ANNEX A

Location, access to site and safety advisory

ANNEX A -

LOCATION AND ACCESS TO SITE

Île Bouchard FRL* (LLN** 2326) and Île Bouchard RRL*** (LLN2327)

The navigation light is located in the Îles de Verchères, southeast of Île Bouchard, facing the Île aux Prunes. The sites are accessible by boat or helicopter only.

Île Bouchard FRL coordinates:

Latitude: 45°47' 56'' 37 Longitude: 73°.20' 40'' 48

Île Bouchard RRL coordinates:

Latitude: 45°48' 20'' 35 Longitude: 73°.20' 14'' 07

EXCERPT FROM CCG SAFETY ADVISORY:

Île Bouchard FRL

Deficiencies: No upper platform and railing

Specific measures: Use the spider method with the y-lanyard and attach at two different opposite points at the top of the platform when ascending the stairway.

Île Bouchard RRL

Deficiencies: Unsafe stairway

Specific measures: Use the y-lanyard to attach to two different points when ascending the stairway.

*FRL = front range light

**LLN = lights list number

***RRL = rear range light

ANNEX B

Photos of existing structures

Île Bouchard FRL

Île Bouchard FRL

Île Bouchard RRL

Île Bouchard RRL

ANNEX C

Work easements

The work easement is shown on plan 07951-01

Source	Target
CARTE MARINE 1339	NAUTICAL CHART 1339
ÉCHELLE:	SCALE:
COORDONÉES	COORDINATES
POINT	POINT
GEOGRAPHIQUES	GEOGRAPHIC
M.T.M. S.I. FUSEAU 08	M.T.M. S.I. FUSEAU 08
F.A. ILE BOUCHARD	FRONT RANGE LIGHT ÎLE BOUCHARD
L.F. 2326	L.F. 2326
LAT.	LATITUDE
LON.	LONGITUDE
NORD	NORTH
EST	EAST
Légende:	Legend:
Feu de navigation	Navigation light
Poteau d`alimentation en électricité	Electrical power pole
Piquet de bois implanté pour limite de servitude, octobre 2013	Wooden stake inserted to indicate easement boundary, October 2013
Ligne d`alimentation en électricité	Electrical power line
Limite de servitude	Easement boundary
Limite de propriété	Property line
Ligne du lot	Lot line
Limite boisé	Boundary of wooded area
Ligne centrale de l`alignement	Centre line of the range line
Secteur de coupe	Cutting area
Notes:	Notes:
Quadrillage et coordonnées sont en valeurs	Grids and coordinates are based on
NAD 83	NAD 83 / M.T.M. values
M.T.M.	
Les directions apparaissant sur ce document sont des courses	The directions that appear in this document are watercourses.
Les élévations sont par rapport au G.S.C.	G.S.C. elevations are used.
No Projet :	Project No.:

Date du relevé:	Date of report:
Chef d`équipe:	Team Leader:
Agent de projet:	Project Officer:
Carnet(s):	Field book(s):
94H03, pages 12 à 24	94H03 pages 12 to 24
UNE PARTIE DE LA REPRÉSENTATION DES LIMITES DE PROPRIÉTÉ A ÉTÉ DÉTERMINÉE PAR CALCUL EN RÉFÉRENCE AU PLAN DU DÉPARTEMENT DES TRANSPORTS No F-696	A PORTION OF THE REPRESENTATION OF THE PROPERTY LINES WAS DETERMINED BY MAKING CALCULATIONS BASED ON MINISTRY OF TRANSPORTATION MAP NO. F-696
ÉMONDAGE JANVIER-FÉVRIER 2016	PRUNING JANUARY-FEBRUARY 2016
SECTEURS A ET F	**SECTORS A AND F**
SECTEUR A :	**SECTOR A**:
140 ARBRES DE 10 À 16 m P/R AU SOL ÉMONDER À 9m P/R AU SOL	140 TREES 10 TO 16 M RELATIVE TO GROUND LEVEL TO BE PRUNED TO 9M RELATIVE TO GROUND LEVEL
SECTEUR F :	**SECTOR F**:
25 ARBRES IDENTIFIÉS DE 15 À 18 m P/R AU SOL ÉMONDER À 9m P/R AU SOL	25 TREES IDENTIFIED AS 15 TO 18 M RELATIVE TO GROUND LEVEL TO BE PRUNED TO 9M RELATIVE TO GROUND LEVEL
Limite	Boundary
LOT 208	LOT 208
PROPRIÉTAIRE CIE VAN MILL ET VAN VLIET	OWNER CIE VAN MILL AND VAN VLIET
F.A. ÎLE BOUCHARD	FRONT RANGE LIGHT ÎLE BOUCHARD
BOISÉ	WOODED
SECTEUR A	SECTOR A:
LIGNE APPROXIMATIVE DES HAUTES EAUX	APPROXIMATE HIGH WATER MARK
VERS ILE MARIE (VOIR CARTOUCHE)	NEAR ÎLE MARIE (SEE INSET)
SECTEUR B :	SECTOR B:
LIMITE DE SERVITUDE	EASEMENT BOUNDARY
SERVITUDE DE PASSAGE	RIGHT OF WAY
SECTEUR B :	**SECTOR B**:
ARBUSTES À COUPER AU SOL EN AVANT DU FEU ANTÉRIEUR SERVITUDE DE NON-OBSTRUCTION AU SOL	SHRUBS TO BE CUT TO GROUND LEVEL IN FRONT OF THE FRONT RANGE LIGHT IN THE NON-OBSTRUCTION EASEMENT AT GROUND LEVEL
CHAMPS EN CULTURE	AGRICULTURAL FIELDS
LOT 209	LOT 209
SECTEUR C :	**SECTOR C**:

250 ARBRES DE 12 À 18m P/R AU SOL ÉMONDER À 9m P/R AU SOL	250 TREES 12 TO 18M RELATIVE TO GROUND LEVEL TO BE PRUNED TO 9M RELATIVE TO GROUND LEVEL
SECTEUR D	**SECTOR D**
25 ARBRES DE 12 À 17m P/R AU SOL ÉMONDER À 9m P/R AU SOL	25 TREES 12 TO 17 M RELATIVE TO GROUND LEVEL TO BE PRUNED TO 9M RELATIVE TO GROUND LEVEL
FLEUVE ST-LAURENT	ST. LAWRENCE RIVER
SECTEUR E	**SECTOR E**
10 GROS ARBRES DE 16 À 18.5m P/R AU SOL ÉMONDER À 9m P/R AU SOL	10 LARGE TREES 16 TO 18.5 M RELATIVE TO GROUND LEVEL TO BE PRUNED TO 9M RELATIVE TO GROUND LEVEL
LOT 210	LOT 210
PROPRIÉTAIRE : PAUL LÉO ET LIONEL PAYETTE	OWNER: PAUL LÉO AND LIONEL PAYETTE
LOT 213	LOT 213
PROPRIÉTAIRE : GABRIEL VAN MILL ET PIERRE VAN VLIET	OWNER: GABRIEL VAN MILL AND PIERRE VAN VLIET
CHAMPS EN CULTURE	AGRICULTURAL FIELDS
BASE DE BÉTON	CONCRETE BASE
7.62m	7.62m
SERVITUDE DE PASSAGE	RIGHT OF WAY
LOT 266	LOT 266
PROPRIÉTAIRE : FRANÇOISE ET JOSEPH LUIZZA	OWNER: FRANÇOISE AND JOSEPH LUIZZA
FERNANDE ET RAYMOND DANSEREAU	FERNANDE AND RAYMOND DANSEREAU
GRANGE	BARN
RUINE	RUINS
FOSSÉ	DITCH
ÎLE MARIE	ÎLE MARIE
LOT PROPRIÉTAIRE: BERNARD BUSSIÈRES	LOT OWNER: BERNARD BUSSIÈRES
ENR No 51443 1948-02-17	REG. No. 51443 1948-02-17
LIMITE NORD-OUEST DE LA SERVITUDE DE L`ALIGNEMENT DE L`ÎLE BOUCHARD	NORTHWEST BOUNDARY OF THE ÎLE BOUCHARD BUILDING LINE EASEMENT
FALAISE DE 3.8m	3.8M CLIFF
CH10	CH10
CHAMPS EN CULTURE	AGRICULTURAL FIELDS
LIMITE DU CHAMPS EN CULTURE	AGRICULTURAL FIELD BOUNDARY
N39° 11` E	N39° 11’ E
CCB	CCB
R8	A8
LIGNE DE CENTRE DE L`ALIGNEMENT SERVITUDE DE NON OBSTRUCTION COUPE AU SOL	CENTRE LINE OF THE RANGE LINE - NON-OBSTRUCTION EASEMENT CUT TO GROUND LEVEL
LIGNE APPROXIMATIVE DU RIVAGE	APPROXIMATE SHORELINE
SECTEUR ÎLE MARIE:	**ÎLE MARIE SECTOR:**
UNE CENTAINE D`ARBUSTES À COUPER AU SOL	AROUND ONE HUNDRED SHRUBS TO BE CUT TO GROUND LEVEL
ANCIENNE BASE DE BÉTON	OLD CONCRETE BASE
FLEUVE ST-LAURENT	ST. LAWRENCE RIVER
ÉCHELLE: 1:500	SCALE: 1:500
MAJ POUR ÉMONDAGE JAN-FÉV 2016	PRUNING UPDATE JAN-FEB 2016
MAJ TEL QUE RELEVÉ	UPDATE AS INDICATED IN SURVEY
MODIFICATION SERVITUDE REQUISE	CHANGE TO EASEMENT REQUIRED
rev	rev.
description	description
par	by
date	date

ÎLE BOUCHARD ALIGNEMENT	ÎLE BOUCHARD RANGE
FA-NO SITE: QE35690/NO L.D.F. 2326	FRL-SITE NO: QE35690/LLN 2326
FP-NO SITE: QE35710/NO L.D.F. 2327	RRL-SITE NO: QE35710/LLN 2327
RELEVÉ DE SITE, SERVITUDE DE NON-OBSTRUCTION	SITE SURVEY, NON-OBSTRUCTION EASEMENT
INDIQUÉE	INDICATED

Source	Target
PLAT 64 X 10 2 MONTANTS DEUXIÈME PARTIE	FLAT 64 x 10 2 POSTS SECOND PART
SOUDÉ	WELDED
ÉCHELON ø19.05	RUNG ø19.05
DÉTAIL DE L`ÉCHELLE	LADDER DETAILS
ÉCHELLE :	LADDER:
SOUDÉ	WELDED
PL 6.4 EP.	PL 6.4 EP.
L50X50X6.4	L50X50X6.4
BOULON	BOLT
DÉTAIL DE L`ATTACHE DU RENFORT	DETAILS OF THE REINFORCEMENT FASTENER
ÉCHELLE:	LADDER:
914 X 25 EP	914 X 25 EP
DÉTAIL DES RENFORTS DE LA BASE	DETAILS OF THE BASE REINFORCEMENTS
ÉCHELLE:	LADDER:
PROFONDEUR 254mm	DEPTH 254mm
L50X50X6.4 EN HAUT ET EN BAS	L50X50X6.4 AT THE TOP AND BOTTOM
PROFONDEUR 431.8mm	DEPTH 431.8mm
DÉTAIL DES BOÎTES ÉLECTRIQUE	DETAILS OF THE SERVICE BOXES
ÉCHELLE:	LADDER:
ROUILLE DE SURFACE VOIR PHOTO #BOUCHARD0153	SURFACE RUST SEE PHOTO #BOUCHARD0153
TIGE ø19.05 TYP.	STANDARD ROD ø19.05
ÉCARTEMENT TYP.	STANDARD DEVIATION
PLAT 51 X 6.4 EP. TYP.	FLAT 51 X 6.4 EP. STANDARD
TIGE DÉFORMÉE VOIR PHOTO #BOUCHARD0156	DEFORMED ROD SEE PHOTO #BOUCHARD0156

PLAQUE D`ACIER 6.4 EP POUR SUPPORT DU PHARE	STEEL PLATE 6.4 EP FOR LIGHT SUPPORT
TIGE Ø19.05 TYP.	STANDARD ROD ø19.05
MANQUE UNE TIGE VOIR PHOTO #BOUCHARD0153	ROD MISSING SEE PHOTO #BOUCHARD0153
COUPE DÉTAIL DU PLANCHER	FLOOR SECTION DETAIL
ÉCHELLE:	LADDER:
SOUDÉ	WELDED
L76X76X6.4 PARTOUT	L76X76X6.4 THROUGHOUT
POINTS D `ATTACHE 18Kn	18Kn MOUNTING POINTS
RENFORT À AJOUTER DÉTAIL SUR FEUILLE 2	REINFORCEMENT TO BE ADDED DETAIL ON SHEET 2
POINTS D`ATTACHE 18Kn	18Kn MOUNTING POINTS
DÉTAIL DE LA STRUCTURE DU PLANCHER (TIGES ENLEVÉS)	FLOOR STRUCTURE DETAIL (RODS REMOVED)
ECHELLE:	LADDER:
BOULON ø10	BOLT ø10
BOULON MANQUANT SUR MÂT GAUCHE VOIR PHOTO #BOUCHARD0144	BOLT IS MISSING ON LEFT MAST SEE PHOTO #BOUCHARD0144
DÉTAIL TYPE DE L `ATTACHEMENT DE LA MARQUE DE JOUR	DETAIL OF DAYMARK ATTACHMENT TYPE
ÉCHELLE:	LADDER:
PL 25 EP.	PL 25 EP.
114 TYP.	STANDARD 114
BOULON D`ANCRAGE AU BÉTON ø25.4	CONCRETE ANCHORING BOLT ø25.4
COUPE TYPE DE LA BASE	STANDARD BASE CUT
ÉCHELLE:	LADDER:
AJOUTER 2 BOULONS ENTRE LES LIMONS ET CORNIÈRES EXISTANTES RÉFÉRENCE RAPPORT D`ANALYSE ÎLE BOUCHARD FP2326	ADD 2 BOLTS BETWEEN SHAFTS AND EXISTING ANGLE IRONS REFERENCE ÎLE BOUCHARD ANALYSIS REPORT FP2326

1334 TYP.	STANDARD 1334
LES LIMONS D`ÉCHELLE POURRONT SERVIR DE POINT D`ATTACHE 18kN APRÈS LA FIXATION DE CEUX-CI À LA STRUCTURE DE LA PLATE-FORME.	THE LADDER SHAFTS CAN BE USED AS 18kN ATTACHMENT POINTS AFTER ATTACHING THEM TO THE PLATFORM STRUCTURE.
RENFORTS À AJOUTER L76X76X6.4 AVEC 4 PLAQUES 8MM ÉPAIS. SOUDER SUR LES RENFORTS ET BOULONNER SUR LES CORNIÈRES EXISTANTES. RÉFÉRENCE RAPPORT D`ANALYSE ÎLE BOUCHARD FP2326	REINFORCEMENTS TO BE ADDED L76X76X6.4 WITH 4 8MM THICK PLATES. WELD THE REINFORCEMENTS AND BOLT THE EXISTING ANGLE IRONS ONTO THEM. REFERENCE ÎLE BOUCHARD FP2326 ANALYSIS REPORT
CRINOLINE ENLEVÉE POUR ALLÉGER LE DESSIN	PROPELLER GUARD REMOVED TO SIMPLIFY DRAWING
ÉLÉVATION "NORD"	“NORTH” ELEVATION
ÉCHELLE:	LADDER:
SOUDÉ	WELDED
SUPPORT D`ÉCHELLE 50 X 6 TYPIQUE	STANDARD 50 x 6 LADDER MOUNT
COUPURE DANS L`ÉCHELLE VOIR PHOTO #BOUCHARD0137	CUT IN THE LADDER SEE PHOTO #BOUCHARD0137
PLAT 50 X 10	FLAT 50 x 10
PREMIÈRE PARTIE DES MONTANTS D`ÉCHELLE	FIRST PART OF LADDER STRINGS
BÉTON	CONCRETE
SOL NATUREL	NATURAL GROUND
SOUDÉ	WELDED
PLAQUE ANTI-DÉRAPANTE 6.4 EP.	NON-SLIP PLATE 6.4 EP.
C76X51X6	C76X51X6
ÉLÉVATION "EST"	“EAST” ELEVATION
ÉCHELLE:	LADDER:
GARDE-CORPS TYPE ø22	RAILING TYPE ø22
TOUTE PERSONNE SUR LA PLATE-FORME DOIT ÊTRE ATTACHÉ AVEC UN DISPOSITIF CHUTE FIXÉ À UN DES POINTS D`ATTACHE PRÉVUS À CETTE FIN	ANY PERSON ON THE PLATFORM MUST BE ATTACHED WITH A FALL-ARRESTING DEVICE ATTACHED TO AN ATTACHMENT POINT PROVIDED FOR THIS PURPOSE
PHARE	LIGHTHOUSE

SOUDÉ	WELDED
PANNEAU SOLAIRE	SOLAR PANEL
BOIS 127 X 19.05 ESPACEMENT 63.5 MM	WOOD 127 x 19.05 WITH 63.5 MM SPACING
CADRAGE D`ACIER L50X50X6.4	STEEL FRAME L50X50X6.4
Ø406 X 6.4 EP	Ø406 X 6.4 EP
2 CYLINDRES	2 CYLINDERS
CENTRE-CENTRE	CENTRE-CENTRE
1575 TYP.	STANDARD 1575
ÉLÉVATION "SUD "	“SOUTH” ELEVATION
ÉCHELLE:	LADDER:
NOTES GÉNÉRALES:	GENERAL NOTES:
1- TOUS LES JOINTS SONT SOUDÉS, SAUF INDICATION CONTRAIRE.	1 - ALL JOINTS ARE TO BE WELDED, UNLESS OTHERWISE INDICATED.
2- TOUTES LES INFORMATIONS CONCERNANT LES ÉLÉMENTS EXISTANTS DU PYLÔNE PROVIENNENT DU RELEVÉ EFFECTUÉ LE 4 NOVEMBRE 2003 PAR SERVICES PRÉCICAD.	2 - ALL INFORMATION ABOUT THE EXISTING TOWER COMPONENTS ARE FROM THE SURVEY CONDUCTED ON NOVEMBER 4, 2003 BY SERVICES PRÉCICAD.
3- TOUTES LES DIMENSIONS SONT EN MILLIMÈTRES SAUF INDICATION CONTRAIRE.	3- ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED.
CRITÈRES D' ANALYSE:	ANALYSIS CRITERIA
-NORME: CAN/CSA-537-01	- STANDARD: CAN/CSA-537-01
-VENT/SOURCE : q = 502 Pa / ENVIRONNEMENT CANADA	- WIND/SOURCE: q = 502 PA / ENVIRONMENT CANADA
- NUANCE D'ACIER PRÉSUMÉE DES MATS CYLINDRIQUES : G40.21M - 44W	- ASSUMED STEEL GRADE FOR THE CYLINDRICAL MASTS: G40.21M - 44W
-NUANCE D' ACIER PRÉSUMÉE DES MEMBRURES (AUTRE QUE LES MATS CYLINDRIQUES) : A36	- ASSUMED STEEL GRADE FOR THE FRAME WORK (OTHER THAN CYLINDRICAL MASTS): A36 A36
Direction des Services techniques	Technical Services Directorate
Infrastructures civiles et maritimes	Civil and Marine Infrastructure
Génie civil	Civil Engineering

101 Boul. Champlain	101 Champlain Blvd.
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INGÉNIEUR	ENGINEER
MODIF. ÉCHELLE ET PLANCHER	MODIFICATIONS TO LADDER AND FLOOR
PRÉCICAD	PRÉCICAD
Relevé, novembre 2003	Survey, November 2003
Révision	Revision
Description	Description
ÎLE BOUCHARD	ÎLE BOUCHARD
FEU ANTÉRIEUR- FP2326	FRONT RANGE LIGHT - FP2326
ANALYSE DE CONFORMITÉ DES STRUCTURES	STRUCTURE COMPLIANCE ANALYSIS
FEU POSTÉRIEUR DE L ÎLE BOUCHARD	ÎLE BOUCHARD REAR RANGE LIGHT
ÉLÉVATIONS TYPES	STANDARD ELEVATIONS

Source	Target
MONTANTS	POSTS
ÉPISSURES	SPLICES
DIAGONALES (4 FACES)	FOUR-SIDED DIAGONALS
REDONDANTES 1 (4 FACES)	FOUR-SIDED REDUNDANT MEMBERS 1
ENTRETOISES PRINC. (4 FACES)	MAIN STRUTS (4 SIDED)
BOULONS	BOLTS
L 81x89x7.9	L 81x89x7.9
NIVEAU 0	LEVEL 0
SUPPORT INUTILISÉ	UNUSED SUPPORT
MARQUE DE JOUR	DAYMARK
CADRE L51X51X6.4	FRAME L51X51X6.4
LATTE EN BOIS 146X25	WOODEN SLAT 146X25
ESPACEMENT 78	SPACING 78
PANNEAU SOLAIRE	SOLAR PANEL
POINTS D`ATTACHE 18kN EXTRÉMITÉ SUP. ET INF. DES DIAGONALES SUR LES 4 FACES	18kN ATTACHMENT POINTS FOR UPPER AND LOWER ENDS OF THE DIAGONALS ON ALL FOUR SIDES
ÉLÉVATION "SUD-OUEST"	“SOUTHWEST” ELEVATION
ECHELLE 1:50	SCALE 1:50
BOITE ÉLECTRIQUE	SERVICE BOX
SOL	GROUND
ÉLÉVATION "SUD-EST"	“SOUTHWEST” ELEVATION
ECHELLE 1:50	SCALE 1:50
NOTES GÉNÉRALES:	GENERAL NOTES:
1- TOUS LES JOINTS SONT BOULONNÉS AVEC	1 - ALL JOINTS MUST BE BOLTED WITH ø16

DES BOULONS ø16 SAUF INDICATION CONTRAIRE.	BOLTS UNLESS OTHERWISE INDICATED.
2- TOUTES LES INFORMATIONS CONCERNANT LES ÉLÉMENTS EXISTANTS DU PYLÔNE PROVIENNENT DU RELEVÉ EFFECTUÉ LE 28 JANVIER 2005 PAR SERVICES PRÉCICAD.	2 - ALL INFORMATION ABOUT THE EXISTING TOWER COMPONENTS ARE FROM THE SURVEY CONDUCTED ON JANUARY 28, 2005 BY SERVICES PRÉCICAD.
3- TOUTES LES DIMENSIONS SONT EN MILLIMÈTRES SAUF INDICATION CONTRAIRE.	3 - ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED.
CRITÈRES D' ANALYSE:	ANALYSIS CRITERIA
-NORME: CAN/CSA-537-01	- STANDARD: CAN/CSA-537-01
-VENT/SOURCE : Q =431 / ENVIRONNEMENT CANADA	- WIND/SOURCE: Q =431 / ENVIRONMENT CANADA
- NUANCE D'ACIER PRÉSUMÉE DES MEMBRURES: A36	- ASSUMED STEEL GRADE FOR THE FRAME WORK: A36
Direction des services techniques infrastructures civiles et maritimes	Marine and Civil Infrastructure Technical Services Branch
Génie civil	Civil Engineering
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Québec, Qc G1K 7Y7	Québec, QC G1K 7Y7
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Relevé janvier 2005	January 2005 survey
Précicad	Précicad
Révision	Revision
Description	Description
ÎLE BOUCHARD	ÎLE BOUCHARD
FEU POSTÉRIEUR	REAR RANGE LIGHT
N.L.F. 2327	LLN 2327

RELEVÉ ET ANALYSE DE CONFORMITÉ ÉLÉVATIONS	SURVEY AND ELEVATION COMPLIANCE TESTING

Source	Target
TIGE FILETÉE ø28.6	THREADED ROD ø28.6
MONTANT SOUDÉ	WELDED POST
PLAQUE 305 X 305, 25 ÉPAIS	PLATE 305 X 305, THICKNESS 25
DÉTAIL DES PATTES	DETAILS OF UPRIGHTS
ÉCHELLE	LADDER
DÉTAIL DES JOINTS TYPIQUE	DETAIL OF STANDARD JOINTS
ÉCHELLE	LADDER
.	.
PLAQUE 534X64X9.5 ÉPAIS	PLATE 534X64X9.5 THICK
DÉTAIL DES ÉCLISSES	DETAILS OF SPLICES
ÉCHELLE	LADDER
PLAQUE 610X64X9.5 ÉPAIS	PLATE 610X64X9.5 THICK
DÉTAIL DES ÉCLISSES	DETAILS OF SPLICES
ÉCHELLE	LADDER
DÉTAIL DES JOINTS	DETAILS OF JOINTS
ÉCHELLE	LADDER
STRUCTURE DU PLANCHER	FLOOR STRUCTURE
MONTANT	POST
BOULONS ø16, 6 ENDROITS 3 FACE SUD-OUEST, 3 FACE NORD-EST	BOLTS ø16, 6 LOCATIONS 3 ON SOUTHWEST SIDE, 3 ON NORTHEASTERN SIDE
PLAQUE DE BOULONNAGE 89 X 44, 6 EP SOUDÉE SUR LA STRUCTURE DU PLANCHER	89 X 44 BOLT PLATE , 6 EP WELDED ONTO THE FLOOR STRUCTURE
ENTRETOISE PRINCIPALE	MAIN STRUTS
DÉTAIL DU JOINT DE LA PLATE-FORME	DETAIL OF THE JOINT ON THE PLATFORM ABOVE

SUPÉRIEURE À LA STRUCTURE	THE STRUCTURE
ÉCHELLE	LADDER
78 ESPACEMENT	78 SPACING
BOIS 146X25	WOOD 146X25
L 51X51X6.4 SOUDÉ	L 51X51X6.4 WELDED
L 89X89X7.9 BOULONNÉ SUR STRUCTURE	L 89X89X7.9 BOLTED ONTO THE STRUCTURE
DÉTAIL TYPIQUE DE L`ATTACHE DE LA MARQUE DE JOUR	STANDARD DETAIL OF DAYMARK ATTACHMENT
ÉCHELLE	LADDER
L 51X51, 6EP SOUDÉ	L 51X51, 6EP WELDED
STRUCTURE DE LA MARQUE DE JOUR	DAYMARK STRUCTURE
MÉTAL DÉPLOYÉ	EXPANDED METAL
DÉTAIL TYPIQUE DE L`ATTACHE DE LA MARQUE DE JOUR	STANDARD DETAIL OF DAYMARK ATTACHMENT
ÉCHELLE	LADDER
PLAQUE, 6EP	PLATE, 6EP
BOULONNÉ	BOLTED
DÉTAIL DES FIXATIONS DES GARDES-CORPS DE L`ESCALIER	DETAIL OF FASTENERS ON STAIRCASE RAILING
ÉCHELLE	LADDER
ENTRETOISE PRINCIPALE	MAIN STRUTS
BOULONNÉ	BOLTED
ENTRETOISE SECONDAIRE	SECONDARY STRUTS
DÉTAIL TYPIQUE FIXATION DES ENTRETOISES SECONDAIRES	STANDARD DETAIL OF FASTENERS ON SECONDARY STRUTS

ÉCHELLE	LADDER
ANCRAGE SOUDÉ PL. 64 X 9.5	WELDED-ON ANCHOR PL. 64 X 9.5
MONTANT	POST
STRUCTURE	STRUCTURE
BOULONNÉ	BOLTED
DÉTAIL TYPIQUE DE FIXATION DES MONTANTS D`ESCALIER ET D`ÉCHELLE	STANDARD DETAIL OF FASTENERS ON STAIRCASE AND LADDER POSTS
ÉCHELLE	LADDER
BOULONNÉ	BOLTED
L 76X76X7.9 SOUDÉ	L 76X76X7.9 WELDED
REDONDANTE PRINCIPALE	MAIN REDUNDANT MEMBER
STRUCTURE DU PALIER C 100 X 8	PLATFORM STRUCTURE C 100 x 8
REDONDANTE PRINCIPALE	MAIN REDUNDANT MEMBER
DÉTAIL TYPIQUE DE FIXATION DE LA STRUCTURE DES PALIERS	STANDARD DETAIL OF PLATFORM STRUCTURE FASTENERS
ÉCHELLE	LADDER
BOULONNÉ	BOLTED
REDONDANTE PRINCIPALE	MAIN REDUNDANT MEMBER
STRUCTURE DU PALIER C 100 X 8	PLATFORM STRUCTURE C 100 x 8
L 76X76X7.9 SOUDÉ	L 76X76X7.9 WELDED
DÉTAIL DE FIXATION DE LA STRUCTURE DES PALIERS 1, 2, 3 ET 5	DETAIL OF FASTENERS FOR PLATFORM STRUCTURE 1, 2, 3 and 5
ÉCHELLE	LADDER
BOULONNÉ	BOLTED
REDONDANTE PRINCIPALE	MAIN REDUNDANT MEMBER

STRUCTURE DU PALIER C 100 X 8	PLATFORM STRUCTURE C 100 x 8
ESPACEUR SOUDÉ TUBE COUPÉ 76 X 76, 8 PAROI	SPACER WELDED TUBE CUT 76 x 76, 8 WALLS
L 76X76X7.9 SOUDÉ	L 76X76X7.9 WELDED
DÉTAIL DE FIXATION DE LA STRUCTURE DU PALIER 4	DETAIL OF FASTENERS FOR PLATFORM STRUCTURE 4
ÉCHELLE	LADDER
229 ESPACEMENT	229 SPACING
MONTANTS PL. 64 X 9.5	POSTS PL. 64 X 9.5
MARCHES L 38X38X3.2	STEPS L 38X38X3.2
457 LARGEUR	457 WIDTH
DÉTAIL DE L`ESCALIER	LADDER DETAILS
ÉCHELLE	LADDER
MONTANTS 64 X 9.5	POSTS 64 x 9.5
450 LARGEUR	450 WIDTH
ÉCHELON	RUNG
DÉTAIL DE L`ÉCHELLE	LADDER DETAILS
ÉCHELLE	LADDER
N	N
VUE EN PLAN BASE DE BÉTON	CONCRETE BASE PLAN VIEW
ÉCHELLE	LADDER
RAIDISSEUR DIAGONAL	DIAGONAL STIFFENER
TYP. 4 COINS	STANDARD FOUR CORNERS
NIVEAU 2	LEVEL 2
VUE DE COUPE RAIDISSEUR DIAGONAL NIVEAU 2	CROSS SECTION OF DIAGONAL STIFFENER LEVEL 2

ÉCHELLE	LADDER
RAIDISSEUR DIAGONAL	DIAGONAL STIFFENER
TYP. 4 COINS	STANDARD 4 CORNERS
NIVEAU 3	LEVEL 3
VUE DE COUPE RAIDISSEUR DIAGONAL NIVEAU 3	CROSS SECTION OF DIAGONAL STIFFENER LEVEL 3
ÉCHELLE	LADDER
Direction des services techniques infrastructures civiles et maritimes	Marine and Civil Infrastructure Technical Services Branch
Génie civil	Civil Engineering
101 Boul, Champlain	101 Champlain Blvd.
Québec, Qc G1K 7Y7	Québec, QC G1K 7Y7
350, bou. Charest Est 1er étage	350 Charest Blvd East, 1st Floor
Québec (Québec) G1K 3H4	Québec, QC G1K 3H4
Tél: (418) 658-7803 Fax: (418) 948-1068	Tel.: (418) 658-7803 Fax: (418) 948-1068
RELEVÉ JANVIER 2005	JANUARY 2005 SURVEY
PRÉCICAD	PRÉCICAD
Révision	Revision
Description	Description
ÎLE BOUCHARD	ÎLE BOUCHARD
FEU POSTÉRIEUR	REAR RANGE LIGHT
N.L.F. 2327	LLN 2327
FEU POSTÉRIEUR ÎLE BOUCHARD ÉLÉVATIONS ET DÉTAILS	REAR RANGE LIGHT ÎLE BOUCHARD ELEVATIONS AND DETAILS

Source	Target
PHARES	LIGHTHOUSES
GARDE-CORPS Ø31.75, 4.8 PAROI TYP. POUR TOUT LE PALIER SUPÉRIEUR	RAILING Ø31.75, 4.8 STANDARD WALL FOR THE ENTIRE UPPER PLATFORM
GARDE-CORPS Ø31.75, 4.8 PAROI TYP. ESCALIERS ET PALIERS	RAILING Ø31.75, 4.8 STANDARD WALL STAIRS AND PLATFORMS
GARDE-PIED, PLAQUE 76 H X 4 EP. TYP TOUS LES PALIERS	TOEBOARD, PLATE 76 H X 4 EP. STANDARD FOR ALL PLATFORMS
BOULON MANQUANT VOIR PHOTO DSCN5876	BOLT MISSING SEE PHOTO DSCN5876
SOL	GROUND
ÉLÉVATION "SUD-OUEST"	“SOUTHWEST” ELEVATION
ÉCHELLE	LADDER
C100 X 8	C100 X 8
MÉTAL DÉPLOYÉ	EXPANDED METAL
L 64X64X6.4	L 64X64X6.4
ENTRETOISE SECONDAIRE	SECONDARY STRUTS
TYP. 4 COINS	STANDARD 4 CORNERS
VUE EN PLAN NIVEAU 2	PLAN VIEW LEVEL 2
ÉCHELLE	LADDER
RAIDISSEUR DIAGONAL	DIAGONAL STIFFENER
TYP. 4 COINS	STANDARD 4 CORNERS
NIVEAU 1, 2 ET 3	LEVEL 1, 2 and 3
VUE DE COUPE RAIDISSEUR DIAGONAL NIVEAU 1	CROSS SECTION OF DIAGONAL STIFFENER LEVEL 1
ÉCHELLE	LADDER
C75 X 6	C75 X 6
L 51 X 51 X 6	L 51 X 51 X 6

PLAQUE ANTIDÉRAPANTE 3.1 EP.	NON-SLIP PLATE 3.1 EP.
MÉTAL DÉPLOYÉ 3/4-16	EXPANDED METAL 3/4-16
TRAPPE D`ACCÈS PLAQUE 3.2 EP	ACCESS HATCH PLATE 3.2 PM
CADRE DE L`OUVERTURE D`ACCÈS L 51X51X6.4	FRAME FOR ACCESS OPENING L 51X51X6.4
AJOUT POINTS D`ATTACHE	ADDING ATTACHMENT POINTS
VUE EN PLAN DE LA PLATE-FORME	PLAN VIEW OF THE PLATFORM
ÉCHELLE	LADDER
C100 x 8	C100 x 8
MÉTAL DÉPLOYÉ	EXPANDED METAL
VUE EN PLAN NIVEAU 4	PLAN VIEW LEVEL 4
ÉCHELLE	LADDER
C100 X 8	C100 X 8
MÉTAL DÉPLOYÉ	EXPANDED METAL
L 64X64X6.4	L 64X64X6.4
ENTRETOISE SECONDAIRE	SECONDARY STRUT
TYP. 4 COINS	STANDARD 4 CORNERS
VUE EN PLAN NIVEAU 4	PLAN VIEW LEVEL 4
ÉCHELLE	LADDER
C100 X 8	C100 X 8
MÉTAL DÉPLOYÉ	EXPANDED METAL
VUE EN PLAN NIVEAU 3	PLAN VIEW LEVEL 3
ÉCHELLE	LADDER
Direction des services techniques infrastructures civiles et maritimes	Marine and Civil Infrastructure Technical Services Branch

Génie civil	Civil Engineering
101 Boul, Champlain	101 Champlain Blvd.
Québec, Qc G1K 7Y7	Québec, QC G1K 7Y7
350, bou. Charest Est 1er étage	350 Charest Blvd East, 1st Floor
Québec (Québec) G1K 3H4	Québec, QC G1K 3H4
Tél: (418) 658-7803 Fax: (418) 948-1068	Tel.: (418) 658-7803 Fax: (418) 948-1068
RELEVÉ JANVIER 2005	January 2005 survey
PRÉCICAD	PRÉCICAD
Révision	Revision
Description	Description
ÎLE BOUCHARD	ÎLE BOUCHARD
FEU POSTÉRIEUR	REAR RANGE LIGHT
N.L.F. 2327	LLN 2327
RELEVÉ ET ANALYSE DE CONFORMITÉ ÉLÉVATIONS ET DÉTAILS	SURVEY AND ELEVATION AND DETAIL COMPLIANCE ANALYSIS

ANNEX D

Existing facilities to be dismantled

Annex D

Existing facilities to be dismantled

08758 Excerpt from FRL compliance testing

08885-01 to 03 Excerpt from RRL compliance testing

ANNEX E

Construction work plans

Source	Target
ESPACEURS, VOIR PIÈCE "E" SUR FEUILLE no. 2	ESPACEURS, VOIR PIÈCE "E" SUR FEUILLE no. 2
VUE EN PLAN	VUE EN PLAN
CHANNEL 76 X 51 X 6	CHANNEL 76 X 51 X 6
PROFIL COMPLET DE LA MARQUE DE JOUR	PROFIL COMPLET DE LA MARQUE DE JOUR
ÉLÉVATION DE LA STRUCTURE	ÉLÉVATION DE LA STRUCTURE
(TOUR 5pi. X 5pi.)	(TOUR 5pi. X 5pi.)
ESPACEURS	ESPACEURS
MARQUE DE JOUR	MARQUE DE JOUR
EXEMPLES D`ASSEMBLAGE MDJ et TOUR	EXEMPLES D`ASSEMBLAGE MDJ et TOUR
VUE EN PLAN	VUE EN PLAN
CÔTÉ TOUR	CÔTÉ TOUR
TROUS OVALISÉS 14 X 25mm POUR ESPACEURS	TROUS OVALISÉS 14 X 25mm POUR ESPACEURS
VUE EN PLAN	VUE EN PLAN
CHANNEL 76 X 51 X 6	CHANNEL 76 X 51 X 6
ÉLÉVATION	ÉLÉVATION
TROUS	TROUS
PIÈCE "A"	**PIÈCE "A"**
PIÈCE	PIÈCE
PIÈCE DE JONCTION	PIÈCE DE JONCTION
COUPE "A"	**COUPE "A"**
DESSUS	DESSUS
DESSOUS	DESSOUS

CHANNEL 76 X 51 X 6	CHANNEL 76 X 51 X 6
TROUS 14ø	TROUS 14ø
ÉLÉVATION	ÉLÉVATION
TROUS OVALISÉS 14 X 25mm POUR ESPACEURS	TROUS OVALISÉS 14 X 25mm POUR ESPACEURS
CÔTÉ TOUR	CÔTÉ TOUR
PIÈCE "B"	**PIÈCE "B"**
VUE EN PLAN	VUE EN PLAN
TROUS 11ø	TROUS 11ø
VOIR DÉTAIL PIÈCE "C3"	VOIR DÉTAIL PIÈCE "C3"
ÉLÉVATION	ÉLÉVATION
PIÈCE "C"	**PIÈCE "C"**
PERCEMENT REQUIS POUR LA POSE DES PLAQUES	**PERCEMENT REQUIS POUR LA POSE DES PLAQUES**
TROUS 11ø	TROUS 11ø
CHANNEL 76 X 51 X 6, 6095 LG	CHANNEL 76 X 51 X 6, 6095 LG
JOINT	JOINT
ÉLÉVATION	ÉLÉVATION
VUE DE CÔTÉ	VUE DE CÔTÉ
DÉTAIL PIÈCE "C3"	**DÉTAIL PIÈCE "C3"**
Direction des Services techniques	Direction des Services techniques
Infrastructures civiles et maritimes	Infrastructures civiles et maritimes
Génie civil	Génie civil
101 Boul. Champlain	101 Boul. Champlain
Québec (Qc) G1K 7Y7	Québec (Qc) G1K 7Y7
AJOUT DIMENSIONS PIÈCE "C"	AJOUT DIMENSIONS PIÈCE "C"

MISE À JOUR DÉTAIL PIÈCE C3	MISE À JOUR DÉTAIL PIÈCE C3
MISE À JOUR GÉNÉRALE	MISE À JOUR GÉNÉRALE
Révision	Révision
Description	Description
MARQUE DE JOUR	MARQUE DE JOUR
2,44m X 4,88m X 7,32m (8'-0" X 16'-0" X 24'-0")	2,44m X 4,88m X 7,32m (8'-0" X 16'-0" X 24'-0")
POUR TOURS À CLAIRE-VOIE 2004	POUR TOURS À CLAIRE-VOIE 2004
ÉLÉVATIONS ET DÉTAILS	ÉLÉVATIONS ET DÉTAILS
GARDE CÔTIÈRE	GARDE CÔTIÈRE

Source	Target
ORANGE	ORANGE
NOIR	NOIR
REQUISE	REQUISE
REQUISES	REQUISES
DÉTAIL DES PLAQUES 1 @ 16	**DÉTAIL DES PLAQUES 1 @ 16**
ORANGE "FLUORESCENT"	ORANGE "FLUORESCENT"
NOIR	NOIR
TOLE EN ALUMINIUM TYPE "UTILITY" ÉPAISSEUR 0.081	TOLE EN ALUMINIUM TYPE "UTILITY" ÉPAISSEUR 0.081
TROUS 11ø	TROUS 11ø
LONGUEUR VARIABLE	LONGUEUR VARIABLE
DÉTAIL TYPE DE POSE DES PLAQUES	**DÉTAIL TYPE DE POSE DES PLAQUES**
ÉCHELLE	ÉCHELLE
DIMENSIONS DES PLAQUES	DIMENSIONS DES PLAQUES
PLAQUE	PLAQUE
LONGUEUR	LONGUEUR
PIÈCES DE CONNEXIONS	PIÈCES DE CONNEXIONS
SPÉCIFICATIONS	SPÉCIFICATIONS
QUANTITÉ	QUANTITÉ
ESPACEURS:	ESPACEURS:
MEMBRURES:	MEMBRURES:
PLAQUES:	PLAQUES:
BOULONS 1/2ø, 5" LG	BOULONS 1/2ø, 5" LG
ÉCROUS	ÉCROUS
RONDELLES "LOCK"	RONDELLES "LOCK"

RONDELLES "FLAT"	RONDELLES "FLAT"
POIS APPROXIMATIFS	POIS APPROXIMATIFS
PLAQUES	PLAQUES
STRUCTURE	STRUCTURE
QUINCAILLERIE	QUINCAILLERIE
TOTAL	TOTAL
95.5 kg	95.5 kg
VOIR PIÈCE "E"	VOIR PIÈCE "E"
PLAN	**PLAN**
VOIR DÉTAIL DU PLIAGE	VOIR DÉTAIL DU PLIAGE
VUE ÉLÉVATION	**VUE ÉLÉVATION**
MARQUE DE JOUR ASSEMBLÉE	**MARQUE DE JOUR ASSEMBLÉE**
CÔTÉ MDJ	CÔTÉ MDJ
CÔTÉ TOUR	CÔTÉ TOUR
VUE EN PLAN	VUE EN PLAN
CHANNEL 76 X 51 X 6 EN ALUMINIUM	CHANNEL 76 X 51 X 6 EN ALUMINIUM
6 TROUS OBLONG 21 X 30mm	6 TROUS OBLONG 21 X 30mm
ÉLÉVATION CÔTÉ TOUR	ÉLÉVATION CÔTÉ TOUR
PROFIL	PROFIL
PIÈCE "E"	**PIÈCE "E"**
(FIXATION A LA TOUR)	(FIXATION A LA TOUR)
6 REQUIS	6 REQUIS
ÉCHELLE	ÉCHELLE

DÉTAIL DU PLIAGE DES PLAQUES	**DÉTAIL DU PLIAGE DES PLAQUES**
NOTE	NOTE
LES CHANNELS DE LA STRUCTURE SERONT EN ALUMINIUM	LES CHANNELS DE LA STRUCTURE SERONT EN ALUMINIUM
LES PLAQUES SERONT EN ALUMINIUM "TYPE UTILITY" 0.081"	LES PLAQUES SERONT EN ALUMINIUM "TYPE UTILITY" 0.081"
LE FABRICANT DEVRA DÉTERMINER ET VÉRIFIER LA LONGUEUR REQUISE POUR CHAQUE TYPES DE BOULONS	LE FABRICANT DEVRA DÉTERMINER ET VÉRIFIER LA LONGUEUR REQUISE POUR CHAQUE TYPES DE BOULONS
TOUTES LES PIÈCES DE CONNEXIONS SERONT EN ACIER INOXYDABLES, NUANCE 316 (FOURNIR LE NOMBRE REQUIS + 10%)	TOUTES LES PIÈCES DE CONNEXIONS SERONT EN ACIER INOXYDABLES, NUANCE 316 (FOURNIR LE NOMBRE REQUIS + 10%)
Direction des Services techniques	Direction des Services techniques
Infrastructures civiles et maritimes	Infrastructures civiles et maritimes
Génie civil	Génie civil
101 Boul. Champlain	101 Boul. Champlain
Québec (Qc) G1K 7Y7	Québec (Qc) G1K 7Y7
MISE À JOUR	MISE À JOUR
QUANTITÉ DE BOULONS CORRIGÉES	QUANTITÉ DE BOULONS CORRIGÉES
LONGUEUR DES BOULONS 1/2ø CORRIGÉS	LONGUEUR DES BOULONS 1/2ø CORRIGÉS
MISE À JOUR GÉNÉRALE	MISE À JOUR GÉNÉRALE
Révision	Révision
Description	Description
MARQUE DE JOUR	MARQUE DE JOUR
2,44m X 4,88m X 7,32m (8'-0" X 16'-0" X 24'-0")	2,44m X 4,88m X 7,32m (8'-0" X 16'-0" X 24'-0")
POUR TOURS À CLAIRE-VOIE 2004	POUR TOURS À CLAIRE-VOIE 2004
DÉTAILS DE PLAQUES DE LA MARQUE DE JOUR	DÉTAILS DE PLAQUES DE LA MARQUE DE JOUR

ANNEX F

Daymark dimensions and assembly plans

Annex F

Daymark dimensions and assembly plan

08809-01 Daymark elevation and details

08809-02 Daymark plate details

Source	Target
ANNEXE G – ORIENTATION DES MARQUES DE JOUR	**ANNEXE G – ORIENTATION DES MARQUES DE JOUR**
CROQUIS POSITION DES MARQUES DE JOURS	CROQUIS POSITION DES MARQUES DE JOURS
Feu postérieur	**Feu postérieur**

ANNEX G

Position of daymarks

Source	Target
VERS BOÎTE DE RACC. HAMMOND FEU PRINCIPAL	VERS BOÎTE DE RACC. HAMMOND FEU PRINCIPAL
VERS BOÎTE DE RACC. HAMMOND FEU DE RELÈVE	VERS BOÎTE DE RACC. HAMMOND FEU DE RELÈVE
120V AC	120V AC
12V DC	12V DC
BRANCHÉS SUR LA BATTERIE	BRANCHÉS SUR LA BATTERIE
1,2m	1,2m
HAUTEUR MINIMAL REQUISE, SELON LE CODE D`ÉLECTRICITÉ DU QUÉBEC	HAUTEUR MINIMAL REQUISE, SELON LE CODE D`ÉLECTRICITÉ DU QUÉBEC
BASE DE LA TOUR	BASE DE LA TOUR
0 OU 610mm IF NO BASE	0 OU 610mm IF NO BASE
SCHÉMA TYPE 1	**SCHÉMA TYPE 1**
POUR INSTALLATION AVEC SERVITUDE HYDRO-ÉLECTRIQUE – BATTERIE/CHARGEUR	POUR INSTALLATION AVEC SERVITUDE HYDRO-ÉLECTRIQUE – BATTERIE/CHARGEUR
VERS BOÎTE DE RACC. HAMMOND FEU PRINCIPAL	VERS BOÎTE DE RACC. HAMMOND FEU PRINCIPAL
VERS BOÎTE DE RACC. HAMMOND FEU DE RELÈVE	VERS BOÎTE DE RACC. HAMMOND FEU DE RELÈVE
120V AC	120V AC
12V DC	12V DC
VIA CAPTEUR SOLAIRE	VIA CAPTEUR SOLAIRE
BRANCHÉS SUR LA BATTERIE	BRANCHÉS SUR LA BATTERIE
1,2m	1,2m
HAUTEUR MINIMAL REQUISE, SELON LE CODE D`ÉLECTRICITÉ DU QUÉBEC	HAUTEUR MINIMAL REQUISE, SELON LE CODE D`ÉLECTRICITÉ DU QUÉBEC
BASE DE LA TOUR	BASE DE LA TOUR
0 OU 610mm IF NO BASE	0 OU 610mm IF NO BASE
SCHÉMA TYPE 2	**SCHÉMA TYPE 2**
FEU PRINCIPAL ET DE RELÈVE	FEU PRINCIPAL ET DE RELÈVE
POUR INSTALLATION AVEC SERVITUDE HYDRO-	POUR INSTALLATION AVEC SERVITUDE HYDRO-

ÉLECTRIQUE – BATTERIE/SOLAIRE	ÉLECTRIQUE – BATTERIE/SOLAIRE
LISTE DE MATÉRIEL:	**LISTE DE MATÉRIEL:**
BOÎTIER POUR ENTRÉE HYDRO-ÉLECTRIQUE. DESSIN #08733-30;	BOÎTIER POUR ENTRÉE HYDRO-ÉLECTRIQUE. DESSIN #08733-30;
BOÎTIER À BATTERIES;	BOÎTIER À BATTERIES;
INSTALLATION AVEC HYDRO-ÉLECTRICITÉ: DESSIN #08733-31;	INSTALLATION AVEC HYDRO-ÉLECTRICITÉ: DESSIN #08733-31;
INSTALLATION SOLAIRE SEULEMENT: DESSIN #08733-29;	INSTALLATION SOLAIRE SEULEMENT: DESSIN #08733-29;
PANNEAU DE DISTRIBUTION "SQUARE D", 60A, 8 CIRCUITS, TYPE Q.O.;	PANNEAU DE DISTRIBUTION "SQUARE D", 60A, 8 CIRCUITS, TYPE Q.O.;
1 DISJONCTEUR DOUBLE PÔLE «SQUARE D», 30A, TYPE QO.	1 DISJONCTEUR DOUBLE PÔLE «SQUARE D», 30A, TYPE QO.
3 DISJONCTEURS SIMPLE PÔLE «SQUARE D», 15A, TYPE QO.	3 DISJONCTEURS SIMPLE PÔLE «SQUARE D», 15A, TYPE QO.
MÂT POUR ENTRÉE ÉLECTRIQUE 1 ¼", INCLUANT TÊTE, ATTACHES LB, CONNECTEURS, BRIDE POUR TRIPLES, CÂBLE RW90 #6;	MÂT POUR ENTRÉE ÉLECTRIQUE 1 ¼", INCLUANT TÊTE, ATTACHES LB, CONNECTEURS, BRIDE POUR TRIPLES, CÂBLE RW90 #6;
PRISE DE SERVICE DDFT, INCLUANT BOÎTE ÉTANCHE À L`EAU, CONDUIT, CONNECTEURS, COUVERCLE ET FILS;	PRISE DE SERVICE DDFT, INCLUANT BOÎTE ÉTANCHE À L`EAU, CONDUIT, CONNECTEURS, COUVERCLE ET FILS;
CHARGEUR DE BATTERIE, SI REQUIS;	CHARGEUR DE BATTERIE, SI REQUIS;
BOITIER DE TRANSFERT POUR FEU DE RELÈVE;	BOITIER DE TRANSFERT POUR FEU DE RELÈVE;
CÂBLE DE M.A.L.T. 2/0 VERT RW90 OU NU ÉTAMÉ;	CÂBLE DE M.A.L.T. 2/0 VERT RW90 OU NU ÉTAMÉ;
BRIDE DE M.A.L.T. T&B #10103-TB;	BRIDE DE M.A.L.T. T&B #10103-TB;
2 TIGES M.A.L.T. ø3/4"X10', CUIVRE;	2 TIGES M.A.L.T. ø3/4"X10', CUIVRE;
SOUDURE EXOTHERMIQUE, INCLUANT ENDUIT DE PROTECTION;	SOUDURE EXOTHERMIQUE, INCLUANT ENDUIT DE PROTECTION;
CÂBLE TECK 10/3 ROUGE /NOIR /BLEU;	CÂBLE TECK 10/3 ROUGE /NOIR /BLEU;
BOITE DE RACCORDEMENT «HAMMOND»;	BOITE DE RACCORDEMENT «HAMMOND»;
CÂBLES DE TYPE «CABTIRE» & SJOW 2/12;	CÂBLES DE TYPE «CABTIRE» & SJOW 2/12;

BATTERIES SELON BESOIN;	BATTERIES SELON BESOIN;
RÉGULATEUR DE VOLTAGE DES PANNEAUX SOLAIRES;	RÉGULATEUR DE VOLTAGE DES PANNEAUX SOLAIRES;
SUPPORT À CAPTEURS SOLAIRES #08827-01, #08827-02; #08827-03;	SUPPORT À CAPTEURS SOLAIRES #08827-01, #08827-02; #08827-03;
BRAQUETTE POUR SUPPORT À CAPTEURS SOLAIRES #08827-01, #08827-02, #08827-03;	BRAQUETTE POUR SUPPORT À CAPTEURS SOLAIRES #08827-01, #08827-02, #08827-03;
CAPTEURS SOLAIRES SELON LES BESOINS;	CAPTEURS SOLAIRES SELON LES BESOINS;
BOITE DE RACCORDEMENT «HAMMOND»;	BOITE DE RACCORDEMENT «HAMMOND»;
*: FOURNI PAR LE GCC;	*: FOURNI PAR LE GCC;
4,572m	4,572m
OU SELON LES CONDITIONS DU SITE	OU SELON LES CONDITIONS DU SITE
ATTACHÉ SUR LA STRUCTURE	ATTACHÉ SUR LA STRUCTURE
0 OU 610mm IF NO BASE	0 OU 610mm IF NO BASE
3,048m	3,048m
VERS BOITIER HAMMOND	VERS BOITIER HAMMOND
BASE DE LA TOUR	BASE DE LA TOUR
SCHÉMA TYPE 3	**SCHÉMA TYPE 3**
POUR INSTALLATION SANS SERVITUDE HYDRO-ÉLECTRIQUE	POUR INSTALLATION SANS SERVITUDE HYDRO-ÉLECTRIQUE
Direction des Services techniques	Direction des Services techniques
Infrastructures civiles et maritimes	Infrastructures civiles et maritimes
Génie civil	Génie civil
101 Boul. Champlain	101 Boul. Champlain
Québec (Qc) G1K 7Y7	Québec (Qc) G1K 7Y7
MISE À JOUR	MISE À JOUR
Révision	Révision
Description	Description

TOUR D`ACIER À CLAIRE-VOIE	TOUR D`ACIER À CLAIRE-VOIE
HAUTEUR DE 3m (10pi) @ 24,4m (80pi)	HAUTEUR DE 3m (10pi) @ 24,4m (80pi)
AIDE À LA NAVIGATION	AIDE À LA NAVIGATION
INSTALLATION ÉLECTRIQUE FUTURE AVEC OU SANS SERVITUDE HYDRO-ÉLECTRIQUE	INSTALLATION ÉLECTRIQUE FUTURE AVEC OU SANS SERVITUDE HYDRO-ÉLECTRIQUE
AUCUNE	AUCUNE

Source	Target
VERS BJ FEU PRINCIPAL	VERS BJ FEU PRINCIPAL
120V AC	120V AC
NEUTRE	NEUTRE
NOIR	NOIR
BLEU	BLEU
ROUGE	ROUGE
VIA PANNEAU DISJONCTEURS	VIA PANNEAU DISJONCTEURS
CHARGEUR	CHARGEUR
VERS BJ FEU DE SECOURS	VERS BJ FEU DE SECOURS
M 15	M 15
AJUSTE	AJUSTE
250 WATTS	250 WATTS
LUMIÈRE AU QUARTZ	LUMIÈRE AU QUARTZ
2 TOURS	2 TOURS
SCHÉMA ÉLECTRIQUE	**SCHÉMA ÉLECTRIQUE**
BOITIER DE TRANSFERT POUR FEU DE RELÈVE	BOITIER DE TRANSFERT POUR FEU DE RELÈVE
LISTE DE MATÉRIEL POUR BOITE DE RACCORDEMENT HAMMOND	**LISTE DE MATÉRIEL POUR BOITE DE RACCORDEMENT HAMMOND**
QUANTITÉ	QUANTITÉ
DESCRIPTION	DESCRIPTION
MODÈLE	MODÈLE
ITEM no.	ITEM no.
BOITES DE JONCTION "ALLIED MOULDED 10" X 8" X 6"	BOITES DE JONCTION "ALLIED MOULDED 10" X 8" X 6"
PLAQUE DE MONTAGE	PLAQUE DE MONTAGE
BORNES "ENTRELEC"	BORNES "ENTRELEC"

BORNE DE MISE À LA TERRE "ENTRELEC"	BORNE DE MISE À LA TERRE "ENTRELEC"
JUMPER "ENTRELEC"	JUMPER "ENTRELEC"
BUTÉE D`ARRÊT	BUTÉE D`ARRÊT
PLAQUE DE FIN DE SECTION "ENTRELEC"	PLAQUE DE FIN DE SECTION "ENTRELEC"
BOUT DE RAIL "DIN" 7 ½"	BOUT DE RAIL "DIN" 7 ½"
"LUG" DE MISE À LA TERRE	"LUG" DE MISE À LA TERRE
"TAG" À BORNIER	"TAG" À BORNIER
VIS 10/32" ½" POUR RAIL ET "LUG"	VIS 10/32" ½" POUR RAIL ET "LUG"
VIS ¼" 20 1"	VIS ¼" 20 1"
"WASHER" ¼	"WASHER" ¼
"LOCK WASHER ¼	"LOCK WASHER ¼
SPRING NUT 5/16	SPRING NUT 5/16
VIS 5/16 1"	VIS 5/16 1"
PLAQUE D`ALUMINIUM DE 12" X 10" X ¼"	PLAQUE D`ALUMINIUM DE 12" X 10" X ¼"
"SUPERSTRUT" DE 4 OU 5 PIEDS GALVANISÉ	"SUPERSTRUT" DE 4 OU 5 PIEDS GALVANISÉ
"SPRING NUT" 1/2	"SPRING NUT" 1/2
VIS ½ 1"	VIS ½ 1"
"WASHER" 1/2	"WASHER" 1/2
"LOCK WASHER" 1/2	"LOCK WASHER" 1/2
"BEAM CLAMP" (SUPPORT À SUPERSTRUT)	"BEAM CLAMP" (SUPPORT À SUPERSTRUT)
TECK 10/3 VIA BOITIER ENTRÉE HYDRO-ÉLECTRIQUE.	TECK 10/3 VIA BOITIER ENTRÉE HYDRO-ÉLECTRIQUE.
CUIVRE	CUIVRE
NOIRE	NOIRE
ROUGE	ROUGE
BLEU	BLEU
120V AC	120V AC

NEUTRE	NEUTRE
TECK 10/3 VIA BOITIER À BATTERIES.	TECK 10/3 VIA BOITIER À BATTERIES.
+12V DC	+12V DC
VERS FEU PRINCIPAL	VERS FEU PRINCIPAL
120V AC	120V AC
GND	GND
NEUTRE	NEUTRE
PRISE D`UTILITÉ SUR DEMANDE	PRISE D`UTILITÉ SUR DEMANDE
VERS FEU DE RELÈVE	VERS FEU DE RELÈVE
SCHÉMA ÉLECTRIQUE	**SCHÉMA ÉLECTRIQUE**
BOITIER DE RACCORDEMENT «HAMMOND»	BOITIER DE RACCORDEMENT «HAMMOND»
Direction des Services techniques	Direction des Services techniques
Infrastructures civiles et maritimes	Infrastructures civiles et maritimes
Génie civil	Génie civil
101 Boul. Champlain	101 Boul. Champlain
Québec (Qc) G1K 7Y7	Québec (Qc) G1K 7Y7
MISE À JOUR	MISE À JOUR
Révision	Révision
Description	Description
TOUR D`ACIER À CLAIRE-VOIE	TOUR D`ACIER À CLAIRE-VOIE
HAUTEUR DE 3m (10pi) @ 24,4m (80pi)	HAUTEUR DE 3m (10pi) @ 24,4m (80pi)
AIDE À LA NAVIGATION	AIDE À LA NAVIGATION
INSTALLATION ÉLECTRIQUE FUTURE AVEC OU SANS SERVITUDE HYDRIO-ÉLECTRIQUE	INSTALLATION ÉLECTRIQUE FUTURE AVEC OU SANS SERVITUDE HYDRIO-ÉLECTRIQUE
AUCUNE	AUCUNE

ANNEX H

Electrical installation plans

Annex H

08990-E02 01/02 and 02/02 Future electrical installation with or without Hydro-Québec easement

APPENDIX I

Summary Table of Work

SUMMARY TABLES OF THE WORK TO BE DONE, page 1 OF 2

STRUCTURES TO BE DISMANTLED

Sites with height (m) of new structures	LLN	Heights of existing towers (m)	Plan of the existing tower to be dismantled	Plan of the existing foundation to be dismantled
Île Bouchard FRL 7.65 m (25')	2326	8.6 m 28.2'	08758	08758
Île Bouchard RRL 26.4 m (80')	2327	16.5 m 54.13'	08885 01/03 to 03/03	---

SUMMARY TABLES OF THE WORK TO BE DONE, page 2 OF 3

TEMPORARY STRUCTURES, FOUNDATION AND FENCES TO BE BUILT

Sites with height (m) of new structures	Temporary structure (mm)	Foundation plan	Foundation (mm)	Elevation of the top of the foundation (m)	Fence to be built (mm)	Fence plan
Île Bouchard FRL 8.25 m	8.25 m min.	QE-35690-S01_01 to 03	Galvanized steel foundation with screw pilings	4.55 chart datum	No	
Île Bouchard RRL 26.4 m	16.0 m min.	QE-35710-S01_01 to 05	Galvanized steel foundation with screw pilings	4.45 chart datum	Yes	

SUMMARY TABLES OF THE WORK TO BE DONE, page 2 OF 2

STRUCTURES AND ACCESSORIES TO BE INSTALLED

Sites	Structure (width x width x height in mm)	Plan of the tower to be built	Lantern, electrical diagram, box if needed	Plans for accessories, monorail and service platform	Height of daymarks (mm)	Daymark plan
Île Bouchard FRL	1219 x 1219 x 7650	08990 SM-04	08990-E02		7320	08809-01 and 08809-02
Île Bouchard RRL	1524 x 1524 x 24 420	08990SM-15	08990-E02		7320	08809-01 and 08809-02

REPORT NO 15671-G-4
GEOTECHNICAL INVESTIGATION
CANADIAN COAST GUARD
AID TO NAVIGATION SITE
Île Bouchard, FRL
CALL FOR TENDERS R4026
SAINT-SULPICE QUEBEC

QUÉFORMAT LTÉE

GEOTECHNICAL INVESTIGATION
MATERIALS ENGINEERING
ENVIRONMENT
WATERTIGHTNESS

File no. 15671-G

November 27, 2009

Fisheries and Oceans Canada
Coast Guard
101 Champlain Boulevard
Québec, Quebec
G1K 7Y7

To the attention of Nicole Perron, Project Lead

Re: Geotechnical Investigation
Canadian Coast Guard Aid to Navigation Site, Île Bouchard, FRL
Call for Tenders R4026
Saint-Sulpice, Quebec

Dear Ms. Perron:

We are pleased to send you the results of the geotechnical investigation you entrusted to us.

All the work done on site and in the laboratory was supervised by Hélène Bilodeau, Project Lead, who also prepared this report. The report was reviewed by the undersigned.

We hope that you will find it satisfactory. Please do not hesitate to contact us if you would like additional information.

QUÉFORMAT LTÉE

Renald Blanchet, Engineer, M.Sc.
Director of Engineering

HB/nc

2cc/ Fisheries and Oceans Canada + 1 CD-ROM

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1.0 INTRODUCTION

The professional services of Quéformat ltée were retained by Fisheries and Oceans Canada to carry out a geotechnical investigation with a view to building a new fixed aid to navigation structure. The proposed structure will serve as a front range light (FRL) for navigation and will replace the existing structure. It will be located in the central-eastern part of Île Bouchard, which is part of the municipality of Saint-Sulpice, Quebec.

The purpose of the geotechnical investigation is to determine the nature and load-bearing capacity of the soils on the site, obtain information needed to design the structure foundations, and make all other relevant geotechnical recommendations.

Environmental characterization of the soils and groundwater are not part of this mandate. Therefore, the descriptions of the terrain provided in this investigation are valid only from a geotechnical perspective, or exclusively for the design and construction of civil engineering work, and are in no way intended to provide conclusions on the presence or absence of toxic materials or contaminants on the site.

The results of work carried out on site and in the laboratory as well as our conclusions and recommendations are presented in this report.

2.0 WORK COMPLETED

2.1 Work on site

The work on site was conducted on October 8, 2009. The staff of Quéformat ltée set up a borehole on the site, as provided for in our service offer dated September 18, 2009. The work was supervised by a senior technician from Quéformat ltée. The location of the borehole was chosen based on the information you gave us.

Quéformat ltée determined the elevation of the terrain to the right of the borehole. All the elevations indicated in this report refer to the same base level. The benchmark used, for which the arbitrary elevation is 100.07 metres, corresponds to the top of the concrete pillar situated at the western base of the existing structure. Drawing 15671-4, included in Annex F, shows the position of the borehole drilled as part of the current mandate, as well as the approximate location of the benchmark.

Before starting the work on site, Quéformat ltée submitted a request to Info-Excavation to locate underground utilities. No utilities were present at the borehole drilling location.

The borehole, identified as F-01, was made using a conventional "BBS-1" type drill. In this borehole, with the exception of the first sample taken from the surface for which an “N” calibre split corer (63 mm in diameter) was used, a standard split corer, 51 mm in diameter, was used to take remoulded samples and to find the “N” value on the standard penetration test. This value makes it possible to assess the compactness of granular soils.

To the right of the borehole, soil sampling continued to 11.29 metres in depth.

Shear strength of the undrained clayey soils was also measured in the borehole using a “Nilcon” site shear tester to a depth of between 3.88 and 11.88 metres.

Also, an intact sample of clayey soils was taken using a thin-sided tube at a depth of between 3.66 and 4.27 metres and at a lateral distance of 1.0 metre in relation to borehole F-01.

A plastic observation tube was left in place in the borehole to measure the groundwater level later on. The annular space around the observation tube was filled with drilling waste.

The drilling report and the results of the shear test provided in Figures A-l and A-2 of Annex A present all the information gathered on site.

During the drilling of borehole F-01, no damage was caused to the structure in place and no solid or liquid waste was left there. As per your request, photographs of the site taken before, during and after the drilling work are attached in Annex E (Figures E-1 and E-2).

2.2 Laboratory work

All the soil samples gathered were taken to our Longueuil laboratory where they were identified by a visual inspection.

To complete the soil identification and description, some soil samples deemed to be representative were submitted to the following tests in the laboratory:

- extraction with thin-sided tube: 1 test;
- determination of water content: 2 tests;
- determination of Atterberg limits: 1 test;
- laboratory fall cone resistance: 1 test;
- sieve analysis: 1 test.

The results of the laboratory tests (Atterberg limits, fall cone resistance and sieve analysis) are presented in detail in Figures B-l and B-2 of Annex B. Some results are also reported in the drilling report in Annex A (Figure A-l).

In addition, a natural soil sample was selected and sent to the Exova laboratory so they could carry out a test to determine the percentage of sulfates (SO_4). The sample submitted for chemical analysis is identified in the drilling report in Annex A (Figure A-1). The chemist's report is presented in Annex C.

The unused samples for the laboratory testing will be saved for a period of six months following the date of this report. They will then be destroyed, unless Fisheries and Oceans Canada gives written notice to the contrary.

3.0 NATURE AND PROPERTIES OF SOILS

The soil descriptions presented in the following paragraphs and in the drilling report are guaranteed only in the location where they were gathered. Consequently, the conclusions and recommendations based on this information are subject to that limitation. The conditions elsewhere on the site may differ from those observed at that location. Quéformat ltée must be promptly informed of any discrepancy found between the materials described in this report and those found during excavations.

At the borehole location, the stratigraphy summarized in the following paragraphs was found.

3.1 Organic soil

On the surface of the ground to the right of borehole F-01, a layer of organic sandy sandy-silty brown-black soil was found that was 0.30 metres thick.

3.2 Sand

Under the layer of organic soil was found the natural ground, composed initially of a layer of brown silty sand, going 2.90 metres deep.

A sieve analysis (Figure B-l) was performed on a sand sample taken between a depth of 1.37 and 1.98 metres to the right of borehole F-01. The results of the analyses indicate that the soil is silty sand, classified as “SM” on the *Unified Soil Classification System.* This sample was found to have 15.9% water content.

According to the “N” values of the standard penetration test, which vary between 6 and 14, the compactness of this sand layer is loose to moderate. It should be noted, however, that the compactness of silty sand diminishes with depth.

3.3 Silty clay

Under the layer of sand was found a deposit of silty clay, with traces of sand. This grey deposit was in a very moist state.

According to undrained shear strength values of 39.7 to 70.9 kPa, measured on site between 3.88 and 11.88 metres in borehole F-01, the consistency of the layer of silty clay was dense, and locally firm on the surface at a depth of 3.88 metres. Also, the laboratory intact fall cone resistance test (C_{uc}) was performed on a clay sample taken using a thin-sided tube in borehole F-01 (see Figure B-2). The shear strength value obtained was 66 kPa, which corresponds to a dense consistency of silty clay for this sample taken between 4.00 and 4.10 metres in depth. Note that the remoulded shear strength (C_{ur}) was also measured for this sample using the laboratory fall cone resistance test, and the value measured was 3.7 kPa. The silty clay was thus of moderate sensitivity with a C_{uc}/C_{ur} relationship of 18.

The limits of plasticity and liquidity (Figure B-2) were measured on sample TS-06C taken between 4.00 and 4.10 metres in depth in borehole F-01. The liquidity limit obtained was 58.4% and the plasticity limit was 21.9%, or a plasticity index of 36.5%. The corresponding liquidity index was 0.91.

Finally, the natural water content of the silty clay, measured on the same clay sample, was 55.1%. In a saturated state, this water content value corresponds to a wet bulk density of 17.0 kN/m^3.

Silty clay with high plasticity is considered as “CH” on the *Unified Soil Classification System.*

Based on the method proposed by Leroueil et al.[1], preconsolidation pressure (σ'_p) can be estimated based on undrained shear strength measured with a "Nilcon" shear tester and Atterberg limits. Taking into account all this information, the density of the soil on site and groundwater depth estimated at 1.8 metres, the minimum preconsolidation gap for the clay ($\sigma'_p - \sigma'_v$) is approximately 90 kPa at 3.88 metres in depth.

Drilling in borehole F-01 was interrupted in the clay deposit after having penetrated a thickness of 8.98 metres, to a depth of 11.88 metres. Therefore, the total thickness was not determined.

1 Leroueil, S., Tavenas, F., Le Bihan, J.-P., "Propriétés géotechniques des argiles de l'est du Canada." *Canadian Geotechnical Journal*, Vol. 20, No. 4, November 1983, pp. 681 to 705.

4.0 GROUNDWATER

The groundwater level was checked on October 30, 2009 in the observation tube installed in borehole F-01. On that date, the groundwater level was at the depth and elevation indicated in Table I.

TABLE I

GROUNDWATER LEVEL

Borehole no	Ground surface elevation (metres)	Groundwater depth (metres)	Groundwater elevation (metres)
F-01	100.07	1.77	98.30

We would like to emphasize that the groundwater level can vary according to precipitation and the seasons.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The plan is to build a new fixed aid to navigation structure to replace the existing one. The characteristics of the new structure were not yet known when this report was written. However, according to a plan of foundation types that you sent to us, the foundation base for the new structure will rest at a depth of 1.80 metres on a granular cushion that would be a minimum of 0.3 metres thick.

Based on the information known about the project and that obtained to the right of the borehole, we have listed our conclusions and recommendations in the following paragraphs.

5.1 Foundations and admissible bearing capacity

In general, the ground to the right of borehole F-01 is covered with a thin layer of organic soil, followed by a layer of silty sand to 2.90 metres in depth. Under the sand, the natural ground is composed of a deposit of silty clay of dense consistency, locally firm to approximately 4.0 metres in depth.

The site appears to be suited to the use of conventional foundations with isolated footings to take over the loads that will be transferred to the support level of the foundation by the new tower. However, no foundation should be built on or in fill materials, organic soils or remoulded soils.

As specified above and for the purpose of calculating load-bearing capacity, we considered that the foundation base of the new structure would be located at 1.80 metres deep and would rest on a granular cushion at least 0.3 metres in thickness. Considering that the terrain is at an elevation of 100.00 metres around the perimeter of the existing structure and that this elevation of the surface soil will remain the same after the construction of the new structure, the foundation base level will therefore be at an elevation of 98.20 metres. At this level, the cushion under the foundations will be placed in the deposit of silty sand. We recommend that the sand at the bottom of the excavation be compacted before the placement of the granular cushion. The sand will have to be compacted to at least 95% of the Modified Proctor Test on a thickness of 0.3

of a metre. If the sand is found in a saturated state at the time of the work, we recommend excavating it and replacing it with MG-56 crushed stone placed on a geotextile membrane. The bed of MG-56 crushed stone will have to go beyond the foundation by at least 1.0 metre and be compacted following the requirements mentioned above. We would note, however, that it is the presence of the clay deposit found under the sand layer that will control the admissible bearing capacity values under the foundation level of the future structure.

The bearing capacity was calculated at ultimate limit states (ULS) and at serviceability limit states (SLS). The ultimate limit state mainly concerns the mechanisms that would cause the structure to collapse and therefore concerns safety, while the serviceability limit state corresponds to mechanisms that limit or prevent the intended use of the structure such as, for example, total and differential settling.

5.1.1 Bearing capacity at the ULS

The general formula used to calculate resistance at the ULS for superficial foundations is as follows:

(1) $q_u = c'N_c s_c i_c + q'N_q s_q i_q + 0.5\gamma' B N_\gamma s_\gamma i_\gamma$

where	c'	=	(or C_u as required): cohesion (kPa) ($c' = 0$ for a granular soil)
	q'	=	Effective earth pressure at the base level (kPa)
	γ'	=	Effective bulk density (kN/m^3)
	N_c, N_q and N_γ	=	Bearing capacity coefficients
	s_c, s_q and s_γ	=	Coefficients of the form function of the geometry of the footing.
	$s_c = s_q$	=	$1+ (B'/L') (N_q/N_c)$
	s_γ	=	$1- 0.4 (B'/L')$
	i_c, i_q and i_γ	=	Load slope correction coefficients
	$i_c = i_q$	=	$(1- \delta/90°)^2$
	i_γ	=	$(1- \delta/\varphi')^2$
	δ	=	Resulting angle of force applied vertically
	φ'	=	Internal angle of friction (use φ_u or φ' according to the case)

If the force is eccentric, the footing must be modified to take into account the eccentricity and make an effective footing with a concentric load, with the width of B' and the length of L', where:

B'	=	$B - 2e_B$, but less than L'
L'	=	$L - 2e_L$
e_B, e_L	=	force eccentricities in directions B and L

Given the presence of a large deposit of clay almost 1.0 metre below the base level of the foundations, we can reduce equation (1) since the angle of friction (φ') is equal to 0 for the clay.

(2) $$q_u = c'N_c s_c i_c + q'N_q s_q i_q$$

Table II summarizes the parameters to be used by the designer to calculate the bearing capacity at the ULS.

If the burial depth of the foundation is different from the one considered in this report, the values in Table II will have to be recalculated accordingly.

TABLE II

PARAMETRES FOR THE CALCUATION OF BEARING CAPACITIES AT THE ULS ON CLAY

Parameters	F-01
Effective earth pressure (q')	31 kPa
Undrained cohesion (C_u*)	50 kPa
Wet bulk density (γ)	17.0
Submerged unit weight (γ')	7.2 kN/m^3
Undrained angle of friction (φ_u)	0°
Coefficient of lift for cohesion (N_c)	5.14
Coefficient of lift for earth pressure (N_q)	1
Coefficient of lift for the soil weight (N_γ)	0

* Corresponds to the average shear strength measured and corrected for the plasticity below the tower's foundation base level.

Based on these parameters, the equation (2) becomes the following:

(3) $q_u = 257\ s_c i_c + 31\ s_q i_q$ (borehole F-01)

A holding coefficient of 0.5 must be applied to the bearing capacity at ULS.

Factors s_c, i_c, s_q and i_q are dependent on the shape of the foundation, the slope of the load, the depth of the foundation, and the slope of the terrain's surface.

5.1.2 Bearing capacity at the SLS

The value of the bearing capacity at the SLS was calculated taking into account that the finished level of the terrain around the tower will not be increased and will have an elevation of about 100.00 metres. As previously mentioned, the SLS capacity value has been calculated for a footing placed at a depth of 1.80 metres.

For the design of the foundations for the new Île Bouchard FRL structure, we recommend using the bearing capacities at the SLS presented in the image in Figure D-1 in Annex D for a square footing resting on a granular cushion of at least 0.3 metres thick. The bearing capacity values presented in Figure D-1 are given for an isolated foundation whose dimension can be between 1.0 and 8.0 metres in width. Taking into consideration the presence of a large clay deposit beneath the foundations, this bearing capacity at the SLS may be considered for dead loads. The application of transient loads, such as wind and earthquakes, does not affect the settling of the foundation. Also, the bearing capacity values shown in Figure D-1 may be increased by 50 percent in the case of the application of dead and transient loads, while not exceeding the load-bearing capacity of Figure D-1 for dead loads.

By bearing capacity at the SLS, we mean the maximum pressure that can be supported at the base of the foundations without the total and differential settling exceeding the usual tolerances of 25 and 19 mm.

5.2 Frost protection

All foundations subject to the effects of freezing will have to be buried at a minimum depth of 1.80 metres under the final terrain surface to obtain effective protection against the harmful effects of frost.

5.3 Temporary excavation

Temporary excavation slopes required for construction are the responsibility of the contractor. The slopes must therefore follow the Commission de la santé et de la sécurité au travail (CSST) standards so that the work can be done safely. For technical and economic evaluations, we recommend adopting slopes of 1.0 vertical for a 1.5 horizontal (1.0V:1.5H) in granular soils (silty sand) after a prior drawdown of the water table. If excavations encounter clay soils, we recommend slopes of 2.0 vertical for 1.0 horizontal (2.0V:1.0H) in this deposit. These recommendations are valid for excavations of 3.0 metres or less.

However, these recommendations are subject to the following restrictions:

- no overload or pile-up at the top of the excavation at a distance from the crest of the slope below the depth of the excavation in the overburden;
- the soil on the surface of the slope will be protected against erosion from rain and runoff.

5.4 Drainage

The groundwater was intercepted in the borehole at a depth of 1.77 metres. It is likely that water will enter the excavation sites, depending on the weather conditions occurring when the work is being done, particularly if the sand-clay contact level is reached.

The infiltration water and all precipitation and runoff water must be evacuated to keep the bottom of the excavations dry and to prevent the formation of unstable areas when compacting the seating materials.

It will be the responsibility of the contractor to keep the bottom of excavations and seating surfaces of future foundations dry to prevent the formation of unstable areas.

5.5 Geotechnical parameters for calculating earth pressure

To calculate earth pressure, we recommend using the geotechnical parameters presented in Table III.

TABLE III

GEOTECHNICAL PARAMETERS

EARTH PRESSURE

Parameters	Soil type	
	Sand	Silty clay
Bulk density (kN/m^3)	18.0	17.0
Internal angle of friction (ϕ) (degrees)	29	25
Coefficient of earth pressure at rest (Ko)	0.52	0.58
Coefficient of earth pressure (Ka)	0.35	0.41
Coefficient of earth abutments (Kp)	2.88	2.46
Effective cohesion (c') (kPa)	0	7

5.6 Backfilling excavations

For backfilling excavations over the footing, we recommend using an MG-112 type of granular borrow material placed in layers no more than 300 mm thick, compacted to at least 95 percent of the maximum dry density obtained in the laboratory on the Modified Proctor Test, as indicated on the section view you sent us.

5.7 Sulfate attacks

A sample of silty sand was subjected to a test to determine the percentage of sulfates (SO_4). The full report by the chemists who conducted the analyses is found in Annex C.

The results of the chemical analyses reveal that for the soil sample F-01/CF-03, taken between 1.37 and 1.98 metres deep, the percentage of sulfates (SO_4) is less than 0.10 percent. According to Table 3 “Additional requirements applicable to concrete exposed to sulfate attacks” of the Canadian Standards Association (A23.1-04, September 2005), the soils are not aggressive to exposed concrete.

6.0 CHANGES AND INSPECTIONS

The conclusions and recommendations made are valid only for the conditions described in this report. Quéformat ltée will have to be notified in writing of any change in the location, the nature or the design of the project in order to assess its impact and, if necessary, to amend the conclusions and recommendations as stated above in a written document.

Furthermore, we recommend that the excavations be inspected by one of Quéformat’s engineers or technicians. This inspection will allow us to verify the nature of the soils and the quality of the foundation bed to detect any features that were unobservable during our geotechnical investigation that may change our conclusions and recommendations.

Moreover, we offer all the control and testing services on materials that will be required during the project.

QUÉFORMAT LTÉE

Hélène Bilodeau, Engineer
Project Lead

Renald Blanchet, Engineer, M.Sc.
Director of Engineering

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ANNEX A

DRILLING REPORT AND

SITE SHEAR TEST

(Figures A-1 and A-2)

EXPLANATORY NOTES FOR DRILLING AND EXPLORATION WELL REPORTS

The appended drilling and exploration well reports contain a detailed description of the materials encountered, including the depth and elevation of each layer encountered, and the type, depth and recovery of each sample taken during work at the site.

SOIL DESCRIPTION

The soil description is based on the particle size classification, the relative importance of each component, and the results of various tests conducted on site and in the laboratory.

Particle classification and dimensions

Terminology	Dimensions (mm)
Boulders	> 300
Pebbles	80 to 300
Gravel	5.0 to 80
Sand	0.080 to 5.0
Silt	0.002 to 0.80
Clay	< 0.002

	Proportion (by weight)
Traces	< 10%
Some	10% to 20%
Adjective (e.g., silty)	20% to 35%
Name (e.g., and sand)	> 35%

Granular soils

In the case of granular soils (silt, sand, gravel), the soil density state, or compactness, is expressed in relation to the “N” index of the standard penetration test.

Compactness	“N” Index
Very loose	< 4
Loose	4 to 10
Compact or average	10 to 30
Dense	30 to 50
Very dense	> 50

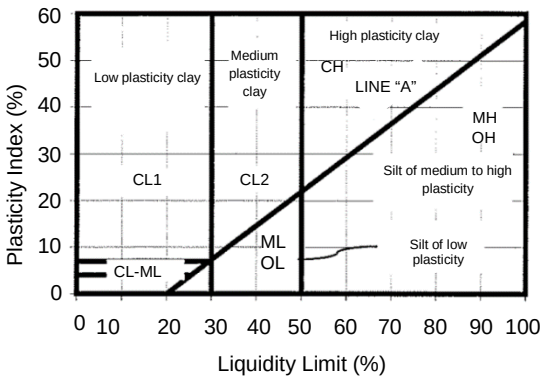
Cohesive soils

For cohesive soils (clay), the consistency of the material is evaluated from shear strength tests (c_u) or, if none, the "N" index. Sensitivity to remoulding (S_t) is defined by the ratio of the shear strength of the intact material (c_u) to that of the remoulded material (c_r).

Consistency	Resistance (c_u) (kPa)	“N” Index
Very soft	< 12	< 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very stiff	100 to 200	15 to 30
Hard	> 200	> 30

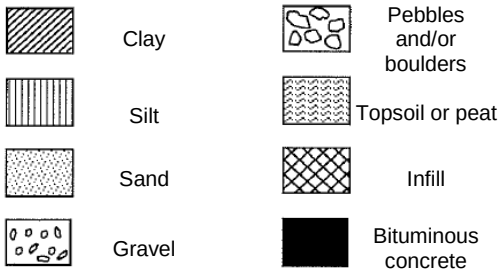
Sensitivity (S_t)	c_u / c_r
Low	< 10
Medium	10 to 40
High	> 40

PLASTICITY DIAGRAM



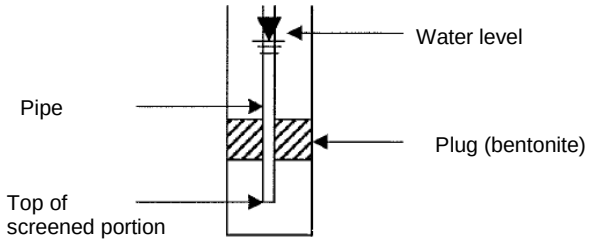
STRATIGRAPHY

The following symbols are used alone or in combination with others to illustrate the observed stratigraphy.



WATER

This column shows the groundwater level measured during reconnaissance work or later. The installation details for a piezometer or observation tube are illustrated in the following diagram.



TESTS

This column shows the results of the tests carried out at the corresponding depths, either at the site or in the laboratory, on the samples collected from the bore sites.

Tx	:	Triaxial cell shearing
Oed	:	Oedometric consolidation
k	:	Permeability, in cm/s
SA	:	Sieve analysis
CA	:	Chemical analysis

EXPLANATORY NOTES FOR DRILLING AND EXPLORATION WELL REPORTS

DESCRIPTION OF BEDROCK

The description of the bedrock is the result of the petrographic examination of the collected samples. This examination describes the colour, the texture, the degree of rock fracturing and alteration, the thickness of the beds and the spacing of discontinuities. The strength of the rock is evaluated using simple compression tests.

Rock texture

Terminology	Grain size (mm)
Coarse grain	Visible to the naked eye
Medium grain	Visible under a magnifying glass
Fine grain	Not visible under a magnifying glass

Degree of fracturation

The degree of rock fracturing is expressed by the Rock Quality Designation (RQD) index, as defined on N calibre cores. It is the result of adding the lengths of samples more than 100 mm long over the entire length of the stroke.

Terminology	RQD index (%)
Very fractured	< 25%
Fractured	25% to 50%
Moderately fractured	50% to 75%
Slightly fractured	75% to 90%
Soil mass	> 90 %

Degree of alteration

Terminology	Description
Not altered	No sign of alteration
Slight	Light alteration on joint surfaces
Medium	Altered, but not brittle. The rock cannot be broken by hand or scratched with a knife blade. Intact texture.
High	Texture indistinct, but grain orientation intact. With effort, the rock can be broken by hand or be scratched with a knife blade.
Complete	The rock breaks easily. Visible grain structure and orientation.
Residual soil	Advanced state of decomposition giving a plastic soil. Structure and orientation of grain destroyed.

Bed thickness

Terminology	Thickness (m)
Very thick	> 2
Thick	0.6 to 2.0
Moderate	0.2 to 0.6
Thin	0.06 to 0.2
Very thin	0.02 to 0.06
Laminated	0.006 to 0.02
Finely laminated	< 0.006

Spacing of discontinuities

Terminology	Spacing (m)
Very tight	< 0.02
Tight	0.02 to 0.06
Close	0.06 to 0.2
Moderately spaced	0.2 to 0.6
Spaced	0.6 to 2.0
Very spaced	2 to 6
Outlying	> 6

Rock compressive strength

Terminology	Strength (MPa)
Extremely low	< 1
Very low	1 to 5
Low	5 to 25
Medium	25 to 50
High	50 to 100
Very High	100 to 250
Extremely high	> 250

STRATIGRAPHY

The following symbols are used alone or in combination with others to illustrate the observed stratigraphy.


Limestone


Shale


Dolomite


Igneous rock


Sandstone


Metamorphic rock

QUÉFORMAT LTÉE

DRILLING REPORT

Figure A-1

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOCATION: **Île Bouchard, FRL**
Saint-Sulpice, Quebec

BOREHOLE: **F-01**

Date: **2009-10-08**

File: **F-01B**

Surf. elev. : **100.07 m (Arbitrary)**

STRATIGRAPHIC SYMBOLS	WATER LEVEL			SAMPLE TYPE AND STATE		BOREHOLE TYPE	
Gravel / Infill	Depth (m)		Date	SC: Split corer	Remoulded	Equipment:	BBS-1
Sand	Borehole	Water	yy-mm-dd	ST: Shelby tube	Intact	Incline:	90°
Silt	10.53	1.77	2009-10-30		Lost	Direction:	
Clay							

DEPTH (m) / ELEVATION	STRATIGRAPHICAL DESCRIPTION	Piezo water	SAMPLES Type Number	State	Rec. %	N or RQD (%)	TESTS AND NOTES
0.26 / 98.97	Organic sandy silty soil. Brown-black. Wet.		CF-01		85	17	Calibre N corer
			CF-02		25	14	
	Silty sand. Brown. Wet. Medium to loose compactness.		CF-03		70	9	SA Sulfates = 0.005%
			CF-04		59	6	
2.20 / 97.03			TS-05		100	1	
			TS-06		100		
	Silty clay, traces of sand. Grey. Very wet. Firm consistency to approx. 4.0 meters in depth, dense further down. Medium sensitivity. High plasticity (CH).		TS-07		100		
			TS-08		100		
			TS-09		100		
			TS-10		100		
12.15 / 87.08	Bottom of borehole at 11.88 meters deep.						

Note: The thin-sided tube sample was taken at a lateral distance of 1.0 metre beside borehole F-01.

Cu shear test (kPa) / Cuc cone (kPa) / Cur cone (kPa): 25 50 75

W_P W_N W_L: 25 50 75

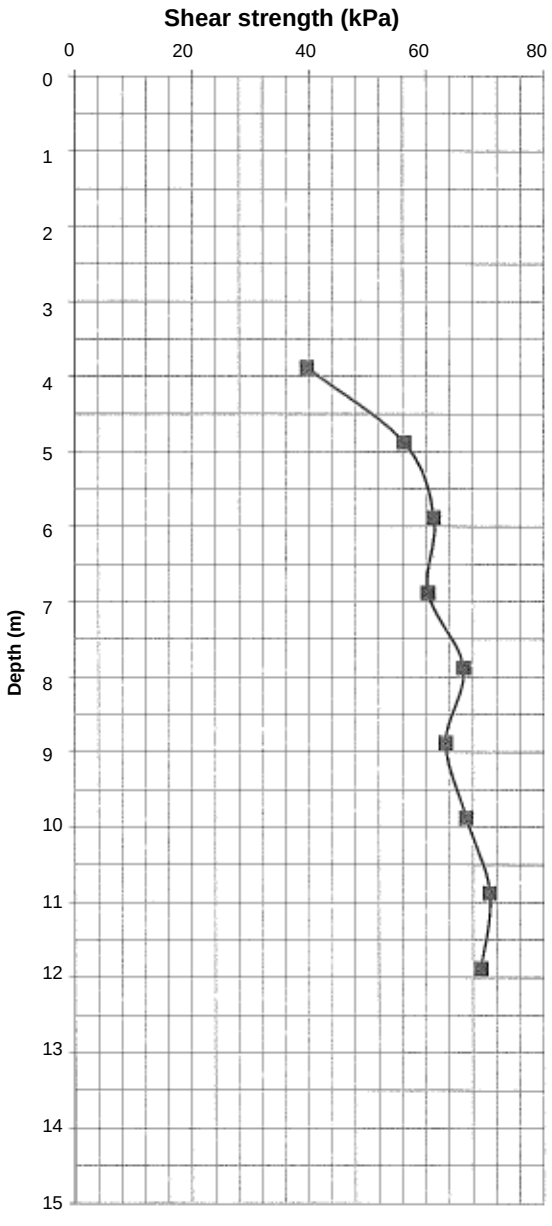
QUÉFORMAT LTÉE

SITE SHEAR TEST

(NQ 2501-200)

Project: Aid to navigation site	Project No.: 15671-G	Borehole No.: F-01
Site: Île Bouchard, FRL	Inspector: C. D.	Date: 2009-10-08
Coordinates	Apparatus no.: 2	Depth of clay (m): 2.90
North:	"K" constant: 1.0523	Depth of water table (m): 1.77
East:	Calibration date: 2009-01-29	Other:
Elevation: 100.07 m	by: Roctest	

Depth (m)	Blades	Shear strength – Intact soil as-af (cm)	Intact soil c_u (kPa)	Remoulded soil as-af (cm)	Remoulded soil c_{ur} (kPa)	Sensitivity c_u/c_{ur}
3.88	M-21	3.95	39.7			
4.88	M-21	5.60	56.3			
5.88	M-21	6.10	61.4			
6.88	M-21	6.00	60.4			
7.88	M-21	6.60	66.4			
8.88	M-21	6.30	63.4			
9.88	M-21	6.65	66.9			
10.88	M-21	7.05	70.9			
11.88	M-21	6.90	69.4			



Refusal depth: m net ☐ Progressive ☐

$C_U = K(as - af)/(101{,}972*C)$

as: maximum radial distance from the pointer (cm)

af: radial distance during the friction of the rods (cm)

Blades	C
G	2.00E-03
M-21	1.03E-03
P	5.00E-04

Remarks (site description, penetration difficulties, special operations, etc.):

Calculated by: H. Bilodeau, Eng. 2009-11-11

Verified by: R. Blanchet, Eng. On: 2009-11-11

ANNEX B

LABORATORY TESTS

(Figures B-1 and B-2)

QUÉFORMAT LTÉE

SIEVE ANALYSIS OF INORGANIC SOILS / AGGREGATES

NQ 2501-025 / LC 21-040

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOCATION: **Île Bouchard, FRL**
Saint-Sulpice, Quebec

BOREHOLE: **F-01**
SAMPLE : **CF-02**
DEPTH (m): **1.37 - 1.98**

Sample no. : **01-03**
File no. : 01-03.GRN

Silty sand.

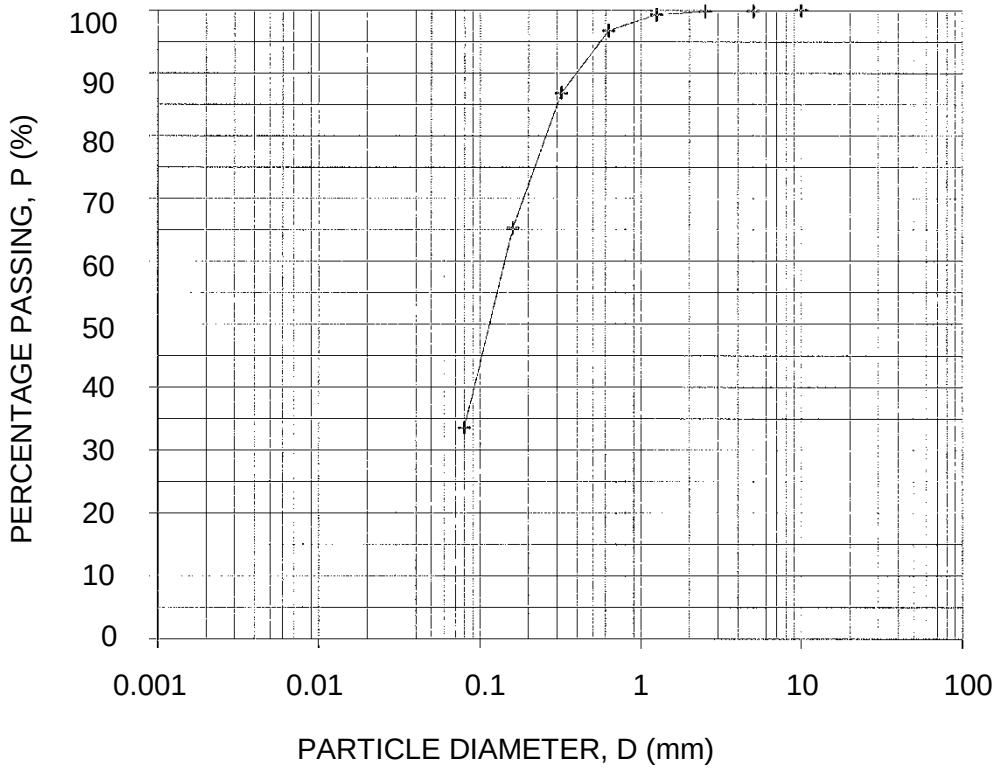
METHOD: **DRY**

Dry total mass (g)	:	667
Total mass > 5mm	:	1
% retained 5mm	:	0.1
Maximum diameter (mm)	:	

WATER CONTENT, w (%) Receipt

Fraction passing through sieve	:	**None**
Wet total mass	:	1,202.5
Dry total mass	:	1,096.5
Tare no C-42	:	429.8
WATER CONTENT, w (%)	:	**15.90**

SIEVE Size (mm)	MASS RETAINED INDIVID.	MASS RETAINED CUMUL.	% RETAINED	% PASSING	% TOTAL PASSING
		SIFTING GRAVEL			
112					
80					
56					
40					
31.5					
20					
14					
10		0	0.0		**100.0**
5		1	0.1		**99.9**
Plateau		667			
		SAND SCREENING			
2.50		0.1	0.0	100.0	**99.9**
1.25		0.9	0.6	99.4	**99.3**
0.63		5.2	3.1	96.9	**96.8**
0.32		21.7	13.1	86.9	**86.9**
0.16		57.6	34.7	65.3	**65.3**
0.08		110.3	66.4	33.6	**33.5**
Plateau		166.1			



DIAMETER (mm)	% PASSING
20	100.0
5	99.9
0.4	90.1
0.08	33.5
0.002	
0.0478	10
0.0740	30
0.1426	60

CU:	3.0
CC:	0.8
USC:	SM
MF:	
Csi:	
Symbol:	SL3

Remarks:

Performed by:
M. Naili 2009-10-14

Verified by:
Hélène Bilodeau, Eng.

Date: 2009-10-15

QUÉFORMAT LTÉE

LABORATORY CONE TESTS

NQ-2501-110 and 092

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOCATION: **Île Bouchard, FRL**
Saint-Sulpice, Quebec

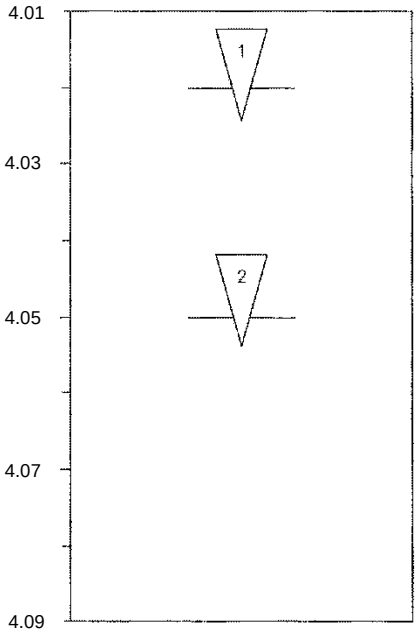
BOREHOLE: **F-01**
SAMPLE : **TS-06C**
DEPTH (m): **4.00 - 4.10**

SAMPLE NO.: **01-06**
FILE: 01-06.CON

TESTS ON INTACT SOIL				
Determination no.:	**1**	**2**	**3**	**4**
Location (cm from top)	1	4		
Cone (Mass - angle)	100-30	100 - 30		
Average penetration (mm)	3.8	3.9		
C_{UC} (kPa)	**68**	**64**		
Natural water content				
Total wet mass	73.73	73.40		
Total dry mass	46.89	46.91		
Tare no.	221	421		
Tare mass	2.41	2.44		
Water content	**60.3**	**59.6**		

TESTS ON REMOULDED SOIL				
Determination type	**Wn**			
Cone (Mass - angle)	60 - 60			
Average penetration (mm)	6.9			
C_{UR} (kPa)	**3.7**			
Water content				
Total wet mass	**39.64**			
Total dry mass	26.41			
Tare no.	1,396			
Tare mass	2.42			
Water content	**55.1**			

Sketch of specimen

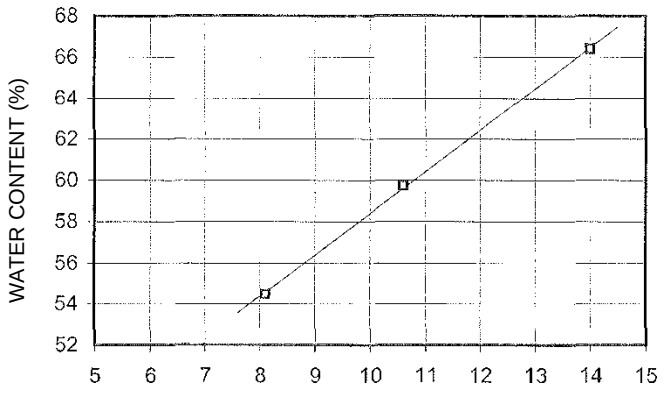


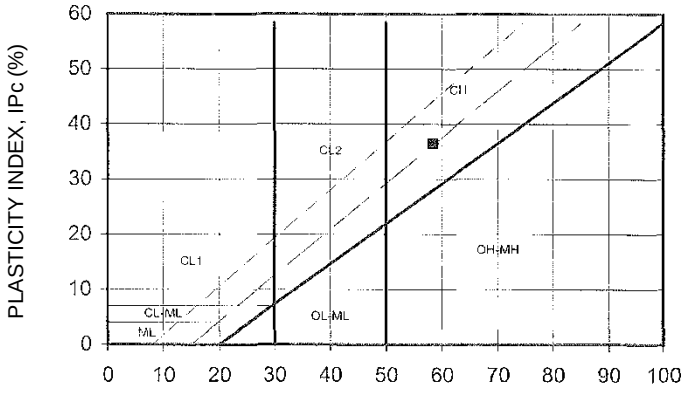
LIMITS OF CONSISTENCY						
	LIMIT OF LIQUIDITY				PLASTICITY	
Cone penetration 60g-60°	**14.0**	**10.6**	**8.1**			
Total wet mass	30.01	24.81	26.38		16.42	14.72
Total dry mass	18.98	16.42	17.93		13.90	12.52
Tare no.	1,227	719	1,117		309	372
Tare mass	2.37	2.38	2.42		2.39	2.44
Water content	**66.4**	**59.8**	**54.5**		**21.9**	**21.8**

RESULTS
C_{UC}: 66 kPa
C_{UR}: 3.7 kPa
S_t: 18
w_N: 55.1
W_{LC}: 58.4
W_P: 21.9
I_{PC}: 36.5
I_{LC}: 0.91
USC: CH
Performed by: M. Naili 2009-10-13
Verified by: Hélène Bilodeau, Eng.
Date: 2009-10-15

Remarks:

(*) Estimated value, ND: Not determined, NP = Non-plastic





ANNEX C

CERTIFICATES OF CHEMICAL ANALYSES

Exova
121 Hymus Boulevard
Pointe-Claire
Quebec
Canada
H9R 1E6

T: +1-514-697-3273
F: +1-514-697-2090
E: info@exova.com
W: www.exova.com

Certificate of Analyses

Analysis request no.: **09-354551**

Analysis request received on: 2009-10-30
Certificate issued on: 2009-11-06
Certificate version no.: 1

☑ Official analysis certificate

☐ Preliminary analysis certificate

Requester

Quéformat Ltée

591 Le Breton
Longueuil, Quebec, Canada
J4G 1R9
Telephone: 450-674-4901
Fax: 450-674-3370

Purchase Order	Your Project	Project Lead
9-014467	NA	Hélène Bilodeau

Comments

The “Soil Protection and Contaminated Sites Rehabilitation Policy” criteria included in this certificate are for information purposes only.
Criteria A for metals are those of the St. Lawrence Lowlands region.
Criteria D corresponding to the “Regulation respecting the burial of contaminated soils” are included in this certificate for information purposes only.

This version supersedes and invalidates any previous versions.

Exova
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Canada
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Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	NA	Hélène Bilodeau

	Sample(s)			
Lab No.	**1666431**	**1666432**	**1666433**	**1666434**
Your Reference	F-01/CF-03/1.37-1.98/Ile Bouchard	F-02/CF-03/1.53-2.14/Ile Bouchard	F-01/CF-03/1.22-1.83/Ste-Thérèse	F-04/CF-03/1.22-1.83/Ste-Thérèse
Matrix	Soil	Soil	Soil	Soil
Taken by	CLIENT	CLIENT	CLIENT	CLIENT
Taken at	NA	NA	NA	NA
Taken on	2009-10-08	2009-10-09	2009-10-15	2009-10-16
Rec'd by lab	2009-10-30	2009-10-30	2009-10-30	2009-10-30
Parameter(s)				
Method Reference				
Moisture (for calculation)	Preparation	2009-11-02	2009-11-02	2009-11-02	2009-11-02
Moisture (gravimetry)	Analysis	2009-11-03	2009-11-03	2009-11-03	2009-11-03
PON-89-01-05, section 5	Sequence no.	183507	183507	183507	183507
Moisture	%	0.2	23.1	<0.1	30.4
Water-soluble sulfates (IC)	Preparation	2009-11-03	2009-11-03	2009-11-03	2009-11-03
Anions by C.I. (water extr.). Results on dry weight.	Analysis	2009-11-03	2009-11-03	2009-11-03	2009-11-03
PON-12-077-04 (REF: MA.300-IONS 1.1, CEAEQ)	Sequence no.	183517	183517	183517	183517
Sulfates in SO4	mg/Kg	50	195	53	73

Exova
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Certificate of Analyses

Client: **Quéformat Ltée**

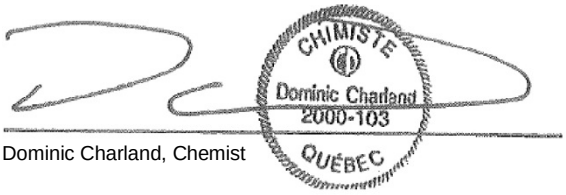
Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	NA	Hélène Bilodeau

	Sample(s)
Lab No.	**1666435**
Your Reference	F-01/CF-03/1.52-2.13/Nicolet
Matrix	Soil
Taken by	CLIENT
Taken at	NA
Taken on	2009-10-20
Rec'd by lab	2009-10-30

Parameter(s) Method Reference		
Moisture (for calculation)	Preparation	2009-11-02
Moisture (gravimetry)	Analysis	2009-11-03
PON-89-01-05, section 5	Sequence no.	183507
Moisture	%	< 0.1
Water-soluble sulfates (IC)	Preparation	2009-11-03
Anions par C.I. (water extr.). Results on dry weight.	Analysis	2009-11-03
PON-12-077-04 (REF: MA.300-IONS 1.1, CEAEQ)	Sequence no.	183517
Sulfates in SO4	mg/Kg	84

Note: These results and comments, if applicable, refer only to the samples submitted for analysis of the above-mentioned parameters.



Dominic Charland, Chemist

Exova
121 Hymus Boulevard
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W: www.exova.com

Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	**NA**	**Hélène Bilodeau**

Quality Control (QC) Results

Parameters (Sequence no.)	Unit	RDL	White	Control certified	
				Obtained	Expected (Interval)
Moisture (for calculation)					
Sequence no.: 183507					
Moisture	%	< 0.1	< 0.1	52.6	47.2 - 57.8
Water-soluble sulfates (IC)					
Sequence no.: 183517					
Sulfates in SO4	mg/Kg	< 3	< 3	631	448 - 672

QC Comments

RDL: Reported detection limit

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W: www.exova.com

Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	**NA**	**Hélène Bilodeau**

Quality Control (QC) Results – Part 2

Parameters (Sequence no.)	Unit	Duplicate		
		Value 1	Value 2	Difference (%)
Water-soluble sulfates (IC)				
Sequence no.: 183517	(Samp. no.)		(1666431)	
Sulfates in SO4	mg/Kg	50	49	2.0

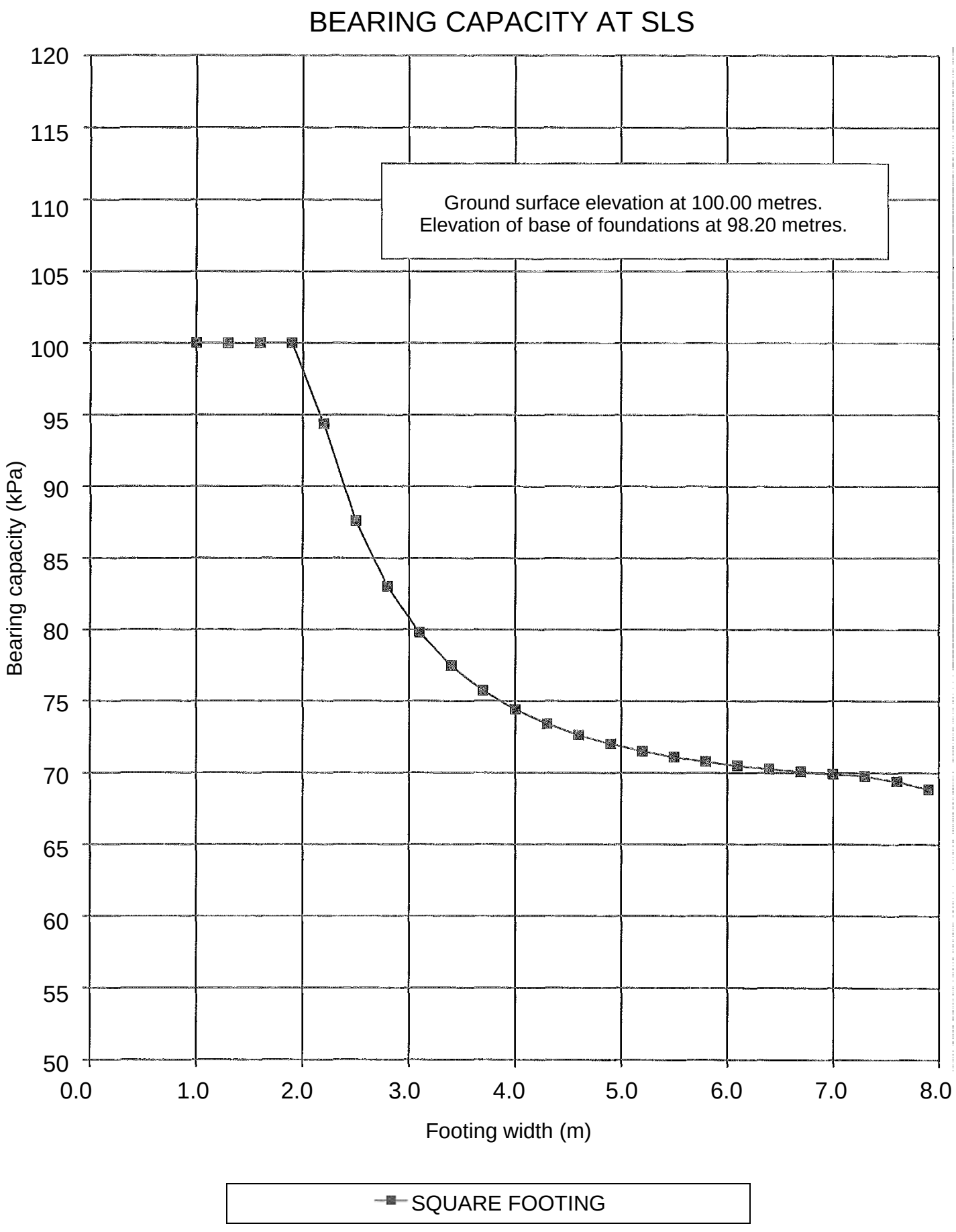
QC Comments

ANNEX D

GRAPH OF BEARING CAPACITY AT SLS

(Figure D-l)

Figure D-1


BEARING CAPACITY AT SLS
Ground surface elevation at 100.00 metres.
Elevation of base of foundations at 98.20 metres.
Bearing capacity (kPa)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Footing width (m)
SQUARE FOOTING

ANNEX E

SITE PHOTOGRAPHS

(Figures E-l and E-2)

***Photograph no. 1*: Northbound view of the front range light (FRL) for navigation on Île Bouchard.**

***Photograph no. 2:* Planned location of borehole F-01 at the foot of the existing structure.**

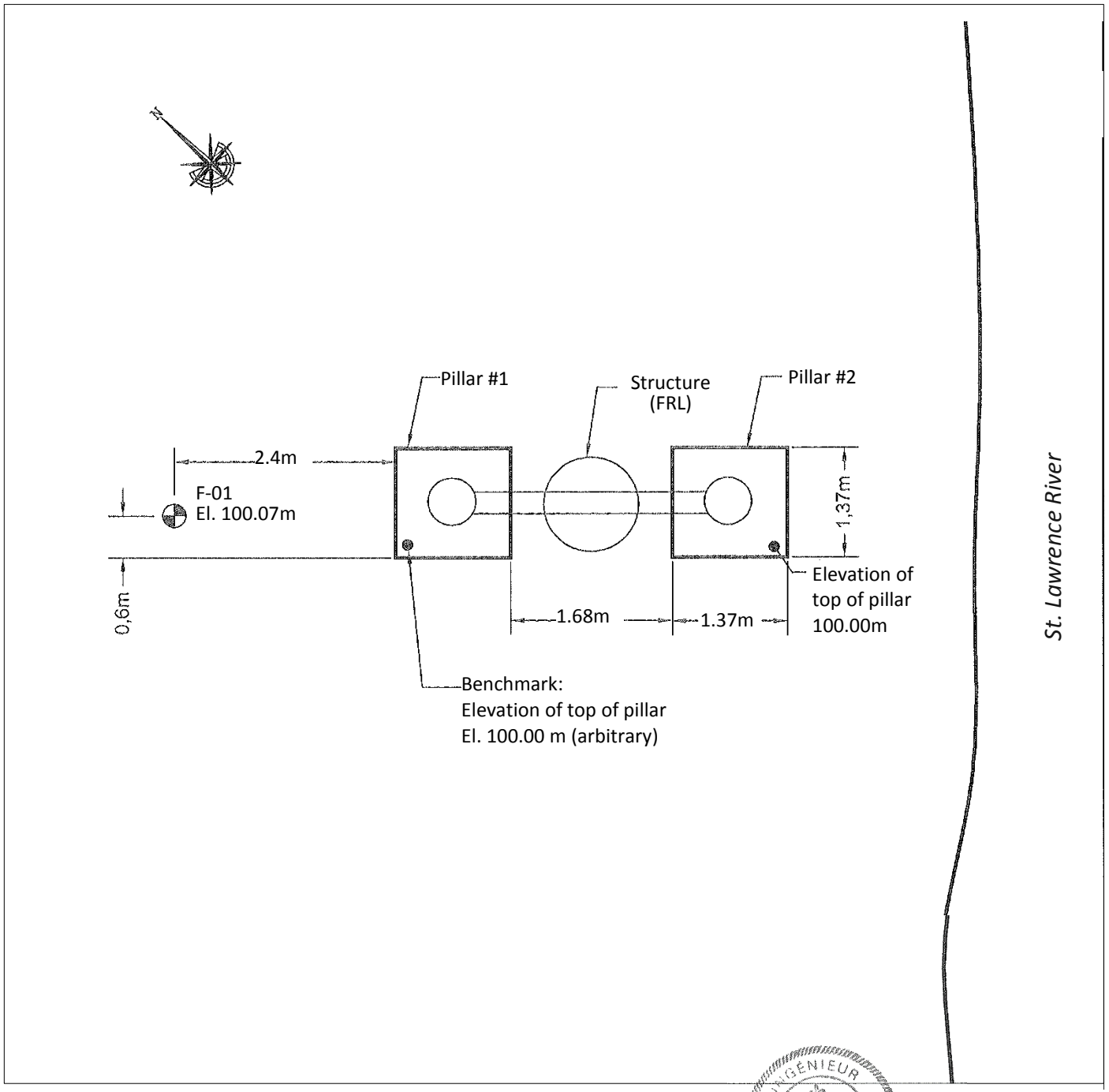
Photograph no. 3: **Location of the drilling equipment to make borehole F-01.**

Photograph no. 4: **Status after drilling borehole F-01.**

ANNEX F

LOCATION OF BOREHOLE F-01

(Drawing 15671-5)



LEGEND

F-01
El. 100.07m — Borehole, number and elevation

INGÉNIEUR
Hélène Bilodeau
98589
QUÉBEC
2009/10/27

PROJECT:	CCG Aid to Navigation Site, Île Bouchard, FRL Saint-Sulpice, Quebec	DATE:	2009-10-14
		SCALE:	None
TITLE:	Location of borehole F-01	DRAWN BY:	J.P.
		APPROVED BY:	H. Bilodeau, Eng.
QUÉFORMAT LTÉE		FILE:	15671-G
		DRAWING:	156714

REPORT NO 15671-G-5
GEOTECHNICAL INVESTIGATION
CANADIAN COAST GUARD
AID TO NAVIGATION SITE
ÎLE BOUCHARD, RRL
CALL FOR TENDERS R4026
SAINT-SULPICE, QUEBEC

File no. 15671-G

November 27, 2009

Fisheries and Oceans Canada
Coast Guard
101 Champlain Boulevard
Québec, Quebec
G1K 7Y7

To the attention of Nicole Perron, Project Lead

Re: Geotechnical investigation
Canadian Coast Guard Aid
to Navigation Site,
Île Bouchard, RRL
Call for Tenders R4026
Saint-Sulpice, Quebec

Dear Ms. Perron:

We are pleased to send you the results of the geotechnical investigation you entrusted to us.

All the work done on site and in the laboratory was supervised by Hélène Bilodeau, Project Lead, who also prepared this report. The report was reviewed by the undersigned.

We hope that you will find it satisfactory. Please do not hesitate to contact us if you would like additional information.

QUÉFORMAT LTÉE

Renald Blanchet, Engineer, M.Sc.
Director of Engineering

HB/nc

2cc/ Fisheries and Oceans Canada + 1 CD-ROM

TABLE OF CONTENTS

Pages

TABLE OF CONTENTS (continued)

1.0 INTRODUCTION

The professional services of Quéformat ltée were retained by Fisheries and Oceans Canada to carry out a geotechnical investigation with a view to building a new fixed aid to navigation structure. The proposed structure will serve as a rear range light (RRL) for navigation and will replace the existing structure. It will be located in the central-eastern part of Île Bouchard, which is part of the municipality of Saint-Sulpice, Quebec.

The purpose of the geotechnical investigation is to determine the nature and load-bearing capacity of the soils on the site, obtain information needed to design the structure foundations, and make all other relevant geotechnical recommendations.

Environmental characterization of the soils and groundwater are not part of this mandate. Therefore, the descriptions of the terrain provided in this investigation are valid only from a geotechnical perspective, or exclusively for the design and construction of civil engineering work, and are in no way intended to provide conclusions on the presence or absence of toxic materials or contaminants on the site.

The results of work carried out on site and in the laboratory as well as our conclusions and recommendations are presented in this report.

2.0 WORK COMPLETED

2.1 Work on site

The work on site was conducted on October 8 and 9, 2009. The staff of Quéformat ltée set up a borehole on the site, as provided for in our service offer dated September 18, 2009. The work was supervised by a senior technician from Quéformat ltée. The location of the borehole was chosen based on the information you gave us.

Quéformat ltée determined the elevation of the terrain to the right of the borehole. All the elevations indicated in this report refer to the same base level. The benchmark used, for which the arbitrary elevation is 100.00 metres, corresponds to the top of the concrete base on the south side of the existing structure. Drawing 15671-5, included in Annex F, shows the position of the borehole drilled as part of the current mandate, as well as the approximate location of the benchmark.

Before starting the work on site, Quéformat ltée submitted a request to Info-Excavation to locate underground utilities. No utilities were present at the borehole drilling location.

The borehole, identified as F-02, was made using a conventional “BBS-1” type drill. In this borehole, with the exception of the first sample taken from the surface for which an “N” calibre split corer (63 mm in diameter) was used, a standard split corer, 51 mm in diameter, was used to take remoulded samples and to find the “N” value on the standard penetration test. This value makes it possible to assess the compactness of granular soils.

To the right of the borehole, soil sampling continued to 11.29 metres in depth.

Shear strength of the undrained clayey soils was also measured in the borehole using a “Nilcon” site shear tester to a depth of between 4.15 and 12.15 metres.

Also, an intact sample of clayey soils was taken using a thin-sided tube at a depth of between 3.05 and 3.66 metres in borehole F-02.

A plastic observation tube was left in place in the borehole to measure the groundwater level later on. The annular space around the observation tube was filled with drilling waste.

The drilling report and the results of the shear test provided in Figures A-l and A-2 of Annex A present all the information gathered on site.

During the drilling of borehole F-02, no damage was caused to the structure in place and no solid or liquid waste was left at the site. As per your request, photographs of the site taken before, during and after the drilling work are attached in Annex E (Figures E-1 and E-2).

2.2 Laboratory work

All the soil samples gathered were taken to our Longueuil laboratory where they were identified by a visual inspection.

To complete the soil identification and description, some soil samples deemed to be representative were submitted to the following tests in the laboratory:

- extraction with thin-sided tube: 1 test;
- determination of water content: 2 tests;
- determination of Atterberg limits: 1 test;
- laboratory fall cone resistance: 1 test;
- sieve analysis: 1 test.

The results of the laboratory tests (Atterberg limits, fall cone resistance and sieve analysis) are presented in detail in Figures B-l and B-2 of Annex B. Some results are also reported in the drilling report in Annex A (Figure A-l).

In addition, a natural soil sample was selected and sent to the Exova laboratory so they could carry out a test to determine the percentage of sulfates (SO_4). The sample submitted for chemical analysis is identified in the drilling report in Annex A (Figure A-1). The chemist's report is presented in Annex C.

The unused samples for the laboratory testing will be saved for a period of six months following the date of this report. They will then be destroyed, unless Fisheries and Oceans Canada gives written notice to the contrary.

3.0 NATURE AND PROPERTIES OF SOILS

The soil descriptions presented in the following paragraphs and in the drilling report are guaranteed only in the location where they were gathered. Consequently, the conclusions and recommendations based on this information are subject to that limitation. The conditions elsewhere on the site may differ from those observed at that location. Quéformat ltée must be promptly informed of any discrepancy found between the materials described in this report and those found during excavations.

At the borehole location, the stratigraphy summarized in the following paragraphs was found.

3.1 Infill

On the surface of the ground to the right of borehole F-02, a layer of infill consisting of brown clayey silt with traces of sand was found that was 0.26 metres thick.

3.2 Sand

Under the layer of infill was found the natural ground, composed initially of a layer of grey-brown to grey sand, with some silt, going 2.20 metres deep. The sand becomes gravelly at the base of the layer.

A sieve analysis (Figure B-1) was conducted on a sample of sand taken between 0.61 and 1.22 metres deep to the right of borehole F-02. The analysis results indicate that the soil is a sand, with some silt, and is classified as “SM” on the *Unified Soil Classification System.* This sample was found to have 22.9% water content.

According to the “N” values of the standard penetration test from 1 and 4, the compactness of this sand layer was loose to very loose.

3.3 Silty clay

Under the layer of sand was found a deposit of silty clay, with traces of sand. This grey deposit was in a very moist state.

According to undrained shear strength values of 42.8 to 50.8 kPa, measured on site between 4.15 and 12.15 metres in borehole F-02, the consistency of the layer of silty clay was firm, locally stiff, at a depth of 11.15 metres. Also, the laboratory fall cone resistance test (C_{uc}) was performed on a clay sample taken using a thin-sided tube in borehole F-02 (see Figure B-2). The shear strength value obtained was 58 kPa, which corresponds to a stiff consistency of silty clay for this sample taken between 3.40 and 3.50 metres in depth. Note that the remoulded shear strength (C_{ur}) was also measured for this sample using the laboratory fall cone resistance test, and the value measured was 4 kPa. The silty clay was thus of moderate sensitivity with a C_{uc}/C_{ur} relationship of 15.

The limits of plasticity and liquidity (Figure B-2) were measured on sample TS-05C taken between 3.40 and 3.50 metres in depth in borehole F-02. The liquidity limit obtained was 59 percent and the plasticity limit obtained was 22 percent, or a plasticity index of 37 percent. The corresponding liquidity index was 0.91.

Finally, the natural water content of the silty clay, measured on the same clay sample, was 56.2 percent. In a saturated state, this water content value corresponds to a wet bulk density of 16.9 kN/m^3.

Silty clay with high plasticity is considered as “CH” according to the *Unified Soil Classification System.*

Based on the method proposed by Leroueil et al.,[1] preconsolidation pressure (σ'_p) can be estimated based on undrained shear strength measured with a "Nilcon" shear tester and Atterberg limits. Taking into account all this information, the wet density of the soil on site and the groundwater depth of 0.63 metres, the minimum preconsolidation gap for clay ($\sigma'_p - \sigma'_v$) was approximately 68 kPa at the base of borehole F-02, i.e., at 12.15 metres deep.

Drilling in borehole F-02 was interrupted in the clay deposit after having penetrated a thickness of 9.95 metres, to a depth of 12.15 metres. Therefore, the total thickness was not determined.

[1] Leroueil, S., Tavenas, F., Le Bihan, J.-P., "Propriétés géotechniques des argiles de l'est du Canada." *Canadian Geotechnical Journal*, Vol. 20, No. 4, November 1983, pp. 681 to 705.

4.0 GROUNDWATER

The groundwater level was checked on October 30, 2009 in the observation tube installed in the borehole. On that date, the groundwater level was at the depth and elevation indicated in Table I.

TABLE I

GROUNDWATER LEVEL

Borehole no	Ground surface elevation (metres)	Groundwater depth (metres)	Groundwater elevation (metres)
F-02	99.32	0.63	98.60

We would like to emphasize that the groundwater level can vary according to precipitation and the seasons.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The plan is to build a new fixed aid to navigation structure to replace the existing one. The characteristics of the new structure were not yet known when this report was written. However, according to a plan of foundation types that you sent to us, the foundation base for the new structure will rest at a depth of 1.80 metres on a granular cushion that would be a minimum of 0.3 metres thick.

Based on the known information about the project and the information obtained to the right of the borehole, we have listed our conclusions and recommendations in the following paragraphs.

5.1 Foundations and admissible bearing capacity

In general, the ground to the right of borehole F-02 is covered with a thin layer of infill consisting of clayey silt, followed by a layer of sand and some silt to a depth of 2.20 metres. Under the sand, the natural ground is composed of a deposit of silty clay of firm consistency, locally stiff, at 3.05 and 11.15 metres deep.

The site appears to be suited to the use of conventional foundations with isolated footings to take over the loads that will be transferred to the support level of the foundation by the new tower. However, no foundation should be built on or in fill materials, organic soils or remoulded soils.

As specified above and for the purpose of calculating load-bearing capacity, we considered that the foundation base of the new structure would be located at 1.80 metres deep and would rest on a granular cushion at least 0.3 metres in thickness. Considering that the terrain is at an elevation of 99.23 metres around the perimeter of the existing structure and that this elevation of the surface soil will remain the same after the construction of the new structure, the foundation base level will therefore be at an elevation of 97.43 metres. At this level, the cushion under the foundations will be placed at the surface of the intact clay deposit.

The bearing capacity was calculated at ultimate limit states (ULS) and at serviceability limit states (SLS). The ultimate limit state mainly concerns the mechanisms that would cause the structure to collapse and therefore concerns safety, while the serviceability limit state corresponds to mechanisms that limit or prevent the intended use of the structure such as, for example, total and differential settling.

5.1.1 Bearing capacity at the ULS

The general formula used to calculate resistance at the ULS for superficial foundations is as follows:

(1) $q_u = c'N_c s_c i_c + q'N_q s_q i_q + 0.5\gamma' B N_\gamma s_\gamma i_\gamma$

where
- c' = (or C_u as required): cohesion (kPa) ($c' = 0$ for a granular soil)
- q' = effective earth pressure at the base level (kPa)
- γ' = effective bulk density (kN/m^3)
- N_c, N_q and N_γ = bearing capacity coefficients
- s_c, s_q and s_γ = coefficients of the form function of the geometry of the footing
- $s_c = s_q$ = $1+ (B'/L') (N_q/N_c)$
- s_γ = $1- 0.4 (B'/L')$
- i_c, i_q and i_γ = load slope correction coefficients
- $i_c = i_q$ = $(1- \delta/90°)^2$
- ii_γ = $(1- \delta/\varphi')^2$
- δ = resulting angle of force applied vertically
- φ' = internal angle of friction (use φ_u or φ' as required)

If the force is eccentric, the footing must be modified to take into account the eccentricity and make an effective footing with a concentric load, with the width of B' and the length of L', where:

- B' = $B – 2e_B$, but less than L'
- L' = $L - 2e_L$
- e_B, e_L = eccentricities of the force in directions B and L

Where the foundation bed rests on clay, the equation (1) can be reduced because the value of the angle of friction (ϕ') is equal to zero (0) for clay.

(2) $q_u = c'N_c s_c i_c + q'N_q s_q i_q$

Table II summarizes the parameters to be used by the designer to calculate the bearing capacity at the ULS.

If the burial depth of the foundation is different from the one considered in this report, the values in Table II will have to be recalculated accordingly.

TABLE II

PARAMETERS FOR THE CALCUATION OF BEARING CAPACITIES AT THE ULS ON CLAY

Parameters	F-01
Effective earth pressure (q')	21 kPa
Undrained cohesion (C_u*)	42 kPa
Wet bulk density (γ)	16.9
Submerged unit weight (γ')	7.1 kN/m^3
Undrained angle of friction (φ_u)	0°
Coefficient of lift for cohesion (N_c)	5.14
Coefficient of lift for earth pressure (N_q)	1
Coefficient of lift for the soil weight (N_γ)	0

* Corresponds to the average shear strength measured and corrected for the plasticity below the tower's foundation base level.

Based on these parameters, the equation (2) becomes the following:

(3) $q_u = 215\ s_c i_c + 21\ s_q i_q$ (borehole F-01)

A holding coefficient of 0.5 must be applied to the bearing capacity at ULS.

Factors s_c, i_c, s_q and i_q are dependent on the shape of the foundation, the slope of the load, the depth of the foundation and the slope of the terrain surface.

5.1.2 Bearing capacity at the SLS

The value of the bearing capacity at the SLS was calculated taking into account that the finished level of the terrain around the tower will not be increased and will have an elevation of about 99.23 metres. As previously mentioned, the SLS capacity value has been calculated for a footing placed at a depth of 1.80 metres.

For the design of the foundations for the new Île Bouchard RRL structure, we recommend using the bearing capacities at the SLS presented in the image in Figure D-1 in Annex D for a square footing resting on a granular cushion of at least 0.3 metres thick. The bearing capacity values presented in Figure D-1 are given for an isolated foundation whose dimension can be between 1.0 and 8.0 metres in width. Since the foundation bed will rest on clay, this bearing capacity value at the SLS may be considered for dead loads. The application of transient loads, such as wind and earthquakes, does not affect the settling of the foundation. Also, the bearing capacity values shown in Figure D-1 may be increased by 50 percent in the case of the application of dead and transient loads, while not exceeding the load-bearing capacity of Figure D-1 for dead loads.

By bearing capacity at the SLS, we mean the maximum pressure that can be supported at the base of the foundations without the total and differential settling exceeding the usual tolerances of 25 and 19 mm.

Special precautions will also have to be taken to avoid shifting the clay in place at the base of the foundations. These precautions will have to include the use of a bucket equipped with a blade and the installation of a geotextile membrane at the bottom of the excavation before the granular cushion is placed.

5.2 Frost protection

All foundations subject to the effects of freezing will have to be buried at a minimum depth of 1.80 metres under the final terrain surface to obtain effective protection against the harmful effects of frost.

5.3 Temporary excavation

Temporary excavation slopes required for construction are the responsibility of the contractor. The slopes must therefore follow the Commission de la santé et de la sécurité au travail (CSST) standards so that the work can be done safely. For technical and economic evaluations, we recommend adopting slopes of 1.0 vertical for a 1.5 horizontal (1.0V:1.5H) in granular soils (silty sand) after a prior drawdown of the water table. If excavations penetrate clay soils, we recommend slopes of 2.0 vertical for 1.0 horizontal (2.0V:1.0H) in this deposit. These recommendations are valid for excavations of 3.0 metres or less.

However, these recommendations are subject to the following restrictions:

- no overload or pile-up at the top of the excavation at a distance from the crest of the slope below the depth of the excavation in the overburden;
- the soil on the surface of the slope will be protected against erosion from rain and runoff.

5.4 Drainage

The groundwater was intercepted in the borehole at a depth of 0.63 metres. It is likely that water will enter the excavation sites, depending on the weather conditions occurring when the work is being done.

The infiltration water and all precipitation and runoff water must be evacuated to keep the bottom of the excavations dry and to prevent the formation of unstable areas when compacting the seating materials.

It will be the responsibility of the contractor to keep the bottom of excavations and seating surfaces of future foundations dry to prevent the formation of unstable areas.

5.5 Geotechnical parameters for calculating earth pressure

To calculate earth pressure, we recommend using the geotechnical parameters presented in Table III.

TABLE III

GEOTECHNICAL PARAMETERS

EARTH PRESSURE

Parameters	Soil type	
	Sand	Silty clay
Bulk density (γ) (kN/m^3)	18.0	17.0
Internal angle of friction (φ) (degrees)	29	25
Coefficient of earth pressure at rest (Ko)	0.52	0.58
Coefficient of earth pressure (Ka)	0.35	0.41
Coefficient of earth abutments (Kp)	2.88	2.46
Effective cohesion (c') (kPa)	0	7

5.6 Backfilling excavations

For backfilling excavations over the footing, we recommend using an MG-112 type of granular borrow material placed in layers no more than 300 mm thick, compacted to at least 95 percent of the maximum dry density obtained in the laboratory on the Modified Proctor Test, as indicated on the section view you sent us.

5.7 Sulfate attacks

A sample of sand was subjected to a test to determine the percentage of sulfates (SO_4). The full report by the chemists who conducted the analyses is found in Annex C.

The results of the chemical analyses reveal that for the soil sample F-02/CF-03, taken between 1.53 and 2.14 metres deep, the percentage of sulfates (SO_4) is less than 0.10 percent. According to Table 3 “Additional requirements applicable to concrete exposed to sulfate attacks” of the Canadian Standards Association (A23.1-04, September 2005), the soils are not aggressive to exposed concrete.

6.0 CHANGES AND INSPECTIONS

The conclusions and recommendations made are valid only for the conditions described in this report. Quéformat ltée will have to be notified in writing of any change in the location, the nature or the design of the project in order to assess its impact and, if necessary, to amend the conclusions and recommendations as stated above in a written document.

Furthermore, we recommend that the excavations be inspected by one of Quéformat's engineers or technicians. This inspection will allow us to verify the nature of the soils and the quality of the foundation bed to detect any features that were unobservable during our geotechnical investigation that may change our conclusions and recommendations.

Moreover, we offer all the control and testing services on materials that will be required during the project.

QUÉFORMAT LTÉE

Hélène Bilodeau, Engineer
Project Lead

Renald Blanchet, Engineer, M.Sc.
Director of Engineering

HB/nc

2cc/ Fisheries and Oceans Canada + 1 CD-ROM

ANNEX A

DRILLING REPORT AND

SITE SHEAR TEST

(Figures A-1 and A-2)

EXPLANATORY NOTES FOR DRILLING REPORTS AND EXPLORATION WELLS

The appended drilling and exploration well reports contain a detailed description of the materials encountered, including the depth and elevation of each layer encountered, and the type, depth and recovery of each sample taken during work at the site.

SOIL DESCRIPTION

The soil description is based on the particle size classification, the relative importance of each component, and the results of various tests conducted on site and in the laboratory.

Particle classification and dimensions

Terminology	Dimensions (mm)
Boulders	> 300
Pebbles	80 to 300
Gravel	5.0 to 80
Sand	0.080 to 5.0
Silt	0.002 to 0.80
Clay	< 0.002

	Proportion (by weight)
Traces	< 10%
Some	10% to 20%
Adjective (e.g., silty)	20% to 35%
Name (e.g., and sand)	> 35%

Granular soils

In the case of granular soils (silt, sand, gravel), the soil density state, or compactness, is expressed in relation to the "N" index of the standard penetration test.

Compactness	"N" Index
Very loose	< 4
Loose	4 to 10
Compact or average	10 to 30
Dense	30 to 50
Very dense	> 50

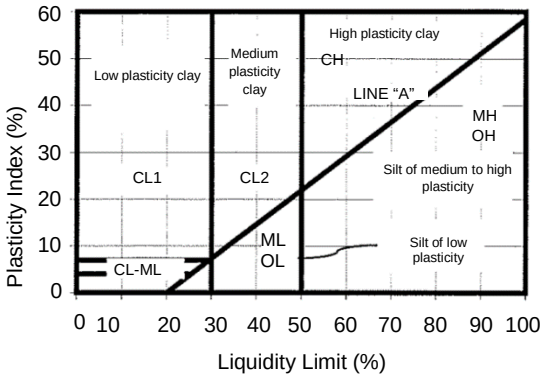
Cohesive soils

For cohesive soils (clay), the consistency of the material is evaluated from shear strength tests (c_u) or, if none, the "N" index. Sensitivity to remoulding (S_t) is defined by the ratio of the shear strength of the intact material (c_u) to that of the remoulded material (c_r).

Consistency	Strength (c_u) (kPa)	"N" Index
Very soft	< 12	< 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very stiff	100 to 200	15 to 30
Hard	> 200	> 30

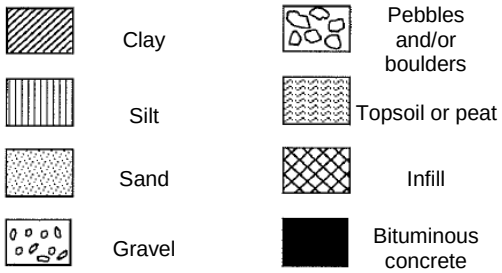
Sensitivity (S_t)	c_u / c_r
Low	< 10
Medium	10 to 40
High	> 40

PLASTICITY DIAGRAM



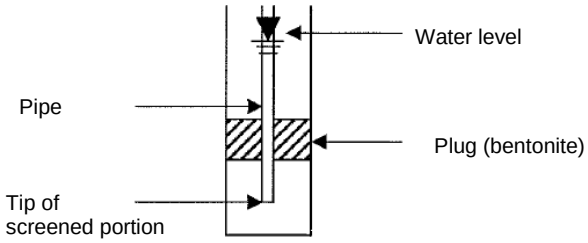
STRATIGRAPHY

The following symbols are used alone or in combination with others to illustrate the observed stratigraphy.



WATER

This column shows the groundwater level measured during reconnaissance work or later. The installation details for a piezometer or observation tube are illustrated in the following diagram.



TESTS

This column shows the results of the tests carried out at the corresponding depths, either at the site or in the laboratory, on the samples collected from the bore sites.

Tx	:	Triaxial cell shearing
Oed	:	Oedometric consolidation
k	:	Permeability, in cm/s
SA	:	Sieve analysis
CA	:	Chemical analysis

EXPLANATORY NOTES FOR DRILLING AND EXPLORATION WELL REPORTS

DESCRIPTION OF BEDROCK

The description of the bedrock is the result of the petrographic examination of the collected samples. This examination describes the colour, the texture, the degree of rock fracturing and alteration, the thickness of the beds and the spacing of discontinuities. The strength of the rock is evaluated using simple compression tests.

Rock texture

Terminology	Grain size (mm)
Coarse grain	Visible to the naked eye
Medium grain	Visible under a magnifying glass
Fine grain	Not visible under a magnifying glass

Degree of fracturation

The degree of rock fracturing is expressed by the Rock Quality Designation (RQD) index, as defined on N calibre cores. It is the result of adding the lengths of samples more than 100 mm long over the entire length of the stroke.

Terminology	RQD index (%)
Very fractured	< 25%
Fractured	25% to 50%
Moderately fractured	50% to 75%
Slightly fractured	75% to 90%
Soil mass	> 90 %

Degree of alteration

Terminology	Description
Not altered	No sign of alteration
Slight	Light alteration on joint surfaces
Medium	Altered, but not brittle. The rock cannot be broken by hand or scratched with a knife blade. Intact texture.
High	Texture indistinct, but grain orientation intact. With effort, the rock can be broken by hand or be scratched with a knife blade.
Complete	The rock breaks easily. Visible grain structure and orientation.
Residual soil	Advanced state of decomposition giving a plastic soil. Structure and orientation of grain destroyed.

Bed thickness

Terminology	Thickness (m)
Very thick	> 2
Thick	0.6 to 2.0
Moderate	0.2 to 0.6
Thin	0.06 to 0.2
Very thin	0.02 to 0.06
Laminated	0.006 to 0.02
Finely laminated	< 0.006

Spacing of discontinuities

Terminology	Spacing (m)
Very tight	< 0.02
Tight	0.02 to 0.06
Close	0.06 to 0.2
Moderately spaced	0.2 to 0.6
Spaced	0.6 to 2.0
Very spaced	2 to 6
Outlying	> 6

Rock compressive strength

Terminology	Strength (MPa)
Extremely low	< 1
Very low	1 to 5
Low	5 to 25
Medium	25 to 50
High	50 to 100
Very high	100 to 250
Extremely high	> 250

STRATIGRAPHY

The following symbols are used alone or in combination with others to illustrate the observed stratigraphy.


Limestone


Shale


Dolomite


Igneous rock


Sandstone


Metamorphic rock

QUÉFORMAT LTÉE

DRILLING REPORT

Figure A-1

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOC.: **Île Bouchard, RRL**
Saint-Sulpice, Quebec

BOREHOLE: **F-02**

Date: **09-10-08 and 09**

File: **F-02B**

Surf. elev.: **99.23 m (Arbitrary)**

STRATIGRAPHIC SYMBOLS	WATER LEVEL			SAMPLE TYPE AND STATE		SURVEY TYPE	
Gravel, Infill, Sand, Silt, Clay	Depth (m) Borehole	Depth (m) Water	Date yy-mm-dd	SC: Split corer ST: Shelby tube	Remoulded Intact Lost	Equipment:	BBS-1
	10.50	0.63	09-10-30			Incline:	90°
						Direction:	

DEPTH (m) / ELEVATION	STRATIGRAPHICAL DESCRIPTION	Piezo water	SAMPLES Type Number	MTA	Rec. %	N or RQD (%)	TESTS AND NOTES
0.26 / 98.97	Infill: Clayey silt, traces of sand. Brown. Wet.		CF-01		66	14	Calibre N corer
	Sand, some silt. Becomes gravely from a depth of 2.14 metres. Grey-brown, becomes grey from a depth of about 1.5 metres.		CF-02		100	4	SA
			CF-03		69	1	Sulfates=0.02%
2.20 / 97.03	Wet to very wet. Loose to very loose compactness.		CF-04		39	2	
			TS-05		100		
			CF-06		100		
			CF-07		100		
	Silty clay, traces of sand. Grey. Very wet. Firm consistency, locally stiff at 3.05 metres and 11.15 metres deep. Medium sensitivity. High plasticity (CH).		CF-08		100		
			CF-09		100		
			CF-10		100		
12.15 / 87.08	Bottom of borehole at 11.29 metres deep.						

Cu shear test (kPa)
Cuc cone (kPa)
Cur cone (kPa)
25 50 75

W_P W_N W_L
25 50 75

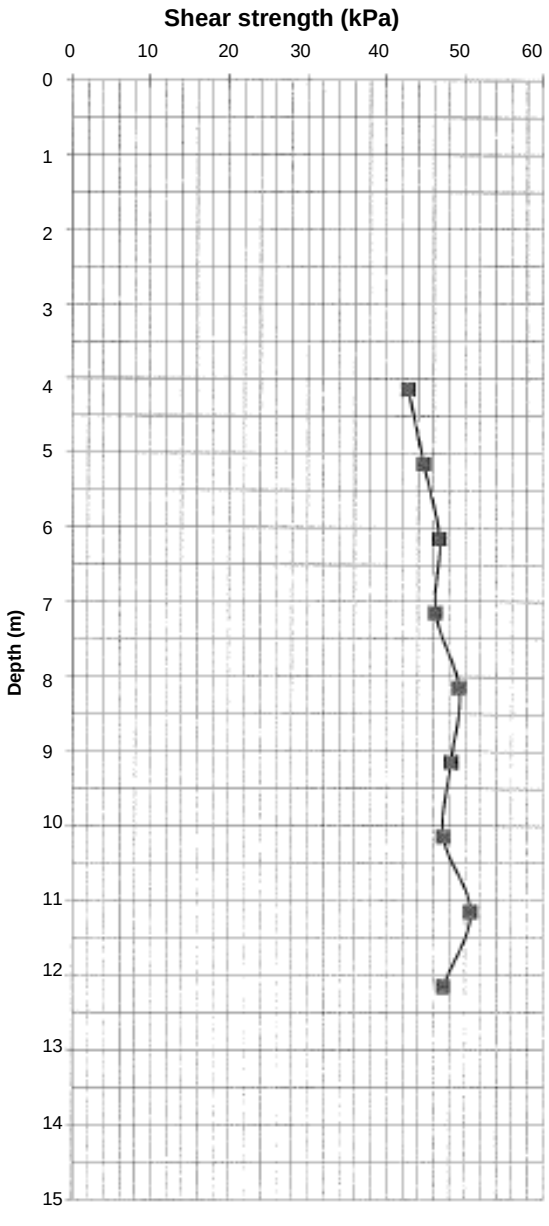
QUÉFORMAT LTÉE

SITE SHEAR TEST

(NQ 2501-200)

Project: Aid to navigation site	Project no.: 15671-G	Borehole No.: F-02
Site: Île Bouchard, RRL	Inspector: C. D.	Date: 09-1-0-09
Coordinates	Apparatus no.: 2	Depth of clay (m): 2.20
North:	"K" constant: 1.0523	Depth of water table (m): 0.63
East:	Calibration date: 09-01-29	Other:
Elevation: 99.23 m	by: Roctest	

Depth (m)	Blades	Shear strength: Intact soil as-af (cm)	Intact soil c_u (kPa)	Remoulded soil as-af (cm)	Remoulded soil c_{ur} (kPa)	Sensitivity c_u/c_{ur}
4.15	M-21	4.25	42.8			
5.15	M-21	4.45	44.8			
6.15	M-21	4.65	46.8			
7.15	M-21	4.60	46.3			
8.15	M-21	4.90	49.3			
9.15	M-21	4.80	48.3			
10.15	M-21	4.70	47.3			
11.15	M-21	5.05	50.8			
12.15	M-21	4.70	47.3			



Refusal depth: m net ☐ Progressive ☐

$C_U = K(as-af)/(101.972*C)$

as: maximum radial distance from the pointer (cm)

af: radial distance during the friction of the rods (cm)

Blades	C
G	2.00E-03
M-21	1.03E-03
P	5.00E-04

Remarks (site description, penetration difficulties, special operations, etc.):

Calculated by: H. Bilodeau, Eng. on: 09-11-12

Verified by: R.Blanchet, Eng. on: 09-11-12

ANNEX B

LABORATORY TESTS

(Figures B-1 and B-2)

QUÉFORMAT LTÉE

SIEVE ANALYSIS OF INORGANIC SOILS / AGGREGATES

NQ 2501-025 / LC 21-040

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOC.: **Île Bouchard, RRL**
Saint-Sulpice, Quebec

BOREHOLE: **F-02**
SAMP.: **CF-02**
DEPTH (m): **0.61 -1.22**
Sample no.: **02-02**
File no.: 02-02.GRN

Sand, some silt.

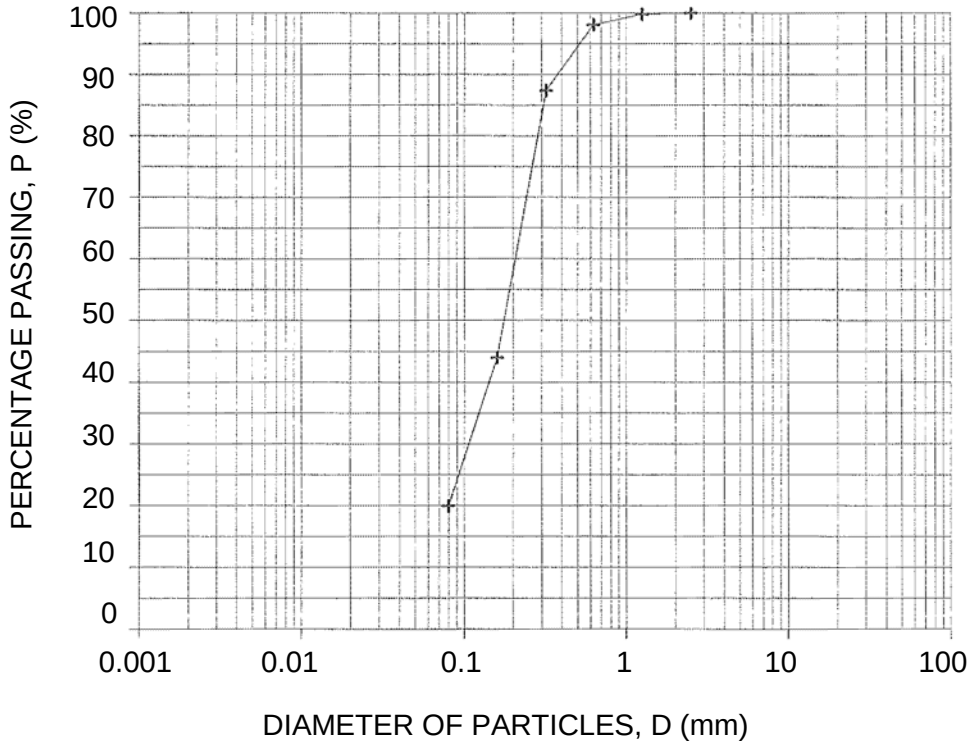
METHOD: DRY

Dry total mass (g):	874
Total mass > 5 mm:	0
% retained 5 mm:	0.0
Maximum diameter (mm):	

WATER CONTENT, w (%) Receipt

Fraction passing through sieve:	**None**
Total wet mass:	1 504.2
Total dry mass:	1 303.8
Tare no. C-39 :	429.7
WATER CONTENT, w (%):	**22.92**

SIEVE Size (mm)	MASS RETAINED INDIVID.	MASS RETAINED CUMUL.	% RETAINED	% PASSING	% TOTAL PASSING
		SIFTING GRAVEL			
112					
80					
56					
40					
31.5					
20					
14					
10					
5		0	0.0		**100.0**
Plateau		874			
		SAND SCREENING			
2.50			0.0	100.0	**100.0**
1.25		0.5	0.2	99.8	**99.8**
0.63		4.2	1.9	98.1	**98.1**
0.32		27.9	12.6	87.4	**87.4**
0.16		123.8	56.0	44.1	**44.1**
0.08		176.9	80.1	19.9	**19.9**
Plateau		221.0			



DIAMETER (mm)	% PASSING
20	100.0
5	100.0
0.4	90.9
0.08	19.9
0.002	
0.0601	10
0.1069	30
0.2067	60
CU:	3.4
CC:	0.9
USC:	SM
MF:	
Csi:	
Symbol:	SL2

Remarks:

Performed by:
M. Naili 2009-10-14

Verified by
Hélène Bilodeau, Eng.

Date: 2009-10-15

QUÉFORMAT LTÉE

LABORATORY CONE TESTS

NQ-2501-110 and 092

FILE: **15671-G**
CLIENT: **Fisheries and Oceans Canada**
PROJECT: **Canadian Coast Guard Aid to Navigation Site**
LOC.: **Île Bouchard, RRL**
Saint-Sulpice, Quebec

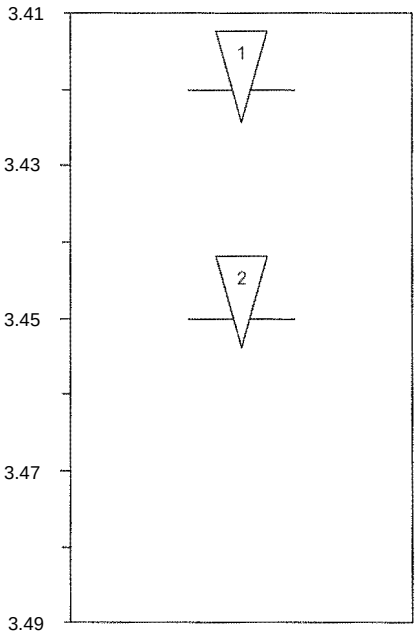
BOREHOLE: **F-02**
SAMP.: **TS-05C**
DEPTH (m): **3.40 – 3.50**

SAMPLE NO.: **02-05**
FILE: 02-05.CON

TEST ON INTACT SOIL				
Determination no.:	**1**	**2**	**3**	**4**
Location (cm from top)	1	4		
Cone (Mass - angle)	100-30	100 – 30		
Average penetration (mm)	4.3	3.9		
C_{UC} (kPa)	**53**	**63**		
Natural water content				
Total wet mass	71.21	69.99		
Total dry mass	45.80	43.84		
Tare no.	245	1 452		
Tare mass	2.38	2.39		
Water content	**58.5**	**63.1**		

TEST ON REMOULDED SOIL				
Determination type	Wn			
Cone (Mass - angle)	60 - 60			
Average penetration (mm)	6.6			
C_{UR} (kPa)	**4.0**			
Water content				
Total wet mass	33.90			
Total dry mass	22.56			
Tare no.	416			
Tare mass	2.39			
Water content	**56.2**			

Sketch of specimen

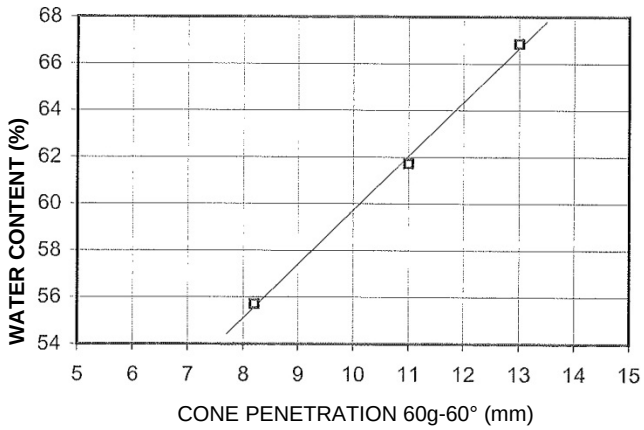


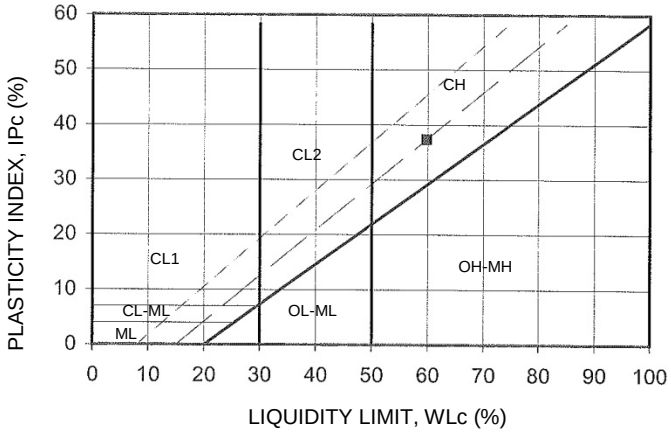
LIMITS OF CONSISTENCY						
	LIMIT OF LIQUIDITY				OF PLASTICITY	
Cone penetration 60g-60°	**13.0**	**11.0**	**8.2**			
Total wet mass	28.85	31.15	26.97		15.03	16.84
Total dry mass	18.25	20.19	18.19		12.73	14.18
Tare no.	1 421	384	1 147		210	707
Tare mass	2.39	2.43	2.43		2.41	2.39
Water content	**66.8**	**61.7**	**55.7**		**22.3**	**22.6**

RESULTS
C_{UC}: 58 kPa
C_{UR}: 4 kPa
S_t: 15
w_N: 56.2
W_{LC}: 59.7
W_P: 22.4
I_{PC}: 37.3
I_{LC}: 0.91
USC: CH
Performed by: M. Naili 2009-10-13
Verified by: Hélène Bilodeau, Eng.
Date: 2009-10-15

Remarks:

(*) Estimated value, ND: Not determined, NP = Non-plastic





ANNEX C

CERTIFICATES OF CHEMICAL ANALYSES

Exova
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Certificate of Analyses

Analysis request no.: **09-354551**

Analysis request received on: 2009-10-30
Certificate issued on: 2009-11-06
Certificate version no.: 1

☑ Official analysis certificate

☐ Preliminary analysis certificate

Requester

Quéformat Ltée

591 Le Breton
Longueuil, Quebec, Canada
J4G 1R9
Telephone: 450-674-4901
Fax: 450-674-3370

Purchase Order	Your Project	Project Lead
9-014467	N/A	Hélène Bilodeau

Comments

The “Soil Protection and Contaminated Sites Rehabilitation Policy” criteria included in this certificate are for information purposes only.
Criteria A for metals are those of the St. Lawrence Lowlands region.
Criteria D corresponding to the “Regulation respecting the burial of contaminated soils” are included in this certificate for information purposes only.

This version supersedes and invalidates any previous versions.

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Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	N/A	Hélène Bilodeau

	Sample(s)			
Lab No.	**1666431**	**1666432**	**1666433**	**1666434**
Your Reference	F-01/CF-03/1.37-1.98/Ile Bouchard	F-02/CF-03/1.53-2.14/Ile Bouchard	F-01/CF-03/1.22-1.83/Ste-Thérése	F-04/CF-03/1.22-1.83/Ste-Thérèse
Matrix	Soil	Soil	Soil	Soil
Taken by	CLIENT	CLIENT	CLIENT	CLIENT
Taken at	N/A	N/A	N/A	N/A
Taken on	2009-10-08	2009-10-09	2009-10-15	2009-10-16
Received by	2009-10-30	2009-10-30	2009-10-30	2009-10-30
Parameter(s)				
Method Reference				
Moisture (for calculation)	Preparation	2009-11-02	2009-11-02	2009-11-02	2009-11-02
Moisture (gravimetry)	Analysis	2009-11-03	2009-11-03	2009-11-03	2009-11-03
PON-89-01-05, section 5	Sequence no.	183507	183507	183507	183507
Moisture	%	0.2	23.1	<0.1	30.4
Water-soluble sulfates (IC)	Preparation	2009-11-03	2009-11-03	2009-11-03	2009-11-03
Anions by C.I. (water extr.). Results on dry weight.	Analysis	2009-11-03	2009-11-03	2009-11-03	2009-11-03
PON-12-077-04 (REF: MA.300-IONS 1.1, CEAEQ)	Sequence no.	183517	183517	183517	183517
Sulfates in SO4	mg/kg	50	195	53	73

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Certificate of Analyses

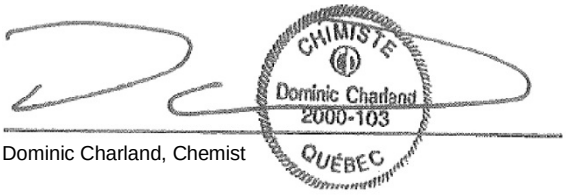
Client: **Quéformat Ltée**

Request number: 09-

Purchase Order	Your Project	Project Lead
9-014467	N/A	Hélène Bilodeau

		Sample(s)
Lab No.		**1666435**
Your Reference		F-01/CF-03/1.52-2.13/Nicolet
Matrix		Soil
Taken by		CLIENT
Taken at		N/A
Taken on		2009-10-20
Received by lab		2009-10-30
Parameter(s)		
Method Reference		
Moisture (for calculation)	Preparation	2009-11-02
Moisture (gravimetry)	Analysis	2009-11-03
PON-89-01-05, section 5	Sequence no.	183507
Humidity	%	< 0.1
Water-soluble sulfates (IC)	Preparation	2009-11-03
Anions by C.l. (water extr.). Results on dry weight.	Analysis	2009-11-03
PON-12-077-04 (REF: MA.300-IONS 1.1, CEAEQ)	Sequence no.	183517
Sulfates in SO4	mg/kg	84

Note: These results and comments, if applicable, refer only to the samples submitted for analysis of the above-mentioned parameters.



Dominic Charland, Chemist

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Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	**N/A**	**Hélène Bilodeau**

Quality Control (QC) Results

Parameters (Sequence No.)	Unit	RDL	White	Control certified	
				Obtained	Expected (Interval)
Moisture (for calculation)					
Sequence no.: 183507					
Moisture	%	< 0.1	< 0.1	52.6	47.2 – 57.8
Water-soluble sulfates (IC)					
Sequence no.: 183517					
Sulfates in SO4	mg/Kg	< 3	< 3	631	448 - 672

QC Comments

RDL = reported detection limit

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Certificate of Analyses

Client: **Quéformat Ltée**

Request number: 09-354551

Purchase Order	Your Project	Project Lead
9-014467	**N/A**	**Hélène Bilodeau**

Quality Control (QC) Results – Part 2

Parameters (Sequence No.)	Unit	Duplicate		
		Value 1	Value 2	Difference (%)
Water-soluble sulfates (IC)				
Sequence no.: 183517	(Samp. no.)		(1666431)	
Sulfates in SO4	mg/kg	50	49	2.0

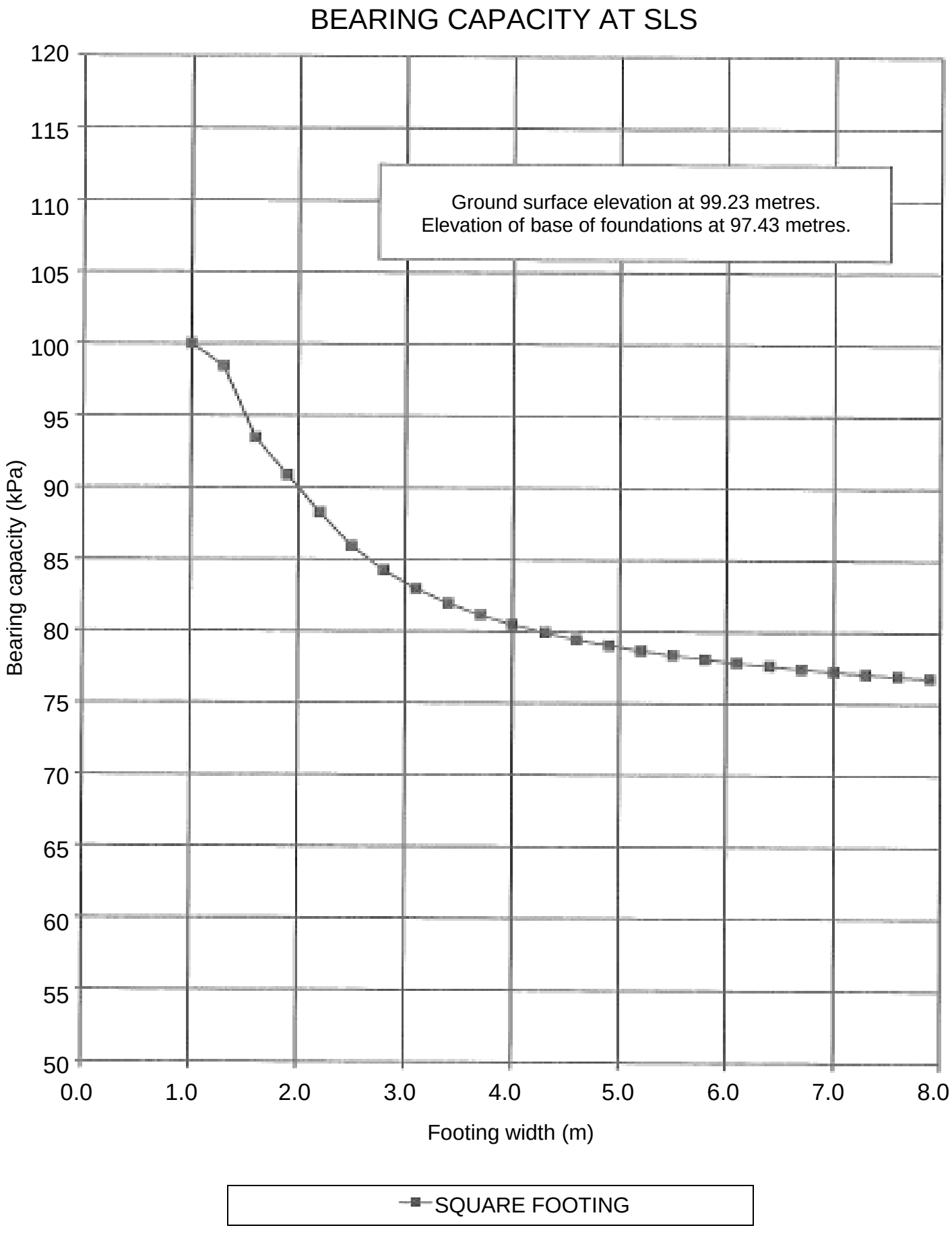
QC Comments

ANNEX D

GRAPH OF BEARING CAPACITY AT SLS

(Figure D-l)

Figure D-1


BEARING CAPACITY AT SLS
Ground surface elevation at 99.23 metres.
Elevation of base of foundations at 97.43 metres.
Bearing capacity (kPa)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Footing width (m)
SQUARE FOOTING

ANNEX E

SITE PHOTOGRAPHS

(Figures E-l and E-2)

***Photograph no. 1*: Northbound view of the rear range light (RRL) for navigation on Île Bouchard.**

***Photograph no. 2:* Status prior to drilling borehole F-02.**

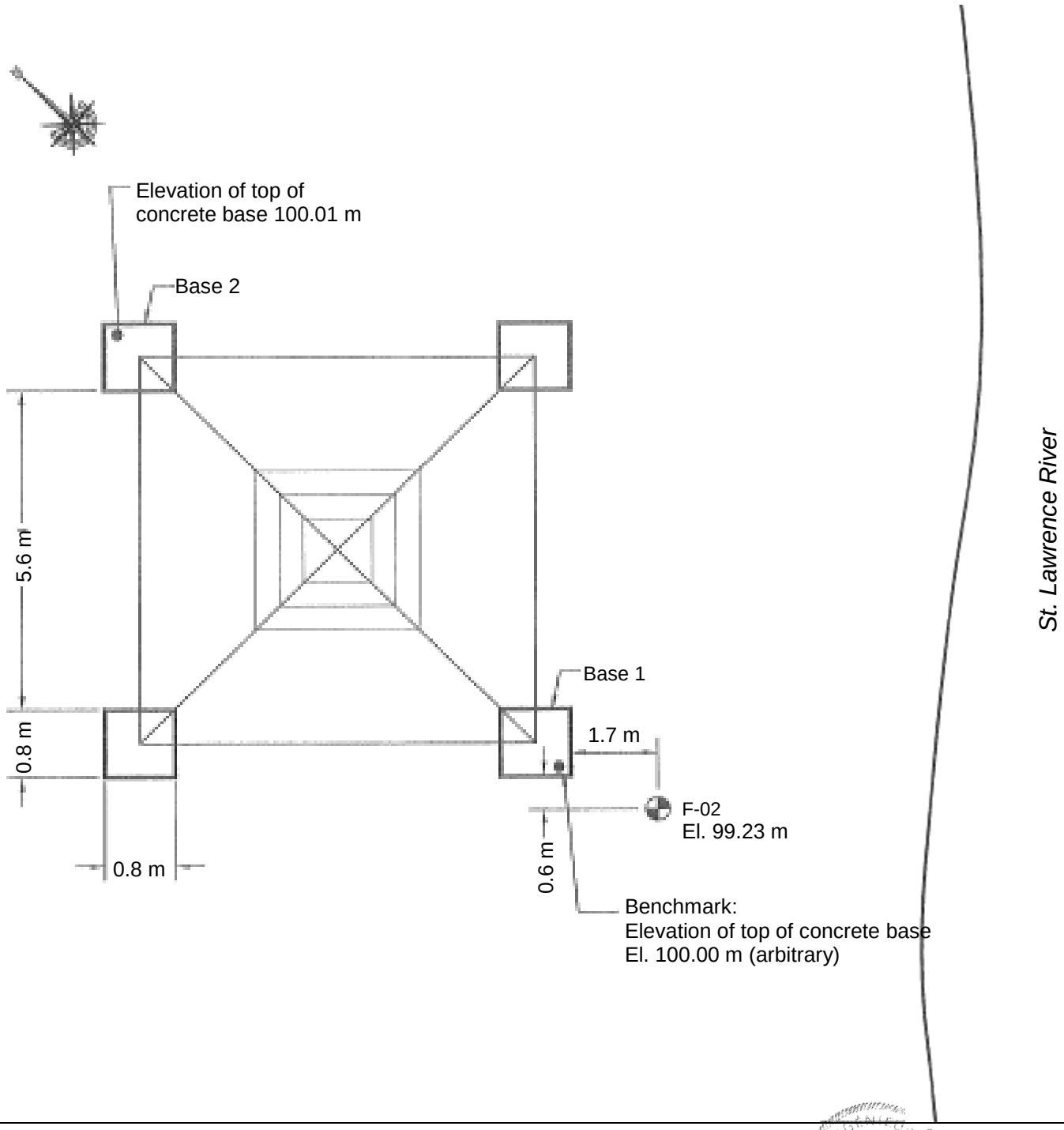
Photograph no. 3: **Status after drilling borehole F-02.**

Photograph no. 4: **Status after drilling borehole F-02.**

ANNEX F

LOCATION OF BOREHOLE F-02

(Drawing 15671-5)



LEGEND

F-02
El.
99.23 m

Borehole, number and elevation

PROJECT	Canadian Coast Guard Aid to Navigation Site, Île Bouchard, RRL Saint-Sulpice, Quebec	DATE:	2009-10-14
		SCALE:	None
TITLE:	Location of borehole F-02	DRAWN BY:	J.P.
		APPROVED BY:	H. Bilodeau, Eng.
QUÉFORMAT LTÉE		FILE:	15671-G
		DRAWING:	15671-5

ANNEX J

Geotechnical Investigation Reports

ANNEX 4

SUMMARY TABLE OF SOURCES AND ENVIRONMENTAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS

Sources and Environmental Effects, Mitigation Measures and Residual Effects

Source of Environmental Effects	Component	Environmental Effects	Mitigation Measures	Residual Effects
Construction of temporary towers and installation of temporary lights	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant	1–8 and 17	Deemed non-significant
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 31–35	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Dismantling and disposal of existing structures	Water quality	Risk of water contamination from hydrocarbons, oils or any other contaminant	18–22	Deemed non-significant
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 31–33	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Replacement of existing foundations (including demolition, soil excavation, formwork and concrete pour for new foundations)	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant Risk of soil alteration from contaminated soils	1–17	Deemed non-significant
	Water quality	Risk of water contamination from hydrocarbons, oils or any other contaminant	1–8 and 10–22	
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–33	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Mobilisation/use of machinery and equipment	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant Risk of soil erosion	1–3, 8 and 15	Deemed non-significant
	Water quality	Risk of water contamination from hydrocarbons, oils or any other contaminant	1–8, 15, 16 and 18–22	
	Air quality	Increase in airborne dust and GHGs	1 and 23–28	
	Sound environment	Increase in sound level		
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–33	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Erection of new steel towers and fences	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant	1–8	Deemed non-significant
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–33	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	

Source of Environmental Effects	Component	Environmental Effects	Mitigation Measures	Residual Effects
Dismantling of temporary structures	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–33	Deemed non-significant
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Demobilization of machinery and equipment	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant Risk of soil erosion	1–8	Deemed non-significant
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–32	
	Wildlife	Habitat disruption	2 and 35–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	To come	41	
Waste disposal and site clean-up	Soil and sediment quality and contamination	Risk of soil contamination from hydrocarbons, oils or any other contaminant	1–8, 10, 11 and 13–16	Deemed non-significant
	Water quality	Risk of water contamination from hydrocarbons, oils or any other contaminant	1–8, 10, 11, 13–16 and 18–22	
	Vegetation	Alteration of terrestrial vegetation or its habitat	2 and 30–34	
	Wildlife	Habitat disruption	2 and 34–38	
	Special status species	Habitat disruption	2, 34 and 36–40	
	Physical and cultural heritage	Deterioration of archaeological or heritage features	41	

Complete list of mitigation measures:

1. Keep machinery and equipment in perfect working order. Check machinery and equipment for contaminant leaks on a daily basis. All leaks must be repaired immediately or the machinery or equipment must be removed from the site.

2. Move machinery and equipment only on existing and preferred access routes within the work area; prohibit the movement of machinery outside these areas.

3. Identify and use temporary storage sites separate from the work site to store machinery and equipment, and, if necessary, excavated soils, fuel, oil, other petroleum products or contaminants. Set up the site in an area where there is no risk of contaminating an aquatic or agricultural environment, more than 30 m from such environments if possible, and in a low slope area.

4. Temporarily stockpile excavated soils and hazardous or potentially contaminated waste on leak-proof liners at the sites until they can be disposed of offsite, or store them in leak-proof containers provided for disposal purposes.

5. If generators must be used, make sure that the fuel tank of each generator is double walled and installed on an impermeable floor with a high curb to prevent any spills.

6. Monitor on a consistent basis the general maintenance of the machinery and equipment and the handling of all fuel, oil, other petroleum products or contaminants, including transfer, to prevent accidental spills. These operations will be completed in the locations provided for this purpose, where there is no risk of contaminating an aquatic environment, and more than 30 m from the aquatic environment.

7. Arrange for and use permanent onsite response kits for excavated material and waste, and absorbent materials in case of a spill.

8. Establish and implement an emergency plan for accidental spills of petroleum products or contaminants. Clearly identify the responsible individuals and authorities, as well as the procedure to follow in case of an environmental emergency. The responsible authorities are Environment Canada emergency services (1-866-283-2333) and the MDDEFP (1-866-694-5454).

9. Limit the excavation areas and depths to what is strictly necessary. Excavate soils in such a way as to minimize dust dispersion.

10. Develop an excavated material and waste management plan in accordance with the regulations in force.

11. Prevent precipitation from infiltrating temporarily stored excavated materials and waste by covering them with leak-proof tarpaulins during work stoppages and at the end of each work day.

12. Limit the excavation areas and depths to what is strictly necessary, based on the extent of the contamination identified.

13. Manage and dispose of contaminated soils offsite in accordance with the management practices described in section 2.5 concerning soil and water contamination and management, and in compliance with the provincial regulations in force.

14. Ensure that contaminated soils are protected from rain at all times and that contaminated runoff water from the excavated site is pumped directly into closed and sealed tanks. This water must be disposed of according to its level of contamination.

15. Decontaminate equipment that has been in contact with contaminated soils and water or hazardous materials prior to use in uncontaminated areas.

16. Transport contaminated soils in containers that are closed or covered with appropriate tarpaulins, and contaminated water in closed and sealed containers. Limit vehicle speeds to minimize the risk of spills.

17. Conduct a new soil contamination study before the work begins, to update knowledge on these sites. Given the movement of soil around the RRL, contamination varies over time.

18. No activities will be conducted in the aquatic environment.

19. Take the necessary precautions to prevent any migration of fine particulate matter to the aquatic environment, throughout all phases of the project.

20. Avoid working during heavy rains whenever possible to reduce the risk of runoff.

21. Do not dispose of any debris, concrete residue or wet mortar in the aquatic environment and ensure that poured concrete is protected from rain at all times. Any debris accidentally introduced into the aquatic environment must be removed as quickly as possible.

22. Prohibit the storage of fine and friable materials (clay, sand, concrete) near the water, i.e., at a minimum distance of 15 m to prevent leaching. When present, these materials are to be removed from the site as quickly as possible.

23. Conduct daily checks to detect any excess air emissions from machinery and equipment, in which case, the machinery or equipment must be repaired immediately or removed from the work site.

24. Carry out the work in such a way as to optimize the movement and use of machinery and equipment and the transportation of materials.

25. Do not allow engines to idle unnecessarily.

26. Use containers and trucks that are closed or equipped with covering tarpaulins to store and transport particulate matter likely to be carried by wind or rain.

27. Rehabilitate the site as soon as possible once the work is completed. This includes cleaning the temporary storage areas.

28. During the work, avoid handling granular materials during strong winds, and apply, as needed, anti-dust materials to surfaces where movement is likely to stir up dust.

29. Use machinery and equipment that is in good working order in accordance with the regulations in force.

30. Delineate the work area to avoid altering the vegetation surrounding the work areas.

31. Avoid brush cutting in the work areas or limit it as much as possible.

32. Stabilize the soils at all locations of the work site where there is a risk of erosion.

33. Minimize the physical damage to the surrounding vegetation (between the shore and the tower for the FRL).

34. When the work is finished, promote the quick recovery of plant cover in the work areas by planting indigenous species adapted to the specific characteristics of the environment and the local climate, in soil that is similar to the original.

35. Limit brush cutting, topsoil stripping and excavation areas to a strict minimum, and protect critical habitats for terrestrial wildlife and avifauna. When possible, leave the regeneration intact during clearing.

36. Ensure that loud equipment is maintained properly and that mufflers are in good condition.

37. Aim to carry out the work after August 15, i.e., after the nesting period for avifauna, to minimize disruption.

38. In the event that the work cannot be completed in the fall and the aid-to-navigation towers are known bird nest sites during the nesting season, it is recommended that a deterrent against using towers for nesting be implemented before the start of nesting season. It is also recommended that the towers be inspected for nests during the nesting period and before the work begins. If a nest is found, move away as quickly and quietly as possible, without disturbing the surrounding vegetation. The work cannot take place and must be postponed until after nesting.

39. Comply with the *Species at Risk Act* (Canada) and the *Act respecting threatened or vulnerable species* (Quebec).

40. If the work reveals the confirmed or suspected presence of special status species, the work should be suspended and the responsible authorities should be notified so that adequate protective measures are taken.

41. If the work reveals the confirmed or suspected presence of archaeological features, the work should cease and the Ministère de la Culture et des Communications [Quebec Ministry of Culture and Communications] should be notified so that adequate protective measures are taken.

ANNEX K

Environmental Impact Mitigation Measures Sheet

PROJECT IDENTIFICATION	
Site:	**Île Bouchard, Saint-Sulpice: Front range light:** 45°47'56,37366" N latitude and longitude -73°20'41,991" W, **Rear range light:** 45°48'20,34891" N latitude and longitude -73°20'14,0682" W
Project Title:	Replacement of Aids to Navigation, Île Bouchard
Date of work:	
Date of monitoring:	
Monitoring activity performed:	Site visit during work
	Other monitoring activity (specify):

Mitigation measures	Measure implemented						If no or N/A, reason
Keep machinery and equipment in perfect working order. Check machinery and equipment for contaminant leaks on a daily basis. All leaks must be repaired immediately or the machinery or equipment must be removed from the site.		YES		NO		N/A	
Move machinery and equipment only on existing and preferred access routes within the work area; prohibit the movement of machinery outside these areas.		YES		NO		N/A	
Identify and use temporary storage sites separate from the work site to store machinery and equipment, and, if necessary, excavated soils, fuel, oil, other petroleum products or contaminants. Set up the site in an area where there is no risk of contaminating an aquatic or agricultural environment, more than 30 m from such environments if possible, and in a low slope area.		YES		NO		N/A	
Temporarily stockpile excavated soils and hazardous or potentially contaminated waste on leak-proof liners at the sites until they can be disposed of offsite, or store them in leak-proof containers provided for disposal purposes.		YES		NO		N/A	
If generators must be used, make sure that the fuel tank of each generator is double walled and installed on an impermeable floor with a high curb to prevent any spills.		YES		NO		N/A	
Monitor on a consistent basis the general maintenance of the machinery and equipment and the handling of all fuel, oil, other petroleum products or contaminants, including transfer, to prevent accidental spills. These operations will be completed in the locations provided for this purpose, where there is no risk of contaminating an aquatic environment, and more than 30 m from the aquatic environment.		YES		NO		N/A	
Arrange for and use permanent onsite response kits for excavated material and waste, and absorbent materials in case of a spill. Establish and implement an emergency plan for accidental spills of petroleum products or contaminants. Clearly identify the responsible individuals and authorities, as well as the procedure to follow in case of an environmental emergency. The responsible authorities are Environment Canada emergency services (1-866-283-2333) and the MDDEFP (1-866-694-5454).		YES		NO		N/A	
Limit the excavation areas and depths to what is strictly necessary. Excavate soils in such a way as to minimize dust dispersion.		YES		NO		N/A	
Develop an excavated material and waste management plan in accordance with the regulations in force.		YES		NO		N/A	
Prevent precipitation from infiltrating temporarily stored excavated materials and waste by covering them with leak-proof tarpaulins during work stoppages and at the end of each work day.		YES		NO		N/A	
Limit the excavation areas and depths to what is strictly necessary, based on the extent of the contamination identified.		YES		NO		N/A	
Manage and dispose of contaminated soils offsite in accordance with the management practices described in section 2.5 concerning soil and water contamination and management, and in compliance with the provincial regulations in force.		YES		NO		N/A	

Mitigation measures	Measure implemented						If no or N/A, reason
Ensure that contaminated soils are protected from rain at all times and that contaminated runoff water from the excavated site is pumped directly into closed and sealed tanks. This water must be disposed of according to its level of contamination.		YES		NO		N/A	
Decontaminate equipment that has been in contact with contaminated soils and water or hazardous materials prior to use in uncontaminated areas.		YES		NO		N/A	
Transport contaminated soils in containers that are closed or covered with appropriate tarpaulins, and contaminated water in closed and sealed containers. Limit vehicle speeds to minimize the risk of spills.		YES		NO		N/A	
Conduct a new soil contamination study before the work begins, to update knowledge on these sites. Given the movement of soil around the RRL, contamination varies over time.		YES		NO		N/A	
No activities will be conducted in the aquatic environment.		YES		NO		N/A	
Take the necessary precautions to prevent any migration of fine particulate matter to the aquatic environment, throughout all phases of the project.		YES		NO		N/A	
Avoid working during heavy rains whenever possible to reduce the risk of runoff.		YES		NO		N/A	
Do not dispose of any debris, concrete residue or wet mortar in the aquatic environment and ensure that poured concrete is protected from rain at all times. Any debris accidentally introduced into the aquatic environment must be removed as quickly as possible.		YES		NO		N/A	
Prohibit the storage of fine and friable materials (clay, sand, concrete) near the water, i.e., at a minimum distance of 15 m to prevent leaching. When present, these materials are to be removed from the site as quickly as possible.		YES		NO		N/A	
Conduct daily checks to detect any excess air emissions from machinery and equipment, in which case, the machinery or equipment must be repaired immediately or removed from the work site.		YES		NO		N/A	
Carry out the work in such a way as to optimize the movement and use of machinery and equipment and the transportation of materials.		YES		NO		N/A	
Do not allow engines to idle unnecessarily.		YES		NO		N/A	
Use containers and trucks that are closed or equipped with covering tarpaulins to store and transport particulate matter likely to be carried by wind or rain.		YES		NO		N/A	
Rehabilitate the site as soon as possible once the work is completed. This includes cleaning the temporary storage areas.		YES		NO		N/A	
During the work, avoid handling granular materials during strong winds, and apply, as needed, anti-dust materials to surfaces where movement is likely to stir up dust.		YES		NO		N/A	
Limit the movement and use of machinery and equipment to existing and preferred access routes within the work area.		YES		NO		N/A	
Use machinery and equipment that is in good working order in accordance with the regulations in force.		YES		NO		N/A	
Delineate the work area to avoid altering the vegetation surrounding the work areas.		YES		NO		N/A	
Avoid brush cutting in the work areas or limit it as much as possible.		YES		NO		N/A	
Move machinery and equipment only on existing and preferred access routes within the work area; prohibit the movement of machinery outside these areas.		YES		NO		N/A	

Mitigation measures	Measure implemented						If no or N/A, reason
Stabilize the soils at all locations of the work site where there is a risk of erosion.		YES		NO		N/A	
Minimize the physical damage to the surrounding vegetation (between the shore and the tower for the FRL).		YES		NO		N/A	
When the work is finished, promote the quick recovery of plant cover in the work areas by planting indigenous species adapted to the specific characteristics of the environment and the local climate, in soil that is similar to the original.		YES		NO		N/A	
Limit brush cutting, topsoil stripping and excavation areas to a strict minimum, and protect critical habitats for terrestrial wildlife and avifauna. When possible, leave the regeneration intact during clearing.		YES		NO		N/A	
Ensure that loud equipment is maintained properly and that mufflers are in good condition.		YES		NO		N/A	
Aim to carry out the work after August 15, i.e., after the nesting period for avifauna, to minimize disruption.		YES		NO		N/A	
In the event that the work cannot be completed in the fall and the aid-to-navigation towers are known bird nest sites during the nesting season, it is recommended that a deterrent against using towers for nesting be implemented before the start of nesting season. It is also recommended that the towers be inspected for nests during the nesting period and before the work begins. If a nest is found, move away as quickly and quietly as possible, without disturbing the surrounding vegetation. The work cannot take place and must be postponed until after nesting.		YES		NO		N/A	
Comply with the *Species at Risk Act* (Canada) and the *Act respecting threatened or vulnerable species* (Quebec).		YES		NO		N/A	
If the work reveals the confirmed or suspected presence of special status species, the work should be suspended and the responsible authorities should be notified so that adequate protective measures are taken.		YES		NO		N/A	
If the work reveals the confirmed or suspected presence of archaeological features, the work should cease and the Ministère de la Culture et des Communications [Quebec Ministry of Culture and Communications] should be notified so that adequate protective measures are taken.		YES		NO		N/A	

COMMENTS
on-site observations, poor waste management, presence of used oil, machinery leaks, work performed or mitigation measures not considered in the environmental assessment, etc.).

Monitoring performed										
Prepared by:										
Date:										
Title:										
Agency:										
Tel. no.:										

ANNEX L

Environmental Monitoring Form