ENVIRONMENTAL ASSESSMENT
REALIGNMENT OF MARINE DRIVE
HIGHWAY 316
ENVIRONMENTAL ASSESSMENT REGISTRATION

Goldboro LNG Project

Pieridae Energy (Canada) Limited

MARCH 2021

APPENDICES
VOLUME 1 OF 4

GOLDBORO LNG

ENVIRONMENTAL ASSESSMENT
REALIGNMENT OF MARINE DRIVE (HIGHWAY 316)

Environmental Assessment Registration
Appendices

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List of Appendices

VOLUME 1

VOLUME 2

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APPENDIX A

REVIEW OF REALIGNMENT ALTERNATIVES

GOLDBORO LNG

Criteria	Alternative 1 (Purple)	Alternative 2 (Blue)	Alternative 3 (Green - Proposed Realignment)
Transportation Planning Objectives	Assessment • Accomplishes increased safety near LNG Site • Provides LNG facility with uninterrupted access to water's edge	Assessment • Accomplishes increased safety near LNG Site • Provides LNG facility with uninterrupted access to water's edge	Assessment • Accomplishes increased safety near LNG Site • Provides LNG facility with uninterrupted access to water's edge
	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference
Geology	Assessment • Bedrock unlikely to include material requiring management pursuant the NS Sulphide Bearing Rock Disposal Management	Assessment • Bedrock unlikely to include material requiring management pursuant the NS Sulphide Bearing Rock Disposal Management	Assessment Bedrock unlikely to include material requiring management pursuant the NS Sulphide Bearing Rock Disposal Management
	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference
Topography	Assessment • Grade challenges	Assessment • Grade challenges	Assessment Grade challenges
	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference	Conclusion • Suitable alignment • No preference
Natural Habitat, Wetlands	Assessment • Natural habitat loss over total road length of 7.2km (approx. 36 ha footprint) • Estimated loss of wetland habitat: > 1.6 ha; expected to be comparable to Alternative 3	Assessment • Natural habitat loss over total road length of 7km (approx. 35 ha footprint) • Estimated loss of wetland habitat: > 2.2 ha; expected to be comparable to Alternative 3	Assessment • Natural habitat loss over total road length of 5.8km (approx. 29 ha footprint) • Loss of wetland habitat: 7.3 ha (field verified)
	Conclusion • Suitable route • Less preferred due to higher habitat loss than Alternative 3 • Likely no preference re loss of wetlands	Conclusion • Suitable route • Less preferred due to higher habitat loss than Alternative 3 • Likely no preference re loss of wetlands	Conclusion • Suitable route • **Preferred** due to lowest habitat loss • Likely no preference re loss of wetlands • Effects can be effectively mitigated / compensated

Criteria	Alternative 1 (Purple)	Alternative 2 (Blue)	Alternative 3 (Green - Proposed Realignment)
	• Effects can be effectively mitigated / compensated.	• Effects can be effectively mitigated / compensated	
Watercourse Crossings	Assessment • Minimum of 6 watercourse crossings (air photo interpretation)	Assessment • Minimum of 6 watercourse crossings (air photo interpretation)	Assessment • 6 watercourse crossings (field verified)
	Conclusion • Suitable route • Slightly less preferred (see Alternative 3) • Effects can be effectively mitigated / compensated.	Conclusion • Suitable route • Slightly less preferred (see Alternative 3) • Effects can be effectively mitigated / compensated.	Conclusion • Suitable route • Slightly **preferred** as other alternatives may require more than 6 watercourse crossings • Effects can be effectively mitigated / compensated.
Land Use	Assessment • No displacement of residences land uses • Alternative with most distance through designated Industrial Zone • Alternative with least distance through designated Natural Resource and Conservation Zone	Assessment • No displacement of existing land uses • Alternative with some distance through designated Industrial Zone • Alternative with most distance through designated Natural Resource and Conservation Zone	Assessment • No displacement of existing land uses • Alternative with least distance through designated Industrial Zone • Alternative with some distance through designated Natural Resource and Conservation Zone
	Conclusion • Suitable route • **Preferred**	Conclusion • Suitable route • Less preferred	Conclusion • Suitable route • Less preferred
Construction and Maintenance Cost	Assessment • Likely highest construction and maintenance cost	Assessment • Construction and maintenance cost likely comparable to Alternative 1 and higher than for Alternative 3	Assessment • Likely lowest construction and maintenance cost
	Conclusion • Less preferred; higher construction and maintenance cost than Alternative 3	Conclusion • Less preferred; higher construction and maintenance cost than Alternative 3	Conclusion • **Preferred**; lower construction and maintenance cost than Alternative 3
Public Input	Assessment	Assessment • Same as for Alternative 1	Assessment • Same as for Alternative 1 but much less of an issue as shorter route was

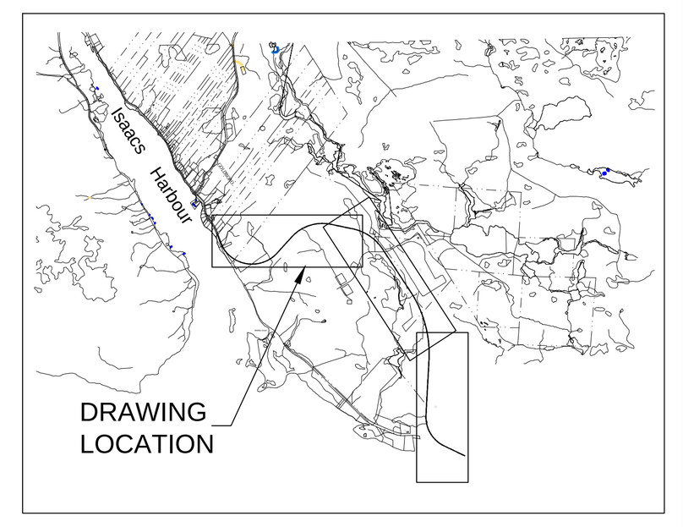
Criteria	Alternative 1 (Purple)	Alternative 2 (Blue)	Alternative 3 (Green - Proposed Realignment)
	• Concern re realignment by-passing communities / residences (e.g., Seal Harbor, Drum Head) • Concern re increased travel time along Marine Drive • Concern re reduced maintenance levels of new "Cul-de-Sac" road segments		developed in response to the concerns and to alleviate issues; Seal Harbor and Drum Head remain along Marine Drive and will not be by-passed
	<u>Conclusion</u> • Less preferred compared to Alternative 3	<u>Conclusion</u> • Less preferred compared to Alternative 3	<u>Conclusion</u> • **Preferred** compared to Alternatives 1 and 2
Overall Conclusion	**Less Preferred**	**Less Preferred**	**Preferred**

APPENDIX B

ROAD DETAILED DESIGN DRAWINGS

GOLDBORO LNG

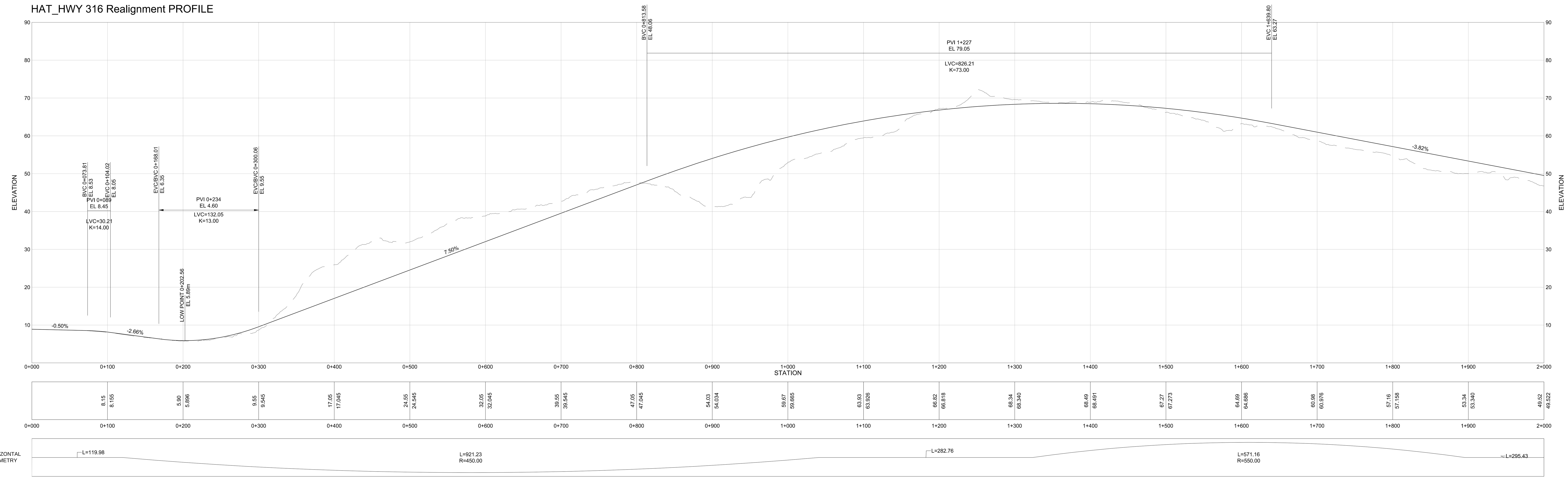
Pave1 Material Table				Pave2 Material Table				Base Material Table				SubBase Material Table			
Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume
0+050.00	0.37	0.00	0.00	0+050.00	0.74	0.00	0.00	0+050.00	1.79	0.00	0.00	0+050.00	9.61	0.00	0.00
2+000.00	0.37	18.50	721.50	2+000.00	0.74	37.00	1443.00	2+000.00	1.79	89.59	3493.91	2+000.00	9.61	480.55	18741.45



KEY PLAN
N.T.S.

PLAN
1:2000

HAT_HWY 316 Realignment PROFILE



PROFILE
1:2000(HOR)/1:400(VERT)

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE
X	REVISION IN PROGRESS			

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	B.WOODMAN	NR	7-22-2020
DESIGNER		NR	
CHECKER			
DESIGN COORD.			
RESP. ENG.			
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

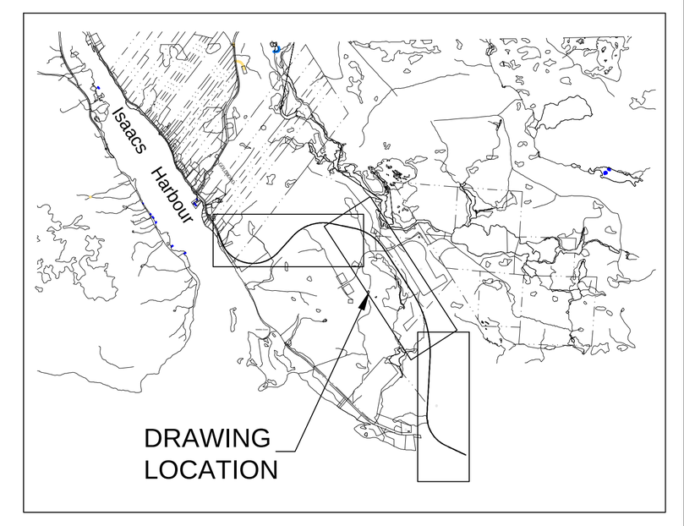
DRAWING APPROVAL STATUS: PRELIMINARY

PIERIDAE ENERGY CANADA LTD.

GOLDBORO LNG

HIGHWAY 316 REALIGNMENT
GOLDBORO, NS
PRELIMINARY PLAN & PROFILE

SCALE 1:2000 OR AS NOTED | DWG. No. GOFF-HAT-000-CV-DWG-CSK-000001 | REV A



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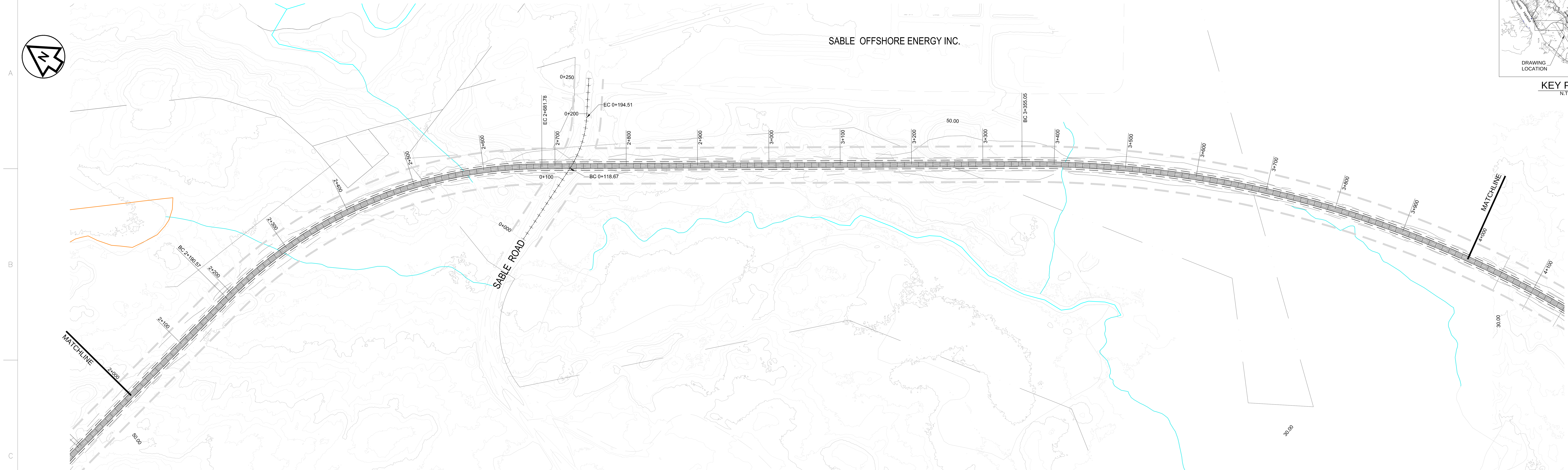
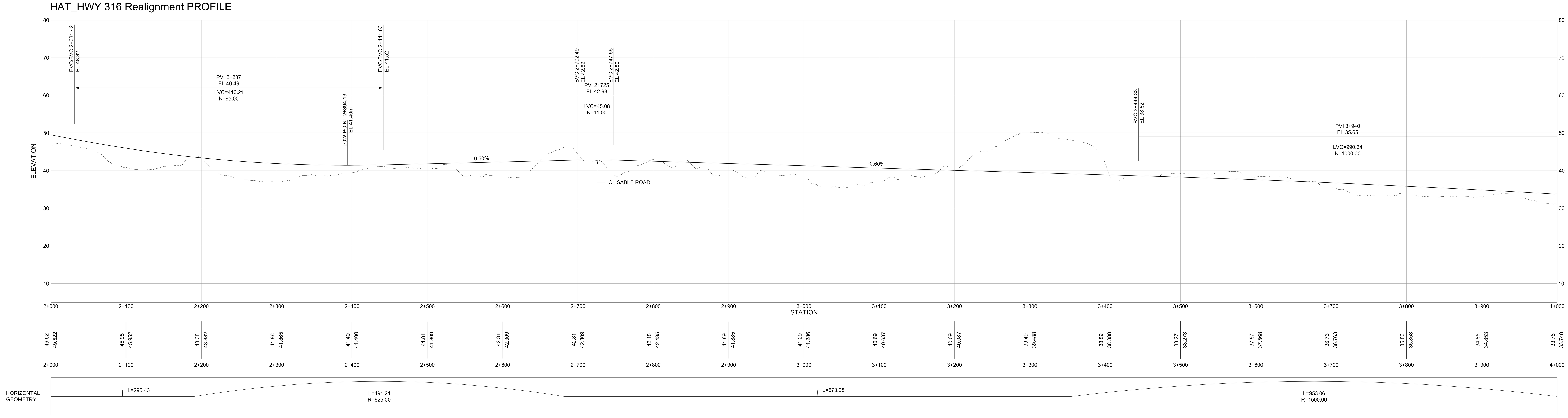


Pave1 Material Table				Pave2 Material Table				Base Material Table				SubBase Material Table			
Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume
2+050.00	0.37	18.50	740.00	2+050.00	0.74	37.00	1480.00	2+050.00	1.79	89.59	3583.50	2+050.00	9.61	480.55	19222.00
4+000.00	0.37	18.50	1461.50	4+000.00	0.74	37.00	2923.00	4+000.00	1.79	89.59	7077.41	4+000.00	9.61	480.55	37963.45

PLAN

1:2000

HAT_HWY 316 Realignment PROFILE



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REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE
X	REVISION IN PROGRESS			

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	B.WOODMAN	NR	7-22-2020
DESIGNER		NR	
CHECKER			
DESIGN COORD.			
RESP. ENG.			
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: PRELIMINARY

PIERIDAE ENERGY CANADA LTD.

GOLDBORO LNG

HIGHWAY 316 REALIGNMENT
GOLDBORO, NS
PRELIMINARY PLAN & PROFILE

SCALE	DWG. No.	REV
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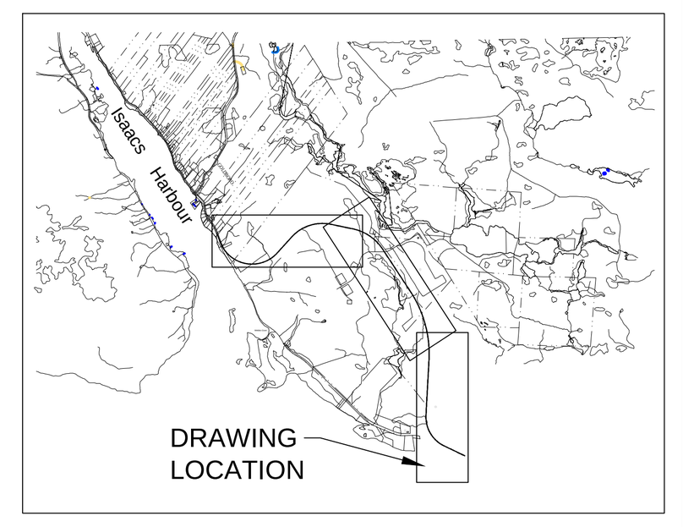

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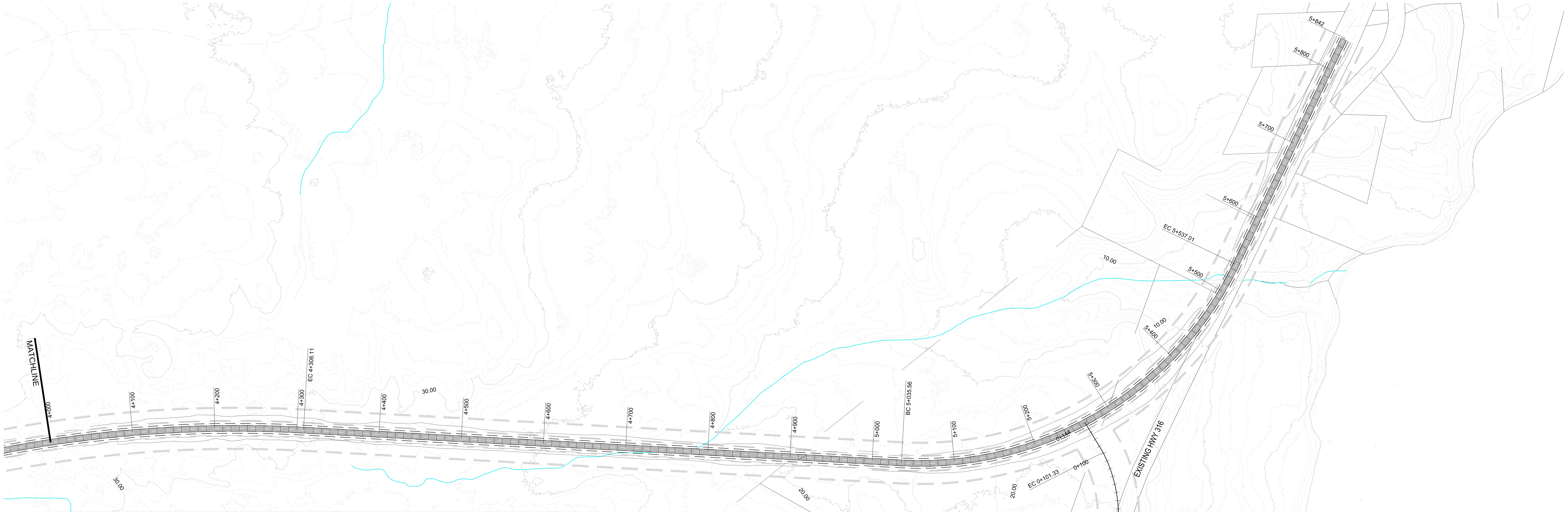
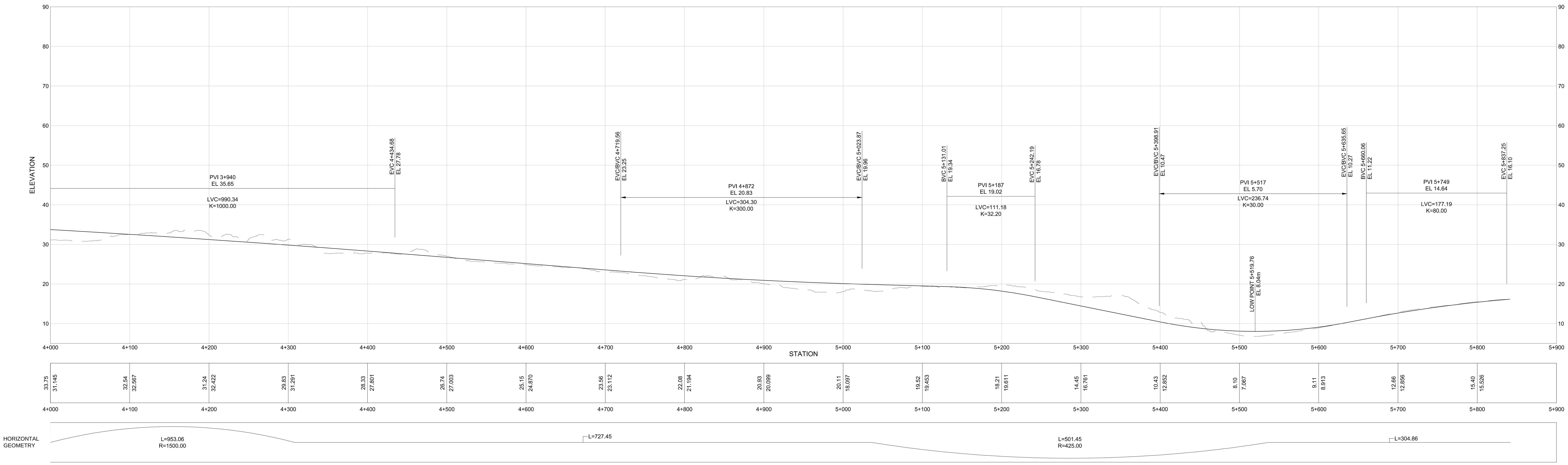


Pave1 Material Table				Pave2 Material Table				Base Material Table				SubBase Material Table			
Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume	Station	Area	Volume	Cumulative Volume
4+050.00	0.37	18.50	1480.00	4+050.00	0.74	37.00	2960.00	4+050.00	1.79	89.59	7167.00	4+050.00	9.61	480.55	38444.00
5+700.00	0.37	18.50	2090.50	5+700.00	0.74	37.00	4181.00	5+700.00	1.79	89.59	10123.39	5+700.00	9.61	480.55	54302.15

PLAN
1:2000

HAT_HWY 316 Realignment PROFILE



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DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

REGISTERED PROFESSIONAL

No.	DESCRIPTION	BY	CHK'D	DATE
X	REVISION IN PROGRESS			

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
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DESIGNER		NR	
CHECKER			
DESIGN COORD.			
RESP. ENG.			
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: PRELIMINARY

PIERIDAE ENERGY CANADA LTD.

GOLDBORO LNG

HIGHWAY 316 REALIGNMENT
GOLDBORO, NS
PRELIMINARY PLAN & PROFILE

SCALE 1:2000 OR AS NOTED | DWG. No. GOFF-HAT-000-CV-DWG-CSK-000003 | REV A

APPENDIX C

SEDIMENT SAMPLE ANALYSES RESULTS AND GUIDELINES

GOLDBORO LNG

TABLE C-1 Metals in Soil

Parameter	Units	RDL	GUIDELINES	Sample ID											
			NSE EQS[1]	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12
Sample Date (d/m/y)				06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/10/2020
Aluminum	mg/kg	10	198,000	11,000	12,600	9,880	1,730	3,680	14,000	8,540	1,270	1,610	3,460	245	3,400
Antimony	mg/kg	1	63	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	mg/kg	1	31	18	11	11	3	6	9	5	3	3	12	3	21
Barium	mg/kg	5	140,000	19	13	7	<5	7	10	5	<5	<5	20	<5	<5
Beryllium	mg/kg	2	320	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	mg/kg	2	24,000	6	2	<2	<2	<2	<2	<2	<2	<2	3	<2	<2
Cadmium	mg/kg	0.3	192	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	mg/kg	2	1,300	12	9	8	<2	3	16	8	<2	2	7	<2	4
Cobalt	mg/kg	1	250	4	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	mg/kg	2	16,000	14	5	6	<2	<2	4	<2	<2	<2	4	<2	<2
Iron	mg/kg	50	144,000	20,400	22,600	27,600	1,430	1,680	34,200	7,600	2,590	3,670	2,740	318	2,450
Lead	mg/kg	0.5	740	23.7	10.0	7.7	6.2	4.9	10.1	4.2	3.5	2.4	20.0	1.3	4.5
Lithium	mg/kg	5	--	11	10	5	<5	<5	7.00	<5	<5	<5	<5	<5	<5
Manganese	mg/kg	2	--	175	86	72	8	16	60	34	11	24	22	3	41
Mercury	mg/kg	0.05	99	0.33	0.11	0.09	0.14	<0.05	0.11	<0.05	<0.05	<0.05	0.12	<0.05	<0.05
Molybdenum	mg/kg	2	1,200	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	mg/kg	2	2,200	9	5	3	<2	<2	10	3.00	<2	<2	3	<2	<2
Selenium	mg/kg	1	1135	<1	1.00	<1	<1	<1	1.00	<1	<1	<1	<1	<1	<1
Silver	mg/kg	0.5	490	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg	5	122,000	<5	<5	<5	<5	<5	<5	<5	<5	<5	11	<5	<5
Thallium	mg/kg	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	mg/kg	2	122,000	<2	<2	<2	<2	<2	<2	<2	<2	2	2	2	<2
Uranium	mg/kg	0.1	300	0.6	0.6	0.4	0.2	0.3	0.6	0.4	0.3	0.2	0.9	0.2	0.3
Vanadium	mg/kg	2	160	18	19	20	3	7	27	16	10	14	11	5	7
Zinc	mg/kg	5	47,000	166	23	12	<5	<5	12	7.00	<5	<5	9	<5	<5

TABLE C-1 Metals in Soil

Parameter	Units	RDL	GUIDELINES									
			NSE EQS[1]	SS13	SS14	SS15	SS16	SS17	SS18	SS19	SS20	SS21	SS22
Sample Date (d/m/y)				06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020	06/10/2020
Aluminum	mg/kg	10	198,000	6,690	1,500	5,980	12,300	3,230	2,340	3,700	4,080	1,510	1,810
Antimony	mg/kg	1	63	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	mg/kg	1	31	30	6	5	9	13	3	**48**	10	3	8
Barium	mg/kg	5	140,000	12	14	10	11	13	12	32	<5	<5	19
Beryllium	mg/kg	2	320	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	mg/kg	2	24,000	<2	2.00	<2	<2	<2	<2	3	<2	<2	2
Cadmium	mg/kg	0.3	192	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	mg/kg	2	1,300	8	3	7	11	4	5	4	7	3	2
Cobalt	mg/kg	1	250	3	<1	2	4	1	1	3	<1	<1	2
Copper	mg/kg	2	16,000	8	4	5	11	4	<2	7	<2	<2	4
Iron	mg/kg	50	144,000	8,880	1,550	8,270	15,200	7,590	2,260	3,010	18,000	549	1,150
Lead	mg/kg	0.5	740	3.7	16.9	5.9	6.3	10.8	3.4	22	1.9	4.7	38.1
Lithium	mg/kg	5	--	9.00	<5	8.00	11	<5	7.00	<5	<5	<5	<5
Manganese	mg/kg	2	--	101	10	86	189	102	42	182	22	17	16
Mercury	mg/kg	0.05	99	<0.05	0.15	<0.05	<0.05	0.09	<0.05	0.11	<0.05	<0.05	0.12
Molybdenum	mg/kg	2	1,200	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	mg/kg	2	2,200	8	2	8	8	3	3	4	4	<2	4
Selenium	mg/kg	1	1135	<1	<1	<1	<1	<1	<1	2	<1	<1	1
Silver	mg/kg	0.5	490	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg	5	122,000	<5	6	<5	<5	12.00	<5	25	<5	<5	28
Thallium	mg/kg	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	mg/kg	2	122,000	<2	2	3	<2	2	2	2	2	2	4
Uranium	mg/kg	0.1	300	0.4	0.1	0.3	0.5	0.3	0.4	0.9	0.2	0.4	0.1
Vanadium	mg/kg	2	160	9	5	10	14	8	8	10	32	6	7
Zinc	mg/kg	5	47,000	28	9	14	19	8	8	9	5	<5	11

Notes:
1. NSE EQS - Tier 1 Environmental Quality Standards f
RDL = Reportable Detection Limit
Bold and shade denotes exceedance of NSE EQS

TABLE C-1 Metals in Soil

Parameter	Units	RDL	GUIDELINES	DUP1 (Duplicate of SS6)	DUP2 (Duplicate of SS13)	SS13-1	SS13-2	SS13-3	SS13-4	SS19-1	SS19-2	SS19-3	SS19-4
			NSE EQS[1]										
Sample Date (d/m/y)				06/09/2020	06/10/2020	09/26/2020	09/26/2020	09/26/2020	09/26/2020	07/15/2020	07/15/2020	07/15/2020	07/15/2020
Aluminum	mg/kg	10	198,000	9,310	5,320	12,300	12,700	4,620	5,240	314	6,470	3,170	4,540
Antimony	mg/kg	1	63	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	mg/kg	1	31	13	**38**	14	7	23	11	2	5	3	25
Barium	mg/kg	5	140,000	14	15	20	12	34	21	<5	9	<5	<5
Beryllium	mg/kg	2	320	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Boron	mg/kg	2	24,000	2.00	<2	<2	<2	4.00	5.00	<2	<2	<2	<2
Cadmium	mg/kg	0.3	192	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	mg/kg	2	1,300	21	10	16	13	7	4	<2	7	4	5
Cobalt	mg/kg	1	250	1	3	7	3	4	3	<1	2	<1	<1
Copper	mg/kg	2	16,000	5	8	12	7	8	5	<2	<2	<2	<2
Iron	mg/kg	50	144,000	23,100	7,530	20,700	15,700	6,530	5,460	299	8,910	1,010	8,170
Lead	mg/kg	0.5	740	14.4	4	10	8	10	10	1.0	6	3.9	5.5
Lithium	mg/kg	5	--	8	11	15	12	<5	<5	<5	13	<5	<5
Manganese	mg/kg	2	--	80	129	490	113	550	128	23	50	27	20
Mercury	mg/kg	0.05	99	0.11	<0.05	<0.05	<0.05	0.16	0.10	<0.05	<0.05	<0.05	0.05
Molybdenum	mg/kg	2	1,200	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel	mg/kg	2	2,200	5	8	11	8	6	5	<2	4	<2	<2
Selenium	mg/kg	1	1135	2.00	<1	<1	<1	5.00	3.00	<1	<1	<1	<1
Silver	mg/kg	0.5	490	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg	5	122,000	<5	<5	<5	<5	43	68	<5	<5	<5	<5
Thallium	mg/kg	0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	mg/kg	2	122,000	3	2	2	2	3	2	3	2	<2	<2
Uranium	mg/kg	0.1	300	0.7	0.5	0.8	0.7	2.0	1.4	0.3	0.5	0	0.4
Vanadium	mg/kg	2	160	39	12	22	19	9	9	5	20	8	15
Zinc	mg/kg	5	47,000	13	17	26	19	28	13	<5	11	<5	<5

Notes:
1. NSE EQS - Tier 1 Environmental Quality Standards f
RDL = Reportable Detection Limit
Bold and shade denotes exceedance of NSE EQS

TABLE C-2: Petroleum Hydrocarbons in Soil

Parameter	Units	RDL	GUIDELINES		Sample ID				
			NSE EQS[1]	RBCA[2]	SS1	SS4	SS8	SS11	SS17
Sample Date					06/09/2020	06/09/2020	06/09/2020	06/09/2020	06/10/2020
Benzene	mg/kg	0.03	0.042	0.042	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene	mg/kg	0.04	0.35	0.35	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	mg/kg	0.03	0.065	0.043	<0.03	<0.03	<0.03	<0.03	<0.03
Total Xylenes	mg/kg	0.05	11	0.73	<0.05	<0.05	<0.05	<0.05	<0.05
C6 - C10 less BTEX (F1)	mg/kg	3	870	--	<3	<3	<3	<3	<3
>C10-C16 Hydrocarbons	mg/kg	15	1800	--	<15	<15	<15	<15	<15
>C16-C21 Hydrocarbons[3]	mg/kg	15	10000	--	<15	<15	<15	<15	20
>C21-C32 Hydrocarbons[3]	mg/kg	15		--	61	135	38	33	230
Modified TPH (Tier1)	mg/kg	20	Gasoline - 870 Diesel/ Fuel Oil - 1,800 Lube Oil - 10,000	Gasoline - 870 Diesel/ Fuel Oil - 1,800 Lube Oil - 10,000	61	135	38	33	250
Resemblance Comment	--	--		--	UC, LR	UC, LR	UC, LR	UC, LR	UC, LR
Return to Baseline at C32	--	N/A		--	Y	Y	Y	Y	Y

Notes:

1. Tier 1 Environmental Quality Standards for coarse grained soil at a potable industrial site.
2. Atlantic Risk-Based Corrective Action (RBCA) for Petroleum Impacted Sites in Atlantic Canada, Tier I Risk-Based Screening Levels for Soil, commercial land use,
3. Fractions C16-C21 and C21-C32 have been added together to compare to CWS F3 guideline for >C16-<C34.

GF - Gasoline Fraction , WGF - Weathered Gasoline Fraction , GR - Product in Gasoline Range , FOF - Fuel Oil Fraction , WFOF - Weathered Fuel Oil Fraction ,
"--" denotes no guideline exists
RDL = Reportable Detection Limit
Bold and shade denotes exceedance of NSE EQS

TABLE C-3: Metals in Sediment

Parameter	Units	RDL	GUIDELINES	Sample ID				
			NSE EQS[1]	SED1	SED2	SED4	SED5	SED7
Sample Date (d/m/y)				5/10/2018	5/10/2018	09/26/2020	9/27/2020	11/26/2020
Aluminum	mg/kg	10	--	4,070	4,480	7,530	4,400	7,730
Antimony	mg/kg	1	25	<1	<1	<1	<1	<1
Arsenic	mg/kg	1	17	8	**17**	59.0	**47**	**256**
Barium	mg/kg	5	--	18	39	72.0	28	62
Beryllium	mg/kg	2	--	<2	<2	<2	<2	<2
Boron	mg/kg	2	--	2	4.0	<2	3	5
Cadmium	mg/kg	0.3	3.5	<0.3	<0.3	<0.3	<0.3	0
Chromium	mg/kg	2	90	5	5	10.0	6	12
Cobalt	mg/kg	1	--	2	3	35.0	3	25
Copper	mg/kg	2	197	4	6	5.0	9	14
Iron	mg/kg	50	43,766	6,050	1,540	267,000.0	10,000	**85,800**
Lead	mg/kg	0.5	91.3	20.1	12.3	2.2	23.0	10.0
Lithium	mg/kg	5	--	<5	<5	10.0	<5	<5
Manganese	mg/kg	2	1,100	50	18	7,630.0	257	878
Mercury	mg/kg	0.05	0.486	0.11	0.06	<0.05	0.07	0.11
Molybdenum	mg/kg	2	--	<2	3.0	<2	<2	<2
Nickel	mg/kg	2	75	3	7	8.0	7	13
Selenium	mg/kg	1	2	<1	<1	<1	1	2
Silver	mg/kg	0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg	5	--	8	53	13	22	65
Thallium	mg/kg	0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	mg/kg	2	--	2	2	3.0	3.0	3.0
Uranium	mg/kg	0.1	--	0.5	1.2	0.5	0.6	0.7
Vanadium	mg/kg	2	--	11	9	15	18	38
Zinc	mg/kg	5	315	10	9	42	125	52

Notes:

1. NSE EQS - Tier 1 Environmental Quality Standards for freshwater sediment

Bold and shade denotes exceedance of NSE EQS

TABLE C-4: Petroleum Hydrocarbons in Sediment

Parameter	Units	RDL	Guidelines		Sample ID				
			NSE EQS[1]	RBCA [2]	SED1	SED2	SED4	SED5	SED7
Sample Date					6/11/2020	6/12/2020	09/26/2020	09/27/2020	11/26/2020
Benzene	mg/kg	0.03	1.2	1.2	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene	mg/kg	0.04	1.4	1.4	<0.04	<0.04	<0.04	<0.04	0.14
Ethylbenzene	mg/kg	0.03	1.2	1.2	<0.03	<0.03	<0.03	<0.03	<0.03
Total Xylenes	mg/kg	0.05	1.3	1.3	<0.05	<0.05	<0.05	<0.05	<0.05
C6 - C10 less BTEX (F1)	mg/kg	3	--	--	<3	<3	<3	<3	77
>C10-C16 Hydrocarbons (F2)	mg/kg	15	--	--	<15	20	<15	62	21
>C16-C21 Hydrocarbons	mg/kg	15	--	--	40	40	19	120	92
>C21-C32 Hydrocarbons	mg/kg	15	--	--	90	319	35	840	899
Modified TPH (Tier1)	mg/kg	20	Gas - 15, Fuel - 25, Lube - 43	500	**130**	**379**	**54**	**1,020**	**1,090**
Resemblance Comment	--	--		--	UC	UC	UC	UC	UC
Total Organic Carbon	%	0.3	--	--	--	--	--	--	--
Return to Baseline at C32	--	N/A	--	--	Y	Y	Y	Y	Y

Notes:

1. NSE EQS - Tier 1 Environmental Quality Standards for freshwater sediment

2. Atlantic Risk-Based Corrective Action (RBCA) for Petroleum Impacted Sites in Atlantic Canada, Tier I Sediment Ecological Screening Levels for the protection of Freshwater and Marine Aquatic Life.

3. Plus Silica Gel Clean-up and Total Organic Carbon Analysis

Range , FOF - Fuel Oil Fraction , WFOF - Weathered Fuel Oil Fraction , FR - Product in Fuel Oil Range , LOF - Lube Oil Fraction , LR - Lube Range , UC - Unidentified Compounds
RDL = Reportable Detection Limit
Shade denotes exceedance of NSE EQS

APPENDIX D

SURFACE WATER SAMPLE ANALYSES RESULTS AND GUIDELINES

GOLDBORO LNG

TABLE D-1: Total Metals and Cyanide in Surface Water

Parameter	Units	RDL	GUIDELINES	Sample ID							
			NSE EQS[1]	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Sample Date (d/m/y)				6/11/2020	6/12/2020	6/12/2020	09/26/2020	09/27/2020	09/27/2020	11/26/2020	11/27/2020
Total Aluminum	ug/L	5	5	**337**	**463**	**205**	**31**	**268**	**293**	**231**	**391**
Total Antimony	ug/L	2	20	<2	<2	<2	<2	<2	<2	<2	<2
Total Arsenic	ug/L	2	5	<2	<2	**8**	4	**9**	**13**	**8**	<2
Total Barium	ug/L	5	1000	<5	<5	<5	7	<5	<5	15	<5
Total Beryllium	ug/L	2	5.3	<2	<2	<2	<2	<2	<2	<2	<2
Total Bismuth	ug/L	2	--	<2	<2	<2	<2	<2	<2	<2	<2
Total Boron	ug/L	5	1,200	5	<5	<5	7	5	6	6	6
Total Cadmium	ug/L	0.017	0.01	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.031	0.026
Total Chromium	ug/L	1	--	<1	<1	<1	<1	<1	<1	1	<1
Total Cobalt	ug/L	1	10	<1	<1	<1	4	<1	<1	6	<1
Total Copper	ug/L	1	2	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron	ug/L	50	300	**462**	**440**	**720**	**3250**	**1590**	**934**	**8170**	**483**
Total Lead	ug/L	0.5	1	0.6	0.7	<0.5	<0.5	0.7	0.6	0.7	0.9
Total Manganese	ug/L	2	820	20	12	83	2320	319	22	**2510**	11
Total Mercury	ug/L	0.026	0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026
Total Molybdenum	ug/L	2	73	<2	<2	<2	<2	<2	<2	<2	<2
Total Nickel	ug/L	2	25	<2	<2	<2	2	<2	<2	<2	<2
Total Selenium	ug/L	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Total Silver	ug/L	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Strontium	ug/L	5	21,000	7	8	8	32	14	12	54	13
Total Thallium	ug/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
Total Tin	ug/L	2	--	<2	<2	<2	<2	<2	<2	<2	<2
Total Titanium	ug/L	2	--	4.0	4.0	2.0	<2	5	<2	3	4
Total Uranium	ug/L	0.1	300	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Total Vanadium	ug/L	2	6	<2	<2	<2	<2	<2	<2	<2	<2
Total Zinc	ug/L	5	30	<5	<5	<5	<5	15	<5	9	8

Notes:
1. NSE EQS - Tier I Environmental Quality Standards for metals in surface water
RDL = Reportable Detection Limit
Bold and shade denotes exceedance of NSE EQS

APPENDIX E

BIRD SURVEYS

GOLDBORO LNG

Table E-1: Priority Bird Species with Potential to Occur in ROW

Common Name *(Scientific Name)*	# of Records Within 5km [1]	Observations in Field Surveys [2]	Habitat Preferences
Short-eared Owl *(Asio flammeus)*	4	n/a	Variety of open habitats, including grasslands, peat bogs, marshes, sand-sage concentrations and old pastures. Nests in dense grasslands and occasionally in agricultural fields.
Long-eared Owl *(Asio otus)*	23	n/a	Roost in dense vegetation and forage in open grasslands or shrublands; also, open coniferous or deciduous woodlands. Uses abandoned nests built in trees by other bird species.
Canada Warbler *(Cardellina canadensis)*	n/a	5 (PC4, PC5, PC18)	Most abundant in moist, mixed forests with a well-developed understory, dense nest site cover. Often near open water. Typically nests on or near the ground, often on slopes, knolls, in earthen banks, or rocky areas.
Wilson's Warbler *(Cardellina pusilla)*	68	7 (PC2, PC8, PC9, PC10, PC15)	Shrub thickets in riparian habitats, edges of beaver ponds, lakes, bogs and overgrown clear-cuts. Typically breeds in clearings or bogs of moist early successional forests or stunted conifers.
Swainson's Thrush *(Catharus ustulatus)*	920	25 (PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, PC12, PC13, PC16, PC17)	Most strongly associated with coniferous (spruce-fir) and mixed hardwood-conifer forests.
Northern Harrier *(Circus hudsonius)*	183	1 (PC15)	Open wetlands, including marshy meadows; wet, lightly grazed pastures; old fields; freshwater and brackish marshes and tundra; dry uplands, including upland prairies, mesic grasslands, drained marshlands, croplands, cold desert shrub-steppe and riparian woodland.
Gray Catbird *(Dumetella carolinensis)*	n/a	2 (PC1, PC15)	Found in dense shrubs or vine tangles; abundant in shrub-sapling-stage successional and edge habitats.
Yellow-bellied Flycatcher *(Empidonax flaviventris)*	503	18 (PC2, PC3, PC4, PC5, PC9, PC10, PC11, PC12, PC13, PC14, PC15, PC18)	Nests in coniferous forests, bogs, swamps and peatlands with a thick cover of moss and a dense understory.
Wilson's Snipe *(Gallinago delicata)*	n/a	2 (PC4, PC5)	In Canada, breeds in sedge bogs, fens, swamps and pond and river edges. Requires soft organic soil rich in food organisms just below surface.
Barn Swallow *(Hirundo rustica)*	n/a	2 (PC7)	Requires open areas (fields, meadows) for foraging and open structures such as barns for nesting; typically found near aquatic habitats, as a source of mud is required for nest construction.

Common Name *(Scientific Name)*	# of Records Within 5km [1]	Observations in Field Surveys [2]	Habitat Preferences
Tennessee Warbler *(Oreothlypis peregrina)*	154	n/a	Found in a variety of forest types, typically associated with open areas containing grasses and dense shrubs
Fox Sparrow *(Passerella iliaca)*	86	n/a	Favours dense willow and alder thickets, spruce and fir bogs and forest edges
Canada Jay/Gray Jay *(Perisoreus canadensis)*	345	4 (PC2, PC11)	Favours coniferous or mixed-coniferous forests. Nests in trees, generally near edge of small forest openings (bogs, trails).
Boreal Chickadee *(Poecile hudsonicus)*	640	6 (PC1, PC2, PC11)	Young and mature coniferous or mixed boreal forests. Nests in holes in trees.
Ruby-crowned Kinglet *(Regulus calendula)*	1168	14 (PC4, PC8, PC9, PC10, PC12, PC13, PC18)	Nests near water in open coniferous forests.
Bay-breasted Warbler *(Setophaga castanea)*	307	3 (PC2, PC3)	Breeds mainly in dense, boreal spruce-fir forests and mixed-woods, especially mature stands; often near water and occasionally in bogs or swamps. Associated with spruce budworm outbreaks.
Blackpoll Warbler *(Setophaga striata)*	87	3 (PC8)	Nests in black spruce and tamarack forests. Prefers mature evergreen and deciduous forests during migration.
Cape May Warbler *(Setophaga tigrina)*	70	n/a	Medium-aged to mature coniferous forests with well-developed crowns. Favours areas with spruce budworm infestations.
Red-breasted Nuthatch *(Sitta canadensis)*	n/a	2 (PC2, PC4)	Prefers mature, diverse conifer forests; occasionally mixed forests.
Common Eider *(Somateria mollissima)*	549	n/a	Breeds on coastal islands or along ponds near the ocean. Winters offshore near marine shoals.
Common Tern *(Sterna hirundo)*	n/a	3 (PC13, PC15)	Usually nests on islands, sometimes on barrier beaches or promontories attached to mainland, or salt marshes; occasionally freshwater marshes.
Greater Yellowlegs *(Tringa melanoleuca)*	n/a	2 (PC9, PC18)	Breeds in boreal wetlands, wet meadows and sedgelands, typically with many small ponds and scattered shrubs or small trees. Uses a variety of fresh and brackish wetlands.
Willet *(Tringa semipalmata)*	n/a	2 (PC13, PC14)	Breeds in saltmashes, barrier islands and barrier beaches. Forages on open beaches, bayshores, marshes and mudflats.

[1] Number of records reported by the ACCDC (2020).

[2] Field surveys include point counts during spring migration and breeding season (point count (PC) stations are shown on Figure D-1)

Table E-2: Early Bird Species Observed at the Site in Late April 2020

Common Name	Scientific Name	Individuals Per Point Count	Incidental Observations
Hermit Thrush	*Catharus guttatus*	0.06	
Northern Flicker	*Colaptes auratus*	0.41	
American Crow	*Corvus brachyrhynchos*	0.29	
Common Raven	*Corvus corax*		X
Empidonax sp.	*Empidonax sp.*	0.06	
Spruce Grouse	*Falcipennis canadensis*		X
Common Loon	*Gavia immer*	0.12	
Purple Finch	*Haemorhous purpureus*	0.12	
Dark-eyed Junco	*Junco hyemalis*	0.41	
Herring Gull	*Larus argentatus*	0.12	
Swamp Sparrow	*Melospiza georgiana*	0.06	
Song Sparrow	*Melospiza melodia*	0.18	
Nashville Warbler	*Oreothlypis ruficapilla*	0.12	
Osprey	*Pandion haliaetus*	0.24	
Downy Woodpecker	*Picoides pubescens*		X
Hairy Woodpecker	*Picoides villosus*		X
Black-capped Chickadee	*Poecile atricapillus*	0.18	
Boreal Chickadee	*Poecile hudsonicus*	0.18	
Common Grackle	*Quiscalus quiscula*	0.18	
Ruby-crowned Kinglet	*Regulus calendula*	0.12	
Golden-crowned Kinglet	*Regulus satrapa*	0.29	
Yellow-rumped Warbler	*Setophaga coronata*		X
Palm Warbler	*Setophaga palmarum*	0.29	
Red-breasted Nuthatch	*Sitta canadensis*		
American Goldfinch	*Spinus tristis*	1.24	
European Starling	*Sturnus vulgaris*	0.24	
Winter Wren	*Troglodytes hiemalis*		X
American Robin	*Turdus migratorius*	0.24	
White-throated Sparrow	*Zonotrichia albicollis*		X

Table E-3: Spring Migration Avifauna Species and Abundance

Species Code	Common Name	Scientific Name	# Individuals	Location (PC#)	Bird Group
AMCR	American crow	*Corvus brachyrhynchos*	5	7, 10, 13, 17	6
AMGO	American goldfinch	*Carduelis tristis*	21	7, 17	6
AMRO	American robin	*Turdus migratorius*	4	6, 8, 13, 17	6
BCCH	Black-capped chickadee	*Poecile atricapilla*	3	1	6
BOCH	**Boreal chickadee**	***Poecile hudsonica***	**3**	**1**	**6**
COGR	Common grackle	*Quiscalus quiscula*	3	8	6
COLO	Common loon	*Gavia immer*	2	16	3
DEJU	Dark-eyed junco	*Junco hyemalis*	7	6, 9, 10, 13, 17, 18	6
EUST	European starling	*Sturnus vulgarius*	4	7	6
GCKI	Golden-crowned kinglet	*Regulus satrapa*	5	5	6
HERG	Herring gull	*Larus argentatus*	2	16	2
HETH	Hermit thrush	*Catharus guttatus*	1	9	6
NAWA	Nashville warbler	*Vermivora ruficapilla*	2	9, 10	6
NOFL	Northern flicker	*Colaptes auratus*	7	1, 6, 7, 8, 9, 14	7
OSPR	Osprey	*Pandion haliaetus*	4	6, 7, 18	4
PAWA	Palm warbler	*Dendroica palmarum*	5	9, 10, 11, 13	6
PUFI	Purple finch	*Carpodacus purpureus*	2	3, 7	6
RCKI	**Ruby-crowned kinglet**	***Regulus calendula***	**2**	**8, 9**	**6**
SOSP	Song sparrow	*Melospiza melodia*	3	7, 14, 17	6
SWSP	Swamp sparrow	*Melospiza georgiana*	1	9	6
UNBI	Empidonax sp.	N/A	1	1	N/A
	Total Species: 20	**Total Individuals: 87**			

Priority species are indicated in bold.

Table E-4: Breeding Avifauna Species and Abundance

Species Code	Common Name	Scientific Name	# Individuals	Location (PC#)	Bird Group	Breeding Evidence
CAWA	**Canada warbler**	***Wilsonia canadensis***	**5**	**4, 5, 18**	**6**	**Possible**
BARS	**Barn swallow**	***Hirundo rustica***	**2**	**7**	**6**	**Probable**
WILL	**Willet**	***Tringa semipalmata***	**2**	**13, 14**	**2**	**Observed**
BOCH	**Boreal chickadee**	***Poecile hudsonica***	**3**	**4, 18**	**6**	**Possible**
GRAJ	**Gray jay**	***Perisoreus canadensis***	**4**	**2, 11**	**6**	**Possible**
COTE	**Common tern**	***Sterna hirundo***	**3**	**13, 15**	**3**	**Observed**
GRCA	**Gray catbird**	***Dumetella carolinensis***	**2**	**1, 15**	**6**	**Possible**
WISN	**Wilson's snipe**	***Gallinago delicata***	**2**	**4, 5**	**2**	**Possible**
WIWA	**Wilson's warbler**	***Wilsonia pusilla***	**7**	**2, 8, 9, 10, 15**	**6**	**Confirmed**
RBNU	**Red-breasted nuthatch**	***Sitta canadensis***	**2**	**2, 4**	**6**	**Possible**
GRYE	**Greater yellowlegs**	***Tringa melanoleuca***	**2**	**9, 18**	**2**	**Observed**
BBWA	**Bay-breasted warbler**	***Dendroica castanea***	**3**	**2, 3**	**6**	**Probable**
BLPW	**Blackpoll warbler**	***Dendroica striata***	**3**	**8**	**6**	**Possible**
NOHA	**Northern harrier**	***Circus cyaneus***	**1**	**15**	**4**	**Possible**
RCKI	**Ruby-crowned kinglet**	***Regulus calendula***	**12**	**4, 8, 9, 10, 12, 13, 18**	**6**	**Probable**
SWTH	**Swainson's thrush**	***Catharus ustulatus***	**25**	**1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 16, 17**	**6**	**Confirmed**
YBFL	**Yellow-bellied flycatcher**	***Empidonax flaviventris***	**18**	**2, 3, 4, 5, 9, 10, 11, 12, 13, 14, 15, 18**	**6**	**Probable**
ALFL	Alder flycatcher	*Empidonax alnorum*	45	1, 4, 6, 7, 8, 9, 11, 12, 13, 14, 16, 17	6	Probable
AMCR	American crow	*Carvus brachyrhynchos*	18	1, 2, 6, 8, 9, 12, 13, 14, 15, 16	6	Probable
AMGO	American goldfinch	*Carduelis tristis*	5	5, 6, 7, 8	6	Possible
AMRE	American redstart	*Setophaga ruticilla*	31	1, 2, 3, 6, 7, 8, 9, 15, 16, 17, 18	6	Probable

Species Code	Common Name	Scientific Name	# Individuals	Location (PC#)	Bird Group	Breeding Evidence
AMRO	American robin	*Turdus migratorius*	21	1, 5, 6, 7, 8, 10, 14, 16, 17	6	Probable
BAWW	Blank-and-white warbler	*Mniotilta varia*	33	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18	6	Probable
BCCH	Black-capped chickadee	*Poecile atricapilla*	11	4, 7, 9, 11, 12, 16	6	Probable
BEKI	Belted kingfisher	*Megaceryle alcyon*	4	16, 17	3	Probable
BHVI	Blue-headed vireo	*Vireo solitarius*	11	1, 3, 4, 5, 9, 10, 11, 17	6	Probable
BLJA	Blue jay	*Cyanocitta cristata*	2	4, 10	6	Possible
BTNW	Black-throated green warbler	*Dendroica virens*	10	1, 3, 4, 5, 8, 17, 18	6	Probable
CEDW	Cedar waxwing	*Bombycilla cedrorum*	11	4, 5, 6, 8, 11, 12, 13, 15, 16	6	Possible
COGR	Common grackle	*Quiscalus quiscula*	1	15	6	Possible
COLO	Common loon	*Gavia immer*	1	14	3	Observed
CORA	Common raven	*Corvus corax*	1	9	6	Possible
COYE	Common yellowthroat	*Geothlypis trichas*	34	1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18	6	Probable
CSWA	Chestnut-sided warbler	*Dendroica pensylvanica*	1	7	6	Possible
DEJU	Dark-eyed junco	*Junco hyemalis*	20	2, 3, 6, 9, 10, 11, 12, 13, 15, 16	6	Possible
GBBG	Great black-backed gull	*Larus marinus*	2	15, 16	2	Observed
GCKI	Golden-crowned kinglet	*Regulus satrapa*	14	2, 3, 5, 6, 7, 11, 14, 17	6	Probable
HAWO	Hairy woodpecker	*Picoides villosus*	4	2, 8, 18	7	Possible
HERG	Herring gull	*Larus argentatus*	6	16, 17	2	Probable
HETH	Hermit thrush	*Catharus guttatus*	43	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	6	Confirmed
LEFL	Least flycatcher	*Empidonax minimus*	1	2	6	Possible
LISP	Lincoln's sparrow	*Melospiza lincolnii*	8	2, 9, 12, 13	6	Probable

Species Code	Common Name	Scientific Name	# Individuals	Location (PC#)	Bird Group	Breeding Evidence
MAWA	Magnolia warbler	*Dendroica magnolia*	28	1, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18	6	Probable
MOWA	Mourning warbler	*Oporornis philadelphia*	4	1, 17	6	Probable
NAWA	Nashville warbler	*Vermivora ruficapilla*	19	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 18	6	Probable
NOFL	Northern flicker	*Colaptes auratus*	1	9	7	Possible
NOPA	Northern parula	*Parula americana*	1	16	6	Possible
OSPR	Osprey	*Pandion haliaetus*	1	16	4	Possible
PAWA	Palm warbler	*Dendroica palmarum*	18	3, 4, 7, 9, 10, 12, 13, 14, 18	6	Probable
PUFI	Purple finch	*Carpodacus purpureus*	5	9, 13	6	Probable
REVI	Red-eyed vireo	*Vireo olivaceus*	10	3, 7, 8, 9, 15, 16, 18	6	Probable
SOSP	Song sparrow	*Melospiza melodia*	19	1, 6, 7, 8, 10, 13, 14, 16, 17	6	Probable
SWSP	Swamp sparrow	*Melospiza georgiana*	5	9, 14, 16	6	Probable
TRES	Tree swallow	*Tachycineta bicolor*	9	6, 8, 16, 17	6	Probable
WIWR	Winter wren	*Troglodytes troglodytes*	3	1, 7	6	Probable
WTSP	White-throated sparrow	*Zonotrichia albicollis*	46	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	6	Probable
YRWA	Yellow-rumped warbler	*Dendroica coronate*	16	2, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 18	6	Probable
YWAR	Yellow warbler	*Dendroica petechia*	16	1, 6, 7, 8, 9, 11, 14, 16	6	Probable
	Total Species: 58	**Total Number: 635**				

Priority species shown in bold.