risks to personnel working in and around the wastewater and solid waste facilities:

- Equipment is to be kept clean;
- Wear protective clothing such as gloves and boots at all times;
- Work clothes must be kept in a designated change room and employees are to change into them when they arrive for work. Work clothes must NOT be worn home. The Hamlet's PW&S Maintenance Garage should be equipped with laundry facilities to wash work coveralls onsite;
- Hands to be washed frequently; as a minimum before eating and after work; and
- Personnel should receive appropriate vaccinations and ensure they are kept up-to-date. Please contact the Department of Health for a list of the appropriate vaccinations.

3.11 Site Access Control

There are no measures in place to control access to the site. Fencing and signage should be considered.

3.12 Contact Numbers

Contacts of those responsible for overseeing the operation and maintenance of the lagoon are as follows:

Hamlet Supervisor:	(867) 580-3531
Public Works Foreman:	(867) 580-3039

4 EMERGENCY RESPONSE

The Hamlet must be able to respond efficiently and effectively to all possible emergencies that may be encountered in the operation of the Hamlet's facilities. These include, but are not limited to fuel, chemical and wastewater spills as well as fires. Due to the nature of the Hamlet's facilities, burning or spillage of unknown or hazardous materials may occur. Only personnel who are properly trained to deal with these situations should respond to such emergencies.

Personnel must familiarize themselves with the emergency preparedness plans before an accident or emergency occurs. Copies of these plans must be kept in all sewage and solid waste disposal vehicles as well as in all common work areas. The following sections list contact numbers and outline procedures to follow in the event of an emergency.

4.1 Emergency Contact Numbers

The following is a list of contact numbers in the case of an emergency:

Fire Department:	(867) 580-2222
RCMP Detachment:	(867) 580-1111
24 Hour Spill Response Line:	(867) 920-8130

4.2 Contingency Planning

In the case of a service disruption, caused by a breach in the sewage lagoon berm, the Hamlet should follow the emergency measures listed below:

- Notify the Municipal Supervisor and the SAO;
- Report the spill to the NT-NU Spill Line (867) 920-8130;
- Contain or divert the spill where possible (consult with the Hamlet of Paulatuk Spill Contingency Plan for appropriate containment measures); and
- Consult with regulatory personnel on next steps.

In the event that the lagoon is not accessible by road and the sewage trucks are not able to discharge sewage to the lagoon, the following procedures should be implemented:

- Notify the Municipal Supervisor and the SAO;
- Notify the public and implement water use restrictions on the community; and
- Consult with regulatory personnel on next steps.

4.3 Spill Contingency Plan

A spill contingency plan has been created for activities associated with Hamlet operations including the sewage lagoon, solid waste facility and storage and handling of hazardous materials. A copy of the plan may be found in the Hamlet office and the PW&S Maintenance Garage. Hamlet personnel must familiarize themselves with the plan in order to respond quickly and effectively in the event of a spill.

4.4 Fire Response Plan

The Hamlet Fire Department is responsible for creating a contingency plan to deal with fires in the Hamlet. As burning of waste may produce harmful gases, special precautions should be taken when responding to fires in and around the solid waste facility. In the event of an uncontrolled fire in the Hamlet, the following steps should be taken:

- Immediately evacuate the area and go to the Hamlet's meeting place;
- Keep everyone including Hamlet personnel up-wind from the source; and
- Contact the Hamlet Fire Department at (867) 580-2222.

5 REFERENCES

1. Department of Indian and Northern Affairs Canada, Water Resources Division & The Northwest Territories Water Board. (1996). *Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class “B” Licensees in Collecting Representative Water Samples in the Field and for Submission of a QA/QC Plan.*
2. Department of Municipal and Community Affairs, Government of the Northwest Territories. *Small Wastewater Treatment Systems Operator – Student Manual.* Yellowknife: Municipal and Community Affairs, Government of the Northwest Territories.
3. Duong, D. and R. Kent. (1996). *Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solids Waste Disposal Facilities in the Northwest Territories.* Produced for MACA.
4. GENEQ inc. – Scientific Instruments Distributor. Photograph Retrieved March 29, 2010 from http://www.geneq.com/catalog/en/sludge_judge.htm
5. IEG Environmental. (2005). *Wastewater Sampling Instructions, Kitikmeot Region.* Produced for Department of Community and Government Services, Government of Nunavut.
6. National Guide to Sustainable Municipal Infrastructure. (2004). *Optimization of Lagoon Operation.* Issue No. 1.0. Retrieved March 29, 2010 from http://www.sustainablecommunities.fcm.ca/files/Infraguide/storm_and_wastewater/optimization_lagoon_operations.pdf
7. Westerman, P. W., Shaffer, K. A., and Rice, J. M. (2008). *Sludge Survey Methods for Anaerobic Lagoons.* Retrieved March 29, 2010 from http://www.bae.ncsu.edu/programs/extension/manure/sludge-survey/sludge_survey.pdf

APPENDIX A

**Hamlet of Paulatuk
Site Layout**



Image retrieved 2015-07-23
 Photos come from the Department of Municipal and Community Affairs

PAULATUK
 WATER LICENCE RENEWAL

FIGURE 1 AREA MAP



- BUILDING FOOTPRINT
- ROADS
- AIRSTRIP
- DRAINAGE PATHS
- WETLAND AREA

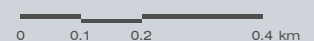


MAP DRAWING INFORMATION:
 DATA PROVIDED BY GNWT

MAP CREATED BY: PMH
 MAP CHECKED BY: AC
 MAP PROJECTION: NAD 1983 UTM Zone 10N

FILE LOCATION: \\DILLON.CA\DILLON_DFS\SASKATOON\CAD\GIS\151920 WATER LICENCE RENEWAL\PAULATUK\PAULATUK.MXD

SCALE 1:12,500



PROJECT: 151920 STATUS: DRAFT DATE: 2015-07-24

APPENDIX B

**Inuvialuit Water Board
ANNUAL REPORT FORM**



Hamlet of

Licence Number:

Municipal Water Licence

Annual Report

Date:

Municipal Water Licence Annual Report

Hamlet of _____
Licence # _____
Reporting year _____

1. Water Usage

Total yearly volume withdrawn:

Table 1 – Monthly Withdrawal Volumes

Month	Volume from Source (m ³ or l)	Volume from any other Source (m ³ or l)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
TOTALS		
% Increase from previous year		

Reasons for increase / decrease (if applicable):

Reasons for exceeding licensed withdrawal volumes (if applicable):

General information:

2. Solid Waste and Sewage Disposal

Total yearly volume of sewage deposited:

Table 2 – Monthly Sewage Disposal Volumes

Month	Volume of Sewage Disposed (m ³ or l)
January	
February	

March	
April	
May	
June	
July	
August	
September	
October	
November	
December	
TOTALS	
% Increase from previous year	

Has any sludge removal been conducted this year? If so, state volume, frequency, disposal method and site:

State when the lagoon was decanted this year. What was the frequency and volumes of the decant:

3. Hazardous Waste Storage and Transportation

On Table 3, list the types of hazardous waste accepted into the facility with volumes, if known.

Table 3 - Monthly Hazardous Waste Storage

Month	Type of Hazardous Waste Accepted (Volume if known in m ³ or l)	Type of Hazardous Waste Transported Off-site (Volume in m ³ or l)
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
TOTALS		
% Increase from previous year		

If hazardous waste has been transported off-site this year, please describe how it was transported and the final destination.

Please describe any changes or improvements to hazardous waste storage areas.

4. Problems, modifications or repairs completed during the year on water supply and waste disposal facilities

Include any changes to infrastructure of all facilities completed during the year, including any changes, repairs and modifications. Please note any problems that occurred during the year. If there are no changes, make note of that also.

5. Abandonment and restoration

Include any abandonment and restoration details including any work anticipated to be completed during the next year.

6. Unauthorized discharges

List any unauthorized discharges here, including any spills, how and when they were reported, and method of clean up.

7. Updates or revisions to approved plans

Details on any changes to approved plans such as the Operating and Maintenance Plan (O&M Plan) or any other specific to your Water Licence.

- *Spill Contingency Plan*
- *Sewage Treatment Plan*
- *Municipal Solid Waste Operations and Maintenance Plan*
- *Abandonment and Restoration Plan*

8. Studies requested by the Board

If the Board has requested that specific studies be completed or have asked for specific information be included in the annual report, include these details in this section. Include a summary of the study completed and the results. Include any attachments with the submission of the Annual Report. Include details of any upcoming studies that will be completed by the Hamlet. Include a copy or a summary of the studies completed.

9. Other Information

Include any other information here that may be valuable to the IWB or to GNWT. Include in this section non-compliance items identified in the inspection reports and how the Hamlet is addressing them. If there is any contaminated soil piles currently in use, please list the details of

containment, remediation and progress in this section. Ongoing issues with compliance can be identified here. If the IWB is aware of ongoing problems with the licence, discussions can occur to find a resolution. Please include any other details of water use or waste disposal as requested by the IWB.

10. SNP data

A condition of the Water Licence is the Surveillance Network Program (SNP). The SNP outlines the sampling requirements and frequency at monitoring stations. *In table 4, insert the sites sampled this year and the sampling period (sampling date). Attach the complete Taiga laboratory results, with your “Municipal Water Licence Annual Report” to the Inuvialuit Water Board.*

Table 4: Sampling Station and Sampling Period

Sampling Station	After Break-Up	Prior to Freeze-Up

APPENDIX C

SNP Sample Locations

Darnley Bay

Old Water Lake

STATION WE-1
455842.234mE, 7692642.118mN

STATION 1619-2
456061.782mE, 7692547.164mN

Sewage
Lagoon

STATION WM-1
455915.942mE, 7692516.038mN



PAULATUK
SEWAGE AND SOLID WASTE SITE ASSESSMENT

**SEWAGE LAGOON
SNP SAMPLING LOCATIONS**
MAP 1

-  ROADS
-  SOLID WASTE FACILITY
-  DRAINAGE PATHS

SCALE 1:3,000

0 25 50 100 Meters



MAP DRAWING INFORMATION:
DATA PROVIDED BY GNWT

MAP CREATED BY: PMH
MAP CHECKED BY: AC
MAP PROJECTION: NAD 1983 UTM Zone 10N

FILE LOCATION: \\DILLON.CA\DILLON_DFS\SASKATOON\CAD\GIS\151921 SEWAGE AND SOLID WASTE SITE ASSESSMENT\PAULATUK MAP 1 SEWAGE LAGOON SNP SAMPLING LOCATIONS .MXD



PROJECT: 151921
STATUS: DRAFT
DATE: 2015-07-23

APPENDIX D

Taiga Environmental Laboratory Sampling Instructions

Water Sampling Instructions

Collecting the Sample



Step One:

Prior to sampling, ensure you have obtained all the sampling equipment you require, such as the proper bottles, filtration devices, *etc.* Refer to the Taiga's Water Sampling Instructions – Ordering Bottles. If there are any questions or concerns, do not hesitate to contact the laboratory. Please have your water license (if applicable) available before contacting the laboratory to ensure proper bottles are ordered. **Note: you may need more than one bottle per sampling site.**



Step Two:

Check your local departure flight schedule to Yellowknife for the day you plan to take your samples. Samples should be shipped to the Laboratory **as soon as possible** after collection. Time your sampling so that the samples can be shipped out by plane as soon as possible.



Step Three:

Follow the sampling instructions on the back of this sheet for each bottle type. Package bottles in a cooler and send to the laboratory. If you require microbiological tests, such as Total Coliforms, E. coli., Fecal Coliforms, BOD, *etc.*, please contact the laboratory with the collection date and time, the Airline name, the waybill number and the expected time of arrival.



Safety Issues:

Wear appropriate gloves when collecting any sample to avoid contamination and possible exposure to unhealthy substances. The sample preservatives provided by the Laboratory are corrosive and will cause a burning sensation on the skin. If you should spill any on your skin or clothes, rinse the area **immediately** with lots of cool water. Call a doctor should the burning sensation continue.



Taiga Environmental Laboratory

4601 52nd Avenue – Yellowknife, NT X1A 2R3
 Phone: (867) 669-2788 Fax: (867) 669-2718 Email: taiga@gov.nt.ca

Parameter Group		Marking	Preservative	Instructions
	Routine	GREEN	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle.
	Nutrients	BLACK	Keep cool at 4°C	
	Biochemical Oxygen Demand (BOD)	PURPLE	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
	Microbiological	STERILE	Sodium thiosulphate and Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
	Total Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
	Dissolved Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. Filter Sample with 0.45 µm Cellulose Acetate filter 2. Rinse bottle three (3) times with filtrate 3. Fill to near the top. 4. Add contents of preservative vial 5. Cap bottle and mix.
	Hexane Extractable Material (HEM) (also known as Oil and Grease)	YELLOW	4mL 1:1 sulphuric acid in YELLOW-dot vial	1. DO NOT RINSE BOTTLE 2. Fill to shoulder of bottle. 3. Add contents of preservative vial 4. Cap bottle and mix
	BTEX, THM & Purgeable Hydrocarbons	40 mL CLEAR GLASS W/ WHITE LID	Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill bottle completely leaving NO air bubbles
	Extractable Hydrocarbons	1 L AMBER GLASS W/ WHITE LID	Keep cool at 4°C	1. DO NOT RINSE BOTTLE 2. Fill to top and cap bottle.
	Cyanide	BLUE	1mL of 6N sodium hydroxide	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
	Thiocyanate	ORANGE	2ml of 25% sulphuric acid	
	Phenol	YELLOW with P	2mL of 20% sulphuric acid	
	Sulphide	ORANGE with S	2mL of 25% zinc acetate	
	Radionuclide	RED with R	25mL of 17.5% nitric acid	
	Chlorophyll A	1L BROWN PLASTIC BOTTLE	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours