Operation & Maintenance Plan for Coral Harbour Municipal Water Licence: Sewage Disposal Facilities 2021

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1.0 Site Description

Date this plan was prepared: June 30, 2021

1.1 Location of the Sewage Disposal Facility (SDF)

Municipality: Coral Harbour
Latitude: 64° 09’ 48” N
Longitude: 83° 11’ 40” W
Proximity to Town: 3 km North

Figure 1 Coral Harbour Sewage Disposal Facility

1.2 SDF History

Year of commissioning the SDF: 2003
Design life of the SDF: 2028

Treatment System:

The natural pond has received wastewater area since 1984. Permeable berms were erected in 2003 to create a lagoon structure around the pond to retain sewage sludge. The lagoon acts as a holding cell during the frozen month and effluent freely flows out upon thaw. Most of the effluent treatment is attributed to the wetland treatment area since effluent passively exfiltrates through the holding berms. The 10.5-hectare wetland treatment area was modified in 2008 by constructing three berms to direct effluent flow away from the municipality and towards the receiving lake at the end of the wetland.

2.0 Staff

Role:	Senior Administrative Officer	**Name:**	Leonie Pameolik
Phone:	(867) 925-8870	**Email:**	munch@qiniq.com

Responsibilities: The SAO manages the municipal staff to ensure that:

- proper operation of the SDF is carried out
- sampling and inspections are completed
- annual reporting to the Nunavut Water Board (NWB) is prepared by the Government of Nunavut Department of Community and Government Services (GN-CGS)

Role:	Foreman	**Name:**	Darryl Nakoolak
Phone:	(867) 925-8323	**Email:**	foremanch@qiniq.com

Responsibilities: The foreman is responsible for:

- daily operations and maintenance of the SDF
- the sampling program at the monitoring stations
- maintaining signage at the SDF and monitoring stations
- annual decanting of the lagoon effluent into the adjacent wetland treatment area

Role:	Sewage Truck Drivers	**Name:**	Various
Phone:	N/A	**Email:**	N/A

Responsibilities: The sewage vacuum truck drivers collect sewage from holding tanks within the municipality. Sewage is transported to the lagoon where it is deposited.

3.0 Health and Safety

All personnel working within the SDF must follow the *Nunavut Safety Act* and be made aware of potential health hazards associated with working around sewage and wastewater. This is imperative so individuals make a conscious effort to perform all necessary safety procedures to protect themselves, their co-workers and family members at home. Safety precautions include:

- Ensure all equipment is kept as clean as possible;
- Assume anything touched by sewage is contaminated;
- Protective clothing such as coveralls, gloves, boots, and safety glasses are to be provided to personnel and always worn when working around sewage;
- Workers must always wear protective gloves
- Work clothing is not worn home
- Workers must wash their hands with soap and water on a regular basis, especially before delivering drinking water, eating and before going home;
- Workers are prohibited from eating or drinking in and around the sewage vacuum trunks; and
- Workers must keep their vaccinations up to date.

4.0 Security and Control

Access Control of to the facility:

- Perimeter fencing around the lagoon
- Signage
- 450 m restricted land use development setback surrounding the SDF

5.0 Wastewater Conveyance

Wastewater transportation: Trucked
Annual volume of sewage collected: 36,000 m^3
Number of days per week sewage is collected: 5

Operations:

1. Sewage is collected Monday through Friday from holding tanks in residences and other buildings in the community. Sewage is collected using sewage vacuum trucks.

2. The vacuum trucks pump out sewage from the building holding tanks and transport it to the detention cell.

3. Sewage is deposited into the lagoon from the vacuum trucks using one of three offload chutes and concrete splash pads, located on the east side of the offload truck pad. The sewage truck backs up to one of the offload chutes and the release valve of the truck is opened. Bollards with railings have been placed in front of each offload chute for safety precautions.

4. The volume of sewage discharged into the lagoon is estimated from the municipal water delivery records

Influent Volume:

Table 1 Wastewater generation estimates

Year	Estimated Wastewater Volume (m^3)	Difference (%)
2015	40,702	-
2016	38,206	-6.1
2017	37,935	-0.7
2018	35,390	-6.7
2019	32,075	-9.4
2020	35,730	11.4
Average	**36,673**	**-2.3**

6.0 SDF Design

Lagoon Capacity:	41,200 m^3
Lagoon Dimensions:	170 m x 155 m x 1.7m
Wetland Treatment Area:	10.5 hectare
Effluent Path Length:	600 m
Discharge Method:	Passive Exfiltration
Final Receiving Environment:	Natural Lake

An overview of the wastewater treatment process:

Wastewater is deposited into the detention cell lagoon year-round. In the winter, the sewage freezes in the fenced lagoon and exfiltrates through the permeable berms upon melt in the spring. Then lagoon was constructed in 2003 by erecting containment berms around the wastewater discharge area. Primary treatment occurs through the settling of solids and retention of sludge. The lagoon also provides some holding time prior to discharge to the tundra wetland. The berms of the detention cell are not impervious and effluent seeps through the permeable east and southeast berms of the detention cell into the tundra wetland during months where effluent has thawed. Most of the secondary effluent treatment is obtained from the wetland treatment area.

The wetland treatment area was modified in 2008 with three berms constructed to direct effluent flow away from town (Appendix A). Once in the tundra wetland, the effluent flows in the east direction, through a combination of defined channels, overland and underground flows, receiving treatment from native vegetation and soil bacteria. Figure 2 shows the seasonal variation in the preferred effluent pathway. Several ponds are present in the wetland, providing increased retention time in the SDF during summer months.

The natural treatment processes include:

- Sedimentation
- Adsorption by soil particles
- Uptake and digestion of nutrient components by plants
- Microbial decomposition of complex molecules
- Physical entrainment in changing flow regimes
- Dilution by intermixing with the natural water system

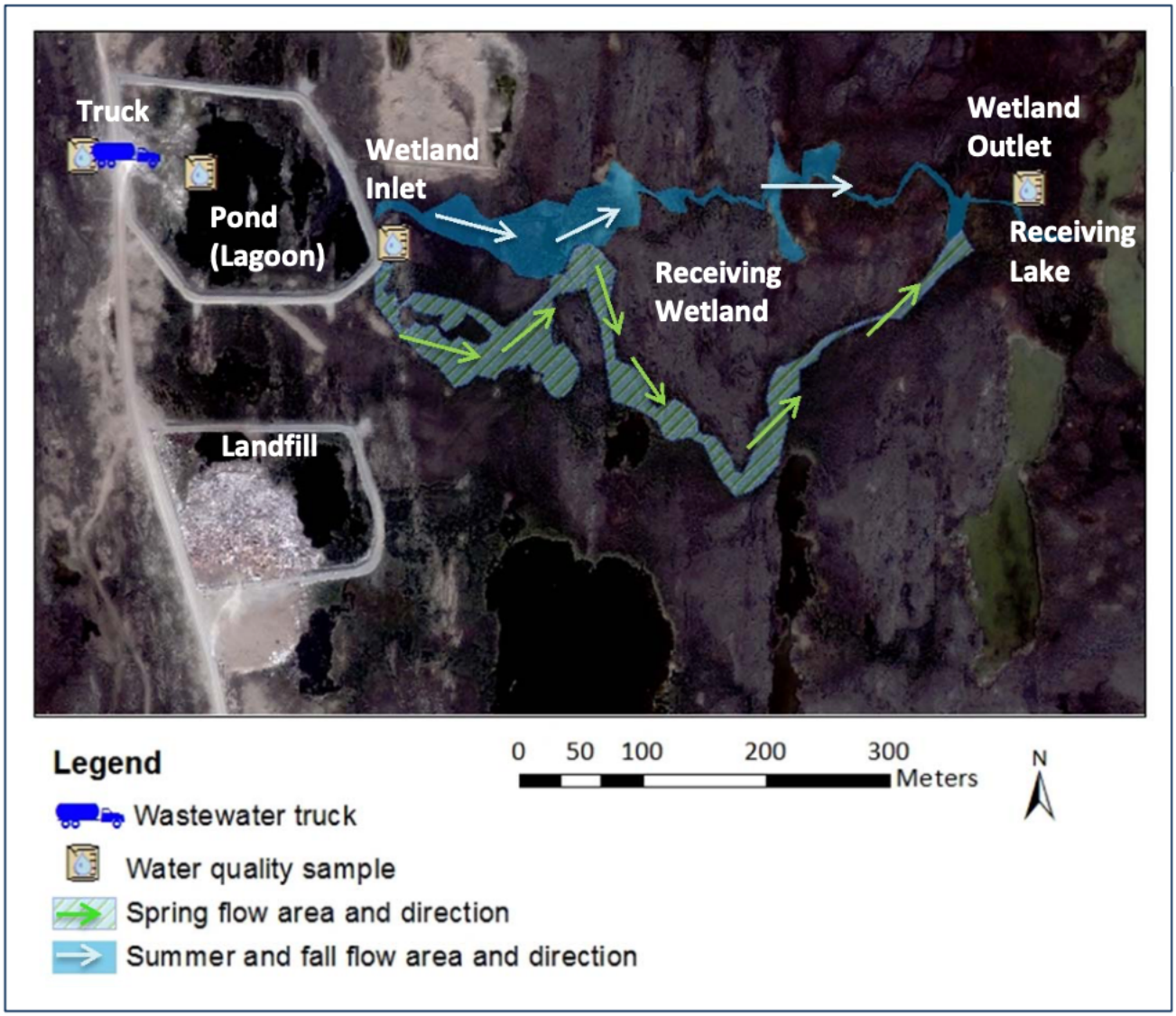


Figure 2 Seasonal Effluent flow through the wetland treatment area (Centre for Water Resources Studies Dalhousie University, 2013)

The wetland treatment area slopes from west to east, with an elevation drop of approximately 10 m between the base of the lagoon and the licence compliance point. The area is characterized by bedrock ridges interspersed with shallow deposits of fine-grained soil. Vegetation typically consists of lichen and mosses on the ridges with shrubs and grasses in the areas where soil is present. Vegetation is lush along shorelines and low-lying areas, likely because of the nutrients from the sewage effluent. The tundra wetland discharges to a freshwater lake. The wetland has been assessed for efficacy several times since 1994 as summarized in the Table 2.

Table 2 Summary of Wetland Treatment Area Assessments in Coral Harbour

Year	Investigator	Findings
1994	Arctic Environmental Services	• The wetland provides 90% removal of BOD/TSS and ammonia within 600 m from the sewage truck discharge point. The first two downstream ponds had a combined detention time of 94 days, and the next pond had a detention time of 236 days. • Flow from the sewage discharge point was to the east and south.
2002	Ferguson Simek Clark	• The existing natural wetland system is sufficient for treating sewage for the next 20 years. • Flow attenuating berms to direct the effluent were recommended.
2005	Jacques Whitford Limited	• The tundra wetland is effectively treating sewage effluent from the detention cell to existing Water Licence effluent quality standards • Toxicity testing confirmed that effluent at the proposed compliance point in the wetland is not toxic to fish; meet treatment requirements for a 20-year planning horizon; • Flow diversion berms should be installed in three key locations to divert effluent flows during periods of high flow (spring freshet).
2005	Government of Nunavut	• CGS Staff conducted effluent sampling at locations in the wetland in July and August 2005. • The effluent discharged from the detention cell met current water licence effluent quality standards and CCME Water Quality Guidelines for the Protection of Aquatic Life at the proposed compliance point in the wetland treatment area.
2006	Government of Nunavut	• CGS Staff conducted effluent sampling at locations in the wetland in June and July 2006. • The effluent discharged from the detention cell met current water licence effluent quality standards and CCME Water Quality Guidelines for the Protection of Aquatic Life at the proposed compliance point in the wetland treatment area.
2007	Jacques Whitford Limited	• Treatment of sewage effluent in the tundra wetland during spring is achieving compliance with licence effluent quality standards; • Based on effluent loading rates and wetland size, the tundra wetland is capable of meeting effluent quality standards for a 20-year horizon;

		• Recognition of the tundra wetland as the main component of the SDF was a more practical and cost-effective method of treating municipal sewage than repairing the lagoon; • Installation of diversion berms to divert potential effluent flows away from the community during periods of high flow should be undertaken to address regulatory concerns
2013	Centre for Water Resources Studies Dalhousie University	• The direction of flow of the effluent in the wetland varied over the treatment season (spring, summer and early fall ice-free months) • Generally, the effluent entered the wetland inlet from the south-east corner of the berm and flowed approximately 700 m east towards the wetland outlet at a large shallow freshwater receiving lake and did not flow towards the municipality or the drinking water reservoir. • The effluent flows from the lagoon into the wetland were highest in June and the treatment provided was the least effective because it quickly passed through the wetland allowing less time for the contaminants to be treated. In the summer and fall, the effluent flow is slower increasing the wetland's treatment capacity. • The wetland inlet flows were smaller than the outlet flows indicating that water is added within the wetland system diluting the strength of the contaminants in the wetland. • The sampling results demonstrated that effluent leaving the wetland treatment area was below 30 mg/L for both total suspended solids (TSS) and carbonaceous biological oxygen demand (CBOD).

8.0 Maintenance

Overview of Maintenance Activities:

1. Annual inspections will be undertaken by Crown Indigenous Relations and Affairs Canada (CIRNAC) accompanied by a licensee and/or a licensee representative from GN-CGS. The inspection report and recommendations will be reviewed by a GN-CGS municipal engineer and submitted in the Annual Report submitted to the Nunavut Water Board (NWB).

2. Regular visual inspections by municipal staff of the:

- Offload chutes
- Lagoon berms
- Lagoon fence
- Signage

  Any issues identified by municipal staff must be reported to the regional municipal engineer. Follow-up actions will be undertaken by the municipality with support from the GN-CGS.

3. Geotechnical inspection of the lagoon berms by a qualified engineer as outlined in the municipal water licence.

Sludge Management:

Sludge has not been removed from the lagoon since it was constructed in 2003. The height of sludge accumulation in the lagoon will continue to be monitored annually to ensure accumulation does not exceed a certain percent volume of the lagoon. A trigger sludge depth of 0.4 m is recommended to determine the need for desludging. Once sludge removal is recommended it will be dewatered using geotextile technology before final disposal at a designated location within the solid waste management facility.

9.0 Monitoring

Regulatory Inspection: The annual CIRNAC inspection will take place accompanied by the licensee and/or with a licensee representative from GN-CGS. The inspection will be reviewed by a GN-CGS municipal engineer and submitted with the annual report.

Table 3 Licence requirements related to O&M of the SDF

Requirements	**Reported**
Monthly and annual quantities of wastewater disposal	Annual report submitted to NWB
Notice of commencement of monitoring program and observed flow	Notice given to the CIRNAC inspector

A summary of modifications and/or major maintenance work carried out on the SDF	Proposal submitted to NWB 60 days prior
A list of spills and unauthorized discharges.	Annual report submitted to NWB
A summary of any studies requested for the SDF and future planned studies planned	Annual report submitted to NWB
Monitoring Program Station COR-5 shall not exceed the effluent quality limits: • 30 mg/L BOD • 30 mg/L TSS • 10000 CFU/dl Fecal Coliform • No visible sheen of Oil and grease • 6-9 pH	Annual report submitted to NWB
Monitoring Program Stations COR-3, COR-4 and COR-5 must be sampled 3 times annually during the open water season for the identified quality parameters	Annual report submitted to NWB
A freeboard of 1.0 m in the lagoon must be maintained	Annual report submitted to NWB

Table 4 Monitoring Program Station description and locations

Station	**Description**	**Latitude**	**Longitude**
COR-2	Sewage truck release point	64° 09’ 49” N	83° 11’ 46” W
COR-3	Effluent from lagoon	64° 09’ 47” N	83° 11’ 30” W
COR-4	Station in wetland	64° 09’ 47” N	83° 11’ 20” W
COR-5	Discharge from wetland	64° 09’ 43” N	83° 11’ 15” W

8.0 Modifications and Upgrades

Modifications or upgrades needed for the SDF: Upgrade to Impervious lagoon

Planned modifications or upgrades:

GN-CGS plans to request funding to develop a business case to upgrade the permeable retention lagoon to an impervious lagoon that allows controlled annual effluent discharge. There is no timeline for when this project may be approved by Cabinet. NWB will be notified once studies are ongoing and prior to making any change to the current SDF infrastructure.

9.0 Previous Reports

- Community Report: Technical Wastewater Treatment and Water Related Community Health Research, Coral Harbour, NU, Community Report: Technical Wastewater Treatment and Water Related Community Health Research, Coral Harbour, NU, 2013
- Water, Sewage and Solid Waste Operations & Maintenance Manual, Coral Harbour, NU, Nunami Jacques Whitford Limited, 2010
- Report of the Natural Tundra Wetland Sewage Treatment Facility, Coral Harbour, NU Nunami Jacques Whitford Limited, 2007
- Schematic Design Report: Natural Tundra Wetland Sewage Treatment Area Design, Coral Harbour, NU Nunami Jacques Whitford Limited, 2007

Appendix A: Sewage Disposal Facility Site

N

COR-2

Offload Area

COR-3

COR-4b

COR-5

COR-4a

COR-4c

Water, Sewage & Solid Waste Facilities Operation & Maintenance Manual
Coral Harbour, NU

Sewage Disposal Facility

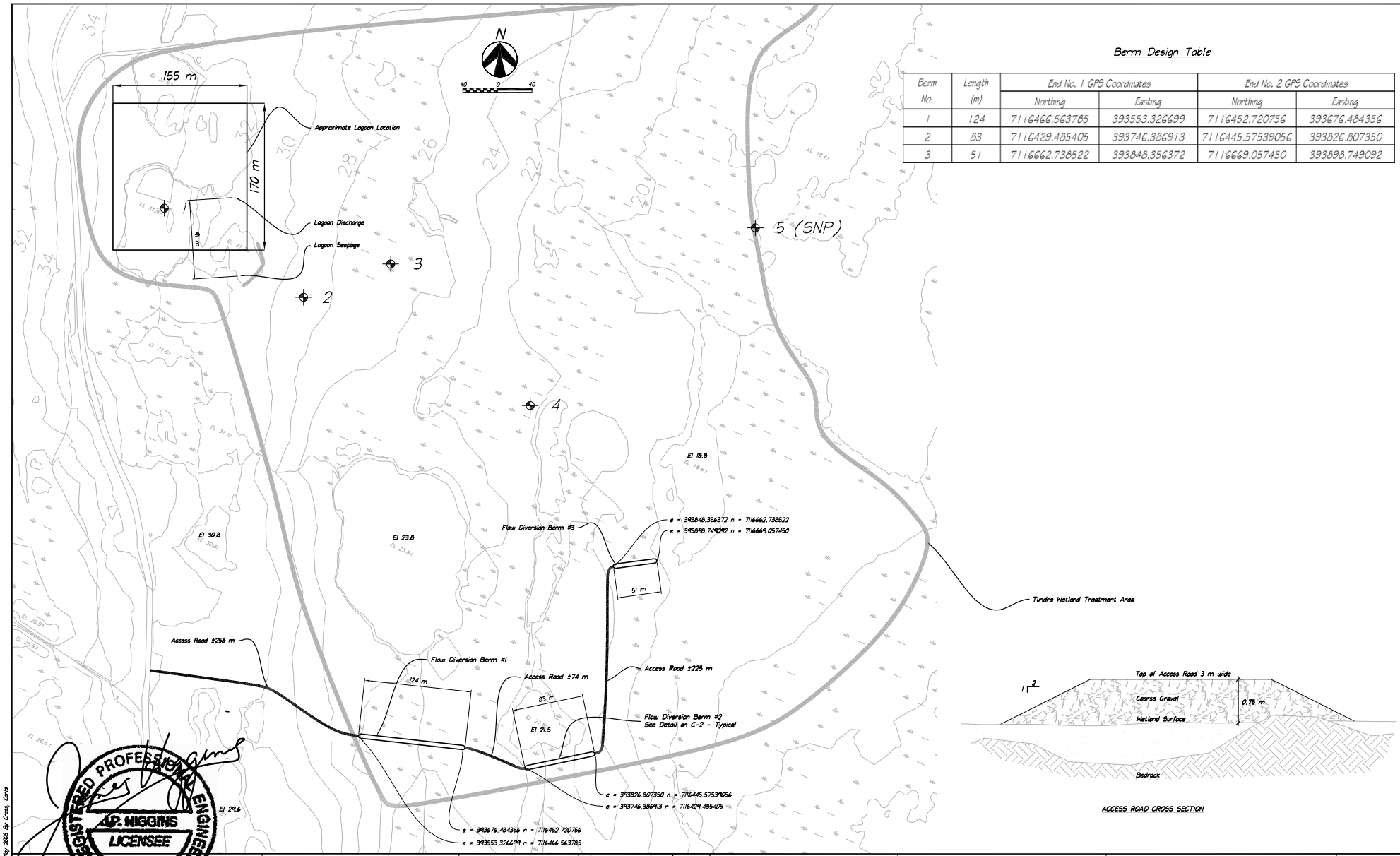
Monitoring Stations
Fence
Contour
Flow Diversion Berm
Stream
Sewage Disposal Facility
Road
Water

0 125 250 500
Metres

PREPARED BY
NUNAMI
JACQUES WHITFORD LIMITED

DRAFT DATE 13/11/2009			SCALE 1:5,000	
REVISION DATE			PROJECT 1054491	FIGURE NO. 3
DRAWN KS	CHECKED	APPROVED	VOL	

Appendix B: Diversion Berm Drawings



Berm Design Table

Berm No.	Length (m)	End No. 1 GPS Coordinates		End No. 2 GPS Coordinates	
		Northing	Easting	Northing	Easting
1	124	7116466.563785	393553.326699	7116452.720756	393676.484356
2	83	7116429.485405	393746.386913	7116445.57539056	393826.807350
3	51	7116662.738522	393848.356372	7116669.057450	393898.749092

ACCESS ROAD CROSS SECTION

REGISTERED PROFESSIONAL ENGINEER
A.P. HIGGINS
LICENSEE
NWT/NU

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NUNAMI
JACQUES WHITFORD LIMITED

Rev	Date	Description
5	5/07/08	Issue for Addendum No. 4
4	4/14/08	Issue for Tender
3	2/07/08	Issue for Review

GOVERNMENT OF NUNAVUT DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES
PROPOSED SYSTEM IMPROVEMENTS
CORAL HARBOUR SEWAGE SYSTEM
CORAL HARBOUR, NORTHWEST TERRITORIES

Site Map

Figure 1

1023336-Fig 1.dwg

Plot Date: 7 May 2008 By: Cross, Carla

K:\1023336 Coral Harbour\dwg\1023336-Fig 1.dwg

Appendix C: Sewage Disposal Facility Photographs

Interior of Lagoon looking east

Lagoon looking east from Truck discharge location

Main effluent seep outside SE corner of lagoon

Secondary Seep outside south side of lagoon, approximately 20m west of main seep

Looking west across wetland to lagoon

Looking east from lagoon, across wetland

Flow in wetland east of lagoon


Pond in Wetland

Wetland vegetation in area of defined flow.

Wetland vegetation in area of diffuse flow

Sampling at Station 5 (proposed SNP Point); flow is from right to left of picture.


Sampling Station 5, looking east into large lake