Hamlet of Pond Inlet
Master Drainage Plan and Geotechnical Investigation



PRESENTED TO

Department of Community and Government Services (CGS)
Government of Nunavut

MARCH 31, 2020
ISSUED FOR USE
FILE: 704-TRN.WTRM03178-01

Tetra Tech Canada Inc.
Suite 1000 – 10th Floor, 885 Dunsmuir Street
Vancouver, BC V6C 1N5 CANADA
Tel 604.685.0275 Fax 604.684.6241

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

LIST OF FIGURES IN TEXT

APPENDIX SECTIONS

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
DEM	Digital Elevation Model
GIS	Geographic Information System
GPS	Global Positioning System
SWMM	Stormwater Management Model
AES	Atmospheric Environmental Service

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Government of Nunavut and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Government of Nunavut, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Department of Community and Government Services (CGS), Government of Nunavut to develop a Master Drainage Plan for the Hamlet of Pond Inlet (Pond Inlet). CGS and Pond Inlet require that a drainage study be conducted in Pond Inlet, for both the existing town site and planned future subdivisions identified in the Community Plan. As part of the deliverables, CGS has also requested that a geotechnical investigation be completed to confirm the geology characteristic to the Hamlet.

The Terms of Reference (ToR) developed by CGS confirmed that Pond Inlet has in-force a Community Plan (By-law No. 240) and a Zoning By-law (By-law No. 241). To make sure the community plans are developed in harmony with the local site drainage limitations, it was recommended that a complete review of the local drainage system be completed. In addition to a detailed review of the community plans and its impacts on the exiting stormwater system, CGS identified the need to review and evaluate the conditions of the existing drainage system. Based on anecdotal information and details provided by CGS, pre-existing drainage issues are present within the existing townsite.

The Pond Inlet Community Plan estimated the 2014 population of Pond Inlet to be 1666 persons. The Pond Inlet Community Plan aims to prepare for a population of 2708 people by 2034 and estimates an additional 363 housing units will be required to meet the estimated population growth. Any of the proposed subdivisions need to be constructed away from the core area of the community. In order to ensure that the Hamlet of Pond Inlet has sufficient and suitable developable land to accommodate population growth forecast in the Community Plan, it is necessary for a qualified team of professionals to conduct a drainage study for these subdivisions.

The study conducted by Tetra Tech encompassed the following tasks:

- A review of all available background material;
- A site visit to Pond Inlet by a team of hydrotechnical engineers to identify, assess, and document all drainage infrastructure and known drainage issues;
- Inventory of existing drainage issues;
- Development of inputs to a hydrologic model;
- Assess the drainage system for existing and proposed development conditions;
- Assess geotechnical conditions and terrain suitability for the proposed development plans; and
- Completion of the Pond Inlet Master Drainage Plan.

Figure 1-1 on the following page shows a Field Map outlining the extent of the study area.

LEGEND

Study Area

NOTES
Base data source: Imagery provided by GoogleEarth; DigitalGlobe (2010)

STATUS
ISSUED FOR USE

GEOTECHNICAL INVESTIGATION AND DRAINAGE PLANNING POND INLET, NUNAVUT

Field Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Government of Nunavut

Scale: 1:12,000

200 100 0 200

Metres

TETRA TECH

FILE NO.
WTRM03178-01_Figure2_1_FieldMap.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	VER	0

DATE	PROJECT NO.
March 26, 2020	TRN.WTRM03178-01

Figure 1-1

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2.0 REVIEW OF BACKGROUND INFORMATION

Tetra Tech collected, compiled and processed all information related to the drainage system of the Hamlet of Pond Inlet, made available by officials from the Government of Nunavut and the Hamlet, and from publicly available reports and data.

The initial background review process provided Tetra Tech with an understanding of the terrain, climate, long-term land-use plans, and known drainage issues in Pond Inlet.

Reviewed background data has included the following:

- 2018 Satellite Imagery (.tif);
- 2018 Digital Elevation Models (Bare earth and surface models available in .tif and .asc formats);
- 2018 Building footprint, infrastructure, and transportation vector datasets (AutoCAD .dwg and ESRI File Geodatabase or Shapefile formats);
- 2018 Hydrology (water bodies and watercourses) vector datasets (AutoCAD .dwg and ESRI File Geodatabase and Shapefile formats);
- 2018 Contours vector datasets (AutoCAD .dwg and ESRI File Geodatabase and Shapefile formats);
- 2014 Community Plan and Community Plan By-law;
- National Topographic Survey (NTS) 1:50,000 Topography Map of Pond Inlet;
- Google Earth 2016 Satellite Imagery; and
- Historical climate data for Pond Inlet, monitored and made available by Environment Canada.

Additional anecdotal background information was collected through informal discussions with Hamlet staff and local residents during the 2019 field visit.

2.1 Geology Background Data Review

The following background information was collected from a variety of sources and referenced while mapping:

- Google Earth Pro™ historical imagery (starting from August 31, 2010);
- 1969 black and white (B&W) air photos (1:12,000 scale);
- 1976 B&W air photos (1:18,000 scale);
- 1983 B&W air photos (1:5,000 scale);
- 1987 B&W air photos;
- 1989 B&W air photos (1:5,000 scale);
- 1995 B&W air photos (1:5,000 scale);
- 1995 colour air photos (1:8,000 scale);

- 1998 B&W air photos (1:10,000 scale);
- Regional surficial geology and permafrost maps (refer to the REFERENCES list of this report);
- Geotechnical site investigation reports by various consultants (refer to the REFERENCES list of this report); and
- Literature on surficial geology and permafrost in the area (Heginbottom et al. 1995; Keen and Williams 1990; Klassen 1993; McCuaig 1994).

2.2 Community Plan, Population and Expansion Plans (Land Use)

The Government of Nunavut CGS division maintain and regularly update community plan maps for each community within the Territory. The purpose of these community plans are to outline Council's policies for managing the physical development of each Hamlet for the next 20 years. The community plan for the Hamlet of Pond Inlet was updated in 2014 (included as Appendix B).

The community plan includes existing land parcels as well as proposed parcels of land allocated for future community growth. This combination of existing and proposed development forms the scope of our Master Drainage Plan, which aims to provide feedback not only on how to improve the existing drainage system, but also prescribe how the drainage features of the future area should be designed. The results of this community drainage study should be incorporated within the 2019 community plan update.

Through the development of this report, Tetra Tech has identified sections of the community plan which should not be developed. Instead, Tetra Tech is recommending that CGS consider revising the community plan so to develop a plan which is less prone to drainage issues. For consideration, Appendix B includes a revised community plan.

2.3 Terrain

The Hamlet of Pond Inlet, hereafter referred to as the study area, is located on the northern tip of Baffin Island, in the Davis Highlands, which are part of the Davis Region of the Canadian Shield (Bostock 1970). The physiography of the region is quite distinct, with mountainous highlands standing in sharp contrast to rolling lowland plains (McCuaig 1994). The lowlands, which contain the study area, are part of the Arctic Lowlands physiographic unit (Bostock 1970).

The crystalline Pre-Cambrian bedrock in the study area consists of igneous and metamorphic rocks – granodiorite, granitic gneiss, granite and schist. These form broad, rounded hills and uplands (Klassen 1993; Keen and Williams, 1990).

This study focuses on the coastal lowlands that fall within the Mid Arctic Ecoclimatic Region (Ecoregions Working Group 1989) and are characterized by a sparse vegetation cover of mixed herbs, dwarf shrubs, mosses and lichens. The climate is humid and cold, and marked by short, cold summers and long winters.

Based on records available from Environment Canada (1923, 2017 to the present) and from several weather stations in Pond Inlet, the mean annual air temperature has averaged about -14°C over the past 30 years, and the freezing and thawing indices have averaged about 5540 C°-days and 480 C°-days, respectively (Tetra Tech 2017). Linear interpolation was used to interpret temperature trends and shows a warming trend of nearly 0.06°C per year since 1976. Additionally, the 1981-2010 climatic normals are available for the Pond Inlet climate station from Environment Canada. Based on these, the mean annual air temperature at Pond Inlet averages -14.6°C and the freezing and thawing average 5740 C°-days and 470 C°-days, respectively. Average annual precipitation in Pond Inlet has averaged 189 mm based on the 1981-2010 climatic normals (Tetra Tech 2017).

2.3.1 Surficial Geology

The surficial materials and permafrost terrain features within the study area were mapped using the regional (1:250,000 scale) surficial geology map (Klassen 1993) as a baseline. Glacial deposits mapped by Klassen as undifferentiated foreign drift are the most widespread surficial materials within the study area. They are described as "muddy sand to sandy diamicton characterized by abundant foreign debris; typically, <1 to 2 m thick and commonly discontinuous over bedrock" (Klassen 1993). The terms "foreign" and "native" were used by Klassen (1993) to distinguish glacial deposits associated with regional ice sheets from those that are associated with local ice caps and mountain glaciers.

Nearshore marine deposits consisting of coarse sand, gravel and boulders, glaciofluvial deposits and landforms (kames), and ice contact stratified drift are also shown on the map within the study area. However, their extent is considerably more limited compared to the glacial deposits.

Tetra Tech reviewed results of the recent geotechnical investigations completed by several geotechnical consultants and summarized surficial geology of the study area in a report submitted to Telesat Canada (Tetra Tech 2017). This work is summarized in the following sections. Figure 2-1 shows locations of the previous geotechnical investigation sites.

Organic Soils

A layer of organics, ranging in thickness from 0.1 to 0.7 m, was encountered at the Land Assembly site (Thurber 1981) and within the sand unit at the RCMP site (EBA 2007).

Silty Sand, Gravelly Sand and Gravel

Stratified silty sand, gravelly sand and gravel underlie the organic layer at the Land Assembly area site. These sediments were deposited in a marine environment and continue to about 10 to 15 m below original ground surface (Thurber 1981). These marine deposits appear to be underlain by a silt-rich glacial till. A layer of glacial deposits (clean sands and gravels to silty sands) was encountered underlying the marine deposits at the Land Assembly site (Thurber 1981).

Sand with some gravel and some silt/clay was encountered at the RCMP site (EBA 2007) at the surface or beneath the organics and extend to bedrock. Moisture content values ranged from 2% to 41%.

The subsurface soils encountered at the Parks Canada site (EBA 2004) primarily consist of silty sands/sandy silts with variable proportions of sand, silt, clay and gravel. Moisture content values ranged from 6% to 32% and averaged 14%. Atterberg limits indicated that the fine portion of the samples comprises inorganic clay of low to medium plasticity.

Sand or Sand and Gravel (Till)

A layer of glacial deposits (till) was encountered underlying the organic soils or the sand fill layers at the Community Centre site (AMEC 2005) and the south residential subdivision (Thurber 1987).

At the Community Centre site (AMEC 2005), the sand till was described as fine-to medium-grained, poorly graded, non-plastic, and containing trace to some amounts of silt, trace to some gravel. Ice layers 0.4 m thick, were found in one of the five boreholes at a depth of 1.0 m. Soil moisture contents in the sand ranged from 7 to 12%.

Bedrock

Bedrock was encountered in only one of the twenty testholes drilled for the Land Assembly investigation (Thurber 1981), at a depth of 14.0 m below the ground surface.

Bedrock was interpreted to be present within each of the seven boreholes completed for the RCMP Station Addition (EBA 2007). Approximate bedrock depth ranged from about 2.1 m to 4.9 m below ground surface. The bedrock was interpreted to have been weathered and fragmented on the surface, but it was felt that within 0.3 to 0.6 m below first contact, the bedrock was intact and solid.

Bedrock was encountered at depth ranging from 5.5 m to 8 m at the Parks Canada Facilities site (EBA 2004).

Granite, gneiss and schist bedrock encountered during the above-summarized drilling programs was found to be relatively hard and resistant to weathering.

2.3.2 Permafrost

According to the Canada Permafrost Map (Heginbottom et al. 1995), the study area is located within the subzone of continuous permafrost, in which 90 to 100% of the land area is underlain by permafrost. Although permafrost in the project area is mapped as “low ground ice content in the upper 10 to 20 m of the ground”, i.e. <10% by volume of visible ice (Heginbottom et al. 1995), recent geotechnical investigations show that significant accumulations of ground ice do occur in the study area.

Numerous ice lenses, ice layers and ice-rich zones were encountered within stratified silty sand, gravelly sand and gravelly sediments beneath the organic layer in testholes completed at the Land Assembly site (Thurber 1981). Ground ice formations ranged from ice lenses 1 or 2 mm thick to massive ice beds more than 3 m in thickness. A particularly large “ice wedge” was encountered in one of the testholes (14.6 m of ice). It is expected that similar size “ice wedges” may occur irregularly throughout the Land Assembly site and throughout the entire study area.

At the Parks Canada site (Figure 2-1), the ground ice was described as random or irregularly oriented formations (EBA 2004). Massive ice layer 0.4 m thick was penetrated at a depth of 1.0 m in one of the five boreholes completed in the sandy, trace to some silt, trace to some gravel till at the Community Centre site (AMEC 2005). The ground ice at the RCMP site (Figure 2-1) was described as individual crystals or inclusions that are well-bonded (EBA 2007).

At the Southern Subdivision site (Figure 2-1), the upper 2 m to 3 m of soil often contained significant excess ice contents. Those soils, which were described to contain more than 10% silt and clay sizes were expected to be highly unstable when thawed (Thurber 1987). It was also noted that significant ice layers and ice-rich zones were encountered in some of the testholes at depths below 3 m.

As per Tetra Tech’s summary description of the subsurface conditions in the Pond Inlet area (Tetra Tech 2017), the ground temperatures at depths below 6 m have been reported to average -6.4°C at the RCMP detachment (EBA 2007), -10.5°C at the community centre site (AMEC 2005), -12.1°C at the Parks Canada site (EBA 2004), -13.7°C at the south residential subdivision (Thurber 1987), and -9.0°C at the Area 4 site (GeoCon 1985). More recently, a temperature of -11.3°C was measured at a depth of 7.9 m, 7 days following pile installation for a five-plex building (Tetra Tech EBA 2015). Based on the records from these investigations and the probable effects of climate change since then, a mean annual ground temperature of -9.5°C at depth is estimated for the proposed community expansion areas.

NOTE:

BASED ON GOOGLE EARTH, DIGITAL GLOBE IMAGE, 8/31/2010

0 500 m

Scale: 1: 10 000

CLIENT

Nunavut

TETRA TECH

GEOTECHNICAL INVESTIGATION AND DRAINAGE PLANNING POND INLET, NU

PREVIOUS GEOTECHNICAL INVESTIGATION SITE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
TRN.WTRM03178-01.001	DBD	VER	0

OFFICE	DATE
EDM	November 2019

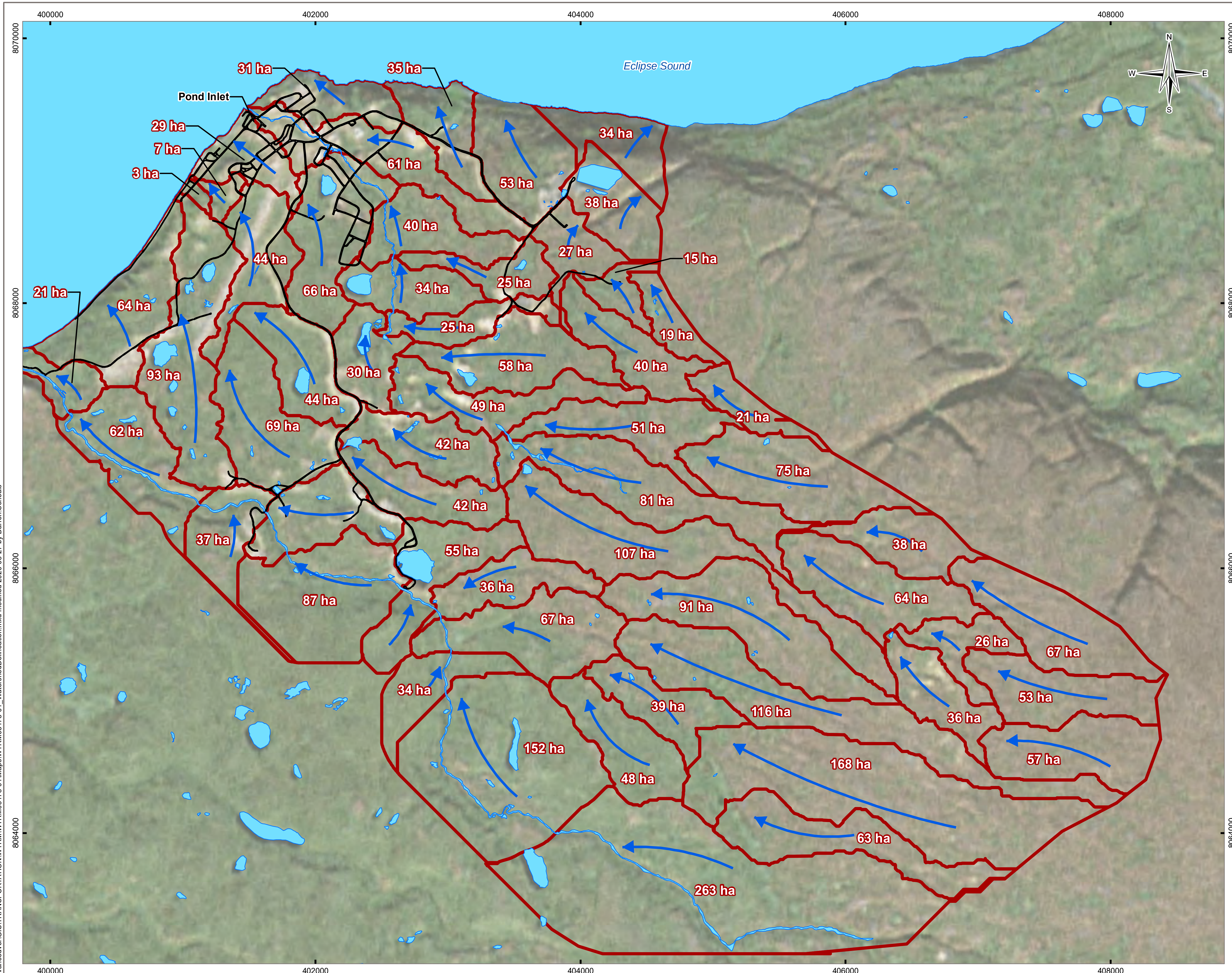
Figure 2-1

Q:\Edmonton\Drafting\PROJECTS\704-TRN.WTRM\TRN.WTRM03178-01\001002_Acad\TRN.WTRM03178-01_001 Figure 1.dwg [FIGURE 1] November 15, 2019 - 2:13:52 pm (BY: DAS, DEBASHIS)

2.3.3 Topography and Watershed Delineation

A Digital Elevation Model (DEM) of the Pond Inlet region was developed to represent the topography of the project area. The DEM was derived from aerial photographs used to extract elevation information through a technique called photogrammetry. The use of measurements from photographs is of sufficient accuracy for use within a drainage planning exercise.

Tetra Tech has reviewed this DEM in conjunction with NTS 1:50,000 topography maps of the area and has performed a watershed delineation analysis to identify drainage patterns in the Pond Inlet area. The existing drainage patterns are presented in Figure 2-2 and were confirmed during the 2019 freshet field visit. Note that several paths are impacted by the presence of other surficial obstructions such as buildings and conveyance systems such as culverts and ditches.



LEGEND

- Flow Direction
- Watershed

Base Data

- Gravel Road
- Waterbody

NOTES
Base data source:
1. Imagery from ESRI; DigitalGlobe (2017)
2. Water bodies from Nunavut base data

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Watershed Delineation

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:28,000
500 250 0 500
Metres

FILE NO.
WTRM03178-01_WatershedDelineation.mxd

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DATE	PROJECT NO.
March 27, 2020	TRN.WTRM03178-01

Figure 2-2

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2.4 Climate

2.4.1 Recorded Data

Climate data for Pond Inlet are based on records collected at Pond Inlet A, from 1975 to present. Data are collected and published by Environment and Climate Change Canada (ECCC). Figure 2-3, Table 2-1, and Table 2-2 present the climate normals determined by ECCC for the period of 1981 to 2010.

The daily average, maximum and minimum temperatures in February, the coldest month of the year, are -33.7°C, -30.2°C, and -37.1°C respectively. The same temperatures in July, the warmest month of the year, are 6.6°C, 10.5°C, and 2.7°C respectively. The annual mean daily temperature is -14.6°C. Extreme maximum and minimum recorded temperatures are 22.0°C and -53.9°C respectively. The average annual precipitation for the climate normal period is 189.0 mm, with 91 mm (48%) of rain and the remainder as snow. Precipitation amounts are highest in the summer months of June and July, with a maximum recorded daily rainfall of 30.5 mm which occurred on July 26, 2002.

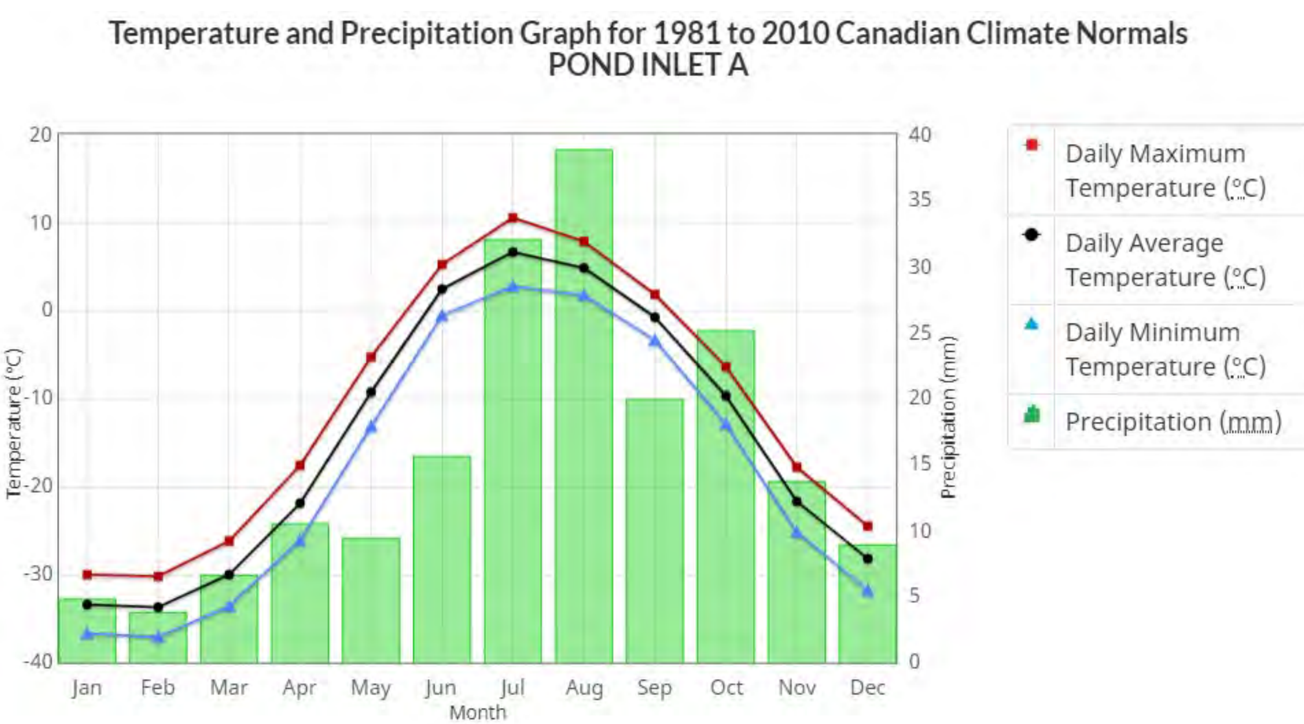


Figure 2-3: Temperature and Precipitation (1981-2010). Pond Inlet A

Table 2-1: Temperature Climate Normals 1981-2010. Pond Inlet A

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average (°C)	-33.4	-33.7	-30	-21.9	-9.3	2.4	6.6	4.8	-0.8	-9.7	-21.7	-28.2	-14.6
Standard Deviation	2.8	3.3	2.9	2.3	2.7	1.3	1.3	1.2	1.5	3.1	3.3	3.6	4.9
Daily Maximum (°C)	-30	-30.2	-26.2	-17.6	-5.3	5.2	10.5	7.8	1.8	-6.4	-17.8	-24.5	-11.1
Daily Minimum (°C)	-36.7	-37.1	-33.6	-26.1	-13.2	-0.6	2.7	1.7	-3.4	-12.9	-25.2	-31.8	-18
Extreme Maximum (°C)	3.7	-3.3	0	3.9	12.1	15.5	**22**	19	11.9	6.5	2	-1	
Date (yyyy/dd)	1977/ 11	1986/ 17	1980/ 20	1975/ 29	1985/ 03	1989/ 30	**1991/ 11**	2006/ 11	1985/ 05	1994/ 17	1995/ 14	2003/ 20	
Extreme Minimum (°C)	-49.8	**-53.9**	-49	-40.2	-28.4	-14	-6.1	-6.1	-16.4	-30.1	-42	-45.5	
Date (yyyy/dd)	1982/ 16	**1979/ 12**	1982/ 10	1983/ 07	1983/ 01	1986/ 02	1986/ 05	1976/ 26	1982/ 20	1978/ 26	1997/ 12	1979/ 14	

Table 2-2: Precipitation Climate Normals 1981-2010. Pond Inlet A

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	0	0	0	0	0	12.1	31.5	35.9	9.8	1.3	0.4	0	91
Snowfall (cm)	5.8	5	8.6	12.7	14.3	4.4	0.4	2.8	13.7	33.8	17.9	12.6	131.9
Precipitation (mm)	4.8	3.8	6.6	10.5	9.4	15.6	32	38.8	19.9	25.1	13.7	8.9	189
Average Snow Depth (cm)	20	19	22	24	26	4	0	0	1	10	16	18	13
Snow Depth at Month-end (cm)	22	19	22	25	23	0	0	0	4	15	20	19	14
Extreme Daily Rainfall (mm)	0	0	0	0	2.4	21.2	**30.5**	25	17	20	11	0	
Date (yyyy/dd)	1975 / 01	1976 / 01	1976 / 01	1975 / 01	1977 / 09	1981 / 29	**2002 / 26**	1996 / 19	1987 / 11	1984 / 14	1998 / 02	1975 / 01	

Computed short duration rainfall characteristics in the form of Intensity Duration Frequency (IDF) data for Pond Inlet A were obtained from Environment and Climate Change Canada and are presented in Table 2-3. The ECCC data were computed with a Gumbel frequency distribution.

Table 2-3: Intensity Duration Frequency (IDF) Data for Pond Inlet A (1975 to 1993)

T (years)	2	5	10	25	50	100
5 min	0.7	1	1.1	1.3	1.4	1.5
10 min	1.1	1.4	1.6	1.9	2	2.2
15 min	1.4	1.8	2	2.3	2.6	2.8
30 min	2.3	3	3.5	4.1	4.5	4.9
1 h	3.6	4.6	5.3	6.1	6.7	7.3
2 h	5.5	7	8.1	9.4	10.4	11.3
6 h	10.1	13.9	16.3	19.5	21.8	24.1
12 h	13.6	18.1	21	24.8	27.6	30.4
24 h	17.3	23.5	27.5	32.7	36.5	40.3

2.4.2 Climate Change Predictions

2.4.2.1 Pond Inlet Regional Climate Projections

Atlas Canada (The Prairie Climate Centre, 2019) climate change projections were retrieved for the Municipality of Pond Inlet. Tetra Tech analysed projected changes between the 30-year time periods of 1976-2005 and 2021-2050 for the RCP8.5 climate change scenario. Between these two time periods, the annual mean temperature is expected to increase by 3.0 °C from -14.4 °C to -11.4 °C. Annual precipitation is expected to increase by 15 percent from 195 mm to 225 mm. The maximum 1-day precipitation is expected to increase by 20 percent from 15 mm to 18 mm between the same time periods. Seasonal mean temperature and precipitation projections are shown in Table 2-4 and Table 2-5 below.

Table 2-4: Atlas Canada RCP8.5 Climate Change Temperature Projections Summary

		1976-2005	2021-2050		2051-2080	
Variable	Period	Mean (°C)	Mean (°C)	Increase (°C)	Mean (°C)	Increase (°C)
Mean Temperature	Annual	-14.4	-11.4	3	-8.1	6.3
Mean Temperature	Spring	-20	-17.5	2.5	-14.9	5.1
Mean Temperature	Summer	3.8	5.5	1.7	7.3	3.5
Mean Temperature	Fall	-11.3	-7.1	4.2	-3	8.3
Mean Temperature	Winter	-30.5	-26.7	3.8	-22	8.5

Table 2-5: Atlas Canada RCP8.5 Climate Change Precipitation Projections Summary

		1976-2005	2021-2050		2051-2080	
Variable	**Period**	**Mean (mm)**	**Mean (mm)**	**Increase (%)**	**Mean (mm)**	**Increase (%)**
Precipitation	Annual	195	225	15	256	31
Precipitation	Spring	32	35	9	39	22
Precipitation	Summer	77	88	14	96	25
Precipitation	Fall	64	74	16	87	36
Precipitation	Winter	23	28	22	34	48
Max 1-Day Precipitation		15	18	20	20	33

As a result of the projected increase in spring temperatures for the 2021-2050 time period, the timing of the spring snowmelt event is expected to occur approximately 5 days earlier in the spring season. The timing of the start of snowfall in the fall season is expected to be delayed by approximately 13 days compared to the 1976-2005 time period due to the projected increase in fall temperatures.

As a result of the projected change in spring melt and fall freeze dates, the duration of winter is expected to decrease for the 2021-2050 time period by approximately 18 days. Due to the expected shorter winter duration, a reduction in total snow accumulation is expected; conversely, as a result of the projected monthly precipitation increases, snowfall in the Pond Inlet region is expected to increase. The combined net effect of a shorter winter and increased precipitation is an increase in snowfall during the winter months. It is estimated that the increase will be in excess of 5%.

In the spring, despite the timing of the freshet being expected earlier, the 2021-2050 warming rate is projected to be very similar to the average warming rate on record in the 1976-2005 time period. As climate change is projected to translate into an increase of 0.07 mm per day during the spring snowmelt period, it is expected that over the freshet period, lasting approximately 15 days, the total increase in precipitation is estimated to be a nominal 1 to 2 mm. Therefore, Tetra Tech estimates the springtime snowmelt runoff rates for the 2021-2050 time period to increase by a marginal amount.

During the part of the year when temperatures in Pond Inlet are above-freezing, rainfall is projected to increase by approximately 32%, from 78 mm to 103 mm, for the 2021-2050 time period. Due to the projected increase in rainfall, larger and more severe summer precipitation events are expected for the Pond Inlet region in the 2021-2050 time period. Figures 2-4 and 2-5 below show the Atlas Canada temperature and precipitation projections discussed in this section.

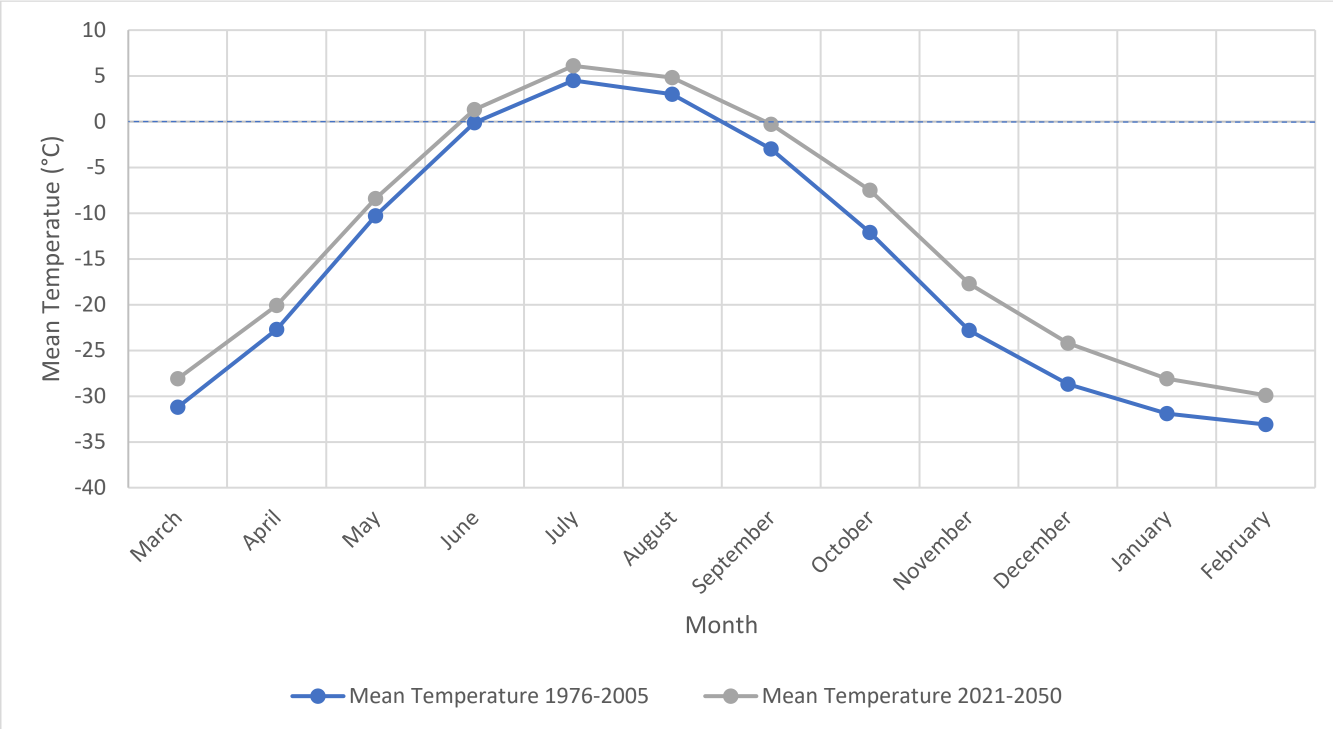


Figure 2-4: Atlas Canada Projected Monthly Mean Temperature

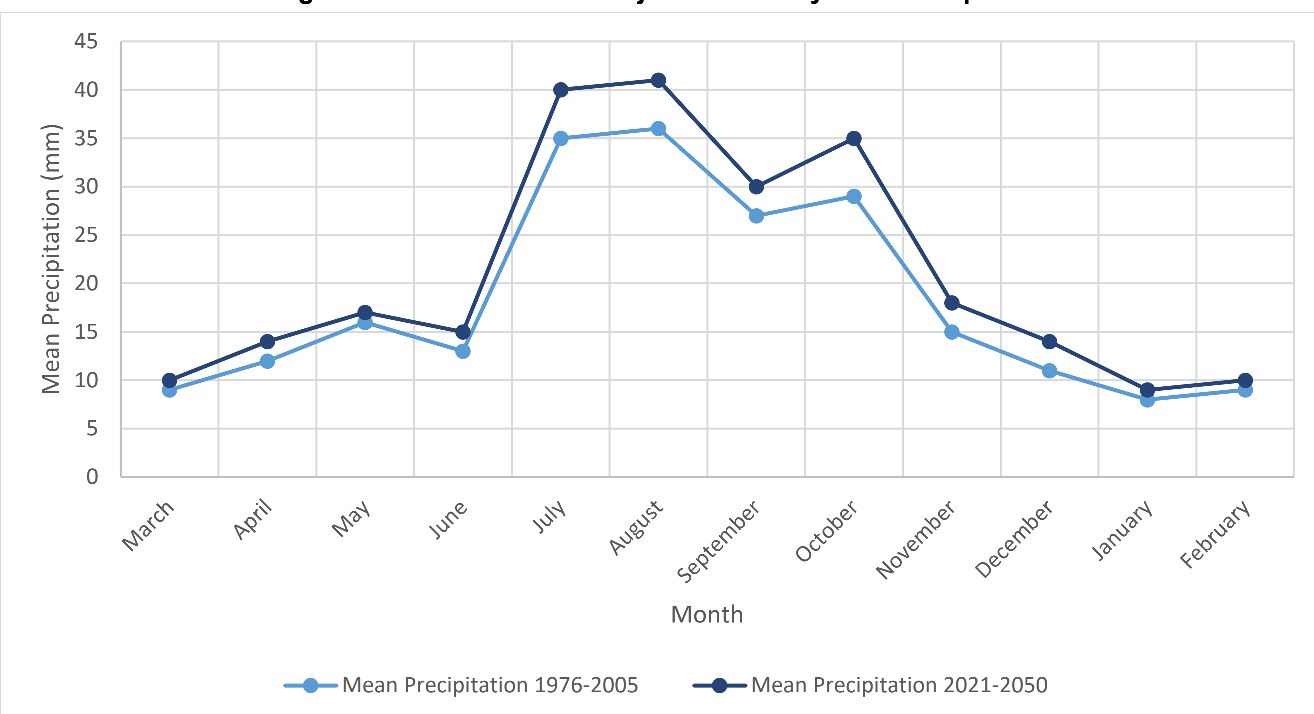


Figure 2-5: Atlas Canada Projected Monthly Mean Precipitation

2.4.2.2 Short Duration Rainfall Events

Climate change effects on short duration rainfall events are available through the IDF_CC Online Tool v4.0 developed by Western University (Simonovic, Schardong, Gaur, & Sandink, 2018). The tool provides rainfall intensity-duration-frequency (IDF) data from historic observations and climate change scenarios from 24 Global Circulation Models (GCMs).

Projected IDF data for the RCP 8.5 scenario and the time period of 2021 to 2050 is listed in Table 2-6. Detailed hydrological modelling of Pond Inlet was conducted based on these climate change adjusted rainfall depths.

Table 2-6: Projected IDF at Pond Inlet (2021 to 2050)

T (years)	2	5	10	25	50	100
5 min	0.87	1.11	1.28	1.48	1.61	1.73
10 min	1.27	1.61	1.87	2.2	2.44	2.68
15 min	1.64	2.06	2.36	2.73	3.02	3.28
30 min	2.86	3.59	4.01	4.39	4.61	4.76
1 h	4.32	5.42	6.13	6.87	7.27	7.61
2 h	6.19	7.97	9.32	11.1	12.35	13.73
6 h	11.61	15.79	18.81	22.59	25.42	27.89
12 h	16.79	21.66	24.38	27.16	28.42	29.38
24 h	20.77	27.75	32.1	36.59	39.41	41.71

2.4.3 Climate Change Implications

Due to limited climate change research available for the Hamlet of Pond Inlet, relevant findings from Lewis and Miller's "*Climate Change Adaptation Action Plan for Iqaluit*" (2010) was utilized for this section of the report. Lewis and Miller (2010) presented a summary of perceived sensitivities to climate change in Iqaluit, including the following:

Infrastructure

1. *Damage to infrastructure is expected to increase due to increases in climate variability and extreme events.*
2. *A decrease in the permafrost layer was identified as the most significant climate-related concern for infrastructure.*
3. *The following may be particularly at risk: buildings with shallow foundations; buildings, roads and buried pipes along steep south facing slopes and/or in areas of high snow accumulation; any building or road in areas of poor drainage where water may pool.*
4. *The following infrastructure may be vulnerable to other climate change impacts: buildings or piping in poor condition due to age, absence of regular maintenance, outdated design or over-extended use; infrastructure located along the coast which may be susceptible to damage from flooding or storm surges; the drainage system which may be impacted by changes in precipitation; and the City's water supply.*
5. *All new municipal infrastructure shall be designed and constructed to specifications that withstand projected changes in climate over their expected design life and meet sustainable development standards.*

6. *City outfalls should be designed to fall outside the range in tidal variability.*

Buildings

7. *With an increase of the active layer of permafrost, many existing building foundations could experience structural damage.*

8. *With a change in weather patterns such as extreme storm events, more extreme temperature variations, increased humidity in snow and more rain, buildings will be more susceptible to weathering and moisture damage.*

9. *Some waterfront buildings are vulnerable to flooding at extreme high tides or under storm surge conditions and minimum foundation levels may need to be established.*

Water Supply System

10. *Changes in permafrost will have implications for both existing and new underground piping.*

11. *Warmer air temperatures could cause surface evaporation of the City's water supply and could eventually reach temperatures that allow algae and other micro-organisms to grow, thereby compromising water quality.*

12. *Increased rainfall could potentially put the municipal water supply at risk by washing contaminants and soil into the reservoir.*

Wastewater Treatment System

13. *Increased precipitation, in the form of heavy rainfall, could overwhelm the system and cause failure or overflow, which could contaminate adjacent water bodies.*

Waste Disposal System

14. *Increase in the active layer of permafrost could lead to changes the freeze-thaw cycle, drainage and water flow around the landfill. Design and operation of the landfill needs to take this into consideration.*

3.0 EXISTING DRAINAGE SYSTEM AND ISSUES

A critical task in the development of a Drainage Master Plan is to identify, assess, and log all critical drainage infrastructure and known deficiencies. This process included the location and description of the physical assets that compose the drainage system, including key geometric characteristics and conditions. Using field and desktop data, this information was used to build a georeferenced map of the drainage infrastructure. The inventory also includes the location and description of existing issues such as ponding and damaged culverts. The following sections describe the activities conducted during the site visit, and the development of the georeferenced map of the drainage system.

3.1 Site Visit

A site visit was conducted from August 25-27, 2019 by two Tetra Tech staff, Mark Aylward-Nally and Josh Weidner. The purpose of the site visit was to:

- Discuss ongoing drainage issues and maintenance practices with the Pond Inlet foreman, Mr. Joanasie Naqitarvik;
- Conduct a walkthrough inspection of the drainage system of the Hamlet; and
- Conduct informal interviews with local residents regarding known drainage issues.

3.1.1 Walkthrough Inspection

A walkthrough of Pond Inlet was conducted from August 25 to August 27 2019. The objective of the site visit was to:

- Develop an understanding of the drainage patterns through the town;
- Identify main drainage routes and key infrastructure assets;
- Get GPS points of key infrastructure locations, for instance upstream and downstream culvert ends;
- Measure culvert dimensions and document culvert conditions;
- Identify areas of ponding;
- Record a photo inventory of key elements of the drainage infrastructure;
- Identify drainage outlet locations; and
- Conduct Informal Interviews with Hamlet residents.

Based on the walkthrough inspection, Tetra Tech has observed the following:

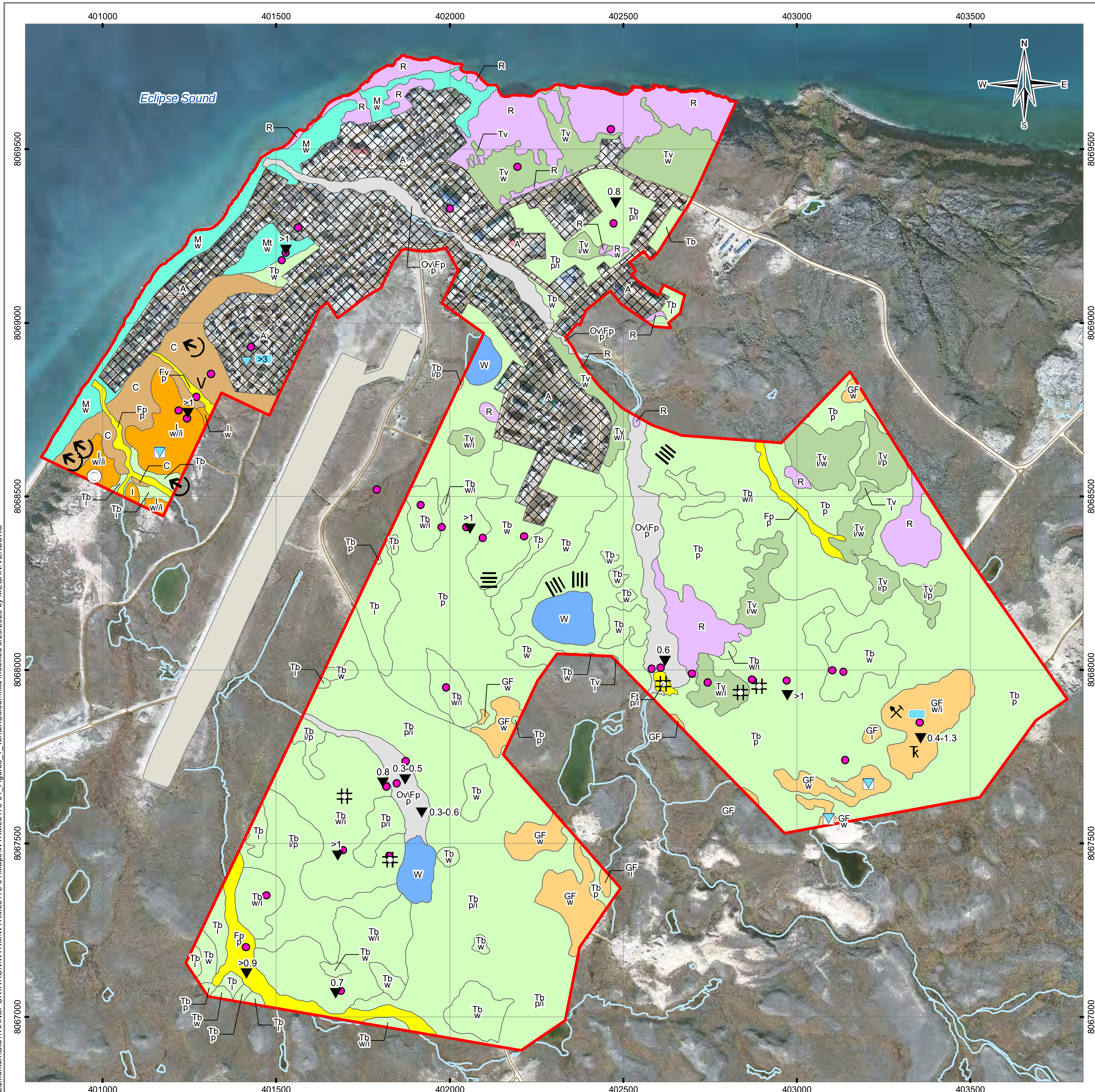
1. Several areas are plagued by nuisance ponding, roadway rutting, and have the potential for roadway washouts.
2. The road nearest Eclipse Sound has the potential for roadway washouts during heavy rainfall events or large snowpack years.

Photographs of the existing system components and their condition are included in Appendix E.

3.2 Geology Field Reconnaissance

The site visit was conducted by Dr. Roujanski of Tetra Tech's Edmonton office from September 5 to 9, 2019. The purpose of the field reconnaissance was to confirm the findings of the background data review and preliminary terrain mapping, as well as to collect additional data relevant to potential terrain-related constraints.

The fieldwork focused on the proposed community expansion areas. A series of foot traverses were conducted across the study area with stops at selected observation sites shown on Figures 3-1 and 3-2. The collected information includes types of surficial materials, surface expression, soil drainage conditions, and permafrost-related processes and landforms. Numerous GPS-linked photographs of the terrain features were taken. The active layer thickness (ALT) was measured with a permafrost probe in finer grained and organic materials. Measuring active layer thickness with the permafrost probe at some observation sites was found ineffective due to the high clast content of the surficial materials. ALT measurements taken at the end of summer are shown on Figures 3-1 and 3-2.



LEGEND

- Field Observation Site Location
- Active Layer Thickness (m, measured)
- Donut-Shaped Ice Contact Features
- Ice Wedge Penetrated by Drill
- Ice Wedge Polygons
- Massive Ice Bed (m, measured thickness)
- Patterned Ground, undifferentiated polygons and circles
- Patterned Ground, undifferentiated soil stripes
- Sand Borrow Pit
- Thaw Flow Slide
- Thermal Erosion Feature
- Thermokarst Terrain
- Study Area
- Runway
- Gravel Road
- Watercourse
- Waterbody

NOTES
Terrain Classification based on data provided by Carleton.
Hydrology and transportation base data provided by Government of Nunavut, August 2016
Imagery provided by Google Earth (August 31, 2010)

SURFICIAL MATERIAL

- **O** — **Organic Deposit:** peaty organic soils observed as thin veneers overlying till or fluvial sediments.
- **F** — **Fluvial (Alluvial) Deposit:** stratified silt, sand and gravel, commonly cobbly and bouldery, transported, deposited or modified by small modern streams.
- **C** — **Colluvial Deposit:** poorly sorted, commonly poorly compacted material (coarse sand, gravel, cobbles, boulders) deposited by mass wasting, including creep, debris flows (or slides) and thaw slumping.
- **M** — **Marine (Nearshore) Deposit:** sediments (coarse sand, gravel, cobbles and boulders) related to marine inundation during periods of higher sea level.
- **GF** — **Glaciofluvial Deposit:** stratified well sorted sand (predominantly) deposited by meltwater in front of retreating glaciers; forming isolated mounds or short ridges.
- **I** — **Ice Contact Drift:** mixture of stratified glaciofluvial material and massive till deposited against glacier ice; forming isolated mounds or short ridges; commonly deformed and faulted.
- **T** — **Till (Glacial Deposit):** unsorted glacial debris (diamicton) deposited directly by glacier ice by lodgment or by melt out during ablation.
- **Tv** — **Till Veneer:** till up to 1 m thick; surface reflects topography of the underlying bedrock; commonly includes patches of exposed bedrock, till blanket, glaciofluvial material and felsenmeer.
- **Tb** — **Till Blanket:** till greater than 1 m thick; may include patches of till veneer, hummocky till (generally 5 to 15 m thick), exposed bedrock, and felsenmeer.
- **R** — **Bedrock:** exposed igneous and metamorphic rocks (granite, gneiss, schist) of Precambrian age.
- **W** — **Water:** water bodies such as lakes and ponds.
- **A** — **Anthropogenic Material:** human-made or modified geological material whose original properties have been changed.

TERRAIN CODE

Upper case letter = Surficial Material
Lower case letter = Surficial Expression

Ov//Fp
p/i

Delimiter; Second unit; Secondary Drainage; First unit; Primary Drainage; Drainage Delimiter

SURFICIAL EXPRESSION

- **v Veneer:** deposit less than 1 m thick (less than 0.3 m for organic deposits); surface mimics form of the underlying unit (generally bedrock).
- **b Blanket:** deposit greater than 1 m thick (generally 1 to 5 m thick; more than 0.3 m for organic deposits); minor irregularities of the underlying unit (generally bedrock) are masked.
- **p Plain:** flat or relatively level landscape element; bedrock topography is masked.
- **t Terrace:** level or gently inclined surface flanked by steep slope or scarp.

DRAINAGE CLASS

- **w** Well Drained Surface
- **i** Imperfectly Drained Surface
- **p** Poorly Drained Surface

DELIMITERS

- **/** First component more common than second (e.g. i/w means that 60-75% of the polygon area is imperfectly drained, with the remainder being well drained.
- **//** First component much more common than second (e.g. w//i means that 80-95% of the polygon area is well drained, with the remainder being imperfectly drained).
- **** First component overlies the second (e.g. Ov\Fp means organic veneer overlies fluvial plain).

STATUS
ISSUED FOR USE

GEOTECHNICAL INVESTIGATION AND DRAINAGE PLANNING POND INLET, NUNAVUT

Terrain, Permafrost Features, and Field Observation Site Locations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:12,000
200 100 0 200
Metres

FILE NO.
WTRM03178-01_Figure3_1_TerrainColour.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	VER	0

DATE	PROJECT NO.
March 26, 2020	TRN.WTRM03178-01

TETRA TECH

Figure 3-1

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LEGEND

- Field Observation Site Location
- Active Layer Thickness (m, measured)
- Donut-Shaped Ice Contact Features
- Ice Wedge Penetrated by Drill
- Ice Wedge Polygons
- Massive Ice Bed (m, measured thickness)
- Patterned Ground, undifferentiated polygons and circles
- Patterned Ground, undifferentiated soil stripes
- Sand Borrow Pit
- Thaw Flow Slide
- Thermal Erosion Feature
- Thermokarst Terrain
- Study Area
- Runway
- Gravel Road
- Watercourse
- Waterbody

NOTES
Terrain Classification based on data provided by Carleton.
Hydrology and transportation base data provided by Government of Nunavut, August 2016
Imagery provided by Google Earth (August 31, 2010)

SURFICIAL MATERIAL

O — **Organic Deposit:** peaty organic soils observed as thin veneers overlying till or fluvial sediments.

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C — **Colluvial Deposit:** poorly sorted, commonly poorly compacted material (coarse sand, gravel, cobbles, boulders) deposited by mass wasting, including creep, debris flows (or slides) and thaw slumping.

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T — **Till (Glacial Deposit):** unsorted glacial debris (diamicton) deposited directly by glacier ice by lodgment or by melt out during ablation.

Tv — **Till Veneer:** till up to 1 m thick; surface reflects topography of the underlying bedrock; commonly includes patches of exposed bedrock, till blanket, glaciofluvial material and felsenmeer.

Tb — **Till Blanket:** till greater than 1 m thick; may include patches of till veneer, hummocky till (generally 5 to 15 m thick), exposed bedrock, and felsenmeer.

R — **Bedrock:** exposed igneous and metamorphic rocks (granite, gneiss, schist) of Precambrian age.

W — **Water:** water bodies such as lakes and ponds.

A — **Anthropogenic Material:** human-made or modified geological material whose original properties have been changed.

TERRAIN CODE

Upper case letter = Surficial Material
Lower case letter = Surficial Expression

Ov//Fp
p/i

Delimiter; Second unit; Secondary Drainage; First unit; Primary Drainage; Drainage Delimiter

SURFICIAL EXPRESSION

v — **Veneer:** deposit less than 1 m thick (less than 0.3 m for organic deposits); surface mimics form of the underlying unit (generally bedrock).

b — **Blanket:** deposit greater than 1 m thick (generally 1 to 5 m thick; more than 0.3 m for organic deposits); minor irregularities of the underlying unit (generally bedrock) are masked.

p — **Plain:** flat or relatively level landscape element; bedrock topography is masked.

t — **Terrace:** level or gently inclined surface flanked by steep slope or scarp.

DRAINAGE CLASS

w Well Drained Surface

i Imperfectly Drained Surface

p Poorly Drained Surface

DELIMITERS

/ First component more common than second (e.g. i/w means that 60-75% of the polygon area is imperfectly drained, with the remainder being well drained.

// First component much more common than second (e.g. w//i means that 80-95% of the polygon area is well drained, with the remainder being imperfectly drained).

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STATUS
ISSUED FOR USE

GEOTECHNICAL INVESTIGATION AND DRAINAGE PLANNING POND INLET, NUNAVUT

Terrain, Permafrost Features, and Field Observation Site Locations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:12,000
200 100 0 200
Metres

TETRA TECH

FILE NO.
WTRM03178-01_Figure3_2_TerrainHollow.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	VER	0

DATE	PROJECT NO.
March 26, 2020	TRN.WTRM03178-01

Figure 3-2

3.3 Geology Terrain Mapping

3.3.1 Surficial Geology and Permafrost

Surficial geology and permafrost feature mapping of the proposed Pond Inlet community expansion areas was carried out by Mr. Vladislav E. Roujanski, Ph.D., P.Geol. and Ms. Jennifer Stirling, P.Geo., with GIS support provided by Ms. Megan Verburg.

The existing surficial geology map of the region (Klassen 1993) and aerial photography interpretation mapping of Pond Inlet by AMEC (2003) were reviewed and modified to create a detailed terrain and permafrost feature map of the study area. The B&W air photos (stereopairs) listed in Section 2.1 were interpreted using a Sokkia MS27 stereoscope. Surficial geology polygons and permafrost features were delineated on Google Earth Pro™ historical imagery of the study area using Google Earth Pro™ mapping tools.

The resultant terrain and permafrost feature map shows spatial distribution of surficial materials, permafrost-related geomorphic features and processes. Surficial geology polygons were delineated in areas where terrain and subsurface data was available. This information was then extrapolated to unknown areas using appearance (texture, colour, hue etc.) on the air photos. Permafrost-related terrain features, such as ice-wedge polygons, thermokarst, thermal erosion features etc.), which may pose a challenge for the proposed community expansion, are shown on the map as point and line symbols.

All terrain polygons were assigned a drainage class, except for “the Anthropogenic Material” map unit, drainage of which was modified during the land development. The following three drainage classes are used to characterize drainage conditions across the study area:

- Well drained (**w**);
- Imperfectly drained (**i**); and
- Poorly drained (**p**).

These drainage classes are relative and qualitative.

The terrain and permafrost feature map is presented at a scale of 1:12,000 and should be considered accurate to that scale (Figures 3-1 and 3-2).

3.3.2 Development Suitability Ranking

Construction suitability within the study area is based on the presence of terrain constraints and potential geohazards.

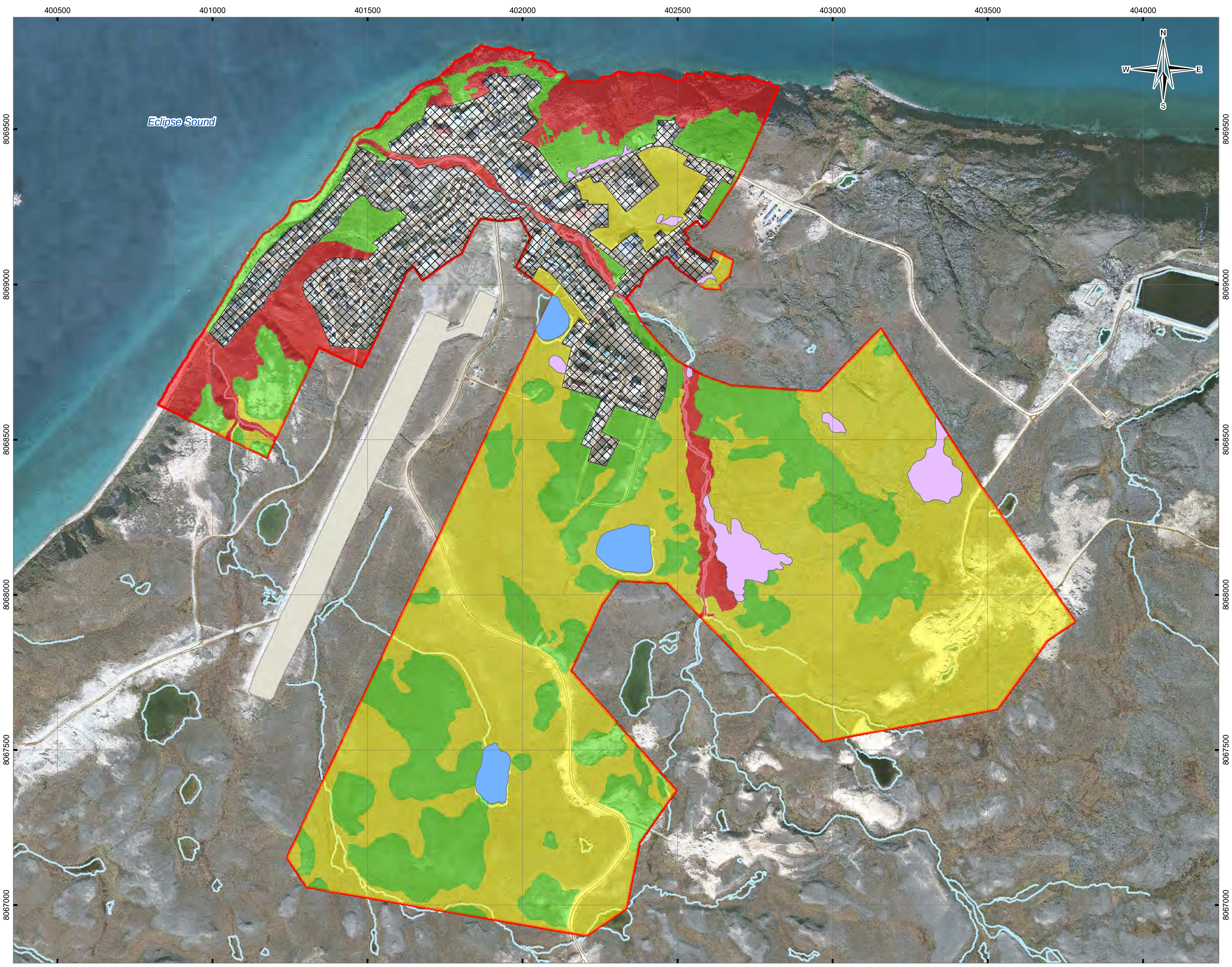
Terrain constraints in the study area include surficial material types, permafrost conditions (thermal state and ice content, especially occurrence of massive ice bodies), permafrost-related geomorphic processes and landforms, drainage conditions, flooding of areas of low-lying ground adjacent to larger stream channels, terrain stability and its ruggedness, particularly slope steepness. These naturally occurring features affect the design, construction techniques and maintenance of the community infrastructure, housing and facilities.

Geohazards in the study area include thermal erosion, permafrost degradation in the form of thermokarst, ground differential settlement and subsidence, permafrost-related mass wasting such as thaw flow slides and other hazardous geomorphic processes and phenomena, such as flooding. These processes may damage or adversely affect existing or potential infrastructure, housing and facilities.

These permafrost terrain features were identified through background data review, desktop terrain analysis and mapping, and field observations during a recent site visit. A Development Suitability Map of the study area was produced at a scale of 1:12,000 (Figure 3-3).

The development suitability classes for the project area were established as follows:

- **Suitable for Development:** Permafrost appears to be predominantly ice-poor with ground ice content generally less than 10% by volume of visible ice; permafrost terrain is generally stable; the ground surface is well- to imperfectly-drained; relatively flat to gently sloping and permafrost processes are inactive to limited.
- **Conditionally Suitable for Development (Provided Tetra Tech's Drainage Improvement Plan is Implemented):** Permafrost appears to be of medium to high ice content, i.e. 10 to more than 20% by volume of visible ice and may locally contain significant accumulations of ground ice; permafrost is relatively stable to locally unstable and sensitive to human-induced disturbance; ground surface is imperfectly to poorly drained with pools of standing water; and there is evidence of active hazardous permafrost processes, such as thermokarst.
- **Unsuitable for Development:** Unsuitable for development terrain category consists of rugged bedrock outcrops with steep slopes, and patches of unstable colluvial veneer, frost-shattered and frost-jacked blocks of rock. It also includes steep slopes developed in unconsolidated perennially frozen ice contact drift and glacial drift deposits. The slopes are covered with unstable colluvial blanket. There is widespread evidence of permafrost-related mass wasting processes such as thaw flow slides, solifluction, debris slides and other hazardous permafrost-related geomorphic processes, such as thermal erosion and thermokarst. For example, an area along the Eclipse Sound coastline, in the southwest corner of the town limits, where five new lots are proposed, is unsuitable for development because of its location within the potential run-out zone of landslides. Floodplains, i.e. areas of low-lying ground adjacent to major stream channels of the study area, which are subject to seasonal flooding should be also excluded from proposed development.



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LEGEND

Study Area

Development Suitability

- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented
- Unsuitable for Development

Terrain Not Assessed for Development Suitability

- Anthropogenic
- Bedrock
- Water

Base Features

- Runway
- Gravel Road
- Watercourse
- Waterbody

NOTES

Base data source:
Terrain Classification based on data provided by Carleton.
Hydrology and transportation base data provided by Government of Nunavut, August 2016
Imagery provided by Google Earth (August 31, 2010)

STATUS
ISSUED FOR USE

GEOTECHNICAL INVESTIGATION AND DRAINAGE PLANNING POND INLET, NUNAVUT

Development Suitability

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:12,000

200 100 0 200

Metres

FILE NO.
WTRM03178-01_Figure3_3_Suitability.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-EDM	MRV	SL	VER	0

DATE
March 26, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 3-3

3.3.3 Development of the Georeferenced Map

Using the GPS points, field notes and photographs obtained during the site visit, the topology of the drainage network was put together in a GIS shapefile. The shapefile includes locations of open channels (ditch or swale) or culverts. A naming convention was developed and every asset was named in the shapefile. Connectivity of the drainage system was developed using data from the site visit, and supplemented by mapping data provided by the government. A separate shapefile was created to mark areas with drainage issues identified during the site visit. The drainage issues identified included ponding areas, damaged culverts, uncontrolled overland flow and erosion issues. Figures 3-4 to 3-9 in Section 3.6 highlight the documented drainage issues.

3.4 Drainage

The drainage patterns of the Hamlet of Pond Inlet follow the natural relief, however the construction of fill pads for buildings and road embankments have modified the natural drainage trends, leading to an increase in surface runoff volume and peak flows. The majority of runoff passing through the community is confined to a single watercourse, with its headwaters located within the uplands which are upstream of the community. Runoff from these uplands collects in a channel alongside the airstrip before flowing north through the community and into Eclipse Sound. We estimate this watercourse to have a watershed area of approximately 89 hectares at its confluence with the sound.

Tetra Tech have completed a delineation of the existing drainage patterns within Pond Inlet using the 2015 Aerial Photograph derived DEM as well as from observations and photographs collected during the site visit. Drainage areas and flow paths are presented on Figure 2-2 in Section 2.3.3.

The majority of the land allocated for future expansion of the community is located on the east side of the airport based on the 2014 Community Plan. Developing drainage paths and proposed drainage infrastructure for these future development areas is included within the scope of the Master Drainage Plan.

3.5 Drainage Infrastructure

During the 2019 site visit, existing ditches, swales, and natural streams were observed. Additionally, 83 culverts were assessed. The diameter of the culverts ranged from 100 mm to 1400 mm, with the majority having a diameter of 500 mm or 600 mm. Most of the culverts were damaged or partially or fully buried, and some were more functional than others. An Inventory of Existing Culverts is included in Appendix E. Naturally formed swales and streams were observed throughout the community including few formal ditches.

3.6 Drainage Issues

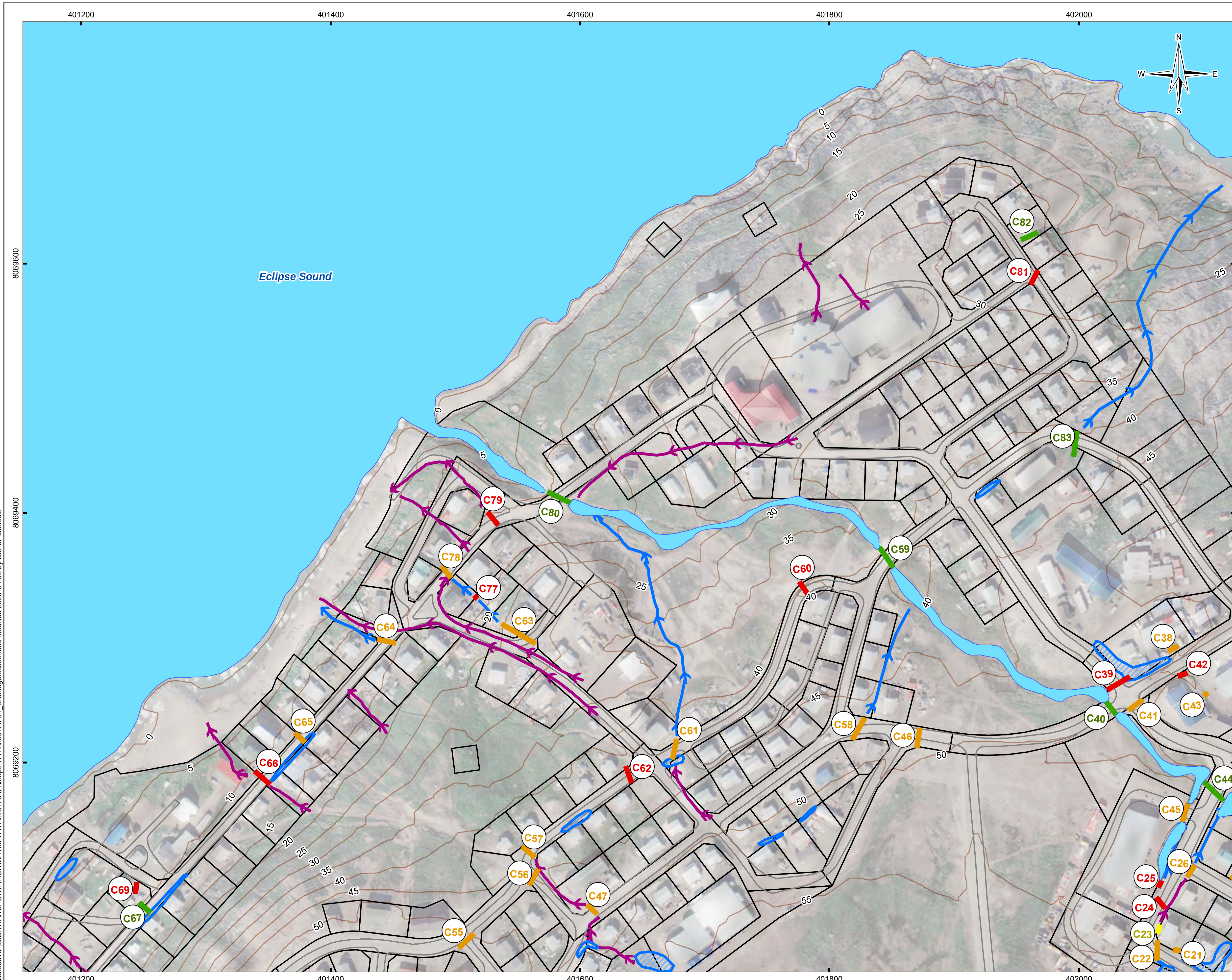
Developing and maintaining a well-functioning drainage system is an ongoing concern within most northern communities. From Tetra Tech's 2019 site visit, several types of drainage issues in Pond Inlet were identified. Many existing culverts were damaged, buried, and/or blocked with sediment, rocks, and debris. Ice blockages were also noted. A lack of formalized ditches was an issue which resulted in ponding and flow paths across roadways which can cause washouts and rutting during a larger rain or snowmelt event.

Typical drainage issues identified within the community of Pond Inlet are detailed in Table 3-1.

Table 3-1: Pond Inlet Drainage Issues

Issue	Cause
Spring flooding	Culvert blocked by ice/snow
Damaged culvert inlet/outlet	Damage caused by excavator cleaning snow and/or ice during spring
Buried or blocked culvert inlet/outlet	Culvert inlet and/or outlet blocked due to sediment, rock, and debris deposition, and/or ice blockage.
Ponding	Blocked culverts, poor grading, vegetation overgrowth, lack of an outlet.
Erosion	Velocity threshold for erosion is exceeded

Figures 3-4 to 3-9 below depict the drainage issues and existing infrastructure identified in Pond Inlet. Figures 3-10 to 3-17 show examples of the typical drainage issues identified during Tetra Tech's site visit. Appendix E includes a summary of the existing culverts and erosion sites identified within the community.



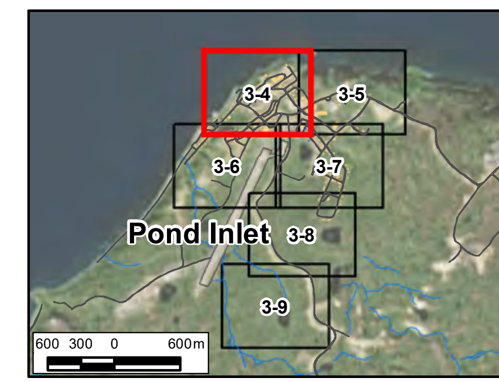
LEGEND

Culverts
- Functioning as Intended
- Partially Blocked
- Damaged
- Blocked

C## Culvert Number

Open Channels
- Well Defined Flow Path
- Overland Flow Path
- Ponding

Base Data
- Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

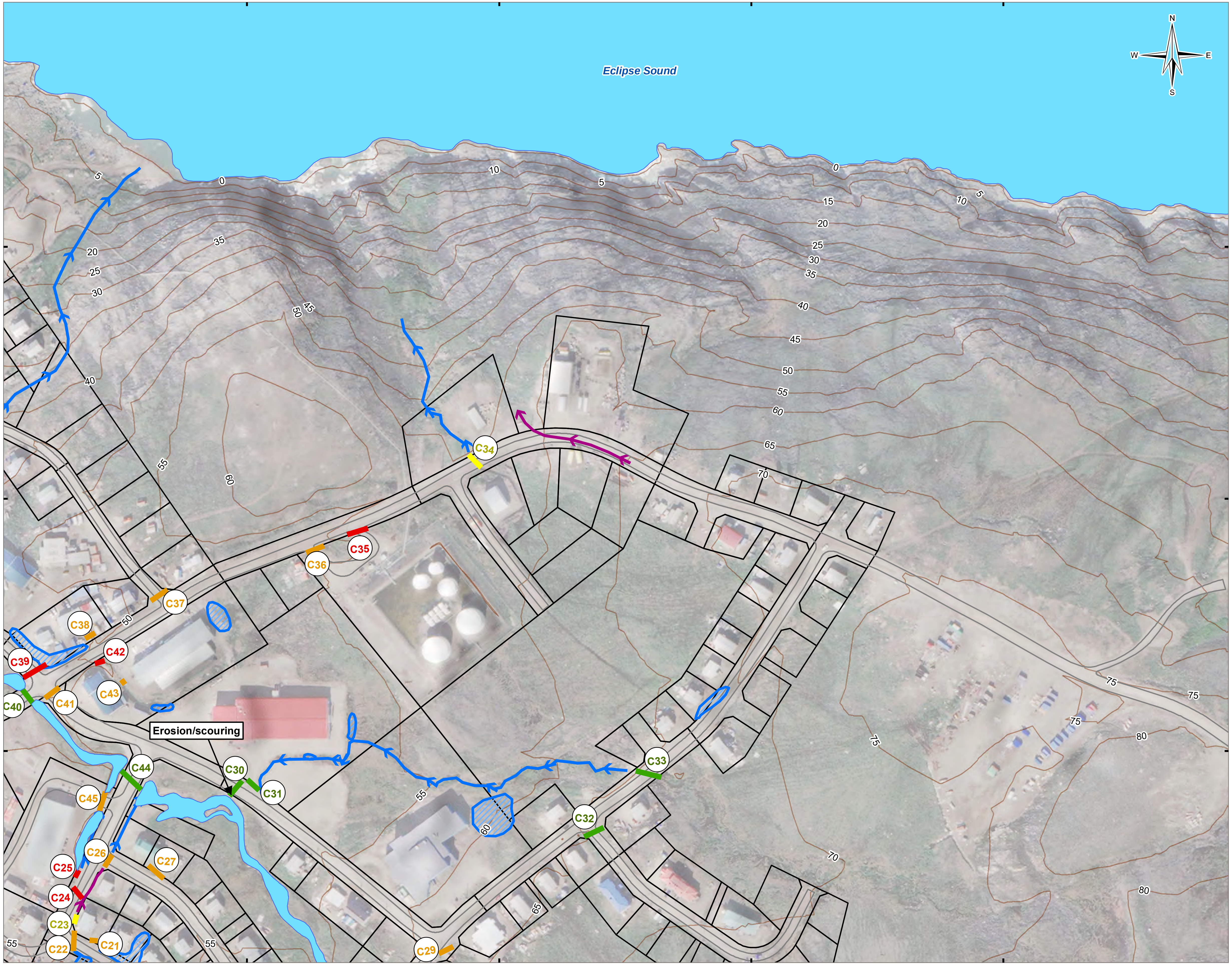
PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageIssues.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 3-4



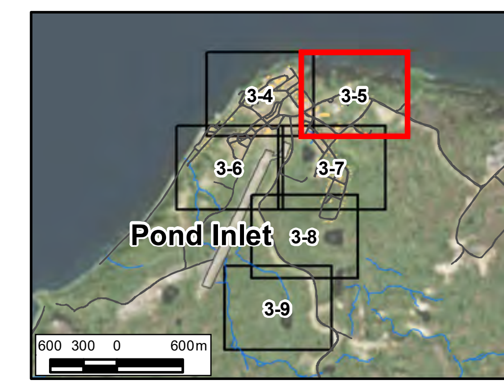
LEGEND

C## Culvert Number

Culverts
- Functioning as Intended
- Partially Blocked
- Damaged
- Blocked

Open Channels
- Well Defined Flow Path
- Overland Flow Path
- Ponding

Base Data
- Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_DrainageIssues.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE
April 6, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 3-5

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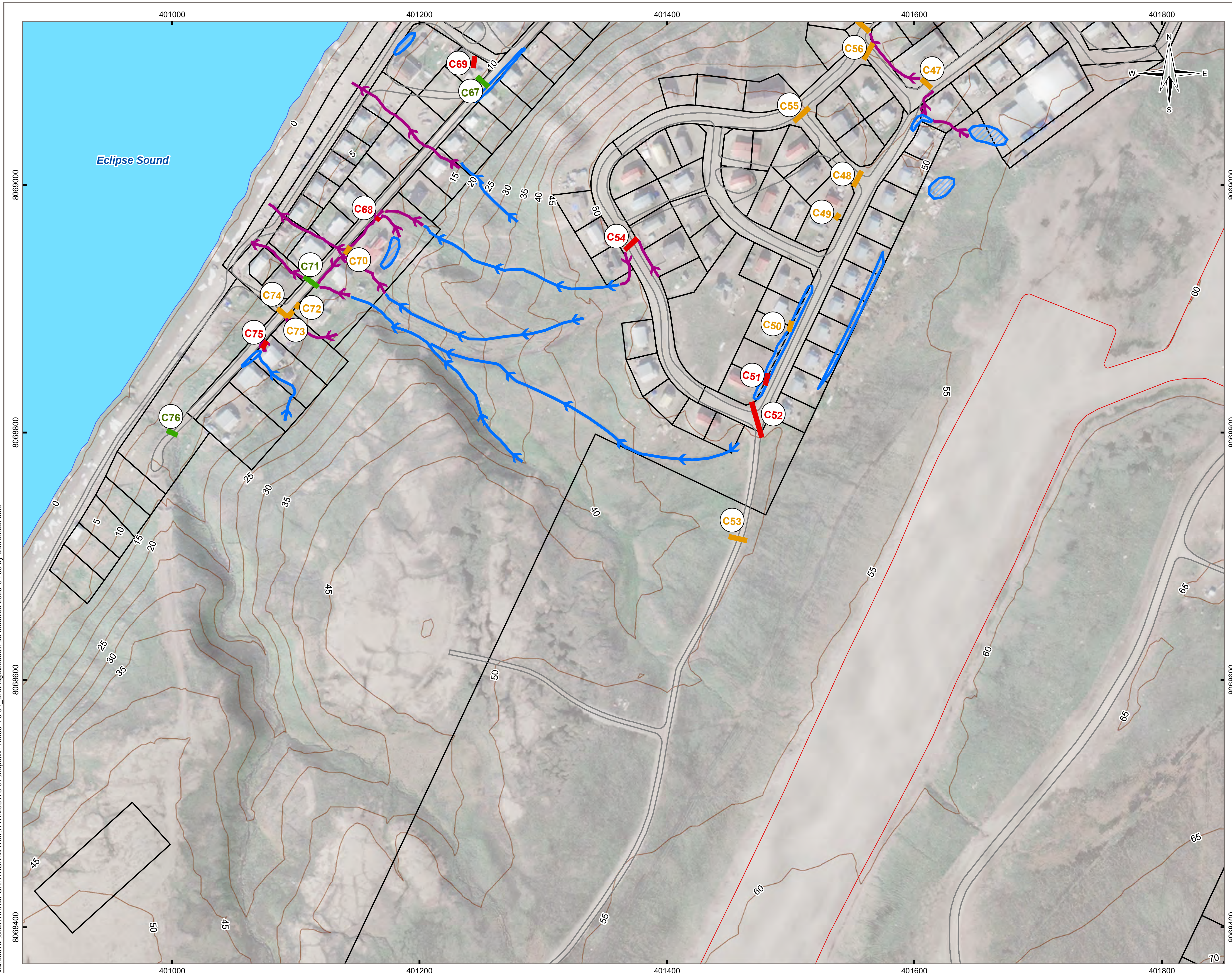


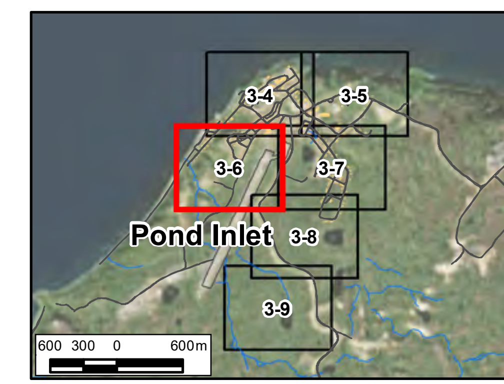
LEGEND

Culverts
- Functioning as Intended
- Damaged
- Blocked

Open Channels
- Well Defined Flow Path
- Overland Flow Path
- Ponding

Base Data
- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody

C## Culvert Number



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.
WTRM03178-01_DrainageIssues.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE
April 6, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 3-6

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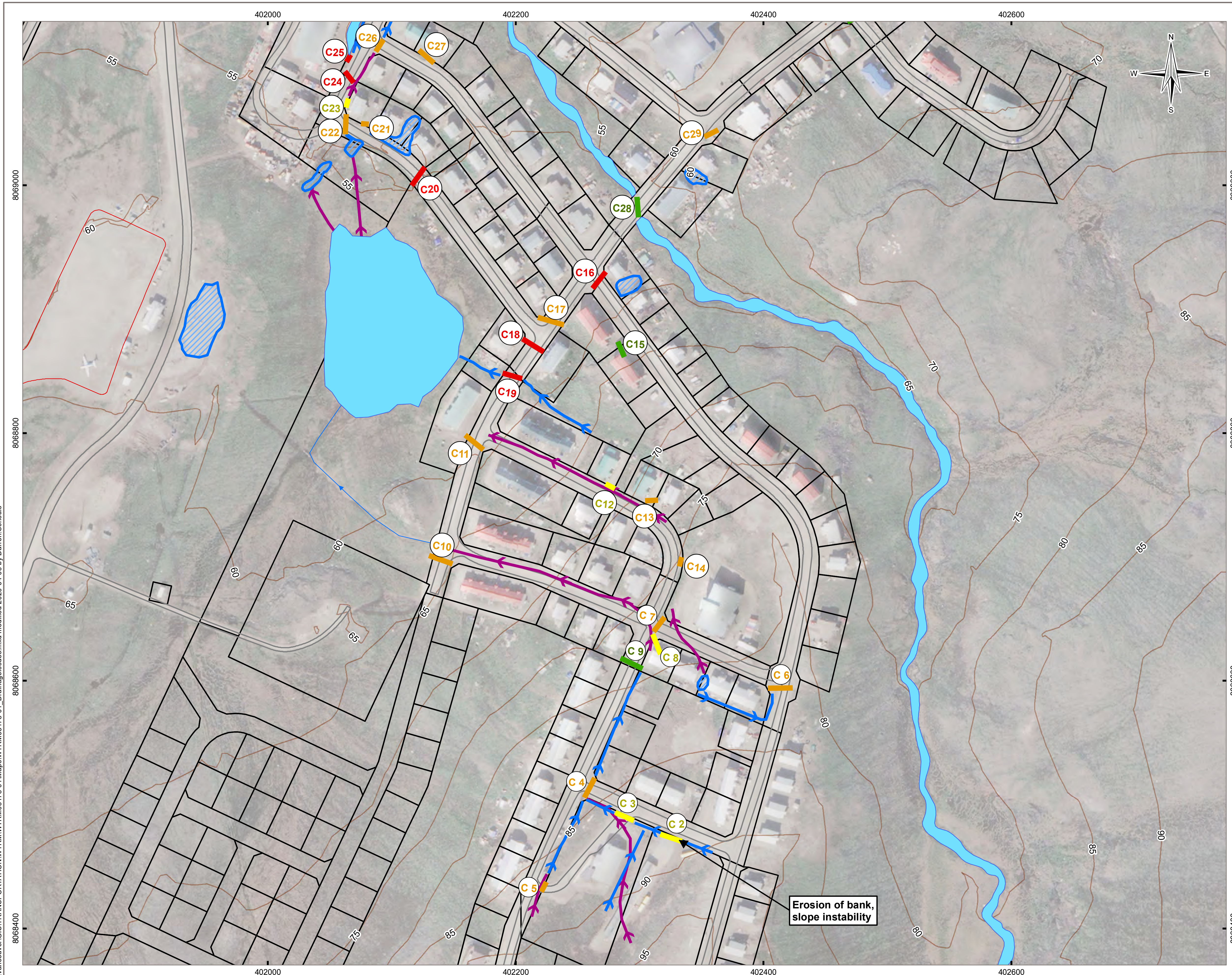


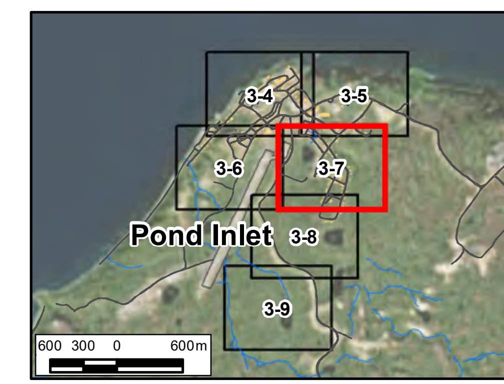
LEGEND

Culverts
- Functioning as Intended
- Partially Blocked
- Damaged
- Blocked

C## Culvert Number

Open Channels
- Well Defined Flow Path
- Overland Flow Path
- Stream
- Ponding

Base Data
- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageIssues.mxd				
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DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 3-7

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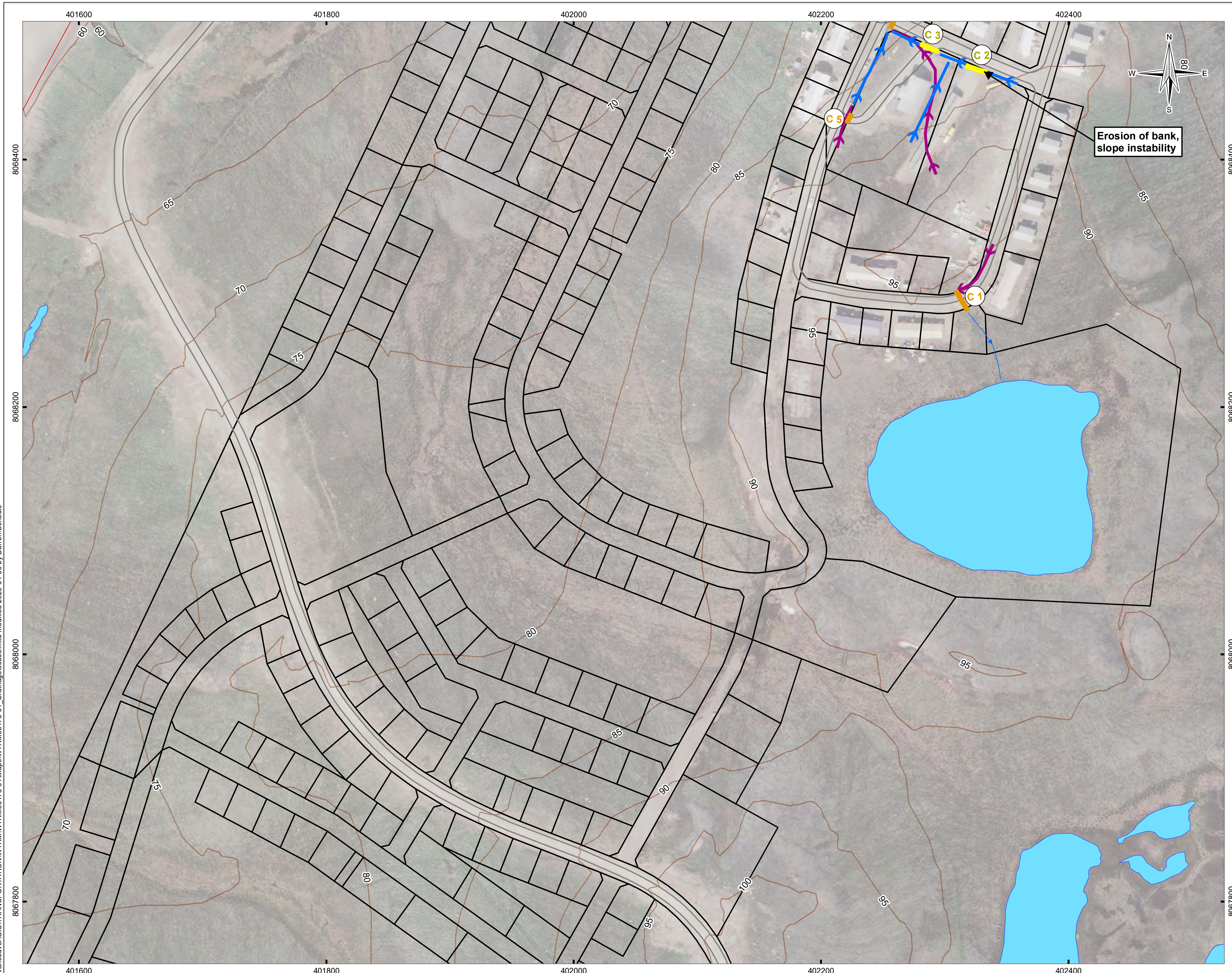


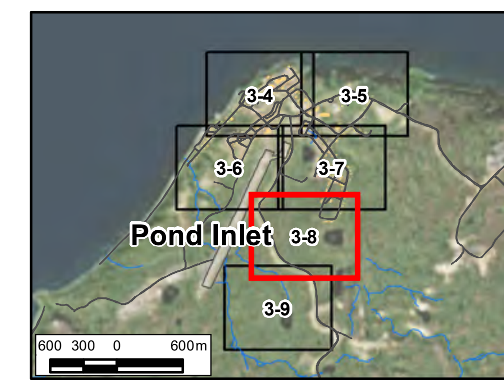
LEGEND

Culverts
- Partially Blocked
- Damaged

Open Channels
- Well Defined Flow Path
- Overland Flow Path
- Stream

Base Data
- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody

C## Culvert Number



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

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FILE NO.
WTRM03178-01_DrainageIssues.mxd

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Tt-VANC	DS	SL	ER	0

DATE
April 6, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 3-8

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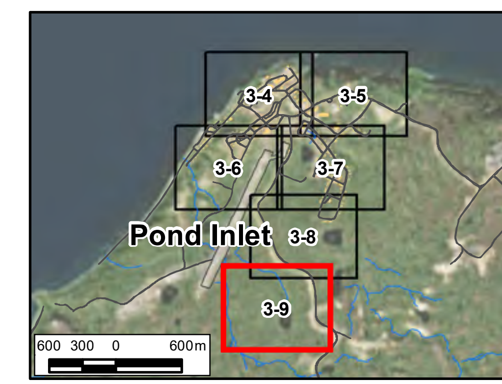
LEGEND

Base Data

- Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody
- C## Culvert Number



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Drainage Issues Based on August 25-27 Field Visit Observations

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageIssues.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 3-9

Figures 3-10 to 3-17: Pond Inlet Drainage Issues – Site Visit August 25-27

Figure No.	Description	Image
3-10	Buried culvert inlet. Culvert C16	
3-11	Damaged culvert outlet. Culvert C57	

Figure No.	Description	Image
3-12	Ponding water near building	
3-13	Road washout	

Figure No.	Description	Image
3-14	Buried culvert outlet. Culvert C37	
3-15	Culvert damaged due to insufficient cover. Culvert C48	

Figure No.	Description	Image
3-16	Ponding water around house. Formalized swale and raised road elevation needed.	
3-17	Erosion caused by runoff flowing across road	

4.0 ANALYSIS OF DRAINAGE SYSTEM

Drainage principles, design criteria, and design scenarios used to develop the proposed drainage system for the Hamlet of Pond Inlet are described in this section of the report, as well as modelling results and recommendations.

4.1 Drainage Principles

According to the guidelines for community drainage system planning, design, and maintenance in northern communities (CSA Group, 2015), the drainage system should be designed in accordance with the level of risk that is established during the planning process. The CSA Group also noted that:

- *"It is recognized that the capacity of any drainage system might be exceeded at some point.*
- *The design will be impacted by physical constraints present within communities.*
- *The desired acceptable level of risk might not be achievable in any given community due to physical (spatial) limitations, resources, subsurface conditions, and topography, among other factors.*
- *The acceptable level of risk established might be impacted by the changing the climate, for example, due to the changing climate, what was previously considered to be a 1-in-10 year event might occur on average every five years in the future."*

In addition to the CSA Group's design principles, the development of the proposed upgrades was based on Tetra Tech's practical principles as follows:

1. Effectively capture and route water around populated areas to protect buildings and communities.
    a. Where possible, minimize the imposition of waterways through populated areas by restricting use of large ditches to areas outside of the populated areas;
2. Utilize shallow swales for driveway crossings and roadside drainage.
3. Minimize complexity for drainage system construction, maintenance, and management by:
    a. Minimizing the number of different culvert diameters specified.
    b. Minimizing the number of new culverts, which would not only need to be barged to Pond Inlet for installation, but also need to be maintained once installed.
    c. Minimizing the number of different ditch and swale dimensions specified.
    d. Keeping the design simple such that the Hamlet foreman and crew can not only construct but also maintain the new drainage systems with ease.
4. Capture and immediately convey water towards the nearest major watercourse/waterbody (i.e. ocean, lake, river, or stream).
5. Use multiple outlets to add redundancy at critical locations throughout the system.
6. Design using projected precipitation trends to account for future climate change.
7. Select culvert sizes based on available roadway embankment cover.

8. Design drainage swales through driveways to comfortably accommodate the tires and undercarriage of vehicles.

9. Develop plans recognizing the land use limitations, for example remove nuisance ponding from the front of the Northern Store and from the foot of exterior staircases leading to residences.

4.2 Design Criteria

As per the guidelines for community drainage system planning, design, and maintenance in northern communities (CSA Group, 2015), the culvert design capacity prescribed by the CSA Group is:

- *Size culverts to accept design flow at 80% capacity under free flow condition (1:10 year event).*
- *Size culverts to accept 1:100 design flow at 80% of available head at entrance.*

In addition to the above requirements the proposed drainage system was developed to meet the following general criteria:

1. Ditches and swales were sized to convey the 10-year snowmelt event. The 10-year snowmelt event was selected as the critical 10-year event following a review of freshet snowmelt events and a number of rainstorm durations ranging from 1 hour to 24 hours. The goal was to provide sufficient capacity to handle the critical event. Tetra Tech has further upsized the culverts to add additional capacity to compensate for debris deposition blocking the culverts and limiting their capacity. Buried culverts and significant deposition was noted in the majority of culverts identified in the field visit described in Section 3.1.

2. Ditches were sized to maintain at least 100 mm of freeboard during the 10-year snowmelt event.

3. Swales were sized to maintain at least 50 mm of freeboard during the 10-year snowmelt event.

4.3 Design Scenarios

The model was run with six design storm scenarios: the 10-year 1-hr, 10-year 24-hr, 10-year snowmelt, 100-year 1hr, 100-year 24hr, and 100-year snowmelt event. Using historical data extracted from the Pond Inlet weather station, a synthetic distribution was developed to represent the rainfall pattern likely to develop over the course of a 24 hour rainfall event.

The 1-hr storm distributions were developed using the Northern Quebec AES distribution. Climate change adjusted precipitation volumes for each of the scenarios were obtained using the IDF_CC Tool v4.0 developed by Western University as described in Section 2.4.1 of this report. The resulting peak flow rates for each design storm are summarized in Table 4-1.

As stated in Section 4-2, the 10-year snowmelt event was selected as the critical 10-year event following a review of freshet snowmelt events and a number of rainstorm event durations ranging from 1 hour to 24 hours. The snowmelt events were estimated by running a continuous model of Pond Inlet between 1989 and 2019. Annual freshet flow rates were generated over this time span. A statistical analysis was carried out on the estimated annual flow rates to produce 10-year and 100-year snowmelt-driven flow rates (Figure 4-1). The results of the statistical analysis for culvert C80 are shown in Table 4-2.

Table 4-1: Pond Inlet Design Storm Events

Design Storm Events	Peak Flow Rate (m^3/s) *
10-year 1-hour	0.1
10-year 24-hour	1.8
10-year Snowmelt	2.8
100-year 1-hour	0.2
100-year 24-hour	2.3
100-year Snowmelt	4.2

* Peak Flow Rate shown for culvert C80 in the PCSWMM model.

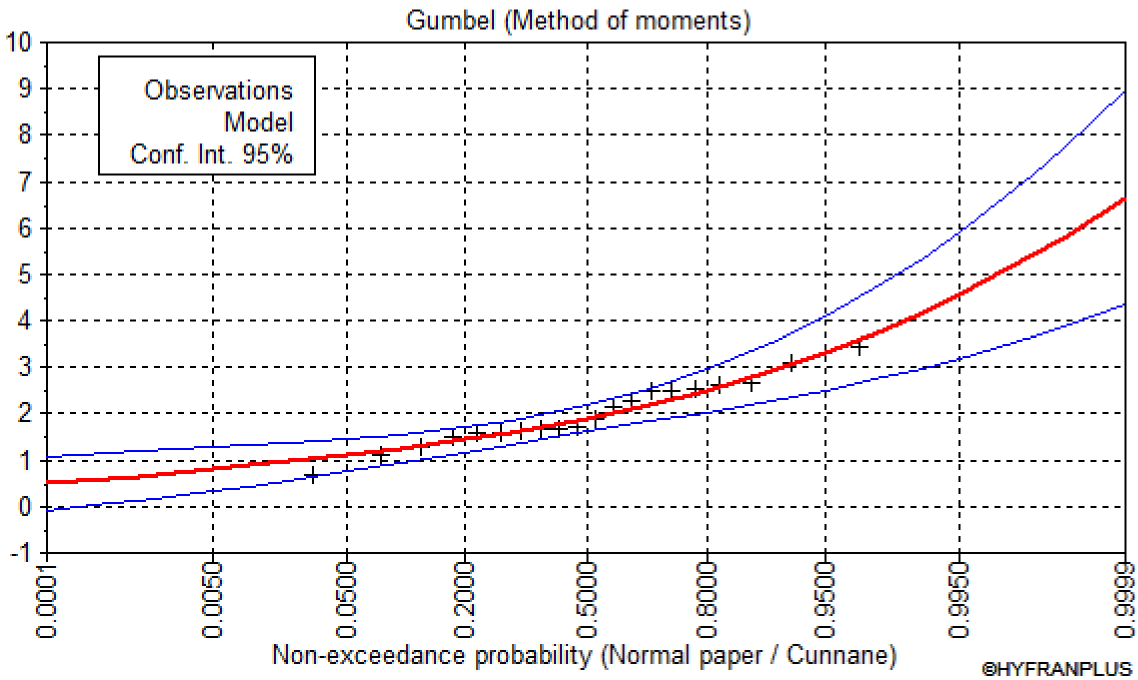


Figure 4-1: Peak Annual Flow Rate Data Fitting

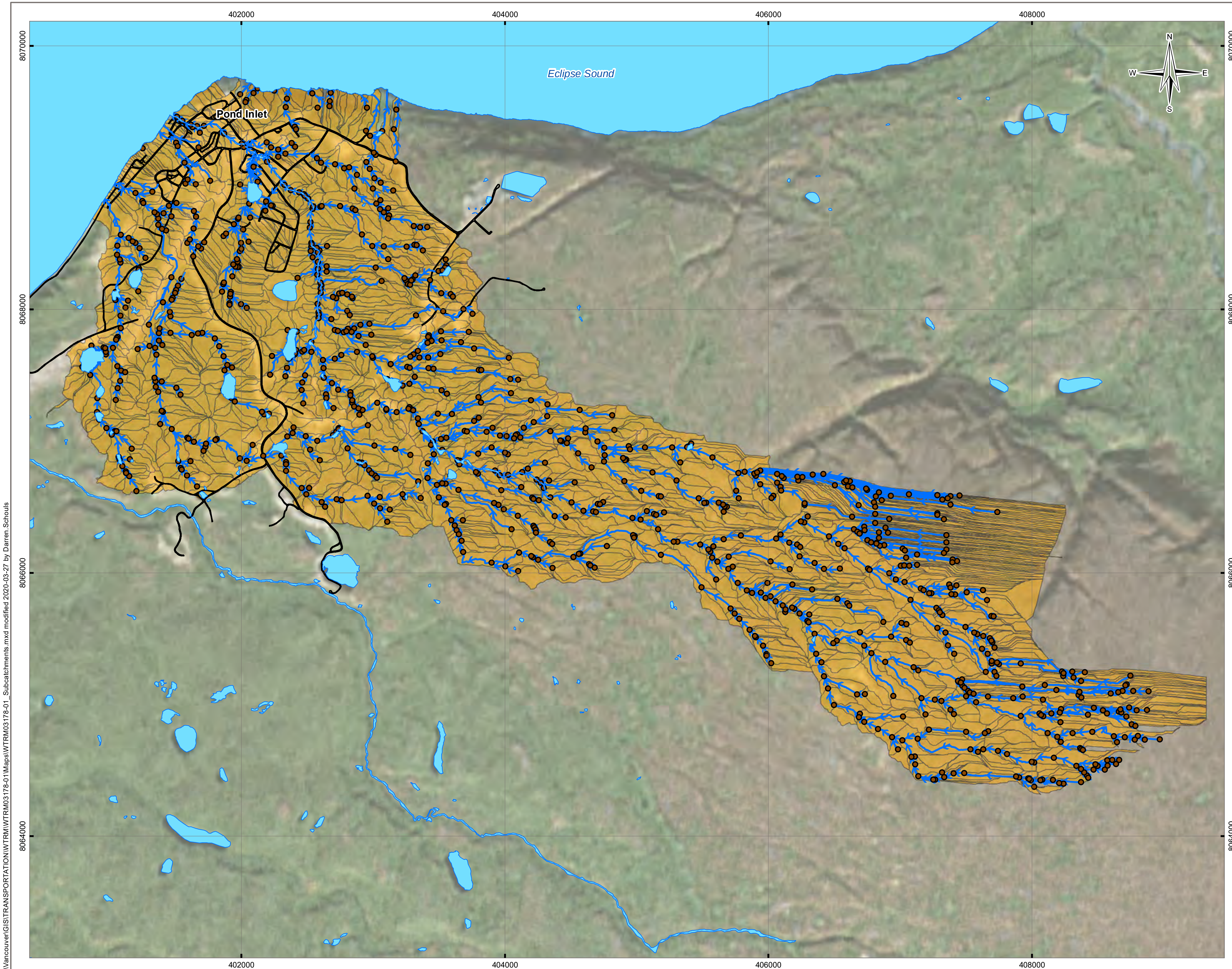
Table 4-2: Pond Inlet Snowmelt Design Storm Events for Culvert C80

Return Period (years)	Max. Flow (m^3/s)
200	4.55
100	4.17
50	3.8
20	3.3
10	2.91
5	2.51
2	1.9

4.4 Modelling of System

A systems analysis approach was adopted to design the proposed drainage system for the Hamlet of Pond Inlet. PCSWMM, a state-of-the-art stormwater program was used to develop the model of the drainage system. The model uses a node-link arrangement where links represent conduits, such as ditches and culverts; and junctions represent a point where two or more links are joined, according to how the drainage network operates.

In addition, the drainage area is split into subareas or subcatchments, which are the hydrological units used to calculate flows. Flows calculated from a subcatchment are assigned to a junction, and then hydraulically routed through the drainage network. Through this approach, flows are aggregated through the system until discharged to an outfall point. Figure 4-2 shows the sub-catchments, junctions and conduits represented in the model. Input parameters for the subcatchments, junctions and conduits are presented in Appendix G.



LEGEND

- Junction
- Natural Drainage Path
- Subcatchment

Base Data

- Gravel Road
- Waterbody

NOTES
Base data source:
1. Imagery from ESRI Basemap Gallery, DigitalGlobe, 2017
2. Water bodies from Nunavut base data

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

PCSWMM Model of Natural Drainage Paths

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:28,000
500 250 0 500
Metres

FILE NO.
WTRM03178-01_Subcatchments.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE	PROJECT NO.
March 27, 2020	TRN.WTRM03178-01

Figure 4-2

Although the typical process followed in developing a stormwater management plan includes the development of a hydrologic/hydraulic model of the existing system, the absence of a proper drainage system within the community has forced Tetra Tech to shortcut directly towards the modelling of the proposed system and then use the modelling results to size and identify the type of infrastructure required to convey the estimated flows.

After modelling the scenarios described in Section 4.3, Tetra Tech proposes that 44 of the existing culverts be replaced and that 31 new culverts be added to the existing system, as shown in Table 4-3. In addition, Tetra Tech is also recommending that a formal system of swales and ditches be integrated into the community allowing for the safe conveyance of runoff. Table 1 in Appendix F shows the specifications and modelled performance of the proposed culverts for the 10-year snowmelt design scenario. As detailed, Tetra Tech is recommending that the proposed culverts range in size between 450 mm to 1200 mm.

As the CSA recommends that culverts be sized to a minimum of 450 mm in diameter, Tetra Tech has opted to maintain this minimum size requirement. It should be noted that in certain cases the swale profiles and site limitations will force the embedment of some culverts so to meet the minimum depth of cover requirements set by the supplier of the selected culvert. The minimum cover requirements are needed to structurally support the integrity of the culverts. Figure 4-3 provides a schematic representation of the typical installation details where the integration of the minimum depth of cover requires culvert embedment.

Table 4-3: Summary of Recommended Culvert Actions

Recommended Culvert Action	Number of Culverts	Total Length (m)
No Action Required	13	225.8
Clean Out	7	93.3
Repair	2	26.6
Remove	61	846.7
Total Existing Culverts	**83**	**1192.4**
Replace Existing	44	625
New – Existing Community	31	415.7
New - Future Community Expansion	18	396.1
Total New Culverts	**93**	**1436.8**

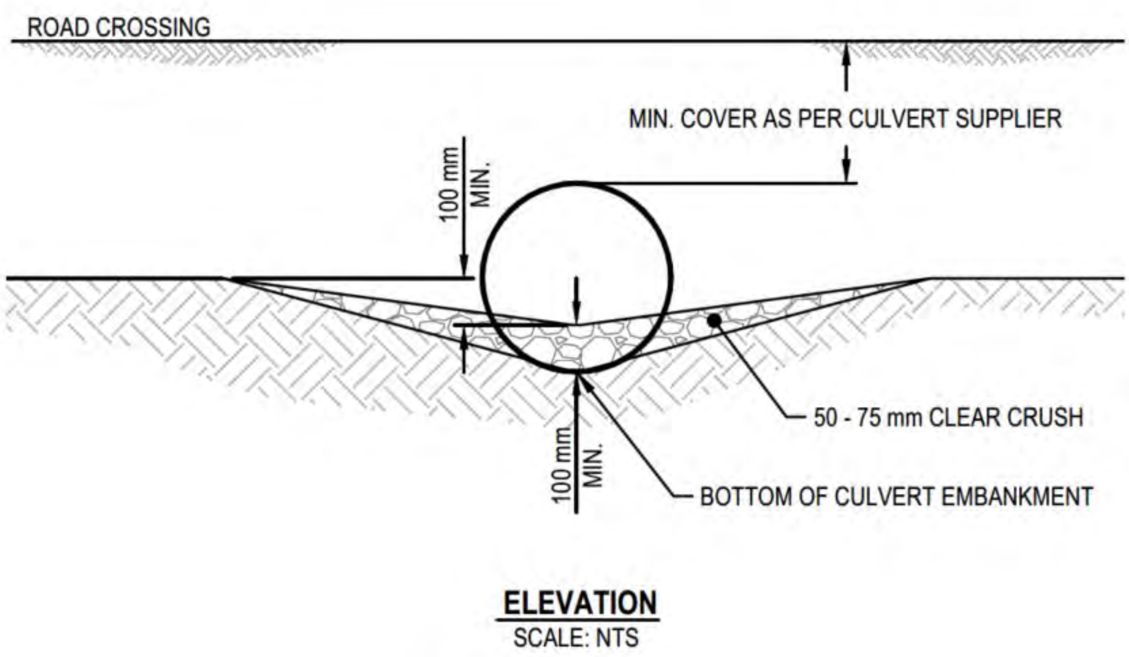


Figure 4-3: Typical Embedded Culvert Details

As noted in the proposed plans, a number of swales are being proposed. Adding deep/wide ditches would inevitably impact the ability of the hamlet residents to access their properties and would likely impact traffic movement.

4.5 Drainage Recommendations

This section presents a summary of recommended actions needed to upgrade the Level of Service of the drainage system of the Hamlet of Pond Inlet. Currently, there are a number of deficiencies as identified in Section 3.0. Tetra Tech has developed the following series of recommendations which, when implemented will remedy the issues identified throughout the community.

The proposed upgrades for the community include the upgrading of culverts, ditches and swales.

4.5.1 Culverts

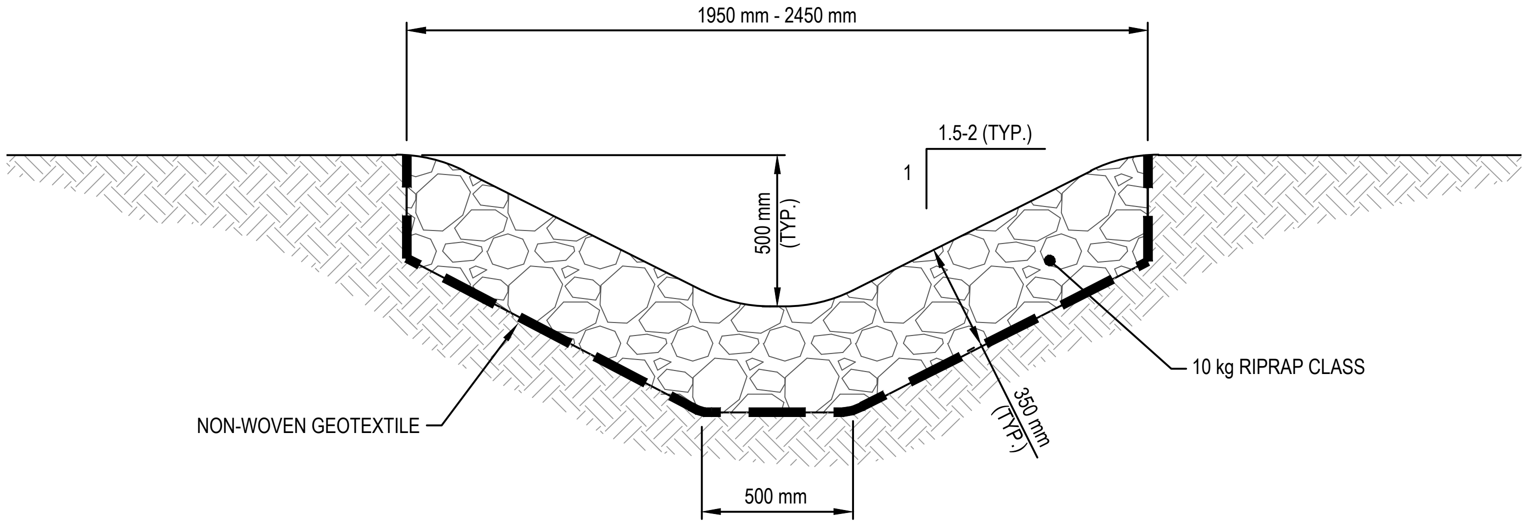
1. The minimum culvert size should be 450 mm. The minimum culvert size recommendation from CSA Group (2015) is 450 mm for de-icing purposes.
2. Cover over culverts shall meet the structural requirement set by the supplier of the selected pipe type. A recommended minimum cover of 300 mm should be included where vehicular traffic is likely to be present.
3. For long-term durability, the proposed culvert material should be Smooth Wall Steel Pipe (SWSP). The use of SWSP including a wall thickness of 10 to 12 mm will afford the community a very long service life. As detailed in Appendix E, most if not all corrugated steel pipes in Pond Inlet have failed to retain their structural integrity and have likely been damaged by maintenance equipment or road traffic. If however CSP culverts are preferred, Tetra Tech recommends the use of culvert end stiffeners or sleeves to better

support the structural integrity of the ends of the culverts. A sample photo of a culvert end stiffener is included in Appendix H. Note that Tetra Tech recommends a wider stiffener covering a width equal to 2 times the culvert diameter. Details of a culvert end stiffener and sleeve are included in Figure 6-15 in Section 6.4.1.

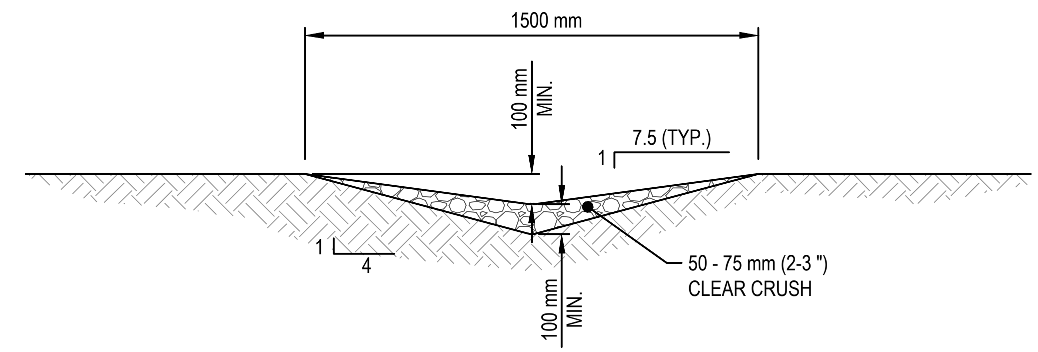
4. Culverts should be provided with high visibility markers to prevent damage during spring cleaning activities.
5. An annual maintenance program should be implemented to prepare the system for the spring freshet. This may include the steaming of specific culverts and/or the removal of debris limiting the capacity of the culvert crossings.
6. Table 1 in Appendix F includes the proposed culvert upgrades throughout the hamlet.
7. Based on the areas of erosion noted during our site visit and on water velocities modelled using PCSWMM, Tetra Tech recommends the use of riprap aprons for culvert inlets and outlets. Appendix E includes riprap recommendation for all culvert aprons.
8. Culverts are to extend a minimum of one culvert diameter past the embankment as shown in Figure 6-22 in Section 6.4.3.
9. Headwall and endwall side slopes are to be 1.5H:1V to 2H:1V. Side slopes of 2H:1V are preferred where space allows.
10. Where space does not allow for a riprap protected side slope, culvert inlets and outlets should include a concrete headwall as a recommended alternative option.

4.5.2 Ditches and Swales

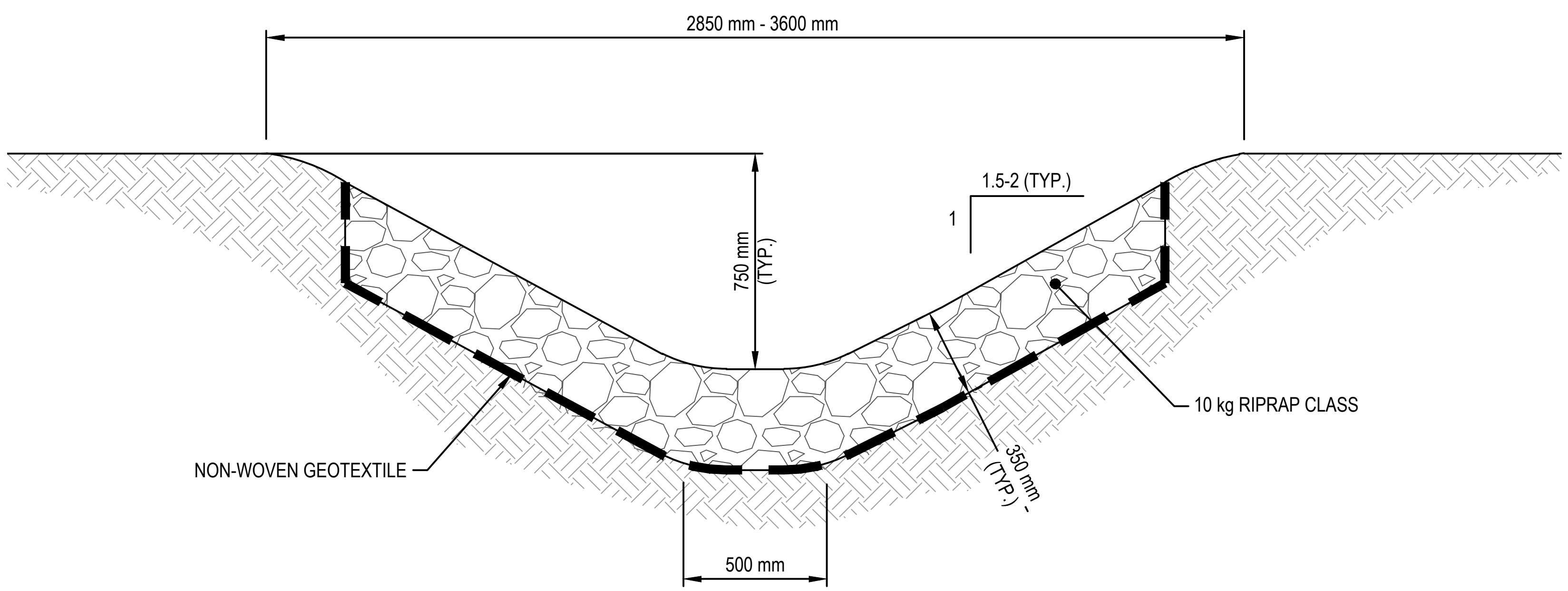
1. Open channels must include a revetment system for erosion protection, particularly in areas where permafrost can be impacted. Failure to do so may lead to hydraulic erosion, which in turn may lead to thermal degradation of the permafrost layer.
2. Ditches and swales should be as flat as possible, but not flatter than 0.5%.
3. Ditches to have a minimum bottom width of 500 mm, a minimum depth of 500 mm and side slopes ranging between 1.5H:1V to 2H:1V. Flatter side slopes should be considered near schools and children's playgrounds.
4. Ditches are to be lined with a 10 kg class riprap layer having a minimum thickness of 350 mm. See Figure 4-4 for riprap gradation.
5. Ditches are to be lined with a non-woven geotextile between the existing soil and the specified riprap layer.
6. Swales are to include a minimum depth of 100 mm. Swale side slopes are to be 7.5H:1V minimum to allow for vehicular traffic to safely cross without damage. Swales are to be lined with a 50-75 mm (2-3") clear crush layer having a minimum thickness of 100 mm in the centre of the swale. Figure 4-4 includes typical cross section details for the proposed ditches and swales.
7. The community of Pond Inlet may wish to increase the active depth of the existing swales throughout the community by raising the road profiles. This may be necessary to formalize the proposed swale sections detailed in Figure 4-4.
8. To the extent possible, ponding water nearby and underneath of buildings should not be promoted. Grading practices underneath buildings should promote the movement of water away from the footprints of buildings.



1 FIG.1 **TYPICAL DITCH**
SCALE: 1:25



2 FIG.1 **TYPICAL SWALE**
SCALE: 1:25



3 FIG.1 **TYPICAL LARGE DITCH**
SCALE: 1:25

10 kg RIPRAP CLASS			
ROCK GRADATION PERCENTAGE (kg)			
15 %	50 %	85 %	
1	10	30	
APPROXIMATE AVERAGE DIMENSIONS (mm)			
15 %	50 %	85 %	100 %
90	195	280	330

TYPICAL 50-75 mm (2-3") CLEAR CRUSH GRADATION
SCALE:NTS

LEGEND

NOTES

NUM	DATE	DWN	CKD	APR	DESCRIPTION
A	03/11/20	MJK	ER	DNM	ISSUED FOR REVIEW

REVISIONS

PROFESSIONAL SEAL

CLIENT

Nunavut

TETRA TECH

POND INLET DRAINAGE PLAN

TYPICAL DITCHES AND SWALE DIAGRAMS

PROJECT NO.	OFFICE	DES	CKD	REV	DRAWING
WTRM03118-02	VANC	ER	ER	A	FIG.4-4
DATE	SHEET No.	DWN	APP	STATUS	
March 11, 2020	- of -	MJK	DNM	IFC	

5.0 SURFICIAL GEOLOGY AND PERMAFROST RESULTS

Most of the study area is underlain by glacial deposits (till) composed of unsorted glacial debris (diamicton) deposited directly by glacier ice by lodgement or by melt out during ablation. The local till generally consists of a sand or sand and gravel matrix with variable amounts of silt, cobbles and boulders disseminated throughout.

Surficial geology units and permafrost-related terrain features, such as ice-wedge polygons, thermokarst, thermal erosion etc.), which may pose a challenge for the proposed community expansion, are shown on the detailed terrain and permafrost feature map (Figures 3-1 and 3-2) and are summarized below.

Organic deposits (**O**) represent peaty organic soils observed as thin veneers (less than 0.3 m thick) overlying till or fluvial deposits.

Fluvial (alluvial) deposits (**F**) consist of stratified silt, sand and gravel, commonly cobbly and bouldery, transported, deposited or modified by small modern streams.

Colluvial deposits (**C**) consist of poorly sorted, commonly poorly compacted material (coarse sand, gravel, cobbles, boulders) deposited by mass wasting, including creep, debris slides and thaw slumping.

Marine (nearshore) deposits (**M**) are related to marine inundation during periods of higher sea level. They consist of stratified coarse sand, gravel, cobbles and boulders and were identified along the Eclipse Sound coastline. Large bodies of massive ice were encountered by Thurber (1981) within stratified silty sand, gravelly sand and gravelly sediments at the Land Assembly site (see Section 1.2.2). Ground ice formations ranged from ice lenses 1 or 2 mm thick to massive ice beds more than 3 m in thickness. A particularly large "ice wedge" was encountered in one of the testholes (14.6 m of ice). The approximate locations of these ground ice formations are shown on the terrain and permafrost feature map (Figures 3-1 and 3-2).

Glaciofluvial deposits (**GF**) consist predominantly of stratified well sorted sand deposited by meltwater in front of retreating glaciers, forming isolated mounds (kames) or short ridges, and may contain buried glacier ice. Active thermokarst, ongoing formation of thaw ponds and saturated sand observed by Dr. Roujanski in a sand pit developed in a glaciofluvial deposit located in the southeast corner of the study area indicate presence of shallow massive ice.

Ice contact drift (**I**) is a mixture of stratified glaciofluvial material and massive till deposited against glacier ice. It is commonly deformed and faulted, and may contain buried glacier ice.

Till veneer (**Tv**) forms deposits up to 1 m thick. Its surface reflects the topography of the underlying bedrock and commonly includes patches of exposed bedrock (**R**), till blanket (**Tb**), glaciofluvial material (**GF**) and felsenmeer. Permafrost within the unit is generally ice-poor.

Till blanket (**Tb**) is generally 1 to 5 m thick. It masks irregularities of the underlying bedrock surface and may include patches of till veneer, hummocky till (5 to 15 m thick), exposed bedrock, and felsenmeer. Hummocky till forms moderately to steeply sloped hills and ridges, and may contain significant accumulations of massive ice.

Bedrock (**R**) in the study area consists of crystalline igneous and metamorphic rocks (granite, gneiss and schist) of Pre-Cambrian age.

Anthropogenic material (**A**) consists of human-made or modified geological material whose original properties have been changed.

6.0 DRAINAGE MASTER PLAN

Based on the issues identified in the field, and on the modeling results, a number of upgrades are proposed for the existing drainage system, as well as for the proposed community expansion areas. The system being proposed is composed of ditches, swales and culverts, with outlet locations as shown in Figures 6-1 to 6-6. With the proposed upgrades combined with a proper maintenance program including removal of debris/sediments and de-icing, the proposed system will handle the design flows identified in Section 4.3 of this report.

6.1 Community Plan (Proposed Development Areas)

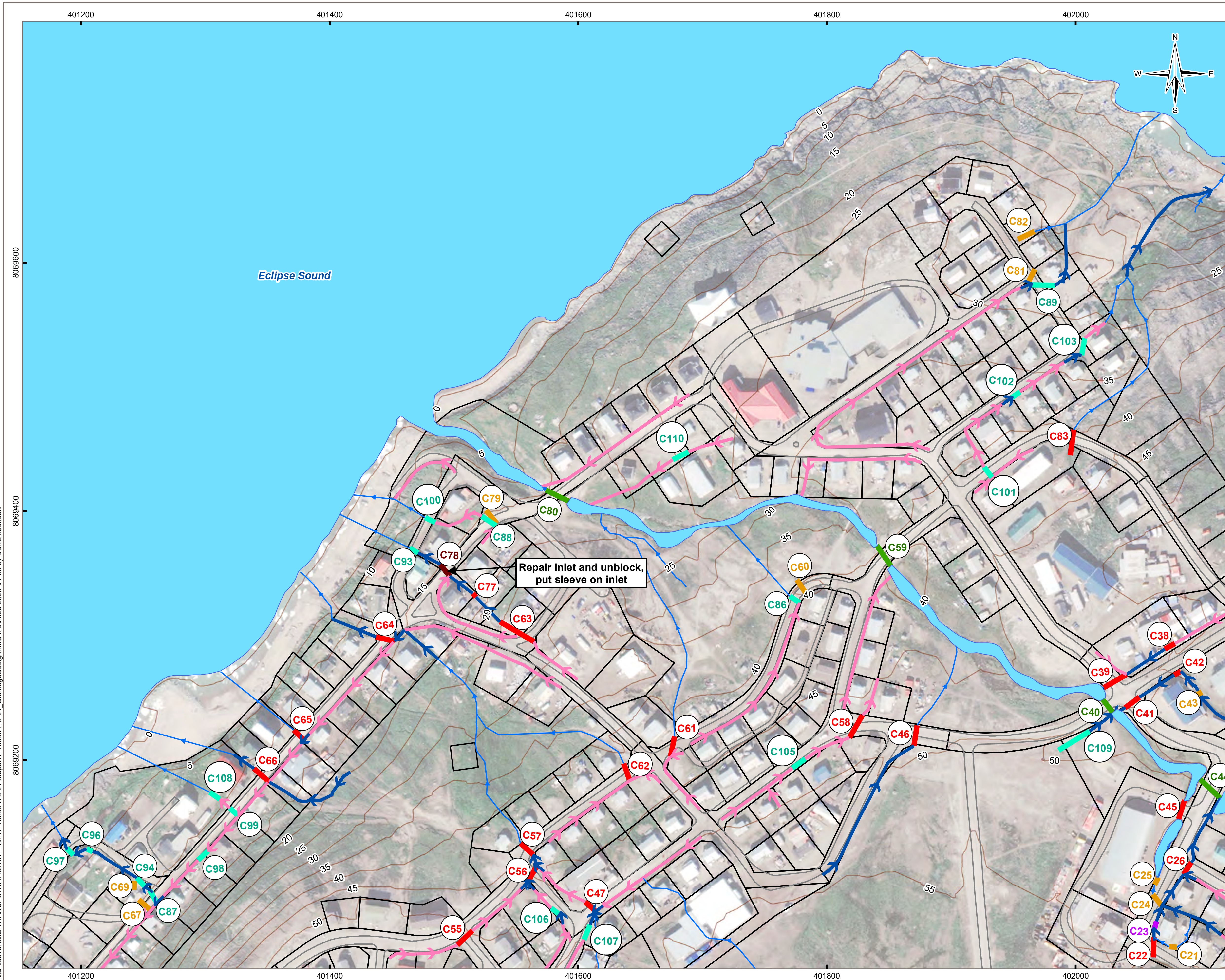
The 2014 Pond Inlet Community Plan included in Appendix B outlines proposed developments which will allow for future community growth. Existing topography and drainage conditions were reviewed and a preliminary design of drainage infrastructure for the proposed development areas was developed.

Appendix B also includes a revised development plan for CGS to consider. Parcels identified as "Relocate GN Proposed Parcel" in Figure B-3 should not be developed due to observed poor drainage and/or geological conditions. Tetra Tech recommends relocating the following proposed development area:

- The westernmost five lots identified as "Relocate GN Proposed Parcel" which are south of the road running along the coast due to the geological conditions observed in the field. The proposed lots are at the toe of a steep hill. Development of these lots would require significant geotechnical improvements adding significant cost to the development. A detailed geotechnical field investigation will be required before proceeding with any of the proposed development along the foreshore area.

The lots falling within the conditionally suitable areas (see Figures B-1 to B-6 in Appendix B) could be relocated to reduce the cost of development. These areas have been identified by our geological team as being poor areas for development. However, we recognize that site specific improvements could be implemented to make the areas developable. At this stage we have provided drainage improvement recommendations based on the current 2014 Pond Inlet Community Plan as shown in Figures 6-1 to 6-6. Revisions to the 2014 Community Plan should include revisions to the proposed drainage improvements.

Parcels outlined in purple are proposed replacement options available for consideration. These lots are strategically located in areas which appear to be well-drained, as well as suitable for construction. The proposed revisions are intended to protect future development from potential drainage issues. These areas have also been selected in recognition of the nature of the site geology. The Construction Suitability Map identified in Section 3.3.2 confirms the suitability of the area based on the nature of the local geology. Specific to the development grades, the use of gravel pads should be considered including a 1% minimum slope directing water away from the building footprint. Figure 6-7 provides details as to the recommended grades which may be considered at the time of development.



LEGEND

C## Culvert Number

Culverts

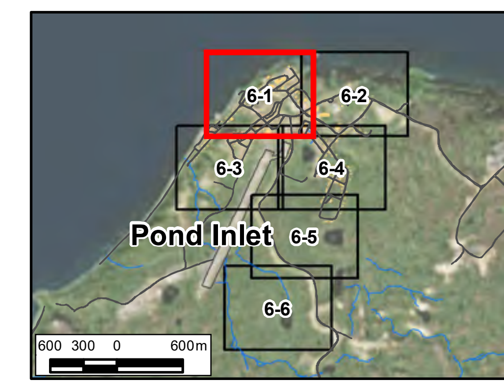
- Functioning as Intended
- Clean
- Repair
- Replace
- Abandon
- New - Existing Community

Open Channels

- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data

- Current Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Conceptual Drainage Design

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

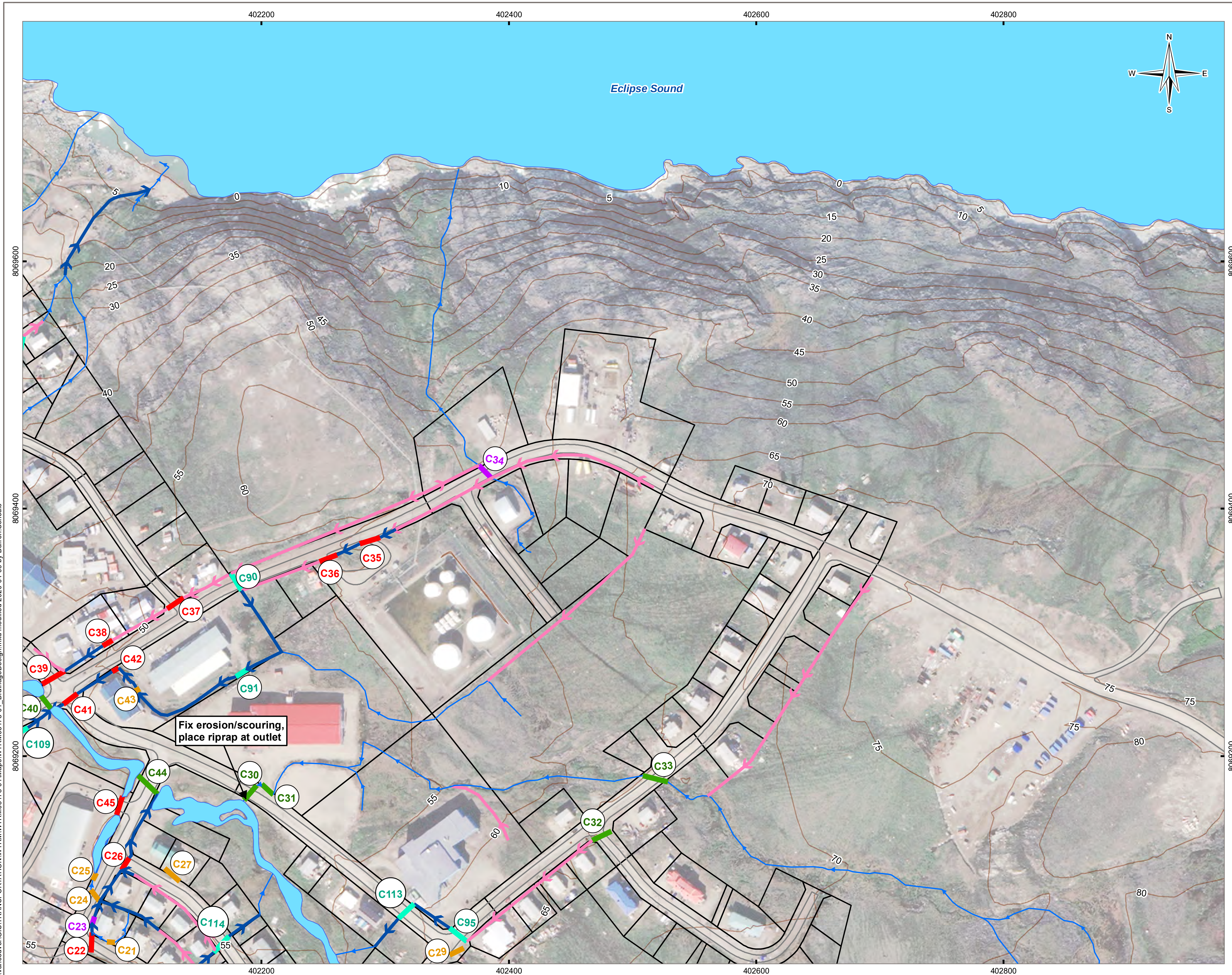
Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageDesign.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 6-1

Q:\Vancouver\GIS\TRANSPORTATION\WTRM\WTRM03178-01\Maps\WTRM03178-01_DrainageDesign.mxd modified 2020-04-06 by Darren Schouls



LEGEND

Culverts

- Functioning as Intended
- Clean
- Replace
- Abandon
- New - Existing Community

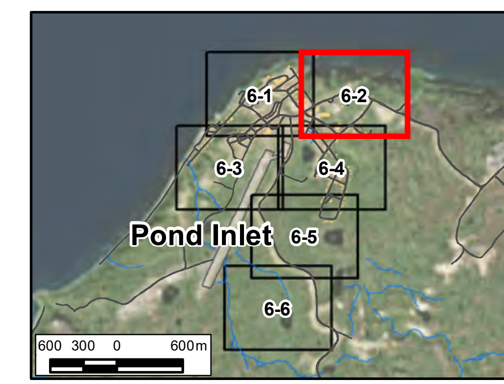
C## Culvert Number

Open Channels

- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data

- Current Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Conceptual Drainage Design

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_DrainageDesign.mxd

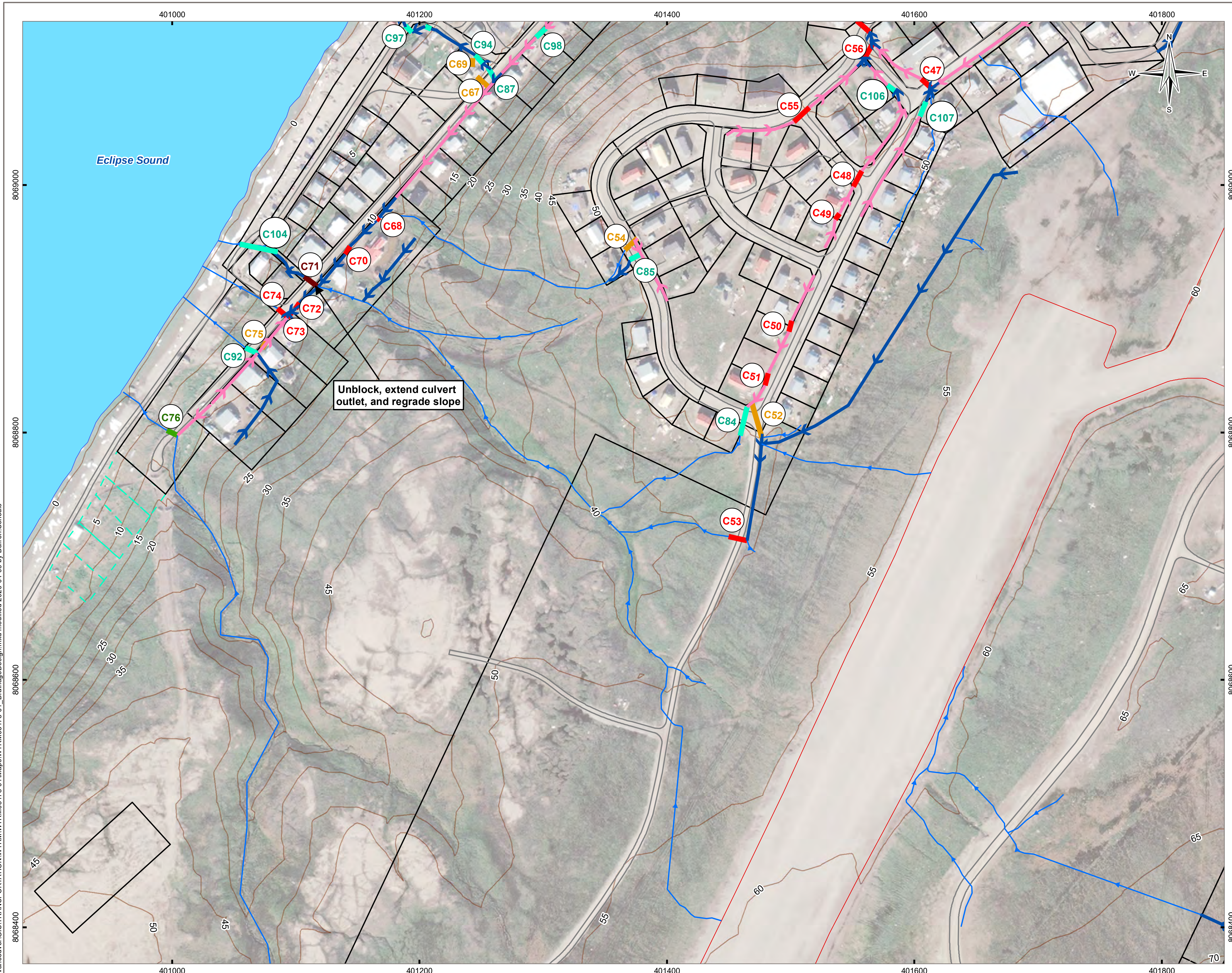
TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE: April 6, 2020
PROJECT NO.: TRN.WTRM03178-01

Figure 6-2

Q:\Vancouver\GIS\TRANSPORTATION\WTRM\WTRM03178-01\Maps\WTRM03178-01_DrainageDesign.mxd modified 2020-04-06 by Darren Schouls



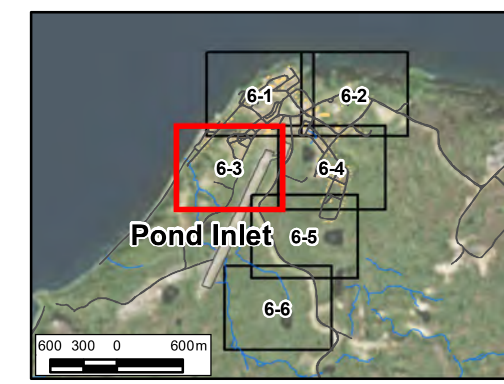
LEGEND

C## Culvert Number

Culverts
- Functioning as Intended
- Repair
- Replace
- Abandon
- New - Existing Community

Open Channels
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data
- Current Parcel
- GN Proposed Parcel
- Relocate GN Proposed Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Conceptual Drainage Design

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

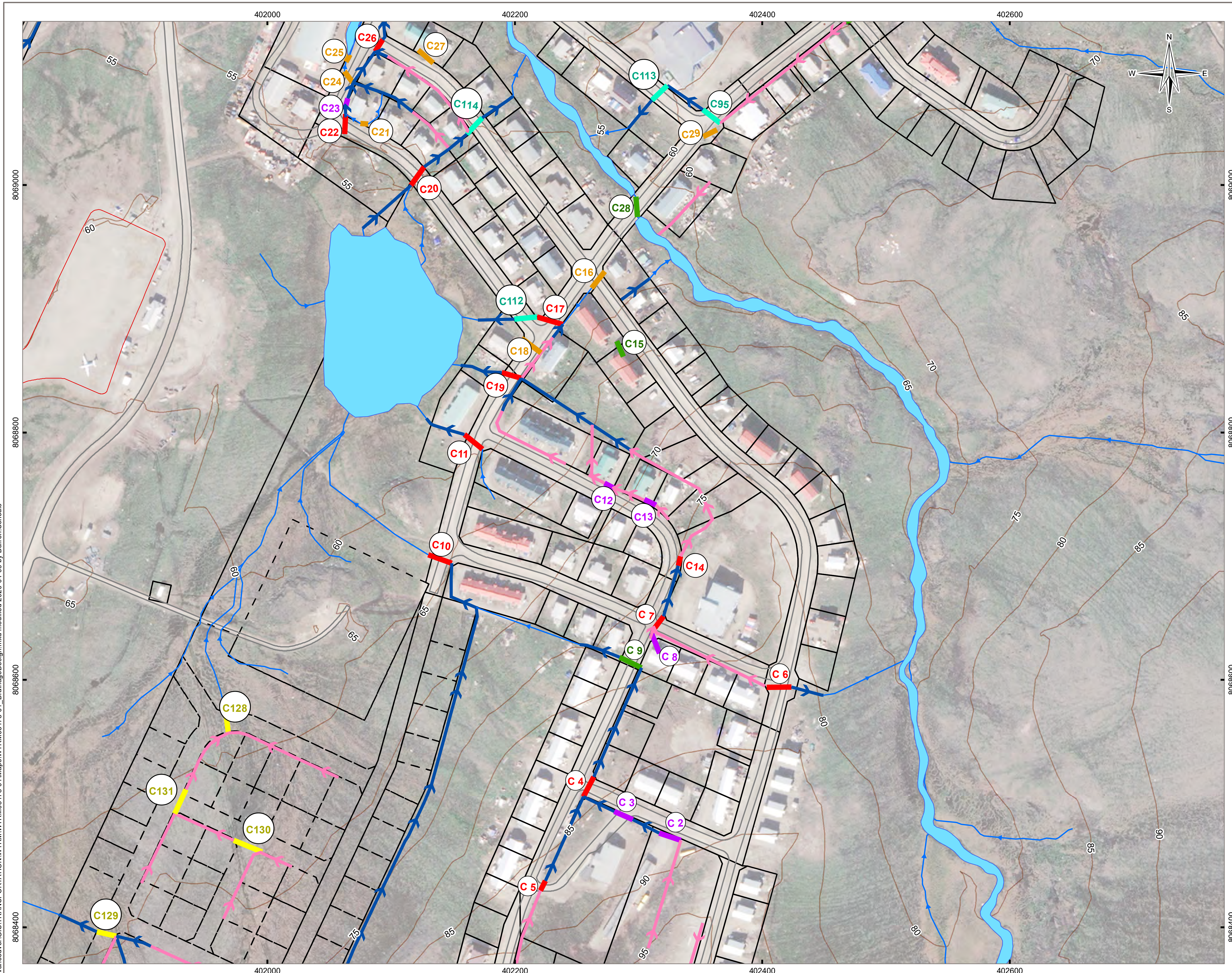
FILE NO.
WTRM03178-01_DrainageDesign.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE	PROJECT NO.
April 6, 2020	TRN.WTRM03178-01

Figure 6-3



LEGEND

Culverts

- Functioning as Intended
- Clean
- Replace
- Abandon
- New - Existing Community
- New - Future Community Expansion

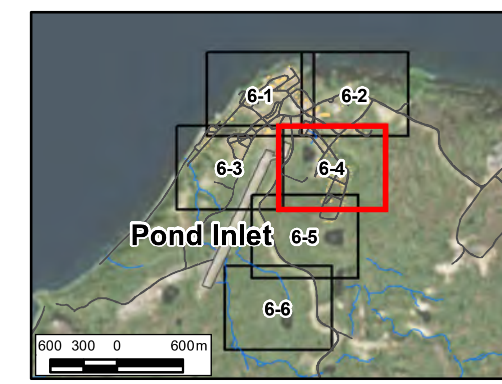
C## Culvert Number

Open Channels

- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data

- Current Parcel
- GN Proposed Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Conceptual Drainage Design

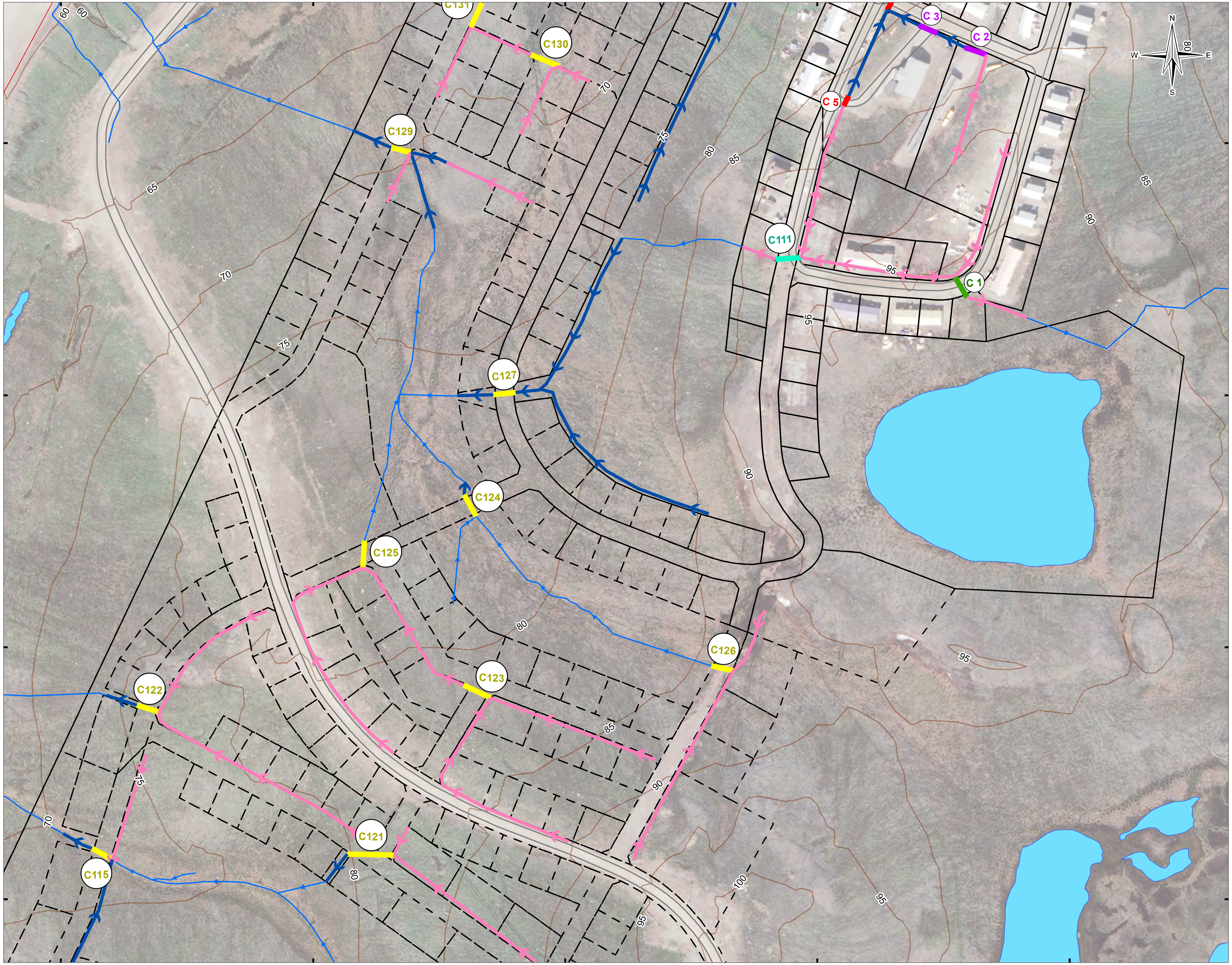
PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageDesign.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 6-4



LEGEND

Culverts

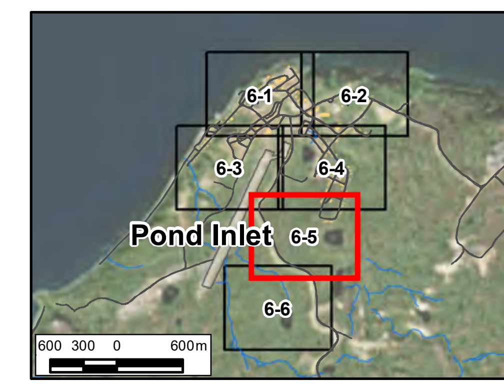
- C## Culvert Number
- Functioning as Intended
- Clean
- Replace
- New - Existing Community
- New - Future Community Expansion

Open Channels

- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data

- Current Parcel
- GN Proposed Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Conceptual Drainage Design

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_DrainageDesign.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE: April 6, 2020
PROJECT NO.: TRN.WTRM03178-01

Figure 6-5

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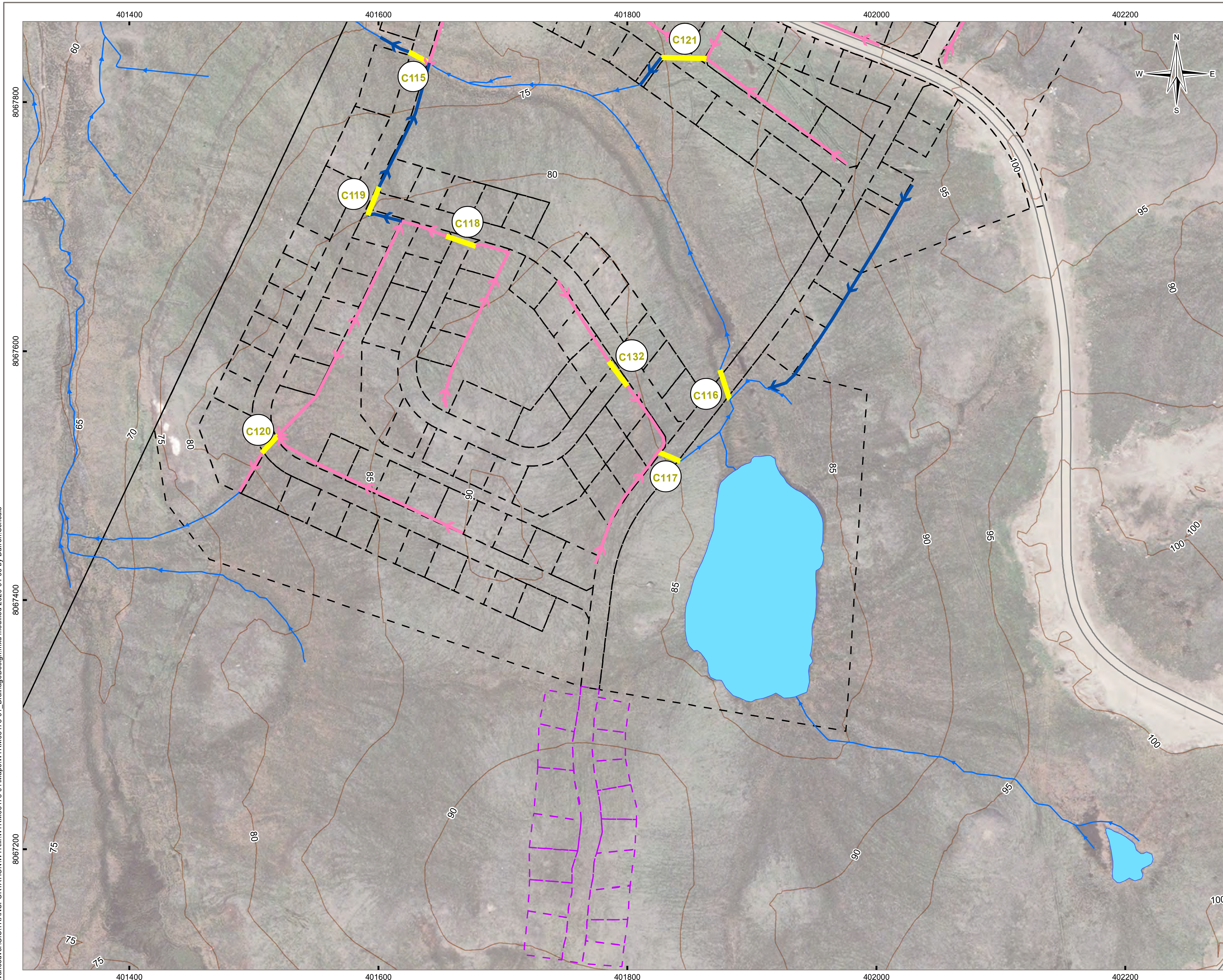


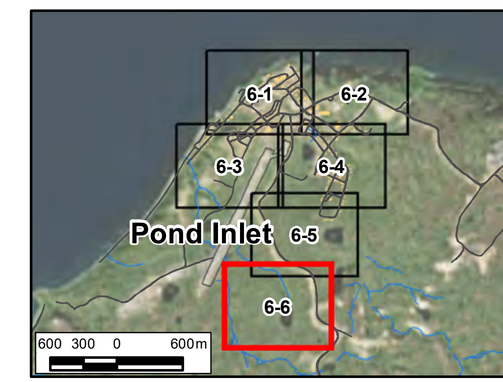
LEGEND

C## Culvert Number

Culverts
- New - Future Community Expansion

Open Channels
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Base Data
- Current Parcel
- GN Proposed Parcel
- Tetra Tech Proposed Relocated Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Conceptual Drainage Design

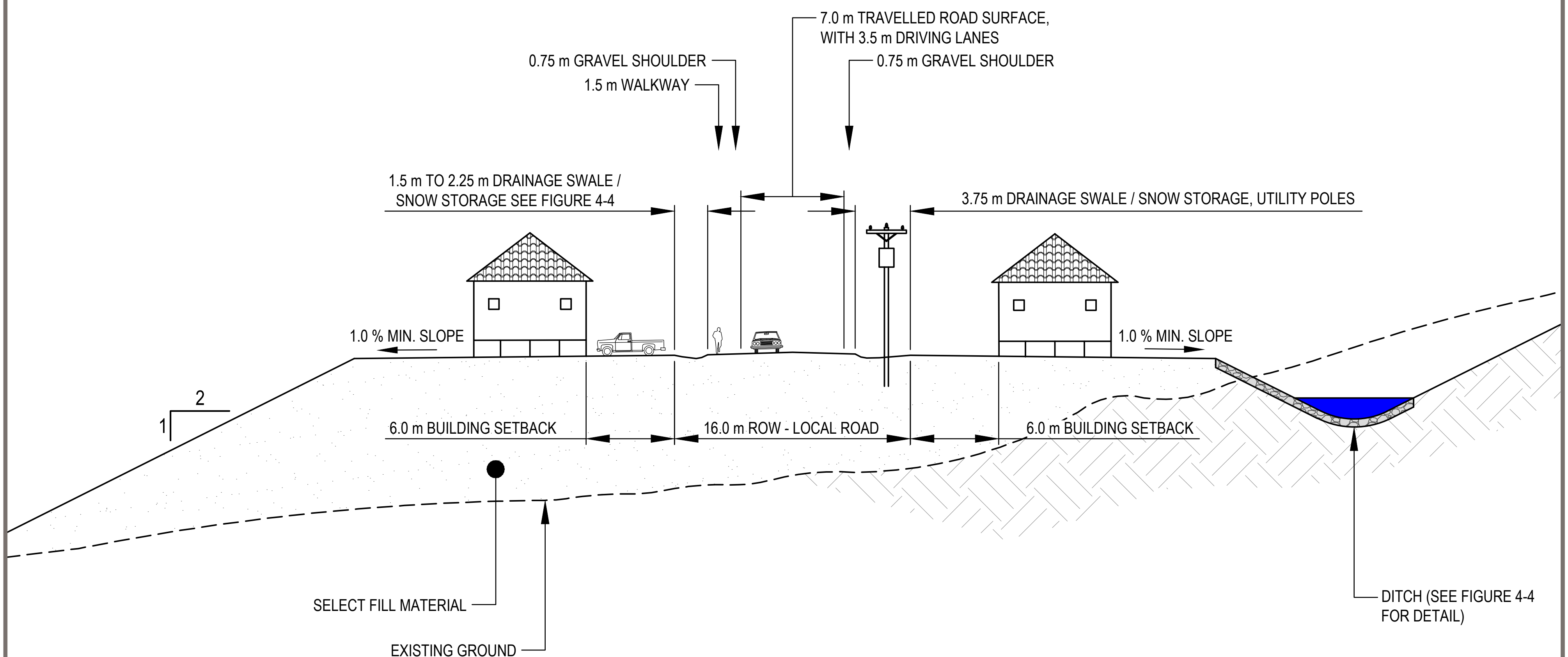
PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_DrainageDesign.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 6-6



LEGEND

-

0 20

Scale: 1: 400 (metres)

NOTES

- Dimensions as per CAN/CSA-S503-15 Figure 5

ISSUED FOR USE

CLIENT

Nunavut

TETRA TECH

POND INLET MASTER DRAINAGE PLAN

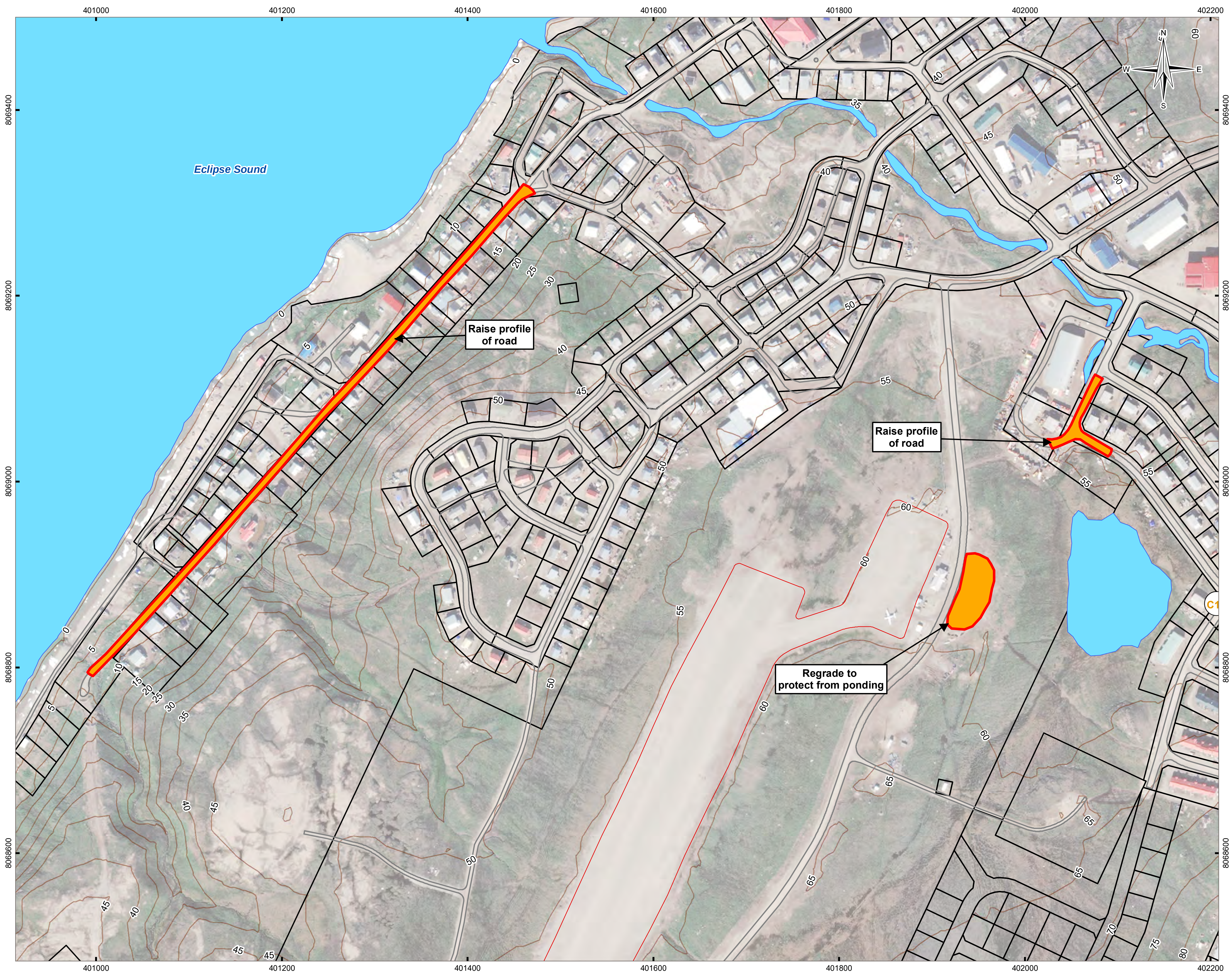
ABOVE GRADE DEVELOPMENT DETAIL

PROJECT NO.	DWN	CKD	REV	
TRN.WTRM03178	AD	ER	0	Fig. 6-7
OFFICE	DATE			
VANC	March 27, 2020			

6.1.1 Grading Plan

Tetra Tech has identified areas in the community in which poor drainage conditions should be improved via regrading. Regrading details are shown in Figure 6-8 and include the following recommendations:

- The profile of the westernmost road nearest to Eclipse Sound should be raised to promote the development of a formal swale on the southeast side of the road. This will prevent the ponding issues noted during the site investigation. By raising the road profile the community will effectively prevent future during snowmelt and rainfall events.
- Raise the road profile in front of the Co-op store and Qilaut garage. This will decrease the ponding and overtopping of the road in this area and improve access. During the site visit, Mr. Joanasie Naqitarvik confirmed the fact that the flooding in this area is a nuisance affecting traffic in this area.
- Ponding was identified in the airport operations area. Regrading the pad area eastwards will direct water away from the traffic area and address ponding issues.

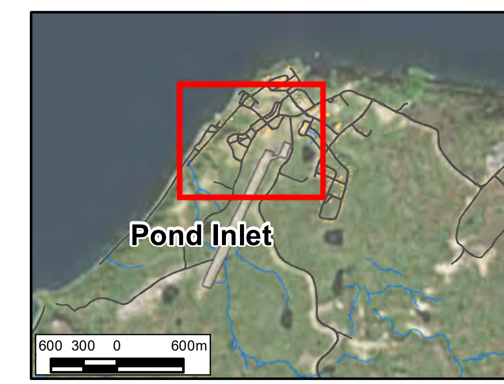


LEGEND

- Grading Area

Base Data

- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Proposed Grading Area

PROJECTION UTM Zone 18			**DATUM** NAD83		**CLIENT** Nunavut
Scale: 1:4,000 (80 40 0 80 Metres)					TETRA TECH
FILE NO. WTRM03178-01_GradingPlan.mxd					
OFFICE Tt-VANC	**DWN** DS	**CKD** SL	**APVD** ER	**REV** 0	Figure 6-8
DATE March 27, 2020	**PROJECT NO.** TRN.WTRM03178-01				

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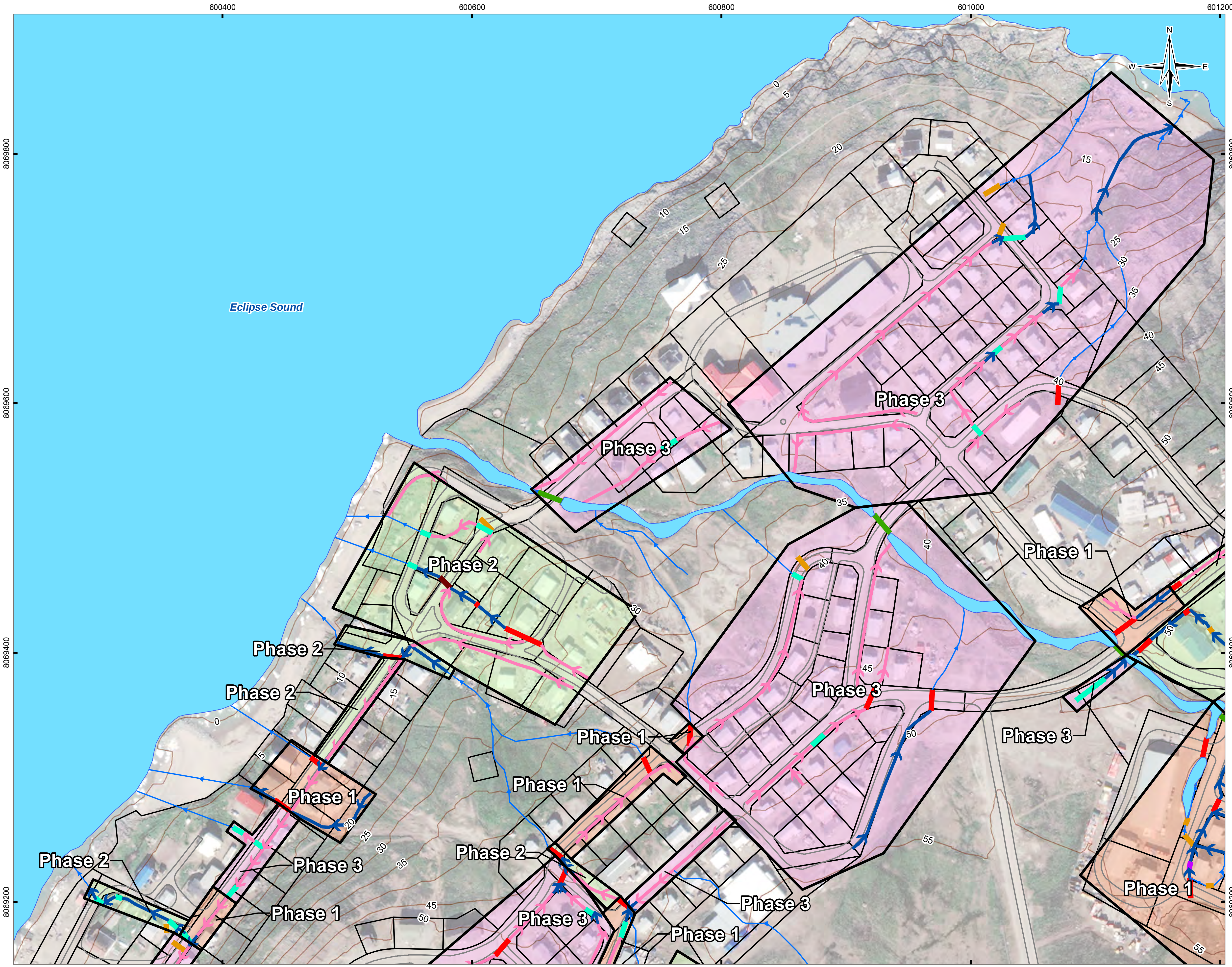
6.2 Project Phasing

Tetra Tech has developed a phasing plan allowing CGS and the Hamlet to first focus on the most important elements of the proposed drainage plan and consider postponing some of the less critical aspects to future construction seasons. For each phase shown in Figures 6-9 to 6-14, we have developed a Class "D" cost estimate to assist with future budgeting (see Section 6.3).

Construction of the Pond Inlet Master Drainage Plan has been broken into four phases, with Phase 1 having the highest priority, Phase 3 having the lowest priority, and Phase 4 denoting future community expansion. The infrastructure phasing was developed based on the following criteria:

- Phase 1: Address flooding areas
  - This phase will address the most prominent areas of flooding concern as observed during the field investigation and discussed with the Hamlet foreman.
- Phase 2: Address critical infrastructure
  - This phase is aimed at upgrading existing infrastructure around the services areas that are most in need of drainage improvements including the Hamlet Office and the Community Centre.
- Phase 3: Address the remaining upgrades
  - This phase is aimed at upgrading drainage infrastructure around common public use amenities as well as the remaining existing infrastructure not addressed under phases 1 and 2.
- Phase 4: Future community expansion infrastructure
  - This Phase is to be completed in conjunction with future community expansions and can be completed as required by the advancement of development.



LEGEND

Culverts

- Functioning as Intended
- Clean
- Repair
- Replace
- Abandon
- New - Existing Community

Open Channels

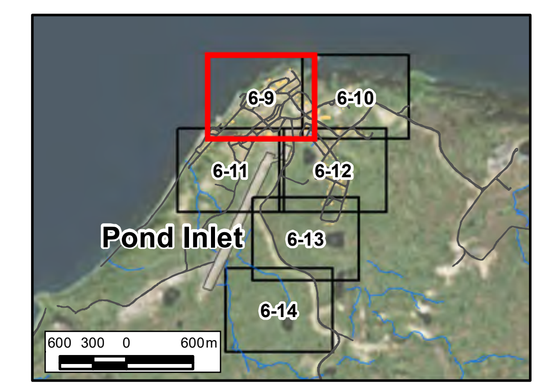
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing

- Phase 1 - Address Existing Flooding
- Phase 2 - Address Critical Infrastructure
- Phase 3 – Address Remaining Upgrades

Base Data

- Current Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_Phasing.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 6-9

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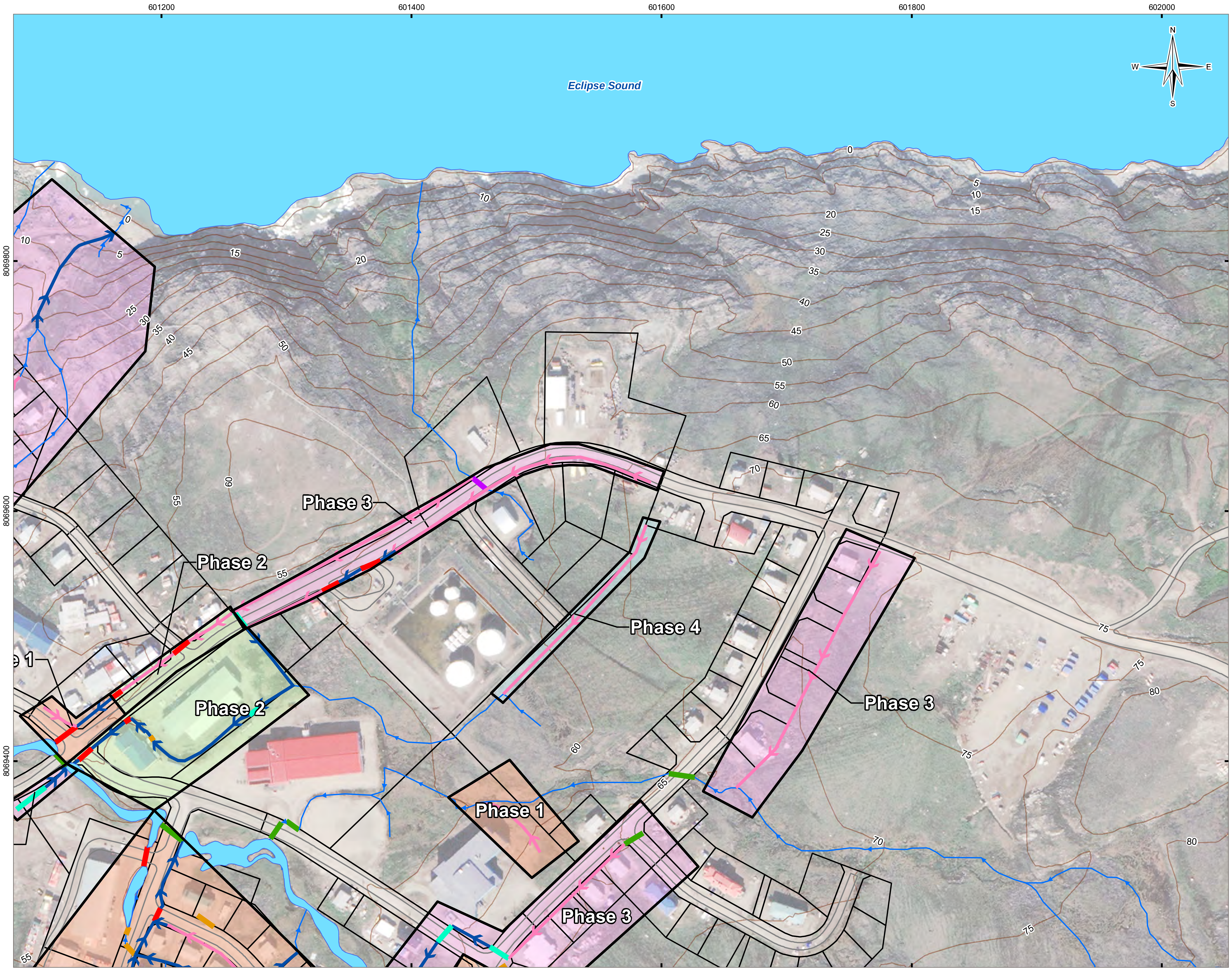


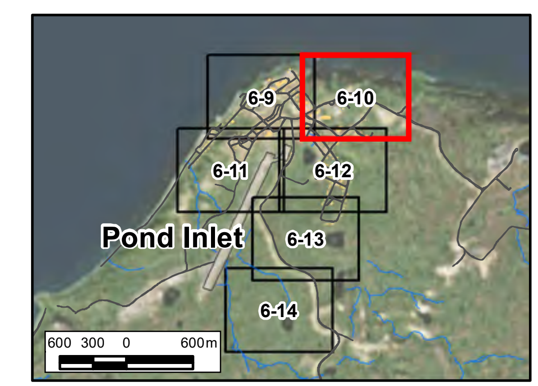
LEGEND

Culverts
- Functioning as Intended
- Clean
- Replace
- Abandon
- New - Existing Community

Open Channels
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing
- Phase 1 - Address Existing Flooding
- Phase 2 - Address Critical Infrastructure
- Phase 3 – Address Remaining Upgrades
- Phase 4 - Future Community Expansion Infrastructure

Base Data
- Current Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_Phasing.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE: April 6, 2020
PROJECT NO.: TRN.WTRM03178-01

Figure 6-10

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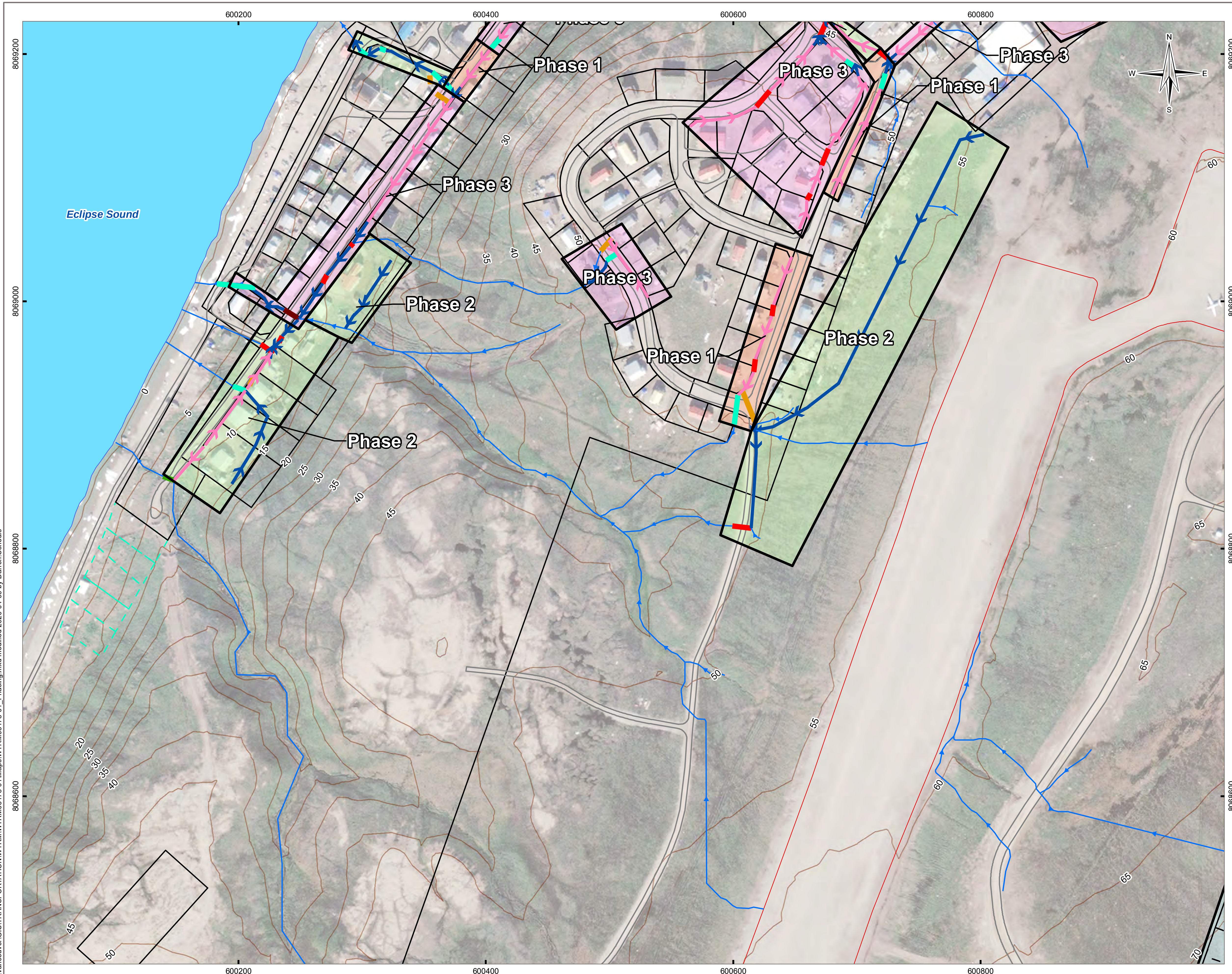


LEGEND

Culverts

- Functioning as Intended
- Repair
- Replace
- Abandon
- New - Existing Community

Open Channels

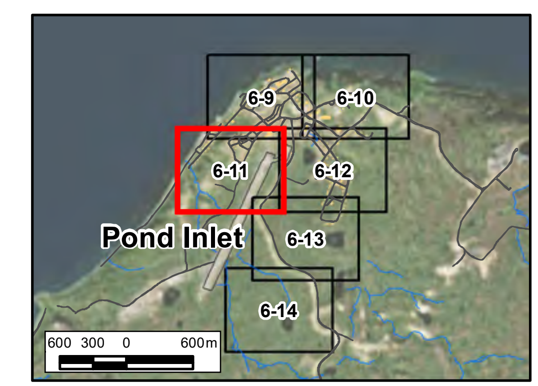
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing

- Phase 1 - Address Existing Flooding
- Phase 2 - Address Critical Infrastructure
- Phase 3 – Address Remaining Upgrades
- Phase 4 - Future Community Expansion Infrastructure
- Runway

Base Data

- Current Parcel
- GN Proposed Parcel
- Relocate GN Proposed Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.
WTRM03178-01_Phasing.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE	PROJECT NO.
April 6, 2020	TRN.WTRM03178-01

Figure 6-11

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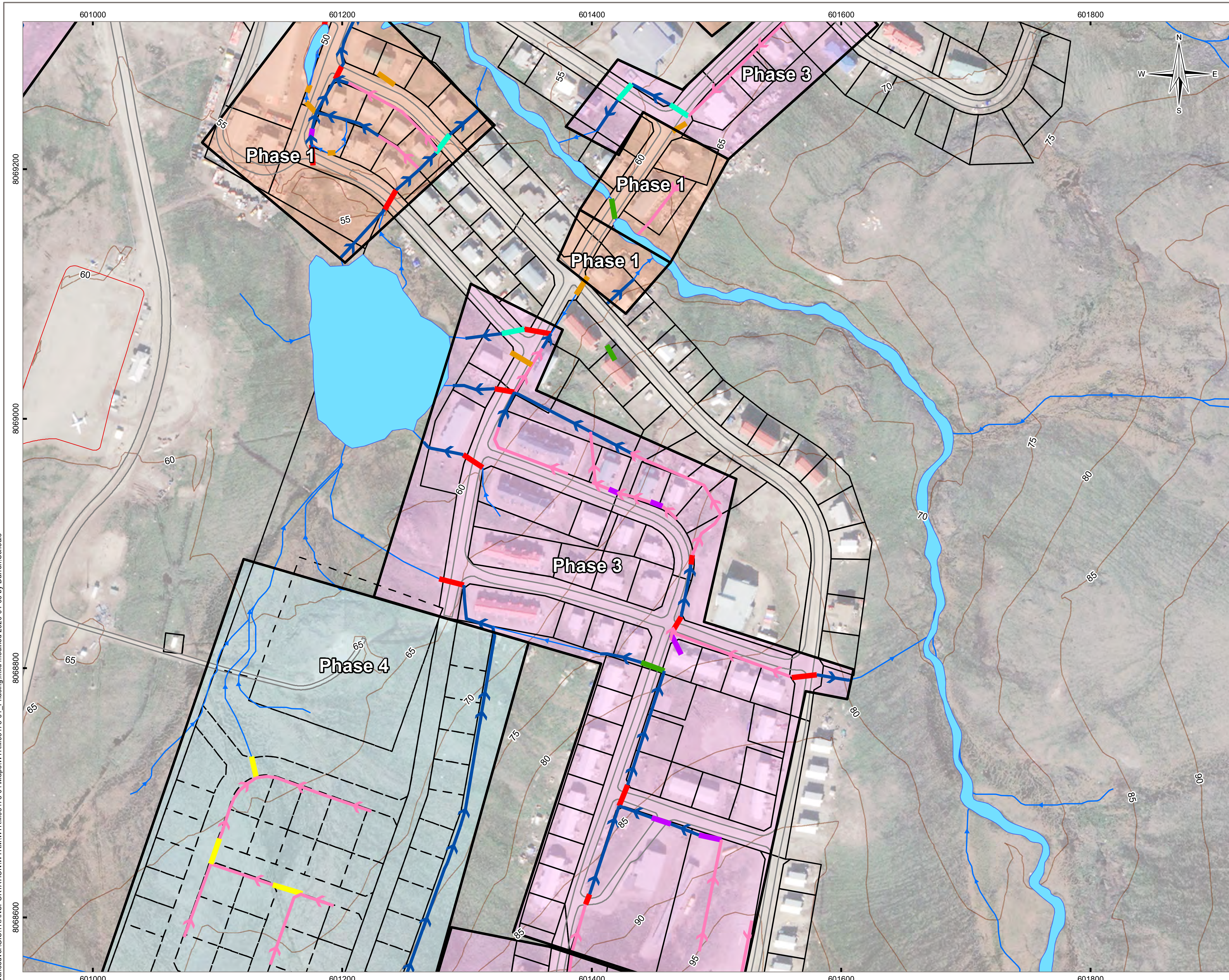


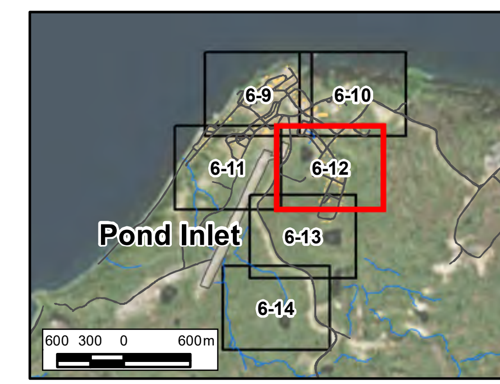
LEGEND

Culverts
- Functioning as Intended
- Clean
- Replace
- Abandon
- New - Existing Community
- New - Future Community Expansion

Open Channels
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing
- Phase 1 - Address Existing Flooding
- Phase 3 – Address Remaining Upgrades
- Phase 4 - Future Community Expansion Infrastructure
- Runway

Base Data
- Current Parcel
- GN Proposed Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

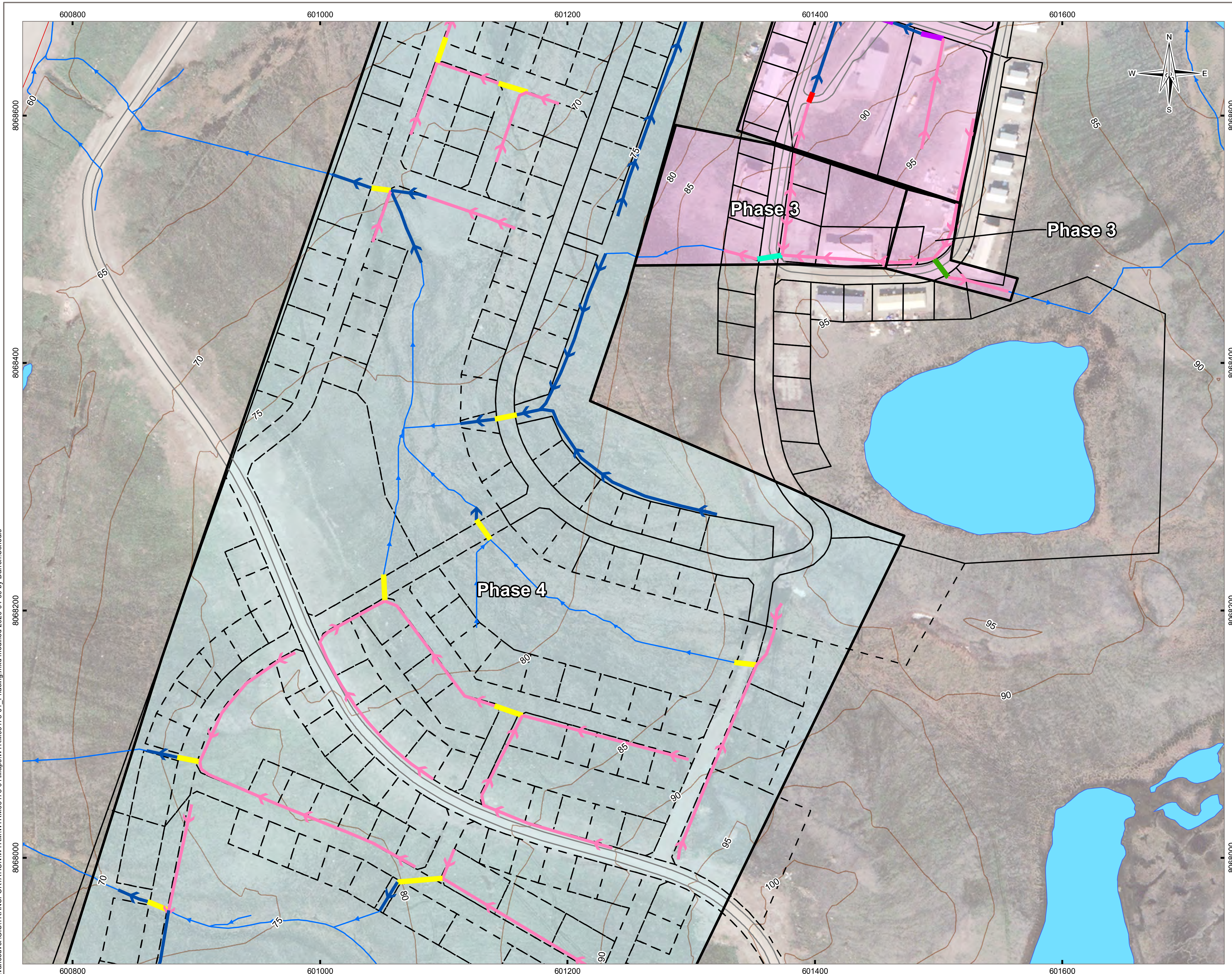
PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_Phasing.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0
DATE	PROJECT NO.			
April 6, 2020	TRN.WTRM03178-01			

Figure 6-12



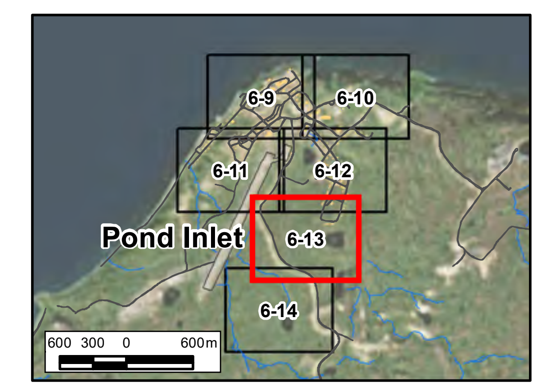
LEGEND

Culverts
- Functioning as Intended
- Clean
- Replace
- New - Existing Community
- New - Future Community Expansion

Open Channels
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing
- Phase 3 – Address Remaining Upgrades
- Phase 4 - Future Community Expansion Infrastructure
- Runway

Base Data
- Current Parcel
- GN Proposed Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000

60 30 0 60

Metres

TETRA TECH

FILE NO.
WTRM03178-01_Phasing.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE
April 6, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 6-13

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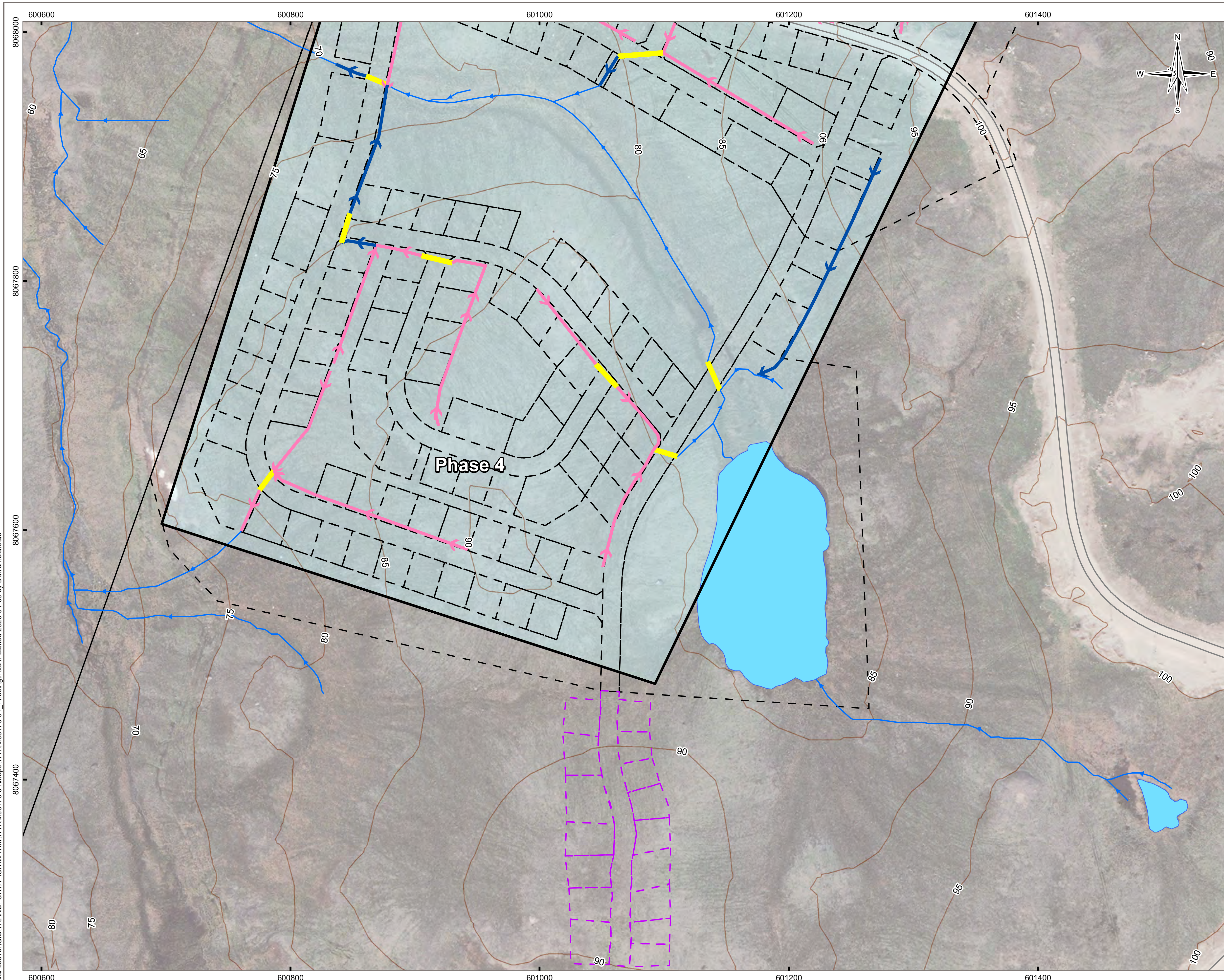


LEGEND

Culverts

- New - Future Community Expansion

Open Channels

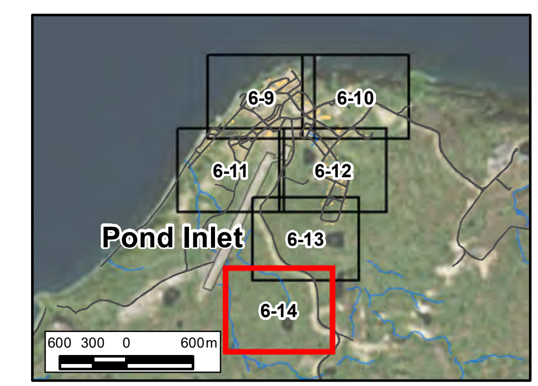
- Formalize Typical Ditch
- Formalize Typical Swale
- Natural Drainage Path

Project Phasing

- Phase 4 - Future Community Expansion Infrastructure

Base Data

- Current Parcel
- GN Proposed Parcel
- Tetra Tech Proposed Relocated Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES

Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet Project Phasing

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_Phasing.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE	PROJECT NO.
April 6, 2020	TRN.WTRM03178-01

Figure 6-14

6.3 Construction Cost Estimate

As stated in Section 6.2, construction of the Pond Inlet Master Drainage Plan has been broken into four phases, with Phase 1 having the highest priority, Phase 3 having the lowest priority, and Phase 4 denoting future community expansion.

A Class "D" cost estimate was developed for each phase. The cost estimates are included in Appendix D. A summary of the cost estimates is shown in Table 6-1 below. Additionally, a summary of the drainage materials required are presented in Table 6-2.

Phasing has been broken down to distribute the cost over a longer period of time to accommodate the availability of annual budgets. Combining phases will translate into greater savings as it will allow the GN to take advantage of the economy of scale.

Table 6-1: Summary of Cost Estimate

	Phase				
	1	**2**	**3**	**4**	**Total**
Preliminaries	$57,221	$66,200	$92,300	$74,620	$290,341
Civil Works	$293,211	$382,996	$644,004	$467,195	$1,787,406
Miscellaneous	$15,000	$15,000	$15,000	$15,000	$60,000
Sub-total	$365,432	$464,196	$751,304	$556,815	$2,137,747
Project Contingencies: (40%)	$146,173	$185,678	$300,522	$222,726	$855,099
Total Estimated Construction Cost	**$511,605**	**$649,874**	**$1,051,826**	**$779,540**	**$2,992,845**

Table 6-2: Summary of Required Drainage Materials

	Phase 1		Phase 2		Phase 3		Phase 4		Total	
Item	Est Quantity	Count	Est Quantity	Count	Est Quantity	Count	Est Quantity	Count	Est Quantity	Count
450 mm Culvert	177 m	12	182 m	17	562 m	38	337 m	15	1258 m	82
600 mm Culvert	28 m	2	30 m	2	0 m	0	42 m	2	100 m	6
900 mm Culvert	37 m	2	16 m	1	0 m	0	19 m	1	72 m	4
1200 mm Culvert	0 m	0	0 m	0	12 m	1	0 m	0	12 m	1
Total Culverts	242 m	16	228 m	20	554 m	39	345 m	18	1369 m	93
600 mm SWSP Sleeve	0 m	0	2 m	1	0 m	0	0 m	0	2 m	1
50-75 mm Clear Crush	53 cu. m		60 cu. m		286 cu. m		235 cu. m		634 cu. m	
10 kg Class Riprap	513 cu. m		1077 cu. m		1266 cu. m		1111 cu. m		3967 cu. m	
Non-Woven Geotextile	1825 sq. m		3813 sq. m		4506 sq. m		3929 sq. m		14073 sq. m	
Culvert Removal		18		16		27		0		61

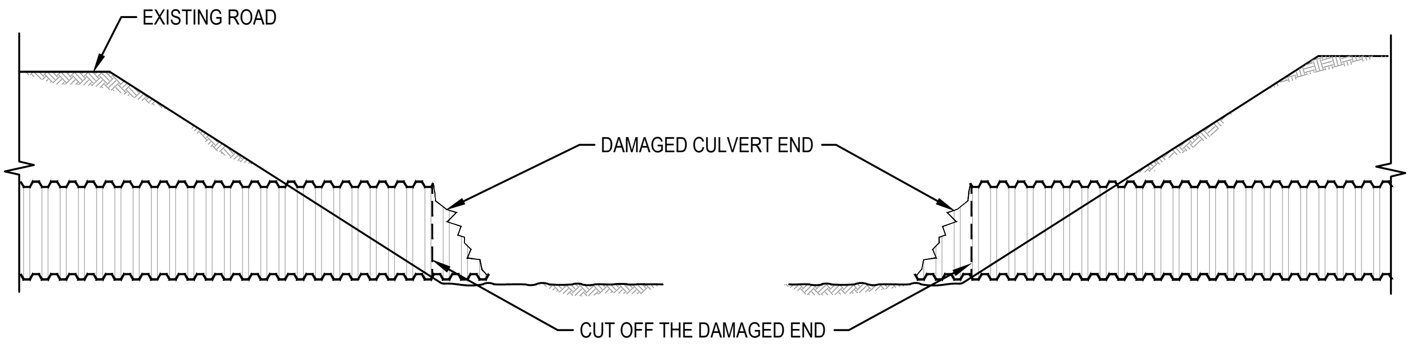
6.4 Ongoing System Maintenance

A properly maintained and monitored community drainage system is an important part of maintaining the safety and well-being of the community. To ensure proper functioning of the drainage system, a program to maintain and monitor the drainage system should be implemented.

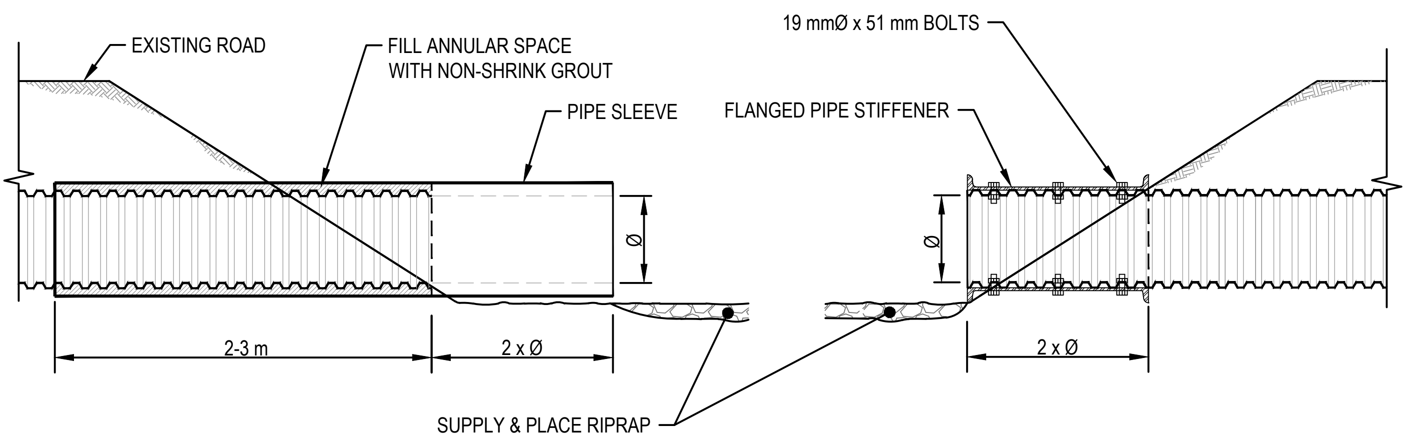
6.4.1 Culvert Maintenance and Repair

As per the guidelines for community drainage system planning, design, and maintenance in northern communities (CSA Group, 2015), culvert maintenance and repair guidelines are as follows:

- Culverts should be marked with a post painted in a bright colour and installed at the precise location of the culvert end. Culverts marking posts, when lost or damaged, shall be replaced.
- Spare culverts of each size shall be kept on hand to facilitate the repair and replacement of all sizes of culverts.
- Where the culverts are in good shape and only the ends are damaged, a SWSP sleeve should be added to reinstate the original length of the culvert. The annular space between the existing pipe and the SWSP sleeve should be grouted and sealed. Figure 6-15 provides a sketch covering the proposed repairs.



BEFORE REPAIR



AFTER REPAIR

PIPE SLEEVE OPTION
SCALE: NTS

PIPE STIFFENER OPTION
SCALE: NTS

NOTE:

CLIENT: Nunavut

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POND INLET MASTER DRAINAGE PLAN

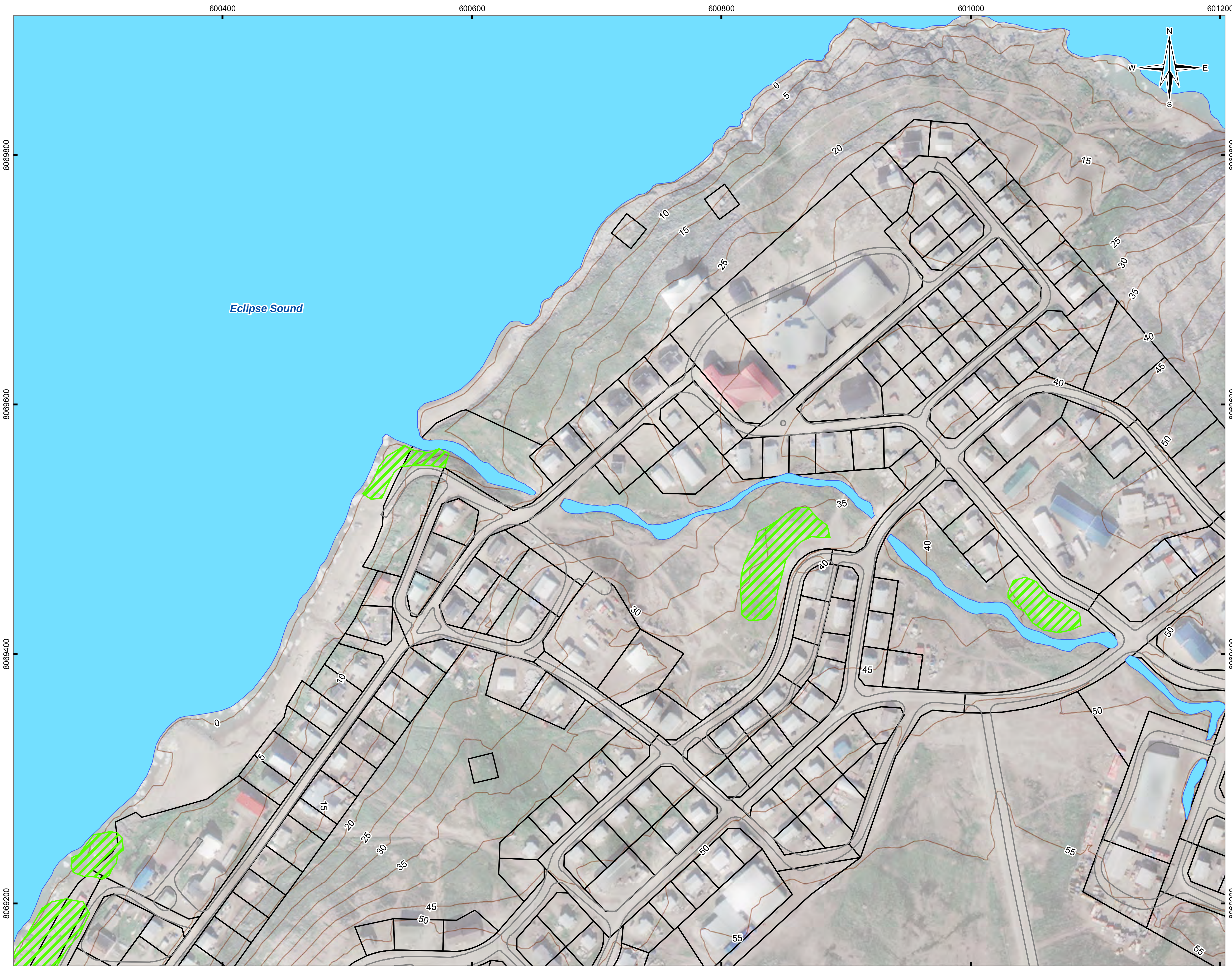
DAMAGED CULVERT END REPAIR DETAILS

PROJECT NO.	DWN	CKD	REV	
WTRM03178-01	MJK	ER	A	FIG.6-15
OFFICE: VANC	DATE: March 27, 2020			

6.4.2 Snow Removal Management Plan

As per the guidelines for Community Drainage System Planning, Design, and Maintenance in Northern Communities (CSA Group, 2015), removed snow should be prevented from re-entering the drainage system. Runoff from stockpiled snow can re-enter and overwhelm the drainage system causing flooding damage.

To that end, Tetra Tech recommends that removed snow from roadways and driveways be safely deposited in one of the designated Deposition Zones as shown in Figures 6-16 to 6-21.

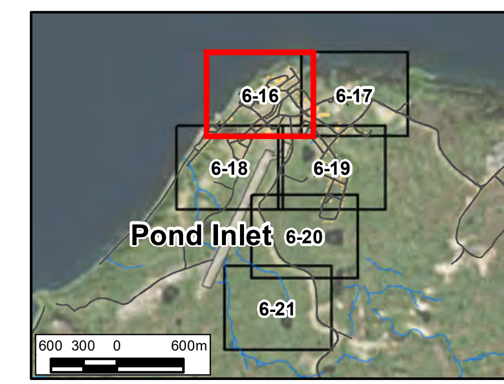


LEGEND

- Snow Deposition Area

Base Data

- Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_SnowRemoval.mxd

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Tt-VANC	DS	SL	ER	0

DATE	PROJECT NO.
March 27, 2020	TRN.WTRM03178-01

Figure 6-16

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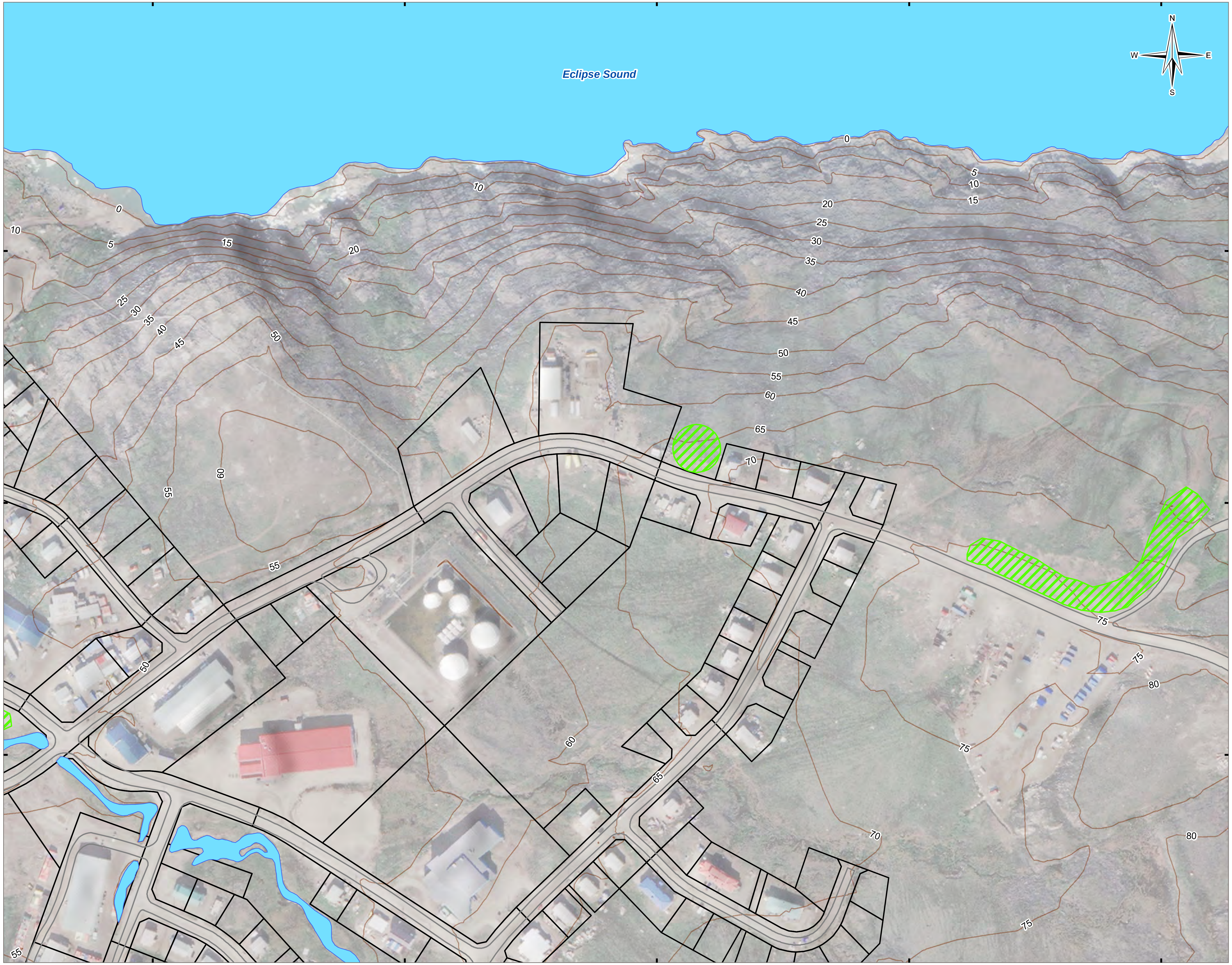
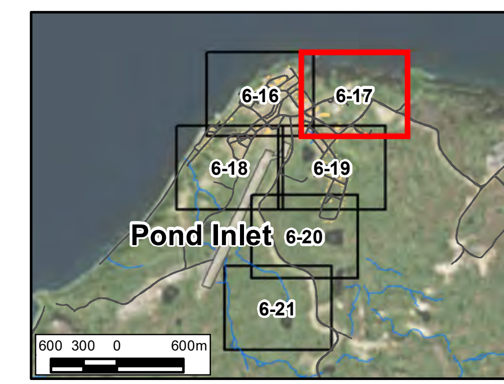


LEGEND

- Snow Deposition Area

Base Data

- Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

FILE NO.
WTRM03178-01_SnowRemoval.mxd

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DATE	PROJECT NO.
March 27, 2020	TRN.WTRM03178-01

Figure 6-17

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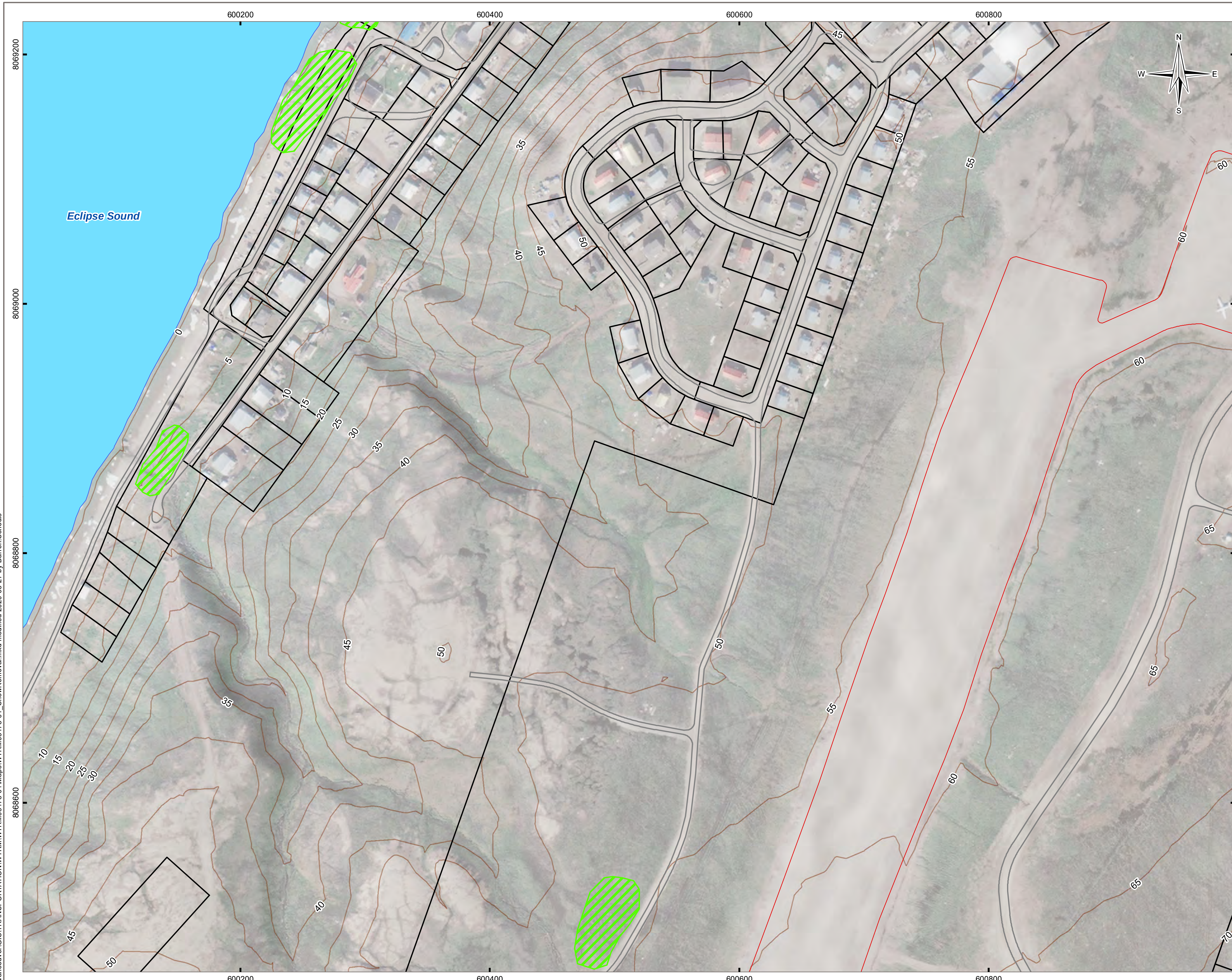
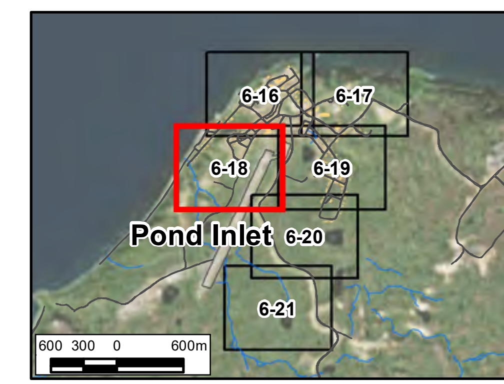


LEGEND

- Snow Deposition Area

Base Data

- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.
WTRM03178-01_SnowRemoval.mxd

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Tt-VANC	DS	SL	ER	0

DATE
March 27, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure 6-18

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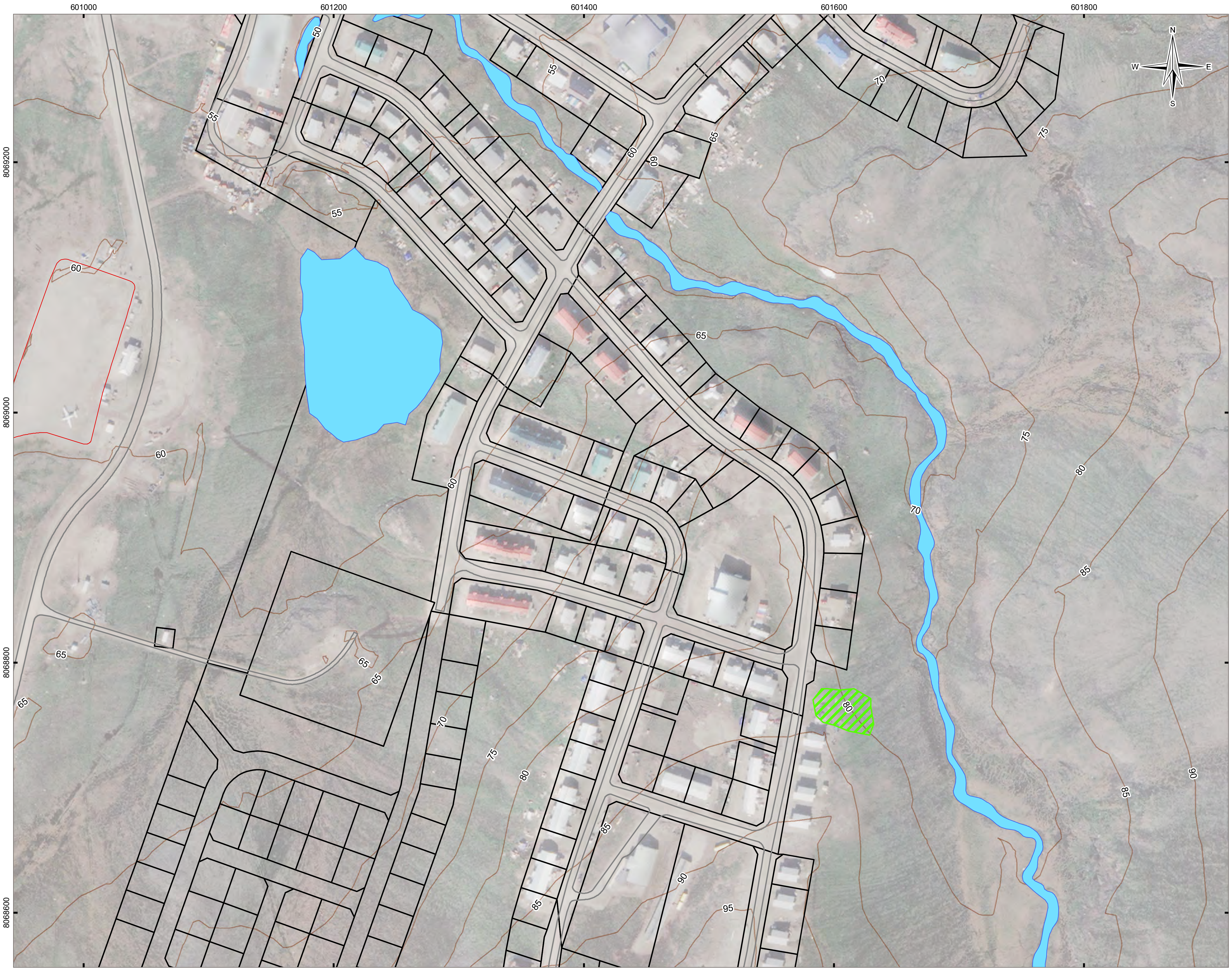
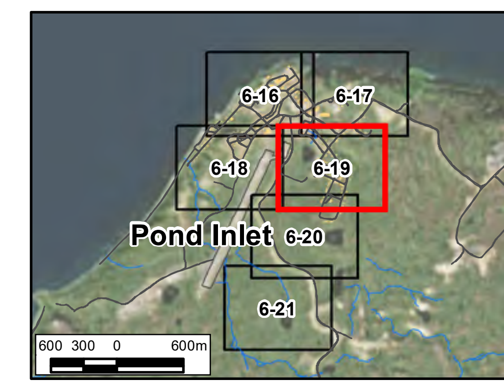


LEGEND

Snow Deposition Area

Base Data

- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_SnowRemoval.mxd				
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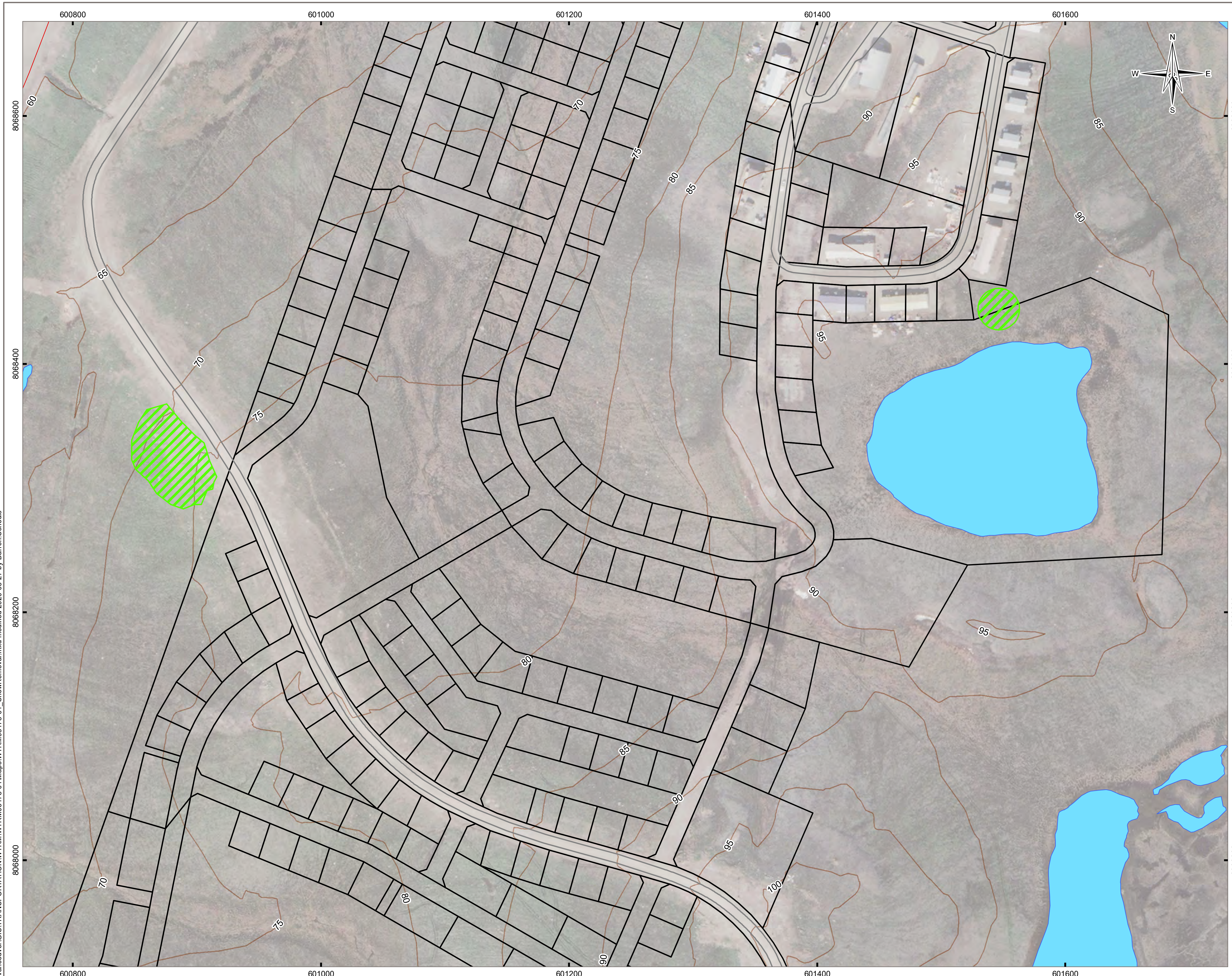
DATE	PROJECT NO.			
March 27, 2020	TRN.WTRM03178-01			

Figure 6-19

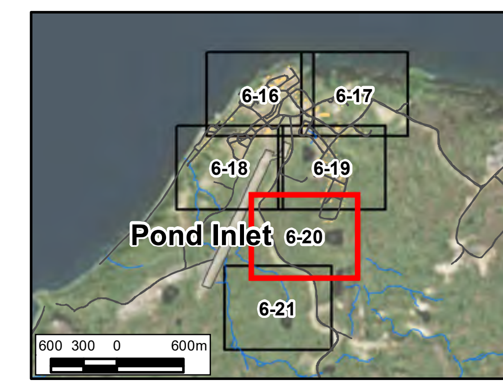


LEGEND

- Snow Deposition Area

Base Data

- Parcel
- Runway
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000

60 30 0 60
Metres

FILE NO.
WTRM03178-01_SnowRemoval.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
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DATE: March 27, 2020
PROJECT NO.: TRN.WTRM03178-01

Figure 6-20

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LEGEND

Snow Deposition Area

Base Data

Parcel

Gravel Road

Topographic Contour (5 m)

Waterbody

NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Pond Inlet
Snow Removal Management Plan

PROJECTION: UTM Zone 18
DATUM: NAD83
CLIENT: Nunavut

Scale: 1:3,000
Metres

FILE NO.: WTRM03178-01_SnowRemoval.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	SL	ER	0

DATE: March 27, 2020
PROJECT NO.: TRN.WTRM03178-01

Figure 6-21

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6.4.3 Culvert Thawing

An annual maintenance program should incorporate a culvert thawing strategy. Some options for thawing culverts are presented in Appendix C for consideration. Figure 6-22 below shows the proposed method for thawing ice inside culverts.

As per the project phasing diagrams shown in Figures 6-9 to 6-14, higher priority culverts should be thawed first. For example, culverts in Phase 1 zones should be thawed before culverts in Phase 2 zones.

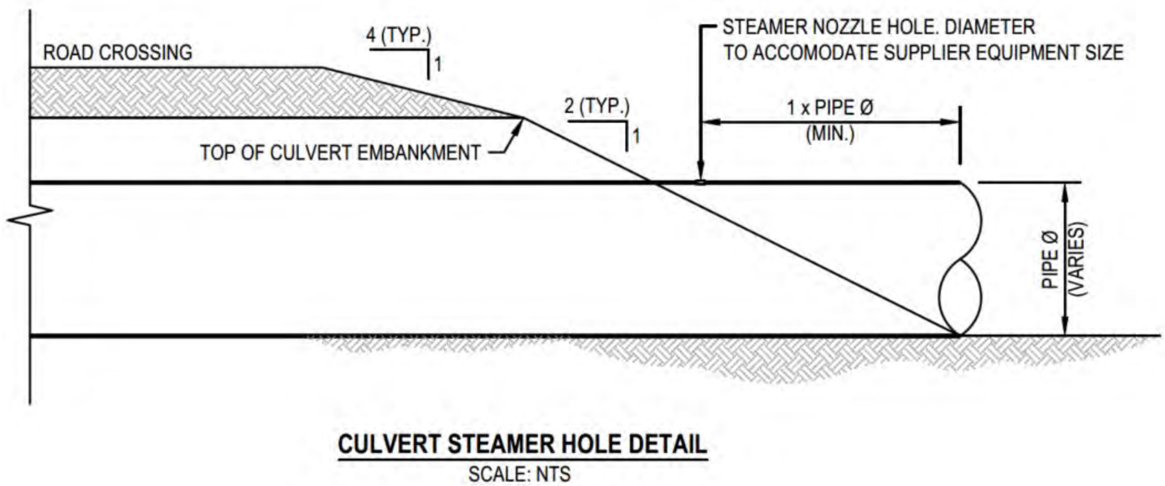

Figure 6-22: Culvert Thawing Detail

6.4.4 Maintenance Schedule

A recommended seasonal maintenance schedule as per the Guidelines for Community Drainage System Planning, Design, and Maintenance in Northern Communities (CSA Group, 2015), is presented as follows:

Spring:

- Visually inspect and thaw frozen culverts in order of their priority level, as discussed in Section 6.4.2. Note any damages to culverts.
- Remove debris from blocked or partially blocked culverts.
- Collect and dispose of litter if present.
- Following the spring freshet, inspect the drainage system to identify deficiencies for repair.

Summer:

- Repair washed out ditches, swales and riprap aprons as necessary. Ponding in ditches and swales should be identified and fixed by re-sloping the ditch.
- A water pump can be used to flush blocked culverts free of sediment, rocks, and debris. Discharge of sediments into natural streams should be avoided and appropriate sediment and erosion control measures should be incorporated to protect the receiving water bodies.

- Repair damaged culvert ends. Replace or re-install culverts that have shifted or moved. Repair culverts in order of their priority level and the level of damage observed.

Fall:

- Complete repairs to the drainage system.
- Replace missing or damaged culvert marking posts.
- Create an inventory of materials required for the next year's maintenance program.

Winter:

- Monitor culverts and culvert marking posts.
- Implement the snow removal management plan as detailed in Section 6.4.2.

7.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

Prepared by:
Eric Rothfels, BSc., E.I.T.
Civil/Water Resources Engineer-in-Training
Direct Line: 778.945-5775
Eric.Rothfels@tetratech.com

PROFESSIONAL ENGINEER
REGISTERED
D.N. MOSCHINI
LICENSEE
NT/NU

Reviewed by:
David Moschini, P.Eng.
Manager - Water Resources and Infrastructure
Direct Line: 604.608.8612
David.Moschini@tetratech.com

Reviewed by:
Vladislav E Roujanski, Ph.D., P.Geol.
Senior Project Geologist – Geocryologist
Direct Line: 587.460.3610
Vladislav.Roujanski@tetratech.com

ER/DM/VR/tak

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APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

HYDROTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

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1.3 STANDARD OF CARE

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If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

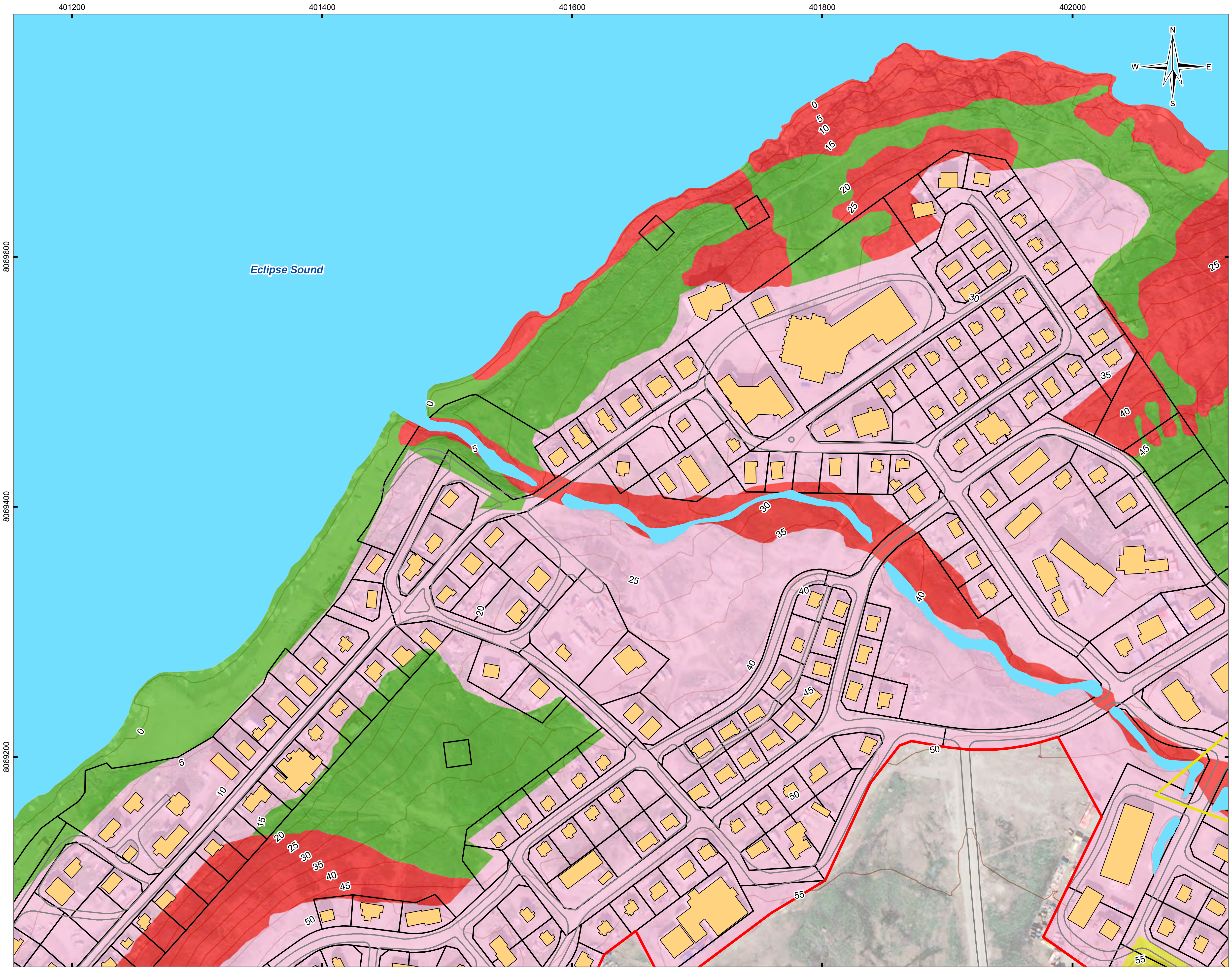
Unless expressly agreed to in the Services Agreement, TETRA TECH was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project.

1.8 LEVEL OF RISK

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the hydrotechnical information that was reasonably acquired to facilitate completion of the design.

APPENDIX B

COMMUNITY PLANS AND BYLAW NO. 240

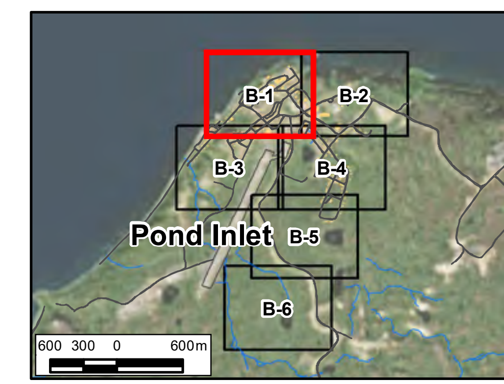


LEGEND

Suitability
- Anthropogenic
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented
- Unsuitable for Development

Site Features
- Airport Property Boundary
- Waste and Sewage 450 m Setback

Base Data
- Current Parcel
- Building Footprint
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

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FILE NO.
WTRM03178-01_CommunityPlan.mxd

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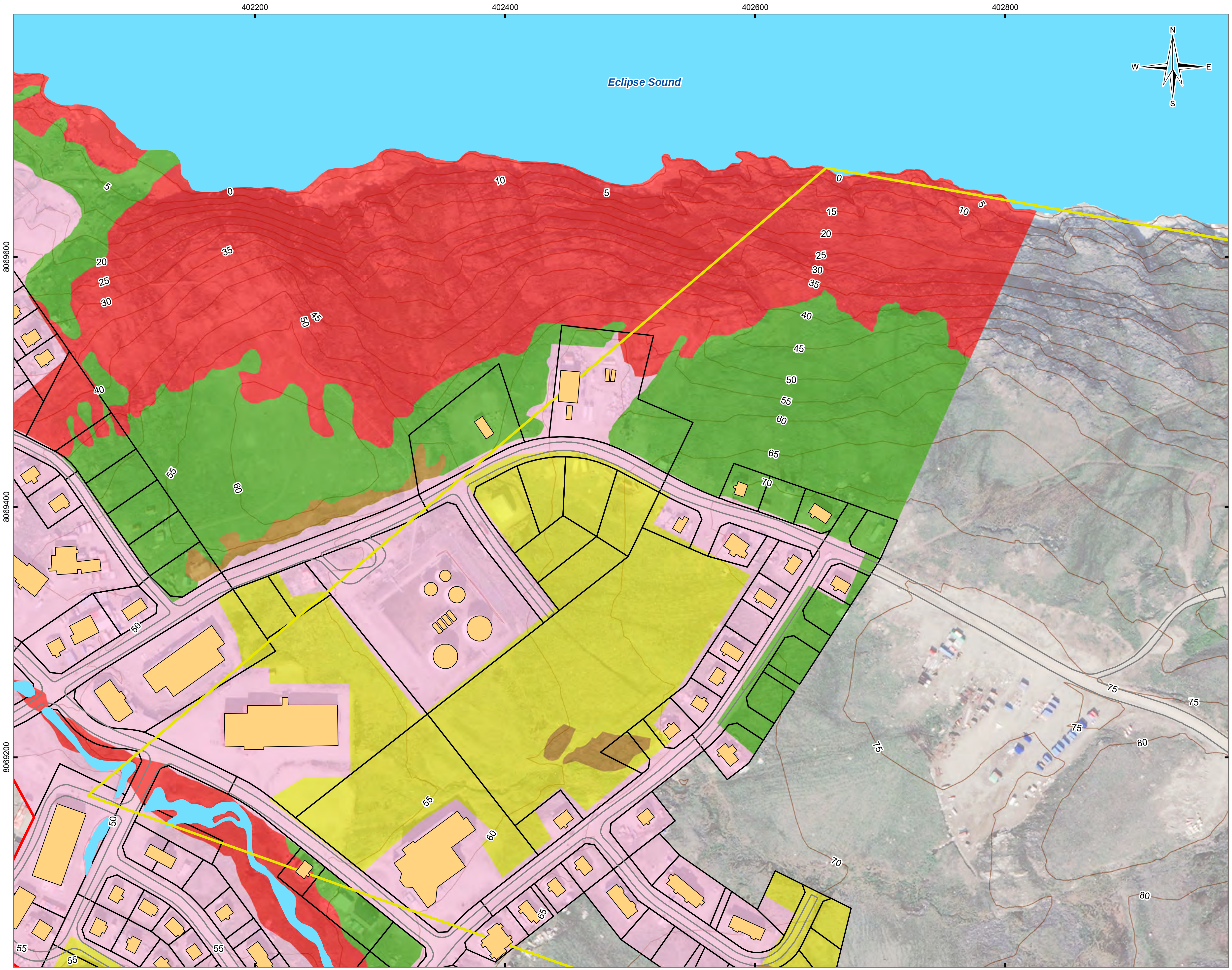
DATE
March 31, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure B-1



LEGEND

Suitability

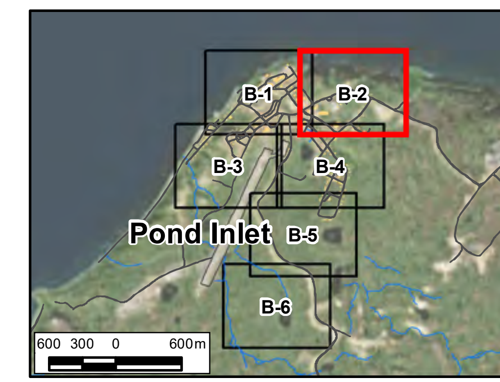
- Anthropogenic
- Bedrock
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented
- Unsuitable for Development

Site Features

- Airport Property Boundary
- Waste and Sewage 450 m Setback

Base Data

- Current Parcel
- Building Footprint
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.
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DATE
March 31, 2020

PROJECT NO.
TRN.WTRM03178-01

Figure B-2

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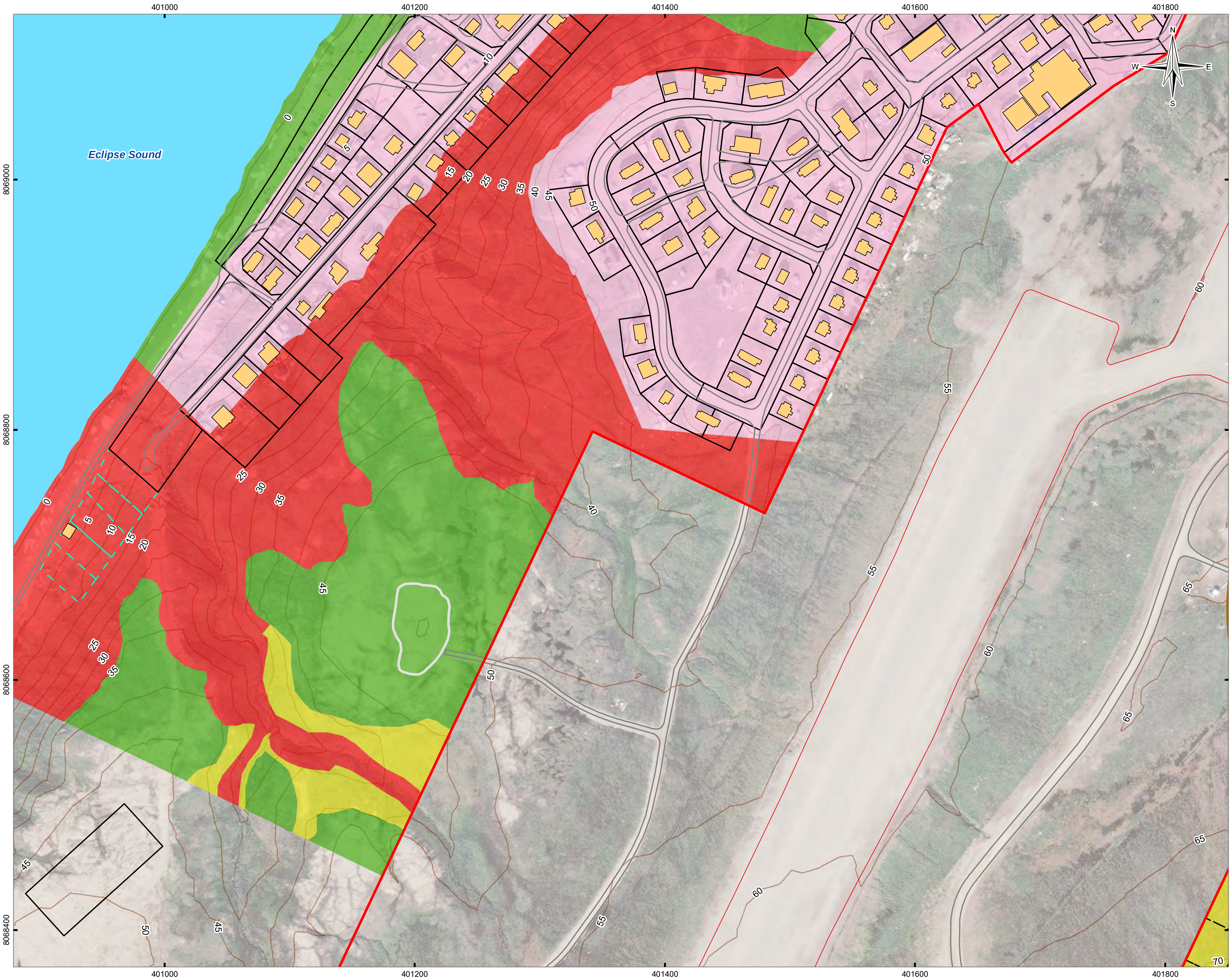


LEGEND

Suitability

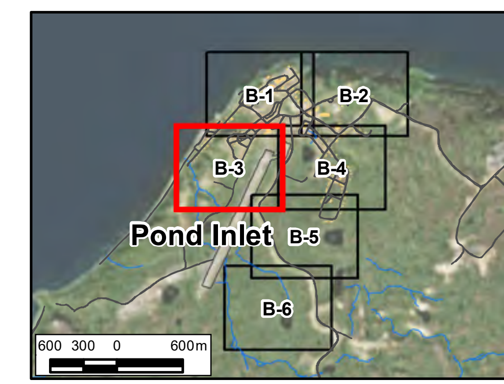
- Anthropogenic
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented
- Unsuitable for Development

Site Features

- Airport Property Boundary
- Cemetery

Base Data

- Current Parcel
- GN Proposed Parcel
- Relocate GN Proposed Parcel
- Runway
- Building Footprint
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
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POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000 (60 30 0 60 Metres)

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DATE	PROJECT NO.			
March 31, 2020	TRN.WTRM03178-01			

Figure B-3

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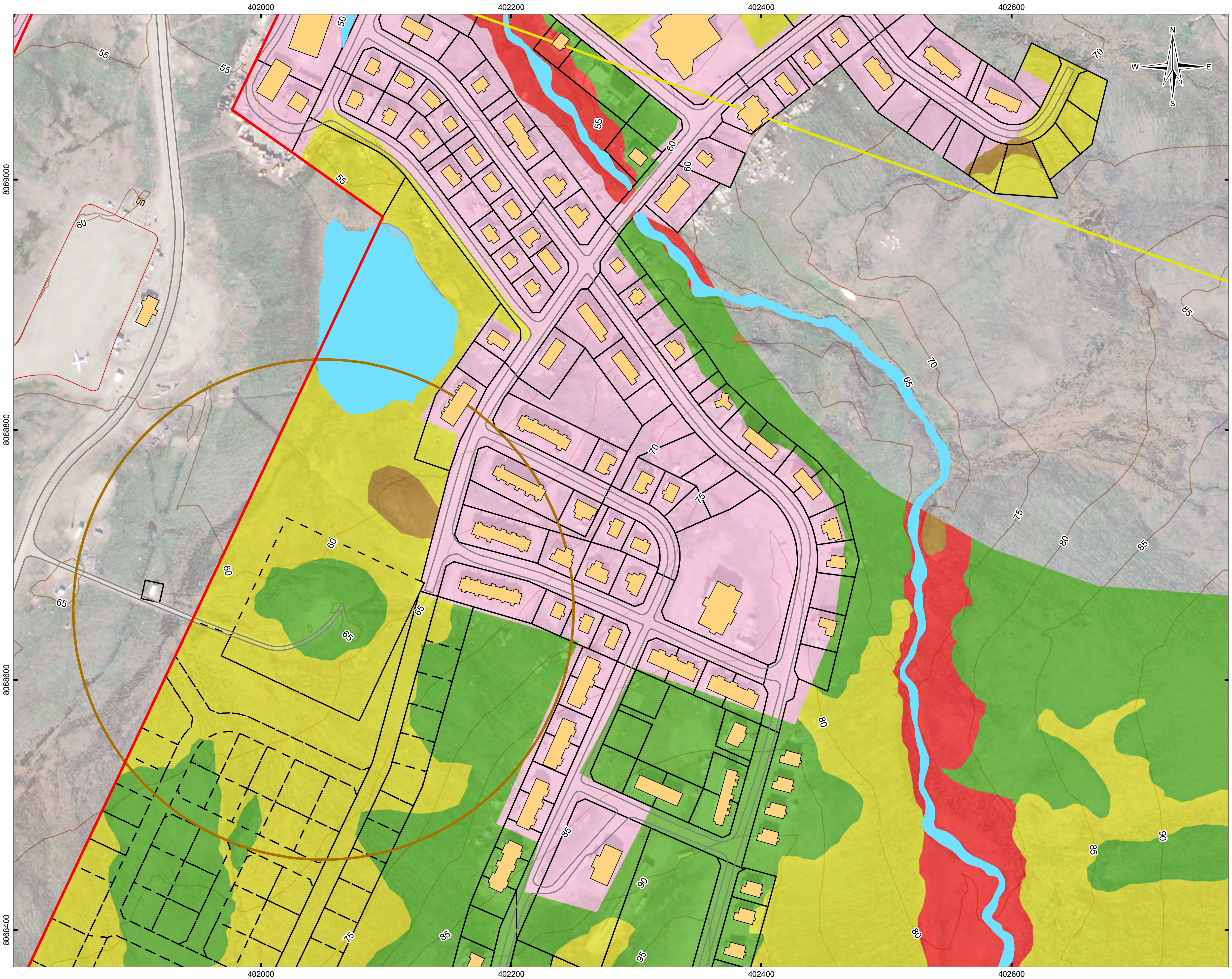


LEGEND

Suitability

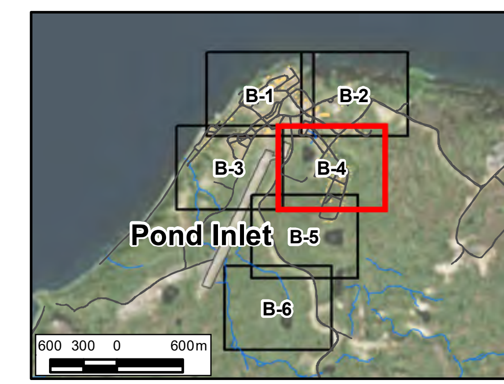
- Anthropogenic
- Bedrock
- Water
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented
- Unsuitable for Development

Site Features

- Airport Property Boundary
- Waste and Sewage 450 m Setback
- Non-Directional Beacon 200 m Setback

Base Data

- Current Parcel
- GN Proposed Parcel
- Runway
- Building Footprint
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

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DATE	PROJECT NO.			
March 31, 2020	TRN.WTRM03178-01			

Figure B-4

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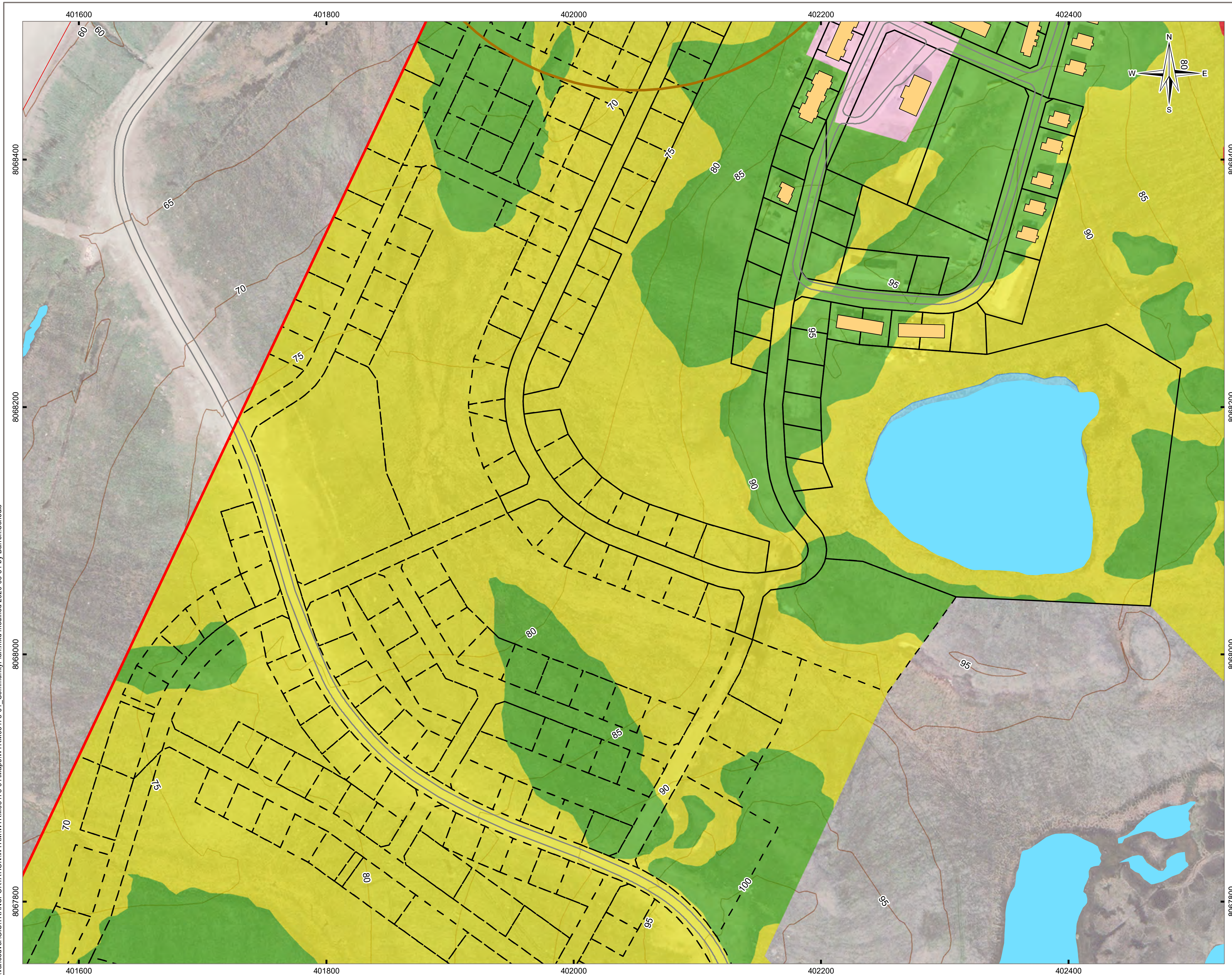

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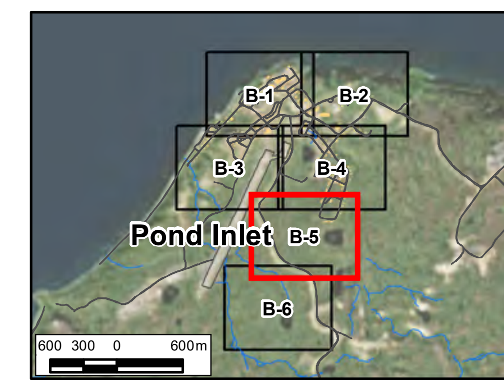
LEGEND

Suitability
- Anthropogenic
- Water
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented

Site Features
- Airport Property Boundary
- Non-Directional Beacon 200 m Setback

Base Data
- Current Parcel
- GN Proposed Parcel
- Runway
- Building Footprint
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
ISSUED FOR USE

POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.				
WTRM03178-01_CommunityPlan.mxd				
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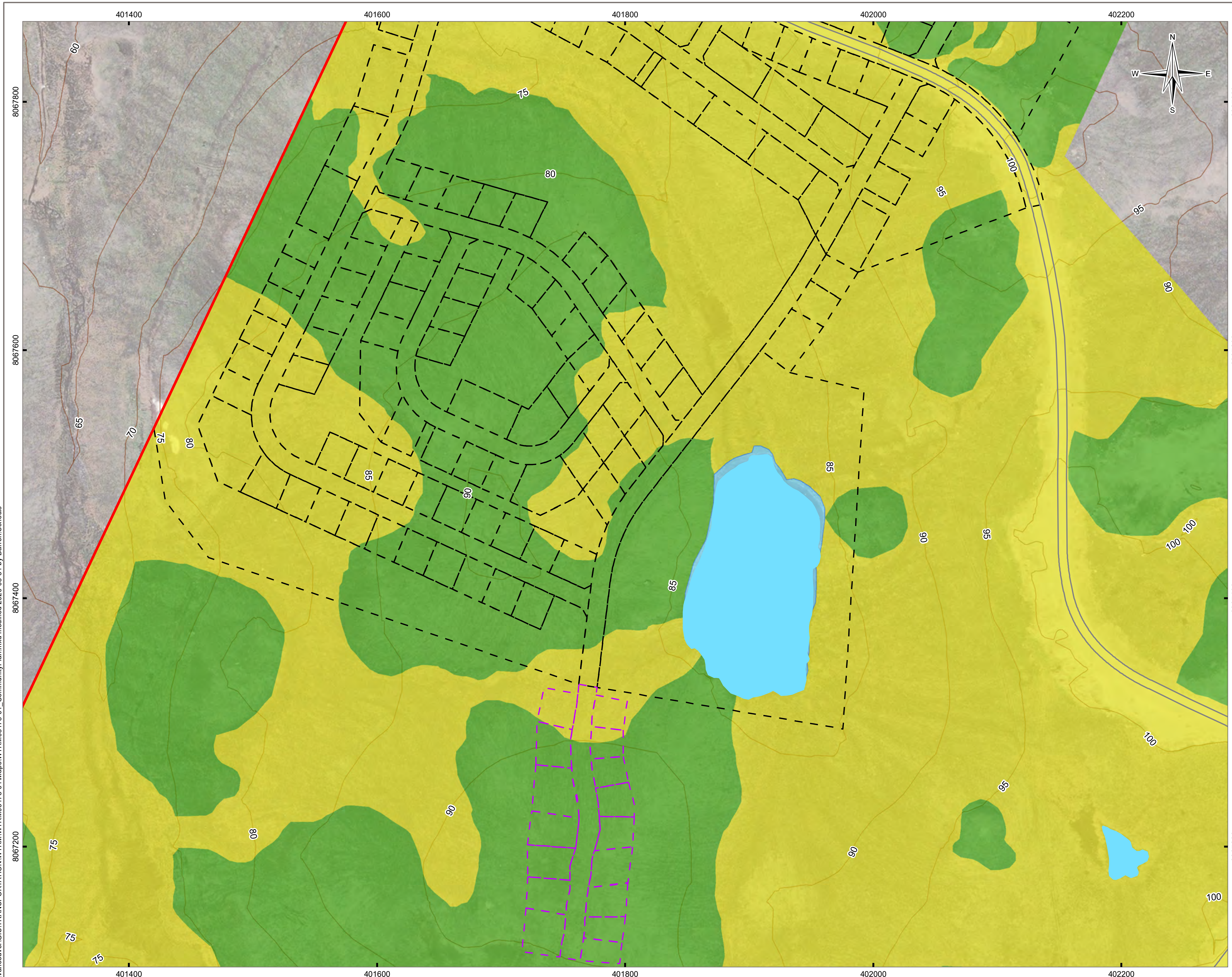
DATE	PROJECT NO.			
March 31, 2020	TRN.WTRM03178-01			

Figure B-5



LEGEND

Suitability

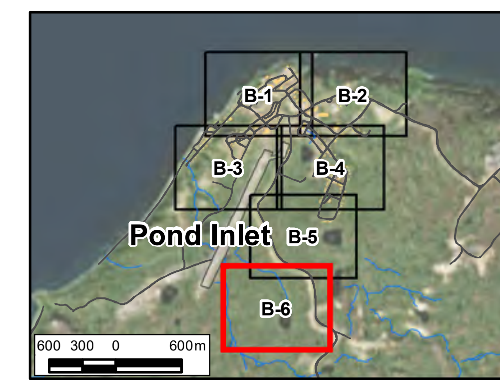
- Water
- Suitable for Development
- Conditionally Suitable for Development Provided the Drainage Improvement Plan is Implemented

Site Features

- Airport Property Boundary

Base Data

- Current Parcel
- GN Proposed Parcel
- Tetra Tech Proposed Relocated Parcel
- Gravel Road
- Topographic Contour (5 m)
- Waterbody



NOTES
Base data source:
1. Pond Inlet base data from Government of Nunavut

STATUS
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POND INLET MASTER DRAINAGE PLAN

Revised Community Planning Map

PROJECTION	DATUM	CLIENT
UTM Zone 18	NAD83	Nunavut

Scale: 1:3,000
60 30 0 60
Metres

TETRA TECH

FILE NO.
WTRM03178-01_CommunityPlan.mxd

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DATE	PROJECT NO.
March 31, 2020	TRN.WTRM03178-01

Figure B-6

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SCHEDULE 1 - COMMUNITY PLAN

SECTION 1. INTRODUCTION

1.1 Purpose of the Plan

The purpose of the Pond Inlet Community Plan is to outline Council's policies for managing the physical development of the Hamlet for the next 20 years - to 2034. The Community Plan was created through a community consultation process and reflects the needs and desires of the Community. The Community Plan builds on previous plans, while incorporating new challenges, issues and needs identified by the Community.

1.2 Goals of the Community Plan

Community Plan policies emerge from the values of a community and its vision of how it would like to grow. The goals established for this Community Plan are:

1. To develop in an orderly fashion creating a safe, healthy, functional, and attractive community that reflects community values and culture.
2. To promote the Plan as a tool for making effective and consistent decisions regarding land use and development in the community.
3. To ensure an adequate supply of land for all types of uses to support the growth and change of the community.
4. To build upon community values of participation and unity to support community projects and local economic development.
5. To protect the natural beauty of “Nuna”, protect viewpoints to the water, and retain waterfront and lakeshore areas for public uses and traditional activities.

1.3 Administration of the Plan

The Community Plan is enacted by By-law. Changes to the Plan can be made by amending the By-laws in accordance with the *Nunavut Planning Act*. The Community Plan should be reviewed and updated every five years as required by the *Nunavut Planning Act*. A Zoning By-law is also being enacted for the purpose of implementing detailed policies based on the Community Plan. All development must follow the intent of the Community Plan and Zoning By-law. The Community Plan includes Schedule 1 (Plan Policy Text), Schedule 2 (Community Plan and Zoning Map) and Schedule 3 (General Land Use Map).

SECTION 2. COMMUNITY GROWTH AND PHASING POLICIES

At the time of preparation of this Plan, the population of Pond Inlet was approximately 1,666 people. This Plan is based on a future population of 2,708 people by 2034. It is estimated that an additional 363 dwelling units will be required to meet the projected population growth, representing the need for approximately 14 hectares of land for residential development. In addition, an appropriate mix and range of industrial, commercial, and community uses has been proposed to meet long-term needs. The policies of Council are:

a) Plan for a 2034 population of 2,708.
b) Identify sufficient land on the Community Plan to meet the needs of the projected 2034 population.
c) Review the Community Plan in 5 years, in 2019, to re-assess actual rates of growth and community needs.
d) Council will generally phase new land development as follows:
   - i.) 2014 - 2019:
     - Build on existing vacant lots within the built-up area.
     - Develop Phase 1 subdivision.
     - Develop lots in the industrial subdivision near the power plant.
   - ii.) 2019 - 2024
     - Develop Phase 2 subdivision.
     - Develop lots in the industrial subdivision and along road leading to landfill.
   - iii.) 2024 - 2034
     - Develop Phase 3 area.
e) Council may change the phasing of development without amendment to this Plan.

SECTION 3. GENERAL POLICIES

The following policies of Council apply to all development in the Hamlet regardless of land use designation:

a) The development of lots shall be subject to the following lot development policies:
   i.) All service connections to buildings shall be easily accessed from the front yard on all lots and grouped together, where possible.
ii.) Access to new buildings will avoid, where possible, main entrances on the south-southeast side to reduce problems associated with snow drifting.
iii.) Buildings shall be sited to respect setbacks identified on the Zoning Chart.
iv.) Any building over 500 m2 in gross floor area shall consider potential wind impacts on surrounding development. A wind study may be required by the Development Officer.
v.) Culverts are required and shall be installed at the access points to lots.
vi.) On any portion of a lot where fill is introduced, drainage shall be directed towards the public road. Exceptions may be made by the Development Officer. Where possible, drainage troughs shall not be located in Utility Rights-of-Way or Easements.
vii.) Road widenings may be obtained as required at the time of development or redevelopment of a lot in situations where the road right of way is less than 16 metres wide.
b) Utilities or communication facilities shall be permitted in any land use designation. Other than designated Rights-of-Way or Easements for Utility or Communication lines, Easements alongside roadways, marked between the edge of the roadway and lot lines, will be used for distribution lines, with a minimum clearance, as specified in the Utility Corporation's Joint Use Agreement.
c) The Hamlet will pile snow in locations to minimize downwind snow drifting and where spring melt run-off can be properly channeled to drainage ditches or waterbodies.
d) The Hamlet will avoid piling snow within at least 30.5 metres (100 feet) of any watercourse.
e) No development is generally permitted within 30 metres from the normal high water mark of a waterbody or watercourse.
f) The Hamlet shall protect any cemeteries and sites of archaeological, ethnicographical, palaeontological or historical significance from disturbance. Any development in or near such sites shall follow the *Nunavut Archaeological and Palaeontological Regulations, 2001* of the Nunavut Act (Canada).
g) The Hamlet shall encourage development that minimizes emissions from fossil fuels, that are energy efficient and that consider alternative energy supply technology.
h) The Hamlet shall work with the Nunavut Planning Commission to ensure that the Pond Inlet Community Plan and the future Baffin Regional Land Use Plan are compatible.

SECTION 4. LAND USE DESIGNATION

4.1 Residential

The Residential designation provides land for primarily residential uses, but also permits other small-scale conditional uses subject to the approval of Council. The policies of Council are intended to maintain an adequate supply of land for residential development, to build safe and livable neighbourhoods and to protect residential areas from incompatible development. The policies of Council are:

a) The Residential designation will be used primarily for housing with all types of dwelling types permitted. Other related residential uses such as a group home, a home occupation, or bed and breakfast will also be permitted.
b) Residential development will be phased so that a target minimum of 2.5 hectares of vacant surveyed land is available at any given time. Residential areas will be developed with an average residential density of 22 units per hectare and will include a mix of unit types including those for elders.

4.2 Community Use

The Community Use designation is intended to maintain an adequate supply of land for community uses, preferably in significant and important locations so that residents may enjoy easy access to public facilities and services. The policies of Council are:

a) The Community Use designation will be used primarily for public uses (i.e. social, cultural, religious, or educational) and government services.
b) Community facilities will be centrally located to ensure safe and convenient access by residents.

4.3 Commercial

The Commercial designation is intended to support local economic development by maintaining an adequate supply of land for commercial uses in a key locations across the Hamlet offering good access for residents and visitors. The policies of Council are:

a) The Commercial designation will be used for commercial uses such as hotels, restaurants, retail, personal and business services, and offices.
b) Residential uses shall be permitted when located above a ground floor commercial use.
c) Commercial facilities will be located along main roads, where possible, to provide safe and convenient access by residents.
d) Council will encourage the re-use or redevelopment of existing commercial sites within the existing townsite.

4.4 Open Space

The Open Space designation is intended to protect shoreline environments, maintain access to the sea and to reserve open spaces within the built up area for recreational uses and cultural events. The policies of Council are:

a) The Open Space designation will be used primarily for parks, walking trails, traditional and recreational uses such as beach shacks, harbour uses, boat storage, dog teams, community docks, temporary storage of sealift materials and equipment during sealift operations, and municipal infrastructure such as a water pump house. All uses are conditional and at the discretion of Council.
b) A playground should be located within 300 metre walking distance from any residence in the community.
c) Unless otherwise noted, all Commissioner's Land forming part of the 100-foot strip (30.5 m) along the seashore measured from the ordinary high water mark will be designated Open Space.
d) No development is generally permitted within 30 metres from the normal high water mark of any river or major creek. Council may consider the filling of a waterbody where it is needed for future development provided that the appropriate approvals are obtained.
e) Open Space corridors will be protected for trail connections and drainage channels.

4.5 Industrial

The Industrial designation is intended to reduce the negative effects and dangers associated with industrial uses such as noise, dust, odours, truck travel and the storage of potentially hazardous substances by concentrating these uses on the periphery of the townsite. The policies of Council are:

a) Permitted uses in the Industrial designation will include all forms of manufacturing, processing, warehousing and storage uses as well as uses associated with marine transportation. Permitted uses will also include garages, power generation plants, and fuel storage.
b) Council will develop new industrial subdivisions near the current landfill site to minimize land use conflicts and to reserve land closer to the townsite for residential and community uses. Council will work with local businesses and government operations to identify opportunities to relocate over time non-conforming industrial uses (eg. garages, warehouses, power plant) to industrial areas.

4.6 Transportation

The Transportation designation is intended to protect and ensure the safe operation of airport and related activities such as the NavCanada communications site. The policies of Council are:

a) Permitted uses in the Transportation designation includes all activities related to air traffic and uses accessory to these activities such as related commercial activities and communications sites.
b) All development within the 4km boundary of the airport, as shown on Schedule 3, shall comply with the Pond Inlet Airport Zoning Regulations. Development applications shall be referred to Nunavut Airports for review and approval where development is proposed adjacent to the airport and/or where development has the potential to interfere with airport operations.
c) All development within the Transportation Influence Zone of the communications facility is subject to the approval of NavCanada.
d) Council will discourage the use of travelled pathways that are not identified as public right-of-ways.

4.7 Hinterland

The Hinterland designation applies to all unsurveyed land within the Municipal Boundary not designated by another land use and is intended to protect the natural beauty and cultural resources of the land - 'Nuna' - while providing access for traditional, recreational and tourism activities, as well as quarrying. The policies of Council are:

a) The Hinterland designation generally permits traditional, tourism and passive recreational uses. Permitted uses also include dog teams, quarrying, and infrastructure projects for local economic development.
b) Council shall ensure that development does not negatively impact wildlife, wildlife habitat and harvesting and is consistent with the guiding principles of Inuit Qaujimajatuqangit (IQ).

4.8 Waste Disposal

The Waste Disposal designation is intended to identify existing or former waste disposal sites and ensure required development setbacks are followed. The policies of Council are:

a) The Waste Disposal designation permits no development except those uses accessory to the operation or remediation of a waste disposal site.
b) The Hamlet shall prohibit the development of residential uses and uses involving food storage or food preparation within the 450 metre setback from any existing or former waste disposal site, pursuant to the *General Sanitation Regulations* of the Public Health Act.
c) The Hamlet shall prohibit the development of any public road allowance or cemetery within a 90 metre setback from a waste disposal ground, pursuant to the General Sanitation Regulation of the *Public Health Act*.
d) The Hamlet will evaluate all possible options for an integrated waste management system, including:
   a. the suitability of the existing landfill site for long-term use;
   b. the use of an incinerator;
   c. metal recovery projects; and
   d. complementary strategies, such as source reduction, reuse, and recycling of waste materials.
e) The Hamlet supports a reduced setback of 90 metres from former waste disposal sites. Development of residential uses and uses involving food storage or food preparation within the 450 metre setback from these former waste disposal sites will require approval from the Nunavut Health Department.

4.9 Granular Resources

The Granular Resources designation is intended to protect aggregate deposits for future extraction. The policies of Council are:

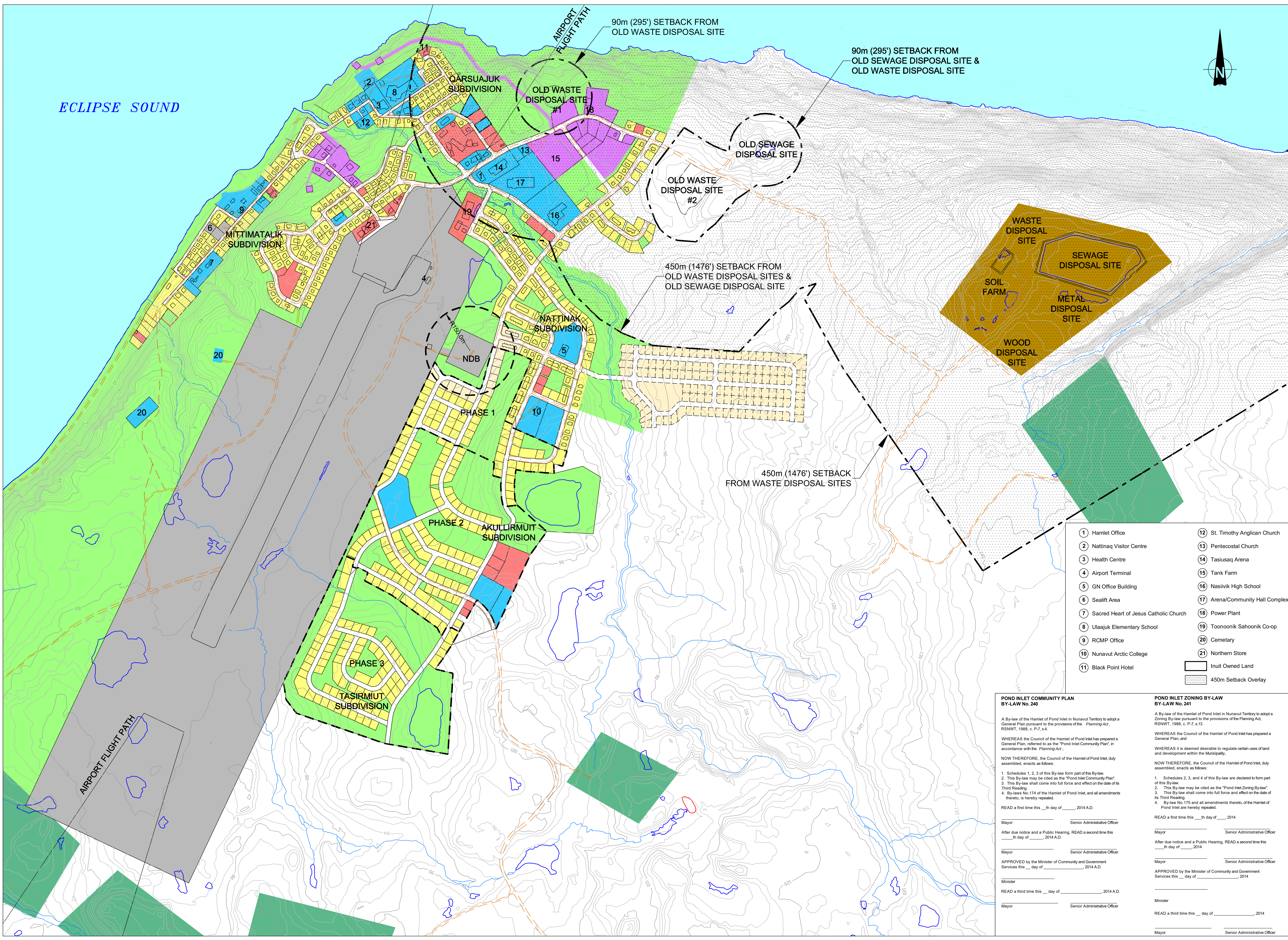
a) The Granular Resources designation does not permit any development except uses accessory to the operation or remediation of a quarry or gravel pit.

4.10 Municipal Reserve

The Municipal Reserve designation is intended to reserve land for the future growth of the community. The policies of Council are:

a) The Municipal Reserve designation does not permit any development except temporary uses approved by Council.
b) Municipal Reserve lands shall be redesignated by amendment to this Plan prior to being used for community expansion.
c) A conceptual road network may be shown on some of the Municipal Reserve lands which considers connections with existing road network, future land uses, prevailing wind direction, solar orientation, drainage and topography. The concept may need to be changed according to community needs during the detailed subdivision design process.

SCHEDULE 2 - COMMUNITY PLAN MAP



POND INLET COMMUNITY PLAN
BY-LAW No. 240

A By-law of the Hamlet of Pond Inlet in Nunavut Territory to adopt a General Plan pursuant to the provisions of the *Planning Act*, RSNWT, 1988, c. P-7, s.4.

WHEREAS the Council of the Hamlet of Pond Inlet has prepared a General Plan, referred to as the "Pond Inlet Community Plan", in accordance with the *Planning Act*;

NOW THEREFORE, the Council of the Hamlet of Pond Inlet, duly assembled, enacts as follows:

1. Schedules 1, 2, 3 of this By-law form part of this By-law.
2. This By-law may be cited as the "Pond Inlet Community Plan".
3. This By-law shall come into full force and effect on the date of its Third Reading.
4. By-laws No.174 of the Hamlet of Pond Inlet, and all amendments thereto, is hereby repealed.

READ a first time this __th day of ______, 2014 A.D.

Mayor ______________________ Senior Administrative Officer ______________________

After due notice and a Public Hearing, READ a second time this _____th day of ______, 2014 A.D.

Mayor ______________________ Senior Administrative Officer ______________________

APPROVED by the Minister of Community and Government Services this __ day of _________________, 2014 A.D.

Minister ______________________

READ a third time this __ day of _________________, 2014 A.D.

Mayor ______________________ Senior Administrative Officer ______________________

POND INLET ZONING BY-LAW
BY-LAW No. 241

A By-law of the Hamlet of Pond Inlet in Nunavut Territory to adopt a Zoning By-law pursuant to the provisions of the Planning Act, RSNWT, 1988, c. P-7, s.13.

WHEREAS the Council of the Hamlet of Pond Inlet has prepared a General Plan, and

WHEREAS it is deemed desirable to regulate certain uses of land and development within the Municipality,

NOW THEREFORE, the Council of the Hamlet of Pond Inlet, duly assembled, enacts as follows:

1. Schedules 2, 3, and 4 of this By-law are declared to form part of this By-law.
2. This By-law may be cited as the "Pond Inlet Zoning By-law".
3. This By-law shall come into full force and effect on the date of its Third Reading.
4. By-law No.175 and all amendments thereto, of the Hamlet of Pond Inlet are hereby repealed.

READ a first time this ___th day of ____, 2014

Mayor ______________________ Senior Administrative Officer ______________________

After due notice and a Public Hearing, READ a second time this ____th day of _____, 2014

Mayor ______________________ Senior Administrative Officer ______________________

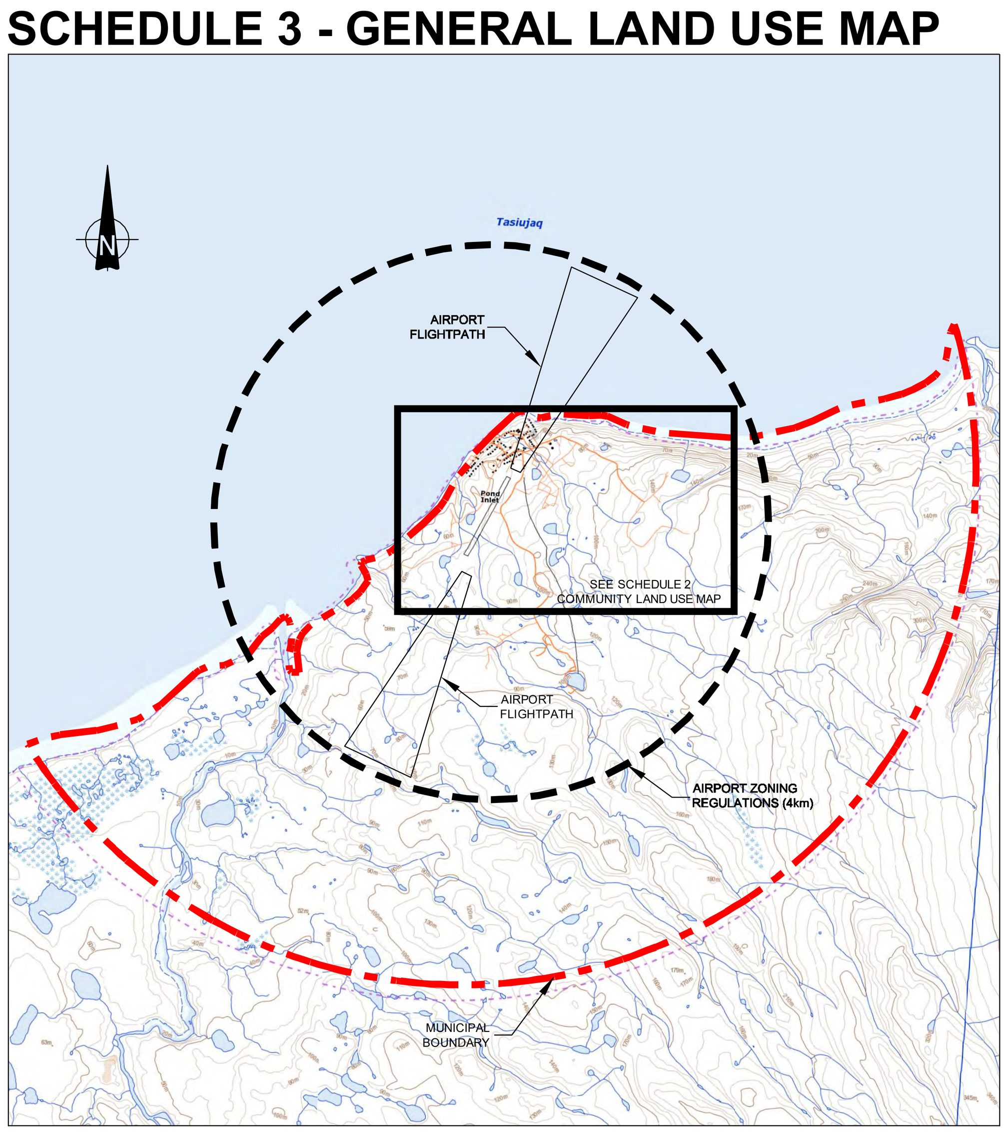
APPROVED by the Minister of Community and Government Services this __ day of _________________, 2014

____
Minister

READ a third time this __ day of _________________, 2014

Mayor ______________________ Senior Administrative Officer ______________________

SCHEDULE 3 - GENERAL LAND USE MAP

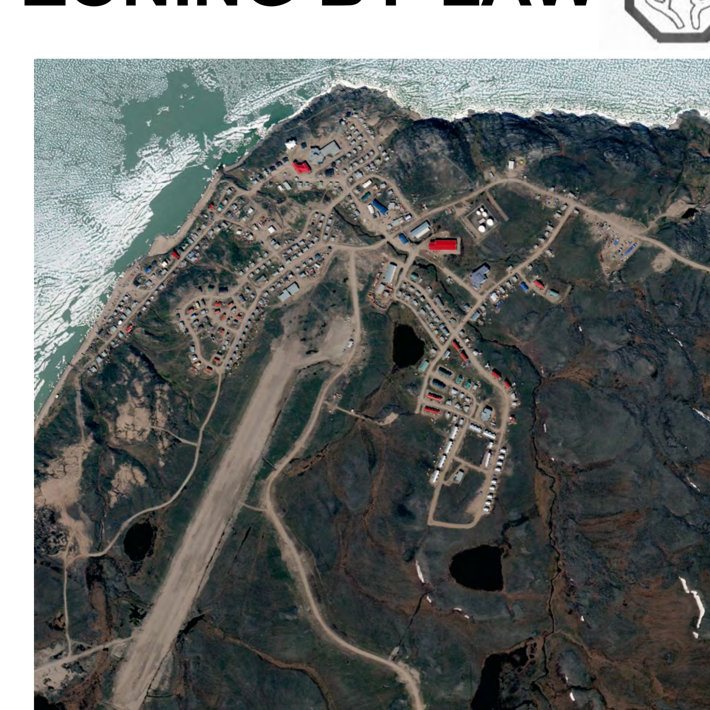


SCHEDULE 4 - ZONE REGULATIONS

	Permitted Uses	Conditional Uses	Zone Requirements
Residential	Dwelling, single-unit Dwelling, semi-detached or duplex Park or playground	Bed and breakfast Craft studio Day care centre Dwelling, multi-unit Dwelling, mini home Elders facility Group home Home occupation Secondary suite Rowhouse	(a) Setbacks (minimum) Front = 6 metres Rear = 6 metres Rear, backing onto an OS Zone = 2.5 metres Side (Exterior) = 4 metres Side (Interior) = 6 metres, or as required by the Fire Marshal Building Height (maximum) 8.5 metres (28 feet) (b) Despite the provisions of Section 6.3(a), for semi-detached dwellings or rowhouse dwellings located on separate, adjacent lots, the side yard where units are attached may be reduced to zero. (c) Parking or storage of a commercial vehicle having a gross vehicle weight of 4,500 kg or more such as construction equipment including bulldozers, backhoes, high hoes, and pay loaders is not permitted. (d) The following provisions will apply to Secondary Suites: (i) The suite forms part of a single unit or semi-detached dwelling; (ii) The suite is structurally attached or located within the principal dwelling; (iii) The suite does not exceed a floor area of 25% of the principal dwelling, or 60m² of gross floor area, whichever is less.
Commercial	Bank Broadcasting studio Commercial recreation Communications facility Convenience store Craft studio Day care centre Hotel Office Parking lot Personal service Restaurant Retail store Service and repair shop	Automotive gas bar Automotive repair, sales, or rental shop Dwelling unit(s) in a non-residential building provided that the dwelling unit(s) are above the ground floor. Contractor's shop Home occupation Uses similar in character and purpose to those listed for this zone	(a) Setbacks (minimum) Front = 6 metres Rear = 6 metres Side (Exterior) = 4 metres Side (Interior) = 6 metres, or as required by the Fire Marshal Building Height (maximum) 3 storeys, not to exceed 13 metres (42.65 feet)
Community Use	Broadcasting studio Communications facility Community freezer Community hall or centre Day care centre Educational facility Elders facility Emergency and protective services Place of Worship Government office Group home Health care facility Park or Playground Parking lot Post office	Cemetery Uses similar in character and purpose to those listed for this zone	(a) Setbacks (minimum) Front = 6 metres Rear = 6 metres Side (Exterior) = 6 metres Side (Interior) = 6 metres, or as required by the Fire Marshal Building Height (maximum) 13 metres (42.65 feet)
Open Space	Archaeological site Beach shacks Boat storage Dock Monument, cairn, or statue Park or playground Shed to store equipment for traditional, cultural, and recreational activities taking place in the Zone. Snow fence Sports field Washroom facility	Communications facility Dog teams Temporary outdoor storage of sealift equipment during sealift Temporary tenting or camping Uses similar in character and purpose to those listed for this zone	(a) The following provisions applies to all development in the Open Space Zone: Gross Floor Area (maximum) 25 sq.m. Building Height (maximum) 3.1 metres (10 feet) (b) No building or structure shall be located closer than 10m to any side or rear lot line. (c) Dog teams may not be located closer than 30.5 m to a water body.
Industrial	Automotive gas bar Automotive repair, sales or facility Building supply or contractors shop Caretaker unit Communications facility Heavy equipment and vehicle yard Outdoor storage Rental shop Warehouse	Community freezer Barge staging and landing site with associated warehousing Food processing facility Fuel storage facility Hazardous goods storage Manufacturing plant Power generation facility Uses similar in character and purpose to those listed for this zone	(a) Setbacks (minimum) Front = 6 metres Rear = 8 metres Side (Exterior) = 6 metres Side (Interior) = 8 metres, or as required by the Fire Marshal Building Height (maximum) 10.7 metres (35 feet) (b) Only 1 caretaker unit is permitted on a lot. (c) Hazardous goods storage or tank farm uses shall not be permitted within 30.5 metres of any water course. (d) No commercial development involving food storage, handling or preparation shall be permitted within 450m of a waste handling facility.
Granular Resources		Quarry	
Waste Disposal		Waste disposal site Sewage treatment system (lagoon, etc.)	(a) No residential development or commercial development involving food storage, handling or preparation shall be permitted within 450 metres of a waste disposal site.
Hinterland	Archaeological site Dog team Temporary tenting or camping	Beach shack Cabin Quarry Cemetery Commercial harvesting Communications facility Permanent hunting and fishing cabins or camps Resource exploration and development Snow fence Tourist facilities Wind turbine Uses similar in character and purpose to those listed for this zone	(a) Any development within the Transportation Influence Zone as indicated on the Land Use Map shall be subject to the approval of NAV Canada. (b) No development is permitted within 150 metres downwind of any snow fence without the approval of council. (c) No development is permitted within 200 metres of a wind turbine. (d) No development is permitted within 100 metres of an Archaeological or Paleontological Site, unless approved by the Territorial Archaeologist or Director of Culture and Heritage from the Department of Culture and Heritage. (e) Cabins may not be located closer than 30.5m to a waterbody and/or road (whether it be surveyed or not).
Transportation	Airport and related uses Communications facility Service shop Sea lift facility		(a) Any development within a 4,000 m radius of the airport reference point, as indicated on the Land Use Map, is subject to the Pond Inlet Airport Zoning Regulations and shall be subject to the approval of NAV Canada and Nunavut Airports. (b) No development shall occur within 150 metres of the Non-Directional Beacon (NDB) Site.
Municipal Reserve			(a) The Municipal Reserve Zone identifies lands that may be interesting for future redevelopment. No development is permitted in the MR Zone unless of temporary nature, subject to Council approval.

POND INLET

COMMUNITY PLAN & ZONING BY-LAW



POND INLET
COMMUNITY PLAN

SCHEDULE 1

BY-LAW NO. 240

POND INLET COMMUNITY PLAN
BY-LAW No. 240

A By-law of the Hamlet of Pond Inlet in Nunavut Territory to adopt a General Plan pursuant to the provisions of the *Planning Act*, RSNWT, 1988, c. P-7, s.4.

WHEREAS the Council of the Hamlet of Pond Inlet has prepared a General Plan, referred to as the "Pond Inlet Community Plan", in accordance with the *Planning Act*;

NOW THEREFORE, the Council of the Hamlet of Pond Inlet, duly assembled, enacts as follows:

1. Schedules 1, 2, 3 of this By-law form part of this By-law.
2. This By-law may be cited as the "Pond Inlet Community Plan".
3. This By-law shall come into full force and effect on the date of its Third Reading.
4. By-laws No.174 of the Hamlet of Pond Inlet, and all amendments thereto, is hereby repealed.

READ a first time this __th day of ______, 201_ A.D.

_________________________ _________________________
Mayor Senior Administrative Officer

After due notice and a Public Hearing, READ a second time this _____th day of ______, 201_ A.D.

_________________________ _________________________
Mayor Senior Administrative Officer

APPROVED by the Minister of Community and Government Services this __ day of ___________________, 201_ A.D.

____
Minister

READ a third time this __ day of ___________________, 201_ A.D.

_________________________ _________________________
Mayor Senior Administrative Officer

SECTION 1. INTRODUCTION

1.1 Purpose of the Plan

The purpose of the Pond Inlet Community Plan is to outline Council's policies for managing the physical development of the Hamlet for the next 20 years – to 2034. The Community Plan was created through a community consultation process and reflects the needs and desires of the Community. The Community Plan builds on previous plans, while incorporating new challenges, issues and needs identified by the Community.

1.2 Goals of the Community Plan

Community Plan policies emerge from the values of a community and its vision of how it would like to grow. The goals established for this Community Plan are:

1. To develop in an orderly fashion creating a safe, healthy, functional, and attractive community that reflects community values and culture.
2. To promote the Plan as a tool for making effective and consistent decisions regarding land use and development in the community.
3. To ensure an adequate supply of land for all types of uses to support the growth and change of the community.
4. To build upon community values of participation and unity to support community projects and local economic development.
5. To protect the natural beauty of "Nuna", protect viewpoints to the water, and retain waterfront and lakeshore areas for public uses and traditional activities.

1.3 Administration of the Plan

The Community Plan is enacted by By-law. Changes to the Plan can be made by amending the By-laws in accordance with the *Nunavut Planning Act*. The Community Plan should be reviewed and updated every five years as required by the *Nunavut Planning Act*. A Zoning By-law is also being enacted for the purpose of implementing detailed policies based on the Community Plan. All development must follow the intent of the Community Plan and Zoning By-law. The Community Plan includes Schedule 1 (Plan Policy Text), Schedule 2 (Community Plan and Zoning Map) and Schedule 3 (General Land Use Map).

SECTION 2. COMMUNITY GROWTH AND PHASING POLICIES

At the time of preparation of this Plan, the population of Pond Inlet was approximately 1,666 people. This Plan is based on a future population of 2,708 people by 2034. It is estimated that an additional 363 dwelling units will be required to meet the projected population growth, representing the need for approximately 14 hectares of land for residential development. In addition, an appropriate mix and range of industrial, commercial, and community uses has been proposed to meet long-term needs. The policies of Council are:

a) Plan for a 2034 population of 2,708.
b) Identify sufficient land on the Community Plan to meet the needs of the projected 2034 population.
c) Review the Community Plan in 5 years, in 2019, to re-assess actual rates of growth and community needs.
d) Council will generally phase new land development as follows:
   i.) <u>2014 - 2019:</u>
      - Build on existing vacant lots within the built-up area.
      - Develop Phase 1 subdivision.
      - Develop lots in the industrial subdivision near the power plant.

   ii.) <u>2019 – 2024</u>
      - Develop Phase 2 subdivision.
      - Develop lots in the industrial subdivision and along road leading to landfill.

   iii.) <u>2024 – 2034</u>
      - Develop Phase 3 area.
e) Council may change the phasing of development without amendment to this Plan.

SECTION 3. GENERAL POLICIES

The following policies of Council apply to all development in the Hamlet regardless of land use designation:

a) The development of lots shall be subject to the following lot development policies:
   i.) All service connections to buildings shall be easily accessed from the front yard on all lots and grouped together, where possible.
   ii.) Access to new buildings will avoid, where possible, main entrances on the south-southeast side to reduce problems associated with snow drifting.
   iii.) Buildings shall be sited to respect setbacks identified on the Zoning Chart.
   iv.) Any building over 500 m^2 in gross floor area shall consider potential wind impacts on surrounding development. A wind study may be required by the Development Officer.
   v.) Culverts are required and shall be installed at the access points to lots.
   vi.) On any portion of a lot where fill is introduced, drainage shall be directed towards the public road. Exceptions may be made by the Development Officer. Where possible, drainage troughs shall not be located in Utility Rights-of-Way or Easements.
   vii.) Road widenings may be obtained as required at the time of development or redevelopment of a lot in situations where the road right of way is less than 16 metres wide.

b) Utilities or communication facilities shall be permitted in any land use designation. Other than designated Rights-of-Way or Easements for Utility or Communication lines, Easements alongside roadways, marked between the edge of the roadway and lot lines, will be used for distribution lines, with a minimum clearance, as specified in the Utility Corporation's Joint Use Agreement.

c) The Hamlet will pile snow in locations to minimize downwind snow drifting and where spring melt run-off can be properly channeled to drainage ditches or waterbodies.

d) The Hamlet will avoid piling snow within at least 30.5 metres (100 feet) of any watercourse.

e) No development is generally permitted within 30 metres from the normal high water mark of a waterbody or watercourse.

f) The Hamlet shall protect any cemeteries and sites of archaeological, ethnicographical, palaeontological or historical significance from disturbance. Any development in or near such sites shall follow the *Nunavut Archaeological and Palaeontological Regulations, 2001* of the Nunavut Act (Canada).

g) The Hamlet shall encourage development that minimizes emissions from fossil fuels, that are energy efficient and that consider alternative energy supply technology.
h) The Hamlet shall work with the Nunavut Planning Commission to ensure that the Pond Inlet Community Plan and the future Baffin Regional Land Use Plan are compatible.

SECTION 4. LAND USE DESIGNATION

4.1 Residential

The Residential designation provides land for primarily residential uses, but also permits other small-scale conditional uses subject to the approval of Council. The policies of Council are intended to maintain an adequate supply of land for residential development, to build safe and livable neighbourhoods and to protect residential areas from incompatible development. The policies of Council are:

a) The Residential designation will be used primarily for housing with all types of dwelling types permitted. Other related residential uses such as a group home, a home occupation, or bed and breakfast will also be permitted.

b) Residential development will be phased so that a target minimum of 2.5 hectares of vacant surveyed land is available at any given time. Residential areas will be developed with an average residential density of 22 units per hectare and will include a mix of unit types including those for elders.

4.2 Community Use

The Community Use designation is intended to maintain an adequate supply of land for community uses, preferably in significant and important locations so that residents may enjoy easy access to public facilities and services. The policies of Council are:

a) The Community Use designation will be used primarily for public uses (i.e. social, cultural, religious, or educational) and government services.

b) Community facilities will be centrally located to ensure safe and convenient access by residents.

4.3 Commercial

The Commercial designation is intended to support local economic development by maintaining an adequate supply of land for commercial uses in a key locations across the Hamlet offering good access for residents and visitors. The policies of Council are:

a) The Commercial designation will be used for commercial uses such as hotels, restaurants, retail, personal and business services, and offices.

b) Residential uses shall be permitted when located above a ground floor commercial use.

c) Commercial facilities will be located along main roads, where possible, to provide safe and convenient access by residents.

d) Council will encourage the re-use or redevelopment of existing commercial sites within the existing townsite.

4.4 Open Space

The Open Space designation is intended to protect shoreline environments, maintain access to the sea and to reserve open spaces within the built up area for recreational uses and cultural events. The policies of Council are:

a) The Open Space designation will be used primarily for parks, walking trails, traditional and recreational uses such as beach shacks, harbour uses, boat storage, dog teams, community docks, temporary storage of sealift materials and equipment during sealift operations, and municipal infrastructure such as a water pump house. All uses are conditional and at the discretion of Council.

b) A playground should be located within 300 metre walking distance from any residence in the community.

c) Unless otherwise noted, all Commissioner's Land forming part of the 100-foot strip (30.5 m) along the seashore measured from the ordinary high water mark will be designated Open Space.

d) No development is generally permitted within 30 metres from the normal high water mark of any river or major creek. Council may consider the filling of a waterbody where it is needed for future development provided that the appropriate approvals are obtained.

e) Open Space corridors will be protected for trail connections and drainage channels.

4.5 Industrial

The Industrial designation is intended to reduce the negative effects and dangers associated with industrial uses such as noise, dust, odours, truck travel and the storage of potentially hazardous substances by concentrating these uses on the periphery of the townsite. The policies of Council are:

a) Permitted uses in the Industrial designation will include all forms of manufacturing, processing, warehousing and storage uses as well as uses associated with marine transportation. Permitted uses will also include garages, power generation plants, and fuel storage.

b) Council will develop new industrial subdivisions near the current landfill site to minimize land use conflicts and to reserve land closer to the townsite for residential and community uses. Council will work with local businesses and government operations to identify opportunities to relocate over time non-conforming industrial uses (eg. garages, warehouses, power plant) to industrial areas.

4.6 Transportation

The Transportation designation is intended to protect and ensure the safe operation of airport and related activities such as the NavCanada communications site. The policies of Council are:

a) Permitted uses in the Transportation designation includes all activities related to air traffic and uses accessory to these activities such as related commercial activities and communications sites.

b) All development within the 4km boundary of the airport, as shown on Schedule 3, shall comply with the Pond Inlet Airport Zoning Regulations. Development applications shall be referred to Nunavut Airports for review and approval where development is proposed adjacent to the airport and/or where development has the potential to interfere with airport operations.

c) All development within the Transportation Influence Zone of the communications facility is subject to the approval of NavCanada.

d) Council will discourage the use of travelled pathways that are not identified as public right-of-ways.

4.7 Hinterland

The Hinterland designation applies to all unsurveyed land within the Municipal Boundary not designated by another land use and is intended to protect the natural beauty and cultural resources of the land – 'Nuna' – while providing access for traditional, recreational and tourism activities, as well as quarrying. The policies of Council are:

a) The Hinterland designation generally permits traditional, tourism and passive recreational uses. Permitted uses also include dog teams, quarrying, and infrastructure projects for local economic development.

b) Council shall ensure that development does not negatively impact wildlife, wildlife habitat and harvesting and is consistent with the guiding principles of Inuit Qaujimajatuqangit (IQ).

4.8 Waste Disposal

The Waste Disposal designation is intended to identify existing or former waste disposal sites and ensure required development setbacks are followed. The policies of Council are:

a) The Waste Disposal designation permits no development except those uses accessory to the operation or remediation of a waste disposal site.

b) The Hamlet shall prohibit the development of residential uses and uses involving food storage or food preparation within the 450 metre setback from any existing or former waste disposal site, pursuant to the *General Sanitation Regulations* of the Public Health Act.

c) The Hamlet shall prohibit the development of any public road allowance or cemetery within a 90 metre setback from a waste disposal ground, pursuant to the General Sanitation Regulation of the *Public Health Act*.

d) The Hamlet will evaluate all possible options for an integrated waste management system, including:

   a. the suitability of the existing landfill site for long-term use;

   b. the use of an incinerator;

   c. metal recovery projects; and

   d. complementary strategies, such as source reduction, reuse, and recycling of waste materials.

e) The Hamlet supports a reduced setback of 90 metres from former waste disposal sites. Development of residential uses and uses involving food storage or food preparation within the 450 metre setback from these former waste disposal sites will require approval from the Nunavut Health Department.

4.9 Granular Resources

The Granular Resources designation is intended to protect aggregate deposits for future extraction. The policies of Council are:

a) The Granular Resources designation does not permit any development except uses accessory to the operation or remediation of a quarry or gravel pit.

4.10 Municipal Reserve

The Municipal Reserve designation is intended to reserve land for the future growth of the community. The policies of Council are:

a) The Municipal Reserve designation does not permit any development except temporary uses approved by Council.

b) Municipal Reserve lands shall be redesignated by amendment to this Plan prior to being used for community expansion.

c) A conceptual road network may be shown on some of the Municipal Reserve lands which considers connections with existing road network, future land uses, prevailing wind direction, solar orientation, drainage and topography. The concept may need to be changed according to community needs during the detailed subdivision design process.

APPENDIX C

CULVERT THAWING METHODS

Culvert Thawing

Culverts are subject to freezing during winter and spring. During winter, ground water can continuously feed streams which either flow through culverts or over roadways causing icing. During spring breakup, daytime melting must be carried through culverts.

When a culvert freezes it can no longer do the job it was designed to do and trapped water will begin to cause problems and ultimately, money.

What's the Solution?

To thaw culverts, a combination of hot water/steam and high pressure water in a mobile environment is the effective method.

Mobile Pressure Washers

To thaw culverts quickly, a skid style hot water pressure washer/steamer, also known as a truck mounted pressure washer is the equipment of choice.

Self-contained and designed to hold up under the toughest of conditions, skid mounted pressure washers/steamers can be bolted onto the back of a truck, on an open deck trailer or in an enclosed trailer.

Enclosed Trailer Mounted Pressure Washer

Open Deck Mounted Pressure Washer

Skid Mounted Presure Washer

Culvert Nozzles

Culvert nozzles are required to dig effectively through ice. The reverse jets on the fixed and rotary nozzles pull the hose through the tube or sewer line and blast debris from the line or tube wall.

Backward ports drive the nozzle forward and flush debris
Forward ports blast into pipe and break up clogs & debris
Physically small for cornering ability up to 4200 PSI
Corrosion resistant stainless steel construction
A wide range of orifice sizes are available for various pressure and flow applications

Rotating style adds extra agitation and surface cleaning

United States Patent [19]

Olsson

[11] **Patent Number: 4,770,211**

[45] **Date of Patent: Sep. 13, 1988**

[54] **METHOD FOR THAWING OUT ROAD CULVERTS CHOKED WITH ICE**

[76] Inventor: **Lars-Uno Olsson**, Heden 4084, S-780 53 Nås, Sweden

[21] Appl. No.: **931,722**

[22] PCT Filed: **Feb. 24, 1986**

[86] PCT No.: **PCT/SE86/00080**

§ 371 Date: **Oct. 24, 1986**

§ 102(e) Date: **Oct. 24, 1986**

[87] PCT Pub. No.: **WO86/04939**

PCT Pub. Date: **Aug. 28, 1986**

[30] **Foreign Application Priority Data**

Feb. 25, 1985 [SE] Sweden 8500914

[51] **Int. Cl.**[4] **E03B 7/10**; F16L 53/00

[52] **U.S. Cl.** **138/32**; 138/28; 138/35

[58] **Field of Search** .... 138/26, 28, 32, 35; 254/262, 263, DIG. 14; 405/124, 130, 131; 137/301

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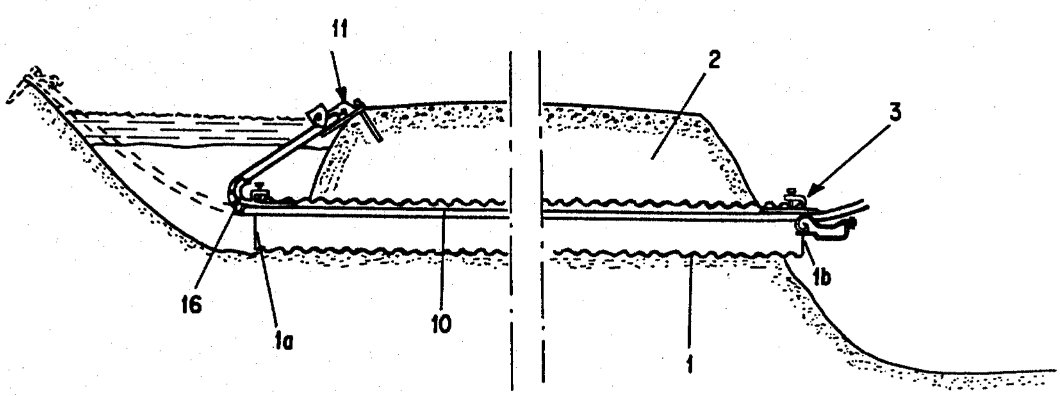
Primary Examiner—James E. Bryant, III
Attorney, Agent, or Firm—Witherspoon & Hargest

[57] **ABSTRACT**

Method for clearing a road culvert or the like which is choked with ice, wherein a substantially homogeneous rope of a material having at least a certain reversible extensibility is extended through the culvert from its inlet side to its outlet side and wherein the rope in its unloaded condition is clamped in connection with the outlet side and the inlet side respectively of the culvert so that the rope extends through the culvert.

4 Claims, 3 Drawing Sheets



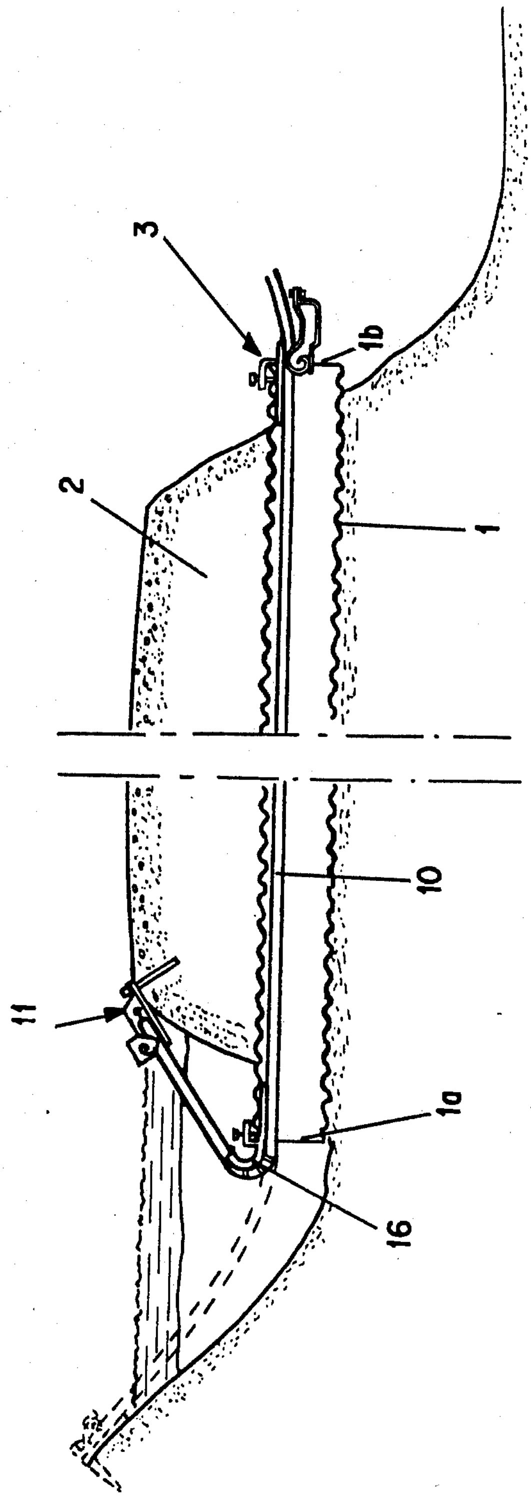


Fig. 1

Fig. 5

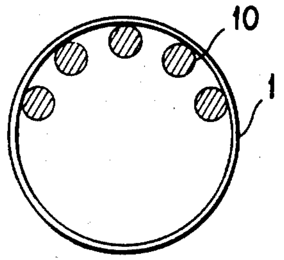
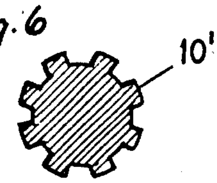


Fig. 6



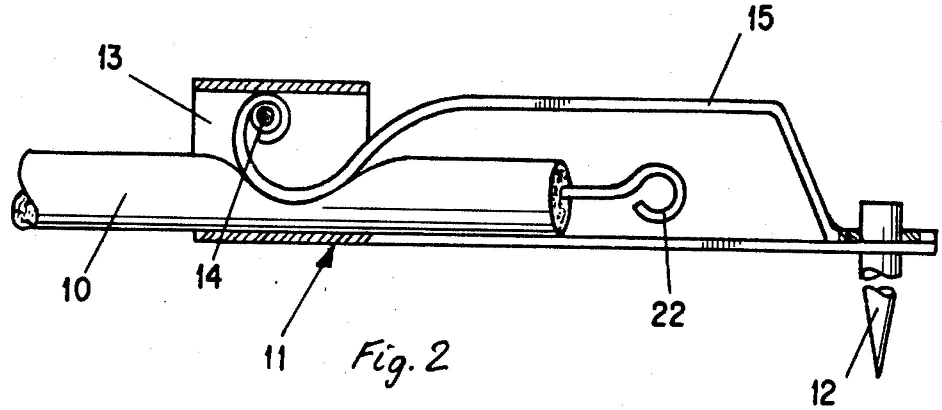


Fig. 2

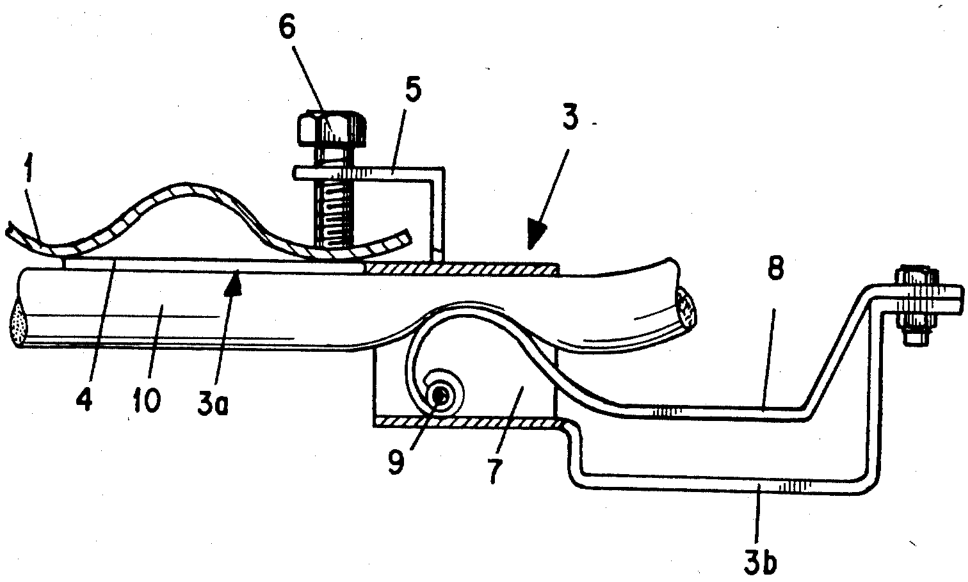
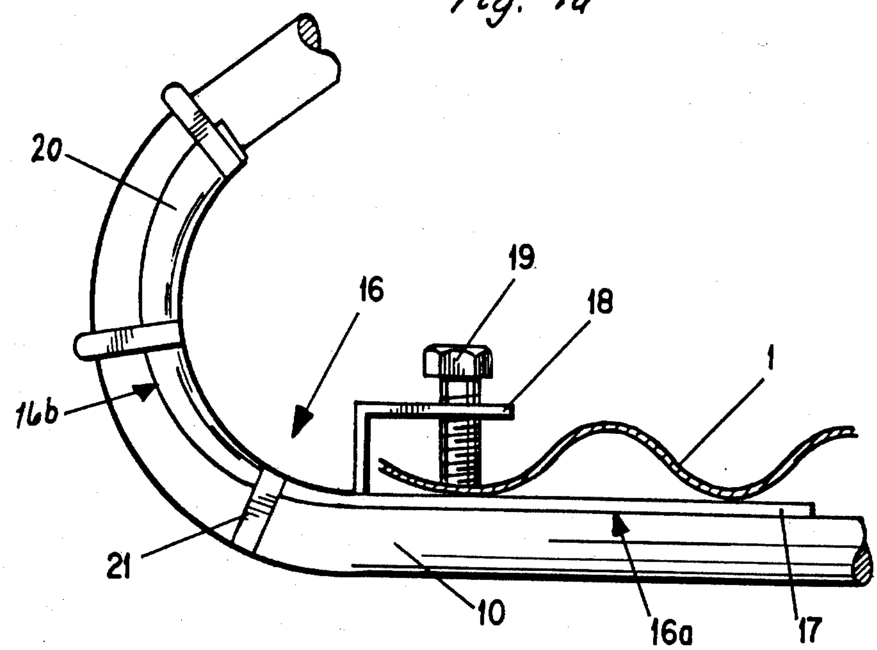


Fig. 3

Fig. 4a



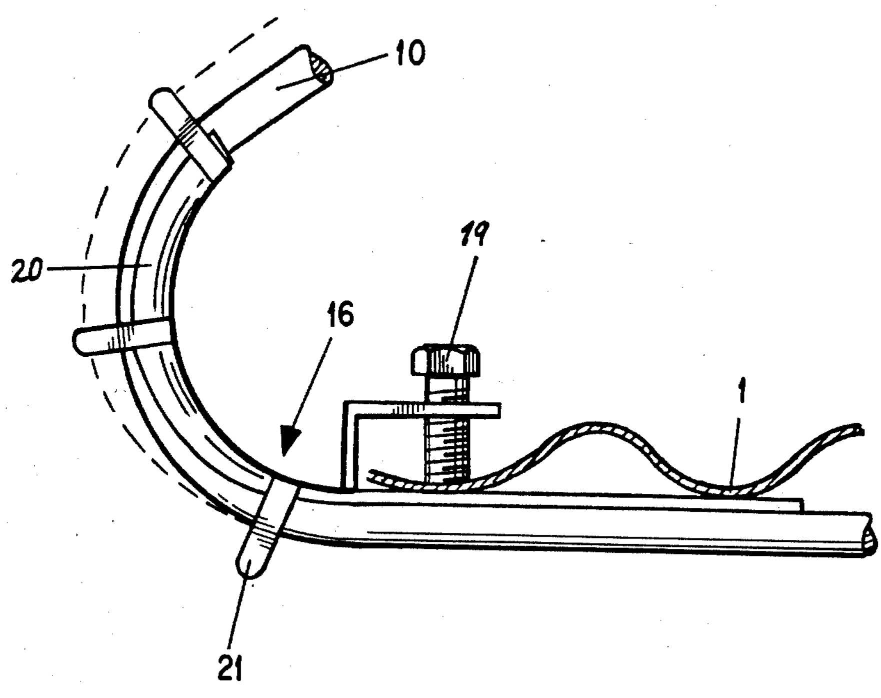


Fig. 4b

METHOD FOR THAWING OUT ROAD CULVERTS CHOKED WITH ICE

BACKGROUND OF THE INVENTION

The present invention relates to a method for thawing out road culverts choked with ice and also relates to an apparatus for carrying out said method.

A common problem in connection with winter maintenance is that road culverts become completely choked with ice, which makes it impossible to drain melted ice through the road culverts in warm weather, and especially by the spring flood. If such a road culvert that is completely choked with ice is not thawed out before the spring flood this may cause serious flooding and also a danger of parts of the road way being washed away.

In order to prevent the above mentioned, serious consequences of a road culvert choked with ice it is presently common practice to continously inspect road culverts which by experience are known to cause problems. When a road culvert choked with ice is found during such a periodical inspection, the procedure is presently to send out a clearing partrol, usually two persons, by car for thawing out the road culvert in question. Today steam generators are mostly used for thawing out road culverts in this manner, although attempts have also been made to use conventional building dryers. Already from the above it is clear that the thawing out of a road culvert in the conventional manner brings about relatively high costs which apart from transport costs also include wage costs for two persons and the cost for the steam generator.

Apart from the fact that the conventional clearing method discussed above is relatively expensive it also suffers from a number of more or less serious disadvantages that are clear from the following general description of the presently employed method using steam thawing. As indicated above a steam generator is transported out to the working place on a lorry or the like, and when the ends of the road culvert have been exposed the steam generator is started and is connected through hoses to steam pipes used for the thawing. In certain cases it is only necessary to thaw out a smaller passage through the culvert, whereupon the flow of water through this smaller passage continues to widen the passage in the ice until the culvert is completely cleared. In such a case it is, for obtaining the best result, absolutely necessary that the first thawing out of the smaller passage is carried out relatively close to the upper portion of the road culvert since the water will eat its way down through the ice towards the bottom of the culvert. Since road culverts may have a length of up to 15–20 meters, depending upon the width of the road, such a thawing out of a first small passage through the entire length of the road culvert is very difficult to achieve with a satisfactory result by means of a steam pipe. The reason for this is that if the steam pipe has such a length that it may reach through the entire length of the road culvert it will not be possible to keep it close to the upper portion of the road culvert throughout the entire length thereof and accordingly the steam pipe will deflect such that in the worst case it will leave the culvert close to its bottom. Accordingly it may also happen that the steam pipe will be stopped and cannot be brought through the entire length of the road culvert in case stones have fallen into the road culvert and remained therein on the bottom of the culvert.

In other cases it is not sufficient to thaw out only a smaller passage in the road culvert in order to avoid flooding, and therefore it will be necessary to clear the whole culvert in order to avoid the risk that a smaller passage is frozen again. It will also be realized that in the above discussed case where it proves impossible even to thaw out a first small passage in the road culvert by means of a steam pipe, it may become necessary to clear the whole culvert. In such a case when the whole culvert is to be cleared the procedure is such that a number of unperforated steam pipes, being upon in the outer end and having a length of approximately 3 meters are successively introduced from the outlet side of the culvert. When these unperforated pipes have been inserted to their full length they are withdrawn and are exchanged for perforated steam pipes which are fixed in position. Then steam is turned on to perform its thawing action until this length of the culvert may be cleared. This procedure is repeated until the culvert has been cleared throughout its length. The last portion of the length of the culvert is usually cleared from its inlet side, but it will be realized that if the culvert has a length of 10–15 meters and possibly even 20 meters it will be necessary for the persons performing the clearing to crawl into the culvert in order to be able to carry out a great deal of the work. Even if this work is not extremely risky it is cold and damp and generally unpleasant. Naturally such a clearing of a complete culvert is very time consuming, and especially so by larger culvert diameters and lengths.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method and an apparatus by means of which the above discussed disadvantages in connection with conventional methods may be eliminated as far as possible.

This object is achieved by means of a method and an apparatus of the kind indicated in the enclosed patent claims. From the patent claims the characteristic features of the invention are also clear.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplifying embodiments of the invention are described more closely below in connection with the enclosed drawings, on which:

FIG. 1 is a schematic illustration of the principles of the present invention in connection with a road embankment with a road culvert, both in cross section,

FIG. 2 illustrates a ground attachment of the apparatus according to the invention.

FIG. 3 illustrates a culvert attachment of the apparatus according to the invention.

FIG. 4*a* illustrates an edge cover in combination with the rope in its unloaded condition.

FIG. 4*b* illustrates the edge cover according to FIG. 4*a*, but with the rope in its loaded condition.

FIG. 5 illustrates a modified embodiment with several apparatuses according to the invention positioned in a road culvert, and

FIG. 6 illustrates another embodiment of the rope having an alternative cross-sectional shape.

Although the invention is described herein with reference only to the clearing of a road culvert, it should be obvious that the invention with the same advantage may be used for thawing out other types of culverts for draining off melted ice and/or rain-water. An example of this may be culverts used in fields by farmers in order to prevent flooding of the fields.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 schematically illustrates the use of the invention by a road culvert 1 extended through a road embankment 2 in order to conduct melted ice and/or rainwater from an inlet side 1*a* to an outlet side 1*b*. Mostly the outlet side 1*b* of the culvert is relatively freely accessible from the outside even if the road culvert 1 is completely choked with ice, and thus, for reasons which will be explained below, a culvert attachment 3 is positioned in connection with the outlet and 1*b* of the culvert. An embodiment of the culvert attachment 3 is illustrated in greater detail in FIG. 3 from which it is clear that the culvert attachment has a first portion 3*a* intended to be clamped to the culvert. In the illustrated embodiment the first portion 3*a* comprises an inner leg 4 and an outer leg 5 between which the culvert 1 is introduced and clamped by means of a bolt 6 engaging a threaded bore in the outer leg 5. The other portion 3*b* of the culvert attachment is formed integral with the first portion 3*a* and is at its outer end releasably connected to a clamping means 8, for instance by means of a screw-nut connection 8*a*. In the illustrated embodiment the clamping means 8 consists of a flat bar being bent into a helical shape in its free end for a pivotal mounting on a pin 9 being firmly connected to a plate secured to the culvert attachment substantially midway between its ends. Through the pivotal mounting of the clamping means 8 on the pin 9 a rope 10 that will be more closely described below may be released and clamped between the helical end of the clamping means 8 and a portion of the culvert attachment close to the middle thereof by swinging the clamping means 8 upwardly and downwardly respectively about the pin 9.

In connection with the inlet side 1*a* of the road culvert 1 and at a distance therefrom a ground attachment 11 is anchored in the road embarkment 2 or at some other suitable place in accordance with what will be discussed below. In FIG. 2 a suitable embodiment of the ground attachment 11 is illustrated which in one of its ends is provided with a peg 12 which is pointed in one of its ends and which is intended to be forced down into the ground for anchoring the ground attachment. In its other end the ground attachment 11 is provided with a plate 13 which essentially corresponds to the plate 7 on the culvert attachment of FIG. 3 and which accordingly is provided with a pin 14 for pivotal mounting of one end of a clamping means 15 which in turn corresponds to the clamping means 8 of FIG. 3. Thus, the clamping means 15 has a helically shaped end for mounting on the pin 14, and in its opposite end it is releasably attached to the ground attachment 11, preferably by means of a nut 15*a* screwed into a threaded upper portion of the anchoring peg 12. It will now be realized that in accordance with what has been described in connection with FIG. 3 the clamping means 15 is intended for releasably clamping the rope 10 between its helical end a portion of the ground attachment 11.

In the case illustrated in FIG. 1 where the ground attachment is anchored in connection with the road embankment 2 it also becomes necessary to provide an edge cover 16 at the inlet end 1*a* of the culvert, and this partly for guiding the rope 10 around the relatively sharp bend and at the same time also for protecting the rope. As is clear from FIGS. 4*a* and 4*b* the edge cover 16 in a suitable embodiment consists of a first portion 16*a* which to a great extent corresponds to the first portion 3*a* of the culvert attachment 3 and thus comprises an inner leg 17 and an outer leg 18 between which the culvert 1 is clamped by means of a bolt 19 screwed into a threaded bore in the outer leg 18. The other portion 16*b* of the edge cover provides the guiding proper for the rope 10 and for this purpose includes an upwardly bent guide rail 20 having a smooth curvature for deflecting the rope 10 between 90° and 180°, in the illustrated embodiment approximately 135°. For providing the best guiding the guide rail 20 has an inner, longitudinal groove having a shape essentially corresponding to that of the rope 10. For additionally securing and guiding the rope 10 in the guide rail 20 the latter is also provided with a number of guide loops 21 evenly distributed along the length of the guide rail, and through these loops the rope is threaded.

For reasons of clarity it should be mentioned that although the elongated means, which according to the invention is intended to be extended through a road culvert, herein is referred to as a rope this term is not intended to delimit the invention regarding the cross-sectional shape or surface of the elongated means. Although the rope in the illustrated embodiments has a substantially circular cross-sectional shape it is obvious that the term rope should also cover rectangular, triangular or other suitable cross-section shapes.

As mentioned above the rope 10 is intended to be extended through the road culvert 1 and to be clamped at the culvert attachment 3 as well as at the ground attachment 11. The rope is substantially solid or homogeneous (possibly with air bubbles contained in the material) and in the illustrated embodiments it has a basically circular sectional area. The rope is cut into a suitable length corresponding to the length of the road culvert to which it is to be attached. Characteristic of the rope is that it is manufactured from a material which at least to a certain degree may be reversibly extended, i.e. a material which when it is subject to a tension load undergoes a certain, not permanent, reduction in cross section. Thus, when the tension load is removed the rope shall resume its original shape. By an embodiment of the invention where a free passage is established through ice in the road culvert by simply pulling the rope out from the culvert, it is sufficient if the rope has a relatively low reversible extensibility sufficient for reducing the cross-sectional area of the rope to such a degree that it without problem is released from the surrounding ice. By another embodiment where the passage through the ice is established with the rope remaining in the culvert by extending the rope to such an extent that its cross-sectional area is greatly reduced, it must on the other hand be possible to subject the material to such a tension load that its cross-sectional area is substantially reduced to half without any danger of the material rupturing or breaking. A material that has been found suitable for the later embodiment and that complies with the requirements thereof is a synthetic rubber EPDM (SIS 1626-70).

In either or both of its ends the rope is provided with a hook 22 the function of which will be described below. In certain cases it may also be preferable to provide the free ends of the rope with a not shown web or stocking intended to protect the rope from external damage through for instance gravel and rocks.

According to an emboidment of the invention the clearing or thawing out of a road culvert is carried out in the following manner:

In good time before the winter, when the culvert is open, the above described equipment is installed, and when installed it can remain there year after year and it will not be necessary to dismount it unless some portion thereof is damaged. The assembly is carried out such that a culvert attachment **3** of the kind described above is clamped to the outlet side *1b* of the culvert **1**. The ground attachment **11** may be secured by forcing the anchoring peg **12** into the ground by means of any suitable tool so that it is firmly anchored, and the anchoring may be carried out in alternative places depending upon the surrounding terrain. Hereby it is determining that the ground attachment shall be anchored at a spot where there is little danger that it will become covered by ice during winter. The reason for this is naturally that it must be easy to get hold of the end of the rope **10** being positioned in connecton therewith without having to expose said end by chopping off ice. Of importance for the positioning is also that the anchoring position must be as close as possible to the inlet end *1a* of the culvert so that the length of the rope may be reduced. In view of this the positioning illustrated with full lines in FIG. **1** seems to be preferable in most cases, but it is also possible to position the ground attachment as illustrated with broken lines in FIG. **1**, in which case the rope will be extended obliquely upwardly in FIG. **1**.

As mentioned above the positioning of the ground attachment **11** illustrated with full lines in FIG. **1** also necessitates the mounting of an edge cover **16** at the inlet end *1a* of the culvert for deflecting and guiding the rope **10**. By the alternative positioning illustrated with broken lines it would be possible to manage without any edge cover or with an edge cover of a simpler design. When the culvert attachment, the ground attachment and possibly an edge cover have been installed the rope **10** is extended through the culvert and, where appropriate, the rope is then threaded through the edge cover, and its ends are clamped to the culvert attachment and to the ground attachment respectively. The clamping is carried out in such a way that the clamping means **8** and **15** respectively is disengaged and is swung about the pin **9** and **14** respectively, whereupon the rope is installed in the respective attachment and is clamped in position by means of the clamping means which are secured by the nut *8a* and *15a* respectively. The rope **10** is clamped to the attachments in its substantially unloaded condition, i.e. without being subject to any essential tension load. However, especially in connection with longer road culverts it may be necessary to clamp the rope **10** when the same is subject to a certain, low tension load in order to make sure that the rope does not hang down towards the middle but runs close to the upper edge of the culvert **1** throughout its extension, and as discussed in the introduction this is essentially in order to make it possible for the water flowing through an opened passage to eat its way down in the ice so that the ice may be efficiently cleared away. The rope remains in the above described position and when it is discovered, during a routine inspection discussed above, that the culvert is completely choked with ice so that melted ice cannot be drained therethrough it will, by employing the invention, no longer be necessary to send out any special patrol for clearing the culvert, but in most cases the person carrying out the inspection may carry out the clearing by himself. By one embodiment the procedure is such that the rope is released at the culvert attachment **3** by the outlet side *1b* of the culvert, possibly subsequent to exposing this side by removing snow, through disengaging the clamping means **8** and swinging the same about the pin **9**. The rope which in this embodiment should have a high reversible extensibility is then stretched or tensioned by hand from the outlet side *1b* while remaining clamped at the ground attachment **11**, and through this tension load and due to the tensibility of the material the rope **10** is immediately released from the ice as its cross-sectional area is greatly reduced. Hereby a free passage for the melted ice is established around the circumference of rope and when this has been achieved the rope is clamped to the culvert attachment **3** again in its loaded condition so that the water may continue to flow in the passage in such a way that it wears its way through the ice and finally clears the whole culvert. When the culvert has been cleared the rope is released from the culvert attachment **3** again and is unloaded so that it resumes its original shape and finally it is clamped again so that the procedure may be repeated if the culvert should become choked with ice once more. As has been mentioned above it is obvious that the rope **10** by this embodiment should have as high a reversible extensibility as possible in order to establish the largest possible passage for the melted ice when it is stretched or tensioned. In this embodiment it may also be suitable if the rope has a rectangular cross-sectional shape in order to leave as wide a passage as possible for the melted ice to thereby ensure a positive clearing of the complete culvert.

When the ground attachment is positioned as illustrated with broken lines in FIG. **1** there is a danger that the reduction of the cross section of the rope at the end closest to the ground attachment, due to the great distance from the place where the tension load is applied, goes on so slowly that the water beginning to flow in freezes before sufficient flow has been established in order to keep the passage open. For that reason it may be preferable in all cases to use the variant illustrated with full lines in FIG. **1**, having an edge cover **16**. The reason for this is that when the rope is stretched about the edge cover the passage may be opened up more quickly by performing the tensioning or stretching in two different steps. In FIG. **4***a* the rope is illustrated guided about the edge cover in its unloaded condition, but in FIG. **4***b* the broken lines illustrate how the extension of the rope is blocked by the guide rail **20** of the edge cover so that the reduction of the cross-sectional area of the rope, when the rope is normally tensioned, has been fully established up to the guide rail and possibly a distance around the same, while the remaining portion of the rope still maintains its full cross-sectional dimension so that no melted ice or snow enters from above. At this state the rope is clamped at the culvert attachment **3** when in its loaded condition and the person moves to the ground attachment **11** and exposes the same when necessary. Then the rope is released at the ground attachment and since only a relatively short portion of the rope from the edge cover **16** and up to the ground attachment is unloaded this portion of the rope may quickly be stretched or tensioned so that a full flow through the established passage is immediately obtained and so that the above mentioned danger of freezing is elminated.

By certain road culverts which by experience are known to cause serious problems, or by road culverts having a large diameter it may suitable to provide several ropes **10** at a distance from each other in connection with the upper portion of the culvert, and for instance in the way schematicaly illustrated in FIG. **5**. Another alternative that may be considered in connection with larger road culverts is to employ thicker ropes therein, but in such a case it may be necessary to provide some kind of not shown auxiliary device having a gear mechanism for tensioning or stretching the rope.

In FIG. 6 a rope 10' is illustrated having an alternative cross-sectional shape with longitudinal grooves or channels. This rope is intended to be twisted in connection with the streching or tensioning thereof so that the grooves assume a screw line shape around the rope. Apart from the fact that this configuration establishes a somewhat larger passage for the melted ice it also gives the ice a non-uniform surface so that the melted ice more efficiently wears off the ice. This is even further emphasized if the grooves or channels initially are helically shaped in the rope.

In extremely difficult situations where the above described method is not sufficient or in cases where it is desirable to open up a culvert in spite of the fact that there is no water such as melted ice or snow present that can wear down through the ice during its flow through the culvert, it is in accordance with another embodiment also possible to use the invention together with a conventional steam unit or possibly together with a hot-air unit, such as a building dryer. For this purpose a hook 22 is provided in one or possibly both ends of the rope. By connecting a particular steam pipe (possibly a flexible steam hose), which is closed in one end and in said end is provided with a loop for engaging the hook 22 and which is perforated along a portion of its length, to the steam unit the complete culvert may be cleared from one side without the necessity for crawling into the culvert. This is achieved by hooking-up the loop of the steam pipe to the hook 22 of the rope, whereupon the steam pipe, through withdrawal of the rope, is pulled stepwise through the culvert as this is thawed out. Due to the fact that the steam pipe is pulled in through the passage established by the rope it will not be necessary to take up separate holes for the perforated steam pipe and moreover the complete culvert may be thawed out in one operation independent of the length of the culvert. This work is naturally speeded up even further if several ropes are installed in the culvert in accordance with FIG. 5, whereby a corresponding number of steam pipes may be used. It should be realized that by this embodiment it is, as mentioned, sufficient if the rope only has a certain reversible extensibility, since it is intended to establish a passage through the ice by being completely withdrawn from the culvert. Thus, the reduction of the cross-sectional area need only be sufficient to ensure that the rope is released from the ice.

Although preferred embodiments of the invention have been described and illustrated herein it should be obvious to those skilled in the art that a great number of changes and modifications may be carried out without departing from the scope of the invention. For instance it is possible to employ alternative designs for the culvert attachment, the ground attachment and the edge cover, both regarding their preferred clamping to the culvert, anchoring in the ground and clamping of the rope respectively. Thus, the scope of the invention should only be restricted by the enclosed patent claims.

I claim:

1. A method for clearing road culverts or the like having become choked with ice, comprising the steps of: extending a substantially homogenous rope of a material having at least a certain reversible extensibility through the culvert from its inlet side to its outlet side before it becomes choked with ice; clamping the rope in its unloaded condition in connection to the outlet side and inlet side of the culvert so that the rope extends through the culvert; and, once the culvert has become choked with ice, releasing the rope from its clamping in connection with the outlet side of the culvert; applying a tension load to the rope from the released end for reducing the cross-sectional area of the rope and thereby forming a free passage through the culvert around the circumference of the rope; clamping the rope again in connection with the outlet side of the culvert, in the loaded extended condition of the rope; and allowing a continuous flow of melted ice or snow in the passage formed around the circumference of the rope, thereby clearing the road culvert.

2. A method as described in claim 1, wherein a rope having a high reversible extensibility is used and wherein the rope is clamped close to the upper portion of the culvert.

3. A method as described in claim 2, wherein the rope in connection with the inlet side of the culvert is deflected from its extension within the culvert through an edge cover; the corresponding end of the rope is clamped at a distance from the inlet side of the culvert and both ends of the rope, one after the other, are released from the clamping, are tensioned or extended and clamped again.

4. A method for clearing road culverts or the like having become choked with ice, comprising the steps of: extending a substantially homogeneous rope of a material having at least a certain reversible extensibility through the culvert from its inlet side to its outlet side before it becomes choked with ice; clamping the rope in its unloaded condition in connection to the outlet side and the inlet side of the culvert so that the rope extends through the culvert; and, once the culvert has become choked with ice, releasing both ends of the rope at their respective clamping positions; connecting a steam pipe perforated along a portion of its length to one end of the rope; connecting the steam pipe to a steam unit; applying a tension load to the end of the rope not connected to the steam pipe, for reducing the cross-sectional area of the rope so that it is released from the ice; successively pulling the rope out from the culvert for forming a free passage through the culvert and successively pulling the steam pipe into the passage in the ice established by withdrawing the rope; thereby successively clearing the culvert by means of steam supplied from the steam unit.

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Sterling et al.

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[45] **Date of Patent: Nov. 16, 1999**

[54] **METHOD FOR THAWING FROZEN ROAD CULVERTS**

[75] Inventors: **Robert Laurel Sterling**, Grande Prairie; **Rudiger Schmidt**, Wainwright, both of Canada

[73] Assignee: **Iceworm International Inc.**, Alberta, Canada

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[51] **Int. Cl.**[6] **H05B 1/00**; H01C 3/06

[52] **U.S. Cl.** **219/213**; 219/549; 338/214

[58] **Field of Search** 219/213, 528, 219/544, 538, 546; 404/77, 79; 405/131, 128; 338/214

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Primary Examiner—Teresa Walberg

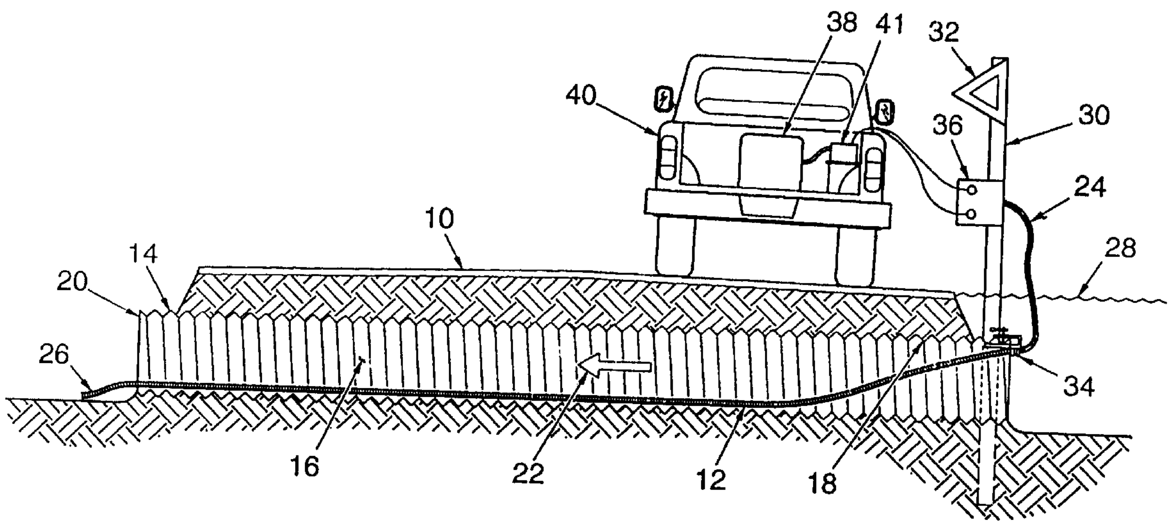
Assistant Examiner—Thor S. Campbell

Attorney, Agent, or Firm—Davis and Bujold

[57] **ABSTRACT**

A method for thawing frozen road culverts. The first step involves positioning an electrically conductive cable in a road culvert prior to an ice blockage occurring. A connection end of the electrically conductive cable is anchored in an accessible location. The second step involves connecting a power source to the connection end of the electrically conductive cable after an ice blockage of the road culvert has occurred and supplying power to the electrically conductive cable, such that energy generated by power flowing through the electrically conductive cable causes a flow path to be created through the ice blockage in the road culvert.

7 Claims, 2 Drawing Sheets



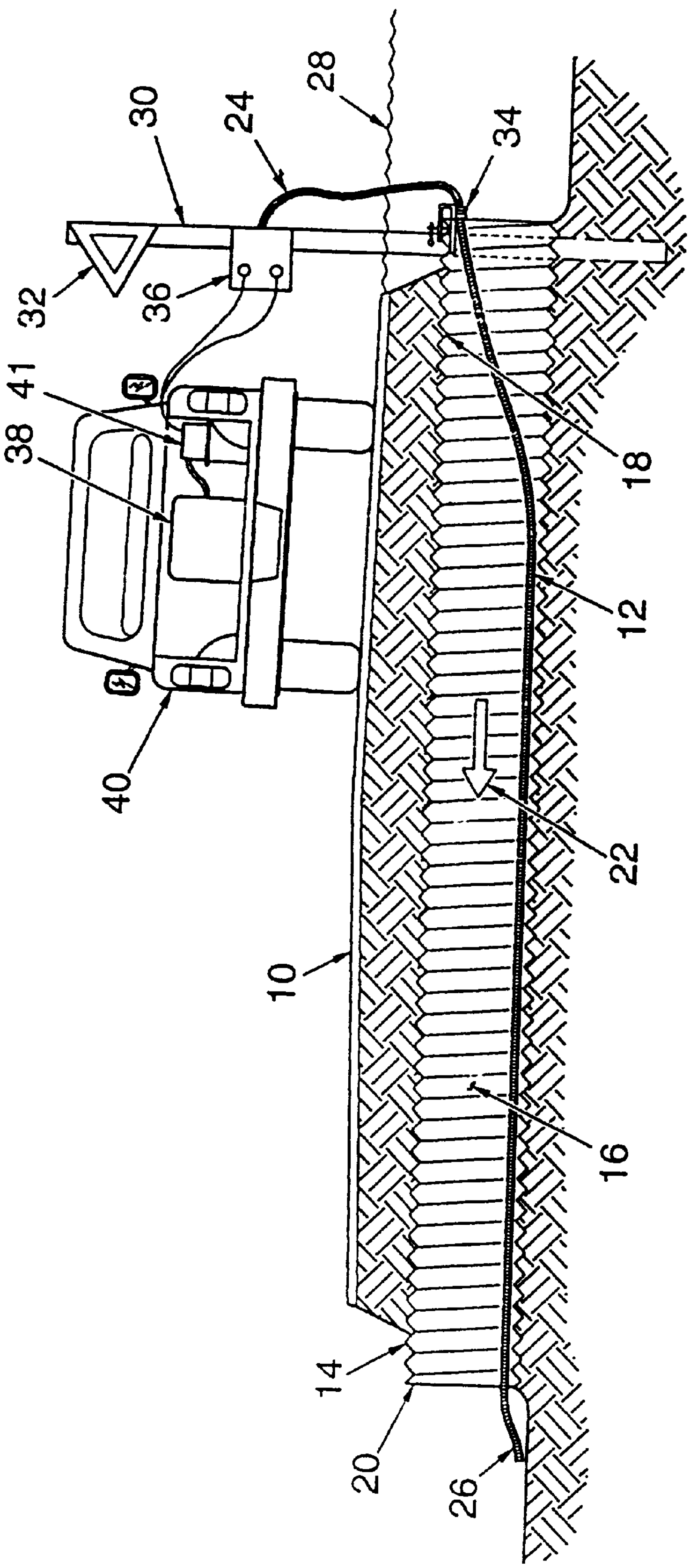


FIGURE 1

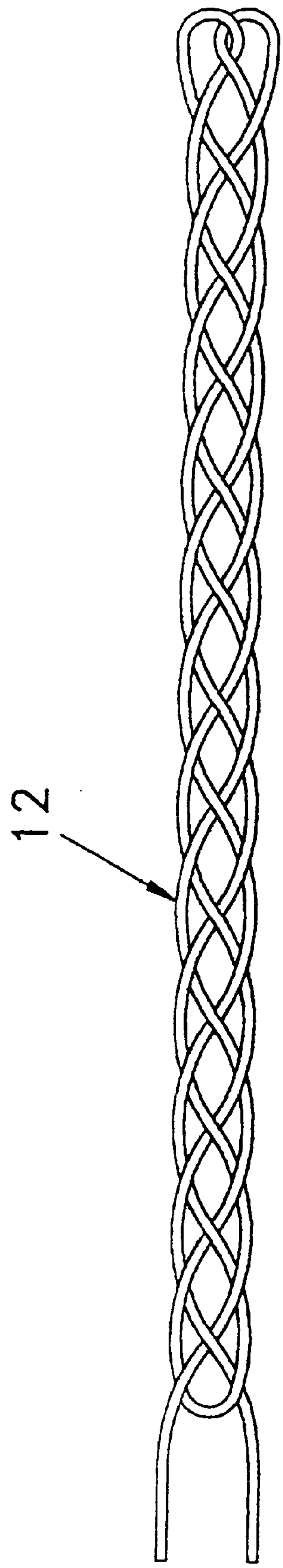


FIGURE 2

METHOD FOR THAWING FROZEN ROAD CULVERTS

FIELD OF THE INVENTION

The present invention relates to a method for thawing frozen road culverts.

BACKGROUND OF THE INVENTION

With the coming of spring every year there is a daily cycle of melting and freezing. The heat of the sun during the day causes snow to melt. As the sun goes down the temperature falls and water resulting from melting of the snow freezes.

Culverts are strategically placed under roads which are in a path followed by a flow of water from the melting snow. The culverts divert the flow of water so the road does not wash out. Unfortunately, the daily cycle of melting and freezing sometimes results in a culvert becoming blocked by an ice plug. If the ice plug is not removed in a timely fashion, the flow of water seeks an alternative path which often results in a washing out of portions of the road.

At the present time, steam truck crews are dispatched whenever it is noted that a culvert is plugged by ice. Removal of an ice plug from a culvert is generally a slow process. High pressure steam is injected into the ice plug, usually from a downstream side of the culvert, until a flow of water is restored. An ice plug that extends part way into a culvert generally can be removed by high pressure steam within three hours. Ice plugs that extend completely through a culvert can take considerably longer to remove.

The problem of road culverts plugging with ice has become so prevalent, that oversize culverts are frequently used for the express purpose of reducing the frequency of the problem.

SUMMARY OF THE INVENTION

What is required is a more time efficient method of thawing frozen road culverts.

According to one aspect of the present invention there is provided a method for thawing frozen road culverts. The first step involves positioning an electrically conductive cable in a road culvert prior to an ice blockage occurring. A connection end of the electrically conductive cable is anchored in an accessible location. The second step involves connecting a power source to the connection end of the electrically conductive cable after an ice blockage of the road culvert has occurred and supplying power to the electrically conductive cable, such that energy generated by power flowing through the electrically conductive cable causes a flow path to be created through the ice blockage in the road culvert.

According to another aspect of the present invention, there provided, a combination including a road culvert and an electrically conductive cable. The road culvert has an interior bore with an upstream end and a downstream end relative to normal water flow. The electrically conductive cable is positioned in the interior bore and extends substantially the length of the road culvert from the upstream end toward the downstream end. A connection end of the electrically conductive cable is anchored in an accessible location, such that a power source connectable to the connection end of the electrically conductive cable to supply power to energize the electrically conductive cable.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, wherein:

FIG. **1** is a front elevation view, in section, of a culvert that has been equipped with an electrically conductive cable in accordance with the teachings of the present method.

FIG. **2** is a detailed top plan view of a electrically conductive cable illustrated in FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred method for thawing frozen road culverts will now be described with reference to FIG. **1**.

The teachings of the preferred method, as will hereafter be further described, require that an electrically conductive cable **12** be positioned in a road culvert **14**. Road is generally indicated by reference numeral **10**. Road culvert **14** has an interior bore **16** with an upstream end **18** and a downstream end **20** relative to a direction of normal water flow as indicated by arrow **22**. Electrically conductive cable **12** has a connection end **24** and a remote end **26**. Beneficial results have been obtained using electrically conductive cable **12** made from #10 insulated copper wire, although in applications requiring higher temperatures wire made from alloys that can withstand higher temperatures may be used. Electrically conductive cable **12** is positioned in interior bore **16** of road culvert **14** and, preferably, extends substantially the length of road culvert **14** from upstream end **18** toward downstream end **20**. It is essential that electrically conductive cable **12** is positioned at upstream end **18**, for it is at upstream end **18** that a lockage by ice is most likely to occur. It is not always ssential that electrically conductive cable **12** reach all the ay to downstream end **20**. Each installation must be made having regard to surface topography and other conditions prevailing. Some road culverts become blocked at both ends, others are prone only to upstream blockage. Connection end **24** of electrically conductive cable **12** is anchored in an accessible location. When choosing an accessible location must bear in mind the conditions that will prevail when an ice blockage condition is encountered. There is likely to be an accumulation of water upstream of road culvert **14**, so the accessible location ispeferably above a high water mark generally indicated by reference numeral **28**. There is also likely to be an accumulation of snow on the ground, so connection end **24** is preferably a sufficient height to be above any accumulation of snow. In order to achieve this objective, it is preferred that connection end **24** be mounted onto a post **30**. Post **30** can be marked with a sign **32** or otherwise marked so as to be readily identified by work crews. In order to ensure that electrically conductive cable **12** does not shift after installation, it is preferred that electrically conductive cable **12** be clamped by means of clamp **34** to upstream end **18** of road culvert **14**. Connection end **24** of electrically conductive cable **12** is preferably is connected to a junction box **36**. A power source **38** is used to supply power to electrically conductive cable **12**. For safety reasons, a low voltage direct current power source which generates six to forty volts is preferred. It will be appreciated that the power required will vary with the gauge and length of electrically conductive cable **12** used. It is not viewed as being cost effective to have a power source at every installation. It is viewed as being more practical to take power source **38** to the particular road culvert that is blocked, it is, therefore, preferred that power source **38** be mounted on a truck **40**. For reasons of safety, it is preferred that power source **38** have a control box **41** which include features that control current and provide overcurrent protection with a breaker trip mechanism.

The use and operation of the above described combination in accordance with the teachings of the preferred method will now be described. The first step involves positioning electrically conductive cable **12** in road culvert **14** prior to an ice blockage occurring. Of course, after an ice blockage has occurred it is too late to insert electrically conductive cable **12**. Historical data can be used to select those of road culverts **14** that are most prone to ice blockage. Connection end **24** of electrically conductive cable **24** is anchored in an accessible location, such as post **30**. It is preferred that cable be secured to road culvert **14** at upstream end **18** by means of clamp **34**. Cable **24** is then laid through road culvert **14**.

The second step involves connecting power source **38** to connection end **24** of electrically conductive cable **12** after an ice blockage (not shown) of road culvert **14** has occurred. As low voltage power source **38** is truck mounted, truck **40** can be dispatched. The connection of power source **38** to connection end **24** of electrically conductive cable **12** is made through junction box **36**. Power source **38** provides power to electrically conductive cable **12**. Tests have shown that energy generated by electrically conductive cable **12** causes a flow path to be created through the ice blockage in the immediate vicinity of electrically conductive cable **12**. The resulting flow of water then tends to accelerate the process of removing the blockage by rapidly washing away the ice. A trickle of water through road culvert **14** generally occurs in as little as two minutes and normal flow through road culvert **14** is generally restored within ten minutes. The rapid clearing of the blockage is believed to be due to more than just the heat generated by power passing through electrically conductive cable **12**.

Referring to FIG. **2**, in addition to thermal energy, there is believed to be an eddy current induced. In order to enhance this effect cable **12** is looped lengthwise back and forth in boustrophedonic fashion. The loops are then twisted together in order to make cable **12** more compact and easier to handle. Regardless of what forces are at work, the energy generated can be objectively shown to clear an ice blockage in a remarkably short time.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

The embodiments of the invention in which an exclusine property or privilege is claimed are defined as follows:

1. A method for thawing frozen road culverts, comprising the steps of:

positioning an electrically conductive cable in a road culvert prior to an ice blockage occurring, with a connection end of the electrically conductive cable anchored in an accessible location;

dispatching a mobile low voltage power source to the road culvert when a blockage occurs; and

connecting the power source to the connection end of the electrically conductive cable and supplying power to the electrically conductive cable, such that energy generated by power flowing through the electrically conductive cable causes a flow path to be created through an ice blockage in the road culvert.

2. In combination:

a road culvert having an interior bore;

an electrically conductive cable positioned in the interior bore and extending substantially the length of the road culvert;

a connection end of the electrically conductive cable being anchored in an accessible location, such that a power source is connectable to the connection end of the electrically conductive cable to supply power to energize the electrically conductive cable; and

a mobile low voltage power source for supplying power to the electrically conductive cable.

3. The combination as defined in claim **2**, wherein the road culvert has with an upstream end and a downstream end relative to normal water flow, the cable extending from the upstream end toward the downstream end.

4. The combination as defined in claim **2**, wherein the cable is looped lengthwise back and forth in boustrophedonic fashion.

5. The combination as defined in claim **4**, wherein the cable is twisted.

6. A method for thawing frozen road culverts, comprising the steps of:

positioning an electrically conductive cable in a road culvert prior to an ice blockage occurring, with a connection end of the electrically conductive cable anchored in an accessible location outside the road culvert and an opposite end of the cable being unattended and extending completely through the road culvert and projecting out through the opposite end thereof;

dispatching a mobile low voltage power source to the road culvert when a blockage occurs in the road culvert; and

connecting the power source to the connection end of the electrically conductive cable and supplying electrical power to the electrically conductive cable, such that energy generated by the electrical power flowing through the electrically conductive cable causes a flow path to be created through the ice blockage in the road culvert thereby assisting with thawing of the road culvert.

7. The combination of claim **2** wherein the accessible location of the connection end of the cable is located outside the road culvert so as to be accessible.

* * * * *

APPENDIX D

PHASED COST ESTIMATES

Community and Government Services - Government of Nunavut

Class 'D' Cost Estimate

Tetra Tech Project WTRM03178-01 - Pond Inlet Drainage Project

Preliminary Estimate of Probable Costs		Total
Preliminaries		$290,341
Civil Works		$1,787,406
Miscellaneous		$60,000
	Sub-total	**$2,137,747**
Project Contingencies	40.0%	$855,099
	Total Estimated Construction Cost	**$2,992,845**

NMS Specs

Preliminaries			Unit	Est Quantity	Est. Unit Price	Est. Total
01 25 01	0-1	Mob / Demob, Temporary Facilities, Security, Quality Control, etc.	lump sum	1	$194,340.60	$194,341
01 35 14	0-2	Traffic Control, Barricades, and Temporary Signage	lump sum	1	$16,000.00	$16,000
01 71 00	0-3	Construction Surveys	lump sum	1	$80,000.00	$80,000
					Sub-total Preliminaries	**$290,341**
Civil Works			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
31 14 11	1-1	Excavation and Off-Site Disposal	cu.m	3,085	$30.00	$92,550
33 42 13	1-2	Supply and Install 450 mm Steel Casing Culvert	m	1,258	$527.00	$662,966
33 42 13	1-3	Supply and Install 600 mm Steel Casing Culvert	m	100	$707.00	$70,700
33 42 13	1-4	Supply and Install 600 mm Steel Casing Sleeve	m	2	$707.00	$1,414
33 42 13	1-5	Supply and Install 900 mm Steel Casing Culvert	m	72	$1,068.00	$76,896
33 42 13	1-6	Supply and Install 1200 mm Steel Casing Culvert	m	12	$1,610.00	$19,320
31 37 10	1-7	Supply and Place 10 kg Class Riprap	cu. m	3,967	$100.00	$396,700
31 37 10	1-8	Supply and Place 50 - 75 mm Clear Crush	cu. m	634	$100.00	$63,400
31 32 21	1-9	Supply and Place Non-Woven Geotextile	sq. m	14,073	$20.00	$281,460
02 41 13	1-10	Culvert Removal and Off-Site Disposal	each	61	$2,000.00	$122,000
					Sub-total Site Services	**$1,787,406**
Miscellaneous			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 35 43	2-1	Dewatering	lump sum	1	$20,000.00	$20,000
01 35 43	2-2	Sediments and Erosion Control Measures	lump sum	1	$40,000.00	$40,000
					Sub-total Miscellaneous	**$60,000**

Notes:

1 Quantities shown on this table are estimates and provided for reference only.

2 Estimated quantities do not account for spare culverts and materials.

Community and Government Services - Government of Nunavut
Class 'D' Cost Estimate - Phase 1
Tetra Tech Project WTRM03178-01 - Pond Inlet Drainage Project

Preliminary Estimate of Probable Costs		Total
Preliminaries		$57,221
Civil Works		$293,211
Miscellaneous		$15,000
	Sub-total	**$365,432**
Project Contingencies	40.0%	$146,173
	Total Estimated Construction Cost	**$511,605**

NMS Specs						
Preliminaries			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 25 01	0-1	Mob / Demob, Temporary Facilities, Security, Quality Control, etc.	lump sum	1	$33,221.10	$33,221
01 35 14	0-2	Traffic Control, Barricades, and Temporary Signage	lump sum	1	$4,000.00	$4,000
01 71 00	0-3	Construction Surveys	lump sum	1	$20,000.00	$20,000
					Sub-total Preliminaries	**$57,221**
Civil Works			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
31 14 11	1-1	Excavation and Off-Site Disposal	cu.m	384	$30.00	$11,520
33 42 13	1-2	Supply and Install 450 mm Steel Casing Culvert	m	177	$527.00	$93,279
33 42 13	1-3	Supply and Install 600 mm Steel Casing Culvert	m	28	$707.00	$19,796
33 42 13	1-4	Supply and Install 900 mm Steel Casing Culvert	m	37	$1,068.00	$39,516
31 37 10	1-5	Supply and Place 10 kg Class Riprap	cu. m	513	$100.00	$51,300
31 37 10	1-6	Supply and Place 50 - 75 mm Clear Crush	cu. m	53	$100.00	$5,300
31 32 21	1-7	Supply and Place Non-Woven Geotextile	sq. m	1,825	$20.00	$36,500
02 41 13	1-8	Culvert Removal and Off-Site Disposal	each	18	$2,000.00	$36,000
					Sub-total Site Services	**$293,211**
Miscellaneous			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 35 43	2-1	Dewatering	lump sum	1	$5,000.00	$5,000
01 35 43	2-2	Sediments and Erosion Control Measures	lump sum	1	$10,000.00	$10,000
					Sub-total Miscellaneous	**$15,000**

Notes:

1 Quantities shown on this table are estimates and provided for reference only.

2 Estimated quantities do not account for spare culverts and materials.

Community and Government Services - Government of Nunavut
Class 'D' Cost Estimate - Phase 2
Tetra Tech Project WTRM03178-01 - Pond Inlet Drainage Project

Preliminary Estimate of Probable Costs		Total
Preliminaries		$66,200
Civil Works		$382,996
Miscellaneous		$15,000
	Sub-total	**$464,196**
Project Contingencies	40.0%	$185,678
	Total Estimated Construction Cost	**$649,874**

NMS Specs

Preliminaries			Unit	Est Quantity	Est. Unit Price	Est. Total
01 25 01	0-1	Mob / Demob, Temporary Facilities, Security, Quality Control, etc.	lump sum	1	$42,199.60	$42,200
01 35 14	0-2	Traffic Control, Barricades, and Temporary Signage	lump sum	1	$4,000.00	$4,000
01 71 00	0-3	Construction Surveys	lump sum	1	$20,000.00	$20,000
					Sub-total Preliminaries	**$66,200**
Civil Works			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
31 14 11	1-1	Excavation and Off-Site Disposal	cu.m	847	$30.00	$25,410
33 42 13	1-2	Supply and Install 450 mm Steel Casing Culvert	m	182	$527.00	$95,914
33 42 13	1-3	Supply and Install 600 mm Steel Casing Culvert	m	30	$707.00	$21,210
33 42 13	1-4	Supply and Install 600 mm Steel Casing Sleeve	m	2	$707.00	$1,414
33 42 13	1-5	Supply and Install 900 mm Steel Casing Culvert	m	16	$1,068.00	$17,088
31 37 10	1-6	Supply and Place 10 kg Class Riprap	cu. m	1,077	$100.00	$107,700
31 37 10	1-7	Supply and Place 50 - 75 mm Clear Crush	cu. m	60	$100.00	$6,000
31 32 21	1-8	Supply and Place Non-Woven Geotextile	sq. m	3,813	$20.00	$76,260
02 41 13	1-9	Culvert Removal and Off-Site Disposal	each	16	$2,000.00	$32,000
					Sub-total Site Services	**$382,996**
Miscellaneous			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 35 43	3-1	Dewatering	lump sum	1	$5,000.00	$5,000
01 35 43	3-2	Sediments and Erosion Control Measures	lump sum	1	$10,000.00	$10,000
					Sub-total Miscellaneous	**$15,000**

Notes:

1 Quantities shown on this table are estimates and provided for reference only.

2 Estimated quantities do not account for spare culverts and materials.

Community and Government Services - Government of Nunavut
Class 'D' Cost Estimate - Phase 3
Tetra Tech Project WTRM03178-01 - Pond Inlet Drainage Project

Preliminary Estimate of Probable Costs		Total
Preliminaries		$92,300
Civil Works		$644,004
Miscellaneous		$15,000
	Sub-total	**$751,304**
Project Contingencies	40.0%	$300,522
	Total Estimated Construction Cost	**$1,051,826**

NMS Specs						
Preliminaries			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 25 01	0-1	Mob / Demob, Temporary Facilities, Security, Quality Control, etc.	lump sum	1	$68,300.40	$68,300
01 35 14	0-2	Traffic Control, Barricades, and Temporary Signage	lump sum	1	$4,000.00	$4,000
01 71 00	0-3	Construction Surveys	lump sum	1	$20,000.00	$20,000
					Sub-total Preliminaries	**$92,300**
Civil Works			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
31 14 11	1-1	Excavation and Off-Site Disposal	cu.m	973	$30.00	$29,190
33 42 13	1-2	Supply and Install 450 mm Steel Casing Culvert	m	562	$527.00	$296,174
33 42 13	1-3	Supply and Install 1200 mm Steel Casing Culvert	m	12	$1,610.00	$19,320
31 37 10	1-4	Supply and Place 10 kg Class Riprap	cu. m	1,266	$100.00	$126,600
31 37 10	1-5	Supply and Place 50 - 75 mm Clear Crush	cu. m	286	$100.00	$28,600
31 32 21	1-6	Supply and Place Non-Woven Geotextile	sq. m	4,506	$20.00	$90,120
02 41 13	1-7	Culvert Removal and Off-Site Disposal	each	27	$2,000.00	$54,000
					Sub-total Site Services	**$644,004**
Miscellaneous			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 35 43	2-1	Dewatering	lump sum	1	$5,000.00	$5,000
01 35 43	2-2	Sediments and Erosion Control Measures	lump sum	1	$10,000.00	$10,000
					Sub-total Miscellaneous	**$15,000**

Notes:

1 Quantities shown on this table are estimates and provided for reference only.

2 Estimated quantities do not account for spare culverts and materials.

Community and Government Services - Government of Nunavut

Class 'D' Cost Estimate - Phase 4

Tetra Tech Project WTRM03178-01 - Pond Inlet Drainage Project

Preliminary Estimate of Probable Costs		Total
Preliminaries		$74,620
Civil Works		$467,195
Miscellaneous		$15,000
	Sub-total	**$556,815**
Project Contingencies	40.0%	$222,726
	Total Estimated Construction Cost	**$779,540**

NMS Specs						
Preliminaries			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 25 01	0-1	Mob / Demob, Temporary Facilities, Security, Quality Control, etc.	lump sum	1	$50,619.50	$50,620
01 35 14	0-2	Traffic Control, Barricades, and Temporary Signage	lump sum	1	$4,000.00	$4,000
01 71 00	0-3	Construction Surveys	lump sum	1	$20,000.00	$20,000
					Sub-total Preliminaries	**$74,620**
Civil Works			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
31 14 11	1-1	Excavation and Off-Site Disposal	cu.m	881	$30.00	$26,430
33 42 13	1-2	Supply and Install 450 mm Steel Casing Culvert	m	337	$527.00	$177,599
33 42 13	1-3	Supply and Install 600 mm Steel Casing Culvert	m	42	$707.00	$29,694
33 42 13	1-4	Supply and Install 900 mm Steel Casing Culvert	m	19	$1,068.00	$20,292
31 37 10	1-5	Supply and Place 10 kg Class Riprap	cu. m	1,111	$100.00	$111,100
31 37 10	1-6	Supply and Place 50 - 75 mm Clear Crush	cu. m	235	$100.00	$23,500
31 32 21	1-7	Supply and Place Non-Woven Geotextile	sq. m	3,929	$20.00	$78,580
					Sub-total Site Services	**$467,195**
Miscellaneous			**Unit**	**Est Quantity**	**Est. Unit Price**	**Est. Total**
01 35 43	2-1	Dewatering	lump sum	1	$5,000.00	$5,000
01 35 43	2-2	Sediments and Erosion Control Measures	lump sum	1	$10,000.00	$10,000
					Sub-total Miscellaneous	**$15,000**

Notes:

1 Quantities shown on this table are estimates and provided for reference only.

2 Estimated quantities do not account for spare culverts and materials.

APPENDIX E

INVENTORY OF EXISTING CULVERTS

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C1	inlet	2019 / 08 / 27	-77.94265381	72.689997517

Diameter (mm):	Material:	Condition:
500	CSP	damaged

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C1	outlet	2019 / 08 / 27	-77.942325673	72.689853482

Diameter (mm):	Material:	Condition:
500	CSP	damaged

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C2	inlet	2019 / 08 / 27	-77.94214249	72.691584209

Diameter (mm):	Material:	Condition:
600	CSP	blocked with debris clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C2	outlet	2019 / 08 / 27	-77.942677993	72.691627521

Diameter (mm):	Material:	Condition:
600	CSP	blocked with debris clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C3	inlet	2019 / 08 / 27	-77.943342578	72.6917173

Diameter (mm):	Material:	Condition:
600	CSP	remove debris

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C3	outlet	2019 / 08 / 27	-77.943797403	72.691769166

Diameter (mm):	Material:	Condition:
600	CSP	remove debris

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C4	inlet	2019 / 08 / 27	-77.944566971	72.691865782

Diameter (mm):	Material:	Condition:
750	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C4	outlet	2019 / 08 / 27	-77.944339361	72.692010964

Diameter (mm):	Material:	Condition:
750	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C5	inlet	2019 / 08 / 27	-77.945497261	72.691170427

Diameter (mm):	Material:	Condition:
500	CSP	damaged crushed

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C5	outlet	2019 / 08 / 27	-77.945386553	72.691241945

Diameter (mm):	Material:	Condition:
500	CSP	damaged crushed

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C6	inlet	2019 / 08 / 27	-77.940245037	72.692722561

Diameter (mm):	Material:	Condition:
600	CSP	damaged crushed

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C6	outlet	2019 / 08 / 27	-77.939639224	72.692732903

Diameter (mm):	Material:	Condition:
600	CSP	damaged crushed

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C7	inlet	2019 / 08 / 27	-77.943083093	72.69309151

Diameter (mm):	Material:	Condition:
600	CSP	damaged crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C7	outlet	2019 / 08 / 27	-77.94283551	72.693199975

Diameter (mm):	Material:	Condition:
600	CSP	damaged crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C8	inlet	2019 / 08 / 27	-77.942886595	72.69292862

Diameter (mm):	Material:	Condition:
600	CSP	clean out buried outlet

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C8	outlet	2019 / 08 / 27	-77.943100464	72.693073022

Diameter (mm):	Material:	Condition:
600	CSP	clean out buried outlet

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C9	inlet	2019 / 08 / 27	-77.943308507	72.692817728

Diameter (mm):	Material:	Condition:
600	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C9	outlet	2019 / 08 / 27	-77.943856022	72.692887247

Diameter (mm):	Material:	Condition:
600	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C10	inlet	2019 / 08 / 27	-77.948042589	72.693506957

Diameter (mm):	Material:	Condition:
600	CSP	damaged blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C10	outlet	2019 / 08 / 27	-77.948628383	72.693560708

Diameter (mm):	Material:	Condition:
600	CSP	damaged blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C11	inlet	2019 / 08 / 27	-77.947435488	72.694344027

Diameter (mm):	Material:	Condition:
600	CSP	damaged damaged, blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C11	outlet	2019 / 08 / 27	-77.947896144	72.694443677

Diameter (mm):	Material:	Condition:
600	CSP	damaged damaged, blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C12	inlet	2019 / 08 / 27	-77.944195663	72.694110164

Diameter (mm):	Material:	Condition:
400	CSP	clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C12	outlet	2019 / 08 / 27	-77.944425522	72.694141764

Diameter (mm):	Material:	Condition:
400	CSP	clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C13	inlet	2019 / 08 / 27	-77.943132687	72.694042082

Diameter (mm):	Material:	Condition:
500	CSP	damaged partially blocked

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C13	outlet	2019 / 08 / 27	-77.943442877	72.694034521

Diameter (mm):	Material:	Condition:
500	CSP	damaged partially blocked

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert: C14

Culvert End: inlet

Date Assessed: 2019 / 08 / 27

Longitude: -77.942534159

Latitude: 72.6935706

Diameter (mm): 600

Material: CSP

Condition: crushed, buried

Recommended Action: Replace Culvert

Proposed Phase: 3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C14	outlet	2019 / 08 / 27	-77.942494479	72.693639562

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:
Replace Culvert

Proposed Phase:
3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C15	inlet	2019 / 08 / 27	-77.944122445	72.695064873

Diameter (mm):	Material:	Condition:
400	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C15	outlet	2019 / 08 / 27	-77.944301597	72.695174776

Diameter (mm):	Material:	Condition:
400	CSP	

Recommended Action:	Proposed Phase:
No Action Required	

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C16	inlet	2019 / 08 / 27	-77.944671318	72.695675706

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:
Abandon

Proposed Phase:
1

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C16	outlet	2019 / 08 / 27	-77.944976743	72.695549613

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C17	inlet	2019 / 08 / 27	-77.945628482	72.695276652

Diameter (mm):	Material:	Condition:
400	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C17	outlet	2019 / 08 / 27	-77.946268384	72.695321696

Diameter (mm):	Material:	Condition:
400	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C18	outlet	2019 / 08 / 27	-77.946620888	72.695160109

Diameter (mm):	Material:	Condition:
1000	CSP	

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C19	inlet	2019 / 08 / 27	-77.946578098	72.694871701

Diameter (mm):	Material:	Condition:
400	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C19	outlet	2019 / 08 / 27	-77.947058555	72.694905719

Diameter (mm):	Material:	Condition:
400	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C20	inlet	2019 / 08 / 27	-77.949488117	72.696228806

Diameter (mm):	Material:	Condition:
600	CSP	blocked clean out

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C20	outlet	2019 / 08 / 27	-77.949189258	72.6963669

Diameter (mm):	Material:	Condition:
600	CSP	blocked clean out

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C21	inlet	2019 / 08 / 27	-77.950600489	72.696656291

Diameter (mm):	Material:	Condition:
400	CSP	crushed, buried

Recommended Action:
Abandon

Proposed Phase:
1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C21	outlet	2019 / 08 / 27	-77.950794813	72.696658011

Diameter (mm):	Material:	Condition:
400	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C22	inlet	2019 / 08 / 27	-77.951164071	72.696575112

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried formalize swale in front of it

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C22	outlet	2019 / 08 / 27	-77.951168024	72.69672246

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried formalize swale in front of it

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C23	inlet	2019 / 08 / 27	-77.951180893	72.696769381

Diameter (mm):	Material:	Condition:
400	CSP	partially buried clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	1

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C23	outlet	2019 / 08 / 27	-77.95113003	72.696837445

Diameter (mm):	Material:	Condition:
400	CSP	partially buried clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C24	inlet	2019 / 08 / 27	-77.951017165	72.696952612

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C24	outlet	2019 / 08 / 27	-77.951249755	72.697031274

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C25	inlet	2019 / 08 / 27	-77.951218823	72.697098942

Diameter (mm):	Material:	Condition:
150	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C25	outlet	2019 / 08 / 27	-77.951131348	72.697152306

Diameter (mm):	Material:	Condition:
150	CSP	buried

Recommended Action:
Abandon

Proposed Phase:
1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C26	inlet	2019 / 08 / 27	-77.950524493	72.69718472

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C26	outlet	2019 / 08 / 27	-77.950355397	72.69727381

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C27	inlet	2019 / 08 / 27	-77.949096481	72.697121386

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C27	outlet	2019 / 08 / 27	-77.949480049	72.697212169

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C28	inlet	2019 / 08 / 27	-77.943945925	72.696078796

Diameter (mm):	Material:	Condition:
1400	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C28	outlet	2019 / 08 / 27	-77.944008147	72.69622712

Diameter (mm):	Material:	Condition:
1400	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C29	inlet	2019 / 08 / 27	-77.94211242	72.696740633

Diameter (mm):	Material:	Condition:
400	CSP	crushed buried

Recommended Action:
Abandon

Proposed Phase:
3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C29	outlet	2019 / 08 / 27	-77.942445469	72.696685632

Diameter (mm):	Material:	Condition:
400	CSP	crushed buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C30	inlet	2019 / 08 / 27	-77.947339708	72.697843646

Diameter (mm):	Material:	Condition:
900	CSP	fix erosion/scouring

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C30	outlet	2019 / 08 / 27	-77.947627832	72.697733065

Diameter (mm):	Material:	Condition:
900	CSP	fix erosion/scouring

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C31	inlet	2019 / 08 / 27	-77.946926233	72.697782816

Diameter (mm):	Material:	Condition:
700	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C31	outlet	2019 / 08 / 27	-77.947218946	72.697854526

Diameter (mm):	Material:	Condition:
700	CSP	

Recommended Action:	Proposed Phase:
No Action Required	

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C32	inlet	2019 / 08 / 27	-77.938660315	72.697637988

Diameter (mm):	Material:	Condition:
100	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C32	outlet	2019 / 08 / 27	-77.939113051	72.697565405

Diameter (mm):	Material:	Condition:
100	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C33	inlet	2019 / 08 / 27	-77.937343905	72.698016643

Diameter (mm):	Material:	Condition:
1200	CSP	

Recommended Action:
No Action Required

Proposed Phase:

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C33	outlet	2019 / 08 / 27	-77.937962729	72.69805323

Diameter (mm):	Material:	Condition:
1200	CSP	

Recommended Action:	Proposed Phase:
No Action Required	

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C34	inlet	2019 / 08 / 27	-77.942002474	72.700152271

Diameter (mm):	Material:	Condition:
600	CSP	partially buried clean out

Recommended Action:	Proposed Phase:
Clean Out Culvert	3

2019 Assessment Photo

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TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert: C34

Culvert End: outlet

Date Assessed: 2019 / 08 / 27

Longitude: -77.942322295

Latitude: 72.700241861

Diameter (mm): 600

Material: CSP

Condition: partially buried clean out

Recommended Action: Clean Out Culvert

Proposed Phase: 3

2019 Assessment Photo

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TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C35	inlet	2019 / 08 / 27	-77.944635455	72.699682352

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C35	outlet	2019 / 08 / 27	-77.945122149	72.699629666

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C36	inlet	2019 / 08 / 27	-77.945659124	72.699541294

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C36	outlet	2019 / 08 / 27	-77.946078827	72.699485023

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C37	inlet	2019 / 08 / 27	-77.949347333	72.699175937

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C37	outlet	2019 / 08 / 27	-77.949731684	72.699091302

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:
Replace Culvert

Proposed Phase:
2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C38	inlet	2019 / 08 / 27	-77.951018427	72.698843036

Diameter (mm):	Material:	Condition:
400	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	2

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2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C38	outlet	2019 / 08 / 27	-77.951251101	72.698798605

Diameter (mm):	Material:	Condition:
400	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C39	inlet	2019 / 08 / 27	-77.952148458	72.698604651

Diameter (mm):	Material:	Condition:
800	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C39	outlet	2019 / 08 / 27	-77.952682607	72.698499584

Diameter (mm):	Material:	Condition:
800	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C40	inlet	2019 / 08 / 27	-77.952396513	72.698313811

Diameter (mm):	Material:	Condition:
1200	CSP	damaged ends

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C40	outlet	2019 / 08 / 27	-77.952699622	72.698417274

Diameter (mm):	Material:	Condition:
1200	CSP	damaged ends

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C41	inlet	2019 / 08 / 27	-77.951810343	72.698443952

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C41	outlet	2019 / 08 / 27	-77.952144223	72.698363089

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C42	inlet	2019 / 08 / 27	-77.950761658	72.698649234

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C42	outlet	2019 / 08 / 27	-77.950992497	72.698624586

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C43	inlet	2019 / 08 / 27	-77.95024984	72.698488031

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C43	outlet	2019 / 08 / 27	-77.950341963	72.698520117

Diameter (mm):	Material:	Condition:
500	CSP	crushed buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C44	inlet	2019 / 08 / 27	-77.949733707	72.697744865

Diameter (mm):	Material:	Condition:
1400	CSP	good condition

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C44	outlet	2019 / 08 / 27	-77.95025652	72.697880074

Diameter (mm):	Material:	Condition:
1400	CSP	good condition

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C45	inlet	2019 / 08 / 27	-77.950712458	72.697580121

Diameter (mm):	Material:	Condition:
700	CSP	crushed, buried, damaged ends

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C45	outlet	2019 / 08 / 27	-77.950592388	72.697718643

Diameter (mm):	Material:	Condition:
700	CSP	crushed, buried, damaged ends

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C46	inlet	2019 / 08 / 27	-77.957203399	72.698014707

Diameter (mm):	Material:	Condition:
600	CSP	damaged

Recommended Action:
Replace Culvert

Proposed Phase:
3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C46	outlet	2019 / 08 / 27	-77.957149543	72.698164298

Diameter (mm):	Material:	Condition:
600	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C47	inlet	2019 / 08 / 27	-77.964711818	72.696709167

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C47	outlet	2019 / 08 / 27	-77.964975384	72.696773846

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C48	inlet	2019 / 08 / 27	-77.966493551	72.695970746

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C48	outlet	2019 / 08 / 27	-77.966310661	72.696087126

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C49	inlet	2019 / 08 / 27	-77.96689974	72.695723844

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C49	outlet	2019 / 08 / 27	-77.966794648	72.695768951

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C50	inlet	2019 / 08 / 27	-77.967834016	72.694977926

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C50	outlet	2019 / 08 / 27	-77.967888058	72.694896708

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C51	inlet	2019 / 08 / 27	-77.968343689	72.694590098

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C51	outlet	2019 / 08 / 27	-77.968401674	72.694498768

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C52	inlet	2019 / 08 / 27	-77.968707905	72.694376982

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C52	outlet	2019 / 08 / 27	-77.968411822	72.694119959

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	1

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C53	inlet	2019 / 08 / 27	-77.968653068	72.693370524

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C53	outlet	2019 / 08 / 27	-77.969107662	72.693392445

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C54	inlet	2019 / 08 / 27	-77.971679785	72.695519844

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C54	outlet	2019 / 08 / 27	-77.971975288	72.695429677

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C55	inlet	2019 / 08 / 27	-77.96801395	72.696416535

Diameter (mm):	Material:	Condition:
500	CSP	blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C55	outlet	2019 / 08 / 27	-77.96766269	72.69652732

Diameter (mm):	Material:	Condition:
500	CSP	blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C56	inlet	2019 / 08 / 27	-77.966398	72.696892886

Diameter (mm):	Material:	Condition:
500	CSP	blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C56	outlet	2019 / 08 / 27	-77.966183591	72.697016089

Diameter (mm):	Material:	Condition:
500	CSP	blocked

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C57	inlet	2019 / 08 / 27	-77.96628041	72.6970947

Diameter (mm):	Material:	Condition:
700	CSP	damaged

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C57	outlet	2019 / 08 / 27	-77.966609028	72.697171728

Diameter (mm):	Material:	Condition:
700	CSP	damaged

Recommended Action:
Replace Culvert

Proposed Phase:
2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C58	inlet	2019 / 08 / 27	-77.958771711	72.698050833

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C58	outlet	2019 / 08 / 27	-77.958490416	72.698217287

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C59	inlet	2019 / 08 / 27	-77.957974616	72.699303433

Diameter (mm):	Material:	Condition:
1400	CSP	good condition

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C59	outlet	2019 / 08 / 27	-77.958348037	72.699445873

Diameter (mm):	Material:	Condition:
1400	CSP	good condition

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C60	inlet	2019 / 08 / 27	-77.959992045	72.699073367

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C60	outlet	2019 / 08 / 27	-77.960239687	72.69917005

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C61	inlet	2019 / 08 / 27	-77.963084416	72.697848776

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C61	outlet	2019 / 08 / 27	-77.963012304	72.697998761

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C62	inlet	2019 / 08 / 27	-77.964039396	72.697664558

Diameter (mm):	Material:	Condition:
150	CSP	buried too small

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C62	outlet	2019 / 08 / 27	-77.964207535	72.697785183

Diameter (mm):	Material:	Condition:
150	CSP	buried too small

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C63	inlet	2019 / 08 / 27	-77.966523889	72.698630563

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C63	outlet	2019 / 08 / 27	-77.967369435	72.698761446

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried

Recommended Action:
Replace Culvert

Proposed Phase:
2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C64	inlet	2019 / 08 / 27	-77.969891368	72.698583076

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C64	outlet	2019 / 08 / 27	-77.970354918	72.698606651

Diameter (mm):	Material:	Condition:
500	CSP	crushed, buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C65	inlet	2019 / 08 / 27	-77.971968351	72.697838273

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C65	outlet	2019 / 08 / 27	-77.972230094	72.697907365

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C66	inlet	2019 / 08 / 27	-77.972758367	72.69752271

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C66	outlet	2019 / 08 / 27	-77.973151758	72.697615696

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	1

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C67	inlet	2019 / 08 / 27	-77.975483048	72.696560135

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C67	outlet	2019 / 08 / 27	-77.975780696	72.696630213

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

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2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C68	inlet	2019 / 08 / 27	-77.977984616	72.695578016

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C68	outlet	2019 / 08 / 27	-77.978051877	72.695552709

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C69	inlet	2019 / 08 / 27	-77.975820075	72.696713215

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C69	outlet	2019 / 08 / 27	-77.975899989	72.696763706

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C70	inlet	2019 / 08 / 27	-77.978662531	72.69535678

Diameter (mm):	Material:	Condition:
400	CSP	buried, damaged

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert: C70

Culvert End: outlet

Date Assessed: 2019 / 08 / 27

Longitude: -77.978770062

Latitude: 72.695297446

Diameter (mm): 400

Material: CSP

Condition: buried, damaged

Recommended Action: Replace Culvert

Proposed Phase: 3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C71	inlet	2019 / 08 / 27	-77.97938737	72.695049748

Diameter (mm):	Material:	Condition:
1200	CSP	clean out extend culvert outlet , readjust slope

Recommended Action:	Proposed Phase:
Repair Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C71	outlet	2019 / 08 / 27	-77.979741543	72.695122025

Diameter (mm):	Material:	Condition:
1200	CSP	clean out extend culvert outlet , readjust slope

Recommended Action:	Proposed Phase:
Repair Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C72	inlet	2019 / 08 / 27	-77.979826785	72.694929287

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C72	outlet	2019 / 08 / 27	-77.979906283	72.694885562

Diameter (mm):	Material:	Condition:
400	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C73	inlet	2019 / 08 / 27	-77.979970218	72.694870942

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C73	outlet	2019 / 08 / 27	-77.980104219	72.694817295

Diameter (mm):	Material:	Condition:
600	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C74	inlet	2019 / 08 / 27	-77.980100138	72.694823433

Diameter (mm):	Material:	Condition:
600	CSP	partially damaged buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C74	outlet	2019 / 08 / 27	-77.980354749	72.694880462

Diameter (mm):	Material:	Condition:
600	CSP	partially damaged buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C75	inlet	2019 / 08 / 27	-77.980678187	72.694585428

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C75	outlet	2019 / 08 / 27	-77.980575505	72.694643173

Diameter (mm):	Material:	Condition:
300	CSP	buried

Recommended Action:
Abandon

Proposed Phase:
2

2019 Assessment Photo

2019 Assessment Photo

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C76	inlet	2019 / 08 / 27	-77.982630682	72.693925924

Diameter (mm):	Material:	Condition:
1200	CSP	

Recommended Action:
No Action Required

Proposed Phase:

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2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C76	outlet	2019 / 08 / 27	-77.982891674	72.69396006

Diameter (mm):	Material:	Condition:
1200	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C77	inlet	2019 / 08 / 27	-77.967982975	72.698930263

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C77	outlet	2019 / 08 / 27	-77.968063682	72.698954911

Diameter (mm):	Material:	Condition:
500	CSP	buried

Recommended Action:	Proposed Phase:
Replace Culvert	2

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C78	inlet	2019 / 08 / 27	-77.968644523	72.699069467

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried repair inlet & unblock. Put sleeve on inlet

Recommended Action:	Proposed Phase:
Repair Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C78	outlet	2019 / 08 / 27	-77.968888165	72.699152506

Diameter (mm):	Material:	Condition:
600	CSP	crushed, buried repair inlet & unblock. Put sleeve on inlet

Recommended Action:	Proposed Phase:
Repair Culvert	2

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C79	inlet	2019 / 08 / 27	-77.967566644	72.699466745

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:
Abandon

Proposed Phase:
2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C79	outlet	2019 / 08 / 27	-77.967842367	72.699558432

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	2

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C80	inlet	2019 / 08 / 27	-77.965809202	72.699647569

Diameter (mm):	Material:	Condition:
1400	CSP	

Recommended Action:
No Action Required

Proposed Phase:

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C80	outlet	2019 / 08 / 27	-77.966419916	72.699726739

Diameter (mm):	Material:	Condition:
1400	CSP	

Recommended Action:	Proposed Phase:
No Action Required	

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C81	inlet	2019 / 08 / 27	-77.955014407	72.701382631

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C81	outlet	2019 / 08 / 27	-77.954847407	72.701487974

Diameter (mm):	Material:	Condition:
1000	CSP	buried

Recommended Action:
Abandon

Proposed Phase:
3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C82	inlet	2019 / 08 / 27	-77.955291686	72.701699279

Diameter (mm):	Material:	Condition:
500	CSP	

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C82	outlet	2019 / 08 / 27	-77.954898514	72.701761626

Diameter (mm):	Material:	Condition:
500	CSP	

Recommended Action:	Proposed Phase:
Abandon	3

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C83	inlet	2019 / 08 / 27	-77.953769575	72.700163208

Diameter (mm):	Material:	Condition:
1000	CSP	replace

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

Inventory of Existing Culverts

Pond Inlet Master Drainage Plan

Culvert:	Culvert End:	Date Assessed:	Longitude:	Latitude:
C83	outlet	2019 / 08 / 27	-77.953713823	72.700347595

Diameter (mm):	Material:	Condition:
1000	CSP	replace

Recommended Action:	Proposed Phase:
Replace Culvert	3

2019 Assessment Photo

2019 Assessment Photo

2019 Assessment Photo

TETRA TECH

APPENDIX F

LIST OF PROPOSED CULVERTS

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C1	No Action Required	N.A.	CSP		19.4	500	0.00	0.40	7
C2	Clean Out Culvert	3	CSP		18.4	600	0.01	0.80	5
C3	Clean Out Culvert	3	CSP		16.2	600	0.01	0.97	9
C4	Replace Culvert	3	SWSP	10-12	17.9	450	0.02	1.10	20
C5	Replace Culvert	3	SWSP	10-12	8.8	450	0.01	0.92	15
C6	Replace Culvert	3	SWSP	10-12	20.2	450	0.00	0.40	8
C7	Replace Culvert	3	SWSP	10-12	14.6	450	0.01	0.84	13
C8	Clean Out Culvert	3	CSP		17.6	600	0.00	0.34	3
C9	No Action Required	N.A.	CSP		19.8	600	0.03	1.38	15
C10	Replace Culvert	3	SWSP	10-12	20.4	450	0.09	1.72	38
C11	Replace Culvert	3	SWSP	10-12	18.9	450	0.02	0.93	18
C12	Clean Out Culvert	3	CSP		8.4	400	0.01	0.75	13
C13	Clean Out Culvert	3	CSP		10.3	500	0.01	0.86	11
C14	Replace Culvert	3	SWSP	10-12	7.8	450	0.02	1.00	16
C15	No Action Required	N.A.	CSP		13.6	400	0.00	0.00	0
C16	Abandon	1	CSP		17.3	600	0.00	0.42	3
C17	Replace Culvert	3	SWSP	10-12	21.8	450	0.02	0.62	21
C18	Abandon	3	CSP		19.6	1000	0.00	0.12	30
C19	Replace Culvert	3	SWSP	10-12	16.4	450	0.03	0.79	30
C20	Replace Culvert	1	SWSP	10-12	18.3	900	0.33	1.43	41
C21	Abandon	1	CSP		6.5	400	0.00	0.00	0
C22	Replace Culvert	1	SWSP	10-12	16.4	600	0.01	0.91	13
C23	Clean Out Culvert	1	CSP		7.8	400	0.01	1.03	17
C24	Abandon	1	CSP		11.5	500	0.00	0.00	0
C25	Abandon	1	CSP		6.6	150	0.00	0.00	42
C26	Replace Culvert	1	SWSP	10-12	11.4	600	0.03	1.47	13
C27	Abandon	1	CSP		16.3	500	0.00	0.00	0

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C28	No Action Required	N.A.	CSP		16.7	1400	2.29	1.86	42
C29	Abandon	3	CSP		12.7	400	0.00	0.00	0
C30	No Action Required	N.A.	CSP		15.6	900	0.38	1.89	36
C31	No Action Required	N.A.	CSP		12.6	700	0.35	1.53	67
C32	No Action Required	N.A.	CSP		17.1	100	0.00	0.61	76
C33	No Action Required	N.A.	CSP		21.0	1200	0.32	2.23	19
C34	Clean Out Culvert	3	SWSP	10-12	14.6	600	0.03	1.68	12
C35	Replace Culvert	3	SWSP	10-12	17.2	450	0.01	0.89	14
C36	Replace Culvert	3	SWSP	10-12	15.3	450	0.01	0.30	28
C37	Replace Culvert	2	SWSP	10-12	15.9	450	0.01	0.30	15
C38	Replace Culvert	2	SWSP	10-12	9.2	450	0.01	0.48	11
C39	Replace Culvert	1	SWSP	10-12	21.3	450	0.02	1.51	12
C40	No Action Required	N.A.	CSP		15.3	1200	2.71	2.94	43
C41	Replace Culvert	2	SWSP	10-12	14.3	450	0.09	1.32	52
C42	Replace Culvert	2	SWSP	10-12	6.0	450	0.08	1.24	44
C43	Abandon	2	CSP		4.7	500	0.09	1.15	42
C44	No Action Required	N.A.	CSP		23.0	1400	2.65	2.77	39
C45	Replace Culvert	1	SWSP	10-12	16.0	450	0.01	0.21	31
C46	Replace Culvert	3	SWSP	10-12	16.8	450	0.03	1.54	16
C47	Replace Culvert	1	SWSP	10-12	11.3	450	0.05	1.22	32
C48	Replace Culvert	3	SWSP	10-12	14.3	450	0.01	0.48	14
C49	Replace Culvert	3	SWSP	10-12	6.1	450	0.00	0.32	13
C50	Replace Culvert	1	SWSP	10-12	9.2	450	0.00	0.29	11
C51	Replace Culvert	1	SWSP	10-12	10.4	450	0.00	0.19	15
C52	Abandon	1	CSP		30.3	600	0.01	0.76	7
C53	Replace Culvert	2	SWSP	10-12	15.3	900	0.46	2.37	34
C54	Abandon	3	CSP		14.1	500	0.02	1.42	12
C55	Replace Culvert	3	SWSP	10-12	17.0	450	0.00	0.59	9
C56	Replace Culvert	3	SWSP	10-12	15.5	450	0.02	0.92	24

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C57	Replace Culvert	2	SWSP	10-12	13.9	600	0.07	1.85	18
C58	Replace Culvert	3	SWSP	10-12	20.8	450	0.01	0.86	13
C59	No Action Required	N.A.	SWSP		20.2	1400	2.75	2.43	40
C60	Abandon	3	CSP		13.6	600	0.00	0.00	0
C61	Replace Culvert	1	SWSP	10-12	16.9	450	0.00	0.98	3
C62	Replace Culvert	1	SWSP	10-12	14.6	450	0.01	1.38	8
C63	Replace Culvert	2	SWSP	10-12	31.7	450	0.01	1.17	10
C64	Replace Culvert	2	SWSP	10-12	15.6	600	0.09	1.60	26
C65	Replace Culvert	1	SWSP	10-12	11.6	450	0.02	1.74	12
C66	Replace Culvert	1	SWSP	10-12	16.7	450	0.01	1.23	10
C67	Abandon	3	CSP		12.6	1000	0.00	0.00	0
C68	Replace Culvert	3	SWSP	10-12	3.6	450	0.03	0.97	26
C69	Abandon	2	CSP		7.1	300	0.00	0.00	0
C70	Replace Culvert	3	SWSP	10-12	7.5	450	0.04	1.11	26
C71	Repair Culvert	2	CSP		14.3	1200	1.23	2.78	46
C72	Replace Culvert	2	SWSP	10-12	5.5	450	0.00	0.23	6
C73	Replace Culvert	2	SWSP	10-12	7.5	450	0.00	0.37	12
C74	Replace Culvert	2	SWSP	10-12	10.6	450	0.02	1.56	12
C75	Abandon	2	CSP		7.3	300	0.00	0.00	0
C76	No Action Required	N.A.	CSP		9.5	1200	1.16	2.63	46
C77	Replace Culvert	2	SWSP	10-12	3.8	450	0.01	1.19	13
C78	Repair Culvert	2	CSP		12.3	600	0.02	1.13	9
C79	Abandon	2	CSP		13.7	1000	0.00	0.00	0
C80	No Action Required	N.A.	CSP		22.1	1400	2.76	2.78	40
C81	Abandon	3	CSP		13.0	1000	0.00	0.00	0
C82	Abandon	3	CSP		14.8	500	0.00	0.00	0
C83	Replace Culvert	3	SWSP	10-12	20.7	450	0.01	1.32	7
C84	New Culvert - Existing Community	1	SWSP	10-12	24.0	450	0.00	0.97	5
C85	New Culvert - Existing Community	3	SWSP	10-12	10.1	450	0.00	0.00	0

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C86	New Culvert - Existing Community	3	SWSP	10-12	9.4	450	0.01	1.56	10
C87	New Culvert - Existing Community	1	SWSP	10-12	11.9	450	0.01	1.34	13
C88	New Culvert - Existing Community	2	SWSP	10-12	13.8	450	0.00	0.83	6
C89	New Culvert - Existing Community	3	SWSP	10-12	21.2	450	0.02	1.09	14
C90	New Culvert - Existing Community	3	SWSP	10-12	16.4	450	0.01	0.61	18
C91	New Culvert - Existing Community	2	SWSP	10-12	12.9	450	0.07	1.03	47
C92	New Culvert - Existing Community	2	SWSP	10-12	10.7	450	0.01	1.47	11
C93	New Culvert - Existing Community	2	SWSP	10-12	8.0	450	0.02	1.62	11
C94	New Culvert - Existing Community	2	SWSP	10-12	9.0	450	0.02	1.24	14
C95	New Culvert - Existing Community	3	SWSP	10-12	17.6	450	0.03	1.19	22
C96	New Culvert - Existing Community	2	SWSP	10-12	5.4	450	0.02	1.18	15
C97	New Culvert - Existing Community	2	SWSP	10-12	7.8	450	0.01	1.14	14
C98	New Culvert - Existing Community	3	SWSP	10-12	11.1	450	0.01	0.37	17
C99	New Culvert - Existing Community	3	SWSP	10-12	9.5	450	0.01	0.81	10

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C100	New Culvert - Existing Community	2	SWSP	10-12	9.0	450	0.00	1.15	5
C101	New Culvert - Existing Community	3	SWSP	10-12	10.4	450	0.02	0.89	16
C102	New Culvert - Existing Community	3	SWSP	10-12	8.3	450	0.02	0.91	17
C103	New Culvert - Existing Community	3	SWSP	10-12	14.1	450	0.02	0.83	21
C104	New Culvert - Existing Community	3	SWSP	10-12	11.7	1200	1.23	2.69	48
C105	New Culvert - Existing Community	3	SWSP	10-12	13.0	450	0.01	0.80	13
C106	New Culvert - Existing Community	3	SWSP	10-12	10.2	450	0.01	0.82	15
C107	New Culvert - Existing Community	1	SWSP	10-12	13.0	450	0.01	0.95	11
C108	New Culvert - Existing Community	3	SWSP	10-12	9.8	450	0.01	1.30	7
C109	New Culvert - Existing Community	3	SWSP	10-12	28.4	450	0.02	1.08	16
C110	New Culvert - Existing Community	3	SWSP	10-12	14.3	450	0.00	0.00	0
C111	New Culvert - Existing Community	4	SWSP	10-12	20.6	450	0.00	1.12	7
C112	New Culvert - Existing Community	3	SWSP	10-12	18.4	450	0.02	1.14	15
C113	New Culvert - Existing Community	3	SWSP	10-12	17.2	450	0.03	1.18	22

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C114	New Culvert - Existing Community	1	SWSP	10-12	18.3	900	0.34	1.36	42
C115	New Culvert - Community Expansion	4	SWSP	10-12	18.6	900	0.42	1.65	42
C116	New Culvert - Community Expansion	4	SWSP	10-12	25.2	600	0.25	1.57	59
C117	New Culvert - Community Expansion	4	SWSP	10-12	19.8	450	0.02	1.44	15
C118	New Culvert - Community Expansion	4	SWSP	10-12	25.2	450	0.02	0.80	19
C119	New Culvert - Community Expansion	4	SWSP	10-12	24.7	450	0.03	0.99	22
C120	New Culvert - Community Expansion	4	SWSP	10-12	19.1	450	0.02	0.90	18
C121	New Culvert - Community Expansion	4	SWSP	10-12	36.8	450	0.02	1.07	18
C122	New Culvert - Community Expansion	4	SWSP	10-12	18.6	450	0.02	1.19	15
C123	New Culvert - Community Expansion	4	SWSP	10-12	23.9	450	0.02	0.83	20
C124	New Culvert - Community Expansion	4	SWSP	10-12	19.8	450	0.09	1.22	48
C125	New Culvert - Community Expansion	4	SWSP	10-12	21.7	450	0.03	1.10	25
C126	New Culvert - Community Expansion	4	SWSP	10-12	18.0	450	0.04	1.16	25
C127	New Culvert - Community Expansion	4	SWSP	10-12	18.0	450	0.04	0.69	40

Table F-1: Proposed Culverts

Name	Proposed Culvert Action	Proposed Phase	Material	Wall Thickness (mm)	Length (m)	Diameter (mm)	Max. Flow (m^3/s)	Max. Velocity (m/s)	Max/Full Depth (%)
C128	New Culvert - Community Expansion	4	SWSP	10-12	17.6	450	0.03	3.13	12
C129	New Culvert - Community Expansion	4	SWSP	10-12	16.1	600	0.22	1.39	62
C130	New Culvert - Community Expansion	4	SWSP	10-12	24.8	450	0.01	0.39	7
C131	New Culvert - Community Expansion	4	SWSP	10-12	23.5	450	0.02	0.69	22
C132	New Culvert - Community Expansion	4	SWSP	10-12	24.9	450	0.01	0.23	13

Table F-2: Culvert Riprap Apron Volumes (Including Headwall and Endwall Protection)

			Inlet				Outlet		
Name	Proposed Phase	Diameter (mm)	Riprap Class (kg)	Riprap Thickness (mm)	Riprap Length (m)	Riprap Volume (m^3)	Riprap Length (m)	Riprap Volume (m^3)	Total Riprap Volume (m^3)
C4	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C5	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C6	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C7	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C10	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C11	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C14	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C17	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C19	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C20	1	900	10	350	3.4	3.2	5.2	4.9	8.2
C22	1	600	10	350	2.3	1.4	3.5	2.2	3.6
C26	1	600	10	350	2.3	1.4	3.5	2.2	3.6
C35	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C36	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C37	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C38	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C39	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C41	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C42	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C45	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C46	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C47	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C48	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C49	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C50	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C51	1	450	10	350	1.7	0.8	2.6	1.2	2.0

Table F-2: Culvert Riprap Apron Volumes (Including Headwall and Endwall Protection)

			Inlet				Outlet		
Name	Proposed Phase	Diameter (mm)	Riprap Class (kg)	Riprap Thickness (mm)	Riprap Length (m)	Riprap Volume (m³)	Riprap Length (m)	Riprap Volume (m³)	Total Riprap Volume (m³)
C53	2	900	10	350	3.4	3.2	5.2	4.9	8.2
C55	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C56	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C57	2	600	10	350	2.3	1.4	3.5	2.2	3.6
C58	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C61	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C62	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C63	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C64	2	600	10	350	2.3	1.4	3.5	2.2	3.6
C65	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C66	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C68	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C70	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C72	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C73	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C74	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C77	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C83	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C84	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C85	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C86	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C87	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C88	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C89	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C90	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C91	2	450	10	350	1.7	0.8	2.6	1.2	2.0

Table F-2: Culvert Riprap Apron Volumes (Including Headwall and Endwall Protection)

			Inlet				Outlet		
Name	Proposed Phase	Diameter (mm)	Riprap Class (kg)	Riprap Thickness (mm)	Riprap Length (m)	Riprap Volume (m³)	Riprap Length (m)	Riprap Volume (m³)	Total Riprap Volume (m³)
C92	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C93	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C94	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C95	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C96	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C97	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C98	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C99	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C100	2	450	10	350	1.7	0.8	2.6	1.2	2.0
C101	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C102	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C103	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C104	3	1200	10	350	4.6	5.7	7.0	8.8	14.5
C105	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C106	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C107	1	450	10	350	1.7	0.8	2.6	1.2	2.0
C108	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C109	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C110	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C111	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C112	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C113	3	450	10	350	1.7	0.8	2.6	1.2	2.0
C114	1	900	10	350	3.4	3.2	5.2	4.9	8.2
C115	4	900	10	350	3.4	3.2	5.2	4.9	8.2
C116	4	600	10	350	2.3	1.4	3.5	2.2	3.6
C117	4	450	10	350	1.7	0.8	2.6	1.2	2.0

Table F-2: Culvert Riprap Apron Volumes (Including Headwall and Endwall Protection)

			Inlet				Outlet		
Name	Proposed Phase	Diameter (mm)	Riprap Class (kg)	Riprap Thickness (mm)	Riprap Length (m)	Riprap Volume (m³)	Riprap Length (m)	Riprap Volume (m³)	Total Riprap Volume (m³)
C118	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C119	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C120	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C121	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C122	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C123	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C124	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C125	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C126	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C127	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C128	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C129	4	600	10	350	2.3	1.4	3.5	2.2	3.6
C130	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C131	4	450	10	350	1.7	0.8	2.6	1.2	2.0
C132	4	450	10	350	1.7	0.8	2.6	1.2	2.0
Total Volume Riprap for Culvert Aprons (m³):								**237**	

Table F-3: Culvert Apron Geotextile Quantities (Including Headwall and Endwall Protection)

			Inlet			Outlet			
Name	Proposed Phase	Diameter (mm)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Total Geotextile Area (m2)
C4	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C5	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C6	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C7	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C10	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C11	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C14	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C17	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C19	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C20	1	900	2.7	4.2	11.5	2.7	6.9	18.8	30.2
C22	1	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C26	1	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C35	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C36	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C37	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C38	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C39	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C41	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C42	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C45	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C46	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C47	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C48	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C49	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C50	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C51	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C53	2	900	2.7	4.2	11.5	2.7	6.9	18.8	30.2
C55	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C56	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C57	2	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C58	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C61	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C62	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C63	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6

Table F-3: Culvert Apron Geotextile Quantities (Including Headwall and Endwall Protection)

			Inlet			Outlet			
Name	Proposed Phase	Diameter (mm)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Total Geotextile Area (m2)
C64	2	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C65	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C66	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C68	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C70	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C72	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C73	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C74	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C77	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C83	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C84	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C85	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C86	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C87	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C88	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C89	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C90	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C91	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C92	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C93	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C94	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C95	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C96	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C97	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C98	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C99	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C100	2	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C101	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C102	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C103	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C104	3	1200	3.6	5.6	20.4	3.6	9.2	33.3	53.7
C105	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C106	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C107	1	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6

Table F-3: Culvert Apron Geotextile Quantities (Including Headwall and Endwall Protection)

			Inlet			Outlet			
Name	Proposed Phase	Diameter (mm)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Riprap Width (m)	Riprap Length (m)	Geotextile Area (m2)	Total Geotextile Area (m2)
C108	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C109	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C110	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C111	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C112	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C113	3	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C114	1	900	2.7	4.2	11.5	2.7	6.9	18.8	30.2
C115	4	900	2.7	4.2	11.5	2.7	6.9	18.8	30.2
C116	4	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C117	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C118	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C119	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C120	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C121	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C122	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C123	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C124	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C125	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C126	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C127	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C128	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C129	4	600	1.8	2.8	5.1	1.8	4.6	8.3	13.4
C130	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C131	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
C132	4	450	1.4	2.1	2.9	1.4	3.5	4.7	7.6
Total Geotextile Area for Culvert Aprons (m2):									**875**

APPENDIX G

PCSWMM MODEL PARAMETERS

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S383	J493	0.9011	51.77	174.058	28.264	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S399	J539	0.4692	56.815	82.584	24.351	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S502	J1	0.5821	54.945	105.942	8.788	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S517	J781	0.6565	22.416	292.871	6.107	0	0.018	0.06	1	1	0.1	0.01	4	7	0.871
S548	J813	1.17	55.055	212.515	5.796	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S578	J8605	0.4183	98.566	42.439	15.002	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S596	J913	1.0503	138.087	76.061	7.006	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S606	J8455	2.2287	137.88	161.641	6.505	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S611	J8671	1.1472	199.905	57.387	5.567	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S612	J951	1.0036	44.393	226.072	7.247	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S652	J8503	1.2739	219.56	58.021	5.394	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S687	J8381	1.1482	157.339	72.976	4.997	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S707	J157	1.4976	109.25	137.08	5.822	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S709	J1089	0.9117	60.998	149.464	11.299	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S727	culv44in	0.8717	54.574	159.728	5.287	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S751	J8503	0.5679	46.52	122.077	6.711	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S752	J8455	1.1791	151.448	77.855	8.085	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S760	J8503	1.4106	110.625	127.512	6.741	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S761	J8503	0.5784	44.035	131.35	8.364	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S777	J1138	2.1024	130.164	161.519	7.367	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S778	J8872	1.2943	98.715	131.115	9.226	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S801	J1302	0.9908	92.774	106.797	10.247	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S802	J1302	0.6667	72.935	91.41	12.863	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S858	J1304	0.6077	60.628	100.234	7.802	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S860	J1373	0.619	81.106	76.32	11.578	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S865	J1304	0.9004	146.269	61.558	12.393	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S873	J1413	0.9531	151.005	63.117	14.286	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S874	J1345	0.6959	76.079	91.471	9.422	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S875	J1345	1.2682	99.321	127.687	7.38	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S883	storage1	0.5762	102.649	56.133	2.548	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S891	J1415	0.7508	95.007	79.026	11.577	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S895	J1455	1.2257	105.098	116.624	7.776	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S912	J1363	0.9158	66.912	136.866	2.792	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S916	J1350	1.7142	121.672	140.887	2.417	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S920	J1380	0.6423	44.86	143.179	8.537	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S924	J1439	1.1521	210.342	54.773	11.956	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S927	J1417	0.8879	69.939	126.953	14.206	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S928	J1487	0.878	33.748	260.164	5.898	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S940	storage1	0.8603	90.922	94.62	2.8	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S943	J1460	2.6675	99.657	267.668	3.115	0	0.018	0.06	1	1	0.1	0.01	4	7	0.869
S946	J8572	0.7423	79.092	93.853	5.553	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S949	J1455	1.049	23.773	441.257	8.331	0	0.018	0.06	1	1	0.1	0.01	4	7	0.869
S951	J1426	0.825	33.29	247.822	7.533	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S952	J1492	0.8056	81.644	98.672	8.261	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S993	J8394	0.5605	84.478	66.349	19.491	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1000	J1501	1.2134	52.467	231.269	6.275	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1002	J8658	2.3845	121.418	196.388	8.645	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1004	J1492	1.0646	72.471	146.9	8.213	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1006	J8572	1.568	111.713	140.36	6.552	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1012	J1505	1.1326	75.32	150.372	6.002	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1022	J1561	1.4741	76.688	192.22	6.856	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1026	J9108	2.1843	85.958	254.112	8.706	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1031	J1535	1.4001	47.31	295.942	7.016	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S1035	J1590	1.8725	100.346	186.604	4.292	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1037	J1572	1.7054	215.659	79.079	10.706	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1040	J1574	0.531	39.065	135.927	6.147	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1045	J8568	1.2075	83.262	145.024	4.645	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1046	J8568	0.8381	104.854	79.93	6.382	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1048	J8394	0.949	159.902	59.349	22.354	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1051	J1574	1.3545	104.773	129.279	7.645	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1052	J1671	1.2184	217.546	56.007	14.012	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1053	J1609	1.1885	74.696	159.112	6.385	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1069	J1609	0.5156	33.893	152.126	7.518	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1073	J1664	0.7759	91.888	84.44	5.203	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1074	J1628	1.0694	58.398	183.123	8.246	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1090	J1671	0.6548	69.362	94.403	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1100	J1655	1.3009	175.182	74.26	10.145	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1110	J1747	1.6977	102.508	165.616	5.464	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1117	J1728	1.284	83.771	153.275	7.557	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1123	J1708	0.6128	42.467	144.3	7.599	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1125	J1796	0.8961	98.507	90.968	5.269	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1127	J8974	0.7281	55.879	130.299	5.124	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1128	J1708	2.0346	312.538	65.099	8.637	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1130	J1706	1.1275	106.89	105.482	4.512	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1133	J8486	1.4395	258.035	55.787	4.644	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1136	J1832	0.9464	35.241	268.551	8.537	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1138	J1699	1.2635	130.472	96.841	6.425	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1141	J1807	0.536	38.593	138.885	5.628	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1145	J1726	1.1698	92.184	126.898	4.007	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1159	J1764	0.669	53.607	124.797	8.165	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1166	J1764	0.7048	136.56	51.611	7.275	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1168	J1774	0.7182	119.951	59.874	6.654	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1180	J8562	1.1074	63.156	175.344	7.596	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1184	J1784	1.3673	61.236	223.284	5.7	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1194	J8486	1.2096	156.462	77.31	7.3	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1195	J1796	1.0914	87.508	124.72	5.956	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1198	J1807	0.5917	61.131	96.792	6.314	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1202	J1817	1.3597	152.573	89.118	4.272	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1203	J1837	1.0454	53.921	193.876	6.273	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1223	J8507	3.6523	123.401	295.97	3.987	0	0.018	0.06	1	1	0.1	0.01	4	7	0.869

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1224	J1868	0.7483	95.507	78.35	6.983	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1231	J1868	0.8968	64.748	138.506	5.368	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1240	J1905	0.5956	61.796	96.382	9.241	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1242	J1907	0.7772	78.5	99.006	8.547	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1264	J1956	0.8508	160.402	53.042	6.1	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1266	J1956	0.6274	52.601	119.275	9.762	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1268	J1907	0.9843	78.098	126.034	7.318	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1269	J8596	0.4928	72.748	67.741	7.869	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1278	J1993	0.8797	107.357	81.942	4.526	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1296	J1993	0.7793	126.448	61.63	4.008	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1310	J8354	1.0778	73.67	146.301	5.078	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1312	J2022	0.9532	69.774	136.612	5.969	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1327	J2004	0.5927	58.498	101.32	5.423	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1329	J2004	0.6879	48.499	141.838	5.413	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1376	J2090	0.7214	40.134	179.748	5.714	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1379	J2090	1.5112	106.389	142.045	5.349	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1420	J2258	2.4304	201.006	120.912	3.421	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1459	J2258	1.8963	167.82	112.996	2.385	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1460	J2258	2.4158	148.834	162.315	2.508	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S1491	J2266	1.9356	87.241	221.868	8.216	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1535	J8735	2.5713	131.849	195.019	4.385	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1536	J8735	1.0691	62.799	170.242	3.807	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1547	J2557	0.574	94.486	60.75	2.666	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1559	J184	1.2527	68.365	183.237	5.176	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1582	J2386	0.9774	32.517	300.581	7.64	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S1596	J2432	0.5602	31.415	178.322	6.779	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1627	J2476	1.1768	44.954	261.779	6.637	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S1633	J8691	1.098	146.437	74.981	8.167	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1640	J2520	0.9533	29.873	319.118	4.654	0	0.018	0.06	1	1	0.1	0.01	4	7	0.869
S1705	J8691	1.4531	276.991	52.46	7.288	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1783	J2754	0.8748	86.512	101.119	7.461	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1850	J2808	1.0276	62.664	163.986	6.515	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1853	J8700	0.5383	78.481	68.59	6.673	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1875	J2909	1.4271	56.578	252.236	7.73	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1882	J2896	0.7893	55.414	142.437	8.411	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1914	J2997	1.9595	100.332	195.302	8.323	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1953	J2997	0.6049	86.251	70.133	7.541	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1955	J2909	0.9956	184.096	54.08	6.581	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1970	J2977	1.248	149.853	83.282	6.392	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S2026	J3069	0.8743	103.095	84.805	5.758	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S2027	J3069	0.5762	52.899	108.925	6.051	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2135	J3199	0.7206	46.318	155.577	8.254	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S2147	J3199	0.618	45.273	136.505	9.043	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2156	J3199	0.8463	74.883	113.016	10.345	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S2180	J8405	0.9865	215.249	45.831	5.148	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2189	J8386	0.9711	34.698	279.872	7.369	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S2206	J3418	0.8452	58.72	143.937	4.615	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S2211	J8689	1.6271	270.67	60.114	8.107	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2219	J3343	0.6453	70.481	91.557	4.849	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2221	J8386	1.2423	107.568	115.49	7.145	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2222	J8371	2.8638	294.325	97.301	7.736	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S2225	J3425	1.3028	76.677	169.908	4.151	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S2251	J3343	0.8496	103.049	82.446	3.848	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2270	J3381	0.7028	44.981	156.244	7.009	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S2271	J3435	2.2295	169.495	131.538	7.104	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2283	J8347	0.9178	133.389	68.806	5.333	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S2294	J3410	1.4622	71.645	204.09	5.028	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S2295	J3410	1.2748	73.278	173.968	5.865	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S2296	J3490	0.6726	91.921	73.172	5.534	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S2307	J3437	0.7544	36.079	209.097	5.704	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S2318	J3425	1.1162	90.939	122.742	6.062	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2361	J3490	0.5145	48.141	106.874	2.542	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S2370	J3555	0.9303	116.939	79.554	3.212	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2378	J3555	0.7076	92.035	76.884	2.016	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S406_2	OF14	0.045	25.686	17.519	3.012	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S546_2	OF14	0.0131	29.788	4.398	2.831	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S316_2	OF24	0.851	83.294	102.168	16.981	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S364_2	OF21	0.014	28.41	4.928	2.95	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S387_4	OF27	0.5084	33.221	153.036	26.062	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S322_1	J615	0.3848	73.705	52.208	21.509	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S263_2	OF32	0.0009	115.282	0.078	12.854	0	0.018	0.06	1	1	0.1	0.01	4	7	0.884
S263_3	OF32	0.2084	115.282	18.077	12.854	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S264_2	OF35	0.1186	110.419	10.741	12.476	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S268_2	OF31	0.4466	52.917	84.396	24.674	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S304_2	OF35	0.7184	111.789	64.264	28.203	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S349_2	J458	0.9682	56.285	172.017	33.472	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S322_5	OF33	0.3665	73.705	49.725	21.509	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S600_1	J147	0.1109	55.792	19.877	6.018	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S600_2	J9278	0.0864	55.792	15.486	6.018	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S897_1	OF10	0.3935	69.426	56.679	17.667	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S575_3	J226	0.1533	32.942	46.536	7.686	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S689_3	J246	0.6031	28.722	209.978	13.269	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S807_1	OF3	0.277	58.46	47.383	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S774_2	J97	0.2793	22.527	123.985	18.412	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S407_2	J92	0.1753	49.599	35.343	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S505_1	OF4	0.1869	24.703	75.659	8.354	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S505_3	J82	0.0849	24.703	34.368	8.354	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S556_1	OF14	0.2839	31.67	89.643	14.539	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S556_3	J245	0.345	31.67	108.936	14.539	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S590_3	J225	0.0209	33.292	6.278	4.252	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S591_1	OF4	0.2553	33.799	75.535	10.114	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S591_3	J225	0.1659	33.799	49.084	10.114	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S773_3	J244	0.321	27.219	117.932	19.363	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S368_1	OF19	0.3211	46.24	69.442	7.429	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S368_3	J238	0.1468	46.24	31.747	7.429	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S604_1	OF19	0.3122	58.455	53.409	16.057	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S690_1	OF17	0.4938	57.256	86.244	12.816	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S690_3	J241	0.0843	57.256	14.723	12.816	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S704_3	J239	0.6572	62.035	105.94	16.65	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S772_2	culv22in	0.6354	178.958	35.506	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S818_4	culv17in	0.4516	113.971	39.624	6.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S877_1	J1392	1.0176	110.354	92.212	5.396	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S955_1	J8629	0.3379	109.02	30.994	7.697	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S664_1	J1126	1.0889	127.115	85.663	9.466	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S729_1	J1126	0.2644	53.782	49.161	7.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S729_2	J31	0.5582	53.782	103.789	7.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S738_1	J1158	0.1634	35.023	46.655	7.842	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S738_2	J32	0.3824	35.023	109.185	7.842	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S743_1	J1158	0.6659	44.926	148.222	7.687	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S743_2	J32	0.6336	44.926	141.032	7.687	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S958_2	culv8in	0.0892	164.798	5.413	7.649	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1071_2	J14	0.2578	24.339	105.921	8.083	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1247_2	culv5in	0.746	51.732	144.205	9.176	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1248_2	J273	0.287	76.321	37.604	11.278	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1043_3	J13	0.1563	37.094	42.136	7.669	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1043_4	culv2in	0.1298	37.094	34.992	7.669	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1070_3	J14	0.3705	44.339	83.561	7.796	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1070_4	culv2in	0.1039	44.339	23.433	7.796	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1106_3	culv4in	0.165	70.763	23.317	9.188	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S618_1	culv59in	0.6934	104.216	66.535	6.956	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S618_2	J55	1.6371	104.216	157.087	6.956	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S638_1	J990	0.5592	86.85	64.387	8.724	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S638_2	culv46in	0.2802	86.85	32.263	8.724	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S721_1	J1066	0.9424	68.668	137.24	11.953	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S721_3	culv61in	0.1382	68.668	20.126	11.953	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S610_2	culv58in	0.0647	46.387	13.948	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S647_3	J145	0.4084	51.497	79.306	6.827	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S647_4	J54	0.466	51.497	90.491	6.827	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S648_3	J258	0.1006	51.797	19.422	9.873	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S648_4	J55	0.04	51.797	7.722	9.873	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S742_2	J58	1.2093	77.714	155.609	6.301	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S831_1	J288	0.1501	133.651	11.231	8.235	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S721_5	J444	0.2009	68.668	29.257	11.953	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S735_3	J444	0.6386	52.22	122.29	6.01	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1017_1	J1526	0.5236	134.208	39.014	4.521	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1018_1	J1526	0.9423	104.664	90.031	8.427	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S958_4	culv10in	0.063	164.798	3.823	7.649	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1043_2	J8568	0.2687	37.094	72.438	7.669	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1071_3	J1611	0.1247	24.339	51.235	8.083	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1071_4	culv10in	0.1536	24.339	63.109	8.083	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1021_3	J1519	0.1505	52.405	28.719	7.685	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1038_3	J1649	0.0443	26.508	16.712	7.204	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S958_1	J8629	0.4686	164.798	28.435	7.649	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S958_6	culv11in	0.7681	164.798	46.609	7.649	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1021_1	culv7out	0.1404	52.405	26.791	7.685	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1021_4	J12	0.422	52.405	80.527	7.685	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1038_1	J272	0.0861	26.508	32.481	7.204	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1038_4	J12	0.2597	26.508	97.97	7.204	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S547_1	J287	0.3286	104.607	31.413	5.923	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S547_2	culv39in	0.7428	104.607	71.009	5.923	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S391_2	J115	0.2021	67.311	30.025	7.704	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S404_2	J113	0.5072	45.432	111.639	7.157	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S405_2	J116	0.2483	62.383	39.803	9.584	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S431_2	culv83in	0.5952	67.73	87.878	10.614	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S275_3	J113	0.0926	75.651	12.24	9.374	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S404_3	J590	0.1469	45.432	32.334	7.157	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S405_3	J590	0.2322	62.383	37.222	9.584	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S275_2	OF30	0.9182	75.651	121.373	9.374	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S356_1	OF22	0.2524	26.354	95.773	7.569	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S356_3	J103	0.0975	26.354	36.996	7.569	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S585_1	OF22	0.3568	59.716	59.749	14.54	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S587_4	OF21	0.1292	84.721	15.25	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S587_6	culv78in	0.2105	84.721	24.846	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S529_2	culv63in	0.0761	56.455	13.48	13.863	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S492_4	culv63in	0.0402	33.725	11.92	15.136	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S585_2	culv78in	0.2459	59.716	41.178	14.54	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S585_4	culv63in	0.0274	59.716	4.588	14.54	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1311_2	J2022	1.1554	72.955	158.372	6.592	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1304_2	J277	0.0923	68.166	13.54	8.782	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1373_2	J274	0.0977	37.849	25.813	8.583	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1387_2	J275	0.0955	37.135	25.717	7.45	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1319_2	J9	0.0168	82.07	2.047	8.315	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1041_3	culv6in	0.2331	79.277	29.403	6.111	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1041_4	culv6out	0.3036	79.277	38.296	6.111	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1041_5	J272	0.5286	79.277	66.678	6.111	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S2	culv11in	0.5836	53.226	109.646	7.639	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S896_2	J28	0.8966	90.162	99.443	12.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S809_2	culv28in	0.0006	63.917	0.094	9.131	0	0.018	0.06	1	1	0.1	0.01	4	7	0.887
S896_3	J1348	0.0672	90.162	7.453	12.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S896_4	J1348	0	90.162	0	12.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S896_5	J30	0.0173	90.162	1.919	12.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S818_3	culv16in	0.1195	113.971	10.485	6.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1	J29	0.0651	111.389	5.844	6.346	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S809_4	J23	0.6618	63.917	103.541	9.131	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S730_1	culv32out	0.3178	60.014	52.954	5.872	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S730_2	J1099	0.8327	60.014	138.751	5.872	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S664_3	culv32in	0.3204	127.115	25.206	9.466	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S664_4	culv32out	0.0774	127.115	6.089	9.466	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S710_1	J8549	0.346	65.835	52.556	7.891	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S710_2	J32	0.0274	65.835	4.162	7.891	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S530_2	culv33in	0.8588	96.148	89.321	7.217	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S635_1	J34	0.6313	146.57	43.072	6.233	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S635_2	culv33in	0.0987	146.57	6.734	6.233	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S530_3	J35	0.7748	96.148	80.584	7.217	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S530_1	J36	0.5251	96.148	54.614	7.217	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S530_5	J34	0.1579	96.148	16.423	7.217	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S818_5	J40	1.0853	113.971	95.226	6.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S817_1	J1376	0.0663	101.129	6.556	2.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S772_3	J43	0.0772	178.958	4.314	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S758_1	culv45in	0.7474	66.381	112.592	7.177	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S758_2	culv26in	0.016	66.381	2.41	7.177	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S509_3	J8671	0.9744	110.073	88.523	9.933	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S509_4	culv35in	1.1966	110.073	108.71	9.933	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S449_1	J630	1.3011	152.435	85.354	11.342	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S449_3	J46	0.0721	152.435	4.73	11.342	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S449_2	culv34in	0.1596	152.435	10.47	11.342	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S449_5	J47	0.0683	152.435	4.481	11.342	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S509_2	J53	0.3335	110.073	30.298	9.933	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S404_1	J75	0.2025	45.432	44.572	7.157	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S405_1	J112	0.4967	62.383	79.621	9.584	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S275_1	J74	0.1697	75.651	22.432	9.374	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S562_1	culv59in	0.3193	161.29	19.797	13.085	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S562_3	J869	1.1833	161.29	73.365	13.085	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S562_4	J135	0.1904	161.29	11.805	13.085	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S492_2	J776	0.6065	33.725	179.837	15.136	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S492_6	OF24	0.1403	33.725	41.601	15.136	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S610_3	J955	0.4713	46.387	101.602	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S610_1	J135	0.0468	46.387	10.089	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S610_4	culv59in	0.1584	46.387	34.147	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S610_6	J135	0.1457	46.387	31.41	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S742_4	J8324	0.393	77.714	50.57	6.301	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S832_4	culv50in	0.2563	85.937	29.824	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1009_1	culv52in	0.3938	65.594	60.036	7.396	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1009_3	J8974	0.5317	65.594	81.059	7.396	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1098_2	J8504	0.5786	184.864	31.299	8.481	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1119_4	J1687	0.2215	121.913	18.169	7.017	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S3	culv53in	0.9638	122.753	78.515	7.361	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1119_2	J1687	0.0639	121.913	5.241	7.017	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1119_3	J1726	0.0752	121.913	6.168	7.017	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S832_6	culv55in	0.043	85.937	5.004	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S779_4	culv49in	0.1189	40.366	29.455	12.633	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S764_3	J266	0.019	48.524	3.916	24.064	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S706_2	J266	0.1145	53.383	21.449	16.958	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S706_4	J239	0.8654	53.383	162.112	16.958	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S779_2	J151	0.1917	40.366	47.49	12.633	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S779_5	J243	0.402	40.366	99.589	12.633	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S932_1	culv54in	0.8247	54.451	151.457	5.98	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S932_2	J1445	0.335	54.451	61.523	5.98	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1025_1	culv52in	0.1049	40.472	25.919	15.986	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1025_2	J1632	0.4886	40.472	120.725	15.986	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S620_3	J907	0.6932	110.506	62.73	16.211	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S620_4	J228	0.082	110.506	7.42	16.211	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S647_2	J972	0.1256	51.497	24.39	6.827	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S647_5	J229	0.2129	51.497	41.342	6.827	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S648_2	J972	0.2388	51.797	46.103	9.873	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S648_5	J230	0.2548	51.797	49.192	9.873	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S735_2	culv61in	0.0222	52.22	4.251	6.01	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S735_5	J137	0.1569	52.22	30.046	6.01	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S587_5	culv63in	0.79	84.721	93.247	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S587_7	J228	0.1061	84.721	12.523	13.05	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S4	J141	0.3864	57.822	66.826	7.12	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S5	J111	0.2883	55.717	51.744	10.27	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S498_3	OF24	0.2093	46.247	45.257	11.394	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S498_4	J823	0.2169	46.247	46.9	11.394	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S498_8	J823	0	46.247	0	11.394	0	0.018	0.06	1	1	0.1	0.01	4	7	0
S498_9	culv80in	0.0651	46.247	14.077	11.394	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S8	J117	0.1569	59.438	26.397	7.763	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S721_4	culv62in	0.3296	68.668	47.999	11.953	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S721_6	J59	0.2166	68.668	31.543	11.953	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S7_1	culv80in	0.9919	54.192	183.034	13.316	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S7	J102	0.1875	37.443	50.076	14.276	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S681_1	culv40in	0.6934	88.18	78.635	6.424	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S681_2	culv45in	0.095	88.18	10.773	6.424	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S405_4	J290	0.1077	62.383	17.264	9.584	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S405_6	J289	0.1767	62.383	28.325	9.584	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S444_1	J728	0.125	53.157	23.515	14.937	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S444_2	J70	0.7009	53.157	131.855	14.937	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S445_1	J728	0.1295	88.144	14.692	15.347	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S445_2	J71	0.9302	88.144	105.532	15.347	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S310_1	OF25	0.8591	53.862	159.5	14.058	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S310_3	J72	0.107	53.862	19.866	14.058	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S391_1	OF27	0.82	67.311	121.823	7.704	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S391_4	J73	0.3433	67.311	51.002	7.704	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S637_1	J990	0.8587	100.606	85.353	9.33	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S637_2	J157	0.0516	100.606	5.129	9.33	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S817_3	culv20in	0.2399	101.129	23.722	2.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S817_4	culv22in	0.6176	101.129	61.071	2.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1892_2	J2896	0.2977	42.827	69.512	6.03	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1916_2	J8569	1.355	104.892	129.18	7.31	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1958_2	J2921	0.5128	26.671	192.269	7.858	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1985_2	J2968	0.3608	56.015	64.411	6.575	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1989_2	J2968	0.5185	40.007	129.602	9.001	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2007_2	J3005	1.0836	204.227	53.059	8.401	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2045_2	J3123	0.3283	55.644	59	7.2	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2049_2	J3123	3.2418	319.845	101.355	10.655	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S2140_2	J3286	1.0619	86.439	122.85	6.676	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S2102_1	J205	1.3872	327.402	42.37	4.636	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2102_2	J8375	1.5168	327.402	46.328	4.636	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S10	J3366	134.3647	141.064	9525.088	7.17	0	0.018	0.06	1	1	0.1	0.01	4	7	0.727
S863_3	culv54in	0.4069	41.769	97.417	14.675	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S863_4	J223	0.5126	41.769	122.723	14.675	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S674_2	J227	0.3384	46.68	72.494	13.581	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S623_2	culv43in	0.5223	126.282	41.36	4.472	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S623_3	culv41in	0.2309	126.282	18.284	4.472	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S623_4	culv43in	0.4839	126.282	38.319	4.472	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S553	J78	0.0095	30.047	3.162	2.269	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S772_4	J234	0.0767	178.958	4.286	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S772_6	J233	0.0963	178.958	5.381	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S818_1	J235	0.1627	113.971	14.276	6.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S818_6	J1376	0.0544	113.971	4.773	6.195	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S772_1	culv26in	0.0422	178.958	2.358	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S772_7	culv24in	0.1892	178.958	10.572	4.593	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S807_4	J236	0.0686	58.46	11.735	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S6_1	culv64in	0.6162	70.071	87.939	14.497	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S6_2	J237	0.1406	70.071	20.065	14.497	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S764_2	J242	0.1823	48.524	37.569	24.064	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S764_4	J240	0.7215	48.524	148.689	24.064	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S764_5	culv66in	0.0848	48.524	17.476	24.064	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S555_3	culv68in	0.0115	34.276	3.355	3.159	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S674_3	culv68out	0.3504	46.68	75.064	13.581	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S674_4	culv70in	0.1382	46.68	29.606	13.581	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S674_6	J247	0.079	46.68	16.924	13.581	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S807_3	J248	0.2526	58.46	43.209	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S808_2	culv70out	0.0292	27.439	10.642	6.352	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S808_4	J248	0.023	27.439	8.382	6.352	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S807_6	J69	0.1717	58.46	29.371	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S807_5	J249	0.0939	58.46	16.062	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S807_7	J250	0.1485	58.46	25.402	16.39	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S897_2	culv72out	0.2278	69.426	32.812	17.667	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S897_4	J252	0.8987	69.426	129.447	17.667	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S811_1	J253	0.0907	25.418	35.683	12.117	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S811_2	J221	0.3207	25.418	126.17	12.117	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S898_1	J255	0.0647	32.068	20.176	12.632	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S898_2	J222	0.6214	32.068	193.776	12.632	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S421_2	culv76in	3.0096	73.438	409.815	18.231	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S421_3	J77	0.042	73.438	5.719	18.231	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S421_4	J254	0.2244	73.438	30.556	18.231	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S6	J8646	90.0644	107.968	8341.768	5.926	0	0.018	0.06	1	1	0.1	0.01	4	7	0.732
S742_1	J257	0.2458	77.714	31.629	6.301	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S742_5	culv57in	0.0538	77.714	6.923	6.301	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S915_1	J8313	0.2153	53.538	40.214	5.505	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S915_2	J261	0.2549	53.538	47.611	5.505	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S931_1	J1421	0.2928	40.006	73.189	5.724	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S931_2	J262	0.4588	40.006	114.683	5.724	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S973_1	J1553	0.702	117.7	59.643	5.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S973_2	J263	1.0122	117.7	85.998	5.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1057_1	J1553	0.0096	50.954	1.884	3.996	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1057_2	J264	0.671	50.954	131.687	3.996	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1084_1	culv52out	0.1434	47.679	30.076	5.557	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S831_4	J56	0.2238	133.651	16.745	8.235	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S831_5	J259	0.5132	133.651	38.399	8.235	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S831_3	J260	0.1777	133.651	13.296	8.235	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S831_6	J155	0.3346	133.651	25.035	8.235	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1084_3	J264	0.3729	47.679	78.211	5.557	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1084_2	J149	0.0266	47.679	5.579	5.557	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1084_5	J265	0.4766	47.679	99.96	5.557	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S832_1	culv49out	0.229	85.937	26.647	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S832_2	J150	0.248	85.937	28.858	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S832_3	J267	0.2182	85.937	25.391	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S832_7	J268	0.2217	85.937	25.798	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S832_8	J152	0.1823	85.937	21.213	7.25	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S877_3	J269	0.2109	110.354	19.111	5.396	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S877_4	J270	0.3538	110.354	32.06	5.396	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S955_3	J18	0.3546	109.02	32.526	7.697	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S955_2	J1519	0.2101	109.02	19.272	7.697	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S955_4	J18	0.0848	109.02	7.778	7.697	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S955_6	J16	0.0685	109.02	6.283	7.697	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1039_3	J15	0.5688	77.473	73.419	8.239	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1039_1	J1586	0.0134	77.473	1.73	8.239	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1039_4	J17	0.071	77.473	9.164	8.239	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1106_2	culv3in	0.2956	70.763	41.773	9.188	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1106_5	J278	0.1919	70.763	27.119	9.188	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S11_1	J276	0.3165	84.831	37.309	7.718	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S11_2	J6	0.0268	84.831	3.159	7.718	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1311_3	J279	0.1485	72.955	20.355	6.592	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1311_4	J10	0.1325	72.955	18.162	6.592	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1260_2	J281	0.5697	48.387	117.738	12.68	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1106_4	J1683	0.3712	70.763	52.457	9.188	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1106_6	J283	0.5778	70.763	81.653	9.188	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1167_3	J210	0.3687	75.572	48.788	8.384	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1247_4	J210	0.3051	51.732	58.977	9.176	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1248_4	J282	0.7178	76.321	94.05	11.278	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1043_6	J206	0.3728	37.094	100.501	7.669	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1304_4	J280	0.2935	68.166	43.057	8.782	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1107_2	J1683	0.4058	30.18	134.46	8.304	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S11	J281	0.0425	75.365	5.639	6.189	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S12	J283	0.2361	73.749	32.014	7.057	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S13	J284	0.2698	96.593	27.932	7.916	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S14	culv10in	0.2	66.35	30.143	7.654	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S15	culv10in	0.1947	149.797	12.998	7.667	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S509_1	J286	0.114	110.073	10.357	9.933	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S509_6	J50	0.25	110.073	22.712	9.933	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S431_4	J291	0.4523	67.73	66.78	10.614	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S431_1	J728	0.2152	67.73	31.773	10.614	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S431_5	J121	0.0697	67.73	10.291	10.614	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S9_7	S9_9	48.1013	101.84	4723.223	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.863
S9_14	S9_18	65.1396	101.84	6396.269	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.83
S9_3	S9_7	62.3087	101.84	6118.293	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.776
S9_15	S9_14	65.3608	101.84	6417.989	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.771
S9_8	S9_12	45.1874	101.84	4437.097	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.894
S9_16	S9_24	25.2101	101.84	2475.462	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.938
S9_1	S9_8	59.4259	101.84	5835.222	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.864
S9_17	S9_16	16.6059	101.84	1630.587	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.957
S9_9	S9_2	129.403	101.84	12706.5	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.736
S9_18	S9_19	20.5028	101.84	2013.236	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.943
S9_2	S9_1	45.6913	101.84	4486.577	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.891

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S9_19	S9_17	16.3856	101.84	1608.955	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.956
S9_10	S9_11	32.758	101.84	3216.614	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.918
S9_20	S9_22	23.99	101.84	2355.656	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.943
S9_4	S9_10	34.8794	101.84	3424.921	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.914
S9_21	S9_20	14.4091	101.84	1414.876	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.965
S9_11	S9_5	36.6321	101.84	3597.025	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.908
S9_22	S9_23	23.103	101.84	2268.559	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.945
S9_5	J8562	35.2407	101.84	3460.399	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.91
S9_23	J8562	26.886	101.84	2640.024	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.936
S9_12	S9_6	44.4865	101.84	4368.274	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.894
S9_24	S9_25	39.3052	101.84	3859.505	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.909
S9_6	S9_4	21.7379	101.84	2134.515	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.946
S9_25	S9_21	39.4485	101.84	3873.576	6.868	0	0.018	0.06	1	1	0.1	0.01	4	7	0.909
S1424_1	J213	0.3031	59.416	51.013	8.197	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1424_2	J305	0.6203	59.416	104.399	8.197	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1425_1	J213	0.1672	29.397	56.877	9.506	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1425_2	J304	0.6205	29.397	211.076	9.506	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1492_2	J306	0.9436	54.254	173.923	7.315	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1543_2	J198	0.0951	78.072	12.181	3.411	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1373_3	J213	0.1039	37.849	27.451	8.583	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1373_4	J303	0.8842	37.849	233.613	8.583	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1386_1	J213	0.1714	58.881	29.11	5.946	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1387_3	J213	0.2018	37.135	54.342	7.45	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1387_4	J214	0.224	37.135	60.32	7.45	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1319_4	J211	0.2463	82.07	30.011	8.315	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1154_1	J1859	0.2114	45.263	46.705	4.9	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1120_2	J8550	0.7301	74.541	97.946	5.086	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1112_1	J8695	1.1119	116.56	95.393	5.831	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1167_1	J1772	0.9739	75.572	128.87	8.384	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S9	J313	0.2114	67.736	31.209	10.544	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1279_1	J1919	1.382	66.339	208.324	4.422	0	0.018	0.06	1	1	0.1	0.01	4	7	0.872
S1370_1	J318	0.0486	60.505	8.032	2.325	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S17	J318	0.1844	62.788	29.369	3.945	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1492_4	J200	0.6902	54.254	127.216	7.315	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S18	J329	0.87	75.659	114.99	8.53	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1883_1	J161	0.1002	111.212	9.01	6.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1893_1	J159	0.2695	41.661	64.689	4.519	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1893_2	J321	0.0987	41.661	23.691	4.519	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1893_3	J320	0.3185	41.661	76.45	4.519	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S16_1	J307	1.1445	143.095	79.982	3.571	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S16_2	J318	0.4872	143.095	34.047	3.571	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1279_3	J319	0.3296	66.339	49.684	4.422	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1279_4	J322	0.1276	66.339	19.235	4.422	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S16	J315	0.1354	93.292	14.514	7.28	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1892_4	J160	0.0966	42.827	22.556	6.03	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1916_4	J160	0.0468	104.892	4.462	7.31	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1958_4	J160	0.0146	26.671	5.474	7.858	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1985_4	J160	0.1314	56.015	23.458	6.575	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1989_4	J160	0.0608	40.007	15.197	9.001	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S2007_4	J162	0.0605	204.227	2.962	8.401	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S2045_4	J162	0.0896	55.644	16.102	7.2	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S2049_4	J162	0.0356	319.845	1.113	10.655	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S2140_3	J208	0.6204	86.439	71.773	6.676	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S2140_4	J162	0.0243	86.439	2.811	6.676	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S20	J207	0.699	102.156	68.425	7.826	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S19_2	J171	0.289	48.362	59.758	6.936	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1952_1	J3022	1.2418	251.075	49.459	6.168	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2012_1	J3022	0.5527	70.993	77.853	4.935	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S2012_2	J172	0.2552	70.993	35.947	4.935	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S2075_1	J57	0.9139	97.133	94.087	6.103	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S19	J167	0.3202	227.222	14.092	6.158	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1548_1	J2557	0.0523	34.067	15.352	2.167	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1593_1	J2399	0.3351	58.97	56.826	1.993	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1593_2	J317	0.819	58.97	138.884	1.993	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1669_1	J2577	0.049	46.311	10.581	5.615	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1543_3	J8582	1.177	78.072	150.758	3.411	0	0.018	0.06	1	1	0.1	0.01	4	7	0.874
S1669_4	J189	0.4044	46.311	87.323	5.615	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1597_2	J203	0.4519	241.042	18.748	6.824	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1618_2	J203	0.1722	100.703	17.1	6.253	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1658_2	J203	0.1153	35.503	32.476	6.771	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1683_1	J2539	0.3046	87.284	34.898	8.075	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1683_2	J203	0.8505	87.284	97.441	8.075	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1682_1	J2539	0.0917	48.023	19.095	6.296	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1682_2	J195	0.6714	48.023	139.808	6.296	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1597_3	J188	0.6382	241.042	26.477	6.824	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1597_4	J8539	0	241.042	0	6.824	0	0.018	0.06	1	1	0.1	0.01	4	7	0
S1597_5	J188	0.5011	241.042	20.789	6.824	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1625_1	J2499	0.5571	61.012	91.31	6.45	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1625_2	J217	1.0929	61.012	179.129	6.45	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S21	J212	0.2331	118.1	19.738	4.218	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1764_2	J175	1.022	87.209	117.19	6.283	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1845_1	J8703	1.0984	130.684	84.05	6.561	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1845_2	J218	0.472	130.684	36.118	6.561	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1902_1	J219	0.8685	212.643	40.843	7.636	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1902_2	J218	0.3273	212.643	15.392	7.636	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S22	J209	0.7226	43.912	164.556	3.024	0	0.018	0.06	1	1	0.1	0.01	4	7	0.873
S1670_1	J2577	0.0572	34.812	16.431	6.852	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1670_2	J189	0.6068	34.812	174.308	6.852	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1618_3	J2447	0.7216	100.703	71.656	6.253	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1618_4	J186	0.1928	100.703	19.145	6.253	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1658_3	J2569	0.2828	35.503	79.655	6.771	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1658_4	J186	0.5293	35.503	149.086	6.771	0	0.018	0.06	1	1	0.1	0.01	4	7	0.876
S1153_1	J1859	1.1079	220.165	50.321	3.687	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1153_2	J314	0.0437	220.165	1.985	3.687	0	0.018	0.06	1	1	0.1	0.01	4	7	0.883
S1229_1	J1850	1.0149	70.316	144.334	4.079	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1229_2	J324	0.1063	70.316	15.117	4.079	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1210_2	J1935	0.3518	63.386	55.501	4.524	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1210_3	J328	0.3684	63.386	58.12	4.524	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S19_3	J169	0.463	48.362	95.736	6.936	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S19_4	J161	0.1985	48.362	41.045	6.936	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S1883_3	J320	0.3758	111.212	33.791	6.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1883_4	J8703	1.8831	111.212	169.325	6.656	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1674_1	J325	0.1769	54.241	32.614	7.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1674_2	J2543	0.9511	54.241	175.347	7.379	0	0.018	0.06	1	1	0.1	0.01	4	7	0.875
S1749_1	J325	0.3996	143.352	27.875	5.811	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S1749_2	J9170	1.26	143.352	87.896	5.811	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878
S1767_1	J326	0.1376	170.65	8.063	6.909	0	0.018	0.06	1	1	0.1	0.01	4	7	0.882
S1764_3	J326	0.6979	87.209	80.026	6.283	0	0.018	0.06	1	1	0.1	0.01	4	7	0.878

Table G-1: Subcatchment PCSWMM Model Parameters

Name	Outlet	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Runoff Coefficient
S1764_4	J2769	0.6364	87.209	72.974	6.283	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1260_4	J327	0.1578	48.387	32.612	12.68	0	0.018	0.06	1	1	0.1	0.01	4	7	0.881
S23	J315	0.9106	67.402	135.1	7.159	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1154_2	J316	0.2331	45.263	51.499	4.9	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1154_4	J329	0.2428	45.263	53.642	4.9	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S1767_3	J2754	1.8407	170.65	107.864	6.909	0	0.018	0.06	1	1	0.1	0.01	4	7	0.877
S1767_4	J180	0.6768	170.65	39.66	6.909	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88
S809_1	J340	0.4457	63.917	69.731	9.131	0	0.018	0.06	1	1	0.1	0.01	4	7	0.879
S809_5	culv28in	0.384	63.917	60.078	9.131	0	0.018	0.06	1	1	0.1	0.01	4	7	0.88

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv10in	601297.377	8068866.6	65	65
culv10out	601277.644	8068871.6	64	64
culv11in	601312.763	8068960.89	59.8	59.8
culv11out	601296.921	8068971.22	58.85	58.85
culv12in	601421.535	8068940.31	68.6	68.6
culv12out	601413.733	8068943.44	67.9	67.9
culv13in	601457.174	8068934.52	71.7	71.7
culv13out	601446.93	8068933.15	70.9	70.9
culv14in	601479.703	8068883	75.4	75.4
culv14out	601480.627	8068890.75	75.2	75.2
culv15in	601418.542	8069046.8	63.854	63.854
culv15out	601411.977	8069058.75	61.78	61.78
culv16in	601396.872	8069113.93	59.021	59.021
culv16out	601387.459	8069099.37	58.933	58.933
culv17in	601367.396	8069067.85	58.27	58.27
culv17out	601345.92	8069071.79	57.9	57.9
culv18out	601335.148	8069053.19	57.941	57.941
culv19in	601338.203	8069021.13	58.48	58.48
culv19out	601322.077	8069024.11	57.6	57.6
culv1in	601496.035	8068484.69	94.28	94.28
culv1out	601507.739	8068469.19	93.13	93.13
culv20in	601234.006	8069167.43	55	55
culv20out	601243.133	8069183.32	54.9	54.9
culv21in	601194.697	8069213.18	54.5	54.5
culv21out	601188.244	8069213.04	54.4	54.4
culv22in	601176.469	8069203.18	54.8	54.8
culv22out	601175.503	8069219.6	53.9	53.9
culv23in	601174.811	8069224.8	53.8	53.8
culv23out	601176.111	8069232.47	53.5	53.5
culv24in	601179.201	8069245.49	53	53
culv24out	601171.043	8069253.87	51.9	51.9

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv25in	601171.686	8069261.46	50.65	50.65
culv25out	601174.284	8069267.55	50.1	50.1
culv26in	601194.222	8069272.19	52.947	52.947
culv26out	601199.324	8069282.4	52.1	52.1
culv27in	601241.932	8069267.54	52.9	52.9
culv27out	601228.699	8069277.01	52.6	52.6
culv28in	601418.637	8069160.07	58.116	58.116
culv28out	601415.731	8069176.49	58.262	58.262
culv29in	601475.676	8069236.91	61.935	61.935
culv29out	601464.944	8069230.22	61.93	61.93
culv2in	601503.98	8068662.34	89	89
culv2out	601485.972	8068666.26	88	88
culv30in	601296.086	8069350.98	51.8	51.8
culv30out	601287.16	8069338.17	51.4	51.4
culv31in	601310.141	8069344.9	51.99	51.99
culv31out	601300.029	8069352.39	51.9	51.9
culv32in	601585.038	8069342.74	65.634	65.634
culv32out	601570.44	8069333.88	64.884	64.884
culv33in	601626.532	8069387.15	66.01	66.01
culv33out	601605.805	8069390.18	64.36	64.36
culv34in	601459.933	8069617.22	55.966	55.966
culv34out	601448.821	8069626.66	55.224	55.224
culv35in	601375.311	8069560.41	56.004	56.004
culv35out	601359.474	8069553.72	55.259	55.259
culv36in	601342.173	8069542.97	54	54
culv36out	601328.578	8069535.99	54.091	54.091
culv37in	601221.966	8069496.03	51.022	51.022
culv37out	601209.703	8069485.95	51.001	51.001
culv38in	601168.448	8069456.12	49.974	49.974
culv38out	601160.985	8069450.78	49.866	49.866
culv39in	601132.332	8069427.66	48.997	48.997

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv39out	601115.217	8069415.05	48.057	48.057
culv3in	601463.419	8068675.14	86.6	86.6
culv3out	601448.039	8068680.15	85.8	85.8
culv40in	601125.755	8069394.83	48.07	48.07
culv40out	601115.119	8069405.85	48.128	48.128
culv41in	601144.453	8069410.32	49.023	49.023
culv41out	601133.84	8069400.75	48.6	48.6
culv42in	601175.575	8069434.46	49.991	49.991
culv42out	601170.676	8069431.04	50.014	50.014
culv43in	601193.796	8069416.32	50.397	50.397
culv43out	601191.078	8069420.12	50.267	50.267
culv44in	601217.268	8069335.93	50.7	50.7
culv44out	601199.167	8069350.11	49.92	49.92
culv45in	601185.749	8069315.92	49.972	49.972
culv45out	601188.945	8069331.56	50.182	50.182
culv46in	600968.067	8069353.41	49.04	49.04
culv46out	600969.007	8069370.17	48.412	48.412
culv47in	600726.474	8069195.33	47.475	47.475
culv47out	600717.37	8069202.09	46.994	46.994
culv48in	600671.556	8069110.06	51.079	51.079
culv48out	600676.964	8069123.34	50.851	50.851
culv49in	600659.478	8069081.87	51.8	51.8
culv49out	600662.708	8069087.07	51.783	51.783
culv4in	601421.965	8068689.61	84.35	84.35
culv4out	601428.69	8068706.17	84	84
culv50in	600632.699	8068997.19	52.6	52.6
culv50out	600631.364	8068988.05	52.5	52.5
culv51in	600617.982	8068953.13	51.998	51.998
culv51out	600616.573	8068942.85	52.016	52.016
culv52in	600607.103	8068928.77	51.561	51.561
culv52out	600618.371	8068900.63	50.078	50.078

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv53in	600614.592	8068816.72	49.163	49.163
culv53out	600599.391	8068818.4	47.827	47.827
culv54in	600502.112	8069051.13	50.986	50.986
culv54out	600492.82	8069040.59	49.961	49.961
culv55in	600618.626	8069157.18	51.852	51.852
culv55out	600629.649	8069170.11	49.716	49.716
culv56in	600669.525	8069212.97	45.543	45.543
culv56out	600675.94	8069227.05	43.897	43.897
culv57in	600672.287	8069235.65	43.642	43.642
culv57out	600660.956	8069243.68	43.014	43.014
culv58in	600915.862	8069354.8	47	47
culv58out	600924.248	8069373.82	46.788	46.788
culv59in	600935.21	8069495.7	39.162	39.162
culv59out	600922.025	8069510.95	37.243	37.243
culv5in	601395.056	8068610.56	87.2	87.2
culv5out	601398.322	8068618.72	86.75	86.75
culv60in	600869.623	8069466.68	39.995	39.995
culv60out	600860.866	8069477.03	38.191	38.191
culv61in	600774.006	8069325.04	42.776	42.776
culv61out	600775.551	8069341.87	41.689	41.689
culv62in	600743.381	8069302.91	42.927	42.927
culv62out	600737.126	8069316.06	41.421	41.421
culv63in	600655.555	8069406.37	27.7	27.7
culv63out	600626.782	8069419.53	23.9	23.9
culv64in	600544.17	8069395.43	14.7	14.7
culv64out	600528.668	8069397.28	12.6	12.6
culv65in	600479.496	8069308.97	13.376	13.376
culv65out	600470.429	8069316.23	11.5	11.5
culv66in	600455.076	8069272.48	12.96	12.96
culv66out	600441.509	8069282.19	11.4	11.4
culv67in	600370.141	8069160.67	11.1	11.1

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv67out	600359.877	8069167.98	9.7	9.7
culv68in	600292.704	8069047.06	10.42	10.42
culv68out	600290.616	8069044.13	10.39	10.39
culv6in	601560.443	8068792.38	81.5	81.5
culv6out	601580.477	8068794.56	81.1	81.1
culv70in	600271.465	8069021.28	9.74	9.74
culv70out	600268.233	8069014.49	9.64	9.64
culv71in	600249.152	8068985.86	8.5	8.5
culv71out	600237	8068993.32	6.6	6.6
culv72in	600235.255	8068971.7	7.9	7.9
culv72out	600232.864	8068966.69	7.8	7.8
culv73in	600230.826	8068964.96	7.77	7.77
culv73out	600226.683	8068958.76	7.64	7.64
culv74in	600226.784	8068959.45	7.6	7.6
culv74out	600218.02	8068965.38	7	7
culv75in	600208.949	8068931.96	7.98	7.98
culv75out	600212.031	8068938.57	7.78	7.78
culv76in	600147.895	8068855.22	7.1	7.1
culv76out	600139.048	8068858.59	7	7
culv77in	600605.489	8069437.32	19	19
culv77out	600602.674	8069439.93	18.7	18.7
culv78in	600582.771	8069451.72	16.3	16.3
culv78out	600574.225	8069460.56	14.85	14.85
culv79in	600616.269	8069497.79	17	17
culv79out	600606.611	8069507.54	14.7	14.7
culv7in	601464.219	8068828.69	77.2	77.2
culv7out	601471.814	8068841.19	76.6	76.6
culv80in	600673.517	8069520.88	14.95	14.95
culv80out	600652.823	8069528.68	14.4	14.4
culv81in	601021.589	8069732.35	27.894	27.894
culv81out	601026.529	8069744.37	27.537	27.537

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
culv82in	601010.605	8069767.16	27.463	27.463
culv82out	601023.286	8069774.77	27.155	27.155
culv83in	601069.759	8069598.58	42.223	42.223
culv83out	601070.564	8069619.22	39.562	39.562
culv8in	601471.662	8068810.87	78.95	78.95
culv8out	601463.748	8068826.6	77.4	77.4
culv9in	601458.298	8068797.8	79.4	79.4
culv9out	601439.744	8068804.62	77.3	77.3
J458	601175.697	8069841.42	-0.742	0.258
J493	601149.998	8069802.87	6.419	7.419
J539	601405.922	8069786.81	24.308	25.308
J590	601047.2	8069783.6	18.589	19.589
J615	601100.74	8069746.12	21.367	22.367
J630	601401.638	8069721.49	39.972	40.972
J728	601093.245	8069727.92	24.388	25.388
J776	600589.963	8069566.22	3.714	4.714
J781	601485.035	8069578.31	56.997	57.997
J813	601498.011	8069560.87	58.437	59.437
J823	600632.795	8069538.38	9.664	10.664
J869	600798.771	8069516.97	25.47	26.47
J907	600715.248	8069498.76	20.073	21.073
J913	601473.383	8069453.79	57.689	58.689
J951	601503.365	8069428.09	58.705	59.705
J955	600746.496	8069500.53	21.999	22.999
J972	600773.072	8069462.35	27.811	28.811
J990	600958.322	8069473.06	39.789	40.789
J1058	601116.802	8069387.4	49.146	50.146
J1066	600601.742	8069369.19	24.713	25.713
J1089	601927.407	8069314.58	74.007	75.007
J1099	601677.908	8069358.49	66.874	67.874
J1126	601434.742	8069368.66	54.407	55.407

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J1138	601302.145	8069294.2	51.967	52.967
J1156	600354.384	8069301.73	-0.071	0.929
J1158	601382.806	8069339.49	52.9	53.9
J1302	601990.585	8069262.11	78.062	79.062
J1304	602122.295	8069172.16	86.565	87.565
J1345	601984.16	8069157.17	84.027	85.027
J1348	601452.392	8069131.6	59.001	60.001
J1350	601117.873	8069100.42	57.013	58.013
J1363	600886.578	8069107.92	57.415	58.415
J1373	601606.163	8069075.79	62.663	63.663
J1376	601203.358	8069239.56	53	54
J1380	602187.614	8069088.64	92.81	93.81
J1392	601246.371	8069136.83	55.5	56.5
J1413	601502.138	8069099.59	59.5	60.5
J1415	601614.73	8069065.08	63.017	64.017
J1417	601568.685	8069087.57	61.836	62.836
J1421	600703.469	8069067.23	50.926	51.926
J1426	602252.934	8069035.1	98.443	99.443
J1439	601642.571	8069046.88	64.625	65.625
J1445	600460.395	8068981.56	42.354	43.354
J1455	601740.015	8068995.48	73.711	74.711
J1460	600781.638	8069069.37	55.206	56.206
J1487	602158.702	8069060.8	93.673	94.673
J1492	601748.581	8069000.83	74.512	75.512
J1501	602221.88	8069000.83	97.04	98.04
J1505	601983.089	8069004.05	89.206	90.206
J1519	601325.611	8068993.34	58.849	59.849
J1526	601216.388	8069000.83	56.128	57.128
J1535	602264.713	8068980.49	99.549	100.549
J1553	600648.858	8068914.1	50.679	51.679
J1561	602007.718	8068994.41	89.932	90.932

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J1572	601682.191	8068972.99	68.456	69.456
J1574	602260.429	8068956.93	99.983	100.983
J1586	601379.151	8068965.5	64.046	65.046
J1590	600786.992	8068864.84	57.774	58.774
J1609	602561.327	8068922.67	117.962	118.962
J1611	601326.681	8068921.59	63.109	64.109
J1628	602506.716	8068915.17	113.872	114.872
J1632	600390.792	8068903.39	28.405	29.405
J1649	601365.231	8068966.57	62.967	63.967
J1655	601675.766	8068871.27	71.665	72.665
J1664	602460.671	8068918.38	112.612	113.612
J1671	600399.359	8068888.4	30.212	31.212
J1683	601216.388	8068859.49	61.228	62.228
J1687	600559.98	8068826.29	43.955	44.955
J1699	602075.179	8068815.58	96.815	97.815
J1706	600809.479	8068825.22	58.19	59.19
J1708	601674.695	8068828.43	74.154	75.154
J1726	600622.087	8068808.09	49.966	50.966
J1728	602478.875	8068779.18	114.339	115.339
J1747	601818.184	8068703.15	83.354	84.354
J1764	600525.714	8068781.32	43.107	44.107
J1772	601174.626	8068764.19	62.879	63.879
J1774	602496.008	8068778.11	114.685	115.685
J1784	602419.98	8068757.76	112.396	113.396
J1796	602249.721	8068743.84	106.086	107.086
J1807	602547.407	8068741.7	118.102	119.102
J1817	600799.842	8068733.13	58.774	59.774
J1832	601699.324	8068714.93	77.622	78.622
J1837	600529.998	8068734.2	44.915	45.915
J1850	601030.067	8068698.87	63.023	64.023
J1859	601099.669	8068797.38	61.172	62.172

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J1868	600593.175	8068697.8	50.37	51.37
J1905	601701.466	8068686.02	78.008	79.008
J1907	602290.412	8068650.68	106.341	107.341
J1919	600889.79	8068637.83	62.791	63.791
J1935	601048.27	8068721.35	62.797	63.797
J1956	601700.395	8068652.82	79.429	80.429
J1993	600763.435	8068620.7	58.947	59.947
J2004	600870.516	8068587.5	62.992	63.992
J2022	601719.669	8068607.85	79.875	80.875
J2090	600818.046	8068523.25	62.871	63.871
J2266	600745.231	8068345.5	61.796	62.796
J2386	600724.279	8068288.96	61.926	62.926
J2388	601126.44	8068283.39	77.138	78.138
J2399	601061.12	8068279.11	76.713	77.713
J2432	600712.656	8068255.69	61.028	62.028
J2447	601126.44	8068246.98	77.923	78.923
J2476	600707.752	8068233.06	60.993	61.993
J2499	601215.317	8068199.87	80.371	81.371
J2520	600693.832	8068194.51	60.953	61.953
J2539	601260.291	8068174.17	82.213	83.213
J2543	600688.478	8068179.52	60.988	61.988
J2557	601064.333	8068335.86	75.654	76.654
J2569	601126.44	8068197.73	78.768	79.768
J2577	601126.44	8068185.95	78.937	79.937
J2754	600690.619	8068053.17	60.963	61.963
J2769	600944.402	8067953.58	74.487	75.487
J2808	600533.21	8067973.93	60.83	61.83
J2896	600702.398	8067928.95	65.608	66.608
J2909	601081.052	8067863.36	80.014	81.014
J2921	600621.017	8067859.35	61.642	62.642
J2968	600649.928	8067829.37	64.652	65.652

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J2977	600554.626	8067812.23	60.943	61.943
J2997	601194.972	8067713.72	82.836	83.836
J3005	600598.53	8067802.6	62	63
J3022	601122.238	8067791.94	81.249	82.249
J3069	600467.89	8067781.18	61.919	62.919
J3123	600614.495	8067753.48	62.804	63.804
J3199	601191.759	8067588.43	82.311	83.311
J3286	600673.486	8067553.1	69.644	70.644
J3343	601144.643	8067535.96	82.346	83.346
J3366	600632.839	8067509.2	66.951	67.951
J3381	601209.963	8067493.13	82.674	83.674
J3410	601199.255	8067495.27	82.571	83.571
J3418	600790.205	8067516.69	78.215	79.215
J3425	600826.612	8067468.5	80.681	81.681
J3435	601239.946	8067457.8	83.989	84.989
J3437	601209.963	8067482.42	82.779	83.779
J3490	601507.649	8067392.48	97.037	98.037
J3555	601472.312	8067382.84	97.066	98.066
J8313	600716.319	8069100.42	50.634	51.634
J8324	600615.662	8069343.49	28.108	29.108
J8347	601455.179	8067399.97	97.107	98.107
J8354	600848.029	8068602.49	62.033	63.033
J8371	601156.422	8067546.67	82.257	83.257
J8375	601139.379	8067686.04	81.88	82.88
J8381	601321.327	8069406.67	51.482	52.482
J8386	600626.371	8067552.03	65.999	66.999
J8394	600331.897	8068959.07	21.19	22.19
J8405	601169.272	8067607.71	82.128	83.128
J8455	601819.255	8069327.43	71.097	72.097
J8486	602160.844	8068737.42	101.102	102.102
J8503	601712.174	8069328.5	68.066	69.066

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J8504	600510.723	8068813.44	41.047	42.047
J8507	600561.051	8068708.5	47.885	48.885
J8529	600595.317	8068886.26	48.357	49.357
J8539	601126.265	8068273.48	77.36	78.36
J8549	601378.241	8069394.88	52.8	53.8
J8550	601125.369	8068839.14	59.951	60.951
J8562	601702.536	8068704.22	77.746	78.746
J8568	601199.255	8068964.43	56.109	57.109
J8569	600615.662	8067917.17	61.2	62.2
J8572	601888.858	8069014.76	85.097	86.097
J8582	601067.545	8068347.64	75.509	76.509
J8596	600778.426	8068648.54	58.913	59.913
J8605	600699.186	8069515.9	16.814	17.814
J8629	601211.034	8069052.23	56.006	57.006
J8646	600252.583	8068632.25	29.21	30.21
J8658	602191.897	8069020.11	94.974	95.974
J8671	601280.623	8069444.86	51.7	52.7
J8689	600617.619	8067576.67	65.974	66.974
J8691	600624.229	8068152.75	60.4	61.4
J8695	601129.652	8068849.85	59.764	60.764
J8703	600910.487	8067944.71	73.704	74.704
J8735	600668.132	8068347.64	60	61
J8872	601890.999	8069302.8	73.604	74.604
J8974	600492.519	8068826.29	39.932	40.932
J9108	601684.333	8068992.27	67.573	68.573
J9170	600683.124	8068085.29	60.8	61.8
J9278	601098.599	8069412.03	47.415	48.415
J1	601481.802	8069609.08	56.659	57.659
J2	601367.39	8069372.91	52.37	52.37
J4	601198.574	8069128.87	55.9	56.9
J5	601249.964	8069106.08	55.9	56.9

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J6	601486.253	8068572.99	95.267	95.267
J7	601528.28	8068597.61	95.465	95.465
J8	601378.87	8068526.08	96.013	96.013
J9	601373.703	8068487.33	94.87	94.87
J10	601467.742	8068481.13	96.982	96.982
J11	601353.356	8068483.92	94.14	94.14
J12	601523.765	8068806.22	79.861	79.861
J13	601437.786	8068734.32	82.587	82.587
J14	601449.411	8068770.3	80.781	80.781
J15	601429.153	8068938.44	69.284	69.284
J16	601432.394	8068971.94	65.973	65.973
J17	601400.002	8068948.77	66.693	66.826
J18	601398.941	8068989.41	63.312	63.312
J19	601265.1	8068981.28	58.064	58.341
J20	601288.459	8069026.53	57.158	57.435
J21	601327.867	8069068.2	57.2	57.2
J22	601298.632	8069064.41	56.1	56.1
J23	601477.639	8069242.42	61.95	61.95
J24	601462.714	8069251.82	61.125	61.125
J25	601432.131	8069268.5	60.6	60.6
J26	601420.871	8069255.47	58.98	58.98
J27	601369.884	8069220.04	55.871	56.251
J28	601463.525	8069122.57	59.005	60.005
J29	601412.446	8069092.42	63.157	63.157
J30	601441.233	8069122.88	59.89	60.677
J31	601544.989	8069308.8	64.079	64.079
J32	601507.856	8069272.2	62.905	62.905
J33	601774.604	8069568.06	73.9	73.9
J34	601659.698	8069378.76	66.506	67.081
J35	601726.287	8069478.84	70.537	70.799
J36	601694.938	8069417.35	68.25	68.69

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J37	601502.895	8069327.2	60.6	60.6
J38	601453.017	8069366.15	55.73	56.597
J39	601274.816	8069213.08	54	54
J41	601285.933	8069227.62	53.65	53.65
J40	601261.846	8069199.92	54.414	54.671
J42	601316.6	8069282.72	52.713	53.595
J43	601204.591	8069309.36	51.41	51.41
J44	601591.434	8069622.83	66.5	66.5
J45	601270.541	8069436.79	51	51
J46	601521.612	8069642.25	61.005	61.005
J47	601493.712	8069635.51	58.852	58.852
J48	600957.24	8069591.69	38.7	38.7
J50	601258.347	8069519.59	52.86	52.86
J51	601268.252	8069506.57	52.5	52.5
J52	601409.643	8069601.45	56	56
J53	601351.163	8069568.88	54.259	54.259
J54	600905.103	8069242.67	54.5	54.5
J55	600936.116	8069306.47	51.492	51.492
J56	600802.719	8069134.95	56	56
J58	600761.663	8069225.8	48.685	48.685
J59	600708.895	8069272.47	43.26	43.26
J62	600641.888	8069409.43	26.7	26.7
J63	600555.776	8069467.9	12.4	12.4
J64	600548.474	8069471.23	11.675	11.675
J65	600532.422	8069509.09	3	3
J66	600579.133	8069535.02	10.5	10.5
J67	600992.388	8069442.03	42.011	43.011
J70	601100.988	8069650.78	34.396	34.68
J71	601124.634	8069676.23	30.29	30.8
J72	600881.157	8069615.26	34.293	34.293
J73	600919.088	8069647.49	32.552	32.552

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J74	600955.71	8069678.6	30.871	30.871
J75	600988.945	8069706.83	29.346	29.346
J77	600194.802	8068852.42	15.132	15.132
J78	600205.599	8068927.72	7.881	7.881
J79	600195.52	8068931.33	7.19	7.19
J68	600323.465	8069033.28	14.388	14.388
J69	600286.34	8068978	12.2	12.632
J80	600204.414	8069013.18	4.094	4.094
J81	600192.928	8069015.43	3.618	3.618
J82	600374.909	8069166.83	11.187	11.187
J83	600367.951	8069176.44	10.054	10.054
J84	600363.466	8069179.33	9	9
J85	600354.787	8069182.57	8.133	8.133
J86	600319.251	8069202.73	4.856	4.856
J87	600314.107	8069204.46	4.34	4.34
J88	600303.921	8069198.55	3.915	3.915
J89	600297.81	8069203.39	3.265	3.265
J90	600294.265	8069210.62	2.476	2.476
J91	600411.651	8069212.65	11.7	11.7
J92	600404.282	8069204.39	11.57	11.57
J93	600433.162	8069243.03	12.097	12.097
J94	600425.433	8069248.56	11.4	11.4
J95	600416.71	8069254.87	9.49	9.49
J96	600408.201	8069259.76	8.569	8.569
J97	600432.435	8069242.3	12.054	12.054
J99	600518.875	8069287.06	20.264	20.264
J98	600424.469	8069291.73	7.939	7.939
J100	600491.926	8069408.13	6.388	6.388
J61	600681.263	8069371.44	32	32
J60	600693.623	8069379.48	32.782	32.782
J101	600603.699	8069502.48	14.987	14.987

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J102	600615.925	8069496.05	17.289	17.289
J103	600605.658	8069480.53	17.539	17.539
OF47	600566.835	8069493.65	11.276	11.276
OF48	600558.544	8069497.01	10.188	10.188
J104	600760.113	8069616.96	26.956	26.956
J105	600649.233	8069530.89	12.34	12.526
J106	600680.15	8069515.37	15.495	15.787
J107	600751.987	8069563.06	24.582	24.582
J108	600764.068	8069570.67	25.907	25.907
J109	600798.592	8069584.74	29.865	29.865
J110	600856.832	8069540.79	30.893	31.432
J111	600951.302	8069580.7	38.8	38.8
J49	601043.937	8069733.28	27.6	27.6
J112	601022.783	8069731.72	27.889	27.889
J113	601008.782	8069574.41	41.365	41.365
J114	601001.722	8069582.07	40.884	40.884
J115	600996.231	8069560.75	41.712	41.712
J116	601039.77	8069600.36	42.372	42.372
J117	600983.359	8069610.5	38.616	38.616
J118	601018.12	8069639.85	37.363	37.363
J119	601024.538	8069645.19	37.078	37.078
J120	601070.735	8069679.6	32.4	32.4
J121	601072.05	8069693.67	31.365	31.365
J122	601087.085	8069707.53	30.24	30.24
J124	601161.264	8069821.55	1.44	2.44
J125	601101.779	8069758.7	18.586	18.952
J126	600482.177	8069014.83	47.42	47.42
J127	600497.492	8069033.09	50.3	50.3
J128	600506.017	8069038.59	51.137	51.137
J132	600603.865	8068924.32	51.67	51.67
J133	600600.768	8068900.54	48.9	48.9

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J134	600647.379	8069035.98	52.7	52.7
J135	600864.929	8069458.7	40.581	40.581
J136	600856.763	8069463.31	39.766	39.766
J137	600789.192	8069336.75	42.854	42.854
J138	600768.241	8069303.18	43.785	43.785
J139	600784.425	8069328.68	43	43
J140	600801.659	8069285.22	48.027	48.027
J141	600819.814	8069278.91	49.168	49.168
J142	600872.631	8069325.6	48.23	48.23
J143	600882.15	8069334.38	48.07	48.07
J144	600865.757	8069293.5	50	50
J145	600853.664	8069308.83	48.75	48.75
J146	600909.501	8069372.57	46.975	46.975
J148	600938.997	8069490.56	39.288	39.488
J147	601105.88	8069443.26	49.237	49.237
J149	600618.454	8068895.73	49.55	49.55
J150	600653.576	8069058.39	51.9	51.9
J151	600565.154	8069141.17	52.1	52.1
J152	600699.311	8069189	47.8	47.8
J153	600690.737	8069194.44	46.8	46.8
J154	600723.16	8069184.18	48	48
J155	600719.468	8069171.69	49.6	49.6
J156	600680.11	8069086.3	53.095	53.095
J157	601084.139	8069361.57	50.7	50.7
J158	601107.411	8069379.16	50	50
J129	600531.266	8069002.73	51.9	51.9
J57	601144.946	8067712.4	81.9	81.9
J76	601134.8	8067735.42	81.75	81.75
J130	600860.622	8067964.87	71.7	72.7
J131	600877.727	8067957.7	72.3	73.3
J159	600905.193	8067820.44	81.77	81.77

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J160	600840.816	8067830.8	79.97	79.97
J161	600929.682	8067814.64	82.755	82.755
J162	600786.522	8067647.78	81.659	81.659
J163	600775.218	8067632.44	80.89	80.89
J164	600847.65	8067854.48	79	79
J165	601091.695	8067665.02	85	85
J166	601110.572	8067659.2	84.56	84.56
J167	601061.991	8067715.1	85.687	85.687
J168	601050.688	8067570.54	89.086	89.086
J169	600834.512	8067734.06	82.8	82.8
J170	600868.662	8067828.85	80.7	80.7
J171	600918.926	8067683.82	87.8	87.8
J172	601045.153	8067733.37	86.18	86.18
J173	601273.676	8067898.75	93.7	93.7
J174	601174.674	8067724.45	82.489	83.118
J175	601119.61	8068026.53	82.5	82.5
J176	601099.237	8067983.45	81.86	81.86
J177	601062.553	8067980.53	81.22	81.22
J178	600902.887	8068077.88	76.6	76.6
J179	600884.613	8068081.38	75.6	75.6
J180	600896.144	8068043.18	75.88	75.88
J181	600979.878	8068166.01	78.6	78.6
J182	601076.922	8067992.67	80.92	80.92
J184	601137.726	8068257.32	77.947	78.947
J185	601163.537	8068115.2	81.2	81.2
J187	601130.514	8068050.65	82.2	82.2
J188	601176.839	8068216.97	79.19	80.19
J189	601150.82	8068090.34	81.585	81.585
J190	601297.879	8068079.54	89.645	89.645
J191	601052.379	8068207.61	78.171	78.171
J192	601051.427	8068229.27	77.7	77.7

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J193	600942.33	8067584.56	89.91	89.91
J194	601021.283	8067767.52	87.1	87.1
J195	601352.824	8068155.94	86.16	86.16
J196	601334.954	8068157.98	85.48	85.48
J198	601320.915	8068277.79	87.554	87.554
J199	601158.946	8068358.3	76.275	76.275
J200	601141.369	8068354.61	76	76
J204	601140.947	8068123.11	80.7	80.7
J206	601320.473	8068833.13	67.53	67.53
J210	601294.505	8068672.57	73.3	73.3
J211	601240.612	8068518.66	77.6	77.6
J213	601157.918	8068508.71	72.76	72.76
J214	601230.865	8068488.49	79.562	79.562
J201	601057.32	8068539.59	69.5	69.5
J215	601009.5	8068552.46	67.8	67.8
J218	601219.765	8067910.56	89.5	89.5
J3	601277.39	8069323.22	51	53
J220	601178.865	8069245.38	53	53
J221	600212.41	8068881.26	13.65	13.65
J222	600222.47	8068904.14	11.486	11.486
J223	600333.104	8069105.92	10.797	10.797
J224	600374.79	8069166.55	11.187	11.187
J225	600363.058	8069149.49	11.077	11.077
J226	600350.857	8069131.74	10.963	10.963
J227	600357.987	8069029.13	23.002	23.002
J228	600827.858	8069364.32	42.137	42.137
J229	600845.268	8069388.5	41.684	41.684
J230	600859.239	8069435.87	40.936	40.936
J231	601261.01	8069200.87	53.72	53.72
J232	601274.685	8069214.33	54.78	54.78
J233	601233.863	8069253.91	53.055	53.055

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J234	601204.426	8069269.09	52.973	52.973
J235	601229.177	8069226.74	53.017	53.603
J236	600248.296	8068985.02	8.69	8.69
J237	600543.2	8069394.68	14.64	14.64
J238	600523.509	8069368.19	14.249	14.249
J239	600498.636	8069334.72	13.756	13.756
J241	600478.193	8069306.82	13.49	13.49
J240	600502.722	8069265.42	17.714	17.714
J242	600453.932	8069272.1	12.916	12.916
J243	600438.352	8069250.29	12.302	12.302
J244	600416.916	8069220.16	11.79	11.79
J245	600394.949	8069192.45	11.448	11.448
J246	600304.518	8069064.27	10.53	10.53
J247	600306.684	8069007.8	13.393	13.59
J248	600296.767	8068992.01	12.772	13.091
J249	600258.977	8069000.6	9.087	9.087
J250	600267.524	8068982.82	10.313	10.525
J251	600207.042	8068929.04	8.08	8.08
J252	600217.23	8068944.45	7.852	7.852
J253	600173.076	8068883.73	9.514	9.514
J254	600172.223	8068882.67	9.609	9.609
J255	600193.836	8068911.81	8.472	8.472
J256	600683.274	8069247.04	43.606	43.606
J257	600693.878	8069259.21	43.396	43.396
J258	600897.977	8069346.11	47.5	47.5
J259	600701.292	8069132.03	51.222	51.222
J260	600740.941	8069207.85	47.972	47.972
J261	600756.815	8069077.25	54.388	54.388
J262	600739.996	8069043.59	53.624	53.624
J263	600709.869	8068983.3	52.255	52.255
J264	600662.879	8068916.39	50.557	50.557

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J265	600656.192	8068885.19	51.844	52.073
J266	600586.557	8069146.87	52	52
J267	600647.396	8069187.57	47.945	47.945
J268	600700.575	8069162.74	48.961	48.961
J269	601338.763	8069021.85	58.46	58.46
J270	601352.046	8069043.19	58.372	58.372
J271	601502.425	8068921.62	72.452	72.452
J272	601477.182	8068869.64	75.783	75.783
J273	601384.39	8068573.08	90.28	90.28
J274	601422.787	8068484.09	95.972	95.972
J275	601400.479	8068485.56	95.471	95.471
J276	601413.782	8068665.08	85.181	85.181
J277	601375.912	8068503.9	95.359	95.359
J278	601495.098	8068617.57	92.14	92.14
J279	601510.747	8068507.69	94.554	94.554
J280	601249.506	8068548.73	76.537	76.537
J281	601262.78	8068585.67	75.143	75.143
J282	601284.261	8068643.9	73.9	73.9
J283	601312.017	8068765.88	70.038	70.038
J284	601406.605	8068811.46	72.96	72.96
J285	601559.281	8068793.11	81.497	81.497
J286	601256.463	8069518.46	52.78	52.78
J287	601239.25	8069505.93	51.612	51.612
J288	600691.457	8069213.85	45.188	45.188
J289	600998.383	8069623.23	38.074	38.074
J290	601041.824	8069659.85	35.36	35.36
J291	601057.405	8069672.32	33.6	33.6
J292	601360.388	8069056.59	58.317	58.317
J293	601012.658	8069635.25	37.56	37.56
J294	600729.484	8069197.93	47.578	47.578
J295	600673.478	8069209.52	45.777	45.777

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J296	600667.024	8069209.84	45.828	45.828
J297	600678.695	8069225.06	44.114	44.114
J298	601387.355	8069568.34	55.999	55.999
J299	600480.665	8069310.54	13.399	13.399
J300	600377.579	8069170.24	11.222	11.222
J301	600700.114	8069186.1	47.923	47.923
J302	601020.398	8069730.46	27.982	27.982
J303	601216.877	8068455.64	78.841	78.841
J304	601205.674	8068419.12	78.118	78.118
J305	601194.53	8068392.29	77.489	77.489
J306	601216.394	8068319.2	79.913	79.913
J307	601081.837	8068481.23	72.023	72.443
J202	601113.665	8068351.12	75.815	76.191
J203	601289.599	8067998.92	93.044	93.044
J216	601048.419	8067957.35	79.779	80.19
J219	601010.654	8067944.06	76.578	77.578
J183	600760.248	8067599.55	77.928	78.191
J308	600836.659	8067974.19	70.304	71.304
J309	600859.845	8068086.71	73.775	73.898
J310	601041.347	8068541.69	68.939	68.939
J311	601131.181	8068712.09	63.9	63.9
J312	601127.302	8068729.27	63.1	63.1
J313	601223.409	8068685.14	67.9	67.9
J314	601101.594	8068663.32	66.995	66.995
J315	601178.636	8068700.77	66.075	66.075
J316	601114.073	8068696.73	65.194	65.194
J317	601002.368	8068178.92	78.77	78.77
J318	601134.813	8068517.7	71.445	71.445
J319	601042.374	8068497.99	71.063	71.063
J320	600943.056	8067776.51	84.794	84.794
J321	600864.685	8067899.84	75.994	76.443

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J322	601086.126	8068534.37	70.207	70.207
J323	600355.224	8069175.46	8.6	8.6
J207	600832.057	8067728.04	82.84	82.84
J208	600874.806	8067608.87	86.413	86.413
J209	601100.732	8068152.2	79.662	79.662
J217	601373.233	8068205.88	88.227	88.227
J186	601223.068	8068099.4	84.942	84.942
J212	601177.505	8068362.18	76.654	76.654
J205	601072.503	8067633.33	86.457	86.457
J324	601073.303	8068584.45	69.14	69.14
J325	600917.758	8068111.09	77.202	77.202
J326	600964.443	8068043.84	78.203	78.203
J327	601193.12	8068609.59	69.4	69.4
J328	601093.779	8068641.18	67.545	67.545
J329	601144.249	8068626.23	68.9	68.9
J197	601236.262	8068007.99	89.7	89.7
J330	601227.648	8068491.49	0	0
J331	601556.634	8068457.74	92.257	92.682
J332	601606.846	8068790.63	79.326	79.581
J333	601433.782	8069112.01	61.232	61.696
J334	601587.779	8069589.01	66.075	66.075
J335	601404.066	8069230.92	57.571	57.743
J336	601309.199	8069247.45	53.234	53.626
J337	600580.343	8069384.41	20.775	21.382
J338	600550.943	8069405.3	16.086	16.086
J339	600356.721	8069185.36	8.072	8.072
J340	601474.38	8069194.75	61.848	61.848
J341	601435.375	8069145.95	58.555	59.051
J123	601259.602	8069323.39	50.902	52.249
J342	600770.53	8069318.76	43.473	43.473
J343	601475.827	8068910.97	73.747	73.747

Table G-2: Junctions PCSWMM Parameters

Name	X-Coordinate	Y-Coordinate	Invert Elev. (m)	Rim Elev. (m)
J344	601387.932	8068953.46	65.632	65.882
J345	601167.739	8068618.24	69.14	69.14

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C16	culv16in	culv16out	culvert_abandon	17.347	0.023	CIRCULAR	0.6	0	0.00507
C29	culv29in	culv29out	culvert_abandon	12.65	0.023	CIRCULAR	0.4	0	0.0004
C43	culv43in	culv43out	culvert_abandon	4.666	0.023	CIRCULAR	0.5	0	0.02787
C60	culv60in	culv60out	culvert_abandon	13.566	0.023	CIRCULAR	0.6	0	0.13417
C81	culv81in	culv81out	culvert_abandon	12.998	0.023	CIRCULAR	1	0	0.02748
C82	culv82in	culv82out	culvert_abandon	14.793	0.023	CIRCULAR	0.5	0	0.02083
C79	culv79in	culv79out	culvert_abandon	13.73	0.023	CIRCULAR	1	0	0.16992
C54	culv54in	culv54out	culvert_abandon	14.056	0.023	CIRCULAR	0.5	0	0.07312
C52	culv52in	culv52out	culvert_abandon	30.322	0.023	CIRCULAR	0.6	0	0.04897
C75	culv75in	culv75out	culvert_abandon	7.291	0.023	CIRCULAR	0.3	0	0.02744
C67	culv67in	culv67out	culvert_abandon	12.605	0.023	CIRCULAR	1	0	0.11176
C21	culv21in	culv21out	culvert_abandon	6.456	0.023	CIRCULAR	0.4	0	0.01549
C24	J220	culv24out	culvert_abandon	11.545	0.023	CIRCULAR	0.5	0	0.09571
C25	culv25in	culv25out	culvert_abandon	6.626	0.023	CIRCULAR	0.15	0	0.08329
C27	culv27in	culv27out	culvert_abandon	16.276	0.023	CIRCULAR	0.5	0	0.01844
C18	J270	culv18out	culvert_abandon	19.641	0.023	CIRCULAR	1	0	0.02195
C69	J323	J85	culvert_abandon	7.126	0.023	CIRCULAR	1	0	0.06568
C2	culv2in	culv2out	culvert_clean	18.435	0.023	CIRCULAR	0.6	0	0.05432
C3	culv3in	culv3out	culvert_clean	16.181	0.023	CIRCULAR	0.6	0	0.0495
C8	culv8in	culv8out	culvert_clean	17.611	0.023	CIRCULAR	0.6	0	0.08836
C13	culv13in	culv13out	culvert_clean	10.338	0.023	CIRCULAR	0.5	0	0.07762
C12	culv12in	culv12out	culvert_clean	8.41	0.023	CIRCULAR	0.4	0	0.08352
C23	culv23in	culv23out	culvert_clean	7.782	0.023	CIRCULAR	0.4	0	0.03858
C34	culv34in	culv34out	culvert_clean	14.585	0.023	CIRCULAR	0.6	0	0.05094
C1	culv1in	culv1out	culvert_existing	19.422	0.023	CIRCULAR	0.5	0	0.05932
C9	culv9in	culv9out	culvert_existing	19.773	0.023	CIRCULAR	0.6	0	0.10681
C15	culv15in	culv15out	culvert_existing	13.632	0.023	CIRCULAR	0.4	0	0.15393
C28	culv28in	culv28out	culvert_existing	16.681	0.023	CIRCULAR	1.4	0	-0.00875
C40	culv40in	culv40out	culvert_existing	15.318	0.023	CIRCULAR	1.2	0	-0.00379
C59	culv59in	culv59out	culvert_existing	20.16	0.023	CIRCULAR	1.4	0	0.09562

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C80	culv80in	culv80out	culvert_existing	22.12	0.023	CIRCULAR	1.4	0	0.02487
C76	culv76in	culv76out	culvert_existing	9.47	0.023	CIRCULAR	1.2	0	0.01056
C44	culv44in	culv44out	culvert_existing	23.003	0.023	CIRCULAR	1.4	0	0.03393
C31	culv31in	culv31out	culvert_existing	12.591	0.023	CIRCULAR	0.7	0	0.00715
C30	culv30in	culv30out	culvert_existing	15.615	0.023	CIRCULAR	0.9	0	0.02562
C32	culv32in	culv32out	culvert_existing	17.078	0.023	CIRCULAR	0.1	0	0.04396
C33	culv33in	culv33out	culvert_existing	20.952	0.023	CIRCULAR	1.2	0	0.079
C116	J57	J76	culvert_expansion	25.158	0.023	CIRCULAR	0.6	0	0.00596
C115	J131	J130	culvert_expansion	18.552	0.023	CIRCULAR	0.9	0	0.03236
C117	J165	J166	culvert_expansion	19.761	0.023	CIRCULAR	0.45	0	0.02227
C118	J161	J159	culvert_expansion	25.175	0.023	CIRCULAR	0.45	0	0.03916
C119	J160	J164	culvert_expansion	24.662	0.023	CIRCULAR	0.45	0	0.03936
C120	J162	J163	culvert_expansion	19.064	0.023	CIRCULAR	0.45	0	0.04037
C121	J176	J177	culvert_expansion	36.81	0.023	CIRCULAR	0.45	0	0.01739
C122	J178	J179	culvert_expansion	18.61	0.023	CIRCULAR	0.45	0	0.05381
C124	J184	J8539	culvert_expansion	19.822	0.023	CIRCULAR	0.45	0	0.02963
C123	J185	J204	culvert_expansion	23.94	0.023	CIRCULAR	0.45	0	0.02089
C125	J191	J192	culvert_expansion	21.688	0.023	CIRCULAR	0.45	0	0.02172
C126	J195	J196	culvert_expansion	17.991	0.023	CIRCULAR	0.45	0	0.03782
C127	J199	J200	culvert_expansion	17.965	0.023	CIRCULAR	0.45	0	0.01531
C129	J201	J310	culvert_expansion	16.115	0.023	CIRCULAR	0.6	0	0.03483
C128	J311	J312	culvert_expansion	17.616	0.01	CIRCULAR	0.45	0	0.04546
C131	J328	J314	culvert_expansion	23.488	0.045	CIRCULAR	0.45	0	0.02342
C130	J345	J329	culvert_expansion	24.822	0.01	CIRCULAR	0.45	0	0.00967
C111	J9	J11	culvert_new	20.636	0.023	CIRCULAR	0.45	0	0.0354
C112	culv17out	J21	culvert_new	18.413	0.023	CIRCULAR	0.45	0	0.03804
C95	J23	J24	culvert_new	17.642	0.023	CIRCULAR	0.45	0	0.04681
C113	J25	J26	culvert_new	17.229	0.023	CIRCULAR	0.45	0	0.09445
C114	J39	J41	culvert_new	18.312	0.023	CIRCULAR	0.9	0	0.01912
C91	J8671	J45	culvert_new	12.92	0.023	CIRCULAR	0.45	0	0.05426

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C90	J50	J51	culvert_new	16.365	0.023	CIRCULAR	0.45	0	0.022
C93	J63	J64	culvert_new	8.028	0.023	CIRCULAR	0.45	0	0.09068
C92	J78	J79	culvert_new	10.709	0.023	CIRCULAR	0.45	0	0.06466
C104	J80	J81	culvert_new	11.706	0.023	CIRCULAR	1.2	0	0.0407
C87	J82	J83	culvert_new	11.864	0.023	CIRCULAR	0.45	0	0.09594
C94	J84	J339	culvert_new	9.047	0.023	CIRCULAR	0.45	0	0.10312
C96	J86	J87	culvert_new	5.429	0.023	CIRCULAR	0.45	0	0.09548
C97	J88	J89	culvert_new	7.797	0.023	CIRCULAR	0.45	0	0.08366
C98	J91	J92	culvert_new	11.073	0.023	CIRCULAR	0.45	0	0.01174
C99	J93	J94	culvert_new	9.507	0.023	CIRCULAR	0.45	0	0.07351
C88	J102	J101	culvert_new	13.816	0.023	CIRCULAR	0.45	0	0.16898
C100	OF47	OF48	culvert_new	8.951	0.023	CIRCULAR	0.45	0	0.12246
C110	J108	J107	culvert_new	14.284	0.023	CIRCULAR	0.45	0	0.09316
C89	J112	J49	culvert_new	21.217	0.023	CIRCULAR	0.45	0	0.01362
C101	J113	J114	culvert_new	10.419	0.023	CIRCULAR	0.45	0	0.04621
C102	J118	J119	culvert_new	8.349	0.023	CIRCULAR	0.45	0	0.03416
C103	J120	J121	culvert_new	14.129	0.023	CIRCULAR	0.45	0	0.07345
C85	J128	J127	culvert_new	10.148	0.023	CIRCULAR	0.45	0	0.08276
C84	J132	J133	culvert_new	23.986	0.023	CIRCULAR	0.45	0	0.11626
C86	J135	J136	culvert_new	9.379	0.023	CIRCULAR	0.45	0	0.08723
C105	J142	J143	culvert_new	12.956	0.023	CIRCULAR	0.45	0	0.01235
C106	J152	J153	culvert_new	10.158	0.023	CIRCULAR	0.45	0	0.09893
C107	J155	J154	culvert_new	13.034	0.023	CIRCULAR	0.45	0	0.12369
C108	J95	J96	culvert_new	9.819	0.023	CIRCULAR	0.45	0	0.09421
C109	J157	J158	culvert_new	28.401	0.023	CIRCULAR	0.45	0	0.02465
C78	culv78in	culv78out	culvert_repair	12.301	0.023	CIRCULAR	0.6	0	0.1187
C71	culv71in	culv71out	culvert_repair	14.263	0.023	CIRCULAR	1.2	0	0.13441
C5	culv5in	culv5out	culvert_replace	8.788	0.023	CIRCULAR	0.45	0	0.05127
C4	culv4in	culv4out	culvert_replace	17.879	0.023	CIRCULAR	0.45	0	0.01958
C6	culv6in	culv6out	culvert_replace	20.158	0.023	CIRCULAR	0.45	0	0.01985

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C7	culv7in	culv7out	culvert_replace	14.634	0.023	CIRCULAR	0.45	0	0.04103
C14	culv14in	culv14out	culvert_replace	7.808	0.023	CIRCULAR	0.45	0	0.02562
C10	culv10in	culv10out	culvert_replace	20.362	0.023	CIRCULAR	0.45	0	0.04917
C11	culv11in	culv11out	culvert_replace	18.915	0.023	CIRCULAR	0.45	0	0.05029
C19	culv19in	culv19out	culvert_replace	16.404	0.023	CIRCULAR	0.45	0	0.05372
C17	culv17in	culv17out	culvert_replace	21.84	0.023	CIRCULAR	0.45	0	0.01694
C35	culv35in	culv35out	culvert_replace	17.197	0.023	CIRCULAR	0.45	0	0.04336
C36	culv36in	culv36out	culvert_replace	15.286	0.023	CIRCULAR	0.45	0	-0.00595
C37	culv37in	culv37out	culvert_replace	15.878	0.023	CIRCULAR	0.45	0	0.00132
C38	culv38in	culv38out	culvert_replace	9.181	0.023	CIRCULAR	0.45	0	0.01176
C42	culv42in	culv42out	culvert_replace	5.979	0.023	CIRCULAR	0.45	0	-0.00385
C41	culv41in	culv41out	culvert_replace	14.295	0.023	CIRCULAR	0.45	0	0.0296
C39	culv39in	culv39out	culvert_replace	21.263	0.023	CIRCULAR	0.45	0	0.04425
C46	culv46in	culv46out	culvert_replace	16.789	0.023	CIRCULAR	0.45	0	0.03743
C58	culv58in	culv58out	culvert_replace	20.792	0.023	CIRCULAR	0.45	0	0.0102
C83	culv83in	culv83out	culvert_replace	20.66	0.023	CIRCULAR	0.45	0	0.12988
C63	culv63in	culv63out	culvert_replace	31.65	0.023	CIRCULAR	0.45	0	0.12094
C64	culv64in	culv64out	culvert_replace	15.617	0.023	CIRCULAR	0.6	0	0.1357
C77	culv77in	culv77out	culvert_replace	3.841	0.023	CIRCULAR	0.45	0	0.07834
C61	culv61in	culv61out	culvert_replace	16.908	0.023	CIRCULAR	0.45	0	0.06442
C62	culv62in	culv62out	culvert_replace	14.573	0.023	CIRCULAR	0.45	0	0.1039
C57	culv57in	culv57out	culvert_replace	13.892	0.023	CIRCULAR	0.6	0	0.04525
C56	culv56in	culv56out	culvert_replace	15.483	0.023	CIRCULAR	0.45	0	0.10692
C55	culv55in	culv55out	culvert_replace	16.998	0.023	CIRCULAR	0.45	0	0.12667
C48	culv48in	culv48out	culvert_replace	14.338	0.023	CIRCULAR	0.45	0	0.0159
C50	culv50in	culv50out	culvert_replace	9.24	0.023	CIRCULAR	0.45	0	0.01082
C51	culv51in	culv51out	culvert_replace	10.372	0.023	CIRCULAR	0.45	0	-0.00174
C53	culv53in	culv53out	culvert_replace	15.298	0.023	CIRCULAR	0.9	0	0.08767
C70	culv70in	culv70out	culvert_replace	7.523	0.023	CIRCULAR	0.45	0	0.01329
C68	culv68in	culv68out	culvert_replace	3.602	0.023	CIRCULAR	0.45	0	0.00833

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C72	culv72in	culv72out	culvert_replace	5.548	0.023	CIRCULAR	0.45	0	0.01803
C73	culv73in	culv73out	culvert_replace	7.46	0.023	CIRCULAR	0.45	0	0.01743
C74	culv74in	culv74out	culvert_replace	10.584	0.023	CIRCULAR	0.45	0	0.05678
C66	culv66in	culv66out	culvert_replace	16.684	0.023	CIRCULAR	0.45	0	0.09391
C65	culv65in	culv65out	culvert_replace	11.619	0.023	CIRCULAR	0.45	0	0.16361
C20	culv20in	culv20out	culvert_replace	18.33	0.023	CIRCULAR	0.9	0	0.00546
C22	culv22in	culv22out	culvert_replace	16.444	0.023	CIRCULAR	0.6	0	0.05481
C26	culv26in	culv26out	culvert_replace	11.419	0.023	CIRCULAR	0.6	0	0.07438
C45	culv45in	culv45out	culvert_replace	15.964	0.023	CIRCULAR	0.45	0	-0.01316
C47	culv47in	culv47out	culvert_replace	11.345	0.023	CIRCULAR	0.45	0	0.04244
C49	culv49in	culv49out	culvert_replace	6.125	0.023	CIRCULAR	0.45	0	0.00278
C2596	J8539	J2388	ditch	9.914	0.045	TRAPEZOIDAL	0.5	0.5	0.0224
C3162	J1058	culv40in	ditch	11.704	0.045	TRAPEZOIDAL	0.5	0.5	0.09233
C18	culv41out	culv40in	ditch	10.021	0.045	TRAPEZOIDAL	0.5	0.5	0.05296
C870_2	culv42out	culv41in	ditch	33.427	0.045	TRAPEZOIDAL	0.5	0.5	0.02966
C870_1	J45	culv43in	ditch	94.73	0.045	TRAPEZOIDAL	0.5	0.5	0.00637
C870_3	culv43out	culv42in	ditch	21.407	0.045	TRAPEZOIDAL	0.5	0.5	0.01289
C2672_3	J1519	culv19in	ditch	30.618	0.045	TRAPEZOIDAL	0.5	0.5	0.01205
C25	culv73out	culv74in	ditch	0.703	0.045	TRAPEZOIDAL	0.5	0.5	0.05699
C1994_5	culv56out	culv57in	ditch	9.344	0.045	TRAPEZOIDAL	0.5	0.5	0.0273
C11	culv22out	culv23in	ditch	5.254	0.045	TRAPEZOIDAL	0.5	0.5	0.01904
C37	culv23out	culv24in	ditch	13.388	0.045	TRAPEZOIDAL	0.5	0.5	0.03737
C44	culv24in	culv26in	ditch	30.637	0.045	TRAPEZOIDAL	0.5	0.5	0.00173
C59	culv2out	culv3in	ditch	24.245	0.045	TRAPEZOIDAL	0.5	0.5	0.05784
C60	culv3out	culv4in	ditch	27.746	0.045	TRAPEZOIDAL	0.5	0.5	0.05233
C62_1	culv4out	J13	ditch	29.591	0.045	TRAPEZOIDAL	0.5	0.5	0.04781
C62_3	J13	J14	ditch	37.819	0.045	TRAPEZOIDAL	0.5	0.5	0.04781
C62_4	J14	culv9in	ditch	28.914	0.045	TRAPEZOIDAL	0.5	0.5	0.04782
C78_3	J16	J18	ditch	37.751	0.045	TRAPEZOIDAL	0.5	0.5	0.07066
C78_4	J18	culv19in	ditch	68.542	0.045	TRAPEZOIDAL	0.5	0.5	0.07067

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C3075_1	culv11out	J19	ditch	34.255	0.045	TRAPEZOIDAL	0.5	0.5	0.02295
C2672_1	culv19out	J20	ditch	34.145	0.045	TRAPEZOIDAL	0.5	0.5	0.01295
C88	J21	J22	ditch	29.488	0.045	TRAPEZOIDAL	0.5	0.5	0.03733
C90	J24	J25	ditch	8.168	0.045	TRAPEZOIDAL	0.5	0.5	0.06441
C54_1	culv20out	J40	ditch	25.026	0.045	TRAPEZOIDAL	0.5	0.5	0.01942
C54	J40	J39	ditch	18.479	0.045	TRAPEZOIDAL	0.5	0.5	0.02241
C100	J1376	culv24in	ditch	24.881	0.045	TRAPEZOIDAL	0.5	0.5	0
C1042_2	culv26out	J43	ditch	28.636	0.045	TRAPEZOIDAL	2	2	0.0241
C1042_3	J43	culv44in	ditch	29.45	0.045	TRAPEZOIDAL	2	2	0.02412
C105	J4	culv20in	ditch	52.38	0.045	TRAPEZOIDAL	0.5	0.5	0.01718
C110	culv35out	culv36in	ditch	20.376	0.045	TRAPEZOIDAL	0.5	0.5	0.06191
C113	J51	J8671	ditch	88.393	0.045	TRAPEZOIDAL	0.5	0.5	0.00905
C117	culv38out	culv39in	ditch	36.83	0.045	TRAPEZOIDAL	0.5	0.5	0.0236
C118_1	J54	J55	ditch	71.998	0.045	TRAPEZOIDAL	0.5	0.5	0.04182
C118_2	J55	culv46in	ditch	58.691	0.045	TRAPEZOIDAL	0.5	0.5	0.04181
J149	J149	culv53in	ditch	79.174	0.045	TRAPEZOIDAL	0.5	0.5	0.00489
C140	culv78out	J63	ditch	19.86	0.045	TRAPEZOIDAL	0.5	0.5	0.12431
C143	culv63out	culv77in	ditch	27.749	0.045	TRAPEZOIDAL	0.5	0.5	0.1794
C147	culv77out	culv78in	ditch	23.14	0.045	TRAPEZOIDAL	0.5	0.5	0.10428
C151	J236	culv72in	ditch	18.645	0.045	TRAPEZOIDAL	0.5	0.5	0.04241
C153	culv72out	culv73in	ditch	2.678	0.045	TRAPEZOIDAL	0.5	0.5	0.0112
C159	culv68out	culv70in	ditch	29.823	0.045	TRAPEZOIDAL	0.5	0.5	0.0218
C22_1	culv71out	J80	ditch	32.171	0.045	TRAPEZOIDAL	0.5	0.5	0.07813
C165	J83	J84	ditch	5.341	0.045	TRAPEZOIDAL	0.5	0.5	0.2013
C170	J339	J86	ditch	41.605	0.045	TRAPEZOIDAL	0.5	0.5	0.07753
C173	J87	J88	ditch	11.779	0.045	TRAPEZOIDAL	0.5	0.5	0.0361
C176	J89	J90	ditch	8.058	0.045	TRAPEZOIDAL	0.5	0.5	0.09839
C188	culv66out	J98	ditch	19.539	0.045	TRAPEZOIDAL	0.5	0.5	0.17998
C1728_1	culv64out	J100	ditch	38.322	0.045	TRAPEZOIDAL	0.5	0.5	0.16427
C200	J49	J590	ditch	53.543	0.045	TRAPEZOIDAL	0.5	0.5	0.17073

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C212_2	J125	J124	ditch	91.883	0.045	TRAPEZOIDAL	0.5	0.5	0.18994
C2957_1	J615	J125	ditch	12.676	0.045	TRAPEZOIDAL	0.5	0.5	0.22487
C29	J127	J126	ditch	25.541	0.045	TRAPEZOIDAL	0.5	0.5	0.11348
C242	J154	culv47in	ditch	11.629	0.045	TRAPEZOIDAL	0.5	0.5	0.04519
C252	J158	J1058	ditch	12.496	0.045	TRAPEZOIDAL	0.5	0.5	0.0685
C267	J173	J174	ditch	204.144	0.045	TRAPEZOIDAL	0.5	0.5	0.055
C63_2	J206	culv10in	ditch	52.626	0.045	TRAPEZOIDAL	0.5	0.5	0.04813
C40	culv52out	J149	ditch	4.902	0.045	TRAPEZOIDAL	0.5	0.5	0.10834
C121_1	J77	J221	ditch	33.798	0.045	TRAPEZOIDAL	0.5	0.5	0.04389
C121_3	J221	J222	ditch	25.035	0.045	TRAPEZOIDAL	0.5	0.5	0.08676
C121_4	J222	J78	ditch	30.606	0.045	TRAPEZOIDAL	0.5	0.5	0.11861
C102_4	J234	culv26in	ditch	10.667	0.045	TRAPEZOIDAL	0.5	0.5	0.00244
C54_4	J235	J1376	ditch	29.128	0.045	TRAPEZOIDAL	0.5	0.5	0.00058
C187_1	J99	J240	ditch	27.91	0.045	TRAPEZOIDAL	0.5	0.5	0.09175
C187_2	J240	culv66in	ditch	52.03	0.045	TRAPEZOIDAL	0.5	0.5	0.09175
C157_6	J246	culv68in	ditch	20.883	0.045	TRAPEZOIDAL	0.5	0.5	0.00527
C21_3	J68	J247	ditch	30.517	0.045	TRAPEZOIDAL	0.5	0.5	0.03262
C21_5	J247	J248	ditch	19.027	0.045	TRAPEZOIDAL	0.5	0.5	0.03266
C21_6	J248	J69	ditch	17.543	0.045	TRAPEZOIDAL	0.5	0.5	0.03262
C161_2	culv70out	J249	ditch	16.694	0.045	TRAPEZOIDAL	0.5	0.5	0.03314
C161_5	J249	culv71in	ditch	17.722	0.045	TRAPEZOIDAL	0.5	0.5	0.03314
C120	J56	J261	ditch	79.373	0.045	TRAPEZOIDAL	0.5	0.5	0.02031
C120	J261	J262	ditch	37.637	0.045	TRAPEZOIDAL	0.5	0.5	0.0203
C120	J262	J263	ditch	67.415	0.045	TRAPEZOIDAL	0.5	0.5	0.02031
C120	J263	J264	ditch	83.621	0.045	TRAPEZOIDAL	0.5	0.5	0.02031
C120	J264	J149	ditch	49.575	0.045	TRAPEZOIDAL	0.5	0.5	0.02032
C76	culv7out	J272	ditch	28.956	0.045	TRAPEZOIDAL	0.5	0.5	0.02823
C76	J272	culv14in	ditch	13.598	0.045	TRAPEZOIDAL	0.5	0.5	0.02818
C61	culv5out	J276	ditch	48.88	0.045	TRAPEZOIDAL	0.5	0.5	0.03212
C61	J276	culv4in	ditch	25.872	0.045	TRAPEZOIDAL	0.5	0.5	0.03214

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C304	J211	J280	ditch	31.372	0.045	TRAPEZOIDAL	0.5	0.5	0.0339
C304	J280	J281	ditch	39.265	0.045	TRAPEZOIDAL	0.5	0.5	0.03552
C304	J281	J282	ditch	62.104	0.045	TRAPEZOIDAL	0.5	0.5	0.02002
C304_2	J210	J283	ditch	95.063	0.045	TRAPEZOIDAL	0.5	0.5	0.03433
C304_2	J283	J206	ditch	68.267	0.045	TRAPEZOIDAL	0.5	0.5	0.03676
C63_1	culv9out	J284	ditch	53.584	0.045	TRAPEZOIDAL	0.5	0.5	0.08126
C208	J291	J120	ditch	15.761	0.045	TRAPEZOIDAL	0.5	0.5	0.07636
C84	J292	culv17in	ditch	13.267	0.045	TRAPEZOIDAL	0.5	0.5	0.00354
C206	J293	J118	ditch	7.141	0.045	TRAPEZOIDAL	0.5	0.5	0.0276
C118_4	J294	culv47in	ditch	3.983	0.045	TRAPEZOIDAL	0.5	0.5	0.02587
C238	J295	culv56in	ditch	5.25	0.045	TRAPEZOIDAL	0.5	0.5	0.04462
C235	J296	culv56in	ditch	4.011	0.045	TRAPEZOIDAL	0.5	0.5	0.07123
C2271_4	J297	culv56out	ditch	3.44	0.045	TRAPEZOIDAL	0.5	0.5	0.06321
C109	J298	culv35in	ditch	14.425	0.045	TRAPEZOIDAL	0.5	0.5	-0.00035
C46_4	J299	culv65in	ditch	1.963	0.045	TRAPEZOIDAL	0.5	0.5	0.01172
C178_2	J300	J82	ditch	4.334	0.045	TRAPEZOIDAL	0.5	0.5	0.00808
C239	J301	J152	ditch	3.005	0.045	TRAPEZOIDAL	0.5	0.5	0.04097
C159_6	J302	J112	ditch	2.697	0.045	TRAPEZOIDAL	0.5	0.5	0.0345
C298	J198	J306	ditch	113.973	0.045	TRAPEZOIDAL	0.5	0.5	0.06719
C2362	J307	J201	ditch	63.345	0.045	TRAPEZOIDAL	0.5	0.5	0.03986
C301	J200	J202	ditch	27.931	0.045	TRAPEZOIDAL	0.5	0.5	0.00662
C271	J177	J216	ditch	27.153	0.045	TRAPEZOIDAL	0.5	0.5	0.05314
C1421_2	J130	J308	ditch	25.792	0.045	TRAPEZOIDAL	0.5	0.5	0.0542
C291	J179	J309	ditch	25.344	0.045	TRAPEZOIDAL	0.5	0.5	0.0722
99_2	J310	J215	ditch	33.627	0.045	TRAPEZOIDAL	0.5	0.5	0.03389
C310	J322	J201	ditch	29.383	0.045	TRAPEZOIDAL	0.5	0.5	0.02407
C49	J282	J210	ditch	30.456	0.045	TRAPEZOIDAL	0.5	0.5	0.0197
C298	J306	J212	ditch	62.052	0.045	TRAPEZOIDAL	0.5	0.5	0.05259
C298	J212	J199	ditch	18.965	0.045	TRAPEZOIDAL	0.5	0.5	0.01999
C50	J214	J303	ditch	35.996	0.045	TRAPEZOIDAL	0.5	0.5	0.02003

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C51	J303	J304	ditch	36.145	0.045	TRAPEZOIDAL	0.5	0.5	0.02001
C52	J304	J305	ditch	29.061	0.045	TRAPEZOIDAL	0.5	0.5	0.02165
C53	J305	J212	ditch	34.86	0.045	TRAPEZOIDAL	0.5	0.5	0.02396
C74	culv6out	J332	ditch	26.772	0.045	TRAPEZOIDAL	0.5	0.5	0.06641
C20_3	J29	J333	ditch	28.979	0.045	TRAPEZOIDAL	0.5	0.5	0.06657
C93	J26	J335	ditch	29.755	0.045	TRAPEZOIDAL	0.5	0.5	0.04741
C97	J41	J336	ditch	30.576	0.045	TRAPEZOIDAL	0.5	0.5	0.01361
C190	J337	J338	ditch	36.071	0.045	TRAPEZOIDAL	0.5	0.5	0.13111
C137	J338	culv64in	ditch	11.968	0.045	TRAPEZOIDAL	0.5	0.5	0.11659
C2566	J2388	J8582	stream	92.032	0.045	TRAPEZOIDAL	0.5	0.5	0.0177
C2995	J2399	J2557	stream	57.271	0.045	TRAPEZOIDAL	0.6	0.6	0.01849
C3012	J2539	J2499	stream	52.824	0.045	TRAPEZOIDAL	0.5	0.5	0.03489
C3751	J2557	J8582	stream	12.494	0.045	TRAPEZOIDAL	0.6	0.6	0.01161
C20_4	J30	J1348	stream	14.167	0.045	TRAPEZOIDAL	0.5	0.5	0.06288
C132	culv61out	J907	stream	181.234	0.04	TRAPEZOIDAL	2	2	0.12013
C141	J64	OF21	stream	62.194	0.04	TRAPEZOIDAL	2	2	0.19112
C9	culv46out	J67	stream	78.452	0.04	TRAPEZOIDAL	2	2	0.08186
C161_1	culv83out	J70	stream	44.348	0.04	TRAPEZOIDAL	2	2	0.11729
C161_3	J70	J71	stream	35.256	0.04	TRAPEZOIDAL	2	2	0.11726
C161_4	J71	J615	stream	76.601	0.04	TRAPEZOIDAL	2	2	0.11729
C189	J98	OF16	stream	85.026	0.04	TRAPEZOIDAL	2	2	0.09378
C211	J122	J728	stream	21.513	0.04	TRAPEZOIDAL	2	2	0.28268
C217	J133	J8529	stream	15.737	0.04	TRAPEZOIDAL	2	2	0.03453
C150	J11	J214	stream	129.316	0.04	TRAPEZOIDAL	2	2	0.11345
C245	J90	OF4	stream	32.065	0.04	TRAPEZOIDAL	2	2	0.07745
C246	culv65out	OF17	stream	75.538	0.04	TRAPEZOIDAL	2	2	0.15404
C247	J79	OF11	stream	65.272	0.04	TRAPEZOIDAL	2	2	0.11083
C248	culv74out	OF10	stream	70.038	0.04	TRAPEZOIDAL	2	2	0.10045
C250	J96	OF15	stream	82.373	0.04	TRAPEZOIDAL	2	2	0.10459
C2846_3	J2499	J188	stream	44.315	0.045	TRAPEZOIDAL	0.5	0.5	0.02666

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C2846_4	J188	J184	stream	56.273	0.045	TRAPEZOIDAL	0.5	0.5	0.02209
C286	J192	J2399	stream	50.781	0.04	TRAPEZOIDAL	0.6	0.6	0.01944
C289	J166	J8375	stream	39.387	0.04	TRAPEZOIDAL	2	2	0.0682
C295	J196	J2539	stream	76.418	0.045	TRAPEZOIDAL	0.5	0.5	0.04279
C316	J215	J2004	stream	143.375	0.04	TRAPEZOIDAL	2	2	0.03355
C41	OF48	J65	stream	28.788	0.04	TRAPEZOIDAL	2	2	0.25785
C45	J65	OF22	stream	34.085	0.04	TRAPEZOIDAL	2	2	0.08836
C2362	J8582	J307	stream	136.901	0.045	TRAPEZOIDAL	0.5	0.5	0.02547
C301	J202	J8582	stream	46.272	0.04	TRAPEZOIDAL	2	2	0.00661
C271	J216	J219	stream	40.163	0.04	TRAPEZOIDAL	2	2	0.07995
C287	J183	J3286	stream	101.056	0.04	TRAPEZOIDAL	2	2	0.08225
C291	J309	J9170	stream	180.224	0.04	TRAPEZOIDAL	2	2	0.07218
C64	J331	J2258	stream	68.038	0.045	TRIANGULAR	0.1	1.5	0.01736
C74	J332	J1708	stream	78.058	0.045	TRAPEZOIDAL	0.5	0.5	0.0664
C20_3	J333	J30	stream	13.178	0.045	TRAPEZOIDAL	0.5	0.5	0.10237
C93	J335	J27	stream	35.881	0.045	TRAPEZOIDAL	0.5	0.5	0.04743
C97	J336	J42	stream	37.204	0.045	TRAPEZOIDAL	0.5	0.5	0.01401
C190	J1066	J337	stream	26.267	0.045	TRAPEZOIDAL	0.5	0.5	0.15164
C67	J10	culv1in	swale	28.524	0.045	TRIANGULAR	0.1	1.5	0.09516
C76_1	J285	J12	swale	37.869	0.045	TRIANGULAR	0.1	1.5	0.04324
C76_2	J12	culv7in	swale	63.661	0.045	TRIANGULAR	0.1	1.5	0.04184
C62	culv8out	culv7in	swale	2.144	0.045	TRIANGULAR	0.1	1.5	0.09369
C83_1	culv13out	J15	swale	18.556	0.045	TRIANGULAR	0.1	1.5	0.08742
C83_2	J15	culv12in	swale	7.846	0.045	TRIANGULAR	0.1	1.5	0.08751
C83_3	culv12out	J17	swale	14.734	0.045	TRIANGULAR	0.1	1.5	0.0822
C83	J17	J18	swale	40.66	0.045	TRIANGULAR	0.1	1.5	0.08344
C20_5	culv32out	J31	swale	35.744	0.045	TRIANGULAR	0.1	1.5	0.02253
C20_7	J31	J32	swale	52.151	0.045	TRIANGULAR	0.1	1.5	0.02252
C20_8	J32	J23	swale	42.438	0.045	TRIANGULAR	0.1	1.5	0.02251
C20_6	J33	J35	swale	101.52	0.045	TRAPEZOIDAL	0.5	0.5	0.03314

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C20_10	J35	J36	swale	69.04	0.045	TRAPEZOIDAL	0.5	0.5	0.03314
C20_11	J36	J34	swale	52.641	0.045	TRAPEZOIDAL	0.5	0.5	0.03315
C20	J37	J38	swale	67.28	0.045	TRIANGULAR	0.1	1.5	0.07257
C107_1	J44	J46	swale	73.493	0.045	TRIANGULAR	0.1	1.5	0.07498
C107_3	J46	J47	swale	28.797	0.045	TRIANGULAR	0.1	1.5	0.07497
C107_4	J47	culv34in	swale	38.598	0.045	TRIANGULAR	0.1	1.5	0.07498
C112	culv36out	J51	swale	51.244	0.045	TRIANGULAR	0.1	1.5	0.03106
C115	J52	culv34out	swale	46.6	0.045	TRIANGULAR	0.1	1.5	0.01665
C107_6	J52	J53	swale	66.959	0.045	TRIANGULAR	0.1	1.5	0.02601
C107_7	J53	J50	swale	105.121	0.045	TRIANGULAR	0.1	1.5	0.01331
C116	culv37out	culv38in	swale	50.925	0.045	TRIANGULAR	0.1	1.5	0.02017
C118_3	J444	J58	swale	57.728	0.045	TRIANGULAR	0.1	1.5	0.02599
C132_2	J59	culv62in	swale	46.011	0.045	TRIANGULAR	0.1	1.5	0.00724
C138	J62	culv78in	swale	96.446	0.045	TRIANGULAR	0.1	1.5	0.10846
C149	J66	J65	swale	65.633	0.045	TRIANGULAR	0.1	1.5	0.11503
C159_1	J48	J72	swale	126.049	0.045	TRIANGULAR	0.1	1.5	0.03498
C159_3	J72	J73	swale	49.785	0.045	TRIANGULAR	0.1	1.5	0.03499
C159_2	J73	J74	swale	48.067	0.045	TRIANGULAR	0.1	1.5	0.03499
C159_4	J74	J75	swale	43.622	0.045	TRIANGULAR	0.1	1.5	0.03498
C185	J94	J95	swale	10.769	0.045	TRIANGULAR	0.1	1.5	0.18022
C186	J241	culv66in	swale	41.405	0.045	TRIANGULAR	0.1	1.5	0.0128
C136	J60	culv63in	swale	47.666	0.045	TRIANGULAR	0.1	1.5	0.10723
C191	J103	J102	swale	18.611	0.045	TRIANGULAR	0.1	1.5	0.01343
C195	J101	OF47	swale	40.942	0.045	TRAPEZOIDAL	0.5	0.5	0.09102
C197	J104	J105	swale	141.34	0.045	TRIANGULAR	0.1	1.5	0.10397
C3	J109	J108	swale	37.352	0.045	TRIANGULAR	0.1	1.5	0.10656
C199	J107	J106	swale	86.974	0.045	TRIANGULAR	0.1	1.5	0.10505
C7	J111	J110	swale	124.989	0.045	TRIANGULAR	0.1	1.5	0.06339
C201	J116	J113	swale	40.642	0.045	TRIANGULAR	0.1	1.5	0.02478
C203	J115	J113	swale	18.552	0.045	TRIANGULAR	0.1	1.5	0.01871

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C205	J114	J117	swale	33.913	0.045	TRIANGULAR	0.1	1.5	0.06703
C210	J121	J122	swale	20.497	0.045	TRIANGULAR	0.1	1.5	0.05497
C218	culv51out	J132	swale	22.809	0.045	TRIANGULAR	0.1	1.5	0.01517
C219	culv50out	culv51in	swale	37.413	0.045	TRIANGULAR	0.1	1.5	0.01342
C220	J134	culv50in	swale	41.48	0.045	TRIANGULAR	0.1	1.5	0.00241
C224	J138	culv62in	swale	28.386	0.045	TRIANGULAR	0.1	1.5	0.03024
C226	J139	culv61in	swale	11.257	0.045	TRIANGULAR	0.1	1.5	0.0199
C230_1	J141	J145	swale	45.194	0.045	TRIANGULAR	0.1	1.5	0.00925
C230_2	J145	J142	swale	25.323	0.045	TRIANGULAR	0.1	1.5	0.02054
C230	J144	J145	swale	19.531	0.045	TRIANGULAR	0.1	1.5	0.06413
C232	J146	J148	swale	124.291	0.045	TRIANGULAR	0.1	1.5	0.06197
C150_1	culv58out	J148	swale	122.499	0.045	TRAPEZOIDAL	0.5	0.5	0.06134
C8	J147	culv39in	swale	30.884	0.045	TRIANGULAR	0.1	1.5	0.00777
C125	culv49out	culv48in	swale	24.64	0.045	TRIANGULAR	0.1	1.5	0.02858
C233	J150	culv49in	swale	24.632	0.045	TRIANGULAR	0.1	1.5	0.00406
C213	J129	J128	swale	43.926	0.045	TRIANGULAR	0.1	1.5	0.01737
C214	culv54in	J128	swale	14.21	0.045	TRIANGULAR	0.1	1.5	-0.01063
C255	J167	J165	swale	63.781	0.045	TRIANGULAR	0.1	1.5	0.01077
C258	J169	J170	swale	100.804	0.045	TRIANGULAR	0.1	1.5	0.02084
C260_1	J159	J170	swale	37.538	0.045	TRIANGULAR	0.1	1.5	0.02852
C260_2	J170	J160	swale	28.407	0.045	TRIANGULAR	0.1	1.5	0.02571
C261	J207	J162	swale	93.454	0.045	TRIANGULAR	0.1	1.5	0.01264
C266	J172	J167	swale	24.853	0.045	TRIANGULAR	0.1	1.5	0.01984
C268	J175	J176	swale	47.664	0.045	TRIANGULAR	0.1	1.5	0.01343
C275	J180	J131	swale	87.469	0.045	TRIANGULAR	0.1	1.5	0.04096
C279_1	J187	J189	swale	44.601	0.045	TRIANGULAR	0.1	1.5	0.01379
C279_2	J189	J185	swale	27.932	0.045	TRIANGULAR	0.1	1.5	0.01378
C293	J194	J172	swale	41.67	0.045	TRIANGULAR	0.1	1.5	0.02208
C317	J218	J176	swale	140.892	0.045	TRIANGULAR	0.1	1.5	0.05431
C157_3	J224	J225	swale	20.711	0.045	TRIANGULAR	0.1	1.5	0.00531

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C157_1	J225	J226	swale	21.541	0.045	TRIANGULAR	0.1	1.5	0.00529
C157_5	J226	J223	swale	31.342	0.045	TRIANGULAR	0.1	1.5	0.0053
C221_1	J137	J228	swale	47.54	0.045	TRIANGULAR	0.1	1.5	0.01508
C221_3	J228	J229	swale	30.048	0.045	TRIANGULAR	0.1	1.5	0.01508
C221_2	J229	J230	swale	49.512	0.045	TRIANGULAR	0.1	1.5	0.01511
C221_5	J230	J135	swale	23.546	0.045	TRAPEZOIDAL	0.5	0.5	0.01508
C102_1	J232	J233	swale	58.73	0.045	TRIANGULAR	0.1	1.5	0.02938
C102_3	J233	J234	swale	33.206	0.045	TRIANGULAR	0.1	1.5	0.00247
C54_3	J231	J235	swale	41.207	0.045	TRIANGULAR	0.1	1.5	0.01706
C46_1	J237	J238	swale	33.021	0.045	TRIANGULAR	0.1	1.5	0.01184
C46_3	J238	J239	swale	41.71	0.045	TRIANGULAR	0.1	1.5	0.01182
C46_2	J242	J243	swale	26.807	0.045	TRIANGULAR	0.1	1.5	0.02291
C46_5	J243	J93	swale	8.93	0.045	TRIANGULAR	0.1	1.5	0.02296
C180_1	J97	J244	swale	27.047	0.045	TRIANGULAR	0.1	1.5	0.00976
C180_2	J244	J91	swale	9.175	0.045	TRIANGULAR	0.1	1.5	0.00981
C178_1	J92	J245	swale	15.154	0.045	TRIANGULAR	0.1	1.5	0.00805
C157_4	J223	J246	swale	50.53	0.045	TRIANGULAR	0.1	1.5	0.00528
C21_2	J251	J252	swale	18.483	0.045	TRIANGULAR	0.1	1.5	0.01234
C21_8	J252	culv73out	swale	17.152	0.045	TRIANGULAR	0.1	1.5	0.01236
C21	J254	culv76in	swale	36.691	0.045	TRIANGULAR	0.1	1.5	0.06854
C46_6	J253	J255	swale	34.934	0.045	TRIANGULAR	0.1	1.5	0.02984
C46_7	J255	J78	swale	19.795	0.045	TRIANGULAR	0.1	1.5	0.02987
C132_1	J256	J257	swale	16.149	0.045	TRIANGULAR	0.1	1.5	0.01301
C132_1	J257	J59	swale	20.036	0.045	TRIANGULAR	0.1	1.5	0.00679
C229	J143	J258	swale	19.752	0.045	TRAPEZOIDAL	0.5	0.5	0.02887
C229	J258	culv58in	swale	19.911	0.045	TRAPEZOIDAL	0.5	0.5	0.02512
C243	J156	J259	swale	50.422	0.045	TRIANGULAR	0.1	1.5	0.03717
C243	J259	J155	swale	43.69	0.045	TRIANGULAR	0.1	1.5	0.03715
C118_4	J58	J260	swale	27.42	0.045	TRIANGULAR	0.1	1.5	0.02601
C234	J151	J266	swale	22.965	0.045	TRIANGULAR	0.1	1.5	0.00435

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C234	J266	culv55in	swale	34.079	0.045	TRIANGULAR	0.1	1.5	0.00434
C235	culv55out	J267	swale	24.897	0.045	TRIANGULAR	0.1	1.5	0.07131
C239	culv48out	J268	swale	46.045	0.045	TRIANGULAR	0.1	1.5	0.04108
C84	J269	J270	swale	25.144	0.045	TRIANGULAR	0.1	1.5	0.0035
C78_1	culv14out	J271	swale	38.987	0.045	TRIANGULAR	0.1	1.5	0.07066
C78_1	J271	J16	swale	91.903	0.045	TRIANGULAR	0.1	1.5	0.07067
C69	J8	J273	swale	47.367	0.045	TRIANGULAR	0.1	1.5	0.12193
C69	J273	culv5in	swale	38.985	0.045	TRIANGULAR	0.1	1.5	0.07925
C68	J10	J274	swale	45.066	0.045	TRIANGULAR	0.1	1.5	0.02242
C68	J274	J275	swale	22.363	0.045	TRIANGULAR	0.1	1.5	0.02241
C68	J275	J9	swale	26.842	0.045	TRIANGULAR	0.1	1.5	0.0224
C65	J8	J277	swale	22.381	0.045	TRIANGULAR	0.1	1.5	0.02923
C65	J277	J9	swale	16.726	0.045	TRIANGULAR	0.1	1.5	0.02925
C53	J6	J278	swale	45.465	0.045	TRIANGULAR	0.1	1.5	0.06894
C53	J278	culv2in	swale	45.652	0.045	TRIANGULAR	0.1	1.5	0.06894
C55	J7	J279	swale	91.647	0.045	TRIANGULAR	0.1	1.5	0.00994
C55	J279	culv1in	swale	27.612	0.045	TRIANGULAR	0.1	1.5	0.00992
C107_5	J286	J287	swale	39.427	0.045	TRIANGULAR	0.1	1.5	0.02964
C107_5	J287	culv37in	swale	19.925	0.045	TRIANGULAR	0.1	1.5	0.02962
C2271_4	culv47out	J288	swale	28.642	0.045	TRIANGULAR	0.1	1.5	0.06318
C206	J117	J289	swale	19.699	0.045	TRIANGULAR	0.1	1.5	0.02752
C208	J119	J290	swale	22.672	0.045	TRIANGULAR	0.1	1.5	0.07599
C208	J290	J291	swale	19.975	0.045	TRIANGULAR	0.1	1.5	0.08845
C84	J270	J292	swale	15.791	0.045	TRIANGULAR	0.1	1.5	0.00348
C206	J289	J293	swale	18.666	0.045	TRIANGULAR	0.1	1.5	0.02755
C118_4	J260	J294	swale	15.16	0.045	TRIANGULAR	0.1	1.5	0.026
C238	J153	J295	swale	22.923	0.045	TRIANGULAR	0.1	1.5	0.04467
C235	J267	J296	swale	29.744	0.045	TRIANGULAR	0.1	1.5	0.07135
C2271_4	J288	J297	swale	17.021	0.045	TRIANGULAR	0.1	1.5	0.06322
C109	culv34in	J298	swale	87.531	0.045	TRIANGULAR	0.1	1.5	-0.00038

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C46_4	J239	J299	swale	30.136	0.045	TRIANGULAR	0.1	1.5	0.01185
C178_2	J245	J300	swale	28.203	0.045	TRIANGULAR	0.1	1.5	0.00801
C239	J268	J301	swale	25.283	0.045	TRIANGULAR	0.1	1.5	0.04109
C159_6	J75	J302	swale	39.542	0.045	TRIANGULAR	0.1	1.5	0.03452
C4	J203	J195	swale	169.602	0.045	TRIANGULAR	0.1	1.5	0.04062
C287	J163	J183	swale	36.14	0.045	TRIANGULAR	0.1	1.5	0.08224
C16_1	J313	J315	swale	47.436	0.045	TRIANGULAR	0.1	1.5	0.0385
C16_2	J315	J311	swale	49.59	0.045	TRIANGULAR	0.1	1.5	0.0439
C22_2	J314	J316	swale	35.754	0.045	TRIANGULAR	0.1	1.5	0.05044
C22_3	J316	J311	swale	23.284	0.045	TRIANGULAR	0.1	1.5	0.05566
C16	J317	J191	swale	57.823	0.045	TRIANGULAR	0.1	1.5	0.01036
C310	J213	J318	swale	24.798	0.045	TRIANGULAR	0.1	1.5	0.0531
C313	J319	J201	swale	44.212	0.045	TRIANGULAR	0.1	1.5	0.03537
C264	J171	J320	swale	97.371	0.045	TRIANGULAR	0.1	1.5	0.03089
C264	J320	J161	swale	66.059	0.045	TRIANGULAR	0.1	1.5	0.03088
C278	J164	J321	swale	48.459	0.045	TRIANGULAR	0.1	1.5	0.06215
C278	J321	J131	swale	59.564	0.045	TRIANGULAR	0.1	1.5	0.06214
C310	J318	J322	swale	51.477	0.045	TRIANGULAR	0.1	1.5	0.02406
C292	J193	J208	swale	71.786	0.045	TRIANGULAR	0.1	1.5	0.04877
C292	J208	J162	swale	97.583	0.045	TRIANGULAR	0.1	1.5	0.04878
C303	J204	J209	swale	52.103	0.045	TRIANGULAR	0.1	1.5	0.01993
C303	J209	J191	swale	74.843	0.045	TRIANGULAR	0.1	1.5	0.01993
C296	J217	J195	swale	55.367	0.045	TRAPEZOIDAL	0.5	0.5	0.03736
C279	J190	J186	swale	77.423	0.045	TRIANGULAR	0.1	1.5	0.06086
C279	J186	J185	swale	61.611	0.045	TRIANGULAR	0.1	1.5	0.06085
C257	J168	J205	swale	66.925	0.045	TRIANGULAR	0.1	1.5	0.03931
C257	J205	J165	swale	37.093	0.045	TRIANGULAR	0.1	1.5	0.03931
C276	J181	J325	swale	84.604	0.045	TRIANGULAR	0.1	1.5	0.01653
C276	J325	J178	swale	36.391	0.045	TRIANGULAR	0.1	1.5	0.01654
C277	J182	J326	swale	123.824	0.045	TRIANGULAR	0.1	1.5	0.02195

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C277	J326	J178	swale	73.085	0.045	TRIANGULAR	0.1	1.5	0.02194
C55_3	J324	J328	swale	60.339	0.045	TRIANGULAR	0.1	1.5	0.02644
C55_6	J329	J328	swale	52.652	0.01	TRIANGULAR	0.1	1.5	0.02574
C55	J197	J187	swale	117.971	0.01	CIRCULAR	1	0	0.0637
C64	culv1out	J331	swale	50.322	0.045	TRIANGULAR	0.1	1.5	0.01735
C56	J334	J913	swale	178.793	0.01	CIRCULAR	1	0	0.04696
C137	J61	J338	swale	138.548	0.045	TRIANGULAR	0.1	1.5	0.11563
C19	J340	J341	swale	62.566	0.01	CIRCULAR	1	0	0.05271
C228	J140	J342	swale	47.154	0.045	TRIANGULAR	0.1	1.5	0.09703
C228	J342	culv61in	swale	7.214	0.045	TRIANGULAR	0.1	1.5	0.09707
C81	J343	culv13in	swale	30.112	0.045	TRIANGULAR	0.1	1.5	0.06814
C83_4	J344	J1519	swale	82.847	0.045	TRIANGULAR	0.1	1.5	0.08215
C55_7	J327	J345	swale	26.819	0.01	TRIANGULAR	0.1	1.5	0.0097
C1	J776	OF26	WDT	43.413	0.045	TRAPEZOIDAL	2	5	0.08587
C2	J823	J776	WDT	52.495	0.045	TRAPEZOIDAL	2	5	0.11408
C5	J955	J8605	WDT	51.747	0.045	TRAPEZOIDAL	2	2	0.10071
C6	J869	J955	WDT	55.927	0.045	TRAPEZOIDAL	2	2	0.06218
C10	culv40out	J9278	WDT	18.227	0.045	TRAPEZOIDAL	2	5	0.03915
C23	J1417	J1413	WDT	69.753	0.045	TRAPEZOIDAL	2	2	0.03351
C26	J1373	J1417	WDT	40.905	0.045	TRAPEZOIDAL	2	2	0.02022
C27	J1415	J1373	WDT	13.717	0.045	TRAPEZOIDAL	2	2	0.02582
C28	J1439	J1415	WDT	33.424	0.045	TRAPEZOIDAL	2	2	0.04816
C30	J9108	J1439	WDT	69.667	0.045	TRAPEZOIDAL	2	2	0.04235
C31	J1572	J9108	WDT	19.502	0.045	TRAPEZOIDAL	2	2	0.04532
C33	J1655	J1572	WDT	108.944	0.045	TRAPEZOIDAL	2	2	0.02947
C34	J1708	J1655	WDT	44.668	0.045	TRAPEZOIDAL	2	2	0.05581
C38	J1832	J1708	WDT	118.089	0.045	TRAPEZOIDAL	2	2	0.02938
C39	J8562	J1832	WDT	11.182	0.045	TRAPEZOIDAL	2	2	0.01109
C281	J1632	J8394	WDT	81.546	0.045	TRAPEZOIDAL	2	2	0.08883
C283	J1671	J1632	WDT	17.415	0.045	TRAPEZOIDAL	2	2	0.10432

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C297	J8504	J8974	WDT	22.482	0.045	TRAPEZOIDAL	2	2	0.04966
C307	J1764	J8504	WDT	36.798	0.045	TRAPEZOIDAL	2	2	0.05607
C312	J1837	J1764	WDT	49.096	0.045	TRAPEZOIDAL	2	2	0.03685
C314	J8507	J1837	WDT	40.689	0.045	TRAPEZOIDAL	2	2	0.07319
C357	J8735	J8507	WDT	463.216	0.045	TRAPEZOIDAL	2	2	0.02616
C388	J8691	J8735	WDT	210.131	0.045	TRAPEZOIDAL	2	5	0.0019
C400	J9170	J8691	WDT	90.879	0.045	TRAPEZOIDAL	2	5	0.0044
C421	J8700	J9170	WDT	159.036	0.045	TRAPEZOIDAL	2	5	0.00084
C430	J8569	J8700	WDT	35.657	0.045	TRAPEZOIDAL	2	2	0.00749
C461	J3005	J2977	WDT	52.065	0.045	TRAPEZOIDAL	2	2	0.02031
C469	J3123	J3005	WDT	61.918	0.045	TRAPEZOIDAL	2	2	0.01299
C505	J8689	J3123	WDT	186.88	0.045	TRAPEZOIDAL	2	2	0.01697
C516	J3366	J8689	WDT	71.049	0.045	TRAPEZOIDAL	2	2	0.01375
C778	culv39out	J9278	WDT	17.35	0.045	TRAPEZOIDAL	2	5	0.03703
C898	J8381	J8671	WDT	55.963	0.045	TRAPEZOIDAL	2	2	-0.0039
C916	J8549	J2	WDT	29.761	0.045	TRAPEZOIDAL	2	2	0.01445
C957	J1126	J8549	WDT	62.374	0.045	TRAPEZOIDAL	2	2	0.02577
C1235	J8629	storage1	WDT	29.255	0.045	TRAPEZOIDAL	2	2	0.00021
C1290	J8455	J8503	WDT	108.372	0.045	TRAPEZOIDAL	2	2	0.02798
C1293	J1526	J8629	WDT	54.95	0.045	TRAPEZOIDAL	2	2	0.00222
C1337	J8568	J1526	WDT	41.473	0.045	TRAPEZOIDAL	2	2	-0.00046
C1379	J8872	J8455	WDT	79.02	0.045	TRAPEZOIDAL	2	2	0.03174
C1409	J1492	J1455	WDT	10.3	0.045	TRAPEZOIDAL	2	2	0.078
C1495	J8550	J8695	WDT	12.222	0.045	TRAPEZOIDAL	2	2	0.0153
C1557	J1345	J8872	WDT	180.173	0.045	TRAPEZOIDAL	2	2	0.05795
C1578	J8572	J1492	WDT	147.561	0.045	TRAPEZOIDAL	2	2	0.07192
C1713	J8529	J8974	WDT	123.878	0.045	TRAPEZOIDAL	2	2	0.06817
C1736	J312	J8550	WDT	121.618	0.045	TRAPEZOIDAL	2	2	0.0259
C1761	J8324	J1066	WDT	30.399	0.045	TRAPEZOIDAL	2	2	0.11238
C1767	J3022	J2909	WDT	82.525	0.045	TRAPEZOIDAL	2	2	0.01497

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C1851	J1487	J1345	WDT	220.412	0.045	TRAPEZOIDAL	2	2	0.04381
C1942	J8658	J1487	WDT	58.368	0.045	TRAPEZOIDAL	2	2	0.0223
C1952	J8375	J57	WDT	29.481	0.045	TRAPEZOIDAL	2	2	-0.00068
C2016	J1699	J8572	WDT	303.527	0.045	TRAPEZOIDAL	2	2	0.03863
C2017	J1089	J8872	WDT	39.391	0.045	TRAPEZOIDAL	2	2	0.01023
C2116	J8405	J8375	WDT	89.357	0.045	TRAPEZOIDAL	2	2	0.00278
C2136	J1706	J1590	WDT	49.469	0.045	TRAPEZOIDAL	2	2	0.00841
C2163	J1905	J8562	WDT	19.988	0.045	TRAPEZOIDAL	2	2	0.01311
C2187	J1302	J1089	WDT	93.883	0.045	TRAPEZOIDAL	2	2	0.04323
C2217	J8486	J1699	WDT	122.33	0.045	TRAPEZOIDAL	2	2	0.03507
C2227	J1956	J1905	WDT	33.222	0.045	TRAPEZOIDAL	2	2	0.04281
C2239	J8371	J8405	WDT	63.734	0.045	TRAPEZOIDAL	2	2	0.00202
C2269	J539	OF35	WDT	79.032	0.045	TRAPEZOIDAL	2	2	0.32324
C2321	J2022	J1956	WDT	49.547	0.045	TRAPEZOIDAL	2	2	0.009
C2328	J1817	J1706	WDT	95.469	0.045	TRAPEZOIDAL	2	2	0.00612
C2395	J3410	J8371	WDT	74.897	0.045	TRAPEZOIDAL	2	2	0.00419
C2419	J2808	J8646	WDT	818.014	0.045	TRAPEZOIDAL	2	2	0.03868
C2433	J630	J539	WDT	66.522	0.045	TRAPEZOIDAL	2	2	0.24228
C2435	J1460	J261	WDT	26.879	0.045	TRAPEZOIDAL	2	2	0.03045
C2440	J1796	J8486	WDT	100.388	0.045	TRAPEZOIDAL	2	2	0.04971
C2490	J1304	J1302	WDT	167.592	0.045	TRAPEZOIDAL	2	2	0.0508
C2506	J3435	J3381	WDT	46.556	0.045	TRAPEZOIDAL	2	2	0.02826
C2513	J2769	J8703	WDT	35.687	0.045	TRAPEZOIDAL	2	2	0.02195
C2517	J2896	J8700	WDT	103.258	0.045	TRAPEZOIDAL	2	2	0.04532
C2527	J1772	J8695	WDT	135.593	0.045	TRAPEZOIDAL	2	2	0.02298
C2532	J2543	J8691	WDT	100.308	0.045	TRAPEZOIDAL	2	2	0.00586
C2534	J8386	J8689	WDT	27.432	0.045	TRAPEZOIDAL	2	2	0.00091
C2535	J8596	J1817	WDT	88.454	0.045	TRAPEZOIDAL	2	2	0.00157
C2578	J2520	J2543	WDT	15.961	0.045	TRAPEZOIDAL	2	2	-0.00219
C2615	J1664	J1574	WDT	218.233	0.045	TRAPEZOIDAL	2	2	0.05797

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C2616	J1501	J8658	WDT	38.738	0.045	TRAPEZOIDAL	2	2	0.05341
C2671	J2476	J2520	WDT	41.542	0.045	TRAPEZOIDAL	2	2	0.00096
C2714	J1993	J8596	WDT	32.609	0.045	TRAPEZOIDAL	2	2	0.00104
C2715	J1380	J1304	WDT	106.635	0.045	TRAPEZOIDAL	2	2	0.05866
C2724	J907	J8605	WDT	28.04	0.045	TRAPEZOIDAL	2	2	0.11702
C2729	J1535	J1501	WDT	49.619	0.045	TRAPEZOIDAL	2	2	0.05063
C2734	J2432	J2476	WDT	23.245	0.045	TRAPEZOIDAL	2	2	0.00151
C2742	J1628	J1664	WDT	47.056	0.045	TRAPEZOIDAL	2	2	0.02679
C2750	J8354	J8596	WDT	91.896	0.045	TRAPEZOIDAL	2	2	0.03397
C2787	J1649	J1519	WDT	48.782	0.045	TRAPEZOIDAL	2	2	0.08472
C2818	J1505	J8572	WDT	99.736	0.045	TRAPEZOIDAL	2	2	0.04123
C2821	J1586	J1649	WDT	14.079	0.045	TRAPEZOIDAL	2	2	0.07687
C2826	J2386	J2432	WDT	35.247	0.045	TRAPEZOIDAL	2	2	0.02549
C2831	J1747	J8562	WDT	124.662	0.045	TRAPEZOIDAL	2	2	0.04503
C2845	J2977	J2808	WDT	178.564	0.045	TRAPEZOIDAL	2	2	0.00063
C2856	J1859	J8550	WDT	50.999	0.045	TRAPEZOIDAL	2	2	0.02395
C2866	J1919	J8354	WDT	55.176	0.045	TRAPEZOIDAL	2	2	0.01374
C2873	J2447	J184	WDT	15.306	0.045	TRAPEZOIDAL	2	2	-0.00157
C2888	J1561	J1505	WDT	27.689	0.045	TRAPEZOIDAL	2	2	0.02623
C2890	J1784	J1796	WDT	173.331	0.045	TRAPEZOIDAL	2	2	0.03643
C2892	J972	J907	WDT	72.329	0.045	TRAPEZOIDAL	2	2	0.1076
C2897	J1609	J1628	WDT	56.589	0.045	TRAPEZOIDAL	2	2	0.07247
C2898	J1553	culv52out	WDT	34.916	0.045	TRAPEZOIDAL	2	2	0.01722
C2943	J1868	J8507	WDT	35.04	0.045	TRAPEZOIDAL	2	2	0.0711
C2947	J1687	J8504	WDT	51.628	0.045	TRAPEZOIDAL	2	2	0.05642
C2987	J1907	J8486	WDT	163.824	0.045	TRAPEZOIDAL	2	2	0.032
C2997	J813	J781	WDT	23.883	0.045	TRAPEZOIDAL	2	2	0.0604
C3019	J2266	J2386	WDT	60.423	0.045	TRAPEZOIDAL	2	2	-0.00215
C3032	J728	J615	WDT	20.75	0.045	TRAPEZOIDAL	2	2	0.14716
C3040	J2090	J1993	WDT	122.939	0.045	TRAPEZOIDAL	2	2	0.03193

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C3042	J1426	J1380	WDT	116.977	0.045	TRAPEZOIDAL	2	2	0.04821
C3062	J2569	J2447	WDT	49.271	0.045	TRAPEZOIDAL	2	2	0.01715
C3084	J1350	storage1	WDT	118.815	0.045	TRAPEZOIDAL	2	2	0.00853
C3103	J2577	J2569	WDT	11.782	0.045	TRAPEZOIDAL	2	2	0.01435
C3115	J2968	J2921	WDT	41.827	0.045	TRAPEZOIDAL	2	2	0.07215
C3117	J1728	J1784	WDT	66.472	0.045	TRAPEZOIDAL	2	2	0.02924
C3138	J1935	J1859	WDT	94.227	0.045	TRAPEZOIDAL	2	2	0.01725
C3139	J458	OF33	WDT	9.007	0.045	TRAPEZOIDAL	2	2	-0.08266
C3160	J8347	J3435	WDT	233.455	0.045	TRAPEZOIDAL	2	2	0.05628
C3172	J1774	J1728	WDT	17.23	0.045	TRAPEZOIDAL	2	2	0.02009
C3202	J3069	J2977	WDT	104.423	0.045	TRAPEZOIDAL	2	2	0.00935
C3203	J1445	J8394	WDT	133.094	0.045	TRAPEZOIDAL	2	2	0.16106
C3221	J3425	J3418	WDT	61.754	0.045	TRAPEZOIDAL	2	2	0.03996
C3224	J3286	J8386	WDT	47.634	0.045	TRAPEZOIDAL	2	2	0.07675
C3228	J3555	J8347	WDT	24.237	0.045	TRAPEZOIDAL	2	2	-0.00169
C3246	J913	J8381	WDT	169.568	0.045	TRAPEZOIDAL	2	2	0.03663
C3272	J3343	J8371	WDT	17.329	0.045	TRAPEZOIDAL	2	2	0.00514
C3287	J3437	J3410	WDT	16.731	0.045	TRAPEZOIDAL	2	2	0.01243
C3321	J3490	J8347	WDT	56.602	0.045	TRAPEZOIDAL	2	2	-0.00124
C3332	J1807	J1774	WDT	65.485	0.045	TRAPEZOIDAL	2	2	0.05225
C3335	J1850	J1935	WDT	30.961	0.045	TRAPEZOIDAL	2	2	0.0073
C3336	J951	J913	WDT	39.761	0.045	TRAPEZOIDAL	2	2	0.02556
C3388	J1421	J8313	WDT	35.839	0.045	TRAPEZOIDAL	2	2	0.00815
C3438	J8974	J1671	WDT	115.149	0.045	TRAPEZOIDAL	2	2	0.08471
C3558	J2754	J9170	WDT	33.528	0.045	TRAPEZOIDAL	2	2	0.00486
C3562	J8503	J1099	WDT	46.799	0.045	TRAPEZOIDAL	2	2	0.02548
C3572	J1455	J9108	WDT	59.204	0.045	TRAPEZOIDAL	2	2	0.10424
C3573	J8695	J8568	WDT	138.496	0.045	TRAPEZOIDAL	2	2	0.0264
C3638	J76	J3022	WDT	61.962	0.045	TRAPEZOIDAL	2	2	0.00809
C3651	J1574	J8658	WDT	115.78	0.045	TRAPEZOIDAL	2	2	0.0433

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C3697	J3381	J3410	WDT	11.35	0.045	TRAPEZOIDAL	2	2	0.00908
C3721	J3418	J8386	WDT	182.878	0.045	TRAPEZOIDAL	2	2	0.06695
C3758	J2921	J8569	WDT	65.938	0.045	TRAPEZOIDAL	2	2	0.0067
C3759	J1683	J8568	WDT	142.231	0.045	TRAPEZOIDAL	2	2	0.03601
C3776	J2258	J2022	WDT	250.857	0.045	TRAPEZOIDAL	2	2	0.0447
C3811	J3199	J8405	WDT	32.083	0.045	TRAPEZOIDAL	2	2	0.0057
C3824	J2004	J8354	WDT	30.13	0.045	TRAPEZOIDAL	2	2	0.03184
C12	J8646	culv76in	WDT	284.884	0.045	TRAPEZOIDAL	2	2	0.07785
C14	culv76out	OF1	WDT	48.122	0.045	TRAPEZOIDAL	2	2	0.14703
C15	J590	OF31	WDT	116.982	0.045	TRAPEZOIDAL	2	2	0.16095
C3075_3	J1611	culv11in	WDT	43.459	0.045	TRAPEZOIDAL	2	2	0.07636
C3175_1	J1726	culv53in	WDT	12.064	0.045	TRAPEZOIDAL	2	2	0.06671
C3175_4	culv53out	J1687	WDT	41.328	0.045	TRAPEZOIDAL	2	2	0.0941
C24	J445	OF3	WDT	26.684	0.045	TRAPEZOIDAL	2	2	0.12102
C2271_1	J8313	culv47in	WDT	100.364	0.045	TRAPEZOIDAL	2	2	0.03149
C1994_4	culv57out	J8324	WDT	115.89	0.045	TRAPEZOIDAL	2	2	0.1297
C2798_2	culv34out	J630	WDT	116.532	0.045	TRAPEZOIDAL	2	2	0.13202
C2867_1	J781	J1	WDT	41.801	0.045	TRAPEZOIDAL	2	2	0.00809
C2867_2	J1	culv34in	WDT	23.915	0.045	TRAPEZOIDAL	2	2	0.02899
C3767_1	J1158	J2	WDT	40.341	0.045	TRAPEZOIDAL	2	2	0.01314
C32	J2	culv31in	WDT	75.042	0.045	TRAPEZOIDAL	2	2	0.00506
C35	culv31out	culv30in	WDT	4.189	0.045	TRAPEZOIDAL	2	2	0.02388
C13_1	J1138	J3	WDT	44.853	0.045	TRAPEZOIDAL	2	5	0.02156
C13	culv30out	J123	WDT	31.801	0.045	TRAPEZOIDAL	2	2	0.01566
C36	culv10out	J8568	WDT	143.57	0.045	TRAPEZOIDAL	2	2	0.05505
C11_1	culv45out	culv44out	WDT	21.988	0.045	TRAPEZOIDAL	2	2	0.01192
C11_2	culv44out	culv40in	WDT	90.339	0.045	TRAPEZOIDAL	2	10	0.02048
C42	culv24out	culv25in	WDT	7.621	0.045	TRAPEZOIDAL	2	2	0.16627
C43	culv25out	culv45in	WDT	49.727	0.045	TRAPEZOIDAL	2	2	0.00257
C1144_1	J1392	culv20in	WDT	39.558	0.045	TRAPEZOIDAL	2	2	0.01264

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C1144_5	culv21in	J1376	WDT	30.236	0.045	TRAPEZOIDAL	2	2	0.04967
C47	culv21out	culv22out	WDT	14.331	0.045	TRAPEZOIDAL	2	2	0.03491
C48	culv16out	culv17in	WDT	37.369	0.045	TRAPEZOIDAL	2	2	0.01774
C53_1	storage1	J4	WDT	58.744	0.045	TRAPEZOIDAL	2	2	0.0017
C1207_1	storage1	J5	WDT	48.606	0.045	TRAPEZOIDAL	2	2	0.00206
C1207_2	J5	J1392	WDT	32.425	0.045	TRAPEZOIDAL	2	2	0.01234
C3075_4	J19	J8629	WDT	90.418	0.045	TRAPEZOIDAL	2	2	0.02277
C2672_4	J20	J8629	WDT	89.078	0.045	TRAPEZOIDAL	2	2	0.01293
C87	J22	storage1	WDT	83.739	0.045	TRAPEZOIDAL	2	2	0.00119
C17_1	culv28out	J27	WDT	63.253	0.045	TRAPEZOIDAL	2	2	0.03783
C20_1	J1413	J28	WDT	47.134	0.045	TRAPEZOIDAL	2	2	0.0105
C20_2	J28	J1348	WDT	14.338	0.045	TRAPEZOIDAL	2	5	0.00028
C1142_1	J1099	J34	WDT	27.952	0.045	TRAPEZOIDAL	2	2	0.01317
C1142_2	J34	culv33in	WDT	37.748	0.045	TRAPEZOIDAL	2	2	0.01314
C1087_1	culv33out	J38	WDT	157.557	0.045	TRAPEZOIDAL	2	2	0.05486
C1087_2	J38	J1126	WDT	24.149	0.045	TRAPEZOIDAL	2	2	0.05487
C17_3	J27	J42	WDT	83.516	0.045	TRAPEZOIDAL	2	2	0.03784
C17_4	J42	J1138	WDT	18.465	0.045	TRAPEZOIDAL	2	5	0.04043
C3369_1	J1363	J58	WDT	188.186	0.045	TRAPEZOIDAL	2	2	0.04644
C118	culv82out	J590	WDT	25.498	0.045	TRAPEZOIDAL	2	2	0.35668
C127	J136	J869	WDT	79.03	0.045	TRAPEZOIDAL	2	2	0.18393
C130	culv62out	J8324	WDT	135.573	0.045	TRAPEZOIDAL	2	2	0.09867
C9_1	J9278	J67	WDT	116.203	0.045	TRAPEZOIDAL	2	5	0.04656
C9_2	J67	J990	WDT	46.365	0.045	TRAPEZOIDAL	2	5	0.04798
C21_1	J8394	J69	WDT	50.084	0.045	TRAPEZOIDAL	2	2	0.18246
C22_4	J81	J445	WDT	2.296	0.045	TRAPEZOIDAL	2	2	0.1824
C1728_3	J100	OF19	WDT	47.327	0.045	TRAPEZOIDAL	2	2	0.13622
C3_1	culv80out	J105	WDT	4.214	0.045	TRAPEZOIDAL	2	2	0.56037
C3_2	J105	J823	WDT	18.405	0.045	TRAPEZOIDAL	2	2	0.14696
C4_1	J8605	J106	WDT	19.407	0.045	TRAPEZOIDAL	2	2	0.06812

Table G-3: Conduits PCSWMM Parameters

Name	Inlet Node	Outlet Node	Tag	Length (m)	Rough-ness	Cross-Section	Geom1 (m)	Geom2 (m)	Slope (m/m)
C4_2	J106	culv80in	WDT	8.627	0.045	TRAPEZOIDAL	2	2	0.0633
C7_1	culv59out	J110	WDT	75.49	0.045	TRAPEZOIDAL	2	2	0.08442
C7_2	J110	J869	WDT	64.473	0.045	TRAPEZOIDAL	2	2	0.08441
C3270_1	J493	J124	WDT	22.683	0.045	TRAPEZOIDAL	2	2	0.22499
C3270_2	J124	J458	WDT	24.757	0.045	TRAPEZOIDAL	2	2	0.08848
C29_1	culv54out	J126	WDT	28.162	0.045	TRAPEZOIDAL	2	2	0.0906
C8_1	J990	J148	WDT	26.074	0.045	TRAPEZOIDAL	2	5	0.01922
C8_2	J148	culv59in	WDT	6.391	0.045	TRAPEZOIDAL	2	5	0.01972
C1421_3	J8703	J131	WDT	35.371	0.045	TRAPEZOIDAL	2	2	0.03972
C2693_1	J2997	J174	WDT	23.495	0.045	TRAPEZOIDAL	2	2	0.01477
C2693_2	J174	J57	WDT	39.859	0.045	TRAPEZOIDAL	2	2	0.01478
C29_3	J126	J227	WDT	131.795	0.045	TRAPEZOIDAL	2	2	0.18854
C29_4	J227	culv68in	WDT	71.831	0.045	TRAPEZOIDAL	2	2	0.17791
C21_4	J69	J250	WDT	19.442	0.045	TRAPEZOIDAL	2	2	0.09752
C21_7	J250	culv71in	WDT	18.675	0.045	TRAPEZOIDAL	2	2	0.09754
C2058	J1590	J265	WDT	137.894	0.045	TRAPEZOIDAL	2	2	0.04304
C2058	J265	J149	WDT	39.254	0.045	TRAPEZOIDAL	2	2	0.05854
C63_1	J284	J206	WDT	88.84	0.045	TRAPEZOIDAL	0.5	0.5	0.06124
C1577	J219	J8703	WDT	101.474	0.045	TRAPEZOIDAL	2	2	0.02833
C3614	J2909	J219	WDT	108.432	0.045	TRAPEZOIDAL	2	2	0.0317
C1421_2	J308	J2754	WDT	172.561	0.045	TRAPEZOIDAL	2	2	0.05421
C19	J1348	J341	WDT	22.267	0.045	TRAPEZOIDAL	2	5	0.02003
C19	J341	culv28in	WDT	21.903	0.045	TRAPEZOIDAL	2	5	0.02005
C13_2	J3	J123	WDT	21.411	0.045	TRAPEZOIDAL	2	10	0.00458
C13_2	J123	culv44in	WDT	44.165	0.045	TRAPEZOIDAL	2	10	0.00457

APPENDIX H

EXAMPLE CULVERT END STIFFENER

Photo 1: Example Culvert End Stiffener