

Operation & Maintenance Plan for
Whale Cove Municipal Water Licence:
Sewage Disposal Facilities
2022

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1.0 Site Description

Date this plan was prepared:

March 31, 2022

1.1 Location of the Sewage Disposal Facility (SDF)

Municipality:

Whale Cove

Latitude:

62° 10' 06" N

Longitude:

92° 35' 21" W

Proximity to Town:

500 m SW



Figure 1 Whale Cove Sewage Disposal Facility

1.2 SDF History

Year of commissioning the SDF: 2016
Design life of the SDF: 2032

Treatment System:

The lagoon was constructed in around a natural pond that had previously been bermed in the 1980s on the northeast and southwest sides to receive wastewater and passively discharge into the adjacent wetland treatment area. The new lagoon was constructed in 2016 to increase the lagoon capacity to meet the wastewater storage needs of the community until at least 2032. The lagoon was constructed with thermosiphons to improve the impermeability of the lagoon allowing for controlled decant into the wetland treatment area each summer.

2.0 Staff

Role:	Senior Administrative Officer	Name:	Brian Fleming
Phone:	(867) 896-9961	Email:	sao@whalecove.ca

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:	Stanley Adjuk
Phone:	(867) 896-9961	Email:	N/A

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
Phone: N/A

Name: Various
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 trucks; and
- Workers must keep their vaccinations up to date.

4.0 Security and Control

Access Control of to the facility:

- 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 two steel offload chutes, located on the north side of the lagoon on the offload truck pad. The sewage truck backs up to one of the offload chutes and the release valve of the truck is opened. Boulders 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 (m³)	Difference (%)
2017	18,685	-
2018	16,790	-10.1
2019	17,013	-6.7
2020	16,440	-9.4
2021	17,407	11.4
Average	17,267	-3.7

6.0 SDF Design

Lagoon Capacity:	36,000 m ³
Wetland Treatment Area:	3.6 hectare
Effluent Path Length:	650 m
Discharge Method:	Annual Decant
Final Receiving Environment:	Ocean

An overview of the wastewater treatment process:

Wastewater is deposited into the lagoon year-round. Then lagoon was upgraded in 2016 to address the existing inability of the existing lagoon to maintain 1 m freeboard year-round. The previous lagoon had two sections of berm, on the northeast and southwest sides. The new construction includes thermosiphons in the northeast berm to promote permafrost aggradation creating an ice dam to improve containment and ultimately prevent effluent from draining towards town. Four areas of discontinuous engineered berms were also constructed on the southwest, west, and northeast sides of the lagoon. The berms included bentonite liners on the inner face, keyed into the existing permafrost below the base of the lagoon. The areas there were not berms are composed of bedrock.

The traditional approach of providing a lined cell to prevent seepage from the sewage lagoon was not considered viable as the facility is an existing lake with a watershed draining into it. Lining a natural water body is difficult as it has an irregular base which requires substantial levelling to provide a firm bearing surface for the liner. In addition, the liner requires substantial ballast due to buoyancy forces from water accumulating under the liner in a naturally occurring depression.

The effluent is pumped from an inlet within the lagoon through a 48 m 150 mm HDPE pipe by a self-priming centrifugal pump placed on the berm adjacent to the wetland each summer. From the pump the effluent moves through 15 m of additional pipe before encountering a T-junction that diverts it through a 50 m long nested pipe dispersion structure that releases it along the width of the wetland treatment area . Effluent is discharged over approximately 4 weeks in late summer once the wetland vegetation has had an opportunity to develop.

The existing wetlands area is approximately 3.6 hectare in size with an average slope of 2.7%. The well-established native vegetation community will be used and alterations or modifications to the plant community composition are not necessary to increase

removal of contaminants. The plant species present, which include willows, grasses, sedges and mosses, are suitable for the phytofiltration processes that are estimated to reduce contaminants such as BOD and TSS by 75-97% based on the 2011 wetland assessment demonstrated in Figure 2.

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

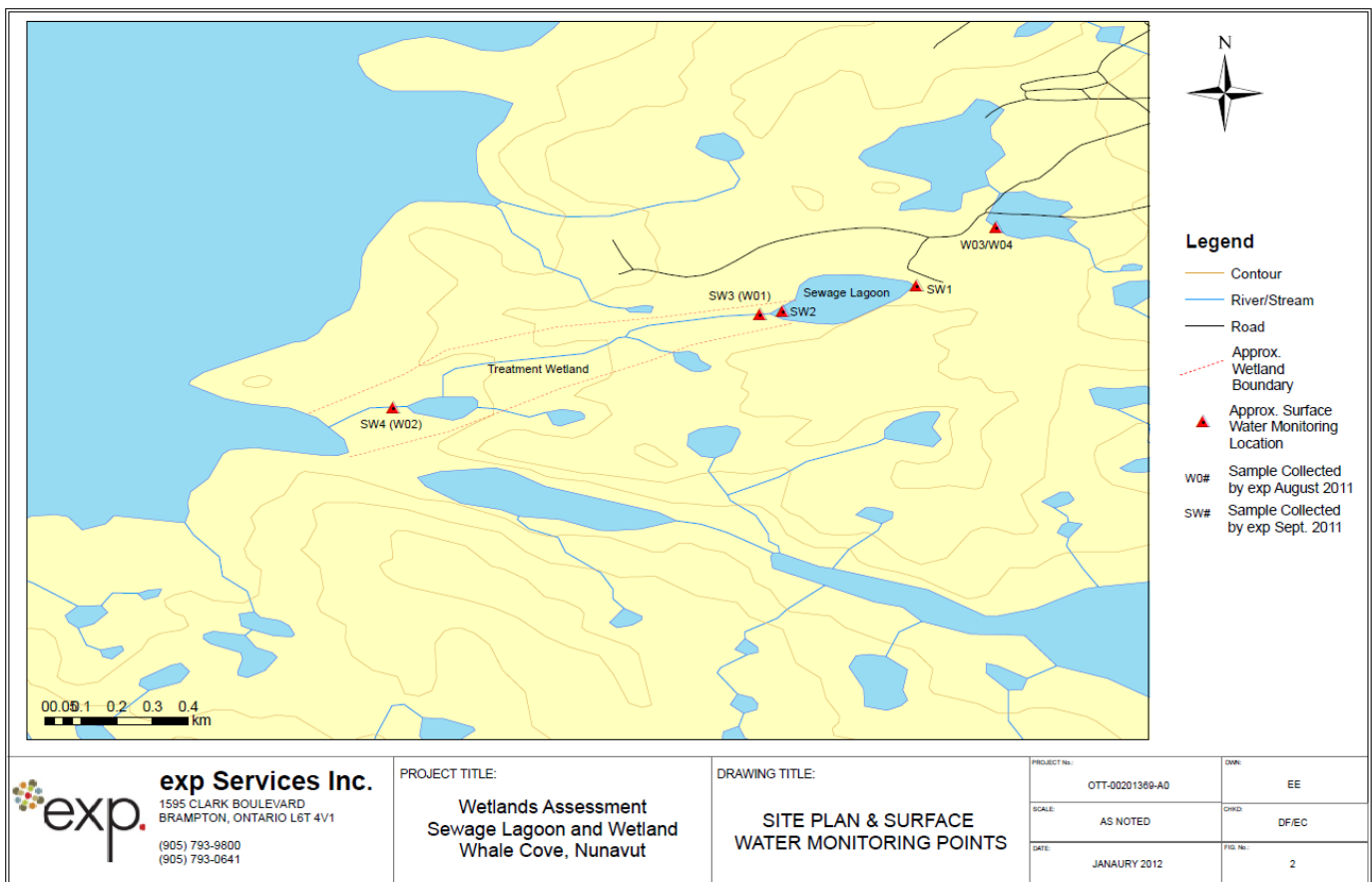


Figure 2 Wetland treatment area

7.0 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 2016. The working volume of the lagoon was constructed to accommodate sludge until at least 2032 based on projections calculations estimating 3,247 m³ of sludge accumulated in this timeframe. The height of sludge accumulation in the lagoon will continue to be monitored annually, through visual inspection and through monitoring sampling results to understand the treatment performance, 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.

8.0 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 report will be reviewed by a GN-CGS municipal engineer and submitted with the annual report.

Table 2 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 WHA-3 shall not exceed the effluent quality limits: • 80 mg/L BOD • 100 mg/L TSS • 10,000 CFU/dl Fecal Coliform • No visible sheen of Oil and grease • 6-9 pH	Annual report submitted to NWB
Monitoring Program Stations WHA-3 and WHA-4 must be sampled monthly 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 3 Monitoring Program Station description and locations

Station	Description	Latitude	Longitude
WHA-3	Final Discharge Point for effluent from the Sewage Disposal Facility prior to the wetland area	62° 10' 4" N	92° 35' 29" W
WHA-4	Effluent outfall area from the wetland area	62° 10' 2" N	92° 35' 38" W

9.0 Modifications and Upgrades

Modifications or upgrades needed for the SDF: N/A

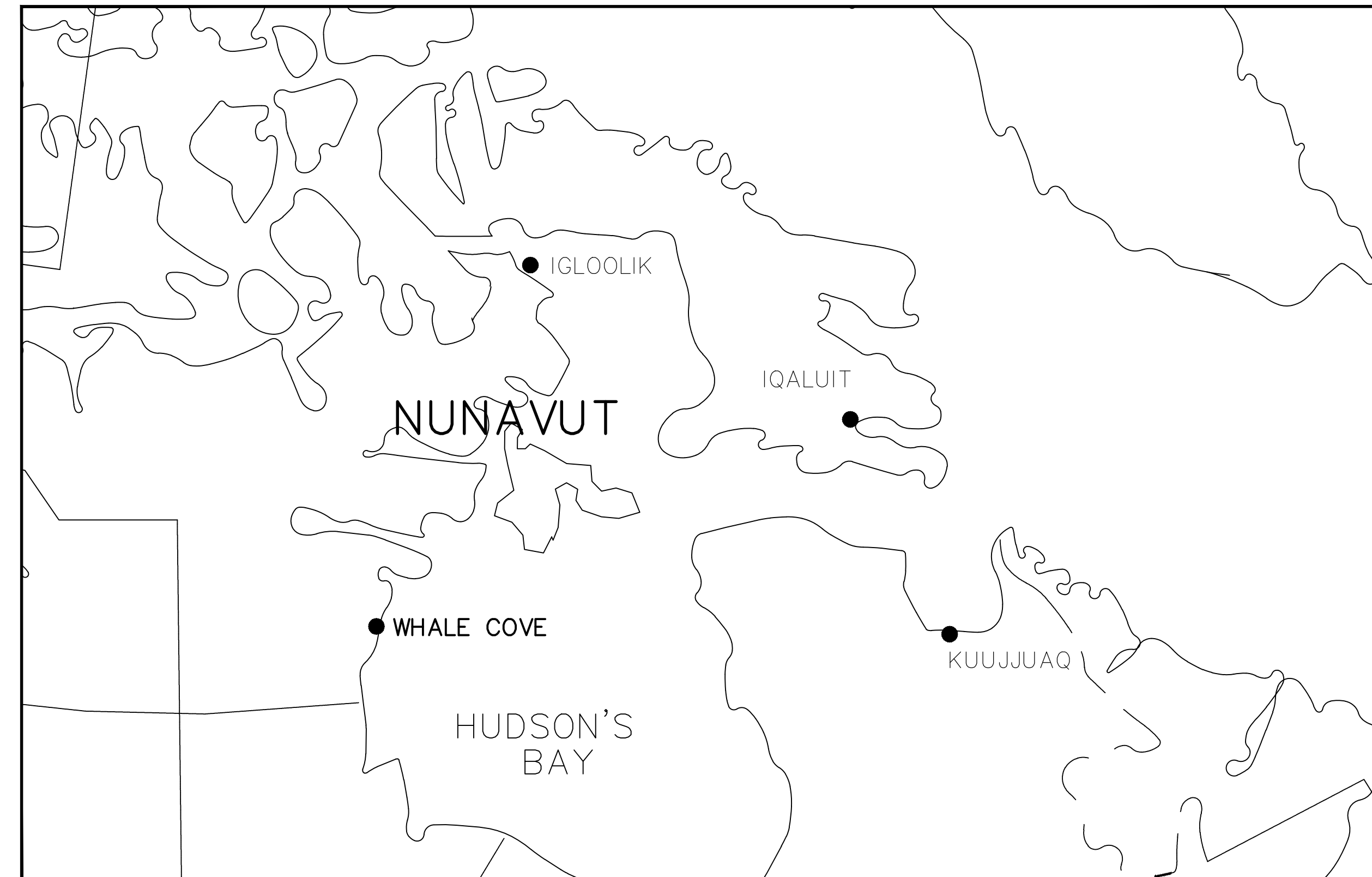
Planned modifications or upgrades: N/A

10.0 Previous Reports

- Sewage Wetland Upgrade, Whale Cove, NU, Design Brief, EXP, 2012
- Wetlands Assessment Report, EXP, 2013

Appendix A: Sewage Disposal Facility As-built Drawings

HAMLET OF WHALE COVE



INDEX OF INCLUDED DRAWINGS

DRAWING NO.	REVISION	DESCRIPTION
OTT-00201369-COV-1		COVER SHEET
OTT-00201369-SLP-1	REV 3	SITE LOCATION PLAN
OTT-00201369-OSP-1	REV 3	OVERALL SITE PLAN
OTT-00201369-CMP-1	REV 3	CONSTRUCTION MANAGEMENT PLAN
OTT-00201369-PLMP-1	REV 3	PROPOSED LAGOON MODIFICATIONS PLAN
OTT-00201369-TDSP-1	REV 3	TRUCK DISCHARGE SITE PLANS
OTT-00201369-CS-1	REV 3	BERM CROSS SECTIONS
OTT-00201369-DE-1	REV 3	PUMPING AND DEWATERING DETAILS
OTT-00201369-DE-2	REV 3	BERM AND THERMISTOR DETAILS
OTT-00201369-DE-3	REV 3	TRUCK DISCHARGE AND MISC. DETAILS

RECORD DRAWING

DATE: NOVEMBER 22nd, 2016

GOVERNMENT OF NUNAVUT

WASTEWATER MANAGEMENT FACILITY

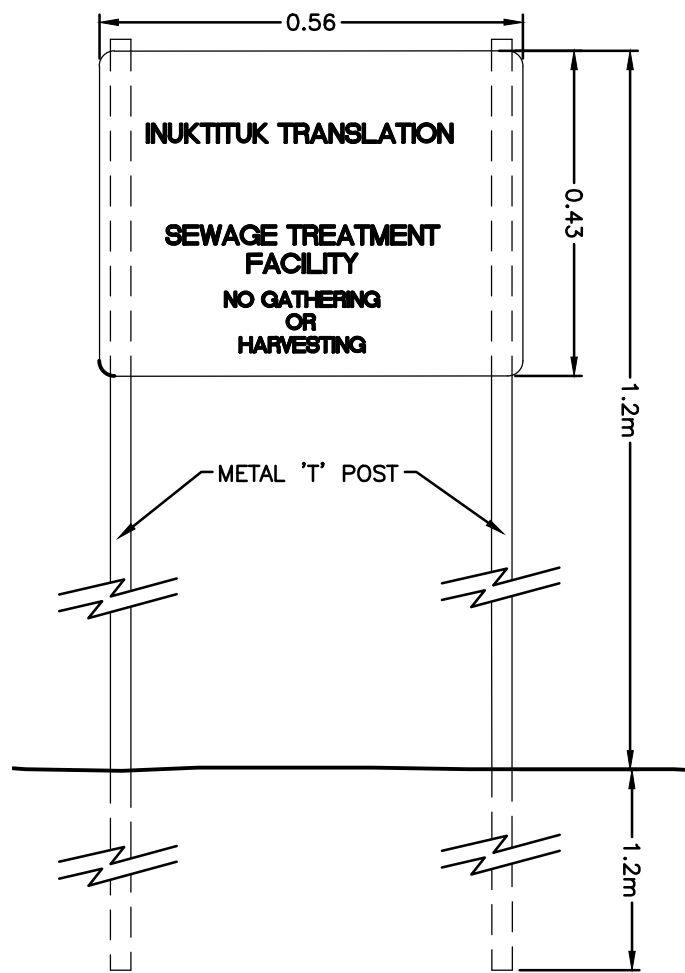
PROJECT OTT-00201369-A exp.

exp Services Inc.

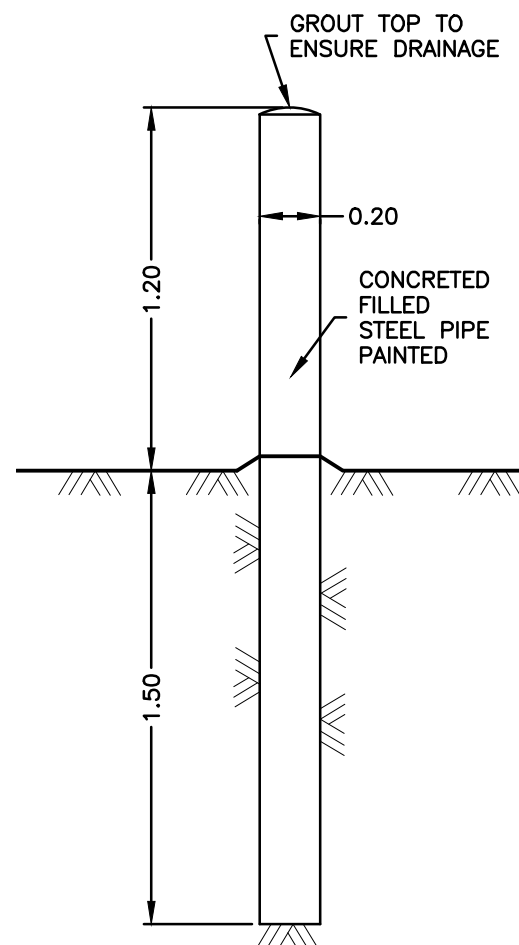
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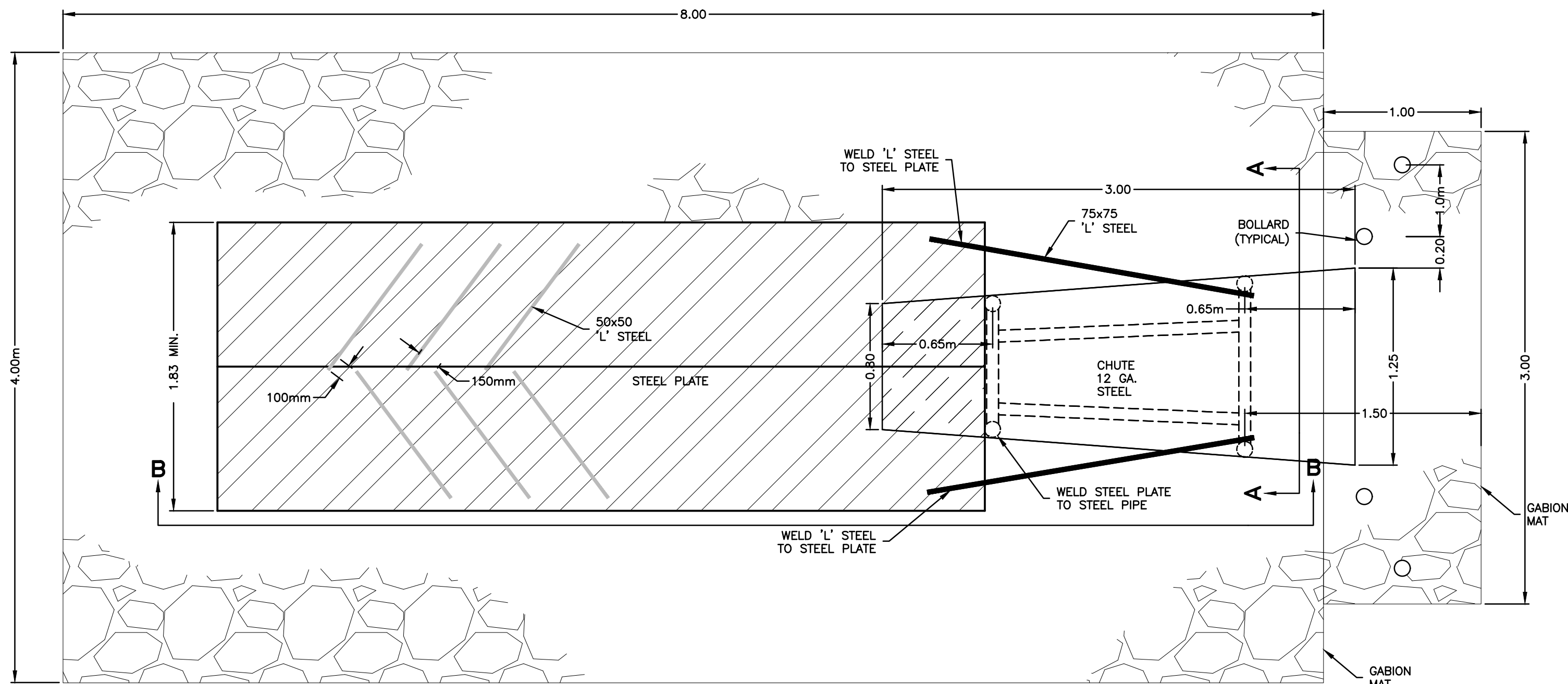
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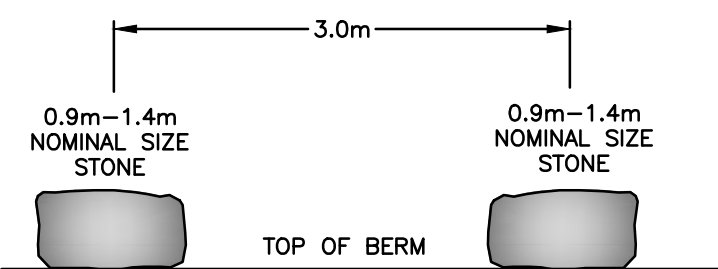
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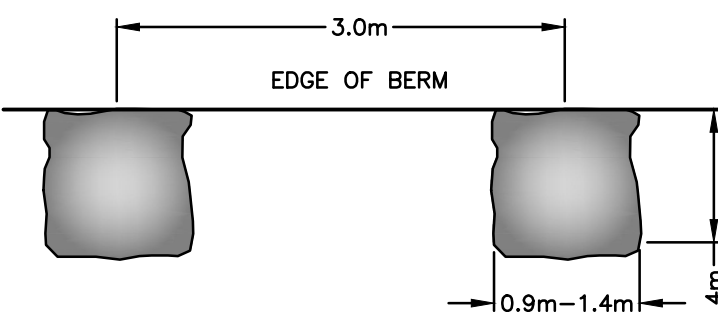
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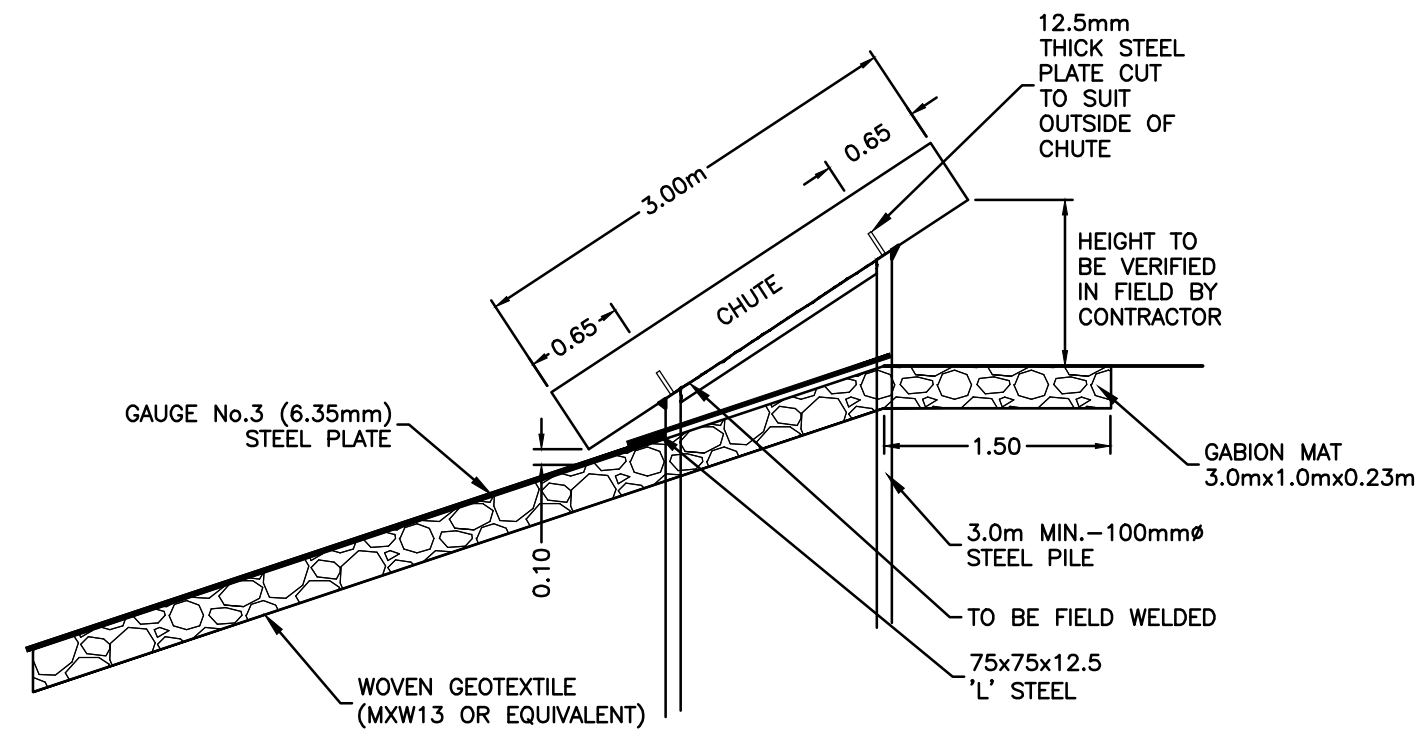
PLAN VIEW
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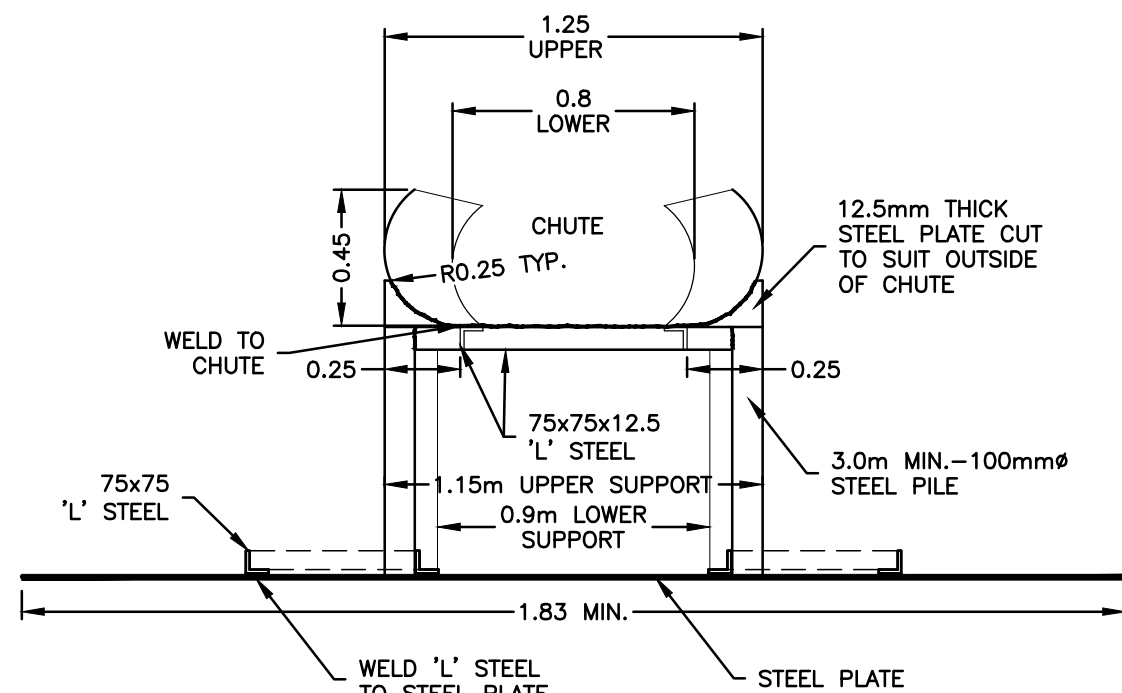
STONE BARRIER DETAIL SECTION VIEW
N.T.S.



STONE BARRIER DETAIL PLAN VIEW
N.T.S.



TRUCK DISCHARGE CHUTE SECTION B-B VIEW
1:50



TRUCK DISCHARGE CHUTE SECTION A-A VIEW
1:25

**RECORD
DRAWING**

DATE: NOVEMBER 22nd, 2016

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY	APPD	NO.	REVISION DESCRIPTION	DATE	BY	APPD
					4	ISSUED FOR CONSTRUCTION	14/04/16	IPC	SLB
					3	ISSUED FOR TENDER	19/12/14	IPC	SLB
					2	ISSUED FOR TENDER	25/02/14	MCK	SLB
					1	ISSUED FOR REVIEW	24/02/12	SAB	SLB

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CHECKED	S.DOUGLAS
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PROJ. MAN	S.BURDEN
APPROVED	S.BURDEN

PROJECT

SEWAGE LAGOON
WHALE COVE, NUNAVUT

DETAIL PLAN
TRUCK DISCHARGE AND MISC. DETAILS

PROJ. NO.

OTT-201369A

SURVEY

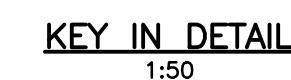
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DETAIL PLAN

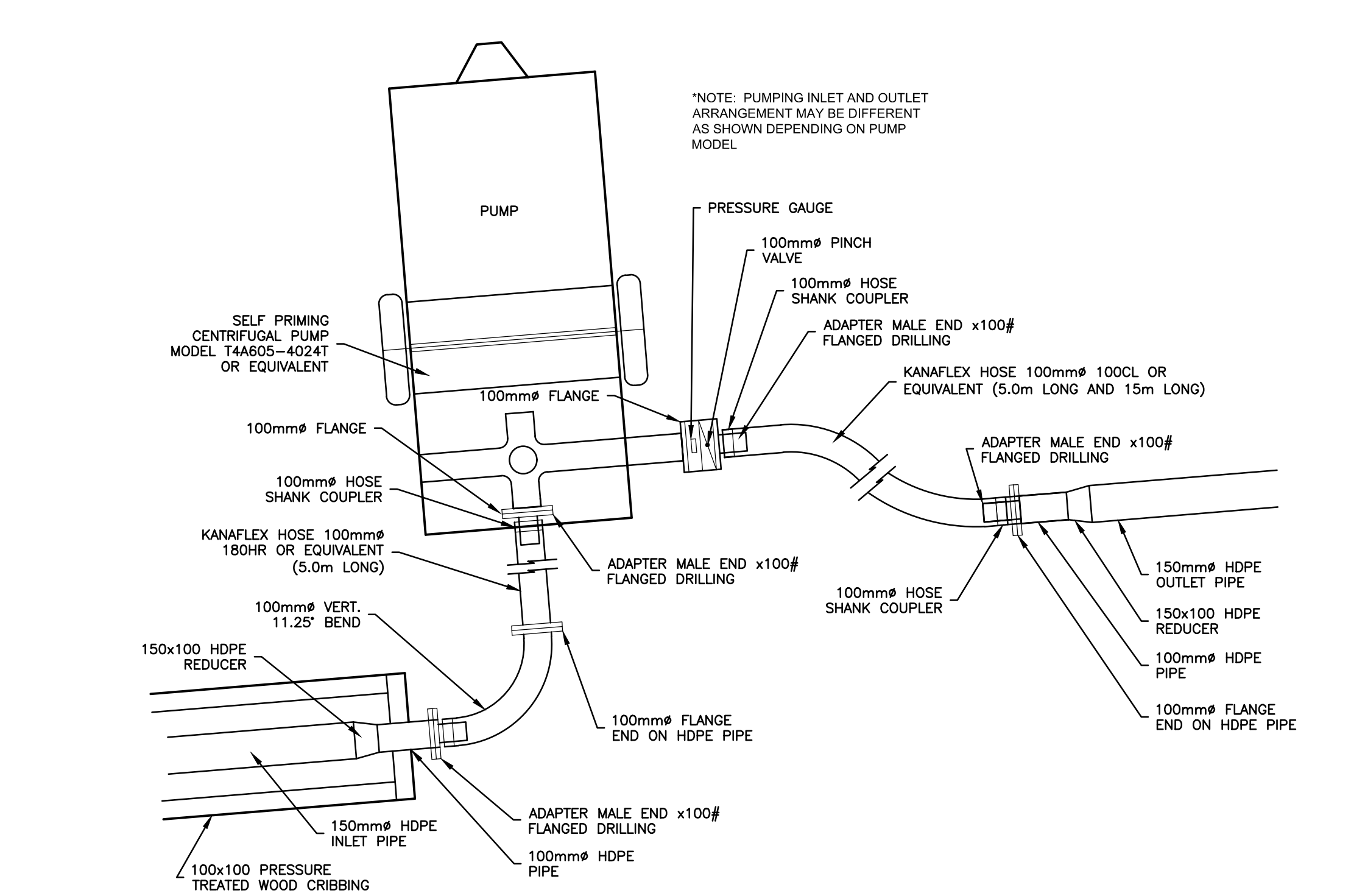
BERM AND THERMISTOR DETAILS

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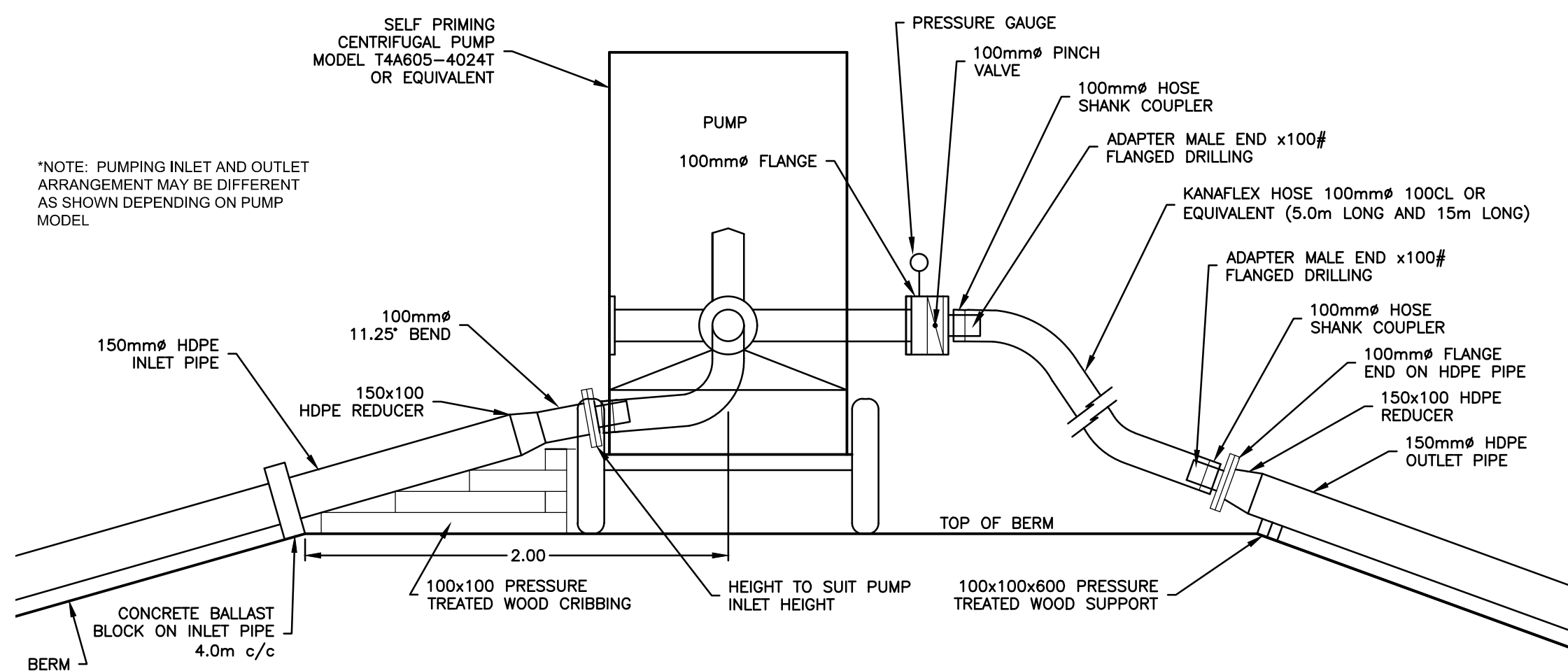
DE-2

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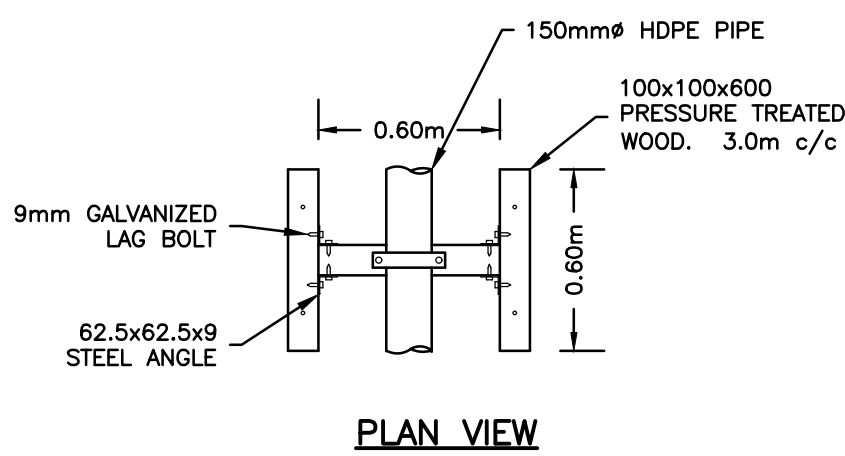
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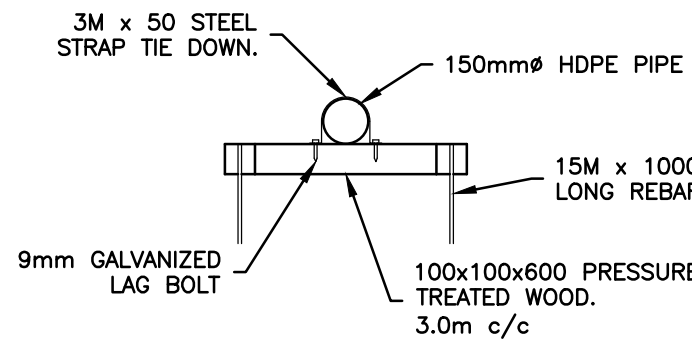
LAGOON DEWATERING PUMP INFRASTRUCTURE PLAN VIEW
1:25



LAGOON DEWATERING PUMP INFRASTRUCTURE
1:25

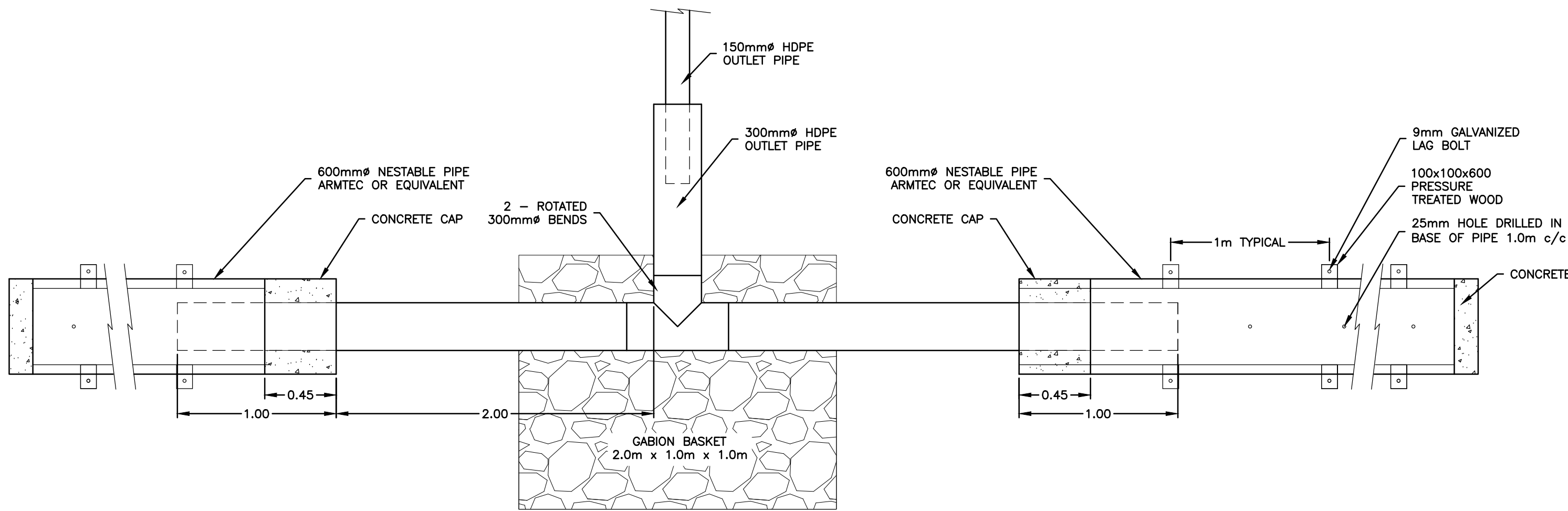


PLAN VIEW



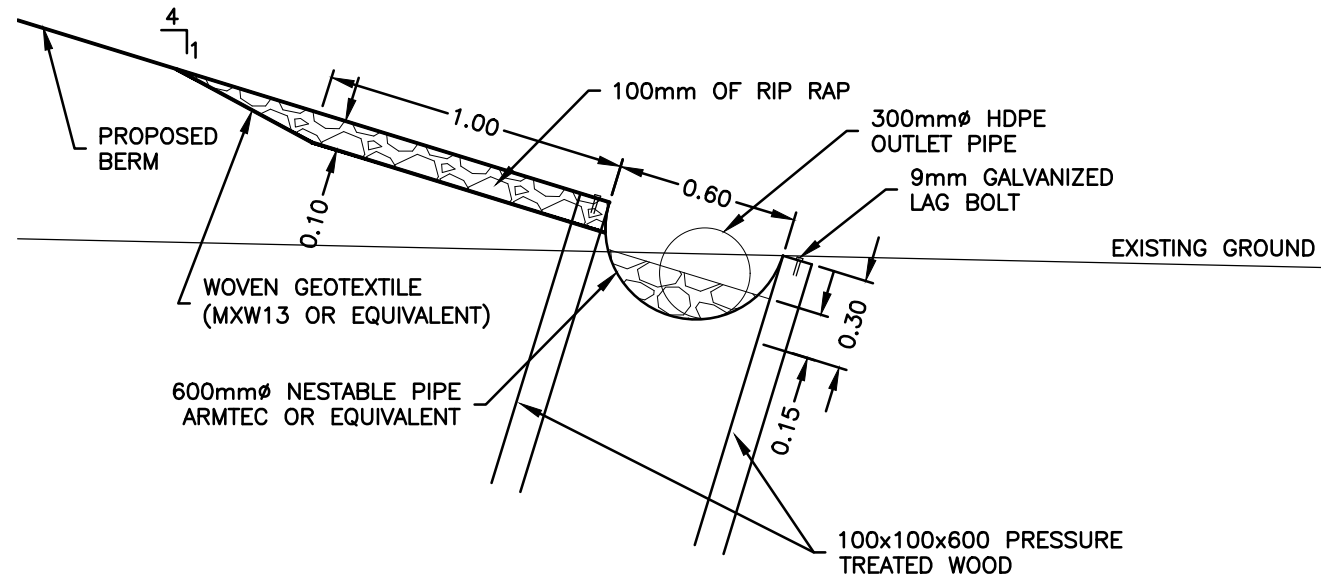
SECTION VIEW

OUTLET PIPE SUPPORT
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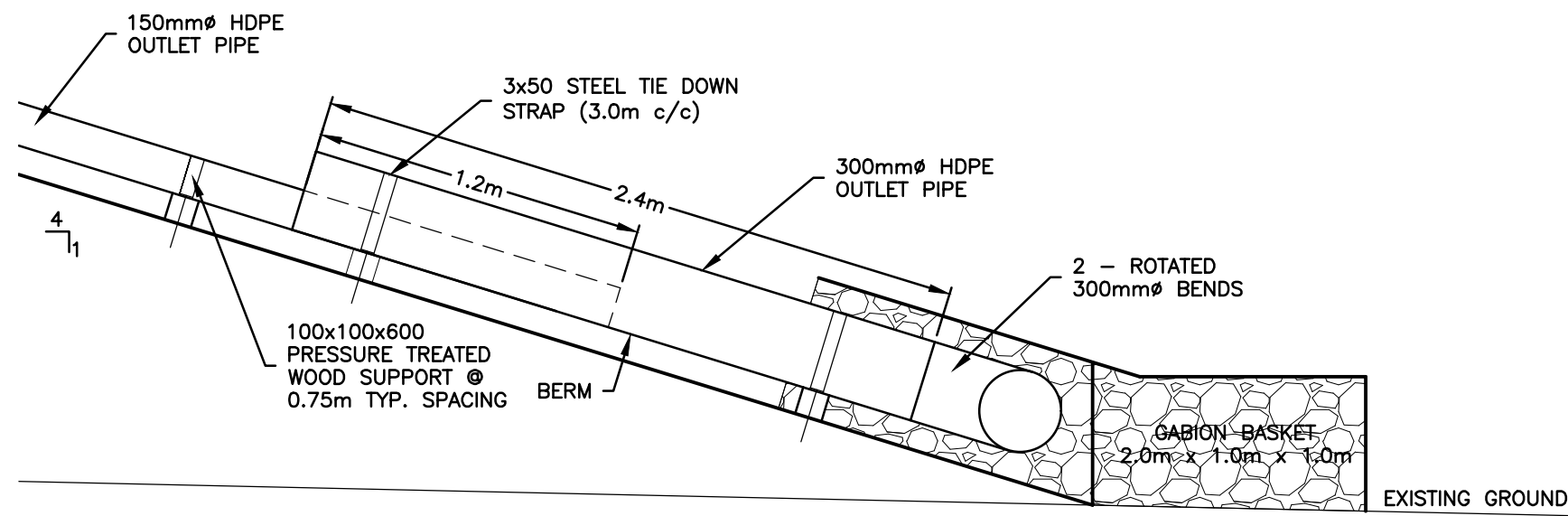
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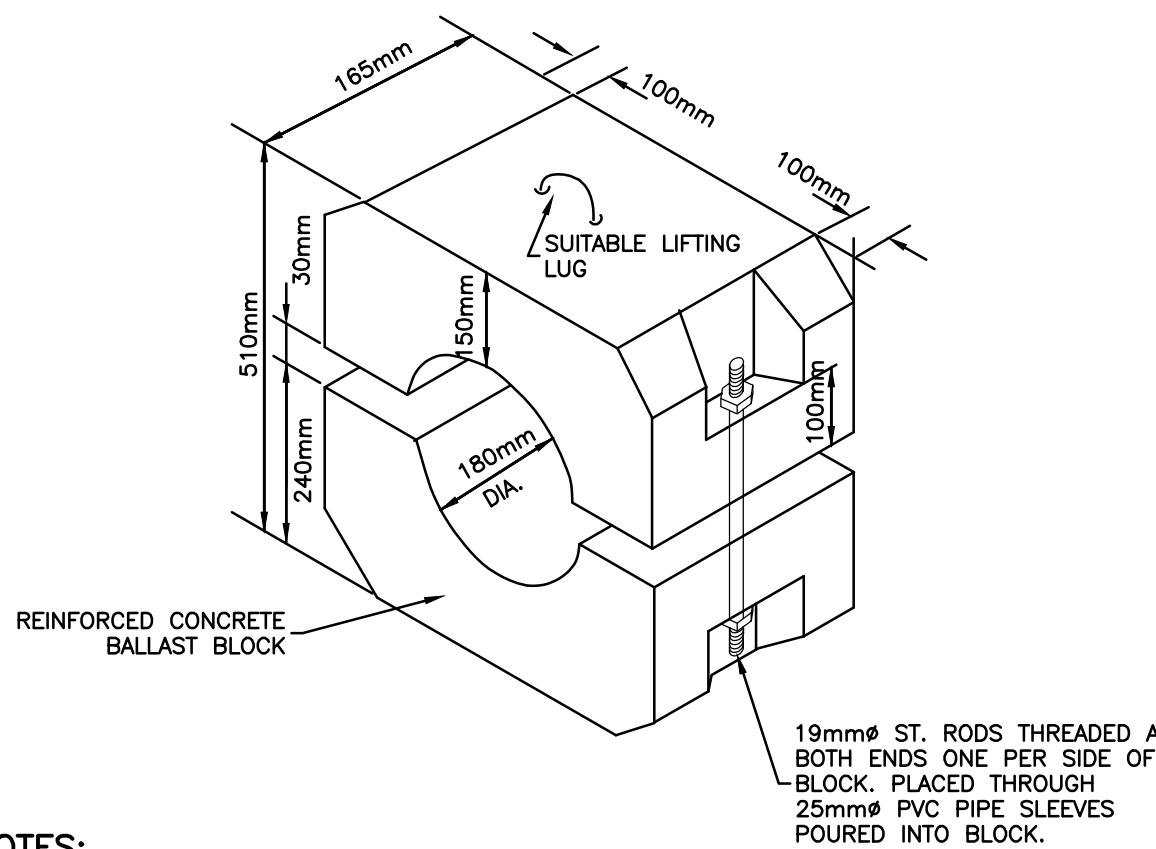
NESTABLE PIPE DETAIL END VIEW

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LAGOON DEWATERING OUTLET INFRASTRUCTURE SECTION VIEW

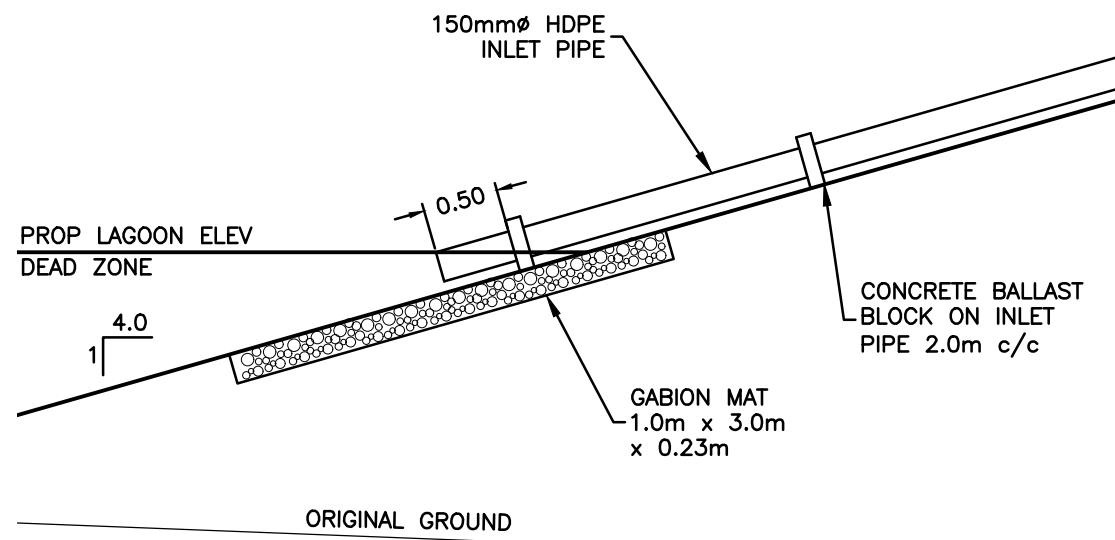
1:25



NOTES:

- CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR CONCRETE BALLAST BLOCKS C/W REINFORCING.
- CONTRACTOR TO USE 6.25mm THICK NEOPRENE SPONGE PADDING BETWEEN PIPE AND BLOCKS TO PREVENT CONTACT. WIDTH TO BE 180mm.

CONCRETE BALLAST BLOCK
N.T.S



LAGOON DEWATERING INLET

1:50

NOTES

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SCALE

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S.BURDEN

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SEWAGE LAGOON
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PUMPING AND DEWATERING DETAILS

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OTT-00201369A

SURVEY

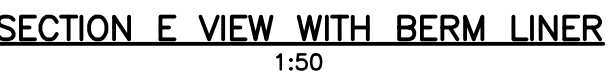
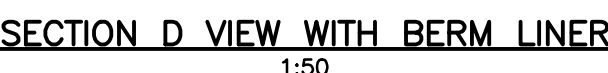
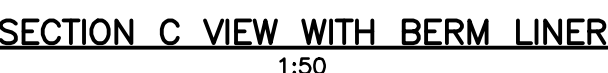
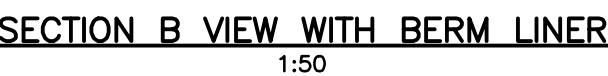
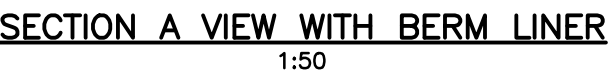
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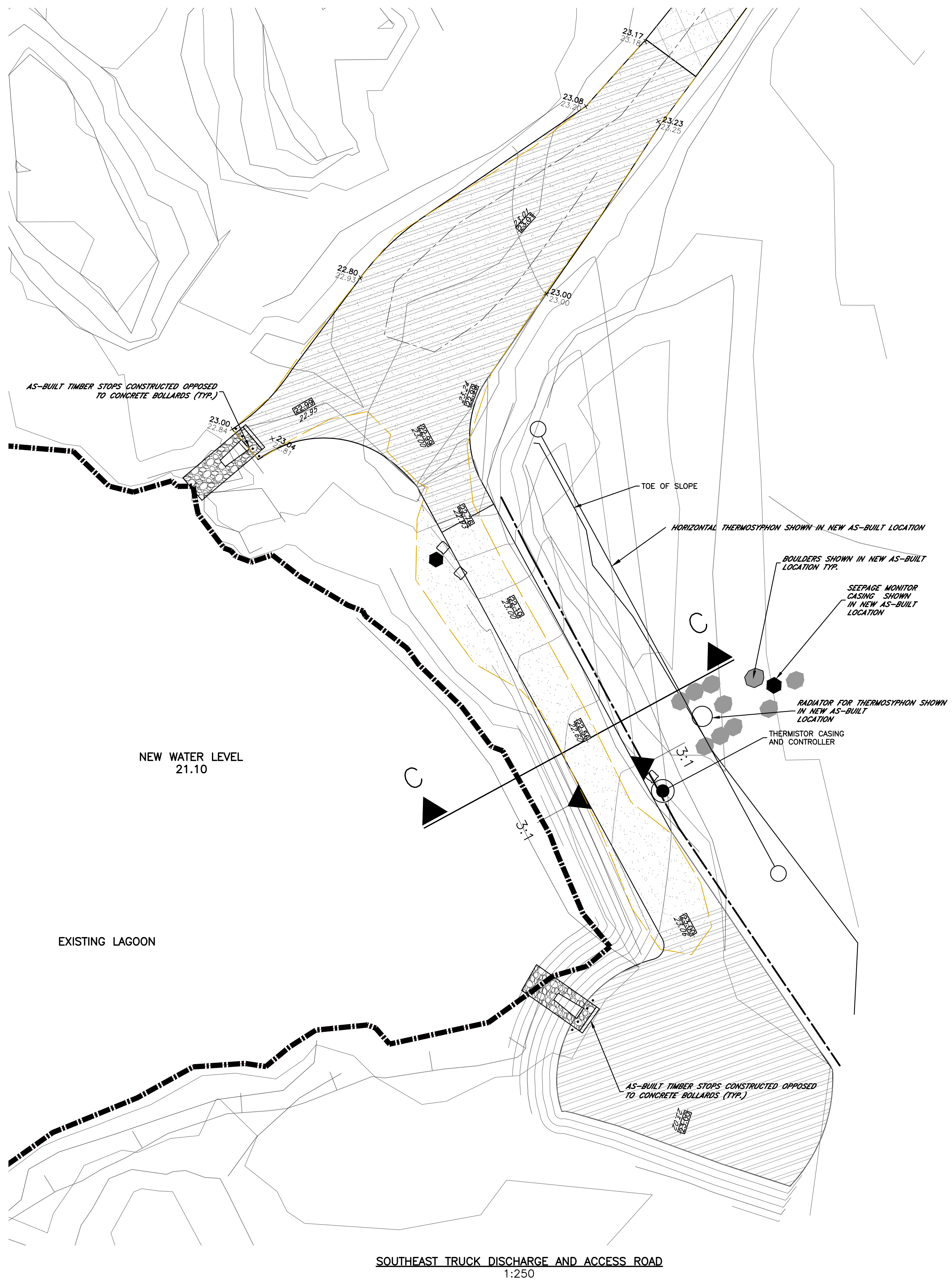
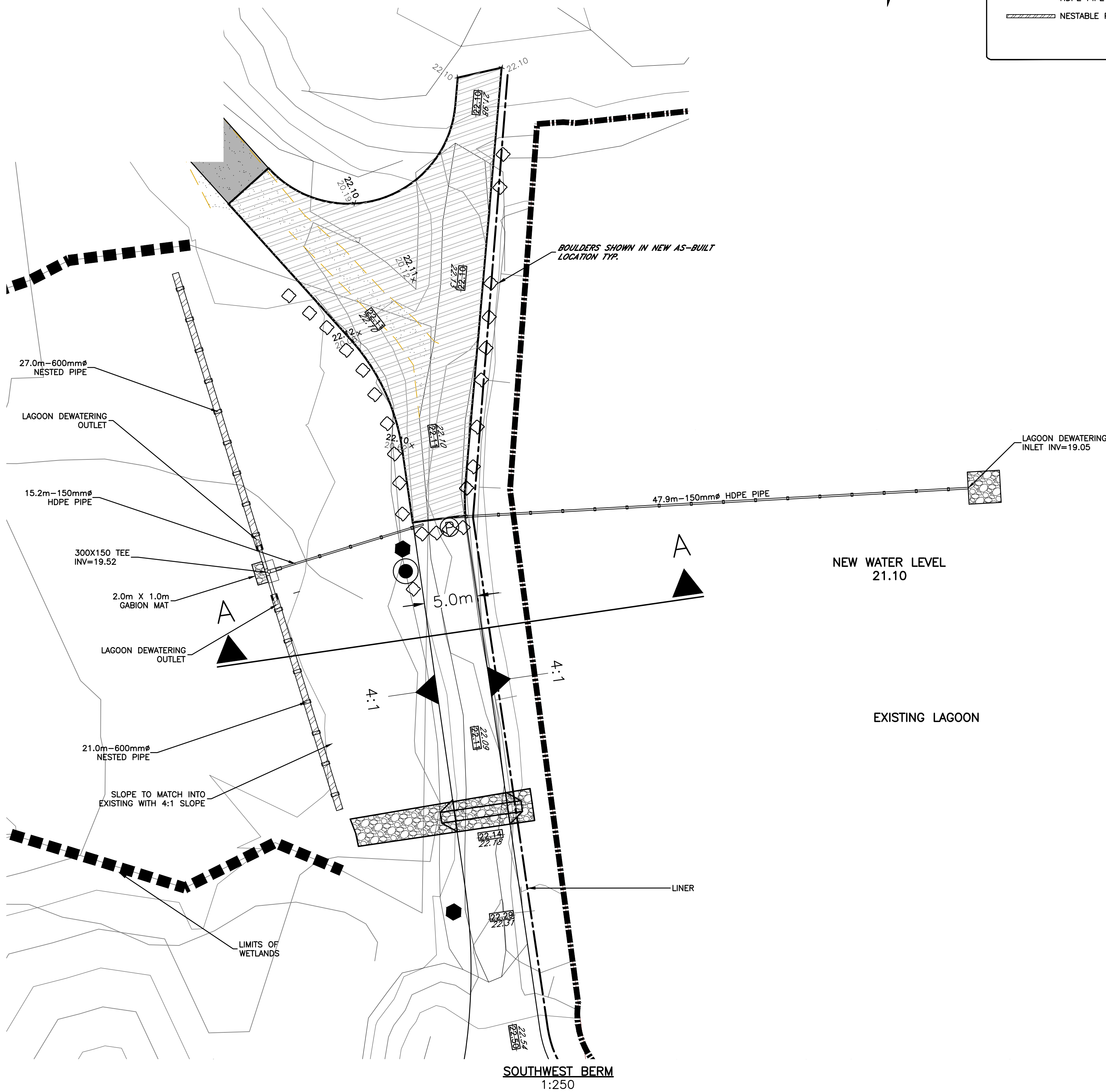
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RECORD DRAWING

DATE: NOVEMBER 22nd, 2016

LEGEND

- EXISTING GRAVEL ACCESS ROAD
- PROPOSED TRUCK TURNING PAD
- PROPOSED NEW ACCESS ROAD
- PROPOSED 150mm GRANULAR 'A' TOP UP ON EXISTING ROAD
- SEEPAGE MONITORING STANDPIPE
- THERMISTOR CASING
- PUMP LOCATION
- STONE BARRIER
- TRUCK DISCHARGE
- GABION MAT
- BOLLARDS
- HDPE PIPE
- NESTABLE PIPE



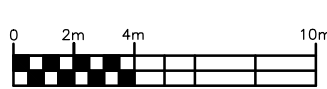
NOTES

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NO.	REVISION DESCRIPTION	DATE	BY	APPD	NO.	REVISION DESCRIPTION	DATE	BY	APPD
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					4	ISSUED FOR CONSTRUCTION	14/04/16	IPC	SLB
					3	ISSUED FOR TENDER	19/12/14	IPC	SLB
					2	ISSUED FOR TENDER	25/02/14	MCK	SLB
					1	ISSUED FOR REVIEW	24/02/12	SAB	SLB

SCALE

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BASEPLAN

S.BUTLER

DESIGN

S.DOUGLAS

PREPARED

S.DOUGLAS

CAD

S.BUTLER

PROJ. MAN

S.BURDEN

APPROVED

S.BURDEN

PROJECT

SEWAGE LAGOON
WHALE COVE, NUNAVUT

TITLE

TRUCK DISCHARGE AND PUMP LOCATION
SITE PLANS

PROJ. NO.

OTT-00201369A

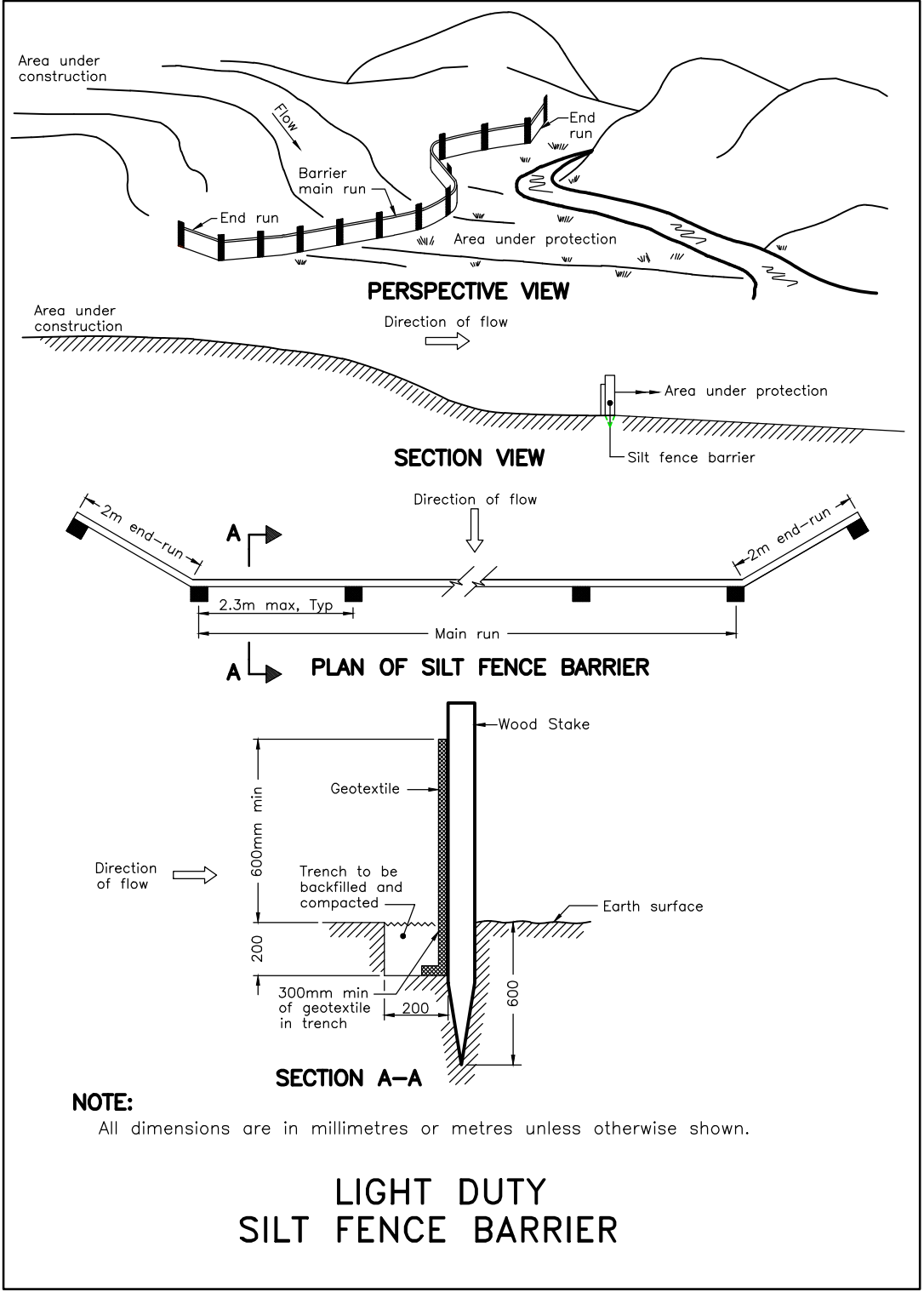
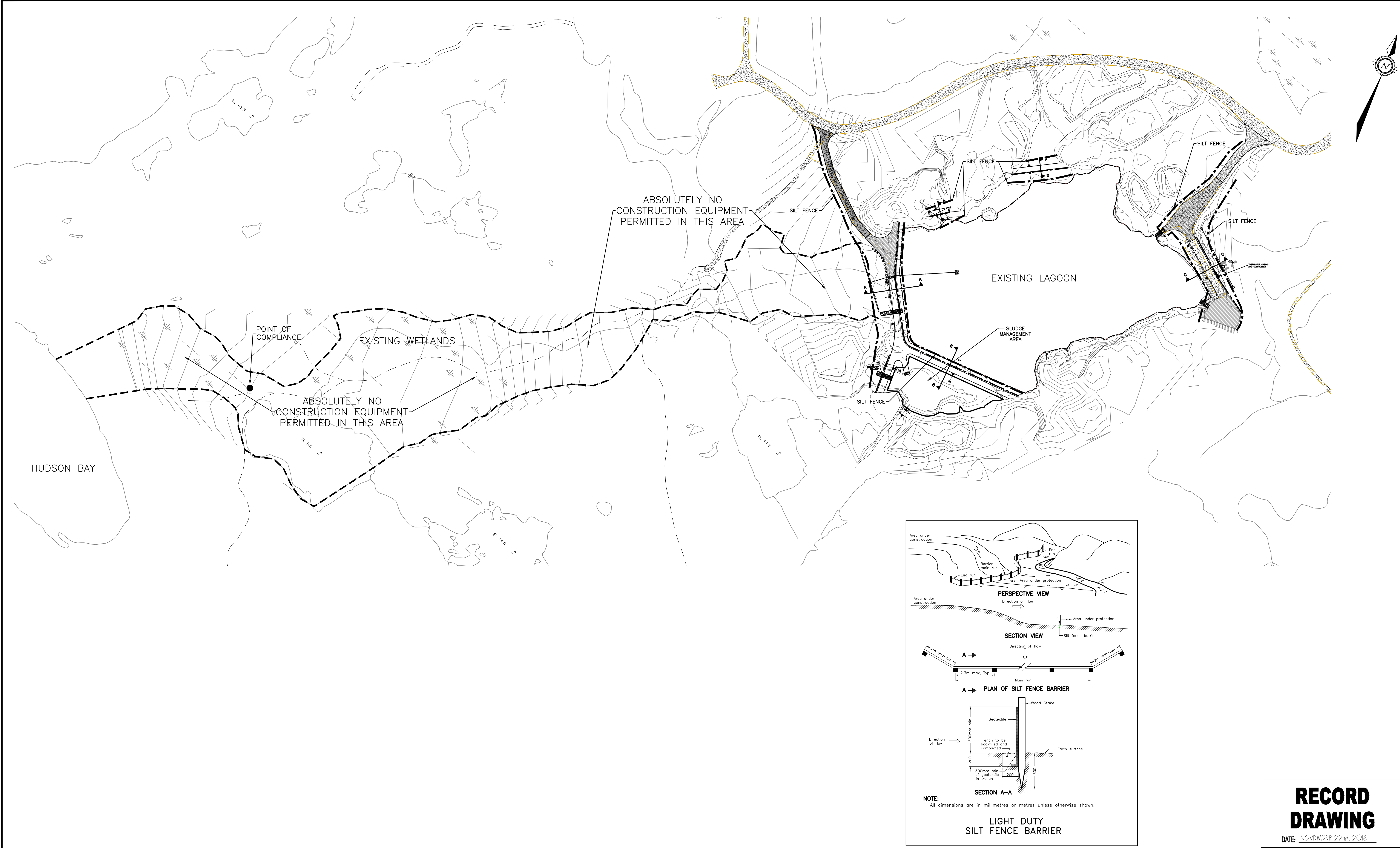
SURVEY

DATE

FEB 01, 2012

DRAWING NO.

TDSP-1



**RECORD
DRAWING**
DATE: NOVEMBER 22nd, 2016

NOTES
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					1	ISSUED FOR REVIEW	24/02/12	SAB	SLB

SCALE
HORZ 1:1250
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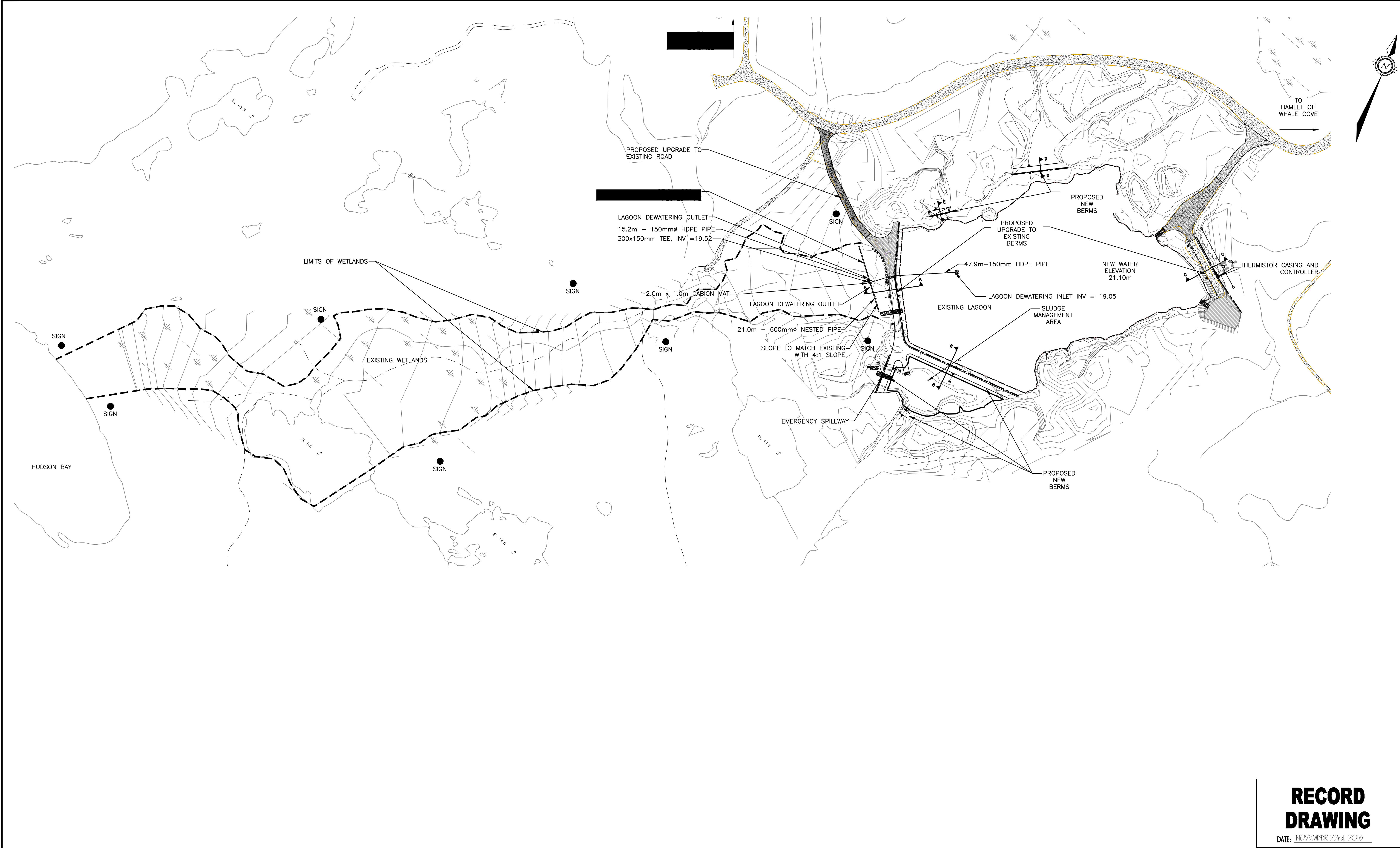
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BASEPLAN
DESIGN
CHECKED
CAD
PROJ. MAN
APPROVED

PROJECT
S.WHOLE COVE, NUNAVUT
CONSTRUCTION
MANAGEMENT PLAN

PROJ. NO.
OTT-00201369A
DATE
FEB 01, 2012
DRAWING NO.
CMP-1



RECORD DRAWING

DATE: NOVEMBER 22nd, 2016

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					1	ISSUED FOR REVIEW	24/02/12	SAB	SLB

SCALE
HORZ 1:1250
0 10m 20m 30m

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PROJECT
**SEWAGE LAGOON
WHALE COVE, NUNAVUT**
TITLE
OVERALL SITE PLAN

PROJ. NO.
OTT-00201369A
SURVEY

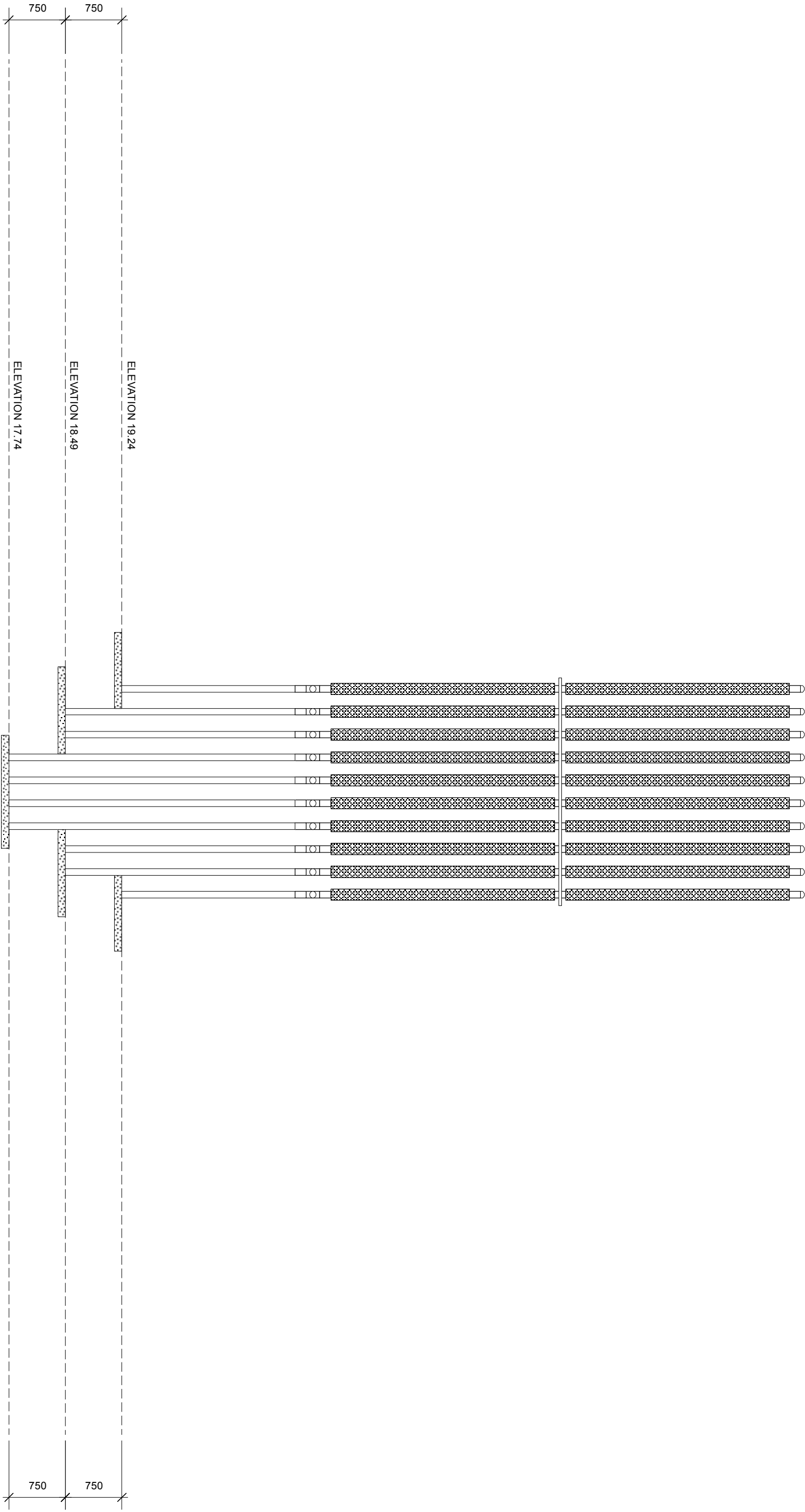
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DRAWING NO.
OSP-1

DATE: NOVEMBER 22nd, 2016



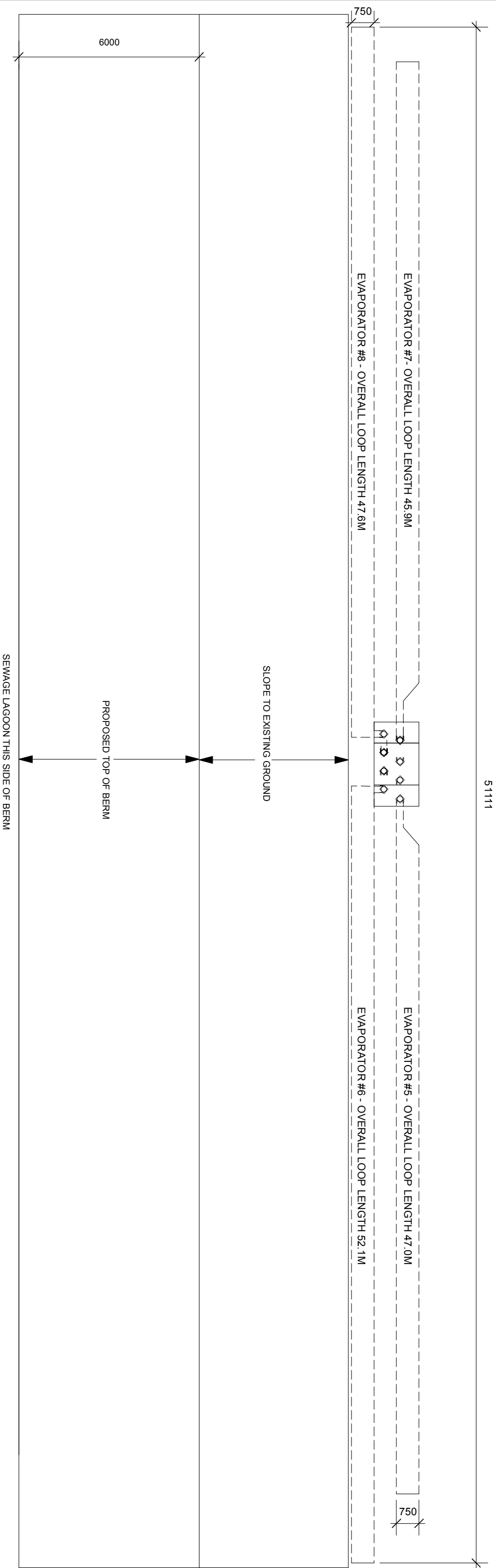
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SURVEY	
DATE	FEB 01, 2012
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0	ISSUED FOR SHOP DRAWING REVIEW	CJ	BW	JUNE 1, 2016				
REV		DWN	APP	DATE				
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					PROJECT	SEWAGE LAGOON WHALE COVE, NUNAVUT		
					DRAWING TITLE	RADIATOR GROUP AS-BUILT		
					SCALE	DATE	DRAWING NO.	REV



EVAPORATOR #7- OVERALL LOOP LENGTH 45.9M

EVAPORATOR #5 - OVERALL LOOP LENGTH 47.0M

EVAPORATOR #8 - OVERALL LOOP LENGTH 47.6M

EVAPORATOR #6 - OVERALL LOOP LENGTH 52.1M

SLOPE TO EXISTING GROUND

PROPOSED TOP OF BERM

SEWAGE LAGOON THIS SIDE OF BERM

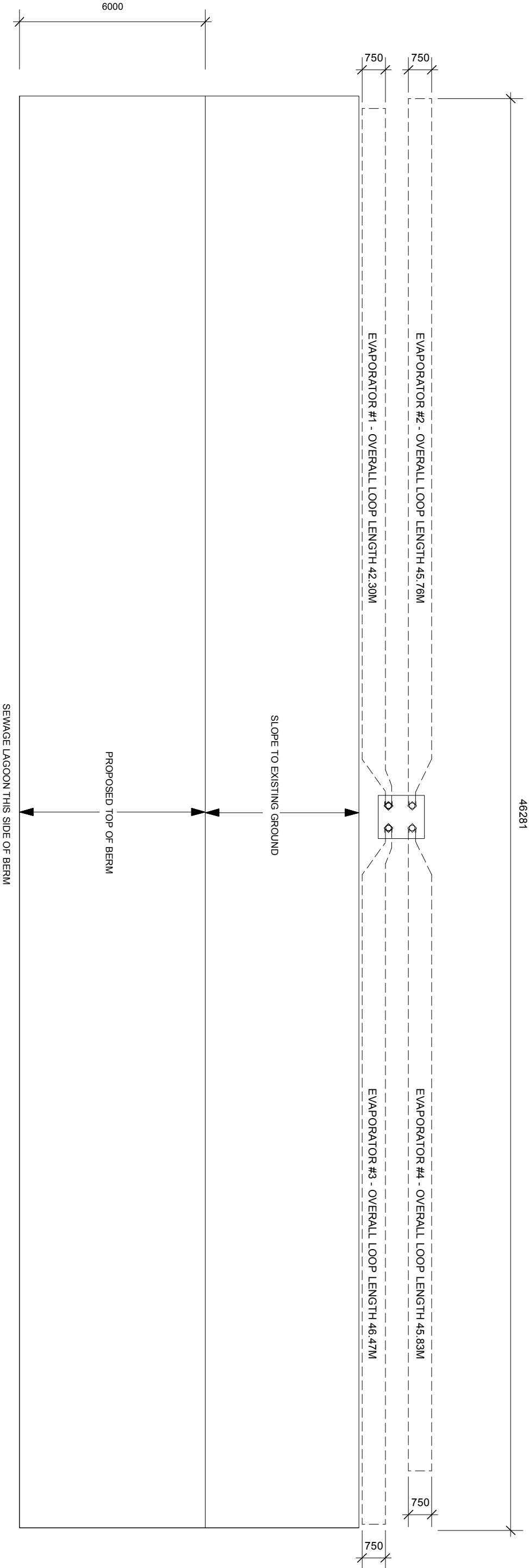
MIDDLE ELEVATION - 18.49

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REV			DWN	APP	DATE						

						 ARCTIC FOUNDATIONS OF CANADA #15 ELIE ST. E. ELIE, MB. R0H 0H0 PH. 204-353-2510 FAX. 204-353-2610	CLIENT KUDLIK CONSTRUCTION	PROJECT SEWAGE LAGOON WHALE COVE, NUNAVUT			
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REV			DWN	APP	DATE						

						 ARCTIC FOUNDATIONS OF CANADA #15 ELIE ST. E. ELIE, MB. R0H 0H0 PH. 204-353-2510 FAX. 204-353-2610	CLIENT KUDLIK CONSTRUCTION	PROJECT SEWAGE LAGOON WHALE COVE, NUNAVUT			
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0		ISSUED FOR SHOP DRAWING REVIEW	CJ	BW	JUNE 1, 2016						
REV			DWN	APP	DATE						



BOTTOM ELEVATION - 17.74

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OF CANADA

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PH: 204-363-2610 FAX: 204-363-2610

CLIENT

KUDLIK CONSTRUCTION

PROJECT

SEWAGE LAGOON
WHALE COVE, NUNAVUT

DRAWING TITLE

EVAPORATOR AS-BUILT ELEVATION 17.74

SCALE

DATE

DRAWING NO.

REV

Appendix B: Sewage Disposal Facility Photographs



Figure 3 Discharge structure



Figure 4 Discharging sewage truck



Figure 5 Radiators for the thermosiphons



Figure 6 Northeast lagoon berm



Figure 7 Self-priming centrifugal pump



Figure 8 Discharge dispersion structure side view



Figure 9 Discharge dispersion structure overall



Figure 10 Discharge dispersion structure facing the wetland



Figure 11 Discharge dispersion structure close up