Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut

Rankin Inlet, NU

Draft Report
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Prepared for:
The Municipality of Rankin Inlet

Prepared by:
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Abbreviations

asl	above sea level
bgs	below ground surface
CGS	Community and Government Services
CSA	Canadian Standards Association
DEM	Digital Elevation Model
GN	Government of Nunavut
GSC	Geological Survey of Canada
IDPA	identified drainage problem area
km	kilometres
m	metres
MAAT	mean annual air temperature
MAGT	mean annual ground temperature
mm	millimetres
NISI	Northern Infrastructure Standardization Initiative
Nunami Stantec	Nunami Stantec Limited

Definitions and Terminology

Active layer – The top layer of ground that is subject to annual freezing and thawing in areas underlain by permafrost (Canadian Standards Association; CSA, 2014).

Catchment – The area which collectively drains to a specified outlet location.

Channel – A natural or apparently natural drainage feature with defined bed and banks and which conveys perennial, intermittent, or ephemeral flow.

Constraint – Naturally occurring features that have the potential to negatively affect the design, construction and maintenance of infrastructures. Examples of terrain constraints include slope steepness, drainage conditions, snow accumulation areas, steep bedrock ridges and ice-rich permafrost.

Cross Culvert – A culvert which conveys flow beneath a travelled road.

Cryostructure – The structural characteristics of frozen earth materials. Includes the amount, distribution, type and arrangement of ice within the frozen material (National Standard of Canada, 2017)

Culvert Invert – the bottom of the end of a culvert (upstream or downstream).

Culvert Obvert – the top of the end of a culvert (upstream or downstream)

Ditch – A constructed or apparently constructed drainage feature with defined bed and banks and which conveys perennial, intermittent, or ephemeral flow.

Drainage Draw – A natural or constructed drainage feature which collects and conveys semi-concentrated flow, but does not have defined bed and banks.

Drainage Pathway – General term to describe drainage direction; includes overland flow, drainage draws, ditches, and channels.

Entrance culvert – A culvert which conveys flow beneath a driveway.

Existing developed areas – Existing built-up areas of Rankin Inlet.

Geohazard – Features or terrain conditions having the potential to lead to localized or widespread damage to property and threaten personal safety. Examples of geohazards are ground subsidence related to permafrost thaw degradation, landslide, flooding and shoreline erosion.

Ground ice – A general term referring to all types of ice contained in freezing and frozen ground (National Standard of Canada 2017).

Overland Flow – Surface drainage occurring in a non-channelized, mostly evenly distributed manner over the land.

Permafrost - Defined on the basis of temperature: it is ground (i.e. soil and/or rock) that remains at or below 0 °C for at least two consecutive years (French, 2007).

Planned future subdivisions – Blocks 8, 9, and 10 within the Municipal Reserve (MR) Zones, as outlined and described in the RFP.

Watershed – Analogous to a catchment but often used for larger scale applications and/or referring to a large river or lake (e.g., the Meliadine River watershed).

1 INTRODUCTION

1.1 General

Nunami Stantec Limited (Nunami Stantec) was contracted by the Municipality of Rankin Inlet (Municipality) to complete a geotechnical evaluation and drainage planning for the hamlet. As instructed in the Request for Quote (RFQ) developed by the Municipality and subsequent proposal prepared by Nunami Stantec, the scope of work is two-fold and includes the following key objectives:

Drainage assessment and planning component:

- Evaluate the existing community drainage infrastructure and make specific recommendations regarding how local drainage can be improved,
- Develop a master drainage plan that will:
  - Specify techniques to plan for and implement the Rankin Inlet community drainage system to account for the effects of a changing climate and permafrost regime,
  - Describe practices for site and community planning that help to maintain the service life of community infrastructure, as well as the natural landscape processes through avoidance, mitigation and drainage system management practices, and
  - Provide low cost, practical solutions that can be adapted and implemented given local constraints on capacity and resources.

Geotechnical evaluation component:

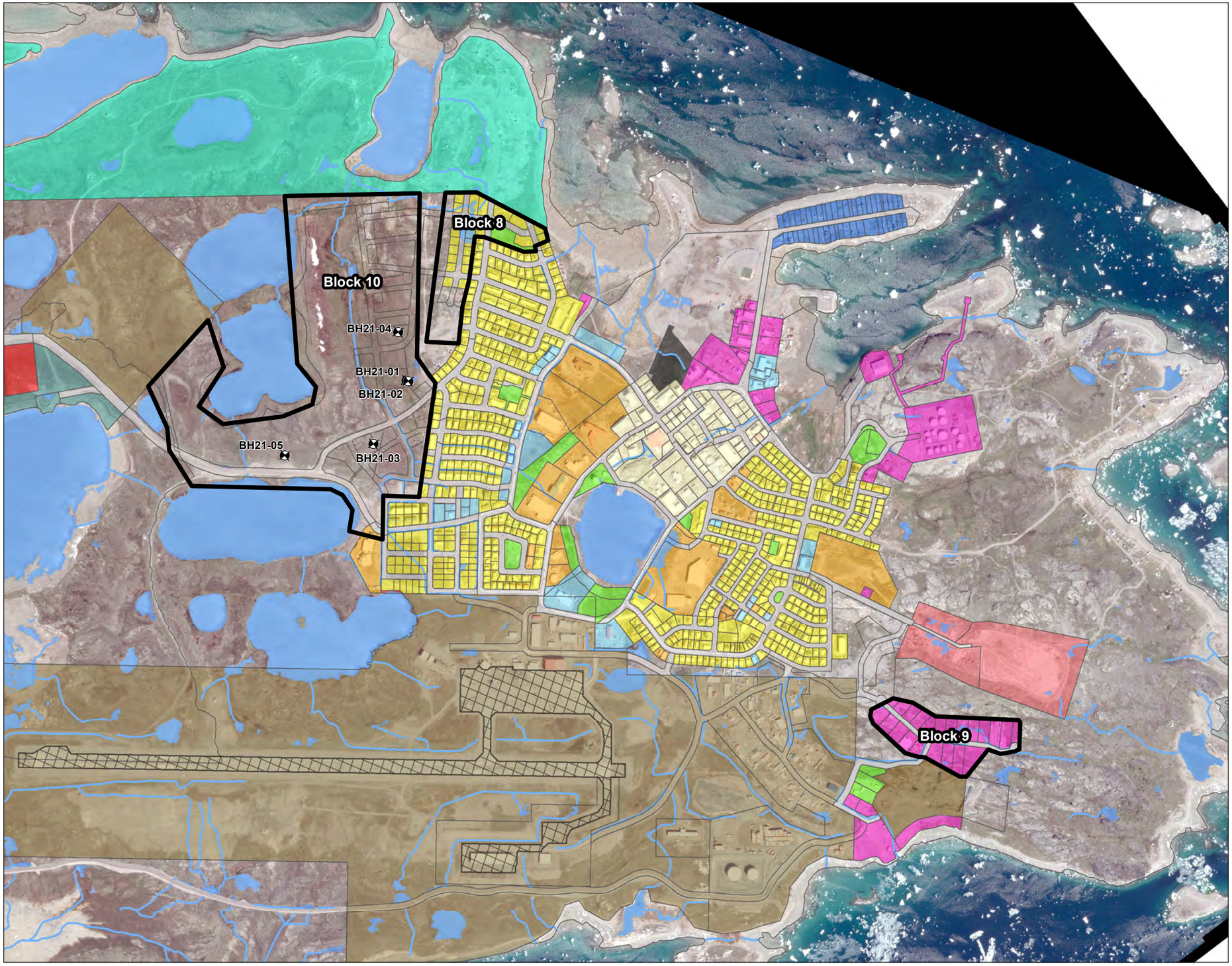
- Conduct a geotechnical investigation of the existing townsite and future development areas through visual observations and borehole investigations.
- Include detailed terrain mapping, including surficial geology, slope assessment, sub-watersheds and drainage conditions, permafrost and periglacial conditions.
- Identify terrain constraints and geohazards, and discuss the impacts of climate change on local permafrost.
- Develop a qualitative construction suitability map categorizing the study area as suitable for development, conditionally suitable for development or unsuitable for development.
- Provide recommendations regarding site works and/or preparations required for future developments, especially for areas identified as conditionally suitable for development.

1.2 Study Area

Rankin Inlet is located on the northwestern shore of Hudson Bay (62°48’ N, 92°05’ W), in the Kivalliq Region of Nunavut. It is the largest hamlet and second-largest settlement in Nunavut after Iqaluit, with an estimated population of 2,842 (2016 census, Government of Nunavut).

As detailed in the RFQ, the study area for the drainage planning includes the existing built-up area of the townsite and the immediate environs around the townsite (Figure 1-1). The “immediate environs” refers to land where new subdivisions may be developed within a twenty-year planning horizon, which includes planned future subdivisions (surveyed subdivisions) and Municipal Reserve (MR) areas identified in (see the 2021-2041 Community Plan in Appendix B).

The study area for the geotechnical evaluation includes the planned future subdivisions (surveyed subdivisions) and most MR areas identified in the Community Plan. Specific areas of interest include proposed subdivisions identified as Block 8, Block 9 and Block 10 (see Figure 1-1 for locations and conceptual layout). Drainage assessment and planning was also completed in these blocks.



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Legend

- Completed Boreholes
- Focus Area
- Watercourses
- Waterbodies
- Runway
- Parcels

Zoning

- Commercial
- Community Core
- Community Use
- Hinterland
- Industrial
- Inuit Owned Lands
- Open Space
- Quarry
- Residential
- Restricted Development
- Road
- Transportation
- Unknown
- Waste Disposal
- Waterfront Recreational

N

0 250 500 metres

(At original document size of 11x17)
1:12,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Government of Nunavut
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by ADC on 2022-02-08
TR by OP on 2022-02-08

Client/Project
144903017-001 REVC
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
1-1

DRAFT

Title
Study Area

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2 SUMMARY OF SITE CONDITIONS

The following sections summarize general site conditions based on a desktop review and terrain mapping.

2.1 Desktop Terrain assessment

2.1.1 Background Data Review

Key background data was obtained from a variety of sources including (but not limited to):

- Bedrock geology (Tella et al. 2005)
- Surficial geology (McMartin 2002; GSC 2017)
- Watershed Study (Land Data Technologies 2005)
- Literature on permafrost, geohazards and potential effects of climate change (Brown 1978; Thurber Consultants Ltd. 1988; Brown et al. 1997, 2002; Fortier and Allard 2004; Golder Associates 2014; Tremblay et al. 2015; Ednie and Smith 2015; Oldenborge et al. 2017; Leblanc and Oldenborge 2020)
- Available geotechnical investigation reports (Genivar 2014; Exp. Services Inc. 2016; Canadrill 2021)

Other key references and guideline documents include:

- CAN/BNQ 2501-500/2017 Geotechnical Site Investigations for Buildings Foundations in permafrost zones (National Standard of Canada 2017).
- CSA S503-20: Community drainage system planning, design, and maintenance in northern communities (CSA 2020).
- CSA S501-14: Moderating the effects of permafrost degradation on existing building foundations (CSA 2014).
- CSA PLUS 4011-19: Technical guide: Infrastructure in permafrost: A guideline for climate change adaptation. (CSA 2019).

2.1.2 Desktop Terrain Mapping

Desktop terrain mapping was conducted to inform on the local topography, distribution of surficial materials and geoprocesses occurring on the landscape. The mapping was conducted using ESRI ArcGIS and Global Mapper software using the following data:

- Satellite Imagery of Rankin Inlet
- Historical air photos (1954, 1965, 1976, 1986 and 1992)
- Satellite-derived 1m Digital Elevation Model (DEM)

- Building footprint, infrastructure, and transportation vector datasets
- Hydrology and watershed vector datasets
- Contours and cadastral vector datasets

Findings of the desktop terrain mapping are presented on the figures in Appendix C. Historical air photos are presented in Appendix D.

2.2 Regional Setting

The municipality of Rankin Inlet is located within the Kivalliq region of Nunavut, along the northwestern coast of Hudson Bay. The landscape of the area is bedrock-controlled, where low hills are locally covered with discontinuous drift deposits. Hummocky bedrock outcrops are frequent. These landforms have undergone modification during late-glacial and postglacial marine submergence which extended as far as 150 km inland from the current coastline, reaching a maximum elevation of approximately 170 m above present sea level (Bellehumeur-Génier et al. 2017).

Crustal uplift is still active in the region.

2.3 Bedrock Geology

Regional bedrock comprises Archaen to Paleoproterozoic metavolcanic, metasedimentary, and intrusive rocks of the Western Churchill Province of the Canadian Shield. Within the hamlet, bedrock comprises basalt, andesite, sandstone, argillite and other metamorphosed sedimentary rocks (Tella et al., 1986). Roughly 80% of the landscape east of the townsite comprises bedrock or outcrops with sparse vegetation cover. Where exposed, the bedrock surface is irregular, and the overburden thickness is expected to vary significantly (0-10 m) over short distances.

Regional bedrock geology mapping by Tella et al. (2005) is presented in Figure C-1 (Appendix C).

2.4 Surficial Geology

The surficial geology surrounding Rankin Inlet consists of till, glaciomarine, marine and glaciofluvial deposits with numerous eskers and bedrock outcrops (McMartin 2002; GSC 2017). The developed portion of the hamlet sits on a mix of till and marine-washed materials. An esker is present northwest from the Municipality. Lower elevations along the shoreline are characterized by tidal flats and littoral sediments.

Surficial geology mapping by McMartin (2002) is presented in Figure C-2 (Appendix C). Material descriptions are provided.

2.5 Topography

Within the developed portion of the hamlet, ground elevations range from sea level along the shoreline, to a maximum of approximately 30 m above sea level (asl) on top of the bedrock hills north of the tank farm area. Because of its overall low elevation, the area occupied by the hamlet was submerged during the postglacial period (Andrews 1989).

Most of the community was developed on flat to gently undulating terrain no steeper than 3°. Moderate to moderately steep slopes (15-30°) are found locally throughout the community (e.g., alongside building pads, road embankments or road cuts, along the shorelines). Short steep slopes in excess of 30° are present; however mainly limited to undeveloped bedrock terrain.

The topography within the planned future subdivisions is as follows:

- **Block 8** is located on a low hill (southwest-northeast oriented) with elevations ranging from 10 to 21 m asl. The dominant slope is oriented towards the east and range between 5 and 10°. The west-facing slope is steeper, with areas reaching above 15°.
- **Block 9** is located on bedrock-controlled terrain with elevations ranging from 27 to 37 masl. The topography is flat to gently undulating (0-10°), with localized steeper slopes (< 25°) found along rock outcrops.
- **Block 10** is located in low-lying terrain with elevations ranging from 4 to 19 m asl. The topography is flat to gently undulating (0-10°). Topography supporting snow drifting and accumulation occur to the northeast (along the snow fence) and northwest (along the esker ridge) portions of the block (Figure 2-1).

A map presenting DEM-derived slope classes and countour data is presented in Figure C-3 (Appendix C). Topographic cross sections representative of conditions within Block 8, Block 9 and Block 10 are presented in Figure 2-1 to Figure 2-5.

Figure 2-1 Topographic Cross-Section Locations within Block 8 and Block 10

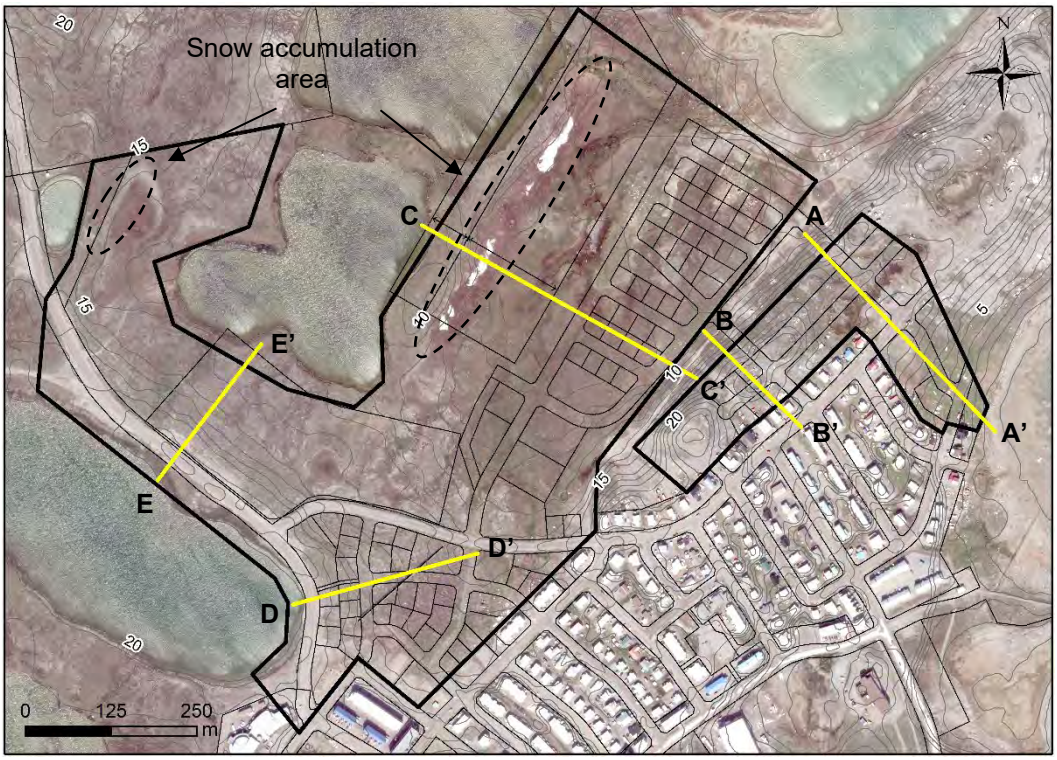


Figure 2-2 Topographic Cross-Sections within Block 8 (A-A' and B-B' on Figure 2-1)

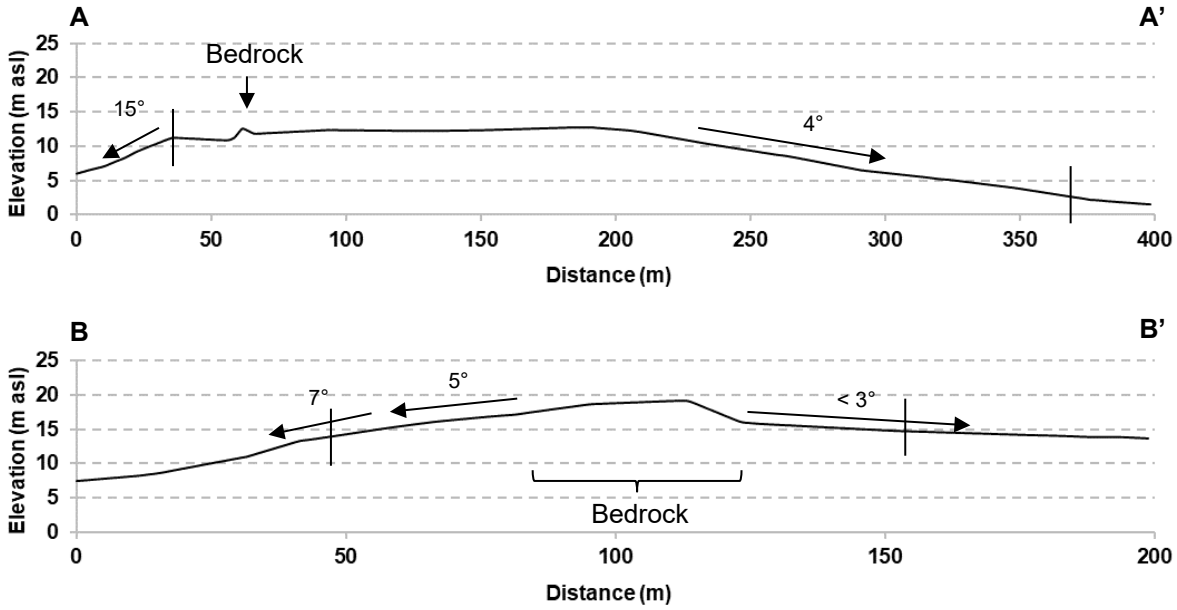


Figure 2-3 Topographic Cross-Sections within Block 10 (C-C' to E-E' on Figure 2-1)

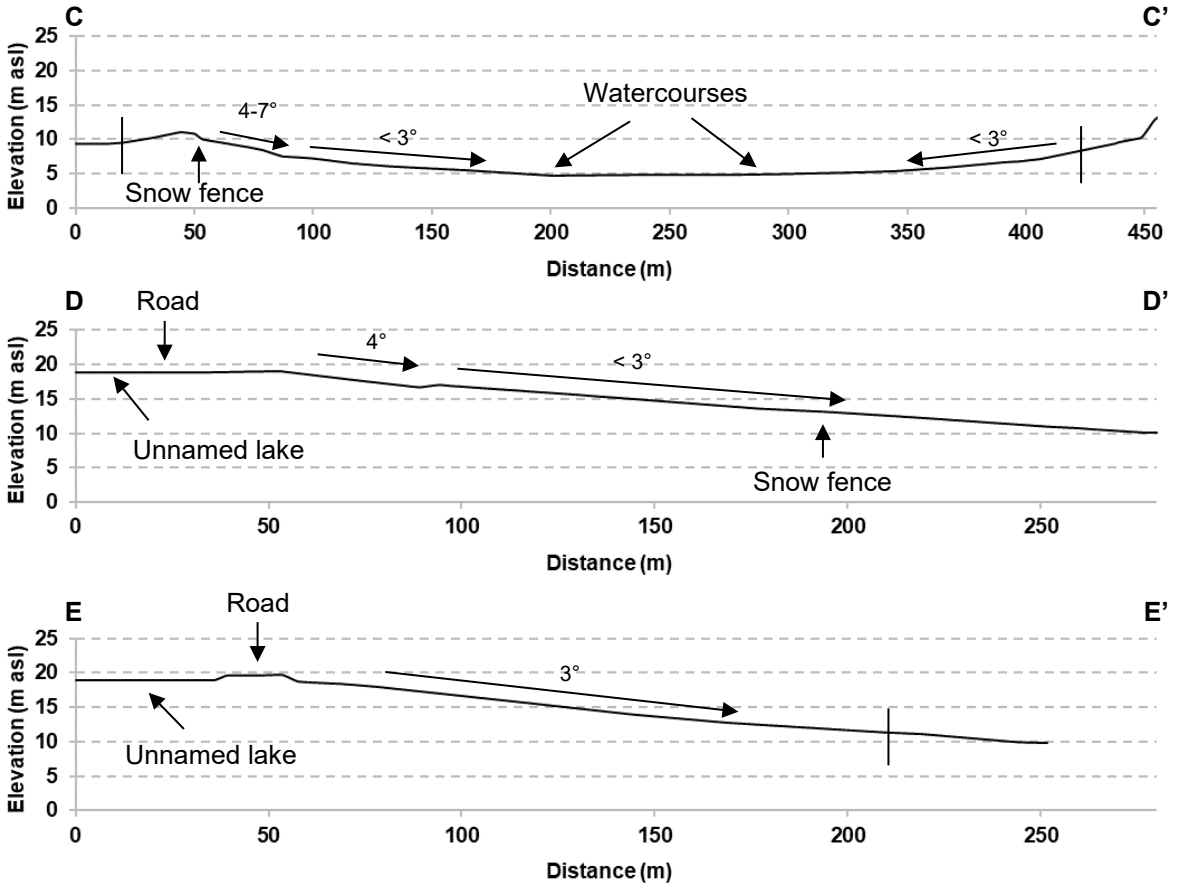


Figure 2-4 Topographic Cross-Section Locations within Block 9

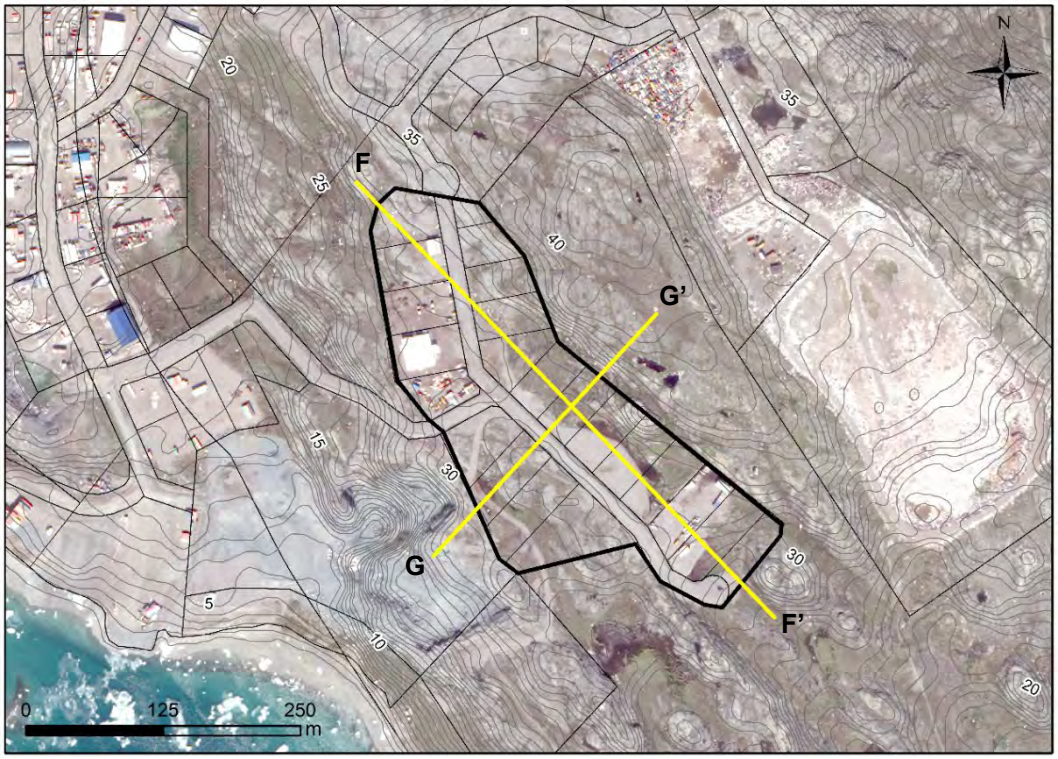
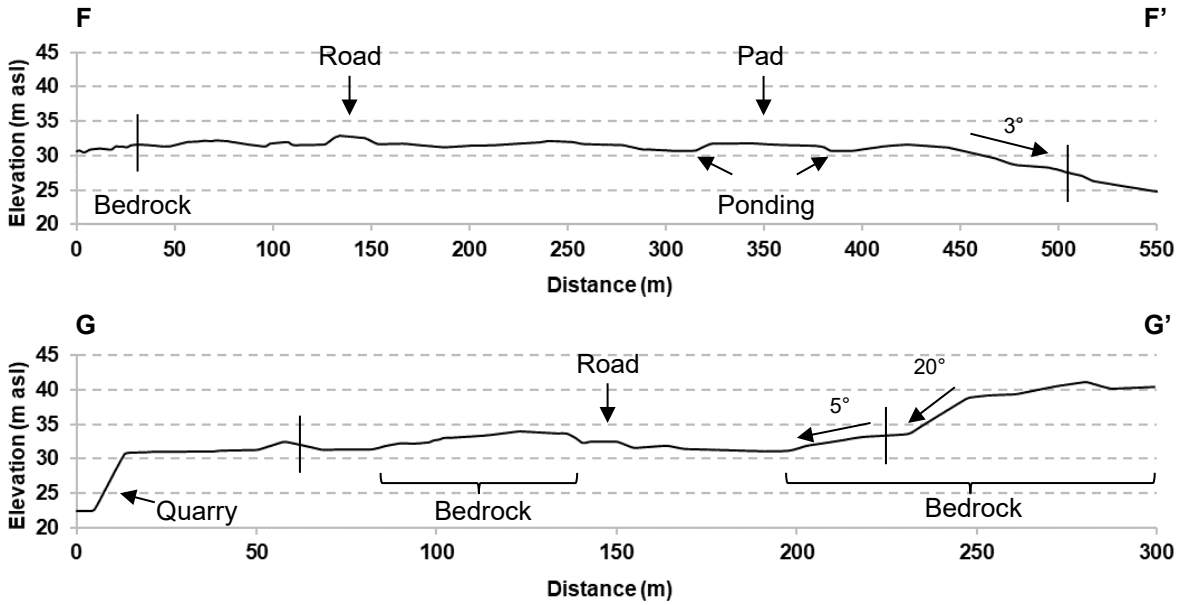


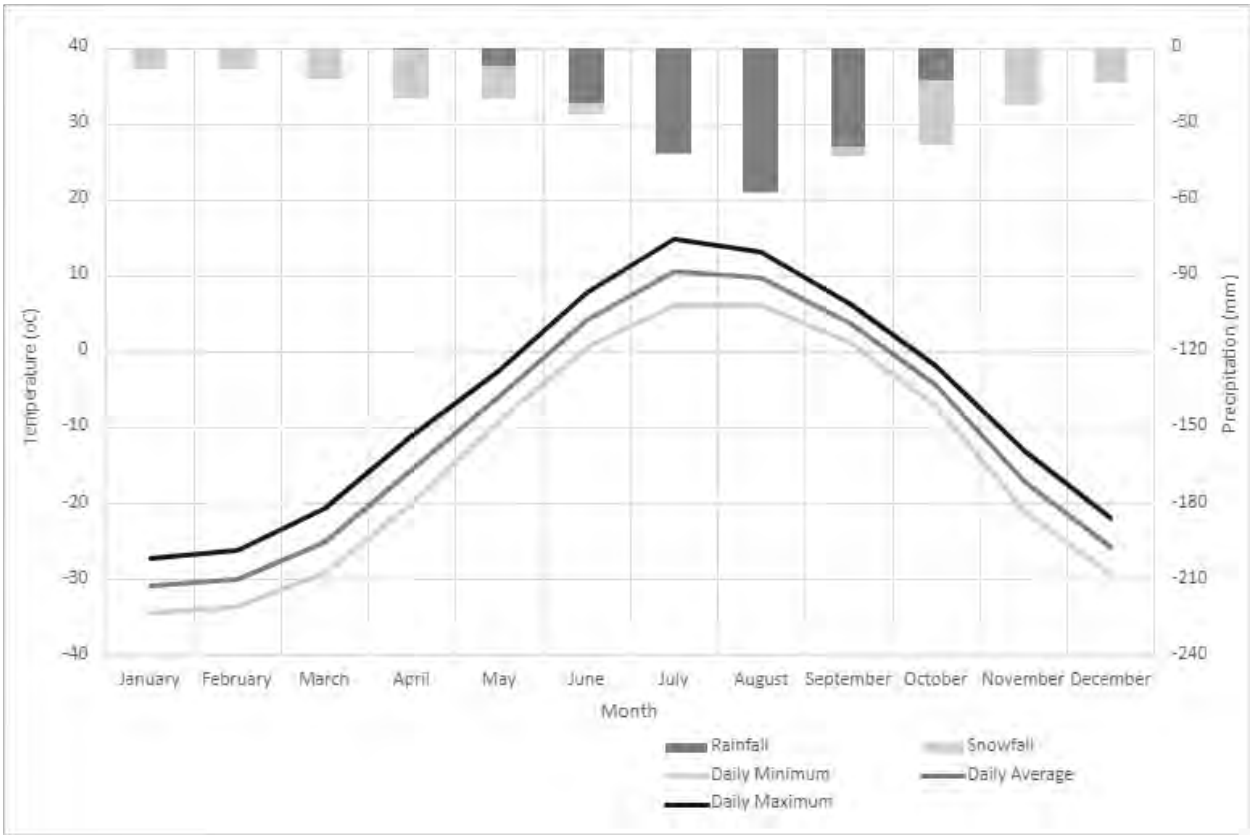
Figure 2-5 Topographic Cross-Sections within Block 9 (F-F' and G-G' on Figure 2-4)



2.6 Climate and Environment

Rankin Inlet has a high arctic ecoclimate. Summers are relatively short, cool, and moist, while winters are long and cold. Climate normals (1981 to 2010) including precipitation (snowfall and rainfall) and temperature are presented in Figure 2-6 (GoC 2021). The total annual precipitation was 314 mm, of which 41% fell as snow. Mean daily air temperatures varied from 10.5°C in July to -30.8°C in January, and mean annual air temperature (MAAT) was -10.5°C. The average thawing and freezing indices were 897°C days and 4698°C days, respectively.

Figure 2-6 Temperature and Precipitation at Rankin Inlet A (1981 – 2010 Climate Normals)



Degree days for a given day are the number of degrees Celsius that the mean temperature is above or below a specified temperature. Degree days for a given period of time is the sum of those daily degrees Celsius values, across the given period of time. Heating degree days provide an estimate of the heating requirements for buildings, and consider temperatures below 18°C. Growing degree days are used in agriculture as an index of crop growth, and consider temperatures above 5°C. Figure 2-7 illustrates the heating degree days and growing degree days (based on 1981 – 2010 climate normals) at Rankin Inlet A (GoC 2021). Figure 2-7 indicates that heating of homes is required for much of the year, and vegetation growth is limited to the summer months (predominantly in July and August).

Figure 2-7 Degree Days at Rankin Inlet A (1981 – 2010 Climate Normals)

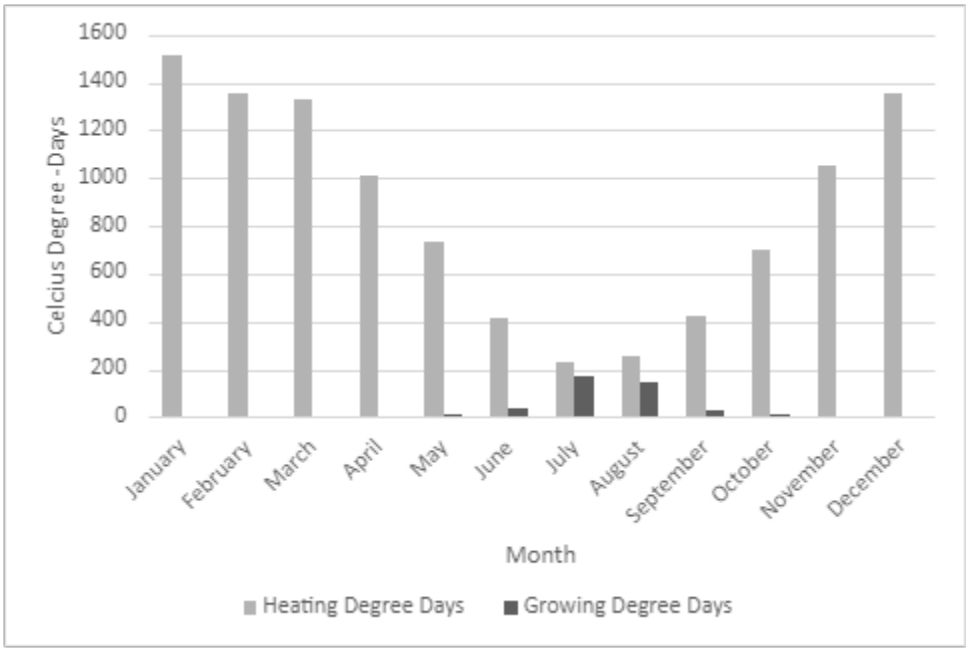
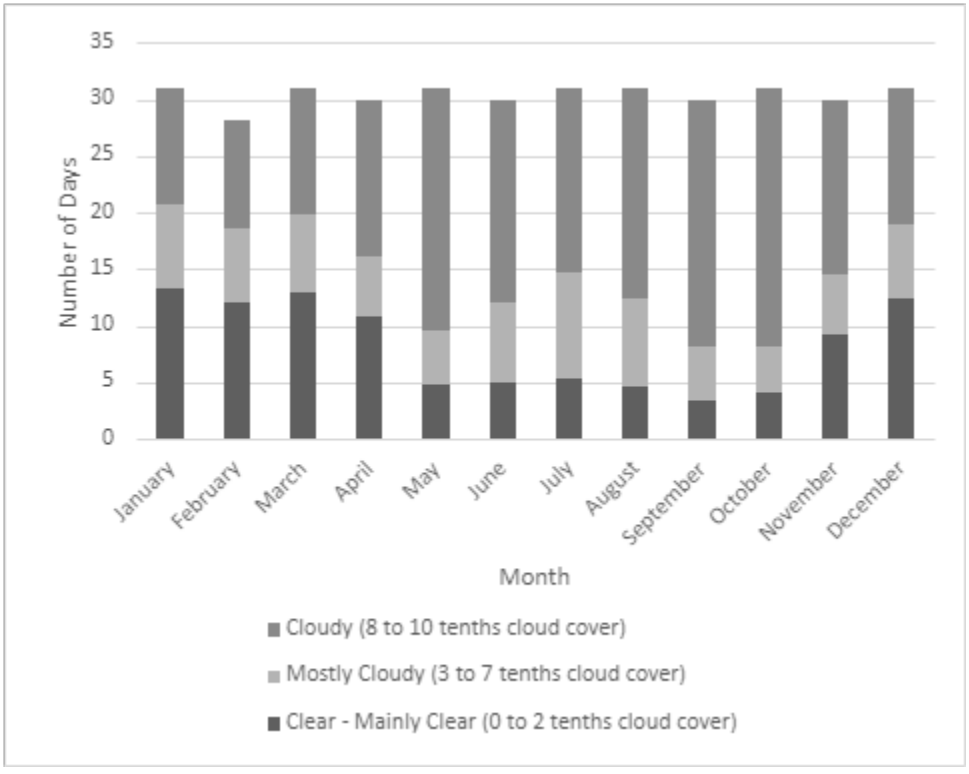


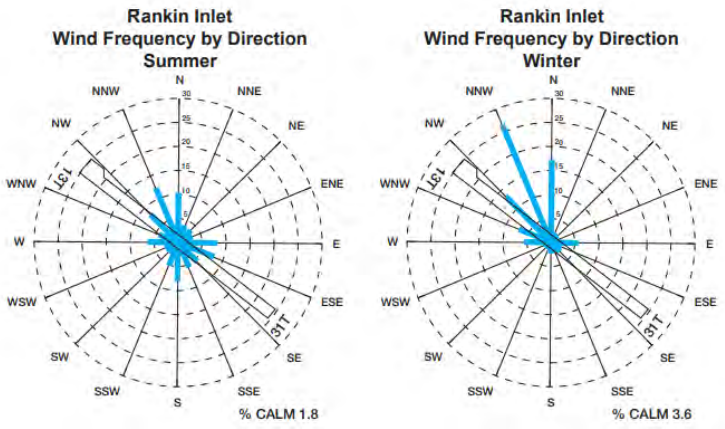
Figure 2-8 summarizes the monthly total cloud cover at the Rankin Inlet A location (GoC 2021), expressed as the amount (in tenths) of clouds covering the dome of the sky. Cloudy conditions are more typical in the summer months, and clear days are more typical in the winter months.

Figure 2-8 Cloud Conditions at Rankin Inlet A (1981 – 2010 Climate Normals)



In the winter, strong north-northwest winds are common across the entire area (Figure 2-9), frequently bringing blowing snow and blizzard conditions (Nav Canada 2010). The average number of blizzard events per year in Rankin Inlet for the period 1982 to 1999 is 16.9 (Nav Canada 2010). These extreme windy conditions can often last for days and result in considerable spatial redistribution of snowpack within the variable topography (e.g., snowdrifts in certain areas, barren ground in others). Two snow fences preventing snow from reaching the community were built to the northwest within Block 10. It is understood that the snow fence located closer to the townsite, to the south of Block 10, is to be relocated.

Figure 2-9 Wind Rosettes for Rankin Inlet Airport



SOURCE: Nav Canada (2010)

2.7 Hydrology

The hydrology in Rankin Inlet is largely snowmelt driven although notable precipitation and runoff events can occur in the summer months. The spatial redistribution of snowpack over the winter is likely to result in increased runoff rates and volumes in catchments with snow accumulation. Ditch and culvert icing during spring melt is a common occurrence in northern communities, and may inhibit drainage in affected areas (CSA 2020).

Watershed (catchment boundary linework) and hydrology (mapped waterbodies and watercourses) vector datasets from Land Data Technologies (2005) were compared to the topographic and aerial imagery datasets from CGS in ESRI ArcGIS. As necessary based on the topographic and aerial imagery, adjustments to the CGS catchment boundary and watercourse/waterbody linework were made. In certain cases, the Land Data Technologies (2005) catchments were amalgamated to simplify the catchment network. The result of this desktop analysis was a preliminary drainage review, consisting of preliminary catchment boundaries and preliminary watercourse/waterbody networks which formed the starting point for the drainage assessment and planning task (Section 3.1, Section 4.1).

Historical air photos indicate that development throughout the townsite, and within Block 9, was conducted over historical lakes. Drainage-related problematics now occur, and ground movements were reported by Oldenborger et al. (2016) within some of these areas (Figure 2-10).

Figure 2-10 Historical Lakes and Adjacent Drainage Features. A) 1954 Historical Air Photo; B) 2019 Satellite Imagery

1. Ponding occurs in the back of houses. Ground movement causing the houses to shift shortly after construction was reported in the area (Oldenborger et al. 2016).
2. Poorly drained terrain still observed in the area.
3. Buildings in the area need levelling to adjust to ground movement (Oldenborger et al. 2016).
4. Ground movement causing damage to municipal pipe system was reported (Oldenborger et al. 2016). This section is located adjacent to the historical outlet of the lake (road appears subsided)
5. It is understood that fill in the area often needs repair.
6. Drainage problematics occur within this area.
7. Ponding occurs surrounding new pad in this area. Tension cracks observed along the road.

2.8 Permafrost

Rankin Inlet is located within the continuous permafrost zone (Brown et al. 2002). In the region, the permafrost was estimated to reach 300 m below ground surface (bgs) near the coast (Brown 1978), and from 360 to 495 m bgs when inland (Golder Associates 2014). Based on permafrost and ground ice conditions mapping from Brown et al. (1997), low ground ice content is generally expected near Rankin Inlet. Because of postglacial land emergence in the area and general low elevation of Rankin Inlet (<30 m asl), it is expected that saline permafrost is present.

The presence of pore water salinity induces freeze point depression. The freezing point depresses approximately 0.28°C for every 5 ppt of salinity. Hence, soils with a pore water salinity of 32 ppt will have an actual freeze/thaw temperature of about -2°C. In Rankin Inlet, Hivon and Sego (1993) reported pore water salinities ranging from 2.6 to 30.6 ppt. Canadrill (2021) reported pore water salinities ranging from 0 to 6.8 ppt, within shallow (< 4 m deep) marine washed till deposits located southwest from Block 10.

2.8.1 Ground Temperature

Mean annual ground temperatures (MAGT) is often used to characterize permafrost temperature (CSA 2014). In Rankin Inlet MAGT were reported to vary from -8°C to -9°C at 30 m bgs in 1960, and from -7°C to -8°C at 16 m bgs in the year 1998 (Tremblay et al. 2015). More recent data published 2020 reported MAGT at the top of permafrost ranging between -9.5°C and -5.5°C. The MAGT near 7 m bgs was reported at -6.7°C in undisturbed ground and -5.5°C in developed land within the townsite (Leblanc and Oldenborge 2020).

2.8.2 Active Layer

The thickness of the active layer depths depends on many site-specific variables such as surficial material, ground disturbance, vegetation and snow cover, drainage, soil moisture content, MAAT, topography and sun exposure. Throughout the hamlet, the active layer is expected to vary from 0.3 m (generally in fine-grained soils and organic rich deposits), to up to 4 m in well-drained granular deposits (Oldenborge et al. 2017).

Refer to Section 4.2.2.5 for active layer measurements obtained during the September 2021 geotechnical investigation program.

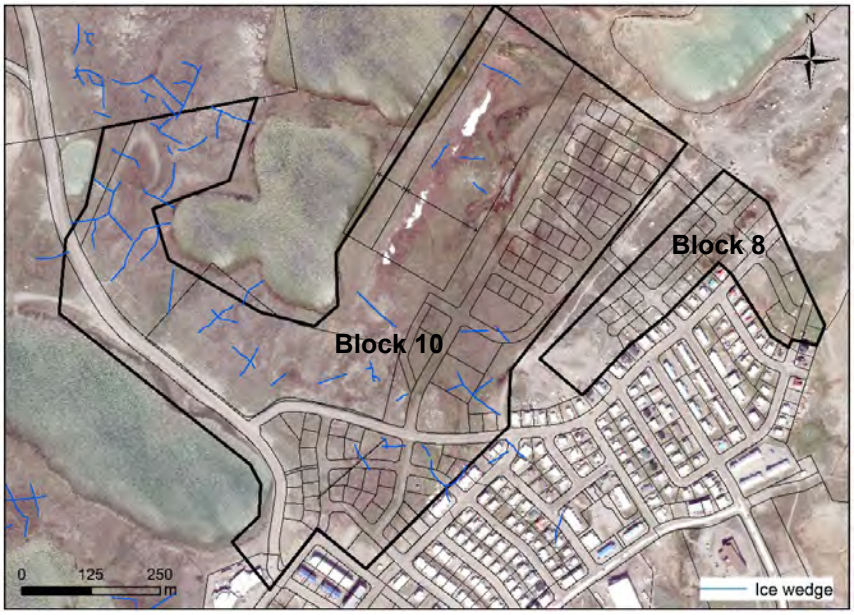
2.8.3 Ground Ice

Ground ice is expected to be present in the form of pore ice (interstitial ice) segregated ice (discrete layers or lenses) and ice wedges. Ice wedges are ground ice features widely distributed in permafrost areas. They result from the thermal contraction of permafrost soils, creating cracks that fill with ice formed from snowmelt water. The yearly repetition of this process facilitates the creation of ice wedges that form huge polygonal networks throughout periglacial landscapes (Fortier and Allard 2004).

Ice wedges near Rankin Inlet were previously mapped by McMartin (2002). Based on the interpretation of satellite imagery and air photos, mapping of ice wedges surrounding the study area was refined as part of the present assessment. Leblanc and Oldenborger (2020) noted the presence of ice-rich permafrost in nearshore marine ice wedge polygons and in poorly drained alluvial and marine sediments. They also noted lenticular and layered cryostructures within the upper layer of till permafrost, though, the overall profile was characterized as not being ice rich.

Within the study area, ice wedges are predominantly located within Block 10 (Figure 2-11). Although the presence of ice wedges was previously reported within Block 9 (GSC 2017); none were identified on the imagery or as part of the field reconnaissance.

Figure 2-11 Location of Ice Wedges in Block 10 (blue lines represent ice wedges)



2.9 Periglacial processes

Frost boils result from the sorting of materials within the active layer due to the repeated cycles of freeze and thaw. The process allows for a preferential migration of finer particles ahead of the migrating freezing plane, just as larger particles would migrate under gravity when mounds and frost-heaved structures are produced (French 2007).

Frost boils were observed in the western and northern portion of Block 10 and developed mostly in marine washed till deposits.

Solifluction is a form of slow mass movement controlled by frost creep (downslope movement occurring from freeze-thaw cycles), gelifluction (movement of saturated soil during thawing of frozen substrate) and plug-like flow (soil sliding at the active layer and ice-rich permafrost boundary) (Mackay 1981; Matsuoka 2001; French 2007). Common resulting feature is the formation of solifluction lobes and sheets; generally consisting of smooth, elongated to stepped features ranging in size from a few decimetres to several metres in length and width.

Solifluction lobes were observed in the northern portion of Block 10 and developed in marine washed till deposits.

2.10 Climate Change

Air temperatures in the Arctic have warmed at approximately twice the global rate for several decades (Anisimov et al. 2007). During the 1981-2014 period, MAAT at the Municipality of Rankin Inlet rose about 2°C at an average rate of 0.068°C yr^{-1} (Tremblay et al. 2015).

The CSA provides guidance for screening the vulnerability of a development to climate change (CSA 2019). Based on future projections of air temperatures derived from climate models under a "high" greenhouse gas scenario, Rankin Inlet may experience a change in MAAT of 1.4°C by 2040, and up to 3.8°C by 2070. Acknowledging that observed permafrost warming in communities of the eastern and high Arctic appears consistent with the changes in regional air temperature (Ednie and Smith 2015), it seems reasonable taking the conservative assumption that near-surface ground temperature increases will match MAAT increases (i.e., 1.4°C warmer by 2040) (Table 2-1).

Table 2-1 Projected Seasonal Mean Air Temperature Change Under a "High" Greenhouse Gas Emission Scenario

Year	Winter	Spring	Summer	Autumn	Annual
2011–2040	2.0	1.3	1.0	1.4	1.4
2041–2070	5.6	3.3	2.7	3.7	3.8
2071–2100	9.8	5.9	4.9	6.1	6.7

NOTE: The value displayed in each cell represents the average change in mean seasonal or annual temperature for the specified 30-year period when compared to the average mean seasonal temperature from 1986 to 2015 (Arctic Sector C1).
SOURCE: modified from CSA (2019).

The overall sensitivity of permafrost can be classified based upon ground material, ice content, and an estimate of the ground temperature (CSA 2019). For the purpose of climate change screening, the CSA developed a permafrost sensitivity ranking based on the following three main factors:

- the likelihood of thaw settlement due to active layer deepening
- the potential for a reduction in bearing strength and creep resistance due to warming of the frozen ground
- the potential for accentuated frost heaving

Because soils in Rankin Inlet are predominantly composed of coarse-grained material overlying bedrock and of potentially saline marine deposits, but also because of the known occurrence of soil containing massive ice (ice wedge) at shallow depth, the overall sensitivity of permafrost to climate change within the study area is anticipated to range from low to high.

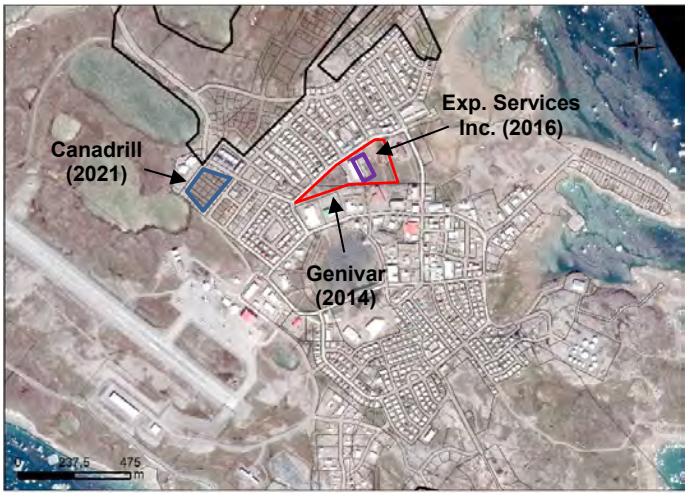
Another important factor to consider is the intensification of the hydrological cycle triggered by the rise in temperatures. The amount, type, and patterns of rainfall and snow precipitation are expected to change, further contributing to permafrost degradation, and adding stress to local drainage infrastructures. The Nunavut Climate Change Secretariat (2021) reports that precipitation in the Arctic has increased by approximately 8 % in the last 100 years, with additional increases predicted for the future. Available precipitation data from the Rankin Inlet airport station, however, is limited and does not present clear trends. It is reasonable to expect that the permafrost degradation and precipitation changes caused by climate change will lead to increased risk of ground instability, local flooding, erosion, and washouts along roads, access trails, and other infrastructure.

2.11 Previous Work

Past geotechnical investigation reports reviewed as part of the current assessment were related to the construction of a new arena and new residential subdivisions. Both sites are located within close

proximity to the current study area and should represent similar subsurface conditions. Locations of the past geotechnical investigations are highlighted in Figure 2-12.

Figure 2-12 Location of Past Geotechnical Investigations



References to these existing geotechnical investigation reports are as follows:

- Genivar 2014. Geo-technical, Topographical and Environmental Assessment for the New Arena in Rankin Inlet, NU. prepared for Government of Nunavut Department of Community and Government Services.
- Exp. Services Inc 2016. Geotechnical Investigation, New Arena, Rankin Inlet, NU. submitted to Stantec Consulting Ltd.
- Canadrill Limited Geotechnical Division 2021. Geotechnical Investigation, Area 5 Phase 3B, Proposed Residential Subdivision, Rankin Inlet, NU. prepared for Government of Nunavut Department of Community and Government Services.

Geotechnical investigations by Genivar (2014) and Exp. Services Inc. (2016) showed a shallow organic layer underlain by a layer of sand to sandy silt with various gravel content; occasional cobbles and boulders were observed. A sand to sand and gravel fill was sometimes observed. Depth to bedrock ranged from 3.0 to 13.1 m bgs. Moisture content ranged from 4.3 to 25.9%. Frozen soils encountered were generally well-bonded with no excess ice (Nbn), well-bonded with excess ice (Nbe), or contained individual ice inclusions (Vx<10%). During their September 2013 field campaign, Genivar (2014) recorded frozen soils at depths of 1.5 to 3.0 m bgs.

Geotechnical investigation by Canadrill (2021) southeast of Block 10 showed a shallow organic layer underlain by silty sand to sand with silt, and depth to bedrock ranged from 2.1 to 4.0 m bgs. Moisture content ranged from 4.8 to 16.1%. Soils were interpreted as predominantly ice-poor; however, zones including well-bonded frozen soils with excess ice (Nbe) were noted.

3 METHODOLOGY

This section provides the methodology for the following tasks:

1. Drainage assessment and planning
2. Geotechnical investigation
3. Qualitative construction suitability assessment

3.1 Drainage Assessment and Planning

In northern communities, surface drainage issues during the short summers and spring/fall shoulder seasons are often a challenge. Typical drainage issues include road washouts after extreme rainfall events, water ponding, culverts with reduced capacity, and obstruction/overflow of ditches with poor definition and/or insufficient depth. The CSA, through the *Community Drainage System Planning, Design, and Maintenance in Northern Communities* (CSA 2020), indicates that a drainage analysis should have due regards for a number of interconnected factors, including existing surface drainage infrastructures, climate data, site inspection data, bedrock and surficial geology maps, topographic data, permafrost features, hydrologic data (e.g., catchment area and drainage patterns), geotechnical investigation and available plans for future development. The activities and expectations of the local community, as well as overall public safety, should also be taken into account when performing drainage assessment and planning.

The drainage assessment and planning component of this project generally followed the guidance and protocols from Clause 4 of CSA (2020). As stated in CSA (2020), under ideal circumstances, drainage system planning and design using the CSA (2020) standard is completed in advance of development. With the exception of the planned future subdivisions (Blocks 8, 9, and 10), the drainage infrastructure for Rankin Inlet has already been constructed. Drainage assessment and planning are therefore discussed separately for the existing developed areas (Section 3.1.1) and the planned future subdivisions (Section 3.1.2).

Within each of these two sections, drainage assessment (characterization of existing conditions) and drainage planning (alterations and improvements) are discussed in sequence. The drainage assessment and drainage planning tasks were based on the results of the desktop terrain mapping (Section 2.1) and the field assessments.

As noted in CSA (2020), field assessments of drainage are best performed during spring melt conditions, to observe the drainage system under peak stress due to (for example) seasonally high runoff volumes, potential culvert and ditch icing, and slope destabilization due to freeze/thaw cycles. Due to the ongoing COVID-19 pandemic and related travel restrictions in the region, Stantec's field assessment could not occur during spring melt and was instead performed September 9 – 13, 2021. While the drainage infrastructure was readily observed at this time and rainy conditions resulted in the drainage system being activated, Stantec could not observe the drainage system under peak stress and our drainage assessment and planning is limited to the conditions we observed in early September of 2021.

3.1.1 Existing Developed Areas

The existing developed areas are illustrated on Figure 1-1.

3.1.1.1 Drainage Assessment

The following was completed during the field inspection:

- Complete tour of Rankin Inlet with T. Aksalnik (Public Works Foreman, Hamlet of Rankin Inlet) and S. Low (Planner, Government of Nunavut) to identify locations and details of areas which have demonstrated notable drainage issues in the past, and where the Hamlet of Rankin Inlet and/or Government of Nunavut (GN) would like specific recommendations for improvement. These areas were referred to as identified drainage problem areas, or IDPAs.
- Performed assessment of cause of drainage issues at IDPAs.
- Determined finalized catchment boundaries by ground truthing the preliminary catchment boundaries (from Section 2.1). Catchment delineation for Rankin Inlet was completed at a scale which functionally informed, or could inform, the drainage infrastructure. For example, two separate roadside ditches (each with a series of culverts) would have their own catchments. The point where these two ditches confluence would represent the downstream end of their respective catchments, and the upstream end of a third catchment for the downstream ditch.
- Delineated ditch (constructed) and channel (natural) network in the field using ESRI ArcGIS Collector with aerial imagery. For the purposes of this project, ditches and channels had a defined bed and banks whereas drainage draws (which convey semi-concentrated overland flow) were low lying areas without bed and bank definition. Ditch measurements (geometry, slope) was considered beyond the scope of this project and was not performed in 2021.
- Completed a detailed inventory of culverts in Rankin Inlet, obtaining the following information:
    - Street that the culvert crosses under (street name, or driveway)
    - Location (northing/easting, referenced to NAD83 UTM Zone 15 CSRS)
    - Type (entrance or cross culvert)
    - Shape (circular, box, arch, other)
    - Material (corrugated metal, metal, plastic, other)
    - Diameter or dimensions (in mm)
    - Crushing of culvert ends (yes/no)
    - Infilling of culvert barrel with sediment (depth of sediment in mm)
    - Elevations of the culvert invert and obvert at the upstream and downstream ends using a Real-Time Kinematic (RTK) GPS (precision +/- 0.03 m). Elevations were referenced to CLSR (1996), Coordinate Control Monument (CCM) 4, 9, 10, 11, and 18. If the ends were crushed, the top of the crushed end of the culvert was surveyed as the obvert. If the culvert was partially filled with sediment, the sediment surface was surveyed as the invert.
    - Road crown elevation over the culvert, obtained with a RTK GPS. Elevations were referenced to CLSR (1996), CCM 4, 9, 10, 11, and 18.

- Four photographs: upstream end of the culvert facing upstream, upstream end of the culvert facing downstream, downstream end of the culvert facing upstream, and downstream end of the culvert facing downstream
- General observations regarding upstream and downstream ditch and embankment conditions

Using the data collected during the field inspection, the following were measured, calculated, or determined:

- Culvert length (in m, as measured from surveyed culvert ends)
- Approximate culvert slope (expressed in percent, using upstream and downstream culvert inverts and culvert length)
- Approximate culvert depth of cover at road crown (in m, calculated by subtracting the average of the upstream and downstream culvert obverts from the road crown elevation)
- Culvert condition ratings for five different categories (Table 3-1), based on general assessment methods from CSA (2020) and a modified version of MTO (2013) to suit the project objectives and infrastructure types found in Rankin Inlet
- Priority levels for remediation (high, medium, low as outlined in) for each of the five culvert condition ratings

Table 3-1 Culvert Rating Methodology (modified from MTO 2013)

Category	Rating Methodology
Material - Metal Culverts	0 - New condition, may also exhibit slight discolouration of surface, galvanizing partially gone along invert. 1 - Discolouration of surface, galvanizing completely gone along invert but no layers of rust. Minor pinholes in pipe material located at end of pipe but not located beneath roadway. 2 - Layers of rust forming. Sporadic pitting of invert, minor pinholes forming throughout pipe. 3 - Heavy rust, thick scaling throughout pipe. Deep pitting, perforations throughout invert. 4 - Extensive Heavy rust, extensive perforations throughout pipe. End sections corroded away. Bottom portion completely corroded exposing underlying granular. Partially to fully collapsed. Priority levels for remediation: High: 3-4 Medium: None Low: 0-2
Material - PVC Culverts	0 - Minor isolated rip caused by floating debris or construction. Minor discolouration. 1 - Slit no longer than 150 mm and no wider than 10 mm at two or three locations. Damage (cuts, gouges or distortions) to end sections from construction or maintenance. Perforations caused by abrasion located within 1.5 metres of outlet and not under roadway. 2 - Slit longer than 150 mm and wider than 10 mm at two or three locations. 3 - Slit longer than 150 mm and wider than 10 mm at several locations. Perforations throughout the pipe. 4 - Slits in pipe causing the loss of backfill. Section loses throughout the pipe caused by abrasion. Invert eroded away. Partially collapsed. Priority levels for remediation:

Category	Rating Methodology
	High: 3-4 Medium: None Low: 0-2
Shape	0 - Smooth curvature in barrel. Span dimension within 3% of design. 1 - Smooth curvature in top half of barrel with flattening on bottom portion. Span dimension up to 5% greater than design. 2 - Slight distortion in one location on the top portion. Bottom has slight reverse curvature in one location. Span dimension up to 10% greater than design. Nonsymmetrical shape. 3 - Significant distortion throughout length. Lower 1/3 may be kinked. Span dimension up to 15% greater than design. 4 - Extreme deflection at isolated locations. Flattening at top of arch or crown. Bottom has reverse curvature throughout. Span dimension greater than 15% of design. Extremely non-symmetrical Priority levels for remediation: High: 3-4 Medium: 2 Low: 0-1
Capacity	0 - Little to no sediment build-up in pipe. Culvert ends are undamaged. Little to no debris blocking flow. 1 - Minor debris and sediment, less than 30% blockage. Possible infiltration of fine roots. No evidence of flooding of roadway or adjacent land. 2 - Major debris and sediment more than 30% blockage, flooding of roadway and/or adjacent properties. Possible infiltration of tap roots causing major flow restriction. Priority levels for remediation: High: 1-2 Medium: None Low: 0
Erosion and Scour	0 - Embankment, slopes, and at culvert outlet are intact and stable. 1 - Minor erosion of embankment, slope, or at culvert outlet less than 100mm around ends. Still protected or well vegetated. 2 - Major erosion of slope, embankment, or at culvert outlet greater than 200mm around culvert ends, guardrail displaced / settled, posts loosened / separated from soil. Priority levels for remediation: High: 2 Medium: None Low: 0-1

Category	Rating Methodology
Upstream and Downstream Channel	0 - No evidence of channel bed or bank erosion. Intermittent patches of grass and exposed earth. 1 - Minor channel erosion. Minor damage to channel protection. 2 - Bank protection eroded. Bank protection debris causing blockage and more significant channel erosion. Channel alignment causing scour holes, bank erosion, and is threatening end treatment. Major erosion of channel. Priority levels for remediation: High: 2 Medium: None Low: 0-1

Integration of observations in ESRI ArcGIS produced an existing conditions drainage map consisting of catchment boundaries, overland drainage pathways, drainage channels/ditches, and culverts. The map was accompanied by a detailed culvert inventory and by text summarizing the general drainage conditions in the developed areas of Rankin Inlet. Collectively, the existing conditions drainage map, detailed culvert inventory, and general summary of drainage conditions represented the drainage assessment. The drainage assessment provided the basis for drainage planning of the Rankin Inlet developed areas.

The results of the drainage assessment were compared to established industry standards and guidelines for northern communities and for local roads from CSA (2020) and MTO (2013):

- Sufficient ROW width of 16 m to accommodate for travelled road surface, shoulders, walkway, snow storage and drainage ditches (CSA 2020)
- Positive drainage across roads to roadside ditches, ideally from the centreline road crown (CSA 2020)
- Roadside ditches have positive drainage and capacity to accommodate piling of snow, in accordance with typical dimensions provided in CSA (2020)
- Adequate culvert conditions (priority levels for remediation provided in Table 3-1)
- Presence of marker post (CSA 2020)
- Adequate depth of cover above culvert: 450 mm for roads (cross-culverts) and 300 mm for driveways (entrance culverts) (CSA 2020).

3.1.1.2 Drainage Planning

The planning task for existing developed areas adopted separate approaches for i) general drainage conditions and ii) the IDPAs:

For General Drainage Conditions:

Based on the general drainage conditions and comparisons to established industry standards outlined at the end of Section 3.1.1.1, a series of community-wide recommendations were developed to improve the existing drainage system. The recommendations for culverts were, naturally, more specific owing to the level of detail of the culvert inventory. The recommendations took into consideration the following:

- Cost efficiency of drainage improvements should be prioritized.

- The expectations and typical activities of the residents of Rankin Inlet should be, to the degree practicable, preserved.
- Construction equipment, materials, or windows may impact the plausibility or timeframe for implementation of drainage improvements.
- Snowmelt conditions are as-yet undocumented by Stantec; drainage conditions in spring may reveal additional drainage issues that were not captured in the drainage assessment.
- Rankin Inlet is the largest hamlet and second largest settlement in Nunavut. The scale and level of entrenchment of the existing drainage infrastructure into the community is considerable. This differs from smaller northern communities, where large-scale changes to the drainage network can be made without significant disruption to the existing community or prohibitive capital costs. Therefore, large-scale alterations to the existing drainage boundaries or existing drainage network were not considered for the developed areas of Rankin Inlet (unless at an IDPA; see description below).

At IDPAs: Specific, site-scale recommendations were provided for each of the IDPAs. The recommendations were developed to address the specific cause of the drainage issue at the IDPA. Recommendations for each IDPA were illustrated on a map of the IDPA and described in text.

3.1.2 Planned Future Subdivisions

The planned future subdivisions (Block 8, 9, and 10) are illustrated on Figure 1-1.

3.1.2.1 Drainage Assessment

During the field assessment, the preliminary catchments from the desktop terrain mapping (Section 2.1) were ground-truthed to confirm their locations. Overland drainage pathways and drainage channels/ditches were documented, and culverts were identified and characterized using the protocol outlined in Section 3.1.1.1. Surrounding drainage infrastructure and potentially sensitive environmental features were identified to inform inflows to the development block(s), and potential outfall locations from the development block(s). Low lying areas prone to seepage and ponding were noted to supplement the geotechnical investigation of construction suitability.

Integration of observations in ESRI ArcGIS produced an existing conditions drainage map consisting of catchment boundaries, overland drainage pathways, drainage channels/ditches, and culverts. The existing conditions drainage map provided the basis for drainage planning of the planned development areas.

3.1.2.2 Drainage Planning

A proposed conditions drainage plan (map with text description) was developed consisting of general development block grading and overland flow direction, constructed channels/ditches, culverts, removals, and outfall locations. The development of the proposed conditions drainage plan considered existing drainage patterns and infrastructure, the inflows to the development block, the downstream receiving systems, any nearby sensitive environmental features, the conceptual road and lot layout in the development blocks, the standards in CSA (2020), and other northern drainage best-management practices.

3.1.3 Hydrologic Model

3.1.3.1 Modelling Approach

Accurate hydrologic modelling of drainage catchments can allow for detailed, quantitative evaluation of existing and proposed drainage infrastructure. Examples of these detailed, quantitative analyses include ditch and culvert capacity analyses (to inform infrastructure replacement or repairs) and existing vs. proposed conditions comparative runoff analyses (to inform impacts of proposed developments on drainage system). These detailed, quantitative analyses were considered beyond the scope of this project. However, development of a hydrologic model for Rankin Inlet positions the Hamlet to perform these additional analyses in the future.

CSA (2020) lists the rational method for hydrologic modelling of delineated catchments in a drainage plan. The rational method is best suited for small catchments (< 60 ha), and is most accurate for smaller, urbanized watersheds with high impervious cover (CSA 2020). The rational method provides the user with a peak flow rate for each catchment but does not provide a time of occurrence for the peak flow rate nor does it provide a runoff hydrograph for the catchment. Therefore, the rational method is not well suited for computing peak flows for more complex drainage systems with networks of catchments draining into one another—as is the case in Rankin Inlet.

Therefore, Stantec completed a hydrologic model for Rankin Inlet using Hydrologic Engineering Centre Hydrologic Modelling System (HEC-HMS) version 4.9 (USACE 2022). HEC-HMS is produced by the United States Army Corps of Engineers (USACE) and is a commonly used program for modelling complete hydrologic processes of dendritic watershed systems (USACE 2022). Further details about HEC-HMS are provided in Section 3.1.3.2.

As with most northern communities, peak runoff volumes and flow rates in Rankin Inlet likely occur during spring melt. Hydrologic modelling of snowmelt processes requires accurate understanding of the snowpack, both in terms of physical characteristics (e.g., snow pack liquid holding capacity and water storage, potential precipitation on snow, mean temperature, radiation, general energy budget) and spatial distribution (e.g., wind-driven snow movement and snow drifts between catchments, snow dumps from clearing operations). To Stantec's knowledge, formal study of snowpack in Rankin Inlet has not been completed to date. While there are software programs available to model wind effects on snowpack distribution and clearing practices can be obtained from operations departments, snow hydrology was considered beyond the scope of this project. Previous snowpack modeling reporting was completed more than 20 years ago, and may not adequately be informed by current climate change considerations.

Given the above, Stantec completed the hydrologic model of Rankin Inlet for rainfall events under snow-free conditions. This model scenario is applicable to summer and early fall in Rankin Inlet.

3.1.3.2 HEC-HMS Hydraulic Model

The HEC-HMS suite provides an integrated modelling framework consisting of several analytical components: data input interfaces, data assimilation utilities, simulation schemes, computation engines, and post-processing capabilities. Managing the simulation processes and moving between model components is also facilitated by a designed graphical user interface for the program. The model can

represent and analyze different types of watersheds by constructing sub-catchments and processing the hydrologic cycle amongst them.

Hydrological simulations in HEC-HMS are based on two main components: the Watershed physiographic features and the Meteorological components. Watersheds are represented in the model using different basin physiographic elements such as reaches, junctions, flow sources, etc. Hydrologic simulations are performed in an upstream to downstream manner in the model. The model's important physical descriptions can be summarized as infiltration losses, runoff models, baseflow contribution, hydrologic routing, and flow attenuation and impoundment.

Different methods are available in the model to account for the flow losses due to infiltration. Infiltration is subtracted from the available water volume that can potentially transform to runoff. The soil stratification includes relatively surficial permafrost layers meaning the ground is expected to saturate quickly under rainfall events, thereby eliminating the infiltrations losses. Therefore, the Initial and Constant method was selected for infiltration losses in our model. The study area mainly consists of barren land and urban developments with little to no vegetation coverage meaning interception and capture losses are negligible.

Several runoff models are available to transform the excess precipitation into surface runoff. These models can be divided into System theoretic models (also known as empirical approaches) and Conceptual models. Based on the basin characteristics and for the purposes of this study, the parametric Clark Unit Hydrograph was used.

Though seasonal creeks and manmade ditches convey flow during the rainfall or snowmelt events, no permanent stream is identified within the study domain and baseflow contribution to the surface runoff was neglected.

Meteorologic data are presented in the hydrologic analysis using different models. The HEC-HMS model includes radiation, precipitation, evapotranspiration and snowmelt models to describe the meteorological components. For the purposes of this study (rainfall only), only the precipitation model was considered and was applied using the Frequency Storm method to reproduce the synthetic precipitation over the study area. An additional or a combination of available approaches may be included in future model refinements.

3.2 Geotechnical Investigation

3.2.1 Field Program

The field program was completed between September 13 and 17, 2021 and focused on planned future subdivisions identified as Block 8, Block 9 and Block 10 (see Community Plan in Appendix B). Although visual observations were conducted within most of the community, only Block 10 was targeted as part of the borehole investigation program.

Shallow boreholes were drilled using a two-person auger operated by Nunami Stantec. The boreholes were advanced by coring 0.3 m length cores, with an approximate 82 mm outside diameter core barrel which allows for the retrieval of undisturbed cores of frozen soils. Whenever frozen soils were not reached, an active layer probe (steel rod) was inserted into the ground and used to estimate the active layer depth based on the refusal of the probe.

Target drilling locations were selected based on the findings of the desktop terrain mapping and focused on areas suspected of containing ice-rich permafrost. A total of 5 boreholes (BH21-01 to BH21-05) were drilled to depths ranging from 1.20 to 2.13 m (bgs).

Borehole coordinates, approximate elevations, and drilling depths are provided in Table 3-2. Borehole locations are displayed on Figure 1-1 as well as on the Figure C-1 through Figure C-3 in Appendix C. Selected field photographs are presented in Appendix E.

Table 3-2 Borehole Locations and Elevations

Borehole No.	Block	Coordinates (UTM 83 Z15)		Estimated Ground Surface Elevation[1] (m)	Depth Drilled (m)
		Northing (m)	Easting (m)		
BH21-01	Block 10	6965620	546084	8.9	2.13
BH21-02	Block 10	6965610	546086	8.9	1.50
BH21-03	Block 10	6965520	545879	13.3	1.25
BH21-04	Block 10	6965750	546155	6.9	1.70
BH21-05	Block 10	6965660	545633	16.5	1.20

NOTES:
[1] Ground surface elevation obtained from DEM data

Soils were described and logged in accordance with the Unified Soil Classification System (USCS). Whenever observed in the core samples, the cryostructures were described using nomenclature and classification derived from ASTM D4083 (Standard Practice for Description of Frozen Soils, Visual-Manual Procedure). On completion, the boreholes were backfilled with the drill cuttings.

3.2.2 Laboratory Testing

Samples recovered from the site were sealed in moisture tight bags and returned to the Stantec geotechnical laboratory in Laval (Quebec) for detailed classification and testing. Laboratory testing was completed on selected samples and limited to the following:

- Moisture content (or gravimetric water content) (ASTM D2216)
- Particle size analysis (sieve; ASTM C136)

The results of the laboratory testing are shown on the borehole logs in Appendix G and on the laboratory testing results provided in Appendix H.

3.3 Qualitative Construction Suitability Assessment

The culmination of the geotechnical evaluation was to develop a construction suitability map which focused on terrain constraints and geohazards that could adversely affect land development.

The construction suitability classification used for the assessment is based on general standard developed by the Canadian Standards Association (CSA) for *Community drainage system planning, design, and maintenance in northern communities* (CSA 2020), adapted for site conditions specific to the study area. A summary of criteria used for assessing construction suitability through the municipality is presented in Table 3-3.

Table 3-3 Criteria Used for Estimating Construction Suitability

Classes Conditions
Terrain suitable for development (green areas[1]) • Permafrost with low to moderate ground ice content (isolated ice wedges may be present). • Well to moderately well drained soils[2]. • Flat to gently undulating topography (slopes under 10°). • Inactive or limited periglacial processes. No observed evidence of mass movement.
Terrain conditionally suitable for development (yellow areas[1]) • Permafrost with moderate ground ice content, may include areas of high ice content. • Permafrost features such as ice wedges may be present but not readily visible. • Moderately well drained to poorly drained soils[2]. • Surface seepage or drainage flow path visible. • Gently to moderately sloping topography (slopes between 10° and 20°). • Site showing limited evidence of past mass movements. • Site is adjacent to an area presenting unsuitable conditions.
Terrain unsuitable for development (red areas[1]) • Permafrost with elevated ground ice content. • Confirmed presence of extensive massive ice. • Observed indicators of unstable terrain (e.g., ground settlement, thermokarst development, thermo-erosion, gully erosion, landslide). • Poorly drained to very poorly drained soils[2]. • Slopes > 20°. • Thick organic soils. • Snow drifting and/or snow accumulation areas. • Site showing active evidence of mass movement. • Areas susceptible to flooding.
NOTES: [1] Refers to color-coded units displayed on the construction suitability map located in Figure C-25a to C-25c in Appendix C. [2] Drainage classes derived from the Canadian Soil Information System (Expert Committee on Soils Survey 1982)

4 RESULTS

4.1 Drainage Assessment and Mapping

4.1.1 Existing Developed Areas

Figure C-4 in Appendix C illustrates the existing conditions drainage boundaries (catchments) for the overall Rankin Inlet study area. The catchment boundaries, drainage pathways, and drainage infrastructure are illustrated in greater detail on Figure C-5 through Figure C-14 in Appendix C. Culvert characteristics are provided in Appendix F.

4.1.1.1 General Drainage Conditions

Drainage Assessment

Catchments. The drainage assessment resulted in a total of 64 catchments within the Rankin Inlet developed area (Figure C-4 in Appendix C). The catchment delineation method resulted in smaller catchments within the developed community centre, owing to the density of drainage infrastructure of interest (i.e., desired outfall points). As a result, two of the catchments to the east of town (negligible development) are substantially larger than the rest; Catchment 163 has an area of 554 ha and Catchment 102 has an area of 300.8 ha. The remainder of the catchments ranged in size from 0.8 ha (Catchment 115) to 54.1 ha (Catchment 100).

ROW Widths. Figure 4 from CSA (2020) recommends a 16 m wide ROW width for local roads. Desktop analysis indicated that the majority of ROW widths are greater than 16 m, although the road footprint is often offset to one side of the ROW.

Ditches and Channels. A total of 14.3 km of ditches or channel were delineated within the 64 catchments. Figure 5 from CSA (2020) recommends that ditches should be present on both sides of roads to convey roadway drainage coming from the road crest. In some cases, ditching on both sides of the road is not required due to the overall drainage patterns in the catchment or on the road. This is reflected in Figure 4 of CSA (2020). In the developed core of Rankin Inlet, 8.4 km of the ditches/channels are within 5 m of the road ROW and may be considered roadside drainage ditches. The total road network within the developed core of Rankin Inlet is approximately 31.9 km; therefore, approximately 26% of the road network within Rankin Inlet's developed core has roadside ditches. CSA (2020) generally recommends that roadside ditches be provided on at least one side of each road for snow accumulation and conveyance of runoff.

- *Drainage deficiency: spatial coverage of the ditch network is insufficient for road network*

The distinction between a ditch/channel and drainage draw (as defined in the Definitions and Terminology section) can be subjective. This was especially true for the Rankin Inlet drainage infrastructure because many of the roadside drainage features are informal (i.e., not intentionally constructed), or have little to no bed or bank definition putting them on the threshold of a ditch/channel. This wide, shallow drainage ditch

design can be important in northern communities to allow for flexible vehicle access to buildings for servicing (e.g., septic pumpouts, fuel tank filling, water tank filling) (CSA 2020). However, the shallow ditch geometry in Rankin Inlet comes at the expense of reduced capacity for snow clearing in the winter and flow conveyance during runoff events in the spring, summer, and fall, as well as increased risk of ditch and culvert icing during the winter and spring melt periods. In addition, the shallow ditch geometry facilitates the driving of vehicles, ATV's and snowmobiles in the ditch which can a) alter the ditch geometry (impairing conveyance) b) compact snow piled in the ditch (increasing risk of ditch and culvert icing/blockages) and c) crushing of culvert ends (impairing conveyance). Depending on the road crest elevation and overall drainage patterns, the impaired spilling or ponding of water on the road may also result from the shallow ditch geometry.

Minimum ditch dimensions provided in by CSA (2020) include 2-4 m width and 0.75 m depth, although ditches should be sized as required to adequately convey the flows they are receiving. The hydraulic model produced by Stantec in this report (Section 3.1.3, Section 4.1.3) provides return period flow rates which may be used for ditch design in the future. Ditch dimensions were not obtained in 2021, however depths of less than 0.75 m were frequently observed both in ditches/channels, and in roadside drainage features not formally categorized as ditches/channels. Ditch width varied from 0.5 m to upwards of 5 m. A more detailed inventory of ditch dimensions (depth, width) should be performed to refine the areas of deficiency.

- *Drainage deficiency: variable and often insufficient ditch depths and widths (qualitative observation).*

Culverts. A total of 149 culverts were inventoried in Rankin Inlet in the 2021 field program, consisting of 97 cross culverts, 51 entrance culverts, and 1 roof drain culvert. The location, IDs, and drainage direction of each culvert are illustrated on Figure C4 through Figure C14 in Appendix C. The detailed database of culvert characteristics, along with datasheets for each culvert, are provided in Appendix F. The detailed database is also provided to Rankin Inlet in electronic form for future use and prioritization of remediation/drainage improvements.

A breakdown of the culvert type, material, and sizes are provided in Table 4-1. All culverts were circular in shape. Corrugated steel pipe (CSP) was the most common culvert material (121 / 149 culverts = 81%) but smooth walled steel pipe (SWSP) and polyvinyl chloride (PVC) pipes were also present. 600 mm diameter culverts were the most common size (55 / 149 culverts = 37%), and 72% of the culverts were between 400 mm and 600 mm (107 / 149 culverts).

Table 4-1 Summary Characteristics of Culverts in Rankin Inlet

Culvert Type	Culvert Material	Culvert Diameter (mm)														Totals	
		120	150	200	230	240	250	300	350	400	450	500	600	800	2800	Unknown	
Cross	CSP						1	1		24	8	5	36	1	1	1	78	97
	PVC			2		3	4										9	
	SWSP	3	2	4				1									10	
Entrance	CSP						1	5	2	3	5	7	19	1			43	51
	PVC		1	3			3										7	
	SWSP		1														1	
Roof Drain	PVC				1												1	1
Totals		3	4	9	1	3	9	7	2	27	13	12	55	2	1	1	149	149

Culvert Condition Ratings: Barrel Material, Shape, Capacity, Erosion and Scour. Table 4-2 provides a summary of culvert condition ratings for the 149 culverts inventoried in Rankin Inlet. The priority level for remediation, as defined in Table 3-1, is also indicated in Table 4-2.

Table 4-2 Summary of Culvert Condition Ratings

Condition Rating	Barrel Material (0-4)		Shape (0-4)		Capacity (0-2)		Erosion and Scour (0-2)		US/DS Channel (0-2)	
0	45	30.2%	74	49.7%	61	40.9%	89	59.7%	90	60.4%
1	72	48.3%	8	5.4%	37	24.8%	41	27.5%	49	32.9%
2	32	21.5%	17	11.4%	51	34.2%	19	12.8%	10	6.7%
3	0	0.0%	19	12.8%						
4	0	0.0%	31	20.8%						
NOTES Priority for remediation (based on Table 3-1):					High	Medium	Low (no highlight)			

Based on the results in Table 4-2, the following drainage deficiencies are noted:

- *Drainage deficiency: 50 of the 149 culverts (33.8%) have damaged ends with a high priority for remediation; an additional 17 culverts have damaged ends with a medium priority for remediation.*
- *Drainage deficiency: 88 of the 149 culverts (59.0%) are infilled with a high priority for remediation.*
- *Drainage deficiency: 19 of the 149 culverts (12.8%) have erosion and scour in the vicinity of the culvert ends with a high priority for remediation.*
- *Drainage deficiency: 10 of the 149 culverts (6.7%) have channel erosion, scour, sedimentation, or other instability upstream or downstream of the culvert that threatens the culvert such that there is a high priority for remediation.*

Culvert Marker Pole. Only one of the 149 culverts had functional marker poles at both the ends of the culvert (culvert 132-02). The purpose of the marker poles is to identify culvert ends so that drivers and snowplows can avoid the culvert ends, therefore minimizing damage to the culvert ends. The absence of culvert marker poles is likely a contributing factor to the high rate of culvert end damage (Table 4-2, Shape condition).

- *Drainage deficiency: culvert marker poles not present.*

Culvert Depth of Cover. Figure 4-1 and Figure 4-2 illustrate the frequency of depth of cover in 50 mm increments for cross culverts and entrance culverts, respectively. Figure 4-1 and Figure 4-2 also indicate the minimum depth of cover requirements for cross culverts and entrance culverts, respectively.

- *Drainage deficiency: 58 of the 97 cross culverts (60%) and 18 of the 51 entrance culverts (35%) have insufficient depth of cover according to the minimum depth of cover requirements from CSA (2020).*

Figure 4-1 Depth of Cover for Cross Culverts in Rankin Inlet

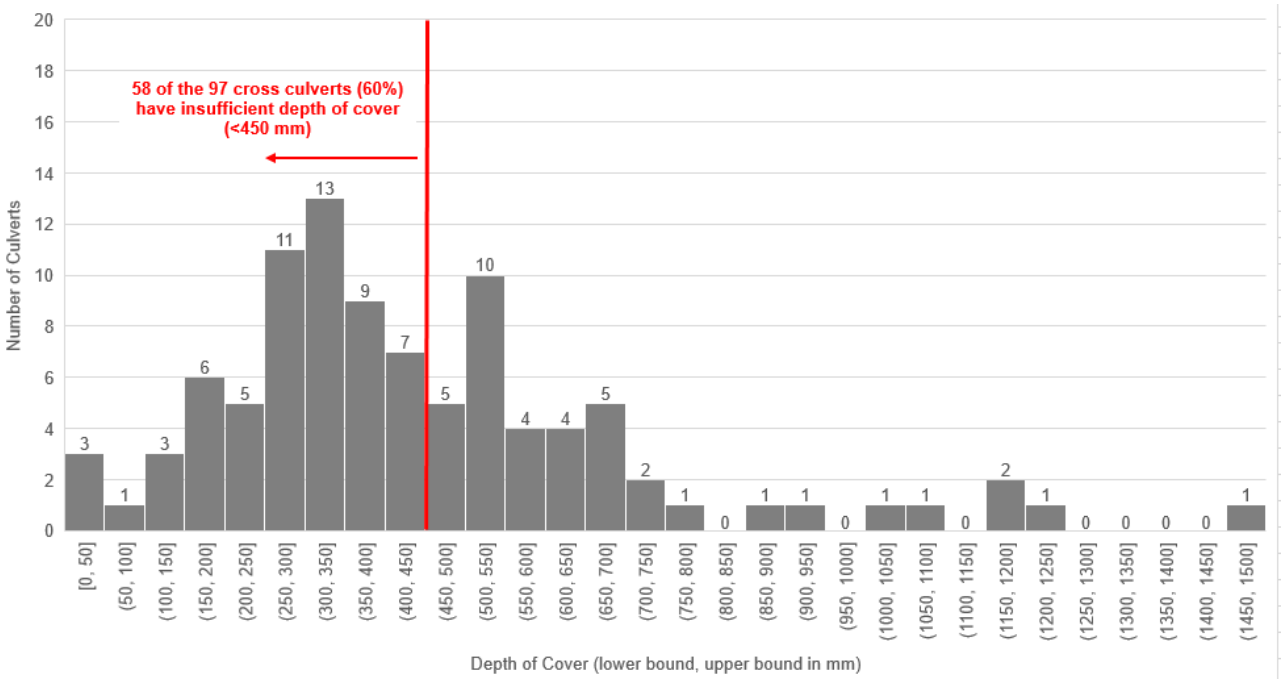
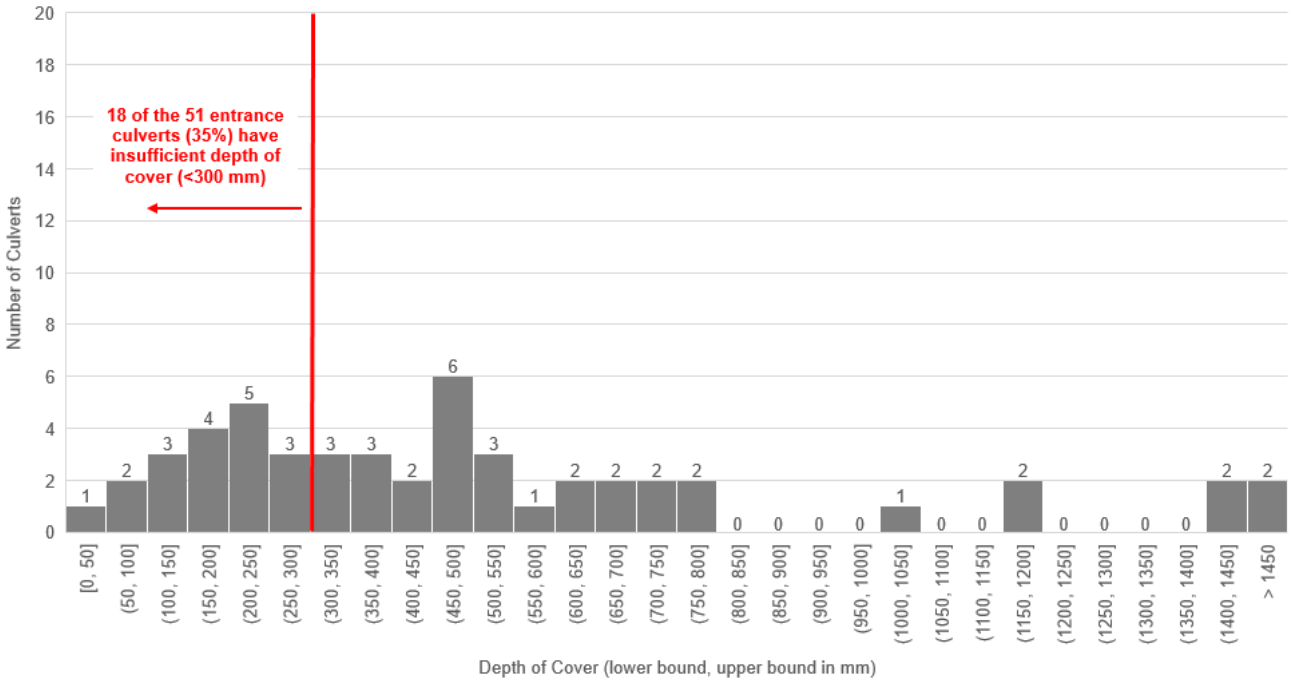


Figure 4-2 Depth of Cover for Entrance Culverts in Rankin Inlet



Other general drainage problems that were observed during the drainage assessment or otherwise expressed to Stantec included:

- *Drainage deficiency: backyard ponding is a frequent occurrence and is likely worse in spring melt conditions than what was observed in the September field visit.*
- *Drainage deficiency: several driveways are missing entrance culverts; this results in a blockage of the existing ditch and conveyance issues.*
- *Drainage deficiency: full complement of emergency flooding equipment and supplies is not held in reserve for emergency use*
- *Drainage deficiency: drainage monitoring is completed on a response- or incident-basis; a formal drainage monitoring program is not currently in place*

Drainage Planning

As was discussed in Section 3.1.1.2, there is an extensive amount of existing drainage infrastructure within Rankin Inlet which is well-entrenched into the overall community infrastructure. Based on the drainage deficiencies noted in the drainage assessment above, 12 community-wide drainage recommendations were developed for Rankin Inlet (Table 4-3). It is Stantec's opinion that implementation of these drainage recommendations is likely to result in improved drainage conditions within the existing drainage infrastructure

CSA (2020) recommends SWSP culverts as the preferred material where depth of cover or culvert icing issues are present. The structural strength and longer lifespan of SWSP culverts is advantageous for the long-term resiliency of the drainage plan, however SWSP is considerably more expensive than CSP.

Depending on the drainage conditions and challenges at a given site and material availability, the increased cost of SWSP may be warranted.

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Table 4-3 Community-Wide Drainage Recommendations

Drainage Deficiency [1]	Recommended Action(s)
Ditch network coverage insufficient for road network	Increase the density of drainage ditches alongside the road network in Rankin Inlet. The existing conditions drainage map delineates the existing ditch network relative to the road network and provides the foundation for Rankin Inlet to identify areas requiring additional roadside ditches. New ditches should meet the ditch geometry standards outlined in CSA (2020); that is, width of 4 m and depth of 0.75 m. These dimensions result in side slopes of approximately 2.7:1 (H:V) which should be reasonable for occasional servicing access by vehicles if required, but will also discourage everyday driving over the ditches which should preserve ditch geometry, conveyance capacity, and snow clearing capacity. If the ditching area has space constraints, the width of the ditch may be narrowed to a minimum of 2 m. Larger ditches may be required if inflows require increased conveyance capacity or if ditch or culvert icing is common in the area. The hydrologic model produced in this report may provide return period flows for ditch sizing. As ditch construction may restrict access to properties, designated site access (driveways) and entrance culverts may need to be provided for private properties. Entrance culverts should have the required depth of cover, have marker posts installed, and have culvert end treatments applied to protect the ends from damage. Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020). Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired. Culvert invert elevations should be such that they connect directly to upstream and downstream ditch elevations and provide positive drainage through the culvert and through the overall drainage network. Verifying elevations for positive drainage conditions during installation may be completed by manual survey using a level and stadia rod or other comparable survey equipment.
Variable and often insufficient ditch depths and widths (qualitative observation)	Improve the geometry of existing drainage ditches. Where permafrost and soil conditions permit, existing ditches should be improved to meet, at a minimum, CSA (2020) guidelines. That is, of 0.75 m deep, 4 m wide CSA (2020). These dimensions result in side slopes of approximately 2.7:1 (H:V) which should be reasonable for occasional servicing access by vehicles if required, but will also discourage everyday driving over the ditches which should preserve ditch geometry, conveyance capacity, and snow clearing capacity. If the ditching area has space constraints, the width of the ditch may be narrowed to a minimum of 2 m. Larger ditches may be required if inflows require increased conveyance capacity or if ditch or culvert icing is common in the area. The hydrologic model produced in this report may provide return period flows for ditch sizing. As ditch construction may restrict access to properties, designated site access (driveways) and entrance culverts may need to be provided for private properties. Entrance culverts should have the required depth of cover, have marker posts installed, and have culvert end treatments applied to protect the ends from damage. Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020). Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired.
50 culverts have damaged ends with a high priority for remediation; an additional 17 culverts have damaged ends with a medium priority for remediation	Repair the damaged/crushed culvert ends to re-establish hydraulic conveyance capacity of the culvert. The 67 culverts requiring remediation are identified in the detailed culvert database in Appendix F. The severity of the damage will determine the required work at each culvert: i. Culverts with minor deformation at the ends may be bent back to the intended shape with appropriate tools ii. Where i) is not possible, culverts may be repaired by cutting off the damaged portion and either leaving it square (if remaining culvert projects from embankment) or adding a short section of new culvert with an appropriate coupling. Culverts with more substantial end damage may require a portion of the road to be dug up to reach a section of non-crushed culvert prior to coupling with the culvert extension. iii. For severely damaged culverts where upon further inspection crushing extends through substantial portions of the barrel, complete culvert replacement may be required. If the culvert is to be replaced, efforts should be made to install SWSP culverts (CSA 2020). For CSP culverts, the repaired culvert ends should be reinforced with a steel end stiffener (e.g., Figure 4-3 as extracted from CSA 2020) or comparable stiff steel collar. This end treatment will make the culvert ends more resistant to damage in the future. As the hardened end treatments will not deform in the same way as CSP culverts, they pose a potential safety hazard to vehicles or humans who are accustomed to driving over the culvert ends (before or after deformation). The installation of the hardened end treatments should be communicated to the local community in advance of implementation. Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020). SWSP culverts are also more resistant to end deformation and do not require end treatments. Multi-level culvert arrangements, as illustrated in Figure 9 of CSA (2020), can be considered if culvert icing is an issue. Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired.
88 culverts are infilled with a high priority for remediation	Clean out the sediment inside the culverts to re-establish culvert conveyance capacity. The 88 culverts requiring cleanouts are identified in the detailed culvert database in Appendix F. Cleaning out of the culverts can be completed hydraulically with a flusher truck, or potentially with a hose from a fire truck. Manual agitation of the sediment in the culvert with a shovel or pole can help loosen sediment and promote hydraulic flushing. If sediment accumulation is too substantial to flush using these methods, culvert replacement may be considered. Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020). SWSP culverts are also more resistant to end deformation and do not require end treatments. Multi-level culvert arrangements, as illustrated in Figure 9 of CSA (2020), can be considered if culvert icing is an issue. Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired.

Drainage Deficiency [1]	Recommended Action(s)
	Infilled culverts are often connected to ditches that have also been infilled. It is highly recommended that improvements to the ditch geometry (to match CSA 2020 standards and connecting to the culvert inverts) upstream and downstream of the culvert be completed in tandem with the culvert cleanout.
19 culverts have erosion and scour in the vicinity of the culvert ends with a high priority for remediation	The 19 culverts requiring repairs to the embankment or scour/erosion at culvert ends are identified in the detailed culvert database in Appendix F. It is worth investigating the cause of embankment or outlet erosion/scour prior to implementing a solution. For example, an embankment could be eroding due to flows entering the ditch from road spillage caused by nearby culverts being crushed or infilled. In this case, improving the conveyance of the crushed or infilled culverts may re-establish normal drainage patterns and alleviate the embankment erosion, and simple re-grading/re-dressing of the embankment slope is sufficient. In other cases, the embankment or outfall erosion/scour may be due to the quantity of water, slope of the culvert, or slope of the receiving system. In these scenarios, angular rip rap is well suited for stabilization. A layer of non-woven geotextile fabric should be installed beneath the rip rap and keyed into the existing ground at the ends to reduce the winnowing of fines and undermining of the rip rap. Well-graded rip rap gradations (i.e., a range of diameters) should be used where possible to improve stability. The rip rap should be graded to match the culvert invert of the affected end, and should be graded to the receiving system avoiding abrupt changes in channel gradient.
10 culverts have channel erosion, scour, or other instability upstream or downstream of the culvert that threatens the culvert such that there is a high priority for remediation.	The 10 culverts requiring improvements to the channels upstream or downstream of the culvert are identified in the detailed culvert database in Appendix F. If erosion is the issue in the upstream or downstream channel(s), coarse rock or rip rap is well suited to reduce erosion. A layer of non-woven geotextile fabric should be installed beneath the rip rap and keyed into the existing ground at the ends to reduce the winnowing of fines and undermining of the rip rap. Well-graded rip rap gradations (i.e., a range of diameters) should be used where possible to improve stability. The rip rap should be graded to match the culvert invert of the affected end, and should slope gradually to the receiving system avoiding abrupt changes in ditch/channel gradient. If sedimentation is the issue in the upstream or downstream channel(s), excavation of the ditch geometry should be performed and ditch dimensions in accordance with upstream or downstream dimensions should be re-established. Sediment should be removed until ditch grade matches the culvert invert of the affected end, and should slope gradually to the receiving system avoiding abrupt changes in ditch/channel gradient.
Culvert marker poles not present.	Culvert marker poles should be installed at the upstream and downstream ends of each culvert in Rankin Inlet. Given the snow ploughing and buildup over the winter in Rankin Inlet, it is likely that marker posts may be damaged over the winter each year. The annual inspection, re-securing, or reinstalling of marker posts should be incorporated into the drainage monitoring program (last item in this table).
58 cross culverts and 18 entrance culverts have insufficient depth of cover	Increase the depth of cover by way of raising the road elevation over the culvert (road construction), or lowering the culvert. The 76 culverts requiring increases to depth of cover, along with their existing depth of cover, are identified in the detailed culvert database in Appendix F. If the culvert is slated for replacement for any of the culvert condition ratings, complete the replacement with a lowered culvert to meet the depth of cover requirements. Where lowering the culvert is not possible given receiving ditches, SWSP culverts should be installed (CSA 2020). Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired. Road raising may also be performed to achieve the required depth of cover, and can provide the added benefit of providing increased road clearance from ditch bottoms.
Backyard ponding.	Connect areas of frequent backyard ponding to the nearest drainage ditch (delineated in Figure C5 through C14 in Appendix C), by way of a small ditch (dimensions to suit field conditions and space constraints). The small ditch should be installed in a direction which matches the general drainage direction (e.g., overland flow path) illustrated in Figure C5 through C14 in Appendix C, to maintain positive drainage.
Driveways are missing entrance culverts	Install entrance culverts at all driveways. Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020). Culvert diameter should be equal to or larger than the upstream culverts; the hydrologic model produced in this report may provide design flows for culvert sizing analyses if desired.
Emergency flooding equipment and supplies not in reserve	To enable emergency flooding response actions, the Hamlet should retain the following supplies in reserve for emergency use: • Sandbags • Rolls of 6 mil plastic sheeting (for use in sandbag berms) • Typical details for sandbag berms (e.g., *Sandbag Dike Construction* from Manitoba (undated), provided in Appendix F) • Gas-powered pumps and hoses for pumps • Rip rap • List of competent individuals and contractors in drainage and civil engineering who can be contacted for emergency technical and construction assistance
Drainage Monitoring Program not in place	A drainage monitoring program should be developed and implemented. The existing drainage maps and culvert inventory provide the foundation for such a program. The components of a drainage monitoring program are outlined in CSA (2020) Clause 6 and include the following considerations/components: • Able to be executed by local competent individuals (e.g., town foreman or equipment and utility operators familiar with or trained in drainage systems) • Should incorporate risk of failure into project prioritization • Spring inspection and maintenance involving culvert inspections (following a similar method to that applied in this report) and any urgent actions, ditch and culvert blockage identification and removal, culvert marker post inventory and repair, litter and debris removal, and identification/documentation of ditch and culvert icing issues for future planning purposes

Drainage Deficiency [1]	Recommended Action(s)
	• Summer inspection and maintenance following a similar approach to the spring inspection, but with snow-free conditions for better observation • Fall construction and repairs, when water levels in northern communities are typically the lowest • Drainage monitoring in the winter consists mainly of snow management considerations and planning for the spring melt

Figure 4-3 Culvert End Treatment – Culvert End Stiffener (Figure 17 from CSA 2020)

Figure 17
Example of culvert end treatment
(See Clause 5.6.4.8.)

Note: *This culvert end stiffener detail was developed by the Ministry of Transportation in Saskatchewan (2018). Originally intended for large diameter culverts (1.8 to 2.4 m diameter), a similar detail would also be useful for the smaller diameter culverts commonly seen in the communities. A wider stiffener band could be considered for culvert sections more prone to damage from maintenance equipment or crushing from traffic.*

4.1.1.2 Identified Drainage Problem Areas

Drainage Assessment

There was a total of 12 IDPA's which were identified by either T. Aksalnik (Public Works Foreman, Hamlet of Rankin Inlet) and/or S. Low (Planner, Government of Nunavut). The location of each IDPA is illustrated on Figure C-5 through Figure C-14 in Appendix C. IDPA numbering was assigned geographically (west to east) and is not indicative of priority level. The drainage issue(s) at each IDPA is/are discussed below and illustrated on Figure C-5 through Figure C-14 (Appendix C). Recommended actions are provided in Table 4-2.

IDPA #1: Unnamed Lake Overflow. IDPA #1 is located within catchment 101. Under existing conditions, Catchment 101 accepts inflows from Catchment 100 and discharges at three different locations: northwest to catchment 102 and Nipissar Lake via an overflow channel (outlet #1), northeast through Culvert 101-01 (600 mm CSP) beneath Nunavut Street into catchment 103 (outlet #2), and if water levels are sufficiently high, east over Nunavut Street into Catchment 104 (outlet #3). Catchment 104 contains a planned future subdivision (Block 10). It is the spilling over Nunavut Street during high water conditions which has been identified by the Hamlet and GN as the main drainage concern for Unnamed Lake.

There is also the risk that Nunavut Street is currently informally functioning as a berm or dike for the lake during high water conditions; whether the road was adequately designed for this function is unknown. Risk of gradual road degradation due to seepage, road overtopping, and "berm breaching" exists which would result in a loss of significant parts of the lake in such an event.

A snow fence is proposed at the northwest end of the lake, to capture snow prior to entry into the community. Stantec's preliminary calculations using the conceptual snow drift Snow-Water-Equivalent (SWE) schematic provided by SLR (B. Waechter 2021, email communication "RE: Future snow fencing and unnamed lake in Rankin Inlet", 21 April) indicates that the snow fence could raise the WL by up to 0.37 m. SLR has indicated that the snow fence can't be moved to another location without losing the intended function of the snow fence (B. Waechter 2021, email communication "RE: Future snow fencing and unnamed lake in Rankin Inlet", 30 April).

IDPA #2: Missing Culvert. A ditch currently exists along the northwest side of the residential road east of Nunavut Street, at the upstream end of Catchment 104. The Hamlet expressed that a cross-culvert is missing under Nunavut Street, as there is currently no inflow to the ditch; the areas due southwest of IDPA#2 drain southeast then northeast through a network of ditches and culverts before discharging to Catchment 104 at culvert 111-16. When water spills from Unnamed Lake over Nunavut Street (outlet #3), the existing IDPA #2 ditch would partially convey those flows northeast.

IDPA #3: Ponding in Playground Area. IDPA #3 is located in the headwaters of Catchment 111. The Hamlet expressed that ponding occurs on the northeast side of the playground at the intersection of Aputti Street and Ilua Street. The ponding is most severe in the spring during snow melt, however rainfall events can also result in ponded water. The area susceptible to ponding drains northwest through culvert 111-12, through a ~30 m long ditch, then through culvert 111-13 into the downstream ditch network.

Around the playground and upstream of culvert 111-02, the roadside drainage consists of poorly defined depressions areas south of Aputii Street. Culvert 111-12 has severely crushed upstream and downstream ends (Shape condition rating = 4, per Appendix F) and the upstream end has substantial infilling blocking the culvert (Capacity condition rating = 2, per Appendix F). The ditch between culvert 111-02 and culvert 111-13 appears to be of sufficient dimensions and is well vegetated, although there was debris near the downstream end of culvert 111-02 in September 2021. Culvert 111-03 is in good condition. Therefore, the cause of the ponding at IDPA #3 is likely the poorly defined ditches on the south side of Aputii Street (upstream of culvert 111-02), and substantially reduced conveyance capacity of culvert 111-02.

IDPA #4: Driveway Ponding at Eksusik Street and Sivulliq Avenue. IDPA #4 is located in the headwaters of Catchment 131. Ponding occurs north of the intersection of Eksusik Street and Sivulliq Avenue. The receiving system for drainage from this area is the lake to the southeast.

The ponding area is bounded by higher elevations of the surrounding roads and the structure to the northeast. This means there is no positive drainage to a receiving waterbody or ditch network. There is no culvert draining the area. Culvert 131-01 is nearby but is not functional as the upstream culvert end could not be located.

IDPA #5: Backyard Area Ponding (Catchment 113). IDPA #5 consists of backyard ponding within Catchment 113. There are no upstream contributions to Catchment 113, and it drains into Catchment 104 via culvert 114-01. Culvert 113-01 is not functional as the downstream end could not be located; it is believed that the construction of the house to the northwest of IDPA #5 covered the downstream end of the culvert.

IDPA #5 coincides with an area of pre-development ponding, as illustrated in Figure 2-10.

The upstream invert of Culvert 114-01 is approximately 0.22 m higher than the upstream invert of culvert 113-01, meaning that the outlet elevation for the backyard drainage area is higher than it was when culvert 113-01 was functional. Although spring melt conditions were not observed, the low lying backyard area would likely accumulate snow through the winter and the single culvert outlet arrangement would likely be susceptible to high runoff volumes as well as potential culvert icing or other blockages.

IDPA #6: Backyard Area Ponding and House Flooding (Catchment 115). IDPA #6 consists of backyard ponding within Catchment 115. There are no upstream contributions to Catchment 115, and it drains into Catchment 116 via a ditch along Piqtuq Avenue then through culvert 116-02 which is a 250 mm diameter PVC pipe. The house to the south of Nappiq Street and Piqtuq Avenue (immediately upstream of culvert 116-02) is reportedly frequently flooded in the spring. Although spring melt conditions were not observed, the low lying backyard area would likely accumulate snow through the winter and the single culvert outlet arrangement would likely be susceptible to high runoff volumes as well as potential culvert icing or other blockages.

IDPA #6 coincides with an area of pre-development ponding, as illustrated in Figure 2-10.

Downstream of culvert 116-02, drainage joins with Catchment 116 contributions before being conveyed under Piqtuq Avenue via a multi-level culvert arrangement (culvert 116-03, 116-04). Culvert 116-05 is not functional as the downstream end could not be located and has presumably been covered by developments on the northwest side of Piqtuq Avenue.

The likely cause of both the backyard ponding and the house flooding in Catchment 115 is the restricted capacity of culvert 116-02. This culvert is below average in size (250 mm), has insufficient depth of cover and is visibly elevated above the elevation of the backyard ponding area.

IDPA #7: Backyard Area Ponding (Catchment 116). IDPA #7 consists of backyard ponding within Catchment 116. Catchment 116 accepts drainage from Catchment 115, and discharges to Catchment 104 via a multi-level culvert arrangement (culvert 116-03, 300 mm diameter and culvert 116-04, 600 mm diameter) beneath Piqtuq Avenue. Culvert 116-05 is not functional as the downstream end could not be located. Although spring melt conditions were not observed, the low-lying backyard area would likely accumulate snow through the winter and outlet arrangement would likely be susceptible to high runoff volumes as well as potential culvert icing or other blockages.

IDPA #7 coincides with an area of pre-development ponding, as illustrated in Figure 2-10.

Both of the culverts in the mulit-level configuration have moderately damaged ends (shape condition rating = 2). The upstream inverts of both culverts are visibly higher than the ponding area bottom elevation, which is the likely cause of the backyard area ponding. Culvert 116-04, the larger of the two culverts and the culvert with more conveyance capacity, is higher than culvert 116-03.

IDPA #8: Conveyance Beneath Kivalliq Street. IDPA #8 is at the downstream extent of Catchment 118. Catchment 118 has no upstream contributing catchments and discharges into Catchment 124. Drainage in Catchment 118 flows east through a network of ditches and culverts along Tupirvik Avenue, eventually reaching Kivalliq at the western extent of the catchment. Drainage is conveyed under Kivalliq Street by four separate culverts:

- Culvert 118-12 which is a 600 mm CSP in overall good condition at the intersection of Tupirvik Avenue and Kivalliq Street
- Culvert 118-09 which is a 600 mm CSP in overall good condition (slight deformation and infilling at the downstream end) at the low point further west along Kivalliq Street.
- Culvert 118-10 and 118-11 which are 120 mm SWSP culverts in overall good condition, and which are elevated in the embankment

Upstream areas in Catchment 118 coincide with an area of pre-development ponding, as illustrated in Figure 2-10. Although spring melt conditions were not observed, Catchment 118 consists of low-lying areas around the recreational centre which would likely accumulate snow through the winter. This means Catchment 118 may have above-average susceptibility to high runoff volumes as well as potential culvert icing or other blockages.

The Hamlet expressed that the area to the immediate south of Kivalluq Street is periodically subject to ponding, likely due to limited conveyance capacity beneath the road.

Without having completed engineering calculations of culvert capacity, the multi-level culvert arrangement would be theoretically well configured to convey flows under Kivalliq Street; if culvert icing, blockage, or culvert capacity causes backwatering upstream of Culvert 118-09, then culvert 118-12 and culverts 118-10 and 118-11 would provide conveyance higher on the embankment.

IDPA #9: Ponding Behind Northern Store, Drainage along Kivalliq Street and Sivulliq Avenue. IDPA #9 is a chain of drainage issues about the intersection of Sivulliq Avenue and Kivalliq Street, starting in the middle of Catchment 132 and extending into the downstream Catchment 133. The GN identified that this intersection is typically among the worst drainage areas in the Hamlet, and also happens to be one of the busiest intersections for vehicle and pedestrian traffic.

Drainage in Catchment 132 occurs eastward. The GN identified an area below the Northern Store which frequently is subject to ponding. Water drains from this low lying area through culvert 132-01, a 600 mm diameter CSP culvert which has severely crushed ends and inflilling, both of which reduce conveyance capacity. Water is conveyed through a short ditch then through culvert 132-02, which is a 600 mm CSP which is substantially infilled and has insufficient depth of cover. After exiting culvert 132-02, water drains west through a poorly formed (shallow) ditch along the south side of Sivulliq Avenue towards Kivalliq Street. Ditch drainage is conveyed beneath Kivalliq Street through culvert 132-03, which is a 600 mm CSP with insufficient depth of cover and substantial damage to the downstream end, reducing

conveyance capacity. Drainage continues east through a poorly formed (shallow) ditch along the south side of Sivulliq Avenue until reaching culvert 133-01 (400 mm CSP with badly damaged ends, infilling, and insufficient depth of cover) which conveys flows north beneath Sivulliq Avenue. Culvert 133-02 (250 mm CSP) also conveys water north under Sivulliq Avenue, but has badly damaged culvert ends and severe infilling which reduces its capacity. The final culvert in the network is culvert 133-03, which is a 500 mm circular CSP conveying water under an earthen berm. Culvert 133-03 has badly damaged ends and infilling, therefore reducing culvert capacity.

Drainage on the north side of Sivulliq Avenue flows east through poorly formed ditches to Kivalliq Street, where it appears to disperse either north next to Kivalliq Street, or over Kivalliq Street and overland into the ocean. The utilidor is on the north side of Sivulliq Avenue which reduces the ability to inmplement drainage infrastructure (such as culverts and ditches) at sufficiently low elevations.

The cause of the drainage issues at IDPA #9 are likely a result of a series of culverts with reduced capacity due to end damage and infilling, a ditch network which consists of shallow, poorly formed geometry, and road elevations which are low relative to the ditch and culvert elevations (as evidenced by the insufficient depth of cover at several culverts). In addition, culvert diameters decrease as the drainage progresses downstream, which increases the risk of hydraulic constrictions and road spillage even if the full capacity of the existing culverts was re-established.

IDPA #10: Pond South of Mivvik Avenue Near School. IDPA #10 a pond approximately 0.42 ha in size located directly south of Mivvik Avenue in the centre of the Hamlet. It is at the downstream end of Catchment 130 and is directly north of a school. Catchment 130 has no upstream contributing catchments, however a snow dump is located between the school and the pond (Rankin Inlet 2018) which would increase runoff during spring melt. Catchment 130 and has no apparent outlet.

Figure 2-10 illustrates that in 1954, this pond was originally a part of the lake to the north of Mivvik Avenue. The construction of Mivvik Avenue between 1954 and 2019 disconnected this 0.42 ha area from the main lake. Stantec did not observe a culvert between the pond and the main lake during the field visit; it is assumed that these two waterbodies do not have a direct surface water connection but may equalize water levels over time through seepage. Both the lake and pond do not have an outlet to the ocean. It is unknown if the pond is considered fish bearing by Fisheries and Oceans Canada (DFO).

The Hamlet indicated that the pond currently represents a safety hazard for the children attending the school, and that there have been past discussions about infilling the pond to eliminate the hazard.

IDPA #11: Springtime Flooding over Inulik Street. IDPA #11 is on Inulik Street to the south of Tariuq Avenue within Catchment 145. The Hamlet indicated that during the spring melt, drainage flowing northeast towards the ocean in the Tariuq Avenue roadside ditch floods over Unulik Road instead of being conveyed through culvert 145-01, and may enter the adjacent properties. A snow dump is located directly upstream of IDPA #11 (Rankin Inlet 2018).

The presence of an upstream snow dump and the poor condition of culvert 145-01 is the likely main cause of this IDPA. The snow dump would result in increased runoff being experienced by IDPA #11 during spring melt, potentially exceeding the conveyance capacity of the culvert and ditch. Related, culvert 145-01 is a 400 mm diameter CSP with insufficient depth of cover and badly damaged ends which are severely limiting culvert capacity. Substantial sediment deposition has occurred immediately upstream

of culvert 145-01 which has decreased ditch definition and raised water level upstream of the culvert, increasing the risk of road spillage.

IDPA #12: Spillage over Inulik Street. IDPA #12 is located at the downstream end of Catchment 148, at the crossing of Inulik Street. Catchment 148 is a relatively large catchment (36 ha) that has three snow dump locations within its boundaries (Rankin Inlet 2018). Catchment 148 drains west into Catchment 149 which outfalls to the ocean. There are no upstream contributing areas to Catchment 148. Given its position on the lee side of prevailing winds, it is likely that in addition to the snow dumps, Catchment 148 accumulates an above-average snowpack and experiences above average runoff volumes for its size. Most of the drainage through Catchment 148 occurs by overland flow or discontinuous channel flow, until Inulik Street where it is conveyed through culvert 148-01. Culvert 148-01 is a single 200 mm SWSP culvert with approximately half of the culvert barrel infilled with sediment crosses the road. During the 2021 field visit, the upstream end of the culvert was underwater and water had ponded upstream of the culvert, resulting in spilling over the road into Catchment 149 approximately 20 m north of culvert 148-01. Ongoing spillage over the road poses a risk to road stability.

Given the size of Catchment 148 and its anticipated runoff volumes, it is likely that culvert 148-01 is undersized even if it was cleaned out. The culvert's outfall ditch is also not well defined immediately downstream of the culvert and sedimentation is present. These downstream conditions may be impacting the tailwater conditions for the culvert thereby further decreasing capacity.

Drainage Planning

Specific recommendations for each of the 12 IDPAs are summarized in Table 4-4, including the corresponding figure reference. Given the prevalence and consequence of culvert and ditch icing during spring melt in northern communities (CSA 2020), Stantec recommends that observation of the IDPAs during snowmelt conditions occur prior to implementation of the recommended actions in Table 4-4. Depending on the level of complexity of the recommended action, detailed engineering design may be required. Drainage conditions should be monitored following design and implementation of any of the drainage planning recommendations to detect any undesireable byproduct impacts of the drainage improvement and inform adaptive or corrective action.

Table 4-4 IDPA Drainage Recommendations – IDPAs

Identified Drainage Problem Area (IDPA)	Summary of Drainage Issue [1]	Recommended Action(s)
IDPA #1	Lake spilling over Nunavut street during high water conditions	Options for this IDPA were previously submitted to S. Low and W. Patch from GN and to Hamlet staff in an email on July 13, 2021 (J. Muirhead 2021, email communication "Rankin Inlet Unnamed Lake – options for discussion", 13 July. The four options presented in the email are summarized below; a copy of the email with full description of the options and associated benefits and challenges is provided in Appendix F. Option 1: Lower the permanent pool of the lake by lowering one of the outlets of the lake. This would increase the amount of water the lake could store during runoff events before spilling. Option 2: Increase outflow capacity at lower stages of Unnamed Lake by enlarging existing outflow culverts/channels or adding additional culverts/channels. This would increase the discharge capacity of Unnamed Lake during low and medium water levels, potentially reducing the WSEs during high water conditions. Option 3: Pumping from Unnamed Lake to downstream catchments on a temporary basis during high water conditions. This may reduce the risk of road overtopping during high water conditions. Option 4: Raise the road to keep water from spilling over the road during high water conditions. Each of the options have benefits and challenges, which have been detailed in the email in Appendix F for Rankin Inlet's consideration. Stantec collected survey data (elevations) of the outlet #1 channel, and the outlet #2 culvert, and the road crest (outlet #3) in 2021 to facilitate more detailed analysis upon Rankin Inlet's direction on the desired option(s).
IDPA #2	Missing culvert	Addition of this cross culvert beneath Nunavut Street is not explicitly necessary. Under existing conditions, drainage problems in the drainage network in Catchment 111 have not been identified by the Hamlet or GN, meaning the flows that would be conveyed through a new culvert are currently being conveyed elsewhere without major issue. Furthermore, addition of a culvert at IDPA #2 would add flows to the upstream end of Catchment 104 which is not advisable given the planned future subdivision in Catchment 104 (Block 10).
IDPA #3	Ponding, poor drainage	Recommended works are illustrated in Figure C15 in Appendix C and described below. Improved ditching on the west side of Aputii Street should be implemented, using the ditch dimensions provided in CSA (2020) (2-4 m width, 0.75 m depth). Culvert 111-02 should either be fully remediated (ends repaired, culvert cleaned out) or replaced. Culvert remediation or replacement should follow the general guidance provided for culvert works in Table 4-3.
IDPA #4	Ponding, poor drainage	Recommended works are illustrated in Figure C16 in Appendix C and described below. Filling of the ponded area such that runoff drains south over Sivulliq Avenue and into the receiving lake. Following construction, monitor the road, parking lot, and channel leading to the lake for signs of erosion. Avoid piling of excessive snow north of the Eskusik Street and Sivulliq Avenue intersection to reduce runoff volumes in this area. While overland flow overtop of roads and parking lots is generally not recommended, Stantec deems it the preferred option at this location given the IDPA #4's position in the Catchment 131 (ie; in the headwaters) – the area should not experience high runoff volumes if snow is managed properly.
IDPA #5	Backyard area ponding	Recommended works are illustrated in Figure C17 in Appendix C and described below. Installation of a new SWSP culvert beneath Piqtuq Avenue, with an invert elevation equal to the upstream low point elevation. The new culvert will join the outflow channel from culvert 112-10 in Catchment 104. Culvert sizing may be completed using the results of an updated version of the hydrologic model provided in this report. The multi-level culvert arrangement (new culvert at low point invert with an elevated existing culvert 114-01) should lower the risk of ponding, and make the conveyance below Piqtuq Avenue less susceptible to culvert icing issues (CSA 2020). A stabilized outlet should be provided at the downstream end, especially given the proposed future subdivision in Catchment 104.
IDPA #6	Backyard area ponding and house flooding	Recommended works are illustrated in Figure C17 in Appendix C and described below. Installation of a new SWSP culvert beneath Piqtuq Avenue, with an invert elevation equal to the upstream low point elevation. The new culvert will join the outflow channel from culvert 114-01. Culvert sizing may be completed using the results of an updated version of the hydrologic model provided in this report. The multi-level culvert arrangement (new culvert at low point invert with an elevated existing culvert 116-02) should lower the risk of ponding, and make the conveyance below Piqtuq Avenue less susceptible to culvert icing issues (CSA 2020). A stabilized outlet should be provided at the downstream end, especially given the proposed future subdivision in Catchment 104.
IDPA #7	Backyard area ponding	Recommended works are illustrated in Figure C17 in Appendix C and described below. Installation of a new SWSP culvert beneath Piqtuq Avenue that either replaces or supplements culvert 116-03. The new culvert should have an invert elevation equal to the upstream low point elevation. Culvert 116-04 should be left in place as an elevated culvert in the multi-level culvert arrangement. Culvert 116-05 can be removed or left in place. The new culvert will outlet to the same channel as culvert 116-03 and culvert 116-04 currently do. Culvert sizing may be completed using the results of an updated version of the hydrologic model provided in this report. The multi-level culvert arrangement (new culvert at ponding area invert with an elevated existing culvert 116-02) should lower the risk of ponding, and make the conveyance below Piqtuq Avenue less susceptible to culvert icing issues (CSA 2020). A stabilized outlet should be provided at the downstream end, especially given the proposed future subdivision in Catchment 104.

Identified Drainage Problem Area (IDPA)	Summary of Drainage Issue [1]	Recommended Action(s)
IDPA #8	Ponding on upstream side of road	The existing multi-level culvert configuration would theoretically be well configured to convey drainage beneath Kivalliq Street. Minor improvements to culvert 118-12 (clean out infilling at downstream end, fix damaged culvert end) may provide marginal improvements to conveyance beneath Kivalliq Street, however the overall mechanism of the flooding issues are unclear. Monitoring of spring snow melt conditions is recommended to obtain better understanding of the cause of flooding and inform potential action(s).
IDPA #9	Ponding and conveyance issues around Sivulliq Avenue and Kivalliq Street	Recommended works are illustrated in Figure C18 in Appendix C and described below. The drainage network from the ponding behind the Northern Store to the Catchment 133 outfall should be upgraded. Culverts 132-01 and 132-02 should have the culvert ends repaired and the barrels cleaned out of the accumulated sediment as outlined in Table 4-3. Formalized ditch geometry along the existing ditch path from culvert 132-02 to the outfall of Catchment 133 should be implemented, following CSA (2020) requirements (4 m width and 0.75 m depth) or otherwise engineered ditch dimensions. Culvert 132-03 and culvert 133-01 should be replaced with 600 mm SWSP culverts in accordance with CSA (2020), to match the size of upstream culverts (i.e., culvert 132-01 and 132-02). Culvert 133-03 and the associated berm should be removed and replaced with a stable open channel to convey drainage towards the ocean. Rip rap underlain by non-wiven geotextile is the recommended material for this channel to reduce the risk of erosion. Detailed engineering design of the culvert/berm removal and channel design may be required. Culvert 133-02 should have ends repaired and accumulated sediment cleaned out. Alternatively, this culvert can be replaced with a SWSP culvert at a lower elevation in the embankment, and the receiving downstream ditch connected to the stable channel discussed above. If possible given the utilidor infastructure in the area, improved ditching can be implemented on the north side of Sivulliq Avenue. A culvert may also be installed on the north side of Sivulliq Avenue beneath Kivalliq Street to improve drainage on the north side of Sivulliq Avenue. The Hamlet or GN may also consider raising the road elevations of Sivulliq Avenue and Kivalliq Street in the vicinity of the intersection. Doing so would improve depth of cover over culverts and reduce the risk of road ovrtopping. If road raising is completed, a review of impacts to drainage should be conducted as runoff which formerly was conveyed east may be directed elsewhere, especially if the Kivalliq Street culvert to the north of Sivulliq Avenue is isntalled.
IDPA #10	Pond south of Mivvik Avenue (safety hazard)	Recommended works are illustrated in Figure C19 in Appendix C and described below. The snow dump between the school and pond should be relocated out of Catchment, to a location where additional runoff will not cause drainage issues. From a drainage perspective, the infilling of the pond (as suggested by the Hamlet) is a potentially viable option to investigate further. If the pond were to be infilled, drainage from Catchment 130 would need to be provided an alternative destination to accumulate/outfall – this is likely the main lake (Catchment 131). Ideally, a multi-level SWSP culvert configuration beneath Mivvik Avenue with appropriate ditching would be installed to reduce the risk of culvert icing and ponding on the south side of Mivvik Avenue. An understanding of the seasonal water levels in both the pond and the lake will inform the viability of the infilling option. Water level monitoring may be installed to obtain this data. Water balance modelling may be required to simulate proposed conditions impacts on lake levels, and check that the lake would not back up through the potential culverts under Mivvik Avenue. The local DFO representative should be contacted regarding the fish bearing status of the pond. If DFO considers the pond fish bearing, then infilling of the pond would likely be considered a contravention to the *Fisheries Act* and habitat offsetting would therefore be required for the infilling to be approved. Alternatively, the Hamlet could install a barrier around the pond to keep the children a safe distance from the water.
IDPA #11	Springtime flooding over Inulik Street	Recommended works are illustrated in Figure C20 in Appendix C and described below. The snow dump upstream of IDPA #11 should be relocated to a location where additional runoff will not cause drainage issues. Repair the damaged ends of culvert 145-01 and (if necessary upon inspection) clean out the barrel of accumulated sediments as outlined in Table 4-3. Clean out ditch and formalize geometry along the existing ditch flowing to culvert 145-01, following CSA (2020) requirements (4 m width and 0.75 m depth) or otherwise engineered ditch dimensions.
IDPA #12	Spillage over Inulik Street	Recommended works are illustrated in Figure C21 in Appendix C and described below. At least one additional culvert should be installed beneath Inulik Road to convey runoff. Efforts should be made to install SWSP culverts (CSA 2020). The new culvert(s) should be appropriately sized for the relatively large catchment and expected runoff rates. The culvert invert should be set flush with the existing ground as to reduce ponding risks. A refined version of the hydrologic model produced in this report (incorporating improved estimates of snowpack in catchment 148) may provide design flows for culvert sizing. Culvert 148-01 should be retained as an elevated culvert for the multi-level culvert configuration, but should have accumulated sediment cleaned out. Improved ditching in the area immediately downstream of the culvert should provide unimpeded outfall flow conditions for both culvert 148-01 and the additional culvert(s). If, following culvert addition, the conveyance capacity beneath Inulik Street cannot be sufficiently increased to convey the Catchment 148 runoff, relocation of the three snow dumps within Catchment 148 may be relocated to an area where they will not cause drainage issues (e.g., on the downstream side of Inulik Street). The Hamlet may also consider raising the road to increase culvert depth of cover to the recommended CSA (2020) depths and reduce the risk of overtopping of the road.

NOTES:
[1] Discussed in greater detail in the preceding Drainage Assessment section

4.1.2 Future Development Areas

4.1.2.1 Drainage Assessment

Existing drainage conditions in each of the planned future subdivisions are briefly summarized below.

Block 8

Block 8 is an approximately 7.4 ha area which is split between Catchment 106, 109, 125, 123, and 122. Existing drainage in this area is illustrated in Figure C5 in Appendix C. Block 8 is at the headwaters of each of these catchments; no external catchments drain onto Block 8 lands. A pond or depression area currently exists in the northeast side of Block 8. There are currently no existing culverts or ditches within Block 8.

Block 9

Block 9 is an approximately 6.4 ha area which is split between Catchments 151, 155, 152, and 156. Headwater portions of Catchments 151 and 155 both drain onto Block 9 and will need to be accounted for in drainage planning. There is an existing ditch and culvert network within part of Block 9 (culvert 155-03, 155-04, 155-05, 151-01, 151-02, 152-01) illustrated with the existing conditions drainage in Figure C14 in Appendix C. Drainage in catchments 155, 151, and 156 is generally due west while Catchment 151 drains south. A small depression area on the west side of the central road is present within Block 9. As illustrated in Figure 2-10, a lake was present in 1954 in the current location of Block 9. Since 1954, the lake has been backfilled and a pad for development has been built.

Block 10

The planned future subdivision within Block 10 is an approximately 21.5 ha area within Catchment 104 and Catchment 106, which have total catchment areas of 7.6 ha and 29.6 ha, respectively. The existing conditions drainage is illustrated in Figure C5 and Figure C9 in Appendix C.

In general, Block 10 is set within a low lying, undeveloped area which collects drainage from considerable upstream areas before discharging to the ocean. Catchments 116, 115, 114, 113, 112, 111, 100, and (during high water) Catchment 101 drain into Catchment 104, and Catchment 104 then drains into Catchment 108. Without including Catchment 101, the total area which drains to Catchment 106 is 126.5 ha although 64.1 ha of that total (51%) is Catchment 100 containing significant lake storage which would attenuate runoff from that area. Catchment 104 contains a snow dump location for the Hamlet (Rankin Inlet 2018) which would increase runoff during spring melt.

One major drainage feature was identified within the low lying area of Block 10 (illustrated on Figure C5 and Figure C9). Conveyance along this drainage feature alternates between channelized flow and dispersed overland flow through the vegetation in the low lying area; the linework in Figure C5 and Figure C9 indicate the best estimate of the concentration of flow. The substrate and vegetation types in and around the drainage feature suggest that this feature would be susceptible to erosion under increased

runoff rates or volumes. Drainage planning for this area should attempt to avoid major alterations to the runoff regime to this feature, to reduce the risk of erosion in the feature.

4.1.2.2 Drainage Planning

The drainage plan for each of the three development blocks are discussed below. The drainage plans are provided at the conceptual planning level; detailed engineering design has not been completed. Development of the drainage plans assumed that site grading could be completed in a way which resulted in the preferred drainage plan. Future engineering and site development works may require amendments to the conceptual drainage plan presented here. Detailed engineering of the site drainage infrastructure, incorporating quantitative analysis of runoff rates, volumes, and conveyance capacities of infrastructure (existing vs. proposed conditions), should be completed alongside the detailed engineering phases of the overall site development.

The conceptual drainage plans for the planned future subdivisions incorporated the following principles in accordance with CSA (2020) and general best management practices for drainage in developed areas:

- Existing drainage directions and boundaries should be preserved as much as practical.
- Road crown should occur in the centre; roadside ditches should be provided on both sides of the road
- Entrance culverts should be located at the driveway entrance of each lot
- Where warranted and/or practicable, efforts should be made to install SWSP culverts (CSA 2020).
- Drainage from upstream areas between lots should be avoided where practical
- All culverts should meet minimum depth of cover requirements
- Culvert marker poles should be installed on both ends of each culvert
- Ditch outfalls should be located at an existing drainage feature; stable outlets and tie-ins should be provided
- Drainage monitoring should be completed to detect drainage issues and inform corrective or adaptive action.

Block 8

Figure C-22 in Appendix C illustrates the proposed conditions drainage plan for Block 8. The existing conditions drainage boundaries will be preserved with the exception of slight alterations between Catchment 123 and Catchment 125 to accommodate the road and lot layout. The existing pond will be infilled to provide positive drainage through the developed area.

In total, the proposed drainage plan for Block 8 includes 5 new cross culverts, 19 new entrance culverts, and approximately 1,275 m of new ditches.

Block 9

Figure C-25 in Appendix C illustrates the proposed conditions drainage plan for Block 9. The existing conditions drainage boundaries will be preserved with the exception of slight alterations between Catchment 151 and Catchment 155 to accommodate the lot layout and resulting ditch configuration. Drainage from upstream areas should be collected in backyard ditches on the east side of the development, and connected to the roadside ditch network. Lots on the west side of the development currently drain west to receiving systems via overland flow; this drainage pattern can be maintained under proposed conditions.

In total, the proposed drainage plan for Block 9 includes no new cross culverts, 11 new entrance culverts, and approximately 765 m of new ditches.

Block 10

Figure C-24 in Appendix C illustrates the proposed conditions drainage plan for Block 10.

Ditching and culverts throughout the road and lot layout in Catchment 104 will outlet to the existing drainage feature. The drainage plan assumes that Unnamed Lake's overtopping of Nunavut Street during high water conditions (IDPA #1) is no longer occurring. If Unnamed Lake continues to overtop Nunavut Street and spill into Catchment 104, changes to the drainage plan may be required. The existing snow dump in Catchment 104 should be relocated.

Development in Block 10 is likely to result in increased runoff rates and volumes which, if directed entirely to the drainage feature, may cause erosion in the feature. To mitigate this risk, a portion of Block 10 (i.e., the areas within Catchment 104) will drain through ditches and culverts to the existing drainage feature, while the other portion (i.e., the development areas within Catchment 108) will be directed away from the existing drainage feature. The development areas within Catchment 108 will instead drain to a single roadside ditch along the proposed road and be conveyed east through a network of culverts to a stable outfall to the ocean. This drainage plan means that the existing Catchment 108 will be split into Catchment 108A and Catchment 108B under proposed conditions.

At the upstream end of catchment 108, the existing drainage feature should be realigned outside of the Block 10 footprint (estimated realignment length of up to 100 m).

In total, the proposed drainage plan for Block 10 includes 15 new cross culverts, 67 new entrance culverts, and approximately 3,325 m of new ditches.

4.1.3 Hydrologic Model

4.1.3.1 Results

Applying the methods outlined in Section 3.1.3, the HEC-HMS hydrologic model produced preliminary estimates of rainfall-driven runoff for the 5-year, 25-year and 100-year events under snow free conditions (Table 4-5). The runoff estimates in Table 4-5 are for the outflow from each catchment considering the entirety of upstream catchment contributions (catchment schematic provided in Appendix F). The 5-year,

25-year, and 100-year return periods were chosen based on the potential service levels for infrastructure in northern communities (CSA 2020).

Physical characteristics such as land coverage, soil moisture, basin length etc. and meteorological parameters are found in the digital model files provided to Rankin Inlet.

4.1.3.2 Limitations

The current stage of the model provides the framework for a more comprehensive hydrologic analysis in the future.

The following improvements can be made to the HEC-HMS model to increase the accuracy of results such that they may be appropriate for engineering or other detailed applications.

- Refinement of catchment characteristics including snowpack characteristics and its interactions with other meteorologic and atmospheric variables such as precipitation, wind and temperature.
- Include additional modules such as radiation, evapotranspiration and especially snowmelt processes, in the analysis.
- With the appropriate survey information, inclusion of stage-storage-discharge relationships and channel routing to capture attenuation effects on the routed catchment hydrographs.
- Depending on the intended use of the model results, event calibration and validation may be completed.

Table 4-5 Preliminary Estimates of Rainfall-Driven Discharge Under Snow-Free Conditions

Catchment ID	Preliminary Estimate of Rainfall-Driven Discharge Under Snow-Free Conditions (m^3/s) [1]		
	5-year	25-year	100-year
100	1.5	2.3	3.2
101	1	1.4	1.8
102	4.5	7.4	10.2
103	1	1.5	1.9
104	0.2	0.3	0.5
105	0	0.1	0.1
106	0.5	0.9	1.3
107	1.1	1.7	2.3
108	0.3	0.4	0.5
109	0.7	1.1	1.5
110	0.6	0.9	1.2
111	0.3	0.5	0.7
112	0.1	0.2	0.2
113	0	0	0.1
114	0	0	0.1
115	0	0	0.1
116	0.1	0.2	0.3
117	0.1	0.2	0.2

Catchment ID	Preliminary Estimate of Rainfall-Driven Discharge Under Snow-Free Conditions (m^3/s) [1]		
	5-year	25-year	100-year
118	0.3	0.5	0.7
119	0.1	0.1	0.2
120	0.1	0.1	0.1
121	0.1	0.1	0.1
122	0.1	0.2	0.2
123	0.2	0.3	0.4
124	0.5	0.8	1.1
125	0.1	0.2	0.3
126	0.2	0.4	0.5
127	0.2	0.2	0.3
128	0.1	0.1	0.2
129	0.1	0.1	0.1
130	0	0.3	0.4
131	0.2	0.9	1.2
132	0.1	0.2	0.3
133	0.1	0.1	0.1
134	0.2	0.4	0.5
135	0.3	0.2	0.2
136	0.1	0.2	0.3
137	0.3	0.3	0.5
138	0.2	0.4	0.6
139	0.1	0.1	0.1
140	0.2	0.4	0.5
141	0.2	0.3	0.4
142	0.2	0.2	0.3
143	0.1	0.3	0.4
144	1.1	0.3	0.4
145	1.1	0.3	0.4
146	0.3	0.1	0.2
147	0.4	1.7	2.2
148	0.1	1.6	2.3
149	1.5	0.4	0.5
150	0.1	0.5	0.7
151	0.1	0.2	0.3
152	0.6	2.1	2.9
153	0.5	0.2	0.3
154	0.6	0.1	0.2
155	0.1	0.9	1.2
156	0.1	0.7	0.9
157	0.7	0.8	1.2
158	0.5	0.2	0.2
159	0.7	0.2	0.2
160	14.4	1	1.4
161		0.8	1.1

Catchment ID	Preliminary Estimate of Rainfall-Driven Discharge Under Snow-Free Conditions (m^3/s) [1]		
	5-year	25-year	100-year
162		1	1.4
163		21.6	28.6

NOTES:
[1] Preliminary runoff estimates provided for the outfall from each catchment considering the entirety of cumulative upstream drainage (i.e., including upstream contributing catchments)

4.2 Geotechnical Investigation

4.2.1 General Observations

The following observations were made from field investigation:

- Signs of thaw degradation (tension cracks and ground subsidence) were observed along an ice wedge located in the northern portion of Block 10.
- Potential signs of thaw degradation (tension cracks and ground subsidence) were observed in marine washed till deposits north of Block 10.
- Shifting of a recent building occurred within an industrial district east of the municipality. According to local knowledge, the building was constructed in two phases, and shifting likely occurred following the second construction phase. Ground settlement could be related to permafrost thaw degradation; however, other mechanisms such as improper construction and poor drainage could have caused the distresses.
- Ruts impacting the growth of vegetation were observed crossing the main drainage flow path within Block 10. No visible sign of thaw degradation was observed surrounding this location. Usually, ice-rich permafrost areas impacted by ground disturbance affecting organic cover are correlated with thaw degradation following a disturbance event. In the present case, the absence of visible sign of thaw degradation suggests that low to moderate ice content permafrost is likely present at this location; this would support the observations made at boreholes BH21-01 and BH21-04.

Refer to photos 36 to 39 in Appendix E for the permafrost degradation features observed.

4.2.2 Subsurface Conditions

Subsurface conditions within Block 10 are summarized based on the results from the field investigation. Geotechnical observations and data are presented in detail on the borehole records provided in Appendix G and are summarized in Table 4-6. The laboratory testing results are presented in the attached gradation curves and summary tables in Appendix H and are summarized in Table 4-7.

Table 4-6 Subsurface Conditions

Block	Borehole No.	Stratigraphy (m bgs)			Groundwater depth (m bgs)
		Organic soil / peat	Granular deposits	Massive ice*	
10	BH21-01	0.00-0.10	0.10 – 2.13	-	0.30
	BH21-02	0.00-0.15	0.15 - 1.20	1.20 - 1.50	0.15
	BH21-03	0.00-0.06	0.06 – 1.25	-	0.06**
	BH21-04	0.00-0.05	0.05 - 1.7	-	0.05
	BH21-05	-	0.00 - 1.20	-	0.50

* Massive ice encountered corresponds to an ice-wedge (based on visual assessment of ice structure and ground surface morphology). Note that only the uppermost portion of the ice wedge was observed/sampled. Full depth and width of the ice wedge are unknown.
** Depth of groundwater seepage. Actual groundwater depth could not be confirmed.

Table 4-7 Particle Size and Moisture Content

Block	Sample No.	Depth (m)	Sediment fraction (%)			Moisture content (%)
			Fine particles	Sand	Gravel	
10	BH21-01-DC-03	1.20 - 1.31	58.4	39.5	2.1	29.4
	BH21-04-DC-03	1.40 - 1.45	7.6	46.8	45.6	13.3

4.2.2.1 Organics

At most borehole locations, the surficial organics were encountered overlying granular soils. They were noted to be thin and varied between 5 and 15 cm in thickness. The surficial organics either consisted of a cover of mosses and sod overlying a thin topsoil (at boreholes BH21-01, BH21-02 and BH21-04), or of a cover of mosses overlying a thin topsoil with sparse patterned ground features (frost boils) occurring (at boreholes BH21-03 and BH21-05). Areas of peat accumulations (< 30 cm-thick) were also noted, but no drilling was conducted within these sections.

4.2.2.2 Granular Deposits

Granular deposits were encountered below the layer of organics at all boreholes. They generally consisted of silty gravelly sand to sand and gravel. Cobbles were observed at all boreholes.

A layer of silt and sand with gravel was observed underlying the silty gravelly sand layer at borehole BH21-01.

A gravel layer with cobbles resulting from frost sorting processes was encountered near the ground surface at borehole BH21-03.

4.2.2.3 Bedrock

No bedrock was encountered within the limits of the boreholes. Bedrock outcrops were observed within the southeastern portion of Block 10 and within Block 8 and Block 9.

4.2.2.4 Groundwater

Groundwater measurements are presented in Table 4-6. Groundwater levels were observed between 0.05 and 0.30 m bgs in low-lying terrain (at boreholes BH21-01, BH21-02 and BH21-04) and at 0.50 m bgs at borehole BH21-05. Groundwater seepage was observed at 0.06 m bgs at borehole BH21-03.

In continuous permafrost terrain, groundwater levels will typically be limited to within the active layer. The level may fluctuate seasonally and in response to precipitation events, or because of site use, adjacent site use and construction activity.

4.2.2.5 Permafrost

Active Layer Measurements

Active layer measurements were taken on September 13 and 14, 2021. Findings are summarized below:

- Active layer depths ranging between 1.20 and 1.40 m bgs were recorded in marine deposits at boreholes BH21-01, BH21-02 and BH21-04.
- The active layer could not be confirmed at boreholes BH21-03 and BH21-05, though it was at least 1.25 and 1.20 m deep, respectively. Refusal of the active layer probe occurred on inferred coarse material.

Ground ice

Moisture content testing conducted on recovered samples was used to estimate the potential ice content within the first meter of permafrost. Findings are summarized below:

- Frozen soils with low to moderate ice content (estimated from moisture content of 13.3 and 29.4 %) were encountered within boreholes BH21-04 and BH21-01, respectively. The frozen soils sampled comprised well-bonded cryostructures with excess ice (Nbe).

  A low to moderate ice content was interpreted from the observation of the soil slurry cuttings recovered to depths of 1.70 (at borehole BH21-04) and 2.13 m bgs (at borehole BH21-01). Drilling of ice-rich soil, if present, generally does not correlate with a soil slurry; instead, intact cores are typically recovered in ice-rich soil.
- Borehole BH21-02 encountered an ice wedge at a depth of 1.20 m bgs. The overall depth and width of the wedge are unknown.
- No frozen ground was recovered from boreholes BH21-03 and BH21-05.

4.3 Qualitative Construction Suitability Assessment

Results of the qualitative construction suitability assessment are presented in Figures C-25a to C-25c in Appendix C along with the constraints and geohazards identified.

Key findings of the construction suitability assessment include the following:

Terrain suitable for development:

- Based on the findings of the construction suitability assessment, short to medium-term developments strategy should focus on terrain identified as suitable for development.
- In most cases, areas of bedrock should be considered suitable for development.

Terrain conditionally suitable for development:

- Terrain conditionally suitable for development consists predominantly of areas associated to the presence of drainage anomalies and/or suspected ice-rich terrain.

- The presence of ice wedge has been confirmed or interpreted in some areas; however, they do not appear to be widespread. Building and maintaining infrastructures over ice-rich terrain is generally costly and involves extra maintenance.
- Areas presenting 10° to 20° slopes were flagged as conditionally suitable. Grading and blasting may be required to develop these areas.

Terrain unsuitable for development:

- The interpretation of unstable terrain relative to thaw degradation within the northern portion of Block 10, suggests that a significant volume of ice is likely contained in some areas within the uppermost portion of permafrost. Because the degradation of ice-rich permafrost may lead to thermokarst, thermo-erosion and to the development of drainage anomalies, planning housing and other infrastructure development in these areas should be avoided until additional data is available.
- Topography with slopes above 20° identified as unsuitable often occurs on elevated bedrock topography and alongside bedrock ridges. Considerable blasting and grading would be required to develop in these areas; however, when completed, development in these areas would result in building lots with long term ground stability and may end up being an appropriate choice for development, even if expensive.
- Areas prone to snow drifting and accumulation are also to be considered carefully. The current layout of Block 10 accounts for a snow fence buffer of 60 m for windward drift and 150 m for leeward drift. No development should be conducted within this area.
- Although engineering measures and construction techniques could be applied to address the above-listed conditions, avoiding these locations is recommended.

Wherever development is to occur in areas presenting constraints and geohazards, then appropriate design, construction and maintenance guidelines should be applied (see Section 5: Conclusion and Recommendations).

5 CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Key Findings

5.1.1 Drainage Assessment and Planning

The drainage component of this project was split into two parts:

1. Drainage assessment. The characterization and evaluation of the existing conditions relative to applicable standards and recommended best management practices
2. Drainage planning. Actions which may be taken to address existing drainage deficiencies and improve overall drainage conditions, as well as drainage infrastructure that should be implemented in areas of new development.

Drainage assessment and planning was completed for three different areas in Rankin Inlet:

- Entirety of the developed area
- Identified Drainage Problem Areas (IDPAs)
- Planned Future Subdivisions

5.1.1.1 Developed Area

Following desktop review of the general hydrology and climate in Rankin Inlet, a field assessment of the existing drainage system was completed. The field assessment included:

- Separate site tours with T. Aksalnik (Public Works Foreman, Hamlet of Rankin Inlet) and S. Low (Planner, Government of Nunavut) to identify locations and details of areas which have demonstrated notable drainage issues in the past, and where the Hamlet or GN would like specific recommendations for improvement. These areas were referred to as Identified Drainage Problem Areas (IDPAs) and are discussed further in Section 5.1.1.2.
- Refinement of catchment boundaries by ground-truthing drainage splits
- Delineation of ditch and channel network
- Completion of a detailed inventory of culverts in Rankin Inlet
- Documentation of other relevant components of the general drainage conditions in Rankin Inlet

The collected field data provided the information required to create a drainage map of the existing drainage system consisting of catchments, ditches/channels, culverts, and overland flow paths. The collected field data also provided the basis for evaluation of the drainage system against the drainage requirements outlined in CSA (2020), MTO (2013), and other relevant drainage best management practices. A total of 12 deficiencies for the overall drainage network in Rankin Inlet were identified; recommendations to address each of the 12 deficiencies were developed (Table 5-1).

Table 5-1 Summary of Drainage Assessment and Planning for Developed Area

Drainage Deficiency	Recommended Action(s) [1,2]
Spatial coverage of the ditch network is insufficient for road network	Increase density of drainage ditches alongside the road network
Variable and often insufficient ditch depths and widths	Improve the geometry of existing drainage ditches
50 culverts have damaged ends with a high priority for remediation; 17 culverts have damaged ends with a medium priority for remediation	Repair the damaged/crushed culvert ends and affix steel end stiffener for protection; if culvert beyond repair, replace culvert
88 culverts are infilled with a high priority for remediation	Clean out the sediment inside the culverts to re-establish culvert conveyance capacity
19 culverts have erosion and scour in the vicinity of the culvert ends with a high priority for remediation	Understand cause of outlet erosion or scour; address root cause and/or stabilize outlet with rip rap
10 culverts have channel erosion, scour, sedimentation, or other instability upstream or downstream of the culvert that threatens the culvert such that there is a high priority for remediation	Understand cause of channel/ditch or scour; address root cause and/or stabilize with rip rap
Culvert marker poles not present	Install culvert marker poles
58 cross culverts and 18 entrance culverts have insufficient depth of cover	Increase depth of cover by lowering culvert or raising road
Backyard ponding is a frequent occurrence	Connect areas of frequent backyard ponding to the nearest drainage ditch by way of a small ditch (to suit field conditions)
Several driveways are missing entrance culverts	Install entrance culverts at all driveways
Emergency flooding equipment and supplies	Acquire and maintain flood emergency response supplies and equipment
Formal drainage monitoring program	Establish standardized drainage monitoring program building off of the drainage inventory completed in this report

NOTES:
[1] Drainage issues and recommended actions are discussed in detail in Section 4.1.1.1
[2] Where new culverts are being installed (replacement or additional), the culvert material should be smooth walled steel pipe (SWSP)

5.1.1.2 Identified Drainage Problem Areas (IDPAs)

At each of the 12 IDPAs identified by the Hamlet and/or GN, Stantec completed an assessment as to the cause of the drainage issue, and developed recommended actions to mitigate the drainage issue (Table 5-2).

Table 5-2 Summary of Drainage Assessment and Planning for IDPAs

IDPA Number	Drainage Issue [1]	Recommended Action(s) [1,2]
IDPA #1	Lake spilling over Nunavut Street during high water	Four potential options provided for Hamlet consideration: lower lake levels, increase outflow capacity of the lake, temporary pumping, and/or raise road
IDPA #2	Missing culvert	No action required - culvert likely not needed for drainage network.
IDPA #3	Ponding, poor drainage	Improved ditching, remediate or replace culverts
IDPA #4	Ponding, poor drainage	Filling of the ponded area, adjust snow clearing practices
IDPA #5	Backyard area ponding	Additional culvert installation
IDPA #6	Backyard area ponding and house flooding	Additional culvert installation
IDPA #7	Backyard area ponding	Additional culvert installation
IDPA #8	Ponding on upstream side of road	Additional culvert installation
IDPA #9	Ponding and conveyance issues around Sivulliq Avenue and Kivalliq Street	Flooding mechanisms are unclear; suggest observation of spring snow melt conditions to inform potential actions
IDPA #10	Pond south of Mivvik Avenue (safety hazard)	Relocate snow dump; further investigate the feasibility and requirements for infilling, or install barrier
IDPA #11	Springtime flooding over Inulik Street	Relocate snow dump; improve ditching, remediate or replace culvert
IDPA #12	Spillage over Inulik Street	Relocate three snow dumps; culvert cleanout, additional culvert(s) installation, improved ditching, consider road raising

NOTES:
[1] Drainage issues and recommended actions are discussed in detail in Section 4.1.1.2
[2] Where new culverts are being installed (replacement or additional), the culvert material should be smooth walled steel pipe (SWSP)

5.1.1.3 Planned Future Subdivisions

There were three planned future subdivisions considered in this project: Block 8, Block 9, and Block 10. For each of the planned future subdivisions, the existing conditions drainage was characterized to inform inflows to the development block, potential outfall locations, existing infrastructure to incorporate/adjust, sensitive environmental features, and other considerations for proposed conditions drainage planning. Using the collected field data and conceptual road and lot layout for the planned future subdivisions, conceptual proposed conditions drainage plans were completed for each of Blocks 8, 9, and 10 (Figure C20, Figure C21, Figure C22 respectively) consisting of ditch and culvert networks, outfall locations, and (where required) alterations to drainage boundaries.

5.1.1.4 Hydrologic Model

Given the relatively high number of points of interest within the drainage network, the drainage map for Rankin Inlet consisted of 64 catchments—many of which flowed into one another. The rational method (as in CSA 2020) was not deemed suitable for this drainage arrangement, and a HEC-HMS hydrologic model framework was developed for Rankin Inlet for rainfall events under snow-free conditions. The

model produced preliminary estimates of rainfall-driven discharges for the 5-year, 25-year, and 100-year return period events under snow free conditions, and provides the foundation for future hydrologic analysis to support the Hamlet's infrastructure maintenance and development.

5.1.2 Geotechnical Evaluation

5.1.2.1 Overburden Soils and Bedrock

- The surficial geology surrounding Rankin Inlet consists of glacial, marine and glaciofluvial deposits with numerous eskers and bedrock outcrops.
- Subsurface conditions within Block 10 generally consisted of a layer of organics underlain by silty gravelly sand to sand and gravel with cobbles. A layer of silt and sand with gravel was observed underlying the silty gravelly sand layer at borehole BH21-01.
- No bedrock was encountered within the limits of the boreholes. Bedrock outcrops were observed within the southeasternmost portion of Block 10 and within Block 8 and Block 9.

5.1.2.2 Permafrost

- Ice wedges likely occur within Block 10.
- Frozen soils with low to moderate ice content (estimated from moisture content of 13.3 and 29.4 %) were encountered within boreholes BH21-04 and BH21-01, respectively. Permafrost sampled comprised well-bonded cryostructures with excess ice (Nbe).
- The upper limit of an ice wedge was confirmed at a depth of 1.20 m bgs at borehole BH21-02 located within Block 10.
- The overall sensitivity of permafrost to climate change is anticipated to be variable ranging from low to high depending on site conditions.
- Signs of thaw degradation (tension cracks and ground subsidence) were observed along an ice wedge north of Block 10.
- Potential signs of thaw degradation (tension cracks and ground subsidence) were observed north of Block 10. Further investigation should be conducted to confirm the presence of ice-rich soils in areas presenting signs of ground subsidence or tension cracks.
- Shifting of a building occurred within an industrial district east of the municipality. Ground settlement could be related to permafrost thaw degradation; however, mechanisms such as improper construction and poor drainage could have caused the distresses.
- Ruts impacting the growth of vegetation were observed crossing the main drainage flow path within Block 10. No visible sign of thaw degradation was observed surrounding this location, suggesting that low to moderate ice content permafrost is likely present at this location; this would support the observations made at boreholes BH21-01 and BH21-04.

- Site assessment through visual inspection did not account for any ground ice feature within Block 8 and Block 9.

5.1.3 Construction Suitability

Assessing construction suitability was conducted using a multi-criteria approach. Key drivers influencing suitability of a given location consisted of local terrain conditions, including the overall topography, nature and properties of local surficial materials, drainage conditions as well as the presence of terrain-related constraints and geohazards. Considerations regarding available construction equipment and potential foundations systems were not accounted for.

The overall assessment and resulting construction suitability maps (Appendix C, Figures C-25a to C-25c) indicate that it is feasible to proceed with land development within the proposed subdivisions; however, that proper design of drainage infrastructures should be implemented in certain areas to avoid adverse drainage conditions within the planned future subdivisions. Refer to Figures C-17 to C-19 in Appendix C for the proposed drainage plans within Block 8, Block 9 and Block 10.

Key findings of the construction suitability assessment include the following:

Terrain suitable for development

- Short to medium-term development strategy should focus on terrain identified as suitable.

Terrain conditionally suitable for development

- Consists predominantly of areas associated to the presence of drainage anomalies and/or suspected ice-rich terrain. Proper design of building and infrastructure should be considered regarding drainage conditions and ice-rich terrain.
- Areas with 10° to 20° slopes were identified. Grading and blasting may be required in some areas.

Terrain unsuitable for development

- Consists of areas with slopes more than 20°, drainage channels, unstable terrain relative to thaw degradation, bedrock ridges, areas subject to flooding, and areas prone to snow drifting and accumulation.
- Planning housing and other infrastructure development in areas with potentially unstable terrain relative to thaw degradation should be avoided until additional data is available.
- Considerable blasting and grading would be required to develop in areas with steep slopes and bedrock topography; however, when completed, development in these areas would result in building lots with long term ground stability and may end up being an appropriate choice for development, even if expensive.
- Areas prone to snow drifting and accumulation should be avoided.
- Although engineering measures and construction techniques could be applied to address the above-mentioned constraints and geohazards, avoiding these locations is recommended.

Wherever development is to occur in areas presenting constraints and geohazards, then appropriate design, construction and maintenance guidelines should be applied.

5.2 Recommendations for Planned Future Subdivisions

Permafrost ground conditions present unique but solvable challenges with regard to land development in the North. Site specific conditions, exacerbated by impacts of changing temperatures and precipitation patterns require adequate planning, design, and maintenance of drainage related infrastructure to ensure that minimal negative impacts and disruption occurs in the future.

Key policy guidance documents have been developed in recent years in relation to reducing the overall vulnerability of infrastructure in northern communities. For the current study, four key documents developed as part of the Northern Infrastructure Standardization Initiative (NISI) provide standards and recommendations regarding proper evaluation, design, construction, operation and maintenance of new and existing infrastructures. They consist of:

- CAN/BNQ 2501-500 Geotechnical Site Investigations for Building Foundations in Permafrost.
- CAN/CSA-S503-20 Community drainage system planning, design, and maintenance in northern communities.
- CSA-S501-14 Moderating the effects of permafrost degradation on existing building foundations.
- CSA PLUS 4011:19 Technical Guide: Infrastructure in permafrost: A guideline for climate change adaptation.

The following sections highlight key recommendations related to the development of new subdivision components in Rankin Inlet (i.e., road access, building pads and drainage infrastructure). The goal is not to summarize the above cited documents, but rather to emphasize on key items with respect to future development in Rankin Inlet.

5.2.1 Appropriate Level of Geotechnical Investigations

Geotechnical site investigations are essential to ensure that a sufficient level of site-specific information is available to support appropriate design, construction, and maintenance of future infrastructures. The current evaluation should be considered a preliminary evaluation to support construction suitability from a geotechnical point of view. As the planning of future developments advances, additional geotechnical investigations should be conducted as they relate to the various stages of land development.

The geotechnical evaluation indicated that the granular deposits encountered are generally classified as low to moderate sensitivity to thaw degradation (with low to moderate ice content). Soils containing ice wedges are highly thaw sensitive and could exhibit significant settlement upon thawing. Soils containing massive ice, other than ice wedges, are also likely to occur within the limits of Block 10. No massive ice feature (including ice wedges) was observed at Block 8 and Block 9.

The following should be considered prior to site development:

- Site-specific geotechnical investigations should be conducted once more specific development plans are available. Confirming that an appropriate level of investigation is achieved will require

the consideration of the infrastructure types, then follow the overall recommendations as presented in CAN/BNQ 2501-500/2017 Geotechnical Site Investigations for Buildings Foundations in permafrost zones (National Standard of Canada 2017).

- The characteristics of readily available fill materials may impact the design and planning of future infrastructures. Proper assessment of the overall suitability of local borrow materials should be conducted.
- Further investigation and analysis should be conducted at the IDPA, where ground movements were reported, and where building shifting occurred. This will allow a better understanding of the mechanisms involved and will inform future development.

5.2.2 Building Pads and Road Embankments

Structural fill consisting of a non-frost susceptible granular fill (i.e., well-graded sand and gravel containing less than 5 to 8 percent fines) should be used as building pad materials. Quality borrow materials appear readily available from gravel sources located north from the municipality. If such material is not readily available, special attention should be given to ensure that an appropriate building foundation system is selected.

Effort should be given to grade building pads so that water drains away from the developed lots (i.e., pads will serve as a drainage barrier). Coarse-textured fill should be also placed on lots and roads characterized by poor drainage. Slope cuts and/or excavations should be limited to minimize potential permafrost degradation.

The thickness of the pads and road embankments should be designed to reduce permafrost degradation, especially in terrain identified as conditionally suitable for development and unsuitable for development (when crossed). Generally, pad/embankments approximately 1.2 to 1.8 m thick placed above grade will reduce permafrost degradation. Thicker pads composed of coarser materials will reduce the potential for permafrost degradation and will drain water more effectively. Side slopes covered with coarse gravel or riprap will reduce erosion and localized sloughing. Compaction of the pads in controlled lifts is also key, given the wet subgrade of most native soils within Block 10; compaction should be limited to static compaction only (i.e., no vibratory compaction).

Pads and road embankments should be constructed during the summer months when the native subgrades are thawed.

5.2.3 Site Grading and Construction

Ground disturbance should be limited to the footprint of the proposed infrastructure as stripping and grading can trigger localized thermokarst or surface subsidence due to the melting of ground ice. Stripping of the surficial topsoil/organic layer should be avoided. The organic topsoil reduces heat flow into the ground and helps preserve the subgrade in a frozen state.

Proper surface water drainage will be essential to avoid surface erosion and preserve the permafrost during construction. If construction occurs during the thawing season, appropriate drainage management

techniques should be in place before spring runoff. The construction of temporary berms is generally preferred over the excavation of drainage ditches or swales.

Building pads should be graded a 2% or more so that water drains away from the lots. Coarse-textured granular fill should be placed on lots and roads characterized by imperfect or poor drainage. Wherever required, slope cuts and/or excavations should be limited to reduce permafrost degradation.

Areas of massive ice (i.e., ice wedges) were observed in some of the terrain within Block 10; an ice wedge was confirmed at borehole BH21-02. Grading and fill placement should be designed to drain water away from any ice wedge, so that the ice wedge depression doesn't trigger preferential flow path and subsequent thaw degradation. Development should be avoided within areas presenting signs of thaw degradation.

If development advances in areas of massive ice, deep foundations such as rock socket piles may be necessary to mitigate the risk of building movement from thaw settlement. Prioritizing rock socket pile foundations over surface foundations or adfreeze pipe piles should also be considered in areas of shallow bedrock.

5.2.4 Conceptual Drainage Plan

Proper surface water drainage is essential for preserving the protection of infrastructure, private property, and the natural environment.

The conceptual drainage plan for Block 8, Block 9, and Block 10 are provided at the conceptual planning level in Figure C20, Figure C21, and Figure C22 (respectively) in Appendix C. The conceptual drainage plans for the planned future subdivisions incorporated the following principles in accordance with CSA (2020) and general best management practices for drainage in developed areas:

- Existing drainage directions and boundaries should be preserved as much as practical.
- Road crown should occur in the centre; roadside ditches should be provided on both sides of the road
- Entrance culverts should be located at the driveway entrance of each lot
- Culverts should be SWSP
- Drainage from upstream areas between lots should be avoided where practical
- All culverts should meet minimum depth of cover requirements
- Culvert marker poles should be installed on both ends of each culvert
- Ditch outfalls should be located at an existing drainage feature; stable outlets and tie-ins should be provided
- Drainage monitoring should be completed to detect drainage issues and inform corrective or adaptive action.

Detailed engineering design has not been completed for the drainage plan. Development of the drainage plans assumed that site grading could be completed in a way which resulted in the preferred drainage

plan. Future engineering and site development works may require amendments to the conceptual drainage plan presented here. Detailed engineering of the site drainage infrastructure, incorporating quantitative analysis of runoff rates, volumes, and conveyance capacities of infrastructure, should be completed alongside the detailed engineering phases of the overall site development.

5.2.5 Erosion Control

Erosion control measures should be included in the design of pads and embankments, especially next to drainage infrastructure (ditches/channels/culverts). Materials to consider are geotextiles and riprap armouring. More specifically:

- Riprap (i.e., a blanket revetment constructed of rocks or rubbles) should be used to armor segments of embankment located alongside culvert inlets/outlets. This material will limit potential erosion of fine fill material. Use of geotextiles or an appropriate filter design is also recommended. Riprap aprons should also be used to mitigate potential erosion at culvert outlets.
- Limiting ground disturbance and potential damage to the native vegetation will minimize soil surface erosion. Maintaining the natural vegetative cover facilitates ground retention and prevents surface erosion.
- Sediment controls should be used to prevent siltation of the culverts, which can cause the drainage system to function poorly. The installation of silt traps, re-vegetation (may be inappropriate for this environment), straw mulching and implementation of other erosion control measures are essential.

5.2.6 Inspection and Maintenance

A properly maintained and monitored drainage system will ensure a high level of efficiency and durability. To do so:

- Inspection and maintenance personnel should be responsible for maintaining the drainage system.
- The drainage infrastructures should be inspected on a weekly basis during melting season and/or after major rain events.
- Damaged culverts should be immediately repaired or replaced.
- Erosion control measures should be implemented as soon as visible signs of surface erosion are identified.
- The cause of any malfunction of the drainage system should be identified and addressed immediately.
- Blocked culverts should be cleared immediately to restore surface water flow through the culvert.
- During winter, carry out frequent inspections to ensure that the drainage system is not damaged by snow removal or completely blocked by ice. Snow removal personnel should be aware of the

location of the drainage infrastructure. Marker poles may be placed to warn operators of the presence of the culvert outlets.

6 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of the Client within the Statement of General Conditions, and its agents to review the conditions and to notify Nunami Stantec should any of these not be satisfied. The statement of general conditions addresses the following:

- use of the report
- basis of the report
- standard of care
- interpretation of site conditions
- varying or unexpected site conditions
- planning, design, or construction

We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report, or if we can be of any other assistance, please do not hesitate to contact us at your convenience.

Yours very truly,

NUNAMI STANTEC LIMITED

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APPENDIX A Statement of General Conditions

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client and may not be used by any third party without the express written consent of Stantec, which may be withheld at Stantec's discretion. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the specific site and project scope as described by the Client. The contents of this report are applicable only to the site conditions encountered at the time of the investigation or study. If the proposed project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is engaged by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the reasonable skill and diligence required by customarily accepted professional practices and procedures normally provided in the performance of such services at the time when and the location in which the services were performed. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, and/or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work at specific field observation locations and/or through interpretation of both digital imagery and/or LiDAR data. Classifications and statements of condition have been made based on anticipated behavior of the materials or geomorphic processes and are interpretive in nature; no specific description should be considered exact, but rather should be considered reflective of the anticipated behaviour of materials or geomorphic processes. Extrapolation of in situ conditions can only be made to some limited extent beyond the observed locations. The extent depends on variability of the soil, superficial materials, bedrock, soil moisture and groundwater conditions as influenced by geological processes, construction activity, and land use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently in advance initiating the next project stage (property acquisition, tender, construction, etc.), to confirm that this report adequately addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site

work relating to the recommendations included in this report should only be carried out in the presence of a qualified engineer or geoscientist; Stantec cannot be responsible for site work carried out without its representative being present.

APPENDIX B Community Plan

ᑲᖏᑭᓪᓗᐅᑦ ᓄᓇᖏᒻᒋᑦ ᐸᖁᓇᐅᑎᖏᓐᖓ

RANKIN INLET COMMUNITY PLAN

2021-2041

ᑎᑎᕆᑲᕆ 2: ᓄᓇᒥᐅ ᐊᑐᖅᓂᖅᓯᒪᓂ ᓄᓇᕐᔪᐊᕆᑦ
SCHEDULE 2: LAND USE MAP

ᑎᑎᕆᑲᕆ 3: ᐄᐊᓯᓕᐅᔾᔪᓯᒪᓂ ᑭᒃᓕᑎᕆᐅᔾᔪᕆᑦ
SCHEDULE 3: MUNICIPAL BOUNDARY

ᐃᖏᓕᓐᓂᖅᓴᖅ Iqalugaarjuup Nunanga Territorial Park

ᓱᖏᓪᓕᖅ ᑕᓱᖅ ᑎᖅᑎᓕᓂᓂᓂ ᒥᑦᑕᖏᓐ (ᑐᒃᓕᐊ ᐃᒪᖏᑦᖏᓐ) First Landing Lake (secondary water source)

ᑎᑎᕆᑲᕆ 2 SCHEDULE 2

Scale: NTS

Nippisar Lake (water source)

ᑲᑎᒪᔨᖅ Baseball Field

ᖃᐅᔨᓴᖅᑕᐅᑦ Community Dock

ᐃᓕᓴᕐᓗ ᑕᓱᖅ Williamson Lake

ᐱᓕᕐᓂᐊᕐᓂᖅ ᑐᓴᖅ Barge Landing Area

Takeoff / Approach Surface

ᖃᖏᑕᒋᔭᐅᓕᕆᔨᖏᑦ

Takeoff / Approach Surface

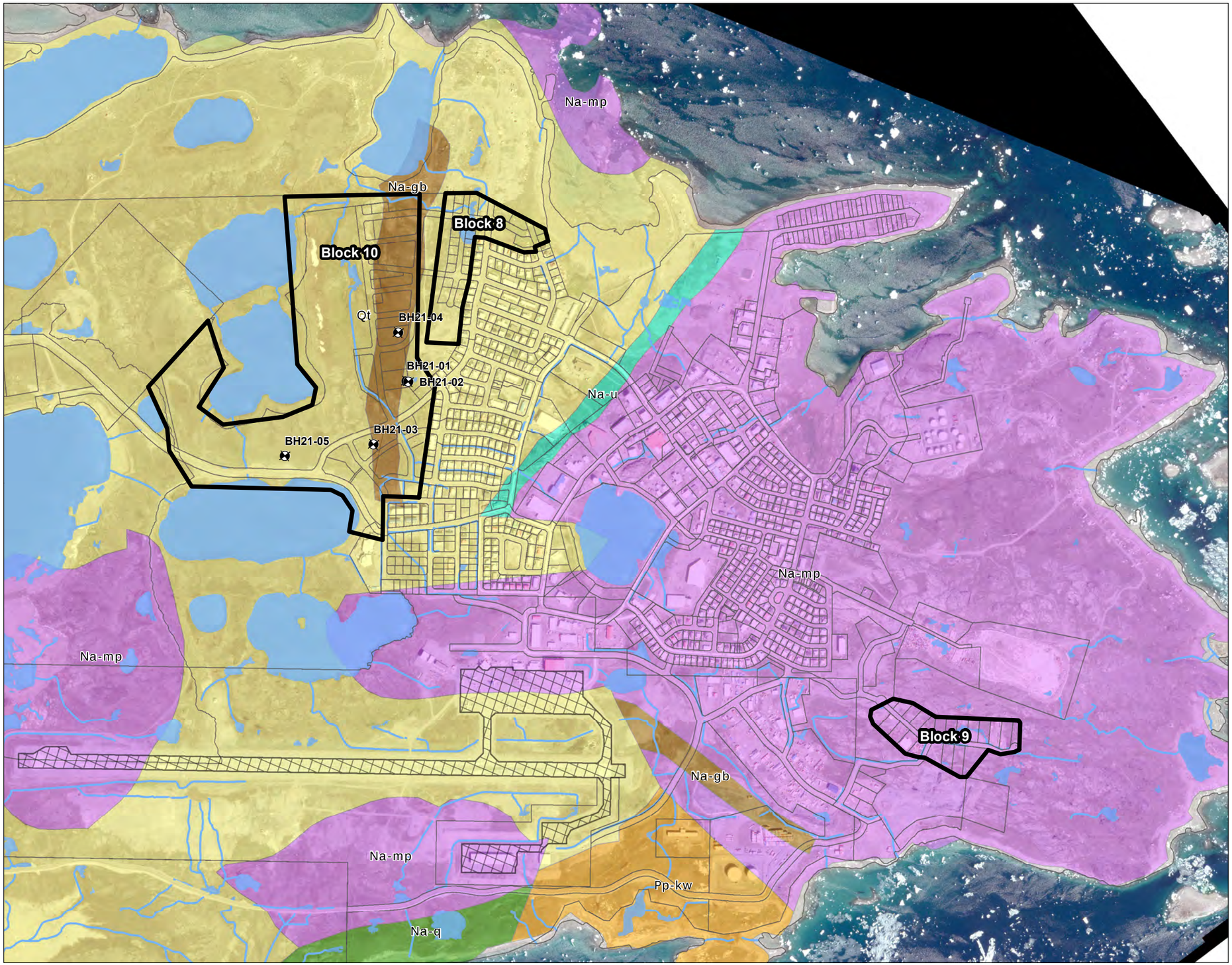
ᖃᖏᑕᒋᔭᐅᓕᕆᔨᖏᑦ

Residential	ᐃᓚᒋᐅᑉᓂᐊᖏᑐᓂᑦ ᓄᓇᑦ	Road		Maani Ulujuk High School	9	ᒪᓂ ᐅᓗᓴᒃ ᐃᓕᓐᓂᓂᐊᖏᓚᒃ
Community Core	ᓄᓇᓕᐅᑦ ᐊᑐᖏᐅᓂᖏᓚᐅᓂᖓ	Trail	ᐃᑉᑦ	Simon Alaittuq Middle School	10	ᓴᐃᒪᓐ ᐊᓪᒪᐃᑐᖅ ᐃᓕᓐᓂᓂᐊᖏᓚᒃ
Community Use	ᓄᓇᓕᐅᑦ ᐊᑐᖏᐅᓂᖓ	Building Footprint	ᐱᔾᖅᑎᑎᓂᖅ ᑐᒥᓂᒃ	Community Hall and Arena	11	ᐱᓐᖓᐊᖏᖅᓴᒃ ᓯᐊᖏᓇᑉᖏᖅᓴᒃ
Commercial	ᑭᓇᐅᔾᔨᒃᓴᓕᑎᑦ	Surveyed Lot Lines	ᖃᐅᔨᓴᖏᓐᖓᐊᓪᓚᒃ ᑭᓪᓕᖅᖏᖅᓴᑦ	Northern Store	12	ᓂᐅᔪᖏᖅᓴᒃ
Open Space	ᐅᒃᑯᐃᓱᖅᓯᑦ ᐃᓚᓗᖅᖏᖅᓴᐅᓂᑦᑐᑦ	Proposed Lot Lines	ᑭᓪᓕᓂᐊᖓᔪᓚᓪᓚᑦ	Arctic Co-op and Inns North	13	ᑯᐊᐸᒃᑯᑦ ᑐᖏᖅᓴᒃ
Waterfront Recreational	ᐃᒪᐅᑦ ᓴᖓᓂ ᐃᓚᓗᖅᖏᖅᓴᑦ	Playground	ᐱᓵᖓᔪᖏᖅᓴᒃ ᓯᓪᓕᒥ	Siniktarviq Inn	14	ᓯᓂᒃᑕᖏᖅᓴᒃ
Industrial	ᓴᓇᖏᖅᐳᒃᑐᓂᑦ	Hamlet Office	1 ᐄᐊᓪᓚᓇᒃᑯᑦ ᑎᑎᕆᖏᖅᓴᖓᓚᖓ	Nanuq Lodge	15	ᓇᓂᖅ ᓯᓂᒃᑕᖏᖅᓴᒃ
Transportation	ᐃᓅᓱᕆᔭᓕᓂᓂᖅ	Fire Hall	2 ᖃᓴᑎᓇᐅᓇᑯᑦ	Holy Comforter Church	16	ᑐᒃᓯᐊᖏᖅᐊᓪᓚᖅ
Nuna	ᓄᓇᓕ	Post Office	3 ᑎᑎᖅᓇᖅᑕᖏᖅᓴᒃ	Roman Catholic Church	17	ᐃᒃᓯᕆᔭᐊᓇᒃᑯᑦ
Waste Disposal	ᐊᒃᑕᑯᑦ	Health Centre	4 ᐊᓐᓂᐊᖏᖅᓴᒃ	Glad Tidings	18	ᐊᔪᖅᖃᑐᐃᐅᒃᑯᑦ
Granular Resources	ᓯᐅᕆᖅᑕᖏᖅᓴᑦ	Nunavut Arctic College	5 ᓄᓇᕗᑦ ᓯᓚᑐᖅᓴᖏᖅᖓ	R.C.M.P.	19	ᐳᑭᖅᑕᓂᒃᑯᑦ
Municipal Reserve	ᐄᐊᓪᓚᒃᑯᑦ ᓴᓂᔪᖅᓯᒪᓕᖅᖓ	Kivalliq Inuit Association	6 ᑭᔪᓐᓂᖅ ᐃᓄᐃᑦ ᑲᑐᐅᖅᑎᑎᒃᑯᑦ	Airport Terminal	20	ᒥᑦᑕᖏᖅᓴᖓᒥ ᐅᑕᖅᑭᕕᒃ
Restricted Development	ᐱᔪᓐᓂᐊᑎᑕᐅᔾᔨᐅᑕᑐᐃᓂᔪᑦ	CBC	7 ᓯᐱᓯᒃᑯᑦ	Cemetery	21	ᐃᓗᓴᑦ
Watershed Overlay	ᐃᒥᖅᑕᖏᖅᐳᑦ ᐋᖅᑭᐅᒪᓂᖓᓚᖓ	Leo Ussak Elementary School	8 ᓂᐅ ᐅᓴᒃ ᐃᓕᓐᓂᓂᐊᖏᖅᓴᒃ	Power Plant	22	ᖅᐅᒪᖅᑯᑎᓂᓗᖏᖅᓴᒃ

N W E S

0 100 200 Meters

APPENDIX C Figures



NUNAMI STANTEC

Legend

- Completed Boreholes
- Focus Area
- Watercourses
- Waterbodies
- Runway
- Parcels

Bedrock Geology

- Na-gb (Gabbro)
- Na-mp (Mafic/intermediate volcanic rocks)
- Na-q (Quartz arenite)
- Na-u (Ultramafic rocks, Konatiitic basalt)
- Pp-kw (Quartz arenite (White Rock member)
- Qt (Quaternary deposits)

N

0 250 500 metres

(At original document size of 11x17)
1:12,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Bedrock Data Source: Tella et al. 2005. Bedrock geology compilation and regional synthesis, parts of Hearne domain, Nunavut. OPen File 4729
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by ADC on 2022-02-08
TR by OP on 2022-02-08

Client/Project
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

144903017-002 REVB

Figure No.
C-1

DRAFT

Title
Bedrock Geology

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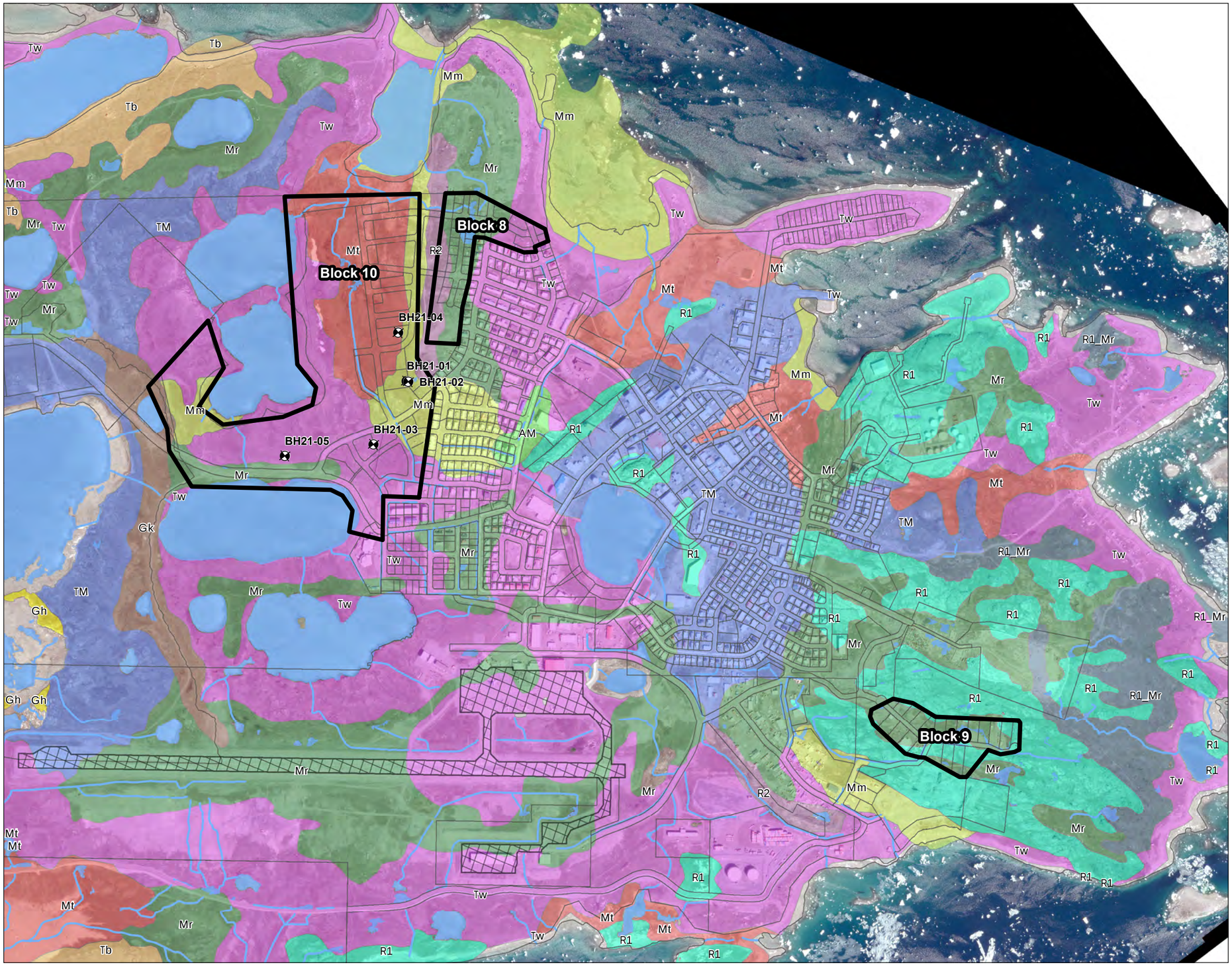

NUNAMI STANTEC

Legend

- Completed Boreholes
- Focus Area
- Watercourses
- Waterbodies
- Runway
- Parcels

Surficial Geology

- AM (Alluvium and marine sediments, undifferentiated)
- Gh (Glaciofluvial and morainal deposits)
- Gk (Ice-contact, stratified)
- Mm (Nearshore sediments)
- Mr (Littoral sediments)
- Mt (Tidal flat sediments)
- R1 (Volcanic/sedimentary rocks)
- R1_Mr (Volcanic/sedimentary rocks, littoral sediments)
- R2 (Plutonic rocks)
- Tb (Till blanket)
- TM Till and marine sediments, undifferentiated)
- Tw (Till, marine washed)

N

0 250 500 metres

(At original document size of 11x17)
1:12,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Surficial Geology Data Source: McMartin, L. 2002. Surficial geology, Rankin Inlet, Nunavut. Geological Survey of Canada, Open File 4116, scale 1:50,000
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by ADC on 2022-02-08
TR by OP on 2022-02-08

Client/Project
144903017-003 REVC
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-2

DRAFT

Title
Surficial Geology

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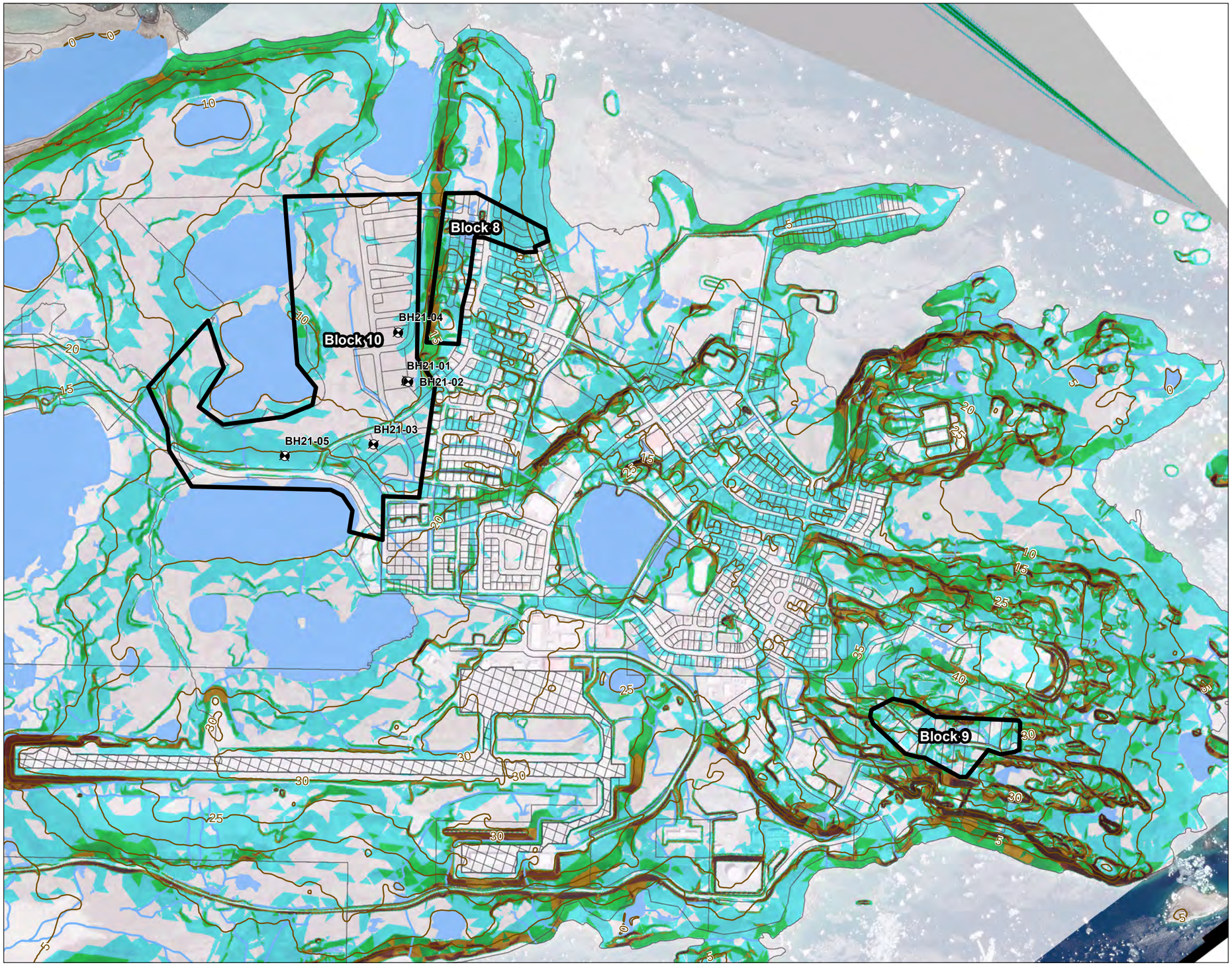
Code	Material Type	Description
AM	Alluvium and marine sediments, undifferentiated	sand and silt; 1 to 5 m thick; modern alluvium mixed with fine grained sediments washed from slopes by wave action; occurs in topographic lows on gently sloping surfaces; surfaces characterized by surface water runoff features or gullying by ephemeral streams, commonly covered by a thin, <40 cm thick, organic mat on which grasses and sedges grow
Gh	Glaciofluvial and morainal deposits	bouldery gravel, sand, and diamicton, undifferentiated; 1 to 5 m thick; includes patches of marine washed till (Tw) or till modified by glacial meltwater flow (Tx); occurs as a complex of low hummocks and ridges, or minor ridges forming a reticulate pattern; locally terraced with abundant ice-wedge polygons in sorted sediments or mudboils in diamictons
Gk	Ice-contact, stratified	sand and bouldery gravel; 5 to 25 m thick; locally includes till patches; deposited by meltwater streams in, over, or around ice or in ice tunnels; essentially occurs in meltwater corridors as continuous esker ridges, or discontinuous beads marking positions of slowed ice retreat; surfaces sparsely vegetated and locally reworked into shoreline features; kettle holes or lakes in places; abundant ice-wedge polygons
Mr	Littoral sediments	sand and gravel; 1 to 5 m thick; generally well sorted material; locally includes patches of marine washed till (Tw); forming flights of beach ridges, bars, spits, terraces, and shore ice pushed ridges; derived from the reworking of upland surficial deposits; occurs commonly on topographic highs; surfaces characterized by sparse vegetation and orthogonal frost cracks or ice-wedge polygons
Mm	Nearshore sediments	sand to silty sand; 1 to 5 m thick; well sorted material; forming thin sheets over till on gentle slopes of glacial landforms, or filling topographic lows; derived from the reworking of surficial deposits and accumulation of winnowed fine material in low-lying areas; surfaces characterized by a thin organic mat, abundant ice-wedge polygons, and the lack of littoral features
Mt	Tidal flat sediments	silty sand to silt and clay; moderately well sorted material locally containing pockets of nearshore sand and gravel; commonly strewn with an open boulder lag; forms a flat coastal plain extending as far as 3 km inland; tidal plain typically covered by a thin organic layer derived from grasses, and scattered with shallow pools and tidal channels; Includes areas of wind-blown sands with sparse vegetation
TM	Till and marine sediments, undifferentiated	till, glacial marine diamictons, and patches of marine nearshore and littoral sediments; 1 to 5 m thick; generally occurs in topographic lows where drainage is poor; surfaces covered by a thin organic mat; mudboils are common; rare ice wedge polygons; commonly grades into nearshore sediments (Mm) or alluvium and marine sediments (AM)
Tb	Till blanket	till, forming a continuous cover; 2 to 25 m thick; occurs as till plain or streamlined landforms; masks underlying bedrock topography; surfaces vegetated by low shrubs, mosses, and grasses, sometimes growing in elevated organic rings around 50 to 100 cm diameter patches of bare or lichen-covered mud (mudboils)
Tw	Till, marine washed	till, reworked from marine wave and current action; >1 m thick; poorly sorted, coarse-grained material with a boulder lag resulting from the winnowing of fines; includes patches of marine sediments (nearshore and littoral), and some glaciomarine diamictons; hummocky to flat terrain
R1	Volcanic/sedimentary rocks	mafic to telsic metavolcanic rocks, metasedimentary rocks, and minor iron formations of the Archean Rankin Inlet Group; may include Paleoproterozoic quartz arenite of the Hurwitz Group; glacially scoured outcrops forming abundant roches moutonnees, and striated or grooved surfaces; locally frost heaved or frost shattered
R2	Plutonic rocks	Paleoproterozoic granite rocks; may include Archean gabbro of the Rankin Inlet Group; gently rolling topography with thin patchy drift cover; surface may be glacially rounded and polished, or frost shattered
Source: McMartin, L. 2002. Surficial geology, Rankin Inlet, Nunavut; Geological Survey of Canada, Open File 4116		



NUNAMI STANTEC

Legend

- Completed Boreholes
- Focus Area
- Contours (5m)
- Watercourses
- Waterbodies
- Runway
- Parcels

Slope Gradient

- 0-5 degrees
- 5-10 degrees
- 10-15 degrees
- 15-20 degrees
- 20-25 degrees
- 25-30 degrees
- >30 degrees

N

0 250 500 metres

(At original document size of 11x17)
1:12,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by ADC on 2022-02-08
TR by OP on 2022-02-08

Client/Project
144903017-004 REVC
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-3

DRAFT

Title
Topography

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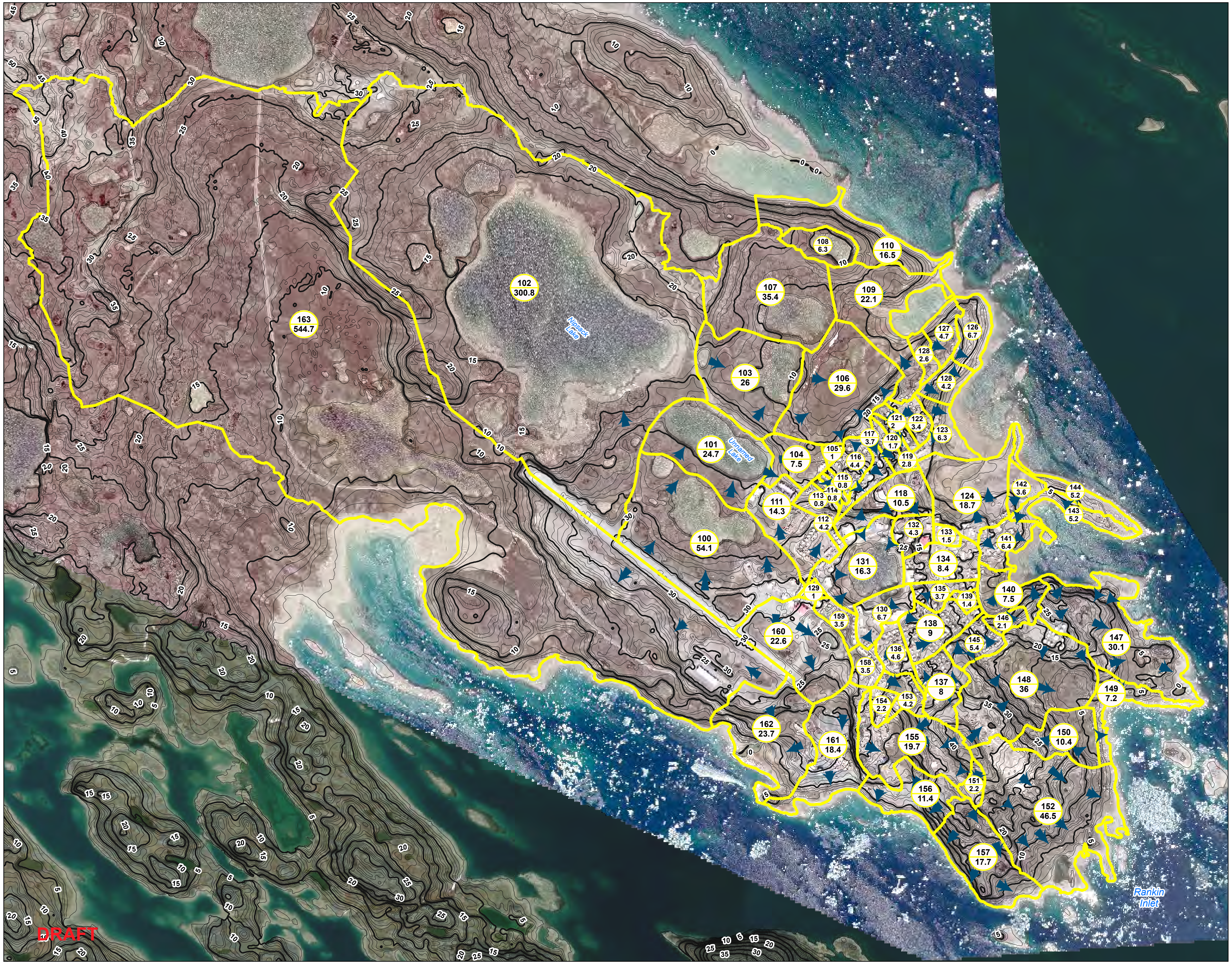


NUNAMI STANTEC

Legend

- Elevation (in m)
- Overland Flow Direction
- Drainage Catchment

Catchment No.
Area (ha)

N

0 400 800 metres

(At original document size of 11x17)
1:22,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Maxar

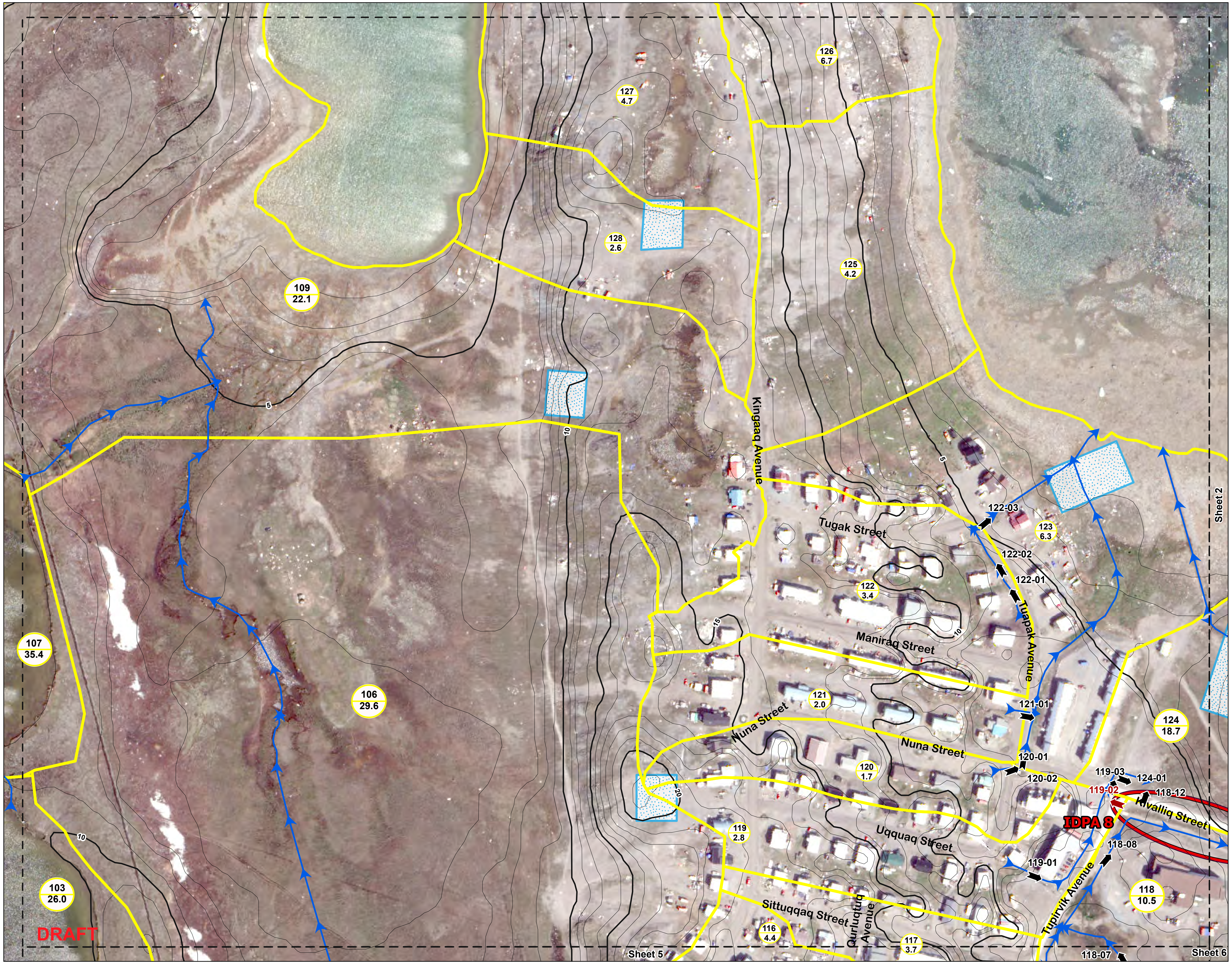
Project Location
Rankin Inlet, Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project
144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-4
DRAFT

Title
Existing Conditions Drainage Map - Catchments



NUNAMI STANTEC

Legend

- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

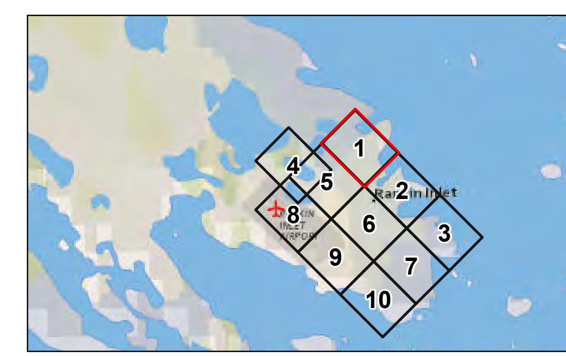
Catchment No. / Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C5 **DRAFT**

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 1

NUNAMI STANTEC

Legend

- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

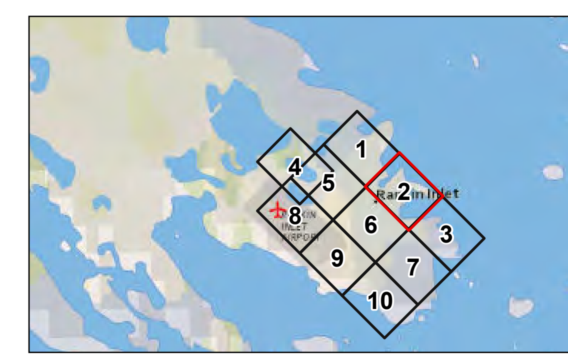
Catchment No. / Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C6

DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 2

NUNAMI STANTEC

Legend

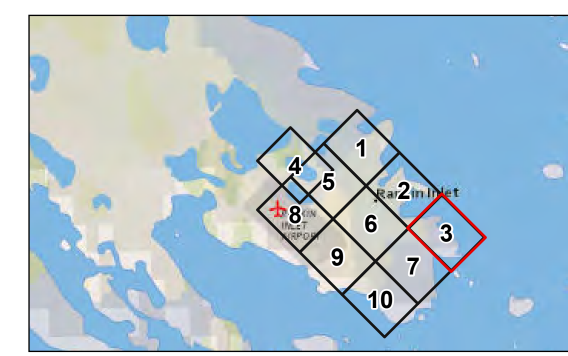
- Elevation (in m)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No.
Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C7 **DRAFT**

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 3

NUNAMI STANTEC

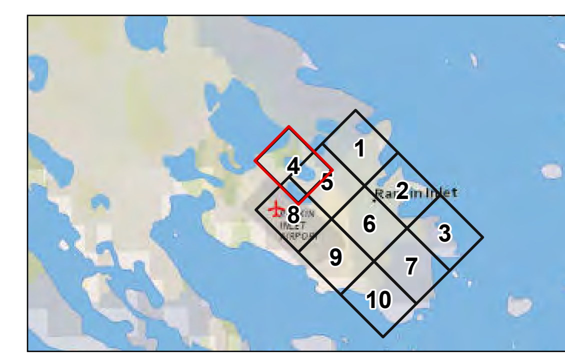
Legend

- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No.
Area (ha)

0 60 120 metres
(At original document size of 11x17)
1:125,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

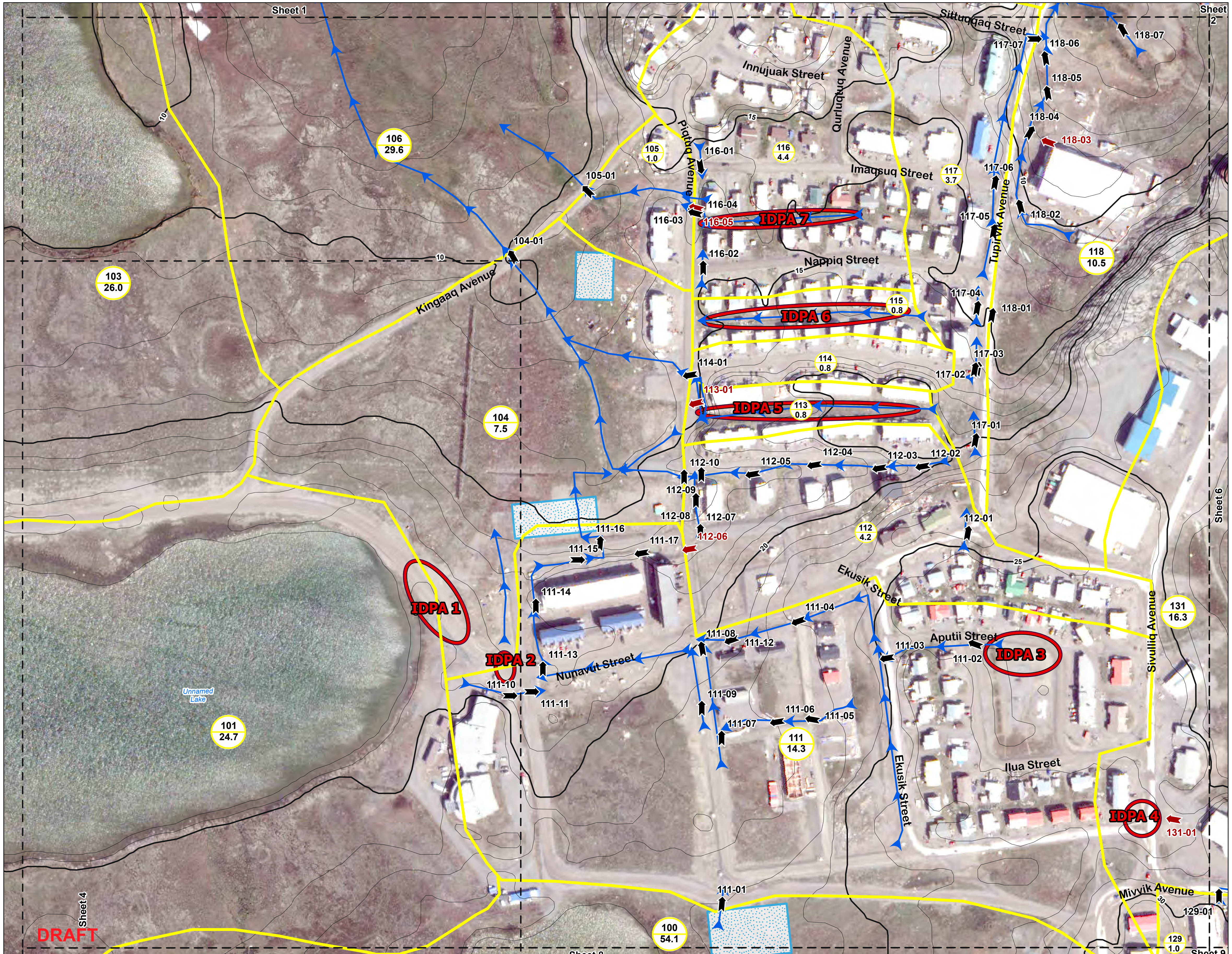
Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C8

DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 4



NUNAMI STANTEC

Legend

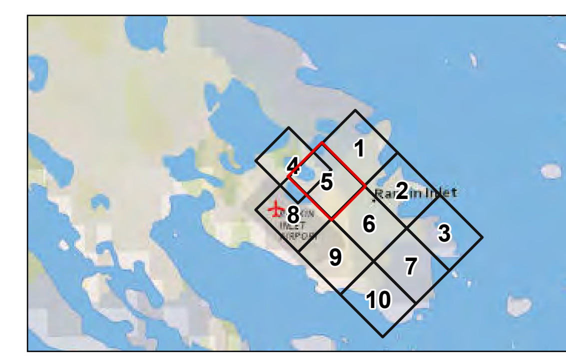
- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No.
Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



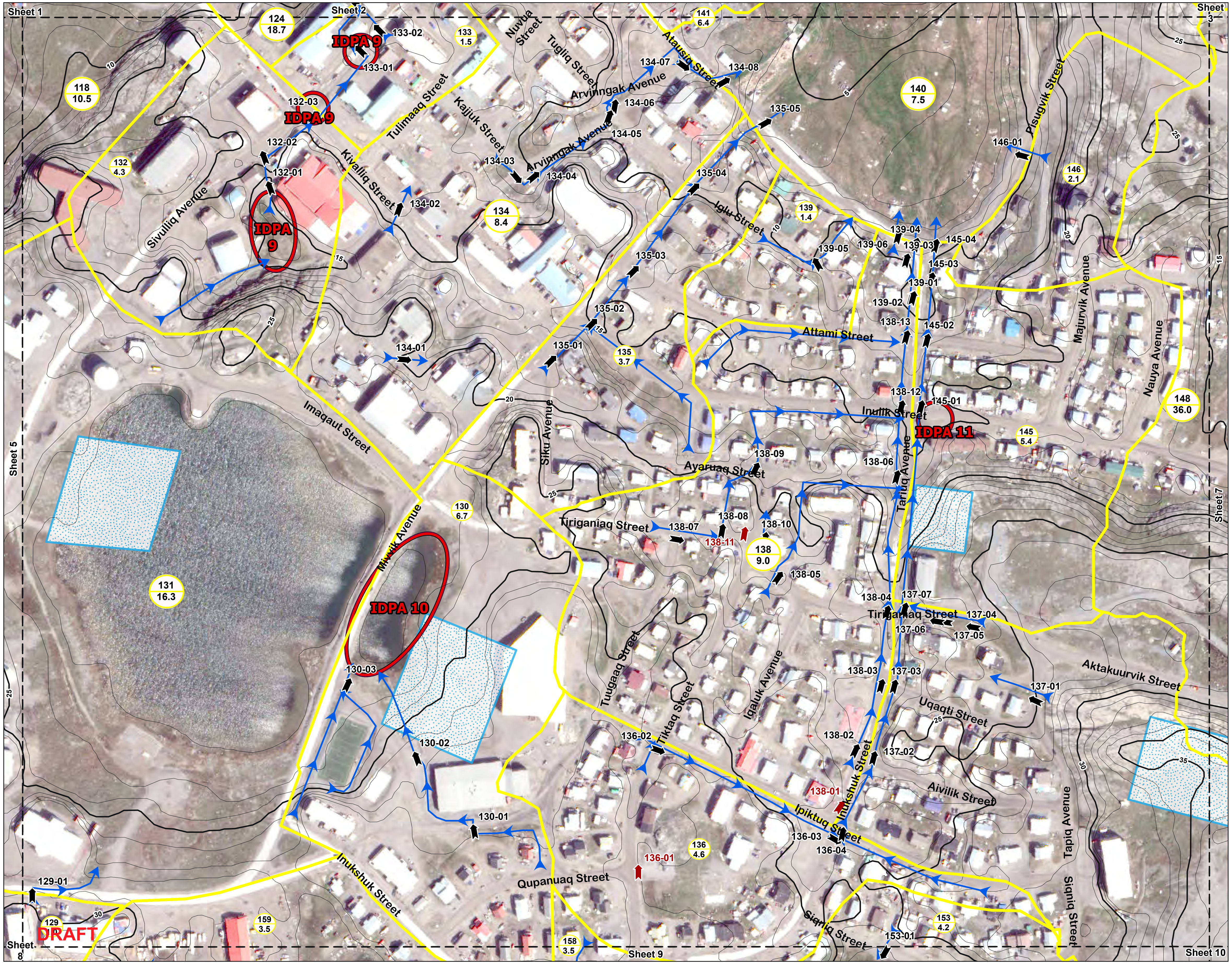
Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C9 **DRAFT**

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 5



NUNAMI STANTEC

Legend

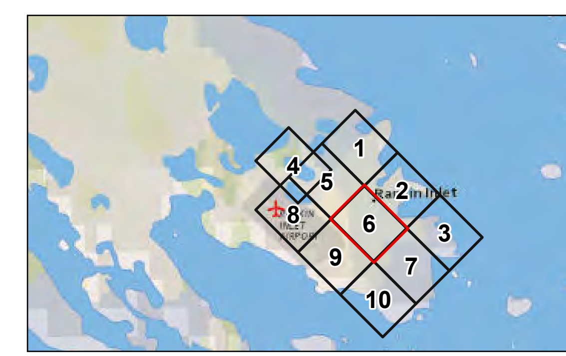
- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No. / Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C10

DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 6

NUNAMI STANTEC

Legend

- Elevation (in m)
- Culvert (Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

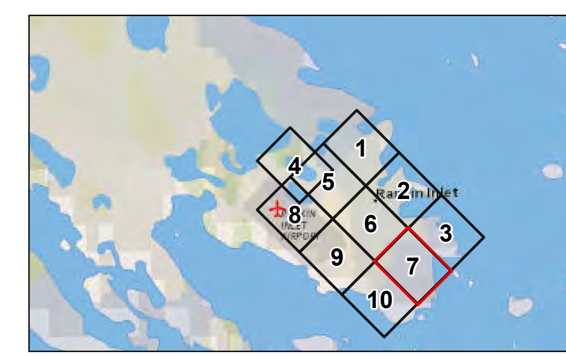
Catchment No. / Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C11 DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 7

NUNAMI STANTEC

Legend

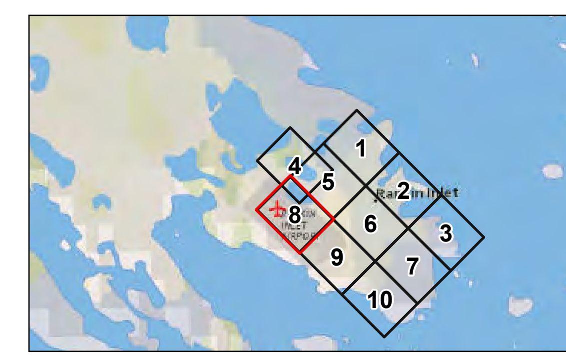
- Elevation (in m)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No. / Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C12

DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 8

NUNAMI STANTEC

Legend

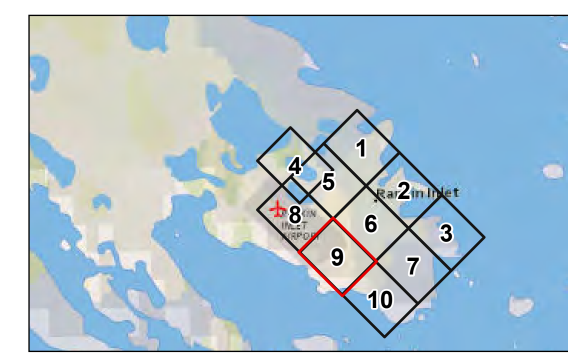
- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

Catchment No.
Area (ha)

0 60 120 metres
(At original document size of 11x17)
1:125,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C13 DRAFT

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 9

NUNAMI STANTEC

Legend

- Elevation (in m)
- Channel/Ditch
- Culvert (Active)
- Overland Flow Direction
- Identified Drainage Problem Area (IDPA)
- Snow Dumping Area
- Drainage Catchment

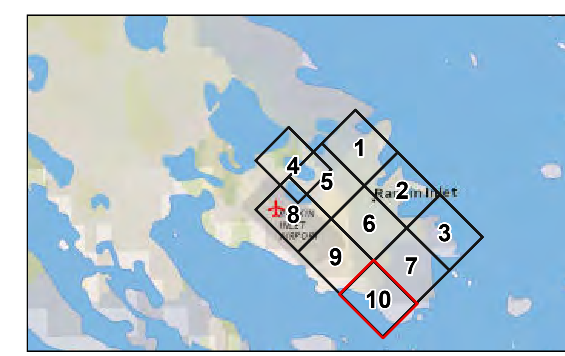
Catchment No.
Area (ha)

0 60 120 metres

(At original document size of 11x17)
1:125,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C14 **DRAFT**

Title
Existing Conditions Drainage Map - Catchments and Drainage Infrastructure - Sheet 10

NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Ditch

N

0 10 20 metres

(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-15

DRAFT

Title
Proposed Conditions Drainage Plan - IDPA #3 - Ponding in Playground Area

NUNAMI STANTEC

Legend

- 10 Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Overland flow Display (Y/N)
- Proposed Feature

0 10 20 metres
(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-16 **DRAFT**

Title
Proposed Conditions Drainage Plan - IDPA #4 - Driveway Ponding at Eksusik Street and Sivulliq Avenue

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NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Culvert

0 10 20 metres
(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

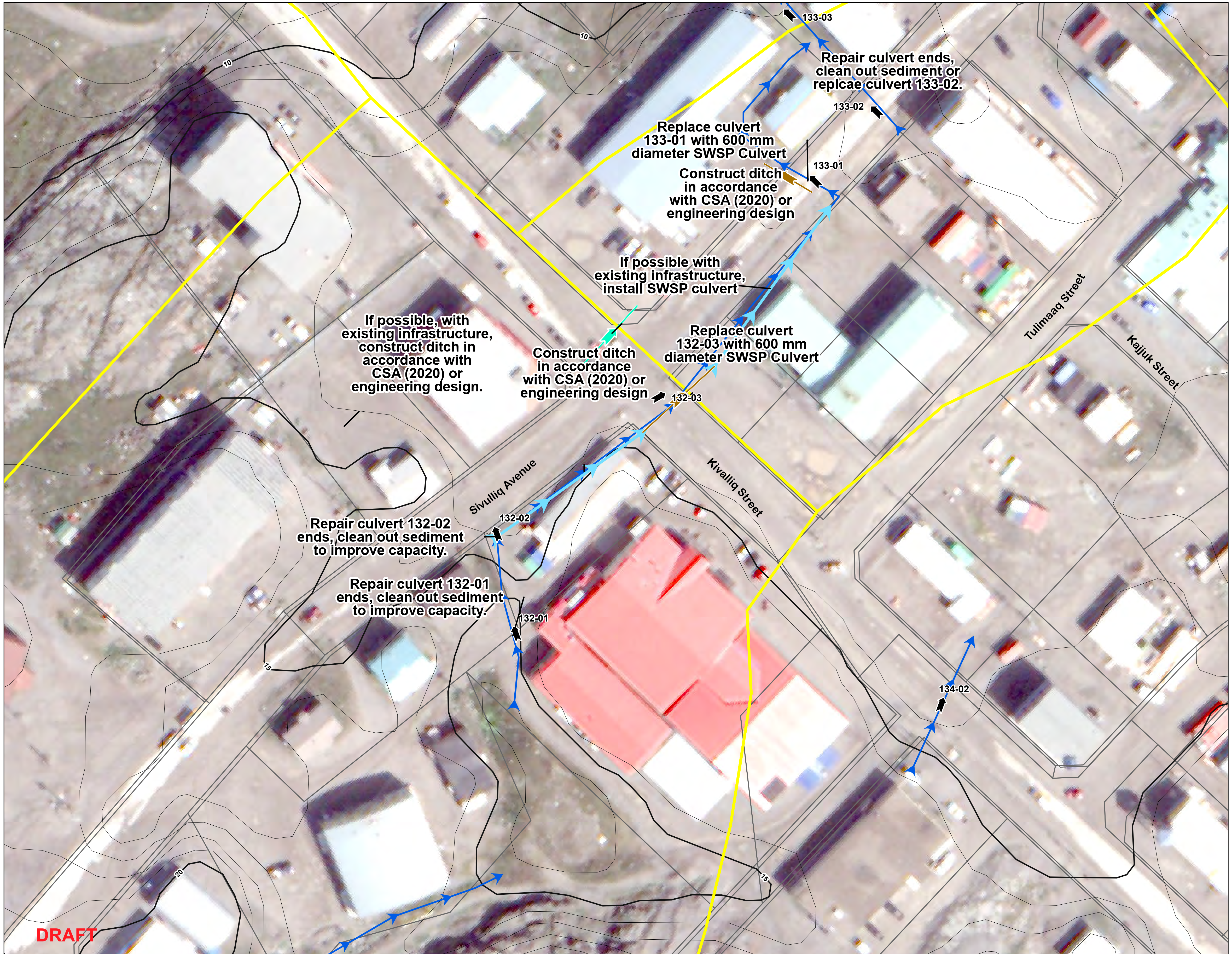
Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-17 **DRAFT**

Title
Proposed Conditions Drainage Plan - IDPA #5, IDPA #6, and IDPA #7 - Backyard Ponding



NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Ditch
- Proposed Culvert
- Proposed Replaced Culvert

0 10 20 metres
(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-18 **DRAFT**

Title
Proposed Conditions Drainage Plan - IDPA #9 - Ponding at Northern Store, Drainage and Ponding around Kivalliq Street and Sivulliq Avenue

NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block

0 30 60 metres

(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-19

DRAFT

Title
Proposed Conditions Drainage Plan - IDPA #10 - Pond South of Mivvik Avenue Near School

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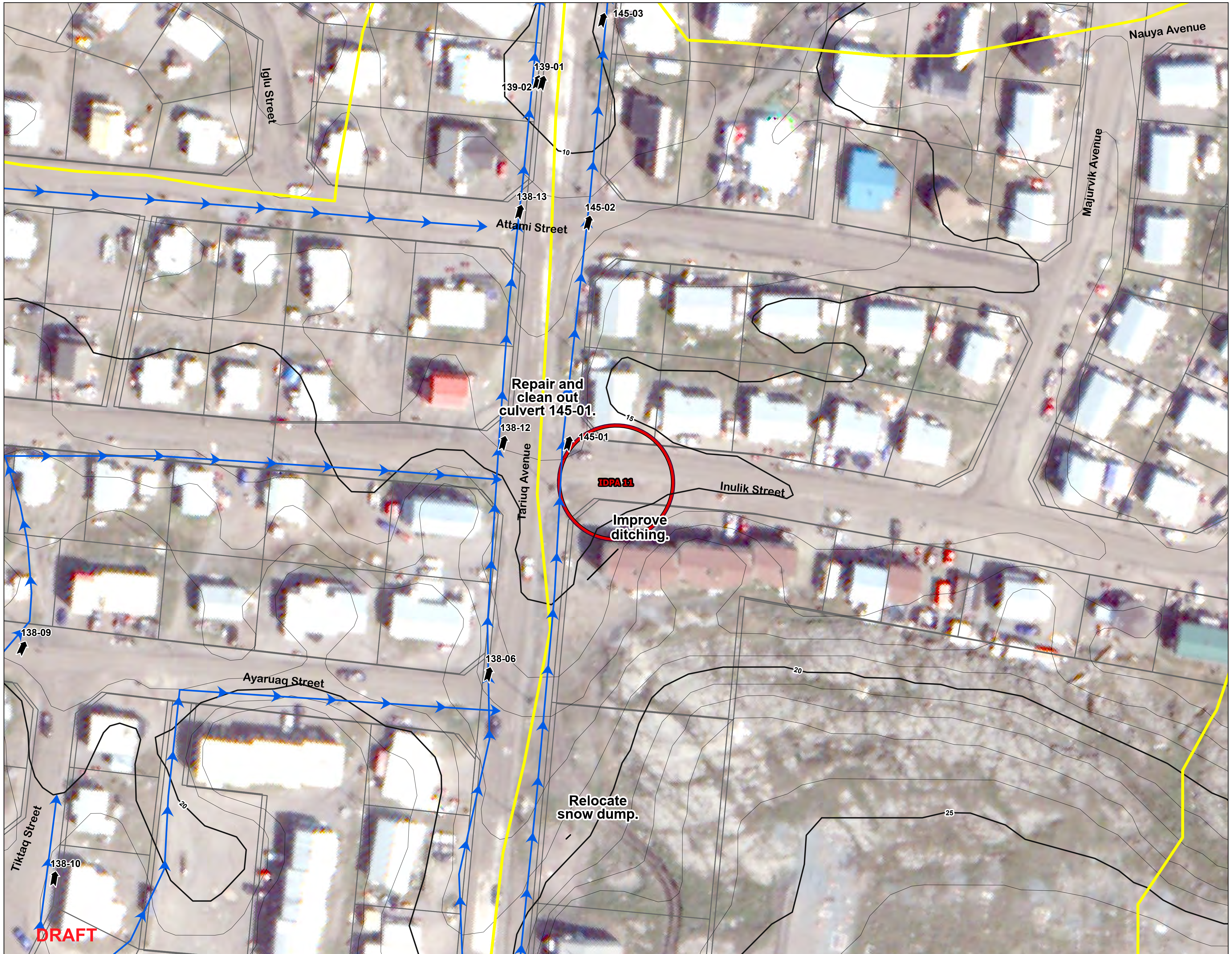


NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block

0 10 20 metres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-20

DRAFT

Title
Proposed Conditions Drainage Plan - IDPA #11 - Springtime Flooding over Inulik Street

NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Ditch
- Proposed Culvert

0 10 20 metres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-21

DRAFT

Title
Proposed Conditions Drainage Plan - IDPA #12 - Conveyance Beneath Inulik Street

\\Ca0183-pbagf01\workgroup\1232\projects\144903107\figures\reports\drainage\Rankin_Inlet_Drainage3.aprx Revised: 2022-02-18 By: LTrudell

NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Entrance Culvert (at each lot driveway)
- Proposed Ditch
- Proposed Culvert
- Proposed Overland flow (May require site grading)
- Proposed Small Ditch
- Proposed Overland flow
- Proposed Drainage Boundary Alteration

0 40 80 metres

(At original document size of 11x17)
1:75,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

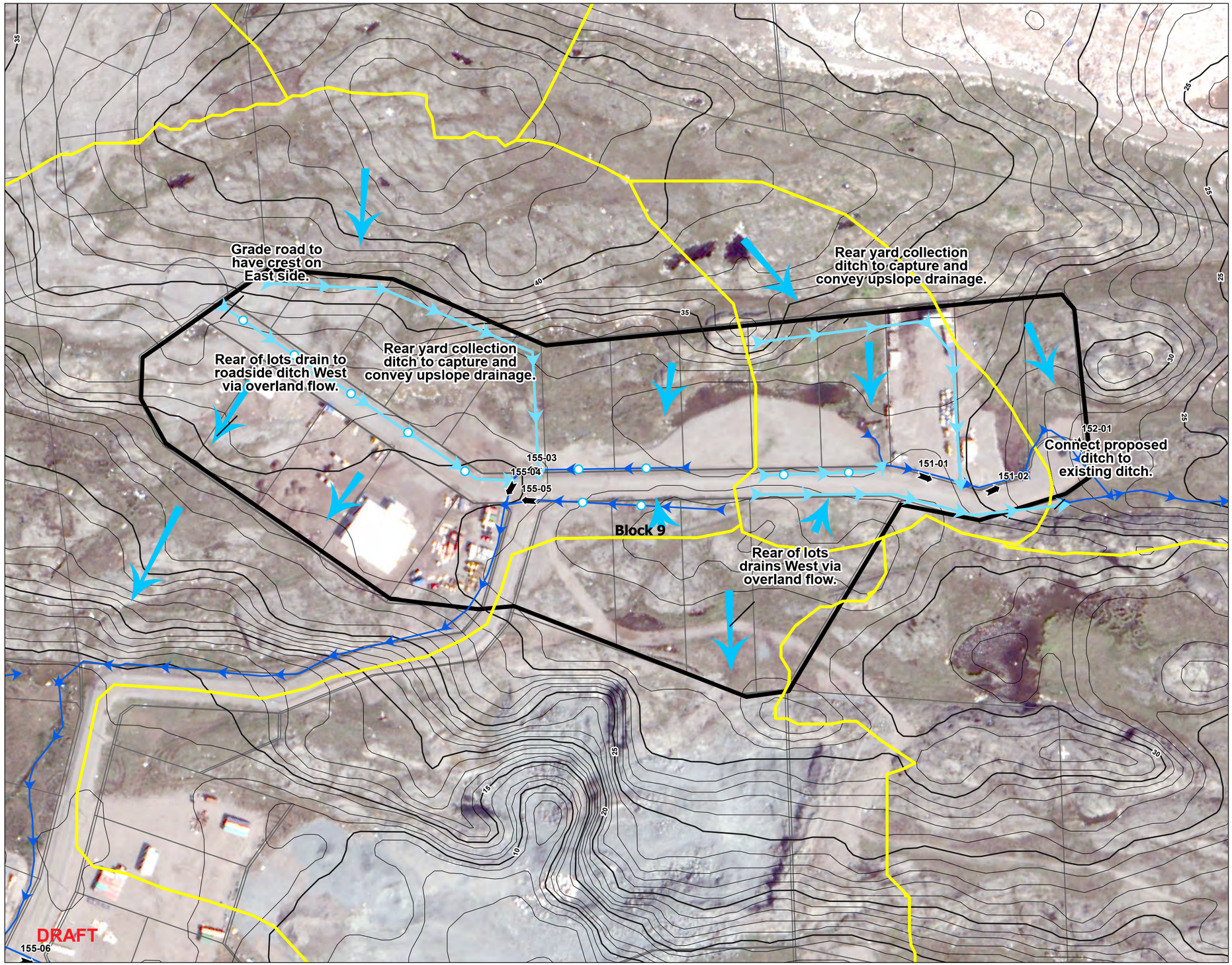
Project Location
Rankin Inlet,
Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project 144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-22 DRAFT

Title
Proposed Conditions Drainage Plan - Block 8



NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Entrance Culvert (at each lot driveway)
- Proposed Ditch
- Proposed Overland flow (May require site grading)

N

0 30 60 metres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

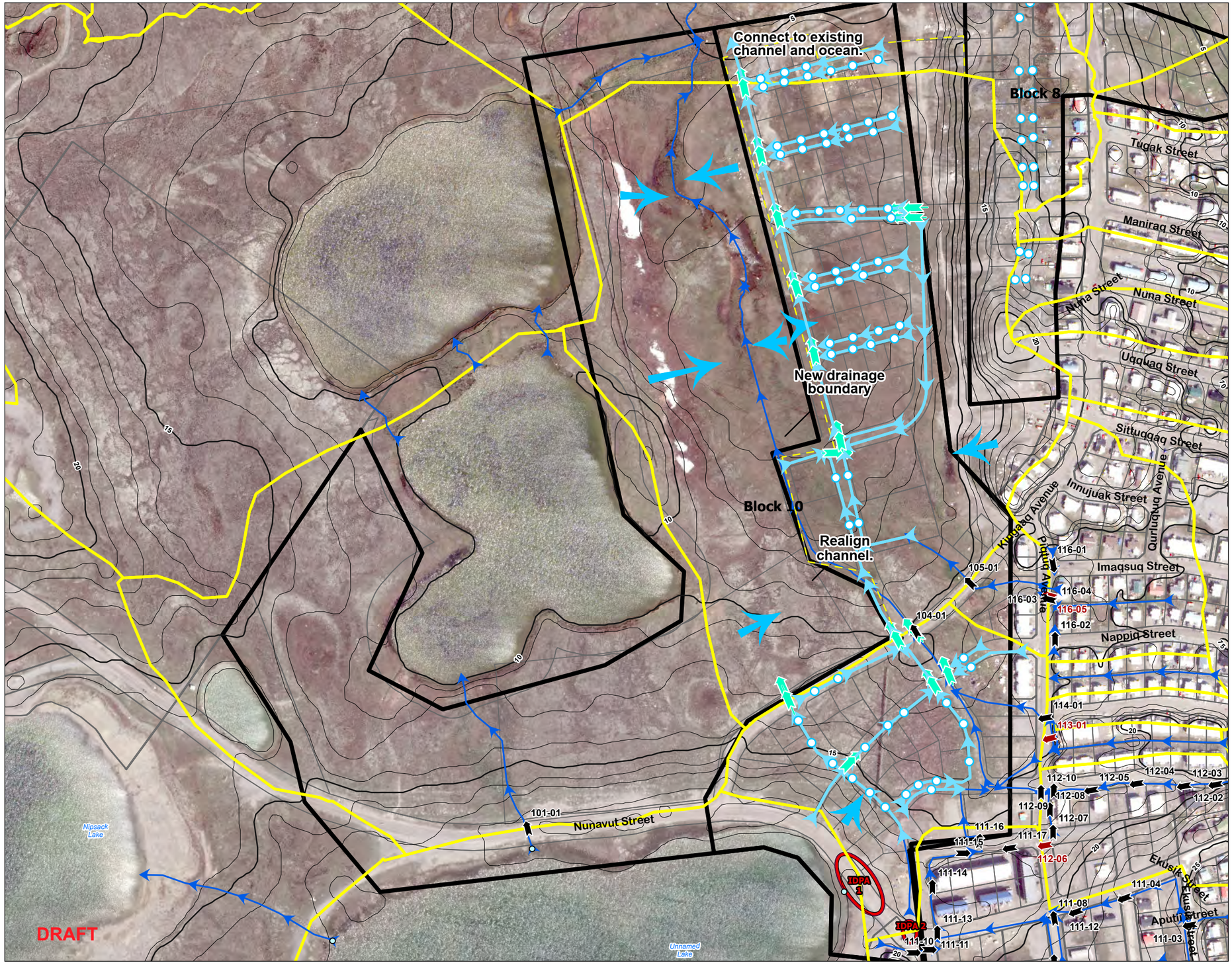
Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

Client/Project
144903017
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-23

DRAFT

Title
Proposed Conditions Drainage Plan - Block 9



NUNAMI STANTEC

Legend

- Elevation (in m)
- Parcel
- Existing Channel/Ditch
- Culvert (Active)
- Culvert (Not Active)
- Drainage Catchment
- Identified Drainage Problem Area (IDPA)
- Development Block
- Proposed Entrance Culvert (at each lot driveway)
- Proposed Ditch
- Proposed Culvert
- Proposed Overland flow
- Proposed Drainage Boundary Alteration

N

0 80 160 metres

(At original document size of 11x17)
1:75,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 15N
2. Data Sources:
3. Background: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by LT on 2022-02-02
TR by JM on 2022-02-02

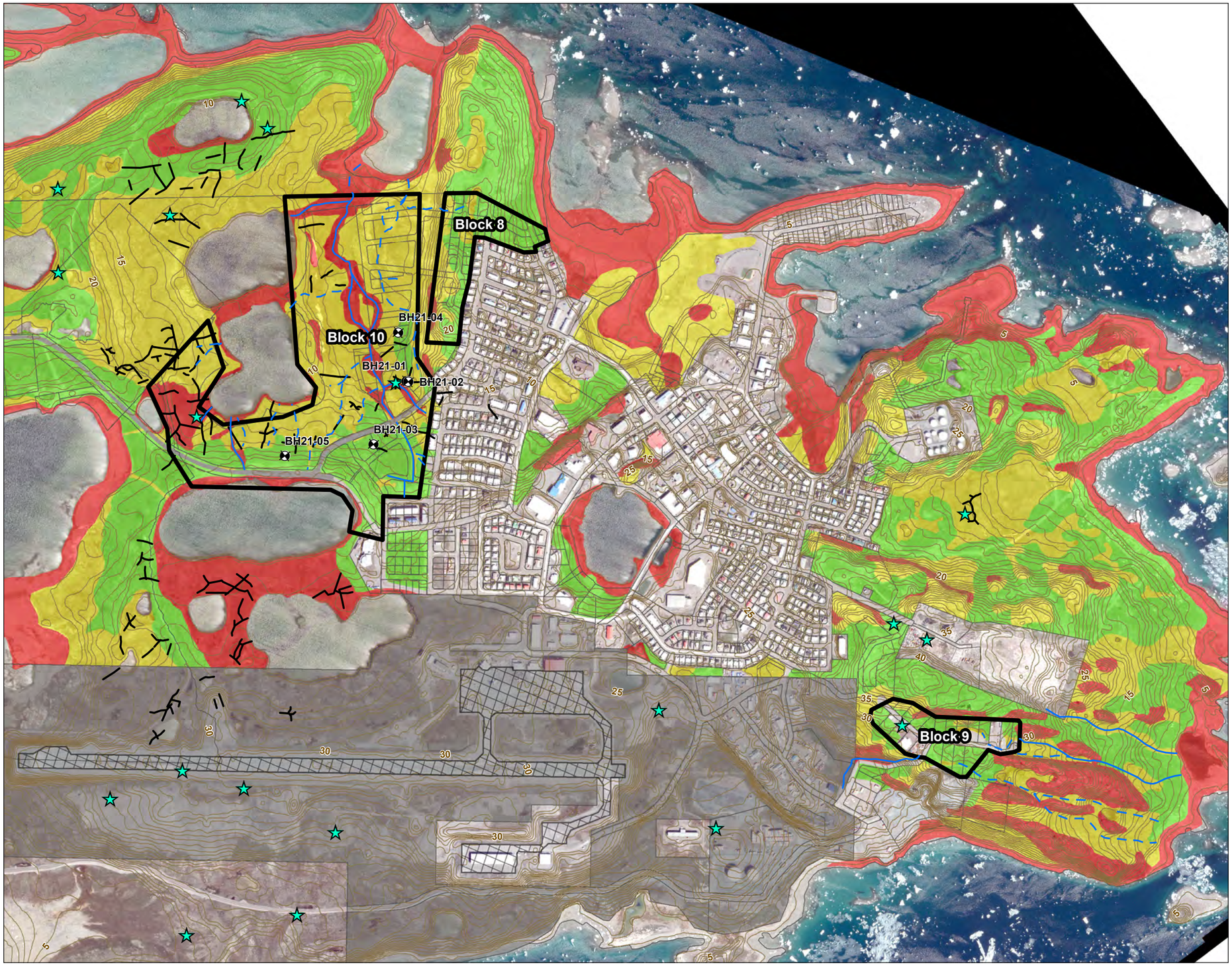
Client/Project
Hamlet of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

144903017

Figure No.
C-24

DRAFT

Title
Proposed Conditions Drainage Plan - Block 10



NUNAMI STANTEC

Legend

- Completed Boreholes
- Focus Area
- Runway
- Parcels
- Ice Wedge
- Ice Wedge Mapping by McMartin (2002)
- Elevation Contour (masl)
- Drainage channel
- Drainage draw

Construction suitability

- Suitable
- Conditionally suitable
- Unsuitable
- N/A

N

0 250 500 metres

(At original document size of 11x17)
1:12,500

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Government of Nunavut, McMartin (2002), Nunami Stantec (2022).
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by ADC on 2022-02-17
TR by OP on 2022-02-17

Client/Project
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

144903017-29a REVA

Figure No.
C-25a

DRAFT

Title
Construction Suitability

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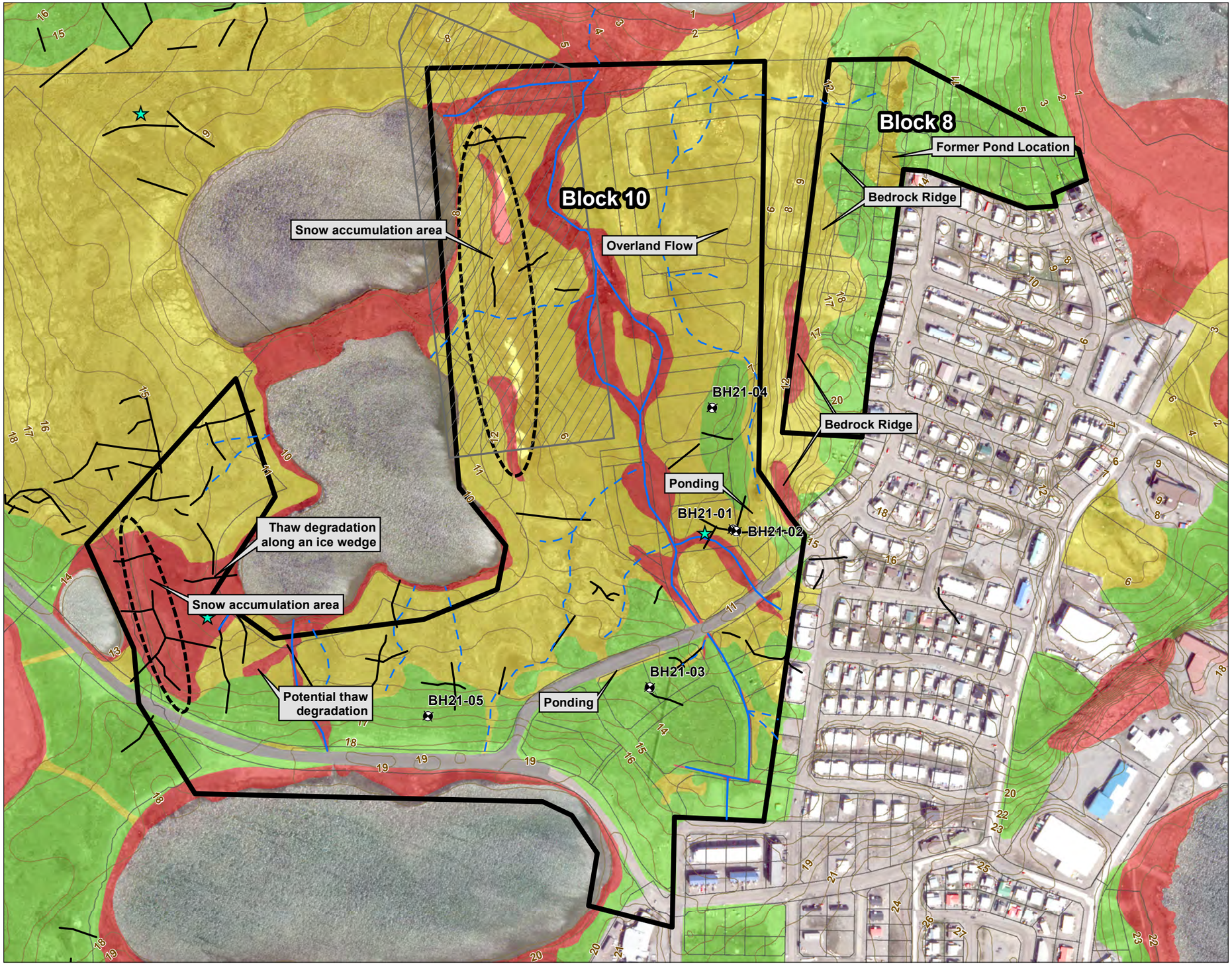

NUNAMI STANTEC

Legend

- Completed Boreholes
- Focus Area
- Snow Accumulation Area
- Snow Fence Buffer
- Parcels
- Ice Wedge
- Ice Wedge Mapping by McMartin (2002)
- Elevation Contour (masl)
- Drainage channel
- Drainage draw

Construction suitability

- Suitable
- Conditionally suitable
- Unsuitable
- N/A

N

0 100 200 metres

(At original document size of 11x17)
1:5,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Government of Nunavut, McMartin (2002), Nunami Stantec (2022), General Guidance - Snow Fence Precipitation Retention (April 21, 2021).
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by ADC on 2022-02-17
TR by OP on 2022-02-17

Client/Project
144903017-29b REVA
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

Figure No.
C-25b

DRAFT

Title
Construction Suitability

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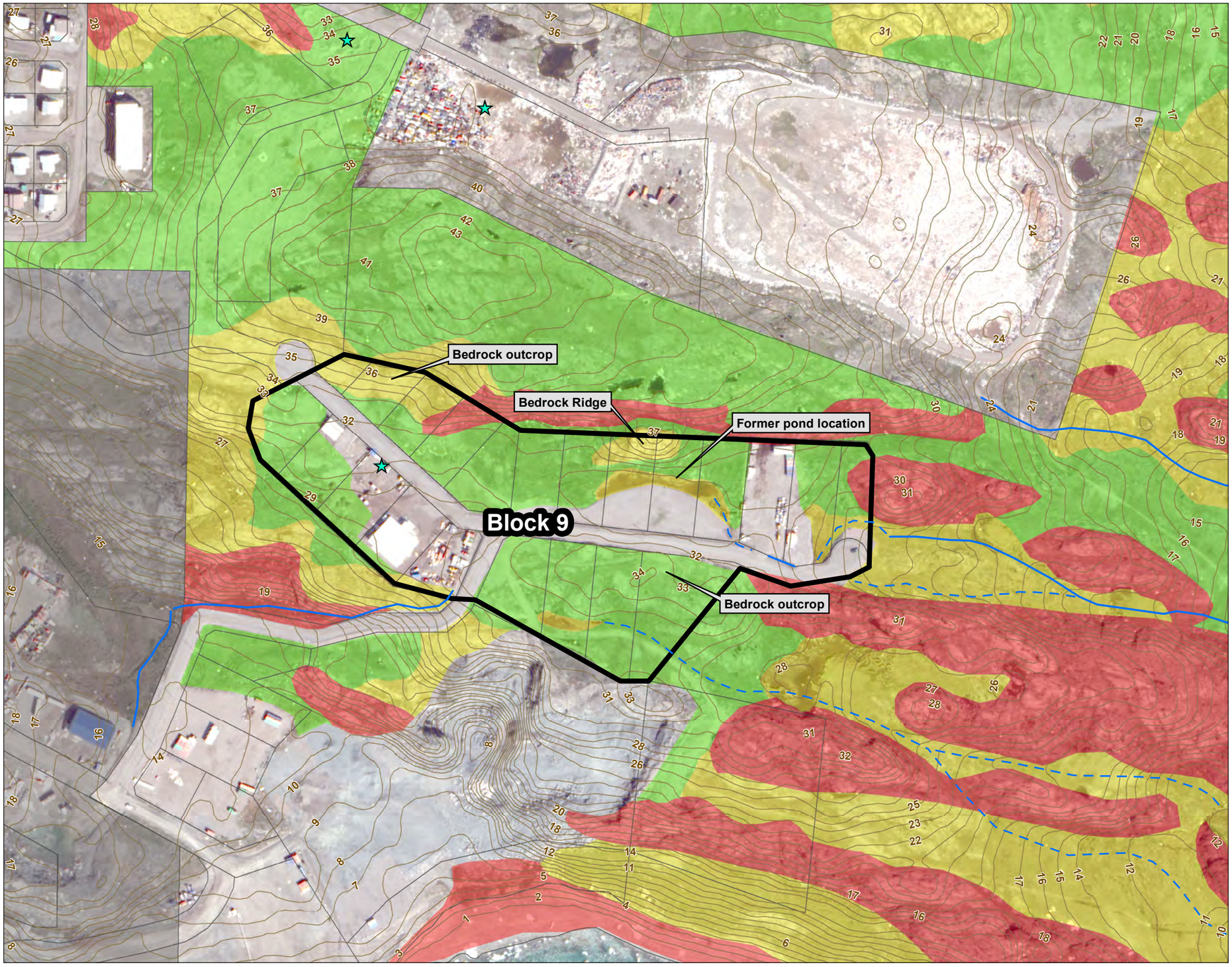

NUNAMI STANTEC

Legend

- Focus Area
- Parcels
- Ice Wedge Mapping by McMartin (2002)
- Elevation Contour (masl)
- Drainage channel
- Drainage draw

Construction suitability

- Suitable
- Conditionally suitable
- Unsuitable
- N/A

N

0 50 100 metres
(At original document size of 11x17)
1:3,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Government of Nunavut, McMartin (2002), Nunami Stantec (2022), General Guidance - Snow Fence Precipitation Retention (April 21, 2021).
3. Background: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Project Location
Rankin Inlet, Nunavut

Prepared by ADC on 2022-02-17
TR by OP on 2022-02-17

Client/Project
Municipality of Rankin Inlet
Geotechnical Evaluation and Drainage Planning

144903017-29c REVA

Figure No.
C-25c

DRAFT

Title
Construction Suitability

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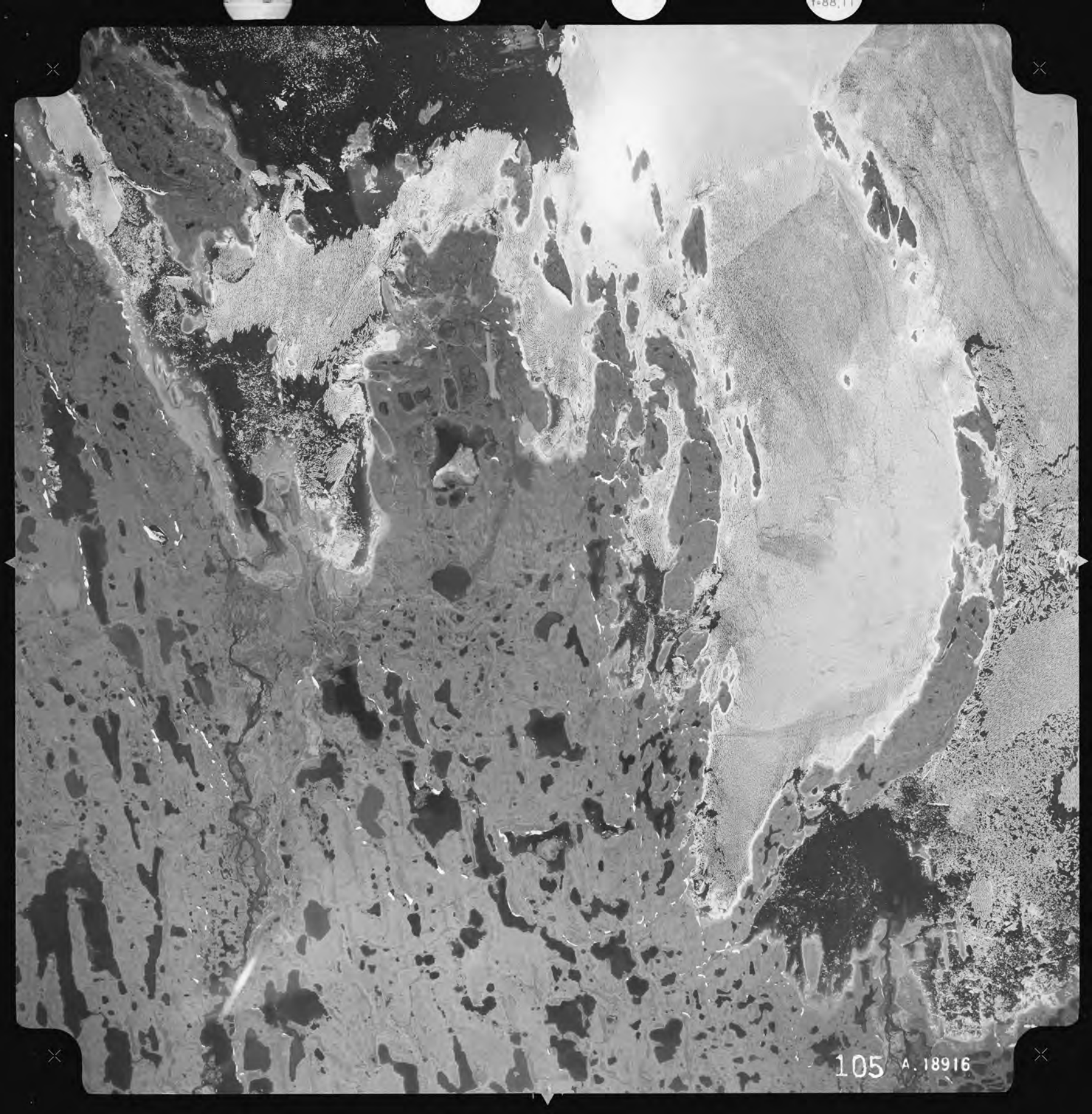
APPENDIX D Historical Air Photos


A-14258-32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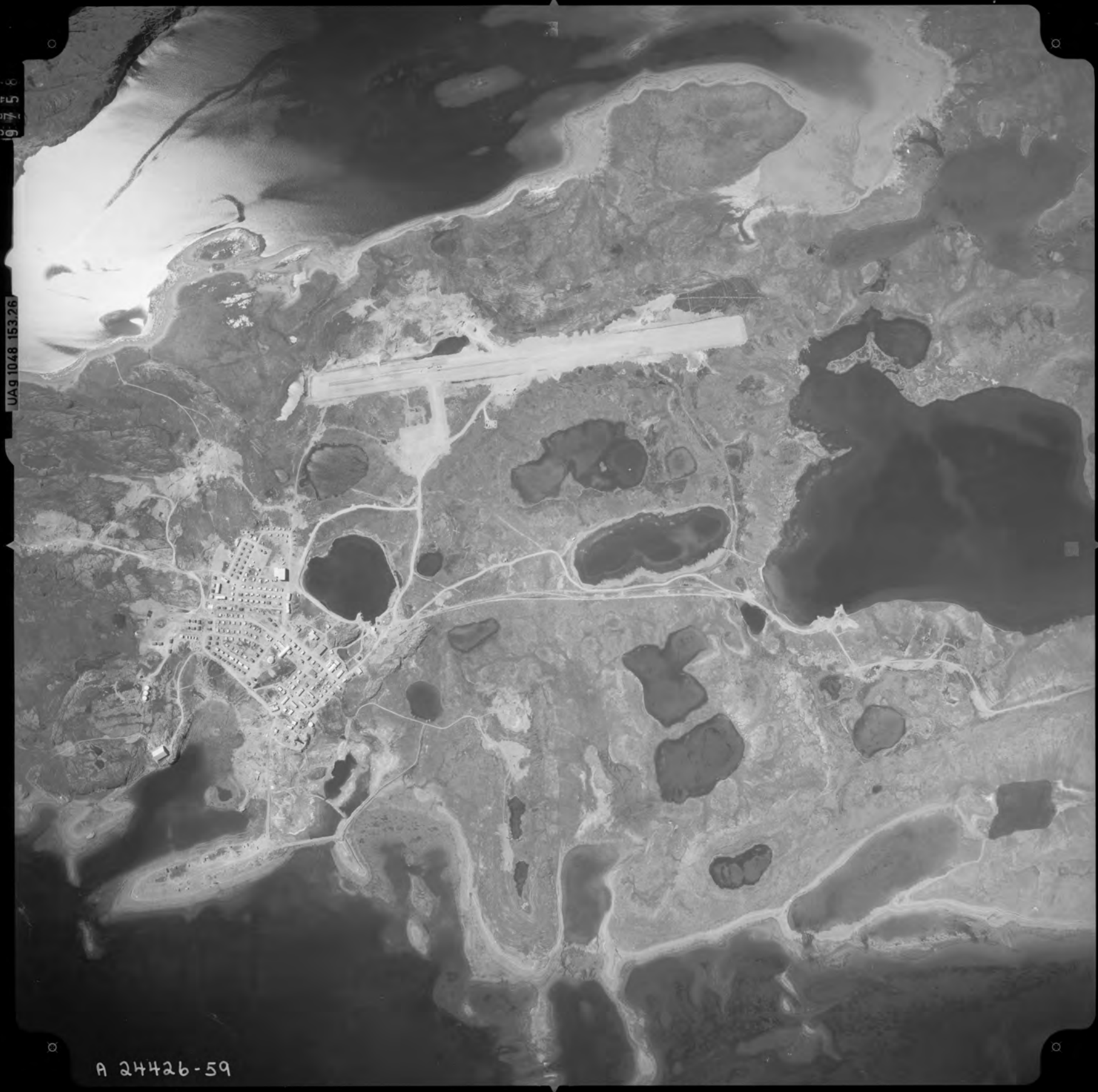
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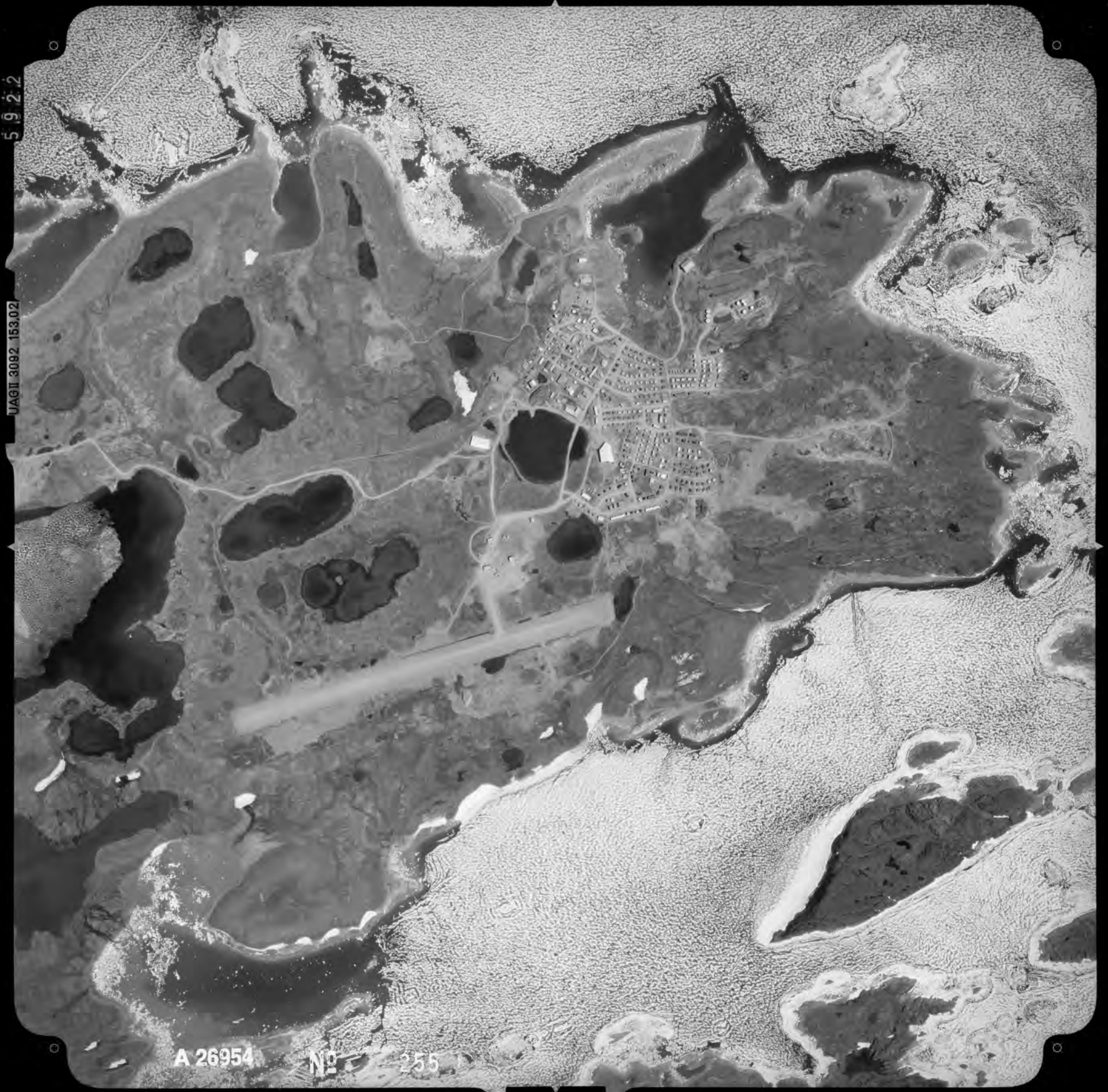
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25/07/92

APPENDIX E Field Photograph Inventory

Photo 1: Overview of Block 8. Facing west.

Photo 2: Overview of south facing slope in Block 8. Facing southwest.

Photo 3: Overview of bedrock outcrops in Block 8.

Photo 4: Overview of northern portion of Block 9. Facing south.

Photo 5: Overview of ponding and bedrock outcrops in Block 9. Facing south.

Photo 6: Overview of southern portion of Block 9. Facing north.

Photo 7: Overview of southwestern portion of Block 9. Facing southwest.

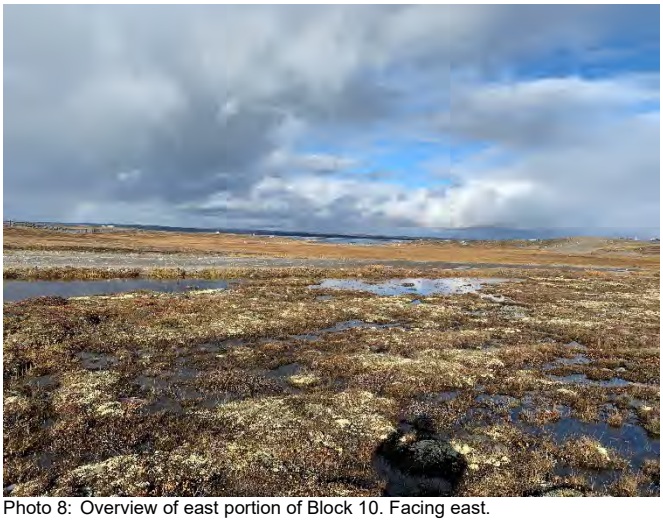


Photo 8: Overview of east portion of Block 10. Facing east.

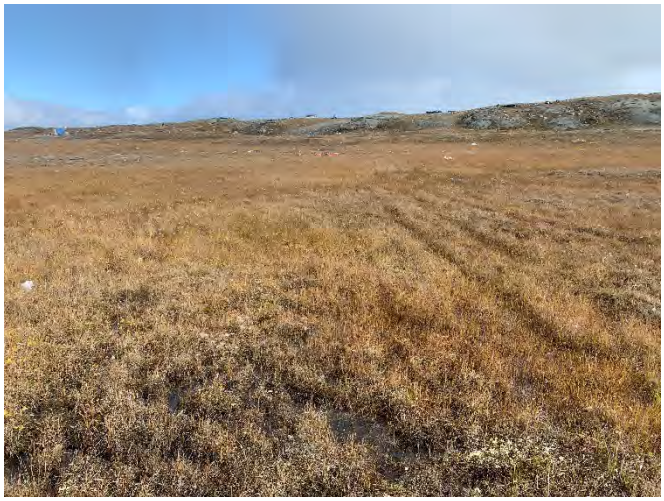


Photo 9: Overview of eastern portion of Block 10. Facing southeast toward Block 8.

Photo 10: Overview of southern portion of Block 10. Facing south.

Photo 11: Overview of south portion of Block 10. Facing southeast.

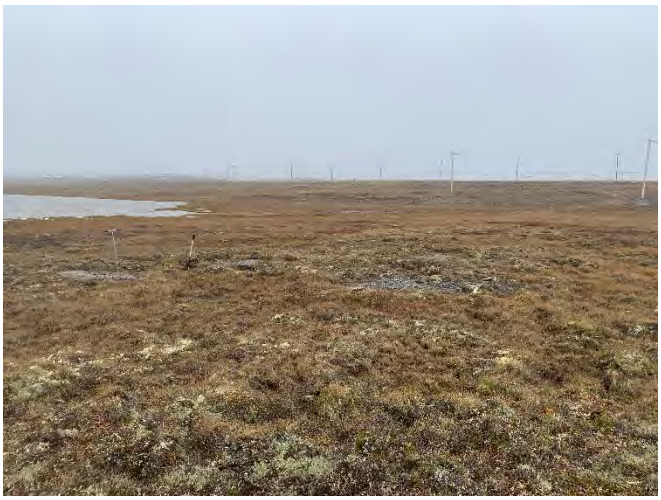


Photo 12: Overview of northern portion of Block 10. Facing south.

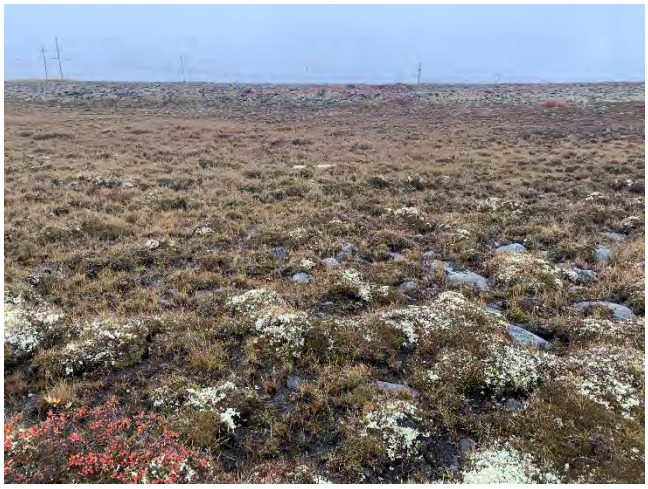


Photo 13: Topography supporting snow accumulation to the northwest of Block 10 along and esker ridge. Facing northwest.

Photo 14: Topography supporting snow accumulation to the northeast of Block 10 along the snow fence. Photo facing northwest.

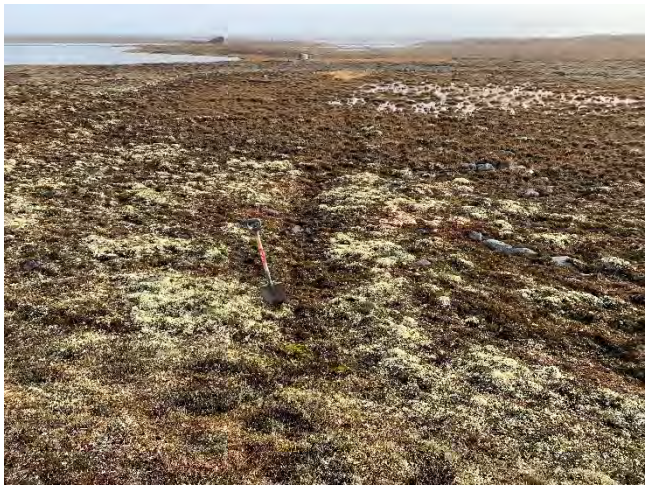


Photo 15: Ice wedge within Block 10.

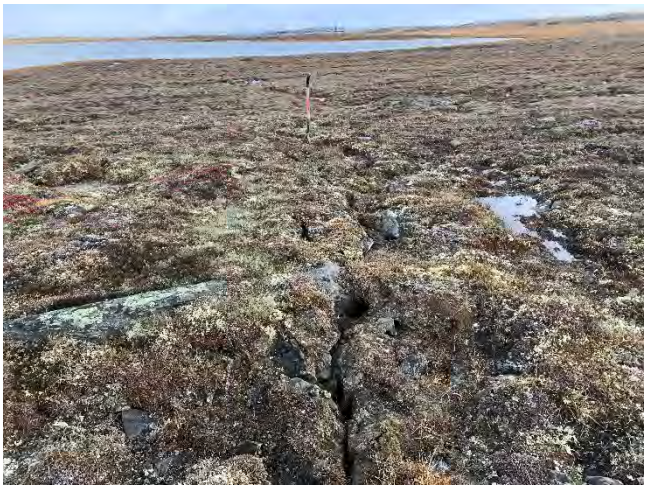


Photo 16: Ice wedge within Block 10.

Photo 17: Ice wedge north of Block 10. Water flows within.

Photo 18: Ice wedge north of Block 10.

Photo 19: Photo of an ice wedge at borehole BH21-02. Includes vertical ice foliation typical of an ice wedge.

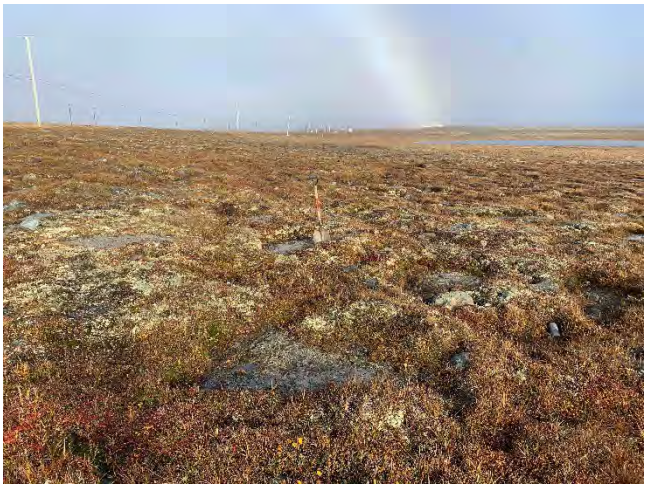


Photo 20: Frost boil that developed in marine washed till deposits within Block 10.

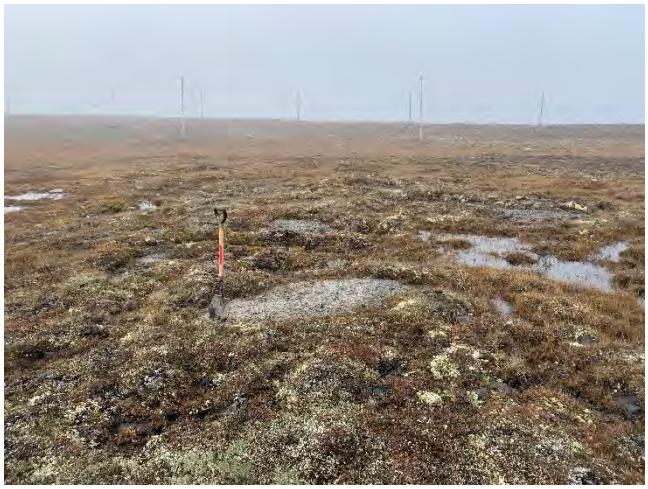


Photo 21: Frost boils that developed in marine washed till deposits north of Block 10.

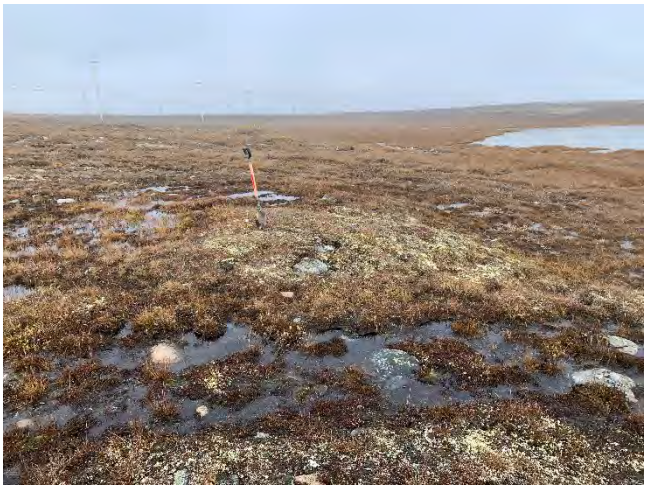


Photo 22: Solifluction lobe that developed in marine washed till deposit north of Block 10.

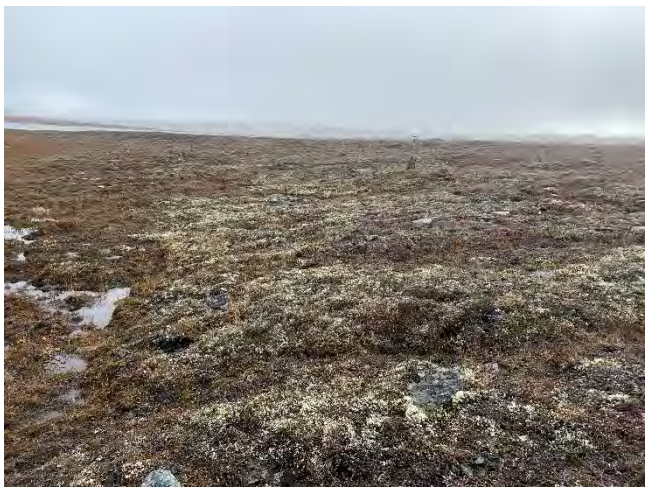


Photo 23: Solifluction sheet that developed in marine washed till deposit north of Block 10.

Photo 24: Poorly drained surficial organics consisting of a cover of mosses and sod overlying a thin topsoil.

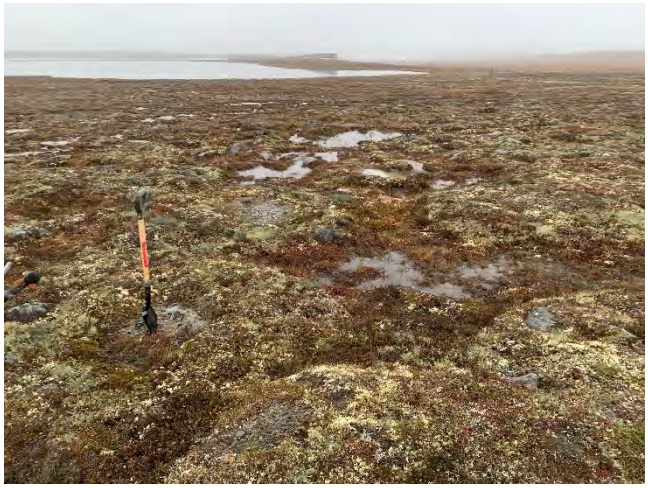


Photo 25: Moderately well to imperfectly drained surficial organics consisting of mosses overlying a thin topsoil. Patterned ground features occur.

Photo 26: Peat accumulation northeast of Block 10.

Photo 27: Location of borehole BH21-01.

Photo 28: Photo of moderate ice content permafrost recovered at Borehole BH21-01. Includes well-bonded cryostructures with excess ice (Nbe).

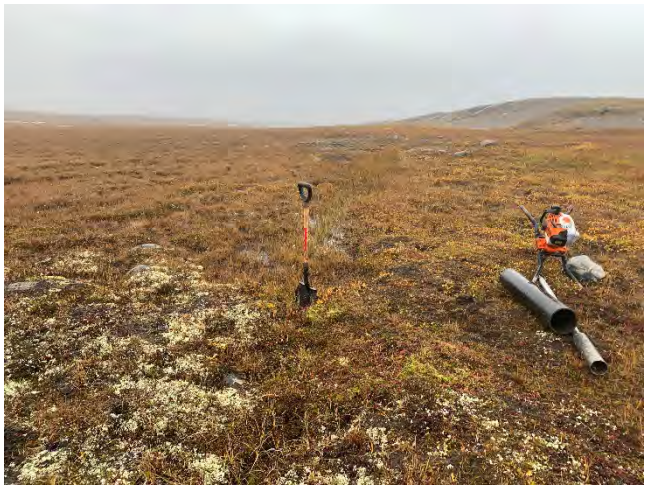


Photo 29: Location of borehole BH21-02 along an ice wedge.

Photo 30: Massive ice recovered at borehole BH21-02. Includes vertical ice foliation typical of an ice wedge.

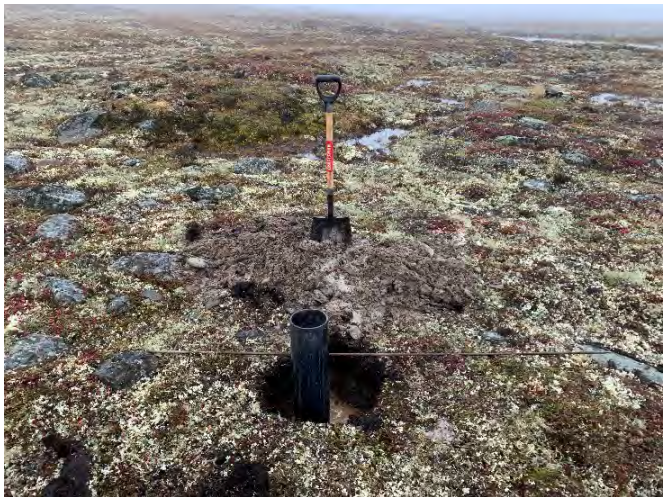


Photo 31: Location of borehole BH21-03.

Photo 32: Near surface gravel layer with cobbles at borehole BH21-03.

Photo 33: Location of borehole BH21-04.

Photo 34: Photo of low ice content permafrost recovered at Borehole BH21-04. Includes well-bonded cryostructures with excess ice (Nbe).

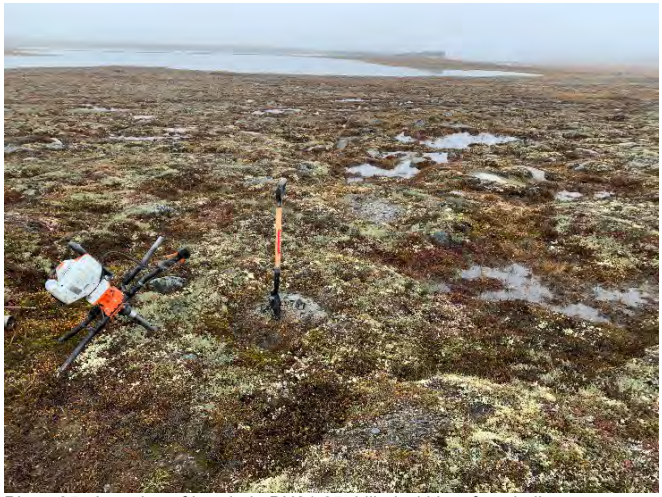


Photo 35: Location of borehole BH21-05 drilled within a frost boil.

Photo 36: Potential signs of thaw degradation (tension cracks and ground subsidence) north of Block 10.

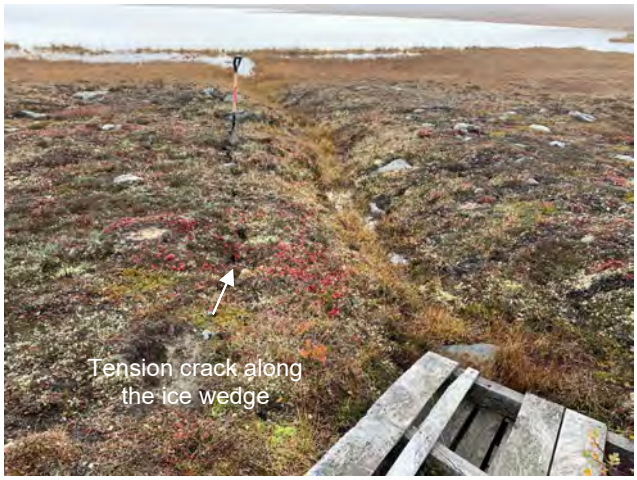


Photo 37: Ice wedge north of Block 10. Tension cracks along the wedge suggest thaw degradation occur.

Photo 38: Shifting of a recent building within an industrial district east of the municipality.

Photo 39: Ruts crossing a drainage flow path in Block 10 (no thaw degradation observed).

APPENDIX F Drainage Assessment and Planning

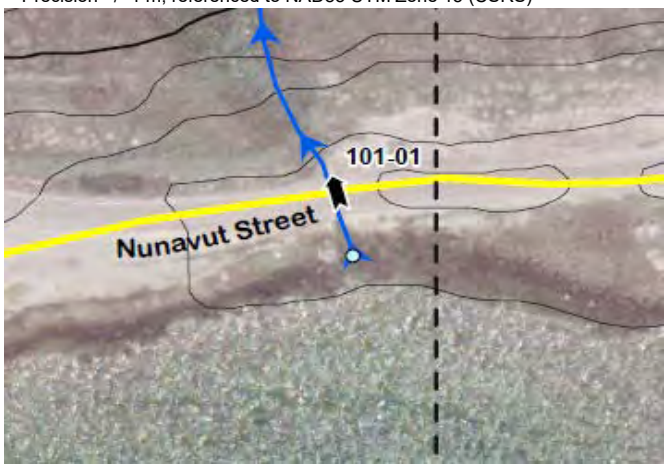
Culvert ID	Street / Location	Northing	Easting	Culvert Type	Shape	Material	Diameter or Dimensions (mm)	Upstream Elevation (masl)		Downstream Elevation (masl)		Length (m)	Est. Culvert Slope	Road Crown Elevation (masl)	Approx. Cover Depth (mm)	Marker Post Present (Y/N)	Crushing		Infill (mm)		Culvert Condition Rating (CSA 2020; MTO 2013)					Recommended Actions	Priority (None, Low, Medium, High)	Comments
								Invert	Obvert	Invert	Obvert						Upstream	Downstream	Upstream	Downstream	Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)			
101-01	Nunavut St	6965689	545509	Cross	Circular	CSP	600	18.37	18.86	-	18.61	19.7	N/A	19.18	445	N	Y	N	0	0	0	4	0	0	0	Replace culvert	High	Gash in culvert top on US end
112-10	Piqtuq Ave	6965304	545952	Cross	Circular	CSP	600	15.45	16.04	15.04	15.66	13.9	0.03	16.29	440	N	N	Y	0	0	0	0	0	0	1	No Action	Low	Minor damage to DS end
114-01	Piqtuq Ave	6965361	546016	Cross	Circular	CSP	600	14.41	15.00	14.26	14.84	23.8	0.01	15.51	590	N	Y	N	0	0	1	0	0	1	1	No Action	Low	US end damaged but clear. DS end has some damage. Culvert seems to be bowed based on outlet location.
104-01	Kingaaq Ave	6965535	545981	Cross	Circular	CSP	800	9.67	10.46	9.42	10.18	14.1	0.02	10.66	340	N	N	N	0	0	1	0	0	2	0	Investigate embankment scour/erosion	High	Debris in DS end
105-01	Kingaaq Ave	6965530	546064	Cross	Circular	SWSP	200	10.25	10.46	9.84	10.16	15.2	0.03	10.71	400	N	N	N	0	0	1	0	0	0	0	No Action	Low	DS end plugged by rocks
111-01	Unataqtutsait St N	6965030	545722	Cross	Circular	CSP	450	22.81	23.16	22.68	23.15	13.8	0.01	23.69	535	N	N	N	50	50	0	0	1	2	0	Clear blockage. Investigate embankment scour/erosion	High	Flow direction unknown
111-02	Ilua St	6965033	546026	Cross	Circular	CSP	450	25.62	25.79	25.44	25.83	31.2	0.01	26.54	730	N	Y	Y	250	0	1	4	2	0	0	Replace culvert	High	Debris & standing water in ditch
111-03	Ekusik St	6965077	545965	Cross	Circular	CSP	450	24.95	25.30	24.45	25.00	16.3	0.03	25.88	730	N	N	N	0	0	1	0	0	0	0	No Action	Low	
111-04	Nunavut St	6965152	545935	Cross	Circular	CSP	500	22.93	23.31	22.59	22.84	16.2	0.02	23.60	525	N	N	N	0	150	1	0	2	1	1	Clear blockage	High	Sedimentation in DS end
111-05	Noolook Ave	6965085	545885	Entrance	Circular	CSP	600	22.80	23.17	22.37	22.98	13.3	0.03	23.64	565	N	N	N	0	0	1	0	0	1	0	No Action	Low	300mm rocks blocking inlet
111-06	Iskernerk St	6965105	545863	Entrance	Circular	CSP	600	22.00	22.61	21.48	22.10	48.1	0.01	22.99	635	N	N	N	50	0	1	0	1	1	0	Clear blockage	High	
111-07	Piqtuq Ave	6965128	545820	Cross	Circular	CSP	600	21.16	21.74	21.12	21.68	15.3	0.00	22.04	330	N	Y	N	0	0	1	1	0	0	0	No Action	Low	
111-08	Piqtuq Ave	6965192	545861	Cross	Circular	CSP	600	19.66	20.27	19.34	19.91	15.9	0.02	20.30	210	N	N	Y	0	200	1	0	2	0	0	Clear blockage	High	DS end damaged. Barrel clear.
111-09	Piqtuq Ave	6965157	545826	Entrance	Circular	PVC	150	21.05	21.19	2.78	20.90	10.4	1.76	21.21	165	N	N	N	0	0	0	0	0	0	1	No Action	Low	Perched US end
111-10	Kugyuk Ave	6965278	545720	Entrance	Circular	CSP	450	18.79	19.14	18.57	19.00	9.6	0.02	19.28	210	N	Y	-	100	0	1	3	1	0	0	Clear blockage, repair culvert end	High	US end crushed. Barrel clear
111-11	Kugyuk Ave	6965268	545735	Cross	Circular	CSP	600	18.52	19.02	18.45	19.04	18.0	0.00	19.31	280	N	N	N	0	0	0	0	0	0	0	No Action	Low	Barrel clear. Minor material buildup on ends from road. Likely to continue accumulating. DS end perched 0.3 m, no scouring evident
111-12	Nunavut St	6965180	545884	Entrance	Circular	CSP	350	20.59	20.91	20.23	20.63	8.7	0.04	21.20	430	N	N	N	0	0	0	0	0	0	2	Remediate channel erosion	High	Rill erosion on US embankment
111-13	Nunavut St	6965275	545755	Cross	Circular	CSP	600	17.94	18.52	17.66	18.24	13.9	0.02	18.98	600	N	Y	Y	100	200	1	2	2	1	2	Clear blockage. Remediate channel erosion	High	Both ends damaged. Rill erosion at DS end from road drainage.
111-14	Kugyuk Ave	6965316	545788	Entrance	Circular	CSP	600	16.76	17.17	16.67	17.13	9.5	0.01	17.40	250	N	Y	Y	200	200	-	-	-	-	-	No Action	-	Both ends damaged and infilled.
111-15	Tuatuq St	6965318	545840	Entrance	Circular	CSP	600	15.82	16.15	15.84	16.16	9.1	0.00	16.53	375	N	Y	-	300	300	1	4	2	2	1	Clear blockage. Investigate embankment scour/erosion	High	US end crushed and blocked by rocks. Barrel clearance unknown. Both ends infilled
111-16	Tuatuq St	6965315	545863	Cross	Circular	CSP	600	15.62	15.97	15.25	15.62	16.1	0.02	16.85	1055	N	Y	Y	250	0	1	4	2	2	1	Clear blockage. Investigate embankment scour/erosion	High	Both end crushed. Debris blocking flow. Barrel clearance unknown.
111-17	Tuatuq St	6965285	545882	Entrance	Circular	CSP	600	15.85	16.25	15.84	16.27	8.8	0.00	16.65	390	N	Y	Y	300	200	1	3	2	1	1	Clear blockage, repair culvert end	High	Both end crushed. Debris in barrel
112-01	Nunavut St	6965103	546086	Cross	Circular	CSP	500	23.73	23.91	23.56	23.78	12.9	0.01	24.50	655	N	Y	Y	300	300	1	2	2	0	0	Clear blockage, repair culvert end	High	
112-02	Pukkinniq St	6965170	546100	Entrance	Circular	CSP	450	19.56	19.84	19.19	19.57	18.1	0.02	20.06	355	N	Y	N	0	0	1	0	0	1	1	No Action	Low	US end crushed
112-03	Pukkinniq St	6965194	546073	Entrance	Circular	CSP	450	18.90	19.30	18.50	18.84	15.8	0.03	19.86	790	N	N	N	0	150	0	0	2	1	1	Clear blockage	High	Infilled DS end
112-04	Pukkinniq St	6965234	546036	Entrance	Circular	CSP	300	17.35	17.65	16.92	17.25	24.1	0.02	17.91	460	N	Y	Y	0	0	0	1	0	0	1	No Action	Low	Ends slightly crushed. DS end close to being buried by driveway embankment.
112-05	Pukkinniq St	6965265	545995	Entrance	Circular	CSP	600	16.62	17.14	16.27	16.75	12.2	0.03	17.27	325	N	N	N	100	100	1	0	1	0	0	Clear blockage	High	Infilled in both ends
112-06	Piqtuq Ave	6965258	545913	Cross	Circular	CSP	-	-	-	-	-	-	N/A	-	-	N	Y	N	0	0	1	0	0	0	0	No Action	Low	US crushed and barely visible. DS end not visible. Not conveying any flow. No CAD points
112-07	Tuatuq St	6965263	545929	Cross	Circular	CSP	450	16.22	16.68	15.93	16.28	14.0	0.02	16.86	380	N	N	N	0	150	1	0	2	1	0	Clear blockage	High	DS end infilled. Barrel clearance unknown
112-08	Piqtuq Ave	6965283	545945	Entrance	Circular	CSP	450/600	15.83	16.17	15.76	16.24	10.1	0.01	16.67	465	N	N	N	100	100	0	0	1	0	0	Clear blockage	High	
112-09	Pukkinniq St	6965295	545964	Entrance	Circular	CSP	800	15.68	16.29	15.64	16.27	4.1	0.01	16.70	420	N	N	N	100	100	0	0	1	1	1	Clear blockage	High	Infilled in both ends
113-01	Piqtuq Ave	6965341	546003	Cross	Circular	CSP	600	14.19	14.76	-	-	-	N/A	15.43	670	N	Y	N	300	0	1	4	2	1	0	Replace culvert	High	US end damaged. No flow observed. No sign of DS, likely covered by development. Culvert probably plugged. DS channel form found, likely location for original outlet
116-01	Imaqsuq St	6965478	546145	Cross	Circular	PVC	250	13.12	13.35	12.73	12.85	10.7	0.04	13.77	670	N	N	N	200	200	0	0	2	0	1	Clear blockage	High	Conveying flow. PVC culvert almost buried
116-02	Nappiq St	6965416	546087	Cross	Circular	PVC	250	14.22	14.46	14.05	14.31	12.1	0.01	14.67	285	N	N	N	0	0	0	0	0	0	1	No Action	Low	
116-03	Piqtuq Ave	6965453	546115	Cross	Circular	CSP	300	12.33	12.53	11.71	12.03	23.1	0.03	13.73	1450	N	Y	Y	0	0	1	2	0	0	1	Repair culvert end	Medium	Conveying flow
116-04	Piqtuq Ave	6965455	546116	Cross	Circular	CSP	600	12.69	13.29	12.52	13.09	17.9	0.01	13.73	540	N	Y	Y	0	0	1	2	0	1	1	Repair culvert end	Medium	
116-05	Piqtuq Ave	6965456	546118	Cross	Circular	PVC	250	12.34	12.61	-	-	-	N/A	13.78	1170	N	N	N	0	0	0	0	0	0	0	No Action	Low	DS end not found, covered by house
117-01	Pukkinniq St	6965154	546146	Cross	Circular	CSP	600	19.60	20.04	19.03	19.41	12.1	0.05	20.52	795	N	N	Y	100	0	0	4	1	1	0	Replace culvert	High	DS end projecting and crushed
117-02	Tupirvik Ave	6965196	546187	Cross	Circular	CSP	600	15.17	15.76	14.95	15.39	15.3	0.01	15.92	345	N	Y	Y	0	150	0	2	1	0	0	Clear blockage, repair culvert end	High	Both ends damaged. Culvert barrel bent or angled based on outlet angle
117-03	Tupirvik Ave	6965195	546189	Cross	Circular	CSP	450	15.57	15.99	15.24	15.63	12.1	0.03	15.96	150	N	N	N	0	0	0	0	0	0	0	No Action	Low	Elevated culvert. Debris in US end
117-04	Tupirvik Ave	6965231	546225	Cross	Circular	CSP	600	13.92	14.20	13.56	14.06	48.3	0.01	15.04	910	N	Y	N	0	200	1	4	2	0	0	Replace culvert	High	Near 61
117-05	Tupirvik Ave	6965266	546280	Entrance	Circular	CSP	600	12.90	13.48	12.69	13.10	12.9	0.02	14.32	1030	N	Y	Y	0	20	1	1	1	0	0	Clear blockage	High	Horizontally compressed. DS end blocked
117-06	Imaqsuq St	6965294	546310	Cross	Circular	CSP	450	11.95	12.34	11.53	11.95	13.6	0.03	12.65	505	N	N	N	0	0	0	0	0	0	1	No Action	Low	
117-07	Tupirvik Ave	6965356	546418	Cross	Circular	CSP	450	7.09	7.27	6.75	6.99	11.2	0.03	7.48	350	N	Y	Y	400	200	0	2	2	0	2	Clear blockage, emediate channel erosion	High	Sedimentation in US end
118-01	Tupirvik Ave	6965218	546229	Cross	Circular	CSP	450	14.70	15.10	14.42	14.82	18.9	0.01	15.25	290	N	N	N	0	0	0	0	0	0	0	No Action	Low	Cracking/slumping on road evident
118-02	Tupirvik Ave	6965265	546310	Entrance	Circular	CSP	500	9.90	10.38	9.74	10.05	30.0	0.01	11.82	1605	N	N	N	0	30	1	0	1	0	0	Clear blockage	High	DS end blocked by rocks
118-03	Tupirvik Ave	6965287	546365	Roof Drain	Circular	PVC	230	-	-	8.44	8.75	-	N/A	-	-	N	N	N	0	0	0	0	0	0	0	No Action	Low	Roof drain? No US end
118-04	Tupirvik Ave	6965303	546360	Entrance	Circular	CSP	500	8.53	8.97	8.03	8.40	21.1	0.02	10.11	1425	N	N	N	0	150	0	0	2	0	0	Clear blockage	High	Embankments material covering ends
118-05	Tupirvik Ave	6965316	546394	Entrance	Circular	CSP	500	6.94	7.42	6.80	7.30	12.0	0.01	7.97	610	N	N	Y	0	0	1	0	0	0	0	No Action	Low	CSP. projecting both ends
118-06	Tupirvik Ave	6965338	546413	Entrance	Circular	PVC	200	6.35	6.56	6.32	6.58	9.3	0.00	7.08	510	N	N	N	0	0	0	0	0	0	1	No Action	Low	Scour US & DS, steel Culvert much smaller US than DS. PVC 230 mm DS
118-07	Tupirvik Ave	6965309	546475	Entrance	Circular	CSP	600	5.88	6.49	5.86	6.47	18.1	0.00	8.69	2210	N	N	N	0	0	1	0	0	2	1	Investigate embankment scour/erosion	High	Slight DS perch, some scouring at DS end. US end elevated but wet
118-08	Tupirvik Ave	6965378	546524	Entrance	Circular	CSP	450	5.41	5.78	4.84	5.24	23.2	0.02	6.94	1430	N	Y	Y	0	100	2	3	1	2	0	r Rusting, clear blockage, Investigate embankment scour/	High	Debris in US. Rill erosion on embankment
119-01	Tupirvik Ave	6965411	546472	Entrance	Circular	CSP	600	6.64	7.19	6.56	6.94	5.7	0.01	7.28	215	N	Y	N	0	0	1	0	0	0	0	No Action	Low	
119-02	Tupirvik Ave	6965404	546564	Cross	Circular	SWSP	150	-	-	5.60	5.77	-	N/A	6.18	410	N	N	N	0	0	1	0	0	0	0	No Action	Low	No US end
120-01	Uqquaq St	6965486	546521	Cross	Circular	CSP	600	6.79	7.01	6.80	7.05	13.8	0.00	7.43	400	N	Y	Y	350	250	2	0	2	0	0	Monitor Rusting, clear blockage	High	Buried. Sedimentation
122-01	Tuapak Ave	6965588	546626	Entrance	Circular	CSP	500	3.85	4.34	3.91	4.24	12.3	0.00	5.00	710	N	Y	Y	0	150	1	3	2	1	1	Clear blockage, repair culvert end	High	Drainage from under house
122-02	Tuapak Ave	6965611	546633	Entrance	Circular	CSP	500	3.77	4.17	3.59	4.05	11.3	0.02	4.79	680	N	Y	Y	50	50	1	3	1	0	1	Clear blockage, repair culvert end	High	
120-02	Nuna St	6965485	546533	Cross	Circular	CSP	600	6.38	6.84	6.31	6.66	11.3	0.01	7.29	540	N	Y	Y	0	100	1	3	1	0	0	Clear blockage, repair culvert end	High	Sunken/buried. Sedimentation
121-01	Tuapak Ave	6965510	546562	Cross	Circular	CSP	400	5.24	6.12	5.70	6.06	16.9	-0.03	6.56	470	N	Y	Y	100	100	1	3	1	0	0	Clear blockage, repair culvert end	High	DS filled with debris
122-03	Tugak St	6965649	546651	Cross	Circular	CSP	600	3.57	4.04	3.06	3.63	17.4	0.03	4.88	1045	N	Y	Y	50	150	1	1	1	0	1	Clear blockage	High	DS end has culvert used for embankment stability. Standing water & sediment at US end. Problem area
133-03	Backyard	6965080	546739	Entrance	Circular	CSP	250	9.67	9.96	9.40	9.67	6.0	0.04	10.98	1165	N	N	N	0	0	1	0	0	2	2	tigate embankment scour/erosion, Remediate channel er	High	US end almost blocked by roacks & sediment
118-09	Kivalliq St	6965282	546636	Cross	Circular	CSP	600	2.64	3.06	2.18	2.60	15.2	0.03	4.07	1240	N	Y	Y	0	300	2	2	2	1	1	Monitor Rusting, clean blockage and sediment	High	
118-10	Kivalliq St	6965285	546635	Cross	Circular	SWSP	120	3.82	3.95	3.60	3.74	13.4	0.02	4.13	285	N	N	N	0	0	1	0	0	1	0	No Action	Low	South of 46, north of 48
118-11	Kivalliq St	6965285	546635	Cross	Circular	SWSP	120	3.67	3.81	3.63	3.76	13.5	0.00	4.10	315	N	N	N	0	0	1	0	0	1	0	No Action	Low	North of 45
118-12	Kivalliq St	6965391	546583	Cross	Circular	CSP	600	4.31	4.89	3.84	4.51	11.9	0.04	5.33	630	N	N	N	0	0	1	0	0	1	1	No Action	Low	
119-03	Nuna St	6965417	546570	Cross	Circular	CSP	400	5.41	5.83	5.03	5.45	12.0	0.03	6.32	680	N	N	N	0	0	0	0	0	1	2	Remediate channel erosion	High	Flow under culvert. Culvert perched
124-01	Ugjuk Ave	6965415	546582	Cross	Circular	CSP	400	4.64	4.94	4.21	4.40	14.1	0.03	-	-	N	Y	Y	100	200	1	2	2	0	1	Clear blockage, repair culvert end	High	Sedimentation in DS end
129-01	Mivvik Ave	6964741	546020	Cross	Circular	CSP	600	28.92	29.13	28.80	29.00	11.2	0.01	29.40	335	N	Y	Y	300	0	0	4	2	2	2	ge. Investigate embankment scour/erosion, Remediate ch	High	Major scouring, perched DS end
130-01	Unnamed Road	6964517	546320	Cross	Circular	SWSP	150	27.17	27.33	27.12	27.24	7.3	0.01	27.47	185	N	N	N	0	0	2	0	0	1	0	Monitor Rusting	Low	DS perched 0.15 m
130-02	Sivulliq Ave	6964594	546329	Cross	Circular	CSP	600	25.80	26.31	25.62	25.82	6.1	0.03	26.46	395	N	N	N	400	250	1	0	2	1	0	Clear blockage	High	Rill erosion on road crest & DS embankment
130-03	Mivvik Ave	6964679	546331	Cross	Circular	PVC	240	21.97	22.19	21.87	22.02	10.7	0.01	22.64	535	N	N	N	50	0	2	0	1	0	0	Monitor Rusting, clear blockage	High	US blocked by rocks
131-01	Sivulliq Ave	6964813	546039	Entrance	Circular	CSP	600	-	-	24.95	25.56	-	N/A	26.73	1170	N	N/A	N	N/A	0	1	0	2	0	0	Clear blockage	High	US end not found
132-01	Backyard	6965018	546579	Entrance	Circular	CSP	600	13.43	13.76	13.16	13.44	16.4	0.02	13.93	330	N	Y	Y	250	0	1	4	2	0	0	Replace culvert	High	Standing water DS
132-02	Sivulliq Ave	6965040	546594	Entrance	Circular	CSP	600	13.22	13.66	13.27	13.66	6.0	-0.01	13.76	100	Y	N	N	200	50	0	0	2	1	0	Clear blockage	High	Attempts made to protect ends (poles)
132-03	Kivalliq St	6965038	546646	Cross	Circular	CSP	400	12.71	13.07	12.49	12.91	16.2	0.01	13.15	160	N	N	Y	50	0	1	4	1	1	0	Replace culvert	High	DS badely blocked with debris
133-01	Sivulliq Ave	6965046	546714	Cross	Circular	CSP	400	11.38	11.62	11.28	11.59	11.4	0.01	11.92	315	N	Y	Y	100	50	1	4	1	1	1	Replace culvert	High	Clogged by debris causing problems
133-02	Sivulliq Ave	6965047	546737	Cross	Circular	CSP	250	11.43	11.52	11.21	11.46	8.8	0.02	11.79	300	N	Y	Y	50	200	1	4	2	1	1	Replace culvert	High	US end almost buried
134-01	Driveway	6964838	546557	Cross	Circular	CSP	400	19.41	19.59	19.28	19.45	8.6	0.02	19.90	380	N	Y	Y	250	250	1	1	2	0	0	Clear blockage	High	DS pblocked by rocks
134-02	Kivalliq St	6964930	546643	Cross	Circular	CSP	400	13.33	13.50	13.10	13.47	11.3	0.02	13.62	135	N	Y	Y	200	0	0	4	2	1	0	Replace culvert	High	US very crushed. DS end perched
134-03	Arvinngak Ave	6964880	546731	Cross	Circular	CSP	500	10.00	10.48	10.08	10.29	9.2	-0.01	10.98	595	N	Y	Y	50	300	0	4	2	0	0	Replace culvert	High	DS end burried
134-04	Arvinngak Ave	6964870	546741	Entrance	Circular	CSP	400	9.68	10.14	9.66	9.94	10.0	0.00	10.82	780	N	Y	Y	0	0	1	2	0	0	1	Repair culvert end	Medium	DS end perched
134-05	Arvinngak Ave	6964860	546821	Cross	Circular	CSP	400	7.99	8.38	7.84	8.19	11.6	0.01	8.52	235	N	Y	Y	0	0	0	4	0	0	0	Replace culvert	High	Outlet perched
134-06	Tugliq St	6964863	546831	Cross	Circular	CSP	600	7.70	8.20	7.49	8.02	13.2	0.02	8.64	530	N	Y	Y	50	50	1	2	1	0	0	Clear blockage, repair culvert end	High	
134-07	Arvinngak Ave	6964847	546896	Cross	Circular	PVC	240	6.38	6.49	5.84	-	24.5	0.02	6.49	-	N	Y	N/A	0	240	1	4	2	2	1	Clear blockage. Investigate embankment scour/erosion	High	Couldn't locate DS end but flow was observed. Took CE point at invert of visible outflow.
135-01	Siku St	6964750	546643	Cross	Circular	CSP	400	17.13	17.39	16.90	17.12	12.0	0.02	17.52	265	N	N	N	200	200	1	0	2	1	1	Clear blockage	High	Accepts drainage from 2 ditches. Infilled with sediment being washed down
135-02	Inulik St	6964748	546689	Cross	Circular	CSP	400	14.95	15.30	14.73	15.01	10.9	0.02	15.48	325	N	Y	Y	0	0	0	4	0	1	0	Replace culvert	High	Debris US end. DS end twisted & perched
135-03	Attami St	6964755	546745	Cross	Circular	CSP	400	12.81	13.16	12.47	12.86	12.0	0.03	13.34	330	N	N	N	0	0	1	0	0	0	1	No Action	Low	Good condition
135-04	Iglu St	6964768	546829	Cross	Circular	CSP	600	8.98	9.39	8.48	8.90	11.3	0.04	9.38	235	N	Y	Y	100	100	1	4	1	1	0	Replace culvert	High	Likely overroad spillage during high flow due to low capacity
136-01	Tikaq St	6964396	546393	Entrance	Circular	CSP	500	-	-	27.43	27.60	-	N/A	28.06	460	N	N	N	0	0	0	0	0	0	0	No Action	Low	Blocked. Only DS end located. Near 58
136-02	Tikaq St	6964457	546476	Cross	Circular	SP	200	25.55	25.76	25.47	25.63	9.2	0.01	25.94	245	N	N	N	50	50	1	0	1	0	0	Clear blockage	High	Flow conveyed South under road. Collects two ditches from NW. Eastern, near 58
136-03	Inukshuk St	6964300	546528	Cross	Circular	CSP	600	22.95	23.21	22.94	23.19	9.5	0.00	23.50	300	N	Y	Y	400	400	1	4	2	1	1	Replace culvert	High	Debris & sediment blocking culvert
136-04	Ipiktuq St	6964298	546535	Cross	Circular	CSP	500	22.86	23.12	22.83	23.14	11.2	0.00	23.38	250	N	Y	Y	300	300	1	4	2	0	1	Replace culvert	High	Debris & sediment blocking culvert
137-01	Taqiq Ave	6964263	546729	Cross	Circular	PVC	200	25.24	25.48	25.02	25.27	10.1	0.02	25.48	105	N	Y	-	0	0	1	4	0	0	1	Replace culvert	High	Likely bent path. Scouring DS end, perched 0.4 m
137-02	Aivilik St	6964325	546599	Cross	Circular	CSP	400	22.22	22.54	22.13	22.48	11.4	0.01	22.77	260	N	Y	Y	50	50	1	3	1	0	0	Clear blockage, repair culvert end	High	Standing water @ DS, blockage US. Very crushed. Put in an extension US because it is crushed and vegitation
137-03	Uqaqti St	6964355	546653	Cross	Circular	CSP	400	21.49	21.84	21.48	21.88	11.5	0.00	22.13	270	N	Y	Y	0	50	1	3	1	0	1	Clear blockage, repair culvert end	High	Standing water @ US & DS ends, ditching improvements
137-04	Triganiaq St	6964343	546736	Entrance	Circular	CSP	600	22.63	22.92	22.10	22.63	11.9	0.04	23.28	505	N	Y	Y	50	0	1	3	1	0	0	Clear blockage, repair culvert end	High	US end blocked with vegitation, DS end blocked with debris
137-05	Triganiaq St	6964363	546722	Entrance	Circular	CSP	300	21.77	22.00	21.79	21.96	5.1	0.00	22.05	70	N	Y	Y	100	0	1	4	2	0	0	Replace culvert	High	Entrance culvert
137-06	Triganiaq St	6964368	546717	Entrance	Circular	CSP	300	21.63	21.86	21.54	21.75	6.0	0.01	21.98	175	N	Y	Y	0	150	1	1	2	0	0	Clear blockage	High	US end partial blockage by vegitation
138-01	Inukshuk St	6964316	546550	Entrance	Circular	PVC	200	-	-	22.72	22.79	-	N/A	23.33	540	N	N/A	N	N/A	200	0	0	2	0	0	Clear blockage	High	US end not found. Likely under parking lot. DS buried, not functional
138-02	Aivilik St	6964340	546592	Entrance	Circular	SWSP	150	22.32	22.45	21.99	22.19	12.9	0.03	22.63	310	N	N	N	0	50	2	0	2	0	0	Monitor Rusting, clean blockage and sediment	High	Likely undersized causing ponding and rutted area US
138-03	Uqaqti St	6964363	546646	Entrance	Circular	CSP	400	21.69	21.97	21.69	21.91	6.4	0.00	22.06	120	N	Y	Y	0	50	1	4	1	0	0	Replace culvert	High	Poor ditching to DS end from problem area. Some of playground drains to US side of culvert. Poor culvert capacity. Could improve that area & conveyance capacity.
138-04	Triganiaq St	6964403	546693	Cross	Circular	CSP	400	20.98	21.29	20.66	20.94	11.7	0.03	21.50	385	N	Y	Y	0	100	1	4	1	0	1	Replace culvert	High	Vegitation & sedimentation at DS end impacting conveyance
138-05	Triganiaq St	6964488	546649	Cross	Circular	PVC	200	20.74	20.97	20.44	20.61	12.2	0.02	21.07	280	N	N	N	100	150	0	0	2	0	0	Clear blockage	High	
138-06	Ayaruaq St	6964477	546778	Cross	Circular	CSP	600	16.49	16.89	16.19	16.51	11.6	0.03	17.16	460	N	Y	Y	300	200	1	2	2	0	1	Clear blockage, repair culvert end	High	Reduced capacity due to infilling
138-07	Tuugaaq St	6964571	546612	Cross	Circular	SWSP	200	20.89	21.12	20.74	20.88	11.9	0.01	21.20	200	N	N	N	0	100	2	0	2	1	0	Monitor Rusting, clear blockage	High	
138-08	Tiriganiaq St	6964549	546643	Cross	Circular	CSP	400	20.23	20.49	19.90	20.08	11.4	0.03	20.60	315	N	Y	Y	100	100	0	4	1	0	0	Replace culvert	High	Backyard drainage
138-09	Ayaruaq St	6964565	546700	Cross	Circular	CSP	400	18.41	18.78	17.88	18.28	11.2	0.05	18.97	440	N	Y	Y	100	100	1	4	1	0	0	Replace culvert	High	Debris in DS end. Backyard drainage
138-10	Tikaq St	6964518	546664	Entrance	Circular	PVC	200	20.65	20.81	20.14	20.26	23.5	0.02	20.70	165	N	N	N	50	100	0	0	2	0	1	Clear blockage	High	
138-11	Tiriganiaq St	6964534	546655	Cross	Circular	CSP	400	-	-	20.12	20.31	-	N/A	20.67	360	N	N/A	Y	N/A	400	1	2	2	0	0	Clear blockage, repair culvert end	High	Couldn't locate US end - Likely buried

138-12	Inulik St	6964516	546823	Cross	Circular	CSP	400	13.99	14.40	13.64	13.99	11.0	0.03	14.34	145	N	Y	Y	0	0	1	3	0	2	0	Investigate embankment scour/erosion, repair culvert end	High	Partially blocked by debris. DS perched 0.4 m, scoured.
138-13	Attami St	6964554	546867	Cross	Circular	CSP	600	10.94	10.44	10.51	10.90	10.3	0.04	11.54	870	N	Y	Y	50	50	0	4	1	2	2	ge. Investigate embankment scour/erosion, Remediate ch	High	Scouring on DS end. Debris
139-01	Tariuq Ave	6964575	546893	Entrance	Circular	PVC	250	9.50	9.76	9.26	9.54	12.1	0.02	9.81	160	N	N	N	0	0	0	0	0	2	2	stigate embankment scour/erosion, Remediate channel er	High	Driveway culverts
139-02	Tariuq Ave	6964574	546894	Entrance	Circular	PVC	250	9.58	9.81	9.28	9.53	12.2	0.02	9.81	140	N	N	N	0	0	0	0	0	2	2	stigate embankment scour/erosion, Remediate channel er	High	Twinned 88/89. 1 set of photos
139-03	Pisugvik St	6964600	546912	Entrance	Circular	CSP	400	8.82	9.17	8.35	8.79	9.6	0.05	8.94	0	N	N	N	0	0	1	0	0	1	0	No Action	Low	Good condition
139-05	Pisugvik St	6964603	546927	Cross	Circular	CSP	600	8.28	8.76	7.84	8.31	16.8	0.03	9.14	605	N	Y	Y	0	50	1	1	1	1	1	Clear blockage	High	
139-04	Iglu St	6964650	546858	Cross	Circular	PVC	240	9.07	9.22	8.82	9.08	12.2	0.02	9.41	260	N	N	N	50	150	0	0	2	0	0	Clear blockage	High	
146-01	Pisugvik St	6964593	547043	Cross	Circular	CSP	600	9.31	9.84	8.96	9.37	12.3	0.03	10.06	455	N	Y	Y	50	250	0	3	2	0	0	Clear blockage, repair culvert end	High	Takes drainage which cuts across road entrance from upslope ditch
139-06	Pisugvik St	6964619	546922	Cross	Circular	CSP	600	7.68	8.23	7.30	7.85	17.3	0.02	8.53	490	N	Y	N	0	0	0	0	0	0	0	No Action	Low	Backyard drainage
135-05	Pisugvik St	6964764	546910	Cross	Circular	CSP	400	5.45	5.76	4.90	5.17	14.4	0.04	5.88	415	N	Y	Y	0	200	1	1	2	1	0	Clear blockage	High	Poor ditch def'n US
134-08	Atausiq St	6964813	546910	Cross	Circular	CSP	600	5.31	5.72	4.84	5.40	10.3	0.05	5.88	320	N	Y	Y	400	0	0	4	2	2	0	Clear blockage. Investigate embankment scour/erosion	High	DS end perched. Sedimentation @ US end. Almost at culvert top
142-01	Unnamed Road	6965395	547146	Cross	Circular	CSP	2800	1.59	2.82	1.51	2.50	9.1	0.01	3.24	580	N	N	N	0	20	1	0	1	0	0	Clear blockage	High	
137-07	Triganiaq St	6964394	546705	Cross	Circular	CSP	400	20.84	21.17	20.36	20.70	11.2	0.04	21.44	505	N	Y	Y	0	150	1	2	2	1	0	Clear blockage, repair culvert end	High	Vegitation at DS end impacting conveyance
145-01	Inulik St	6964504	546834	Cross	Circular	CSP	400	13.87	14.06	13.31	13.70	11.0	0.05	14.25	370	N	Y	Y	0	0	0	4	0	2	1	Investigate embankment scour/erosion	High	Partially blocked by debris. DS slightly perched
145-02	Attami St	6964540	546877	Cross	Circular	CSP	400	11.09	11.34	10.64	11.06	11.3	0.04	11.58	380	N	Y	Y	0	0	1	3	0	0	1	Repair culvert end	High	Slight DS perch, scouring at DS end. Debris
145-03	Tariuq Ave	6964574	546916	Cross	Circular	CSP	600	8.97	9.49	8.99	9.36	8.1	0.00	9.58	155	N	Y	Y	50	100	1	3	1	0	0	Clear blockage, repair culvert end	High	DS end very torn up. 2 pieces
145-04	Pisugvik St	6964591	546938	Cross	Circular	CSP	600	8.31	8.88	8.18	8.58	17.8	0.01	9.29	560	N	Y	Y	50	50	1	4	1	2	1	Clear blockage. Investigate embankment scour/erosion	High	Debris pileup US end. DS end perched, scouring
148-01	Inulik St	6964107	547519	Cross	Circular	SWSP	200	2.34	2.58	2.23	2.42	7.0	0.02	2.68	180	N	N	N	100	100	2	0	2	1	1	Monitor Rusting, clean blockage and sediment	High	Not working well. Road wet
151-01	Makpah St	6963575	546869	Entrance	Circular	CSP	600	30.26	30.87	30.06	30.65	12.1	0.02	31.48	720	N	N	N	0	0	0	0	0	1	0	No Action	Low	
151-02	Makpah St	6963546	546889	Entrance	Circular	CSP	600	29.24	29.84	29.01	29.59	12.1	0.02	30.01	295	N	N	N	0	0	1	0	0	0	0	No Action	Low	
152-01	Makpah St	6963531	546937	Entrance	Circular	CSP	600	27.42	27.98	27.01	27.62	12.0	0.03	28.28	480	N	N	N	0	0	0	0	0	0	0	No Action	Low	
153-05	TikTaq St	6964045	546415	Entrance	Circular	CSP	600	18.76	19.35	17.93	18.38	18.2	0.05	19.34	475	N	N	N	0	0	1	3	0	0	0	Repair culvert end	High	
153-04	TikTaq St	6964099	546441	Entrance	Circular	CSP	600	21.29	21.89	21.05	21.65	9.1	0.03	21.99	220	N	N	N	0	0	0	0	0	0	0	No Action	Low	
153-03	TikTaq St	6964114	546457	Entrance	Circular	CSP	600	21.38	22.00	21.31	21.86	9.2	0.01	22.16	230	N	N	N	50	100	1	0	1	0	0	Clean blockage and sediment	High	
153-02	TikTaq St	6964146	546481	Cross	Circular	CSP	400	22.00	22.26	21.85	22.10	11.6	0.01	22.52	340	N	Y	Y	50	100	1	3	1	1	0	Clear blockage, repair culvert end	High	
153-01	Siqiniq St	6964204	546491	Cross	Circular	SWSP	120	23.07	23.16	-	-	-	N/A	23.21	50	N	Y	-	0	0	1	3	0	1	1	Repair culvert end	High	DS end buried
154-01	Itivia St	6964044	546313	Entrance	Circular	CSP	350	22.10	22.28	22.02	22.30	6.1	0.01	22.42	130	N	Y	Y	150	150	0	3	2	0	1	Clear blockage, repair culvert end	High	Severly crushed. Two separate barrels
154-02	TikTaq St	6964001	546382	Entrance	Circular	CSP	300	16.24	16.44	16.22	16.57	6.0	0.00	16.79	285	N	Y	N	0	0	1	2	0	0	1	Repair culvert end	Low	Flow overtop from property
154-03	TikTaq St	6964031	546392	Entrance	Circular	CSP	450/300	17.44	17.78	16.47	16.75	36.6	0.03	17.94	675	N	Y	N	0	100	0	2	2	1	1	Clear blockage, repair culvert end	High	450 US end, 300 DS end
155-01	Itivia St	6964031	546296	Entrance	Circular	CSP	500	22.04	22.43	21.69	22.20	17.9	0.02	22.60	285	N	Y	Y	100	50	1	3	1	0	1	Clear blockage, repair culvert end	High	
155-02	Itivia St	6963943	546316	Cross	Circular	PVC	250	18.21	18.44	17.59	17.82	15.5	0.04	18.45	320	N	N	Y	0	0	2	1	0	2	1	Monitor Rusting, Investigate embankment scour/erosion	High	Perched DS end
154-04	TikTaq St	6963990	546384	Cross	Circular	CSP	600	16.15	16.39	15.96	16.41	11.1	0.02	16.93	530	N	Y	Y	0	150	1	4	1	0	0	Replace culvert	High	Accepts ditch flow from 2 directions, cross culvert, conveys under road
155-03	Makpah St	6963715	546720	Cross	Circular	CSP	600	30.67	31.31	30.60	31.24	12.0	0.01	31.80	525	N	N	N	0	0	0	0	0	0	0	No Action	Low	
155-04	Makpah St	6963714	546713	Cross	Circular	CSP	600	30.59	31.20	30.53	31.13	14.3	0.00	31.83	665	N	N	N	0	0	1	0	0	0	0	No Action	Low	
155-05	Amarok St	6963707	546711	Cross	Circular	CSP	600	30.96	31.54	30.61	31.18	14.6	0.02	31.98	620	N	N	N	0	0	0	0	0	0	0	No Action	Low	
155-06	Itivia St	6963723	546374	Cross	Circular	CSP	500	12.66	13.07	12.52	12.95	13.1	0.01	13.33	320	N	N	N	0	0	1	0	0	1	0	No Action	Low	Debris blocking US end
155-07	Itivia St	6963609	546459	Entrance	Circular	PVC	250	8.90	9.13	8.27	8.52	15.1	0.04	9.28	455	N	N	N	0	0	0	0	0	2	2	stigate embankment scour/erosion, Remediate channel er	High	Scouring on DS end
158-01	Inukshuk St	6964372	546294	Cross	Circular	CSP	400	27.26	27.63	27.13	27.36	11.1	0.01	27.96	465	N	Y	Y	0	150	1	2	2	0	0	Clear blockage, repair culvert end	High	cross culvert connecting 2 swales. Eventually discharges to the humanmade right angle swale DS
159-01	Unataqtutsait St S	6964494	546116	Cross	Circular	CSP	600	26.26	26.90	25.75	26.45	24.1	0.02	27.84	1165	N	N	N	0	0	0	0	0	0	0	No Action	Low	Perched US end
158-02	Itivia St	6964195	546192	Cross	Circular	SWSP	300	23.15	23.45	22.71	23.05	18.3	0.02	23.60	350	N	N	N	0	0	0	0	0	2	1	Investigate embankment scour/erosion	High	Perched outlet. Scouring

Culvert Information		
Culvert ID		101-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		19.7
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		445
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Gash in culvert top on US end	

Culvert Location	
Street	Nunavut St
Northing (m) [1]	6965689
Easting (m) [1]	545509

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.37	18.86	-	18.61	19.18

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

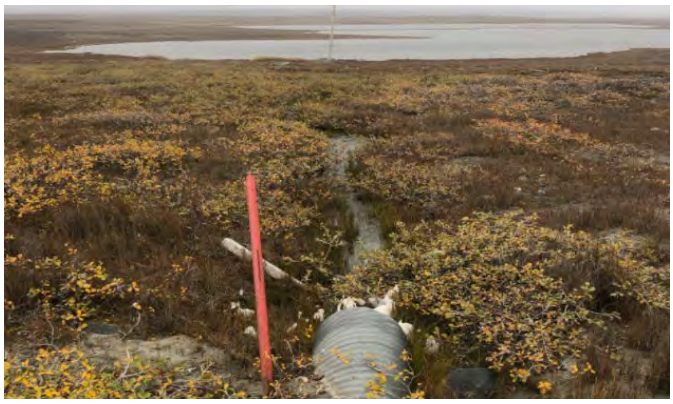
Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	0	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View



Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		104-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		800
Marker Post Present		N
Barrel Length (m)		14.1
Approx. Barrel Slope (%)		1.8%
Approx. Depth of Cover (m)		340
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Debris in DS end	

Culvert Location	
Street	Kingaaq Ave
Northing (m) [1]	6965535
Easting (m) [1]	545981

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.67	10.46	9.42	10.18	10.66

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	2	0

Recommended Action(s):	Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

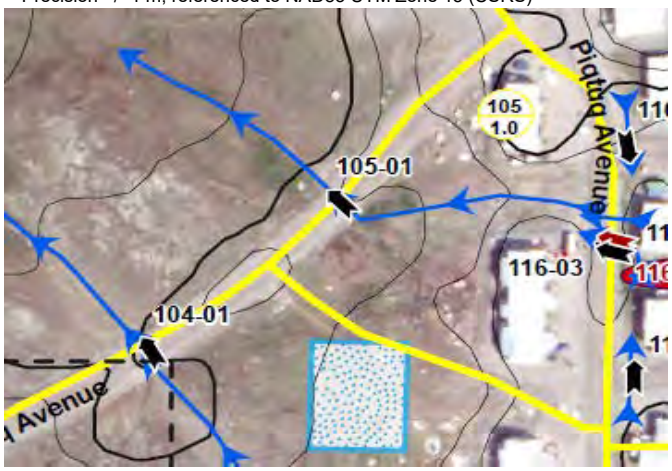
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		105-01
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		15.2
Approx. Barrel Slope (%)		2.7%
Approx. Depth of Cover (m)		400
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	DS end plugged by rocks	

Culvert Location	
Street	Kingaaq Ave
Northing (m) [1]	6965530
Easting (m) [1]	546064

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
10.25	10.46	9.84	10.16	10.71

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		13.8
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		535
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	Flow direction unknown	

Culvert Location	
Street	Unataqtutsait St N
Northing (m) [1]	6965030
Easting (m) [1]	545722

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.81	23.16	22.68	23.15	23.69

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	1	2	0

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

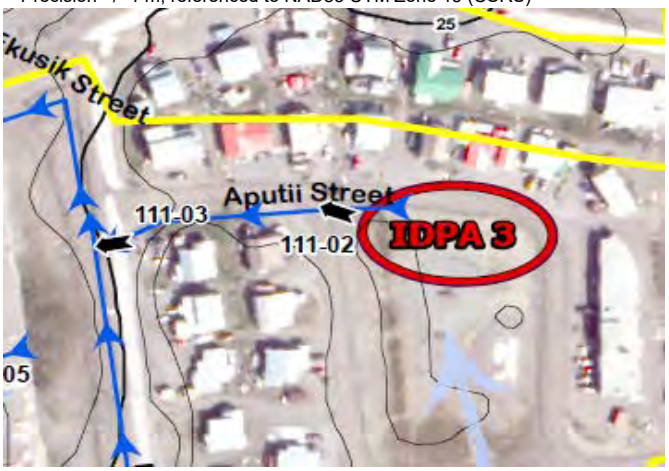
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		31.2
Approx. Barrel Slope (%)		0.6%
Approx. Depth of Cover (m)		730
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	250
	Downstream	0
Other Comments	Debris & standing water in ditch	

Culvert Location	
Street	Ilua St
Northing (m) [1]	6965033
Easting (m) [1]	546026

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
25.62	25.79	25.44	25.83	26.54

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		16.3
Approx. Barrel Slope (%)		3.1%
Approx. Depth of Cover (m)		730
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Ekusik St
Northing (m) [1]	6965077
Easting (m) [1]	545965

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
24.95	25.3	24.45	25	25.88

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		16.2
Approx. Barrel Slope (%)		2.1%
Approx. Depth of Cover (m)		525
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Sedimentation in DS end	

Culvert Location	
Street	Nunavut St
Northing (m) [1]	6965152
Easting (m) [1]	545935

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.93	23.31	22.59	22.84	23.6

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	1	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		13.3
Approx. Barrel Slope (%)		3.2%
Approx. Depth of Cover (m)		565
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	300mm rocks blocking inlet	

Culvert Location	
Street	Noolook Ave
Northing (m) [1]	6965085
Easting (m) [1]	545885

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.8	23.17	22.37	22.98	23.64

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-06
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		48.1
Approx. Barrel Slope (%)		1.1%
Approx. Depth of Cover (m)		635
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Iskernerk St
Northing (m) [1]	6965105
Easting (m) [1]	545863

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22	22.61	21.48	22.1	22.99

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	1	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-07
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		15.3
Approx. Barrel Slope (%)		0.3%
Approx. Depth of Cover (m)		330
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965128
Easting (m) [1]	545820

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.16	21.74	21.12	21.68	22.04

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-08
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		15.9
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		210
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	200
Other Comments	DS end damaged. Barrel clear.	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965192
Easting (m) [1]	545861

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
19.66	20.27	19.34	19.91	20.3

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-09
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		150
Marker Post Present		N
Barrel Length (m)		10.4
Approx. Barrel Slope (%)		175.8%
Approx. Depth of Cover (m)		165
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Perched US end	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965157
Easting (m) [1]	545826

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.05	21.19	2.78	20.9	21.21

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-10
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		9.6
Approx. Barrel Slope (%)		2.3%
Approx. Depth of Cover (m)		210
End Crushing	Upstream	Y
	Downstream	-
Infill Depth (mm)	Upstream	100
	Downstream	0
Other Comments	US end crushed. Barrel clear	

Culvert Location	
Street	Kugyuk Ave
Northing (m) [1]	6965278
Easting (m) [1]	545720

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.79	19.14	18.57	19	19.28

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-11
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		18.0
Approx. Barrel Slope (%)		0.4%
Approx. Depth of Cover (m)		280
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Barrel clear. Minor material buildup on ends from road. Likely to continue accumulating. DS end	

Culvert Location	
Street	Kugyuk Ave
Northing (m) [1]	6965268
Easting (m) [1]	545735

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.52	19.02	18.45	19.04	19.31

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-12
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		350
Marker Post Present		N
Barrel Length (m)		8.7
Approx. Barrel Slope (%)		4.1%
Approx. Depth of Cover (m)		430
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Rill erosion on US embankment	

Culvert Location	
Street	Nunavut St
Northing (m) [1]	6965180
Easting (m) [1]	545884

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.59	20.91	20.23	20.63	21.2

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	2

Recommended Action(s):	Remediate channel erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-13
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		13.9
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		600
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	200
Other Comments	Both ends damaged. Rill erosion at DS end from road drainage.	

Culvert Location	
Street	Nunavut St
Northing (m) [1]	6965275
Easting (m) [1]	545755

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
17.94	18.52	17.66	18.24	18.98

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	1	2

Recommended Action(s):	Clear blockage. Remediate channel erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-14
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		9.5
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		250
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	200
	Downstream	200
Other Comments	Both ends damaged and infilled.	

Culvert Location	
Street	Kugyuk Ave
Northing (m) [1]	6965316
Easting (m) [1]	545788

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.76	17.17	16.67	17.13	17.4

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
-	-	-	-	-

Recommended Action(s):	No Action	Priority:	-

Upstream View	Upstream Culvert End
NO PHOTOS	NO PHOTOS

Downstream View	Downstream Culvert End
NO PHOTOS	NO PHOTOS

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-15
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		9.1
Approx. Barrel Slope (%)		-0.2%
Approx. Depth of Cover (m)		375
End Crushing	Upstream	Y
	Downstream	-
Infill Depth (mm)	Upstream	300
	Downstream	300
Other Comments	US end crushed and blocked by rocks. Barrel clearance unknown. Both ends infilled	

Culvert Location	
Street	Tuatuq St
Northing (m) [1]	6965318
Easting (m) [1]	545840

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.82	16.15	15.84	16.16	16.53

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	2	1

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-16
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		16.1
Approx. Barrel Slope (%)		2.3%
Approx. Depth of Cover (m)		1055
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	250
	Downstream	0
Other Comments	Both end crushed. Debris blocking flow. Barrel clearance unknown.	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.62	15.97	15.25	15.62	16.85

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tuatuq St
Northing (m) [1]	6965315
Easting (m) [1]	545863

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	2	1

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		111-17
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		8.8
Approx. Barrel Slope (%)		0.1%
Approx. Depth of Cover (m)		390
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	300
	Downstream	200
Other Comments	Both end crushed. Debris in barrel	

Culvert Location	
Street	Tuatuq St
Northing (m) [1]	6965285
Easting (m) [1]	545882

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.85	16.25	15.84	16.27	16.65

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	2	1	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

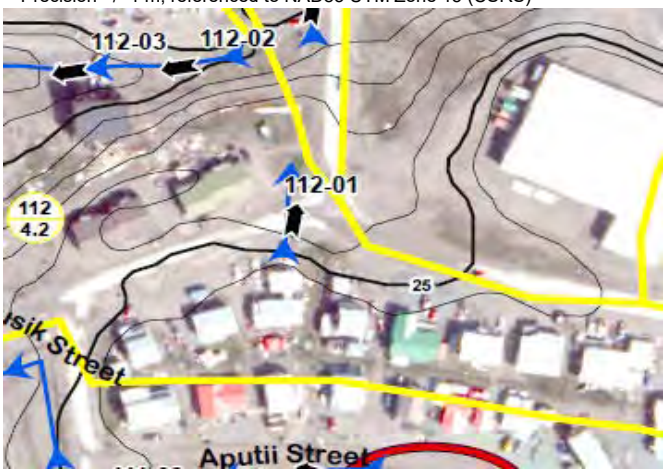
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		12.9
Approx. Barrel Slope (%)		1.3%
Approx. Depth of Cover (m)		655
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	300
	Downstream	300
Other Comments	0	

Culvert Location	
Street	Nunavut St
Northing (m) [1]	6965103
Easting (m) [1]	546086

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
23.73	23.91	23.56	23.78	24.5

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		18.1
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		355
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	US end crushed	

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965170
Easting (m) [1]	546100

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
19.56	19.84	19.19	19.57	20.06

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

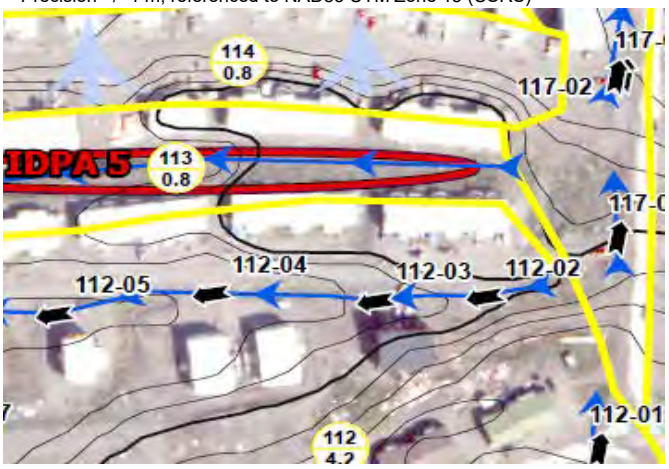
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		15.8
Approx. Barrel Slope (%)		2.5%
Approx. Depth of Cover (m)		790
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Infilled DS end	

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965194
Easting (m) [1]	546073

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.9	19.3	18.5	18.84	19.86

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	1	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

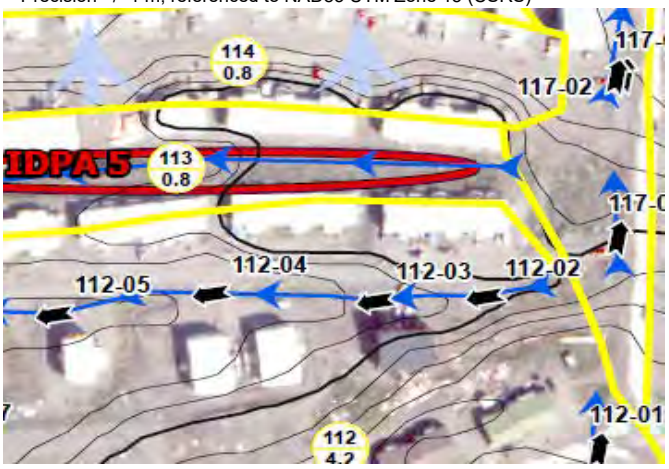
Culvert Information		
Culvert ID		112-04
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		24.1
Approx. Barrel Slope (%)		1.8%
Approx. Depth of Cover (m)		460
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Ends slightly crushed. DS end close to being buried by driveway embankment.	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
17.35	17.65	16.92	17.25	17.91

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965234
Easting (m) [1]	546036

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	1	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

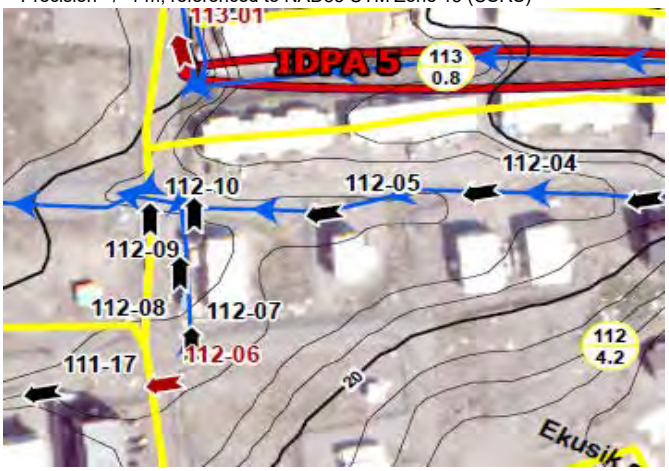
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.2
Approx. Barrel Slope (%)		2.9%
Approx. Depth of Cover (m)		325
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Infilled in both ends	

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965265
Easting (m) [1]	545995

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.62	17.14	16.27	16.75	17.27

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		-
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		-
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	US crushed and barely visible. DS end not visible. Not conveying any flow. No CAD points	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	-	-	-

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965258
Easting (m) [1]	545913

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-07
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		14.0
Approx. Barrel Slope (%)		2.1%
Approx. Depth of Cover (m)		380
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	DS end infilled. Barrel clearance unknown	

Culvert Location	
Street	Tuatuq St
Northing (m) [1]	6965263
Easting (m) [1]	545929

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.22	16.68	15.93	16.28	16.86

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	1	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-08
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450/600
Marker Post Present		N
Barrel Length (m)		10.1
Approx. Barrel Slope (%)		0.7%
Approx. Depth of Cover (m)		465
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	0	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965283
Easting (m) [1]	545945

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.83	16.17	15.76	16.24	16.67

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-09
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		800
Marker Post Present		N
Barrel Length (m)		4.1
Approx. Barrel Slope (%)		1.0%
Approx. Depth of Cover (m)		420
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Infilled in both ends	

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965295
Easting (m) [1]	545964

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.68	16.29	15.64	16.27	16.7

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	1	1	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		112-10
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		13.9
Approx. Barrel Slope (%)		2.9%
Approx. Depth of Cover (m)		440
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Minor damage to DS end	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965304
Easting (m) [1]	545952

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.45	16.04	15.04	15.66	16.29

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

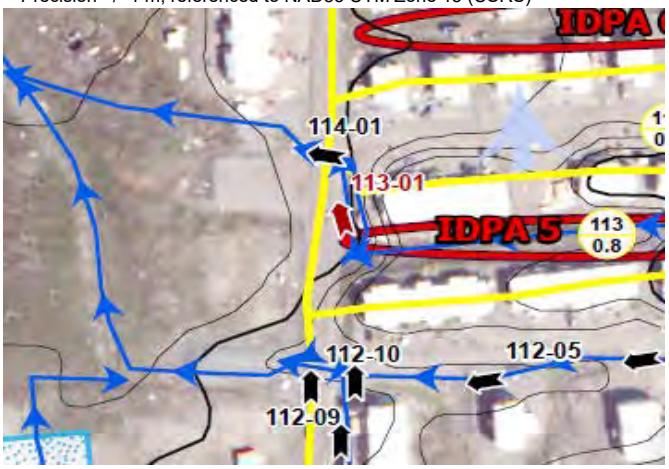
Culvert Information		
Culvert ID		113-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		670
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	300
	Downstream	0
Other Comments	US end damaged. No flow observed. No sign of DS, likely covered by development. Culvert	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
14.19	14.76	-	-	15.43

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965341
Easting (m) [1]	546003

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

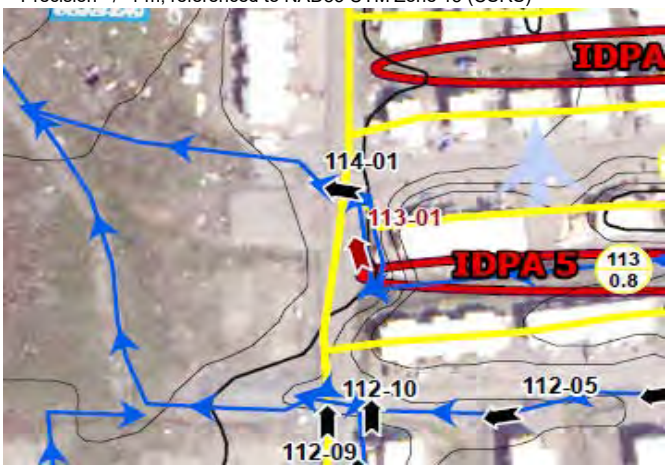
Culvert Information		
Culvert ID		114-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		23.8
Approx. Barrel Slope (%)		0.6%
Approx. Depth of Cover (m)		590
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	US end damaged but clear. DS end has some damage. Culvert seems to be bowed based on	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
14.41	15	14.26	14.84	15.51

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965361
Easting (m) [1]	546016

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

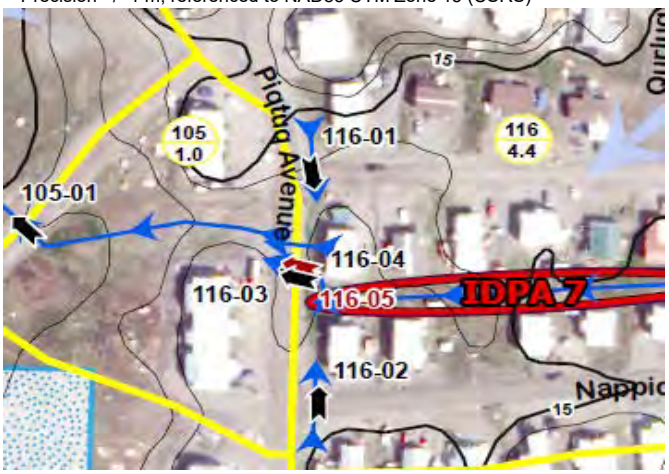
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		116-01
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		10.7
Approx. Barrel Slope (%)		3.7%
Approx. Depth of Cover (m)		670
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	200
	Downstream	200
Other Comments	Conveying flow. PVC culvert almost buried	

Culvert Location	
Street	Imaqsuq St
Northing (m) [1]	6965478
Easting (m) [1]	546145

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.12	13.35	12.73	12.85	13.77

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

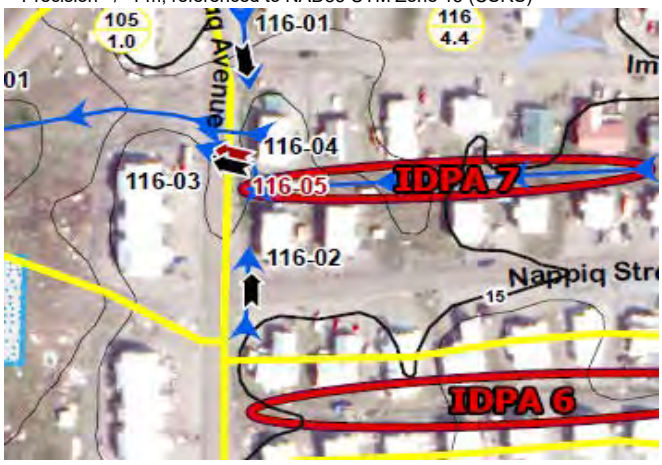
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		116-02
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		1.4%
Approx. Depth of Cover (m)		285
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Nappiq St
Northing (m) [1]	6965416
Easting (m) [1]	546087

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
14.22	14.46	14.05	14.31	14.67

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

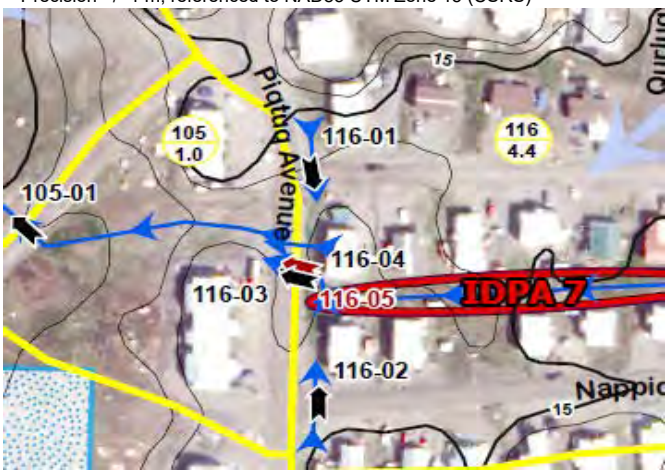
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		116-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		23.1
Approx. Barrel Slope (%)		2.7%
Approx. Depth of Cover (m)		1450
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Conveying flow	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965453
Easting (m) [1]	546115

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.33	12.53	11.71	12.03	13.73

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	0	0	1

Recommended Action(s):	Repair culvert end	Priority:	Medium

Upstream View

Upstream Culvert End

Downstream View

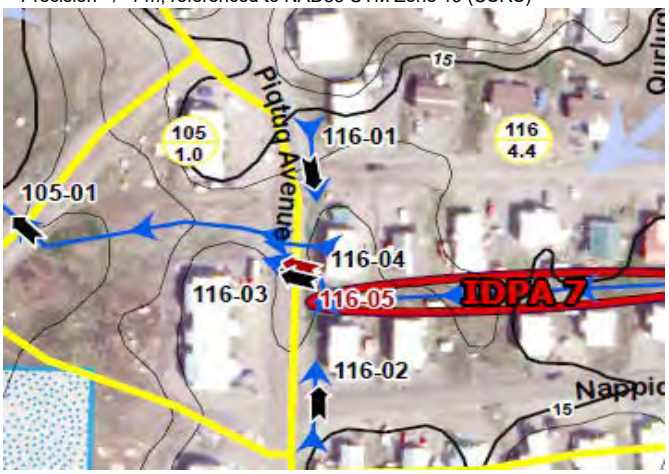
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		116-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		17.9
Approx. Barrel Slope (%)		1.0%
Approx. Depth of Cover (m)		540
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965455
Easting (m) [1]	546116

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.69	13.29	12.52	13.09	13.73

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	0	1	1

Recommended Action(s):	Repair culvert end	Priority:	Medium

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

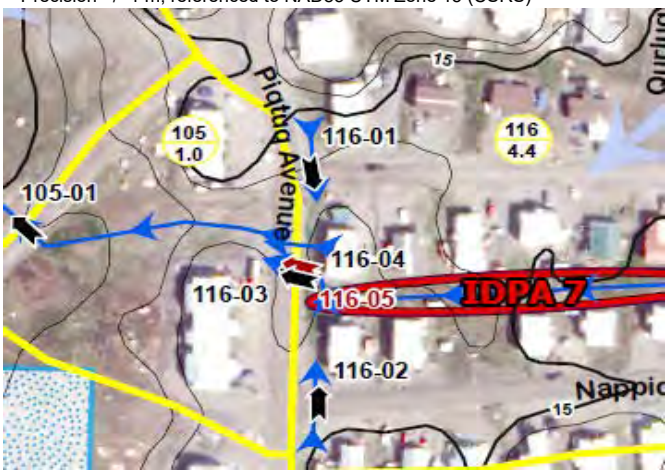
Culvert Information		
Culvert ID		116-05
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		1170
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	DS end not found, covered by house	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.34	12.61	-	-	13.78

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Piqtuq Ave
Northing (m) [1]	6965456
Easting (m) [1]	546118

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

NO PHOTO

Downstream Culvert End

NO PHOTO

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		4.7%
Approx. Depth of Cover (m)		795
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	0
Other Comments	DS end projecting and crushed	

Culvert Location	
Street	Pukkinniq St
Northing (m) [1]	6965154
Easting (m) [1]	546146

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
19.6	20.04	19.03	19.41	20.52

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	1	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

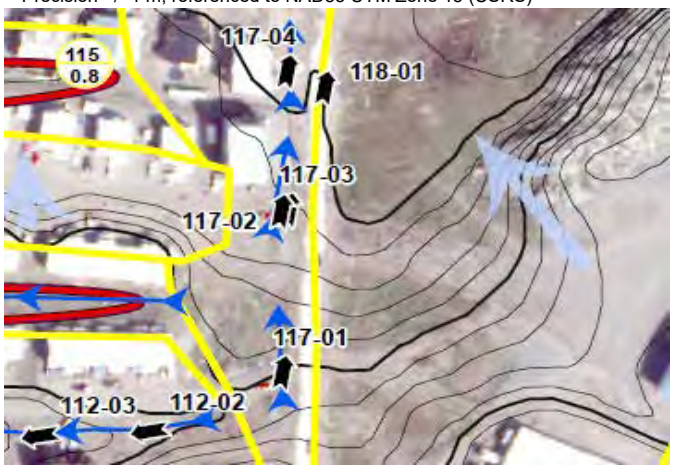
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		15.3
Approx. Barrel Slope (%)		1.4%
Approx. Depth of Cover (m)		345
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Both ends damaged. Culvert barrel bent or angled based on outlet angle	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965196
Easting (m) [1]	546187

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.17	15.76	14.95	15.39	15.92

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	2	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

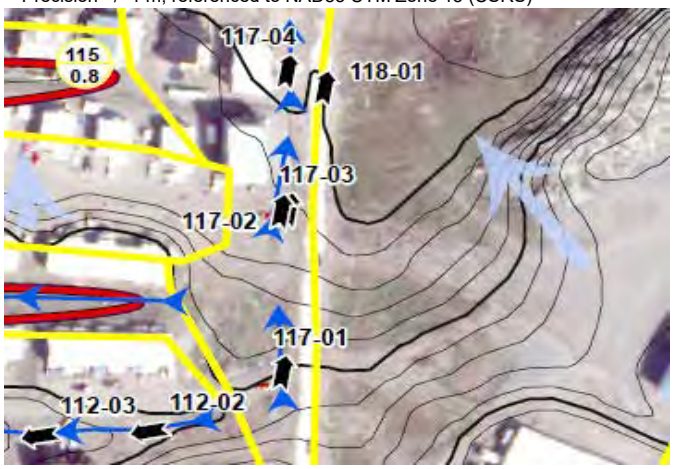
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		2.7%
Approx. Depth of Cover (m)		150
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Elevated culvert. Debris in US end	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965195
Easting (m) [1]	546189

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
15.57	15.99	15.24	15.63	15.96

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		48.3
Approx. Barrel Slope (%)		0.7%
Approx. Depth of Cover (m)		910
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	200
Other Comments	Near 61	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965231
Easting (m) [1]	546225

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.92	14.2	13.56	14.06	15.04

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.9
Approx. Barrel Slope (%)		1.6%
Approx. Depth of Cover (m)		1030
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	20
Other Comments	Horizontally compressed. DS end blocked	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965266
Easting (m) [1]	546280

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.9	13.48	12.69	13.1	14.32

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		13.6
Approx. Barrel Slope (%)		3.1%
Approx. Depth of Cover (m)		505
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Imaqsuq St
Northing (m) [1]	6965294
Easting (m) [1]	546310

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
11.95	12.34	11.53	11.95	12.65

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		117-07
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		11.2
Approx. Barrel Slope (%)		3.0%
Approx. Depth of Cover (m)		350
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	400
	Downstream	200
Other Comments	Sedimentation in US end	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965356
Easting (m) [1]	546418

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
7.09	7.27	6.75	6.99	7.48

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	2	2	0	2

Recommended Action(s):	Clear blockage, emediate channel erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		18.9
Approx. Barrel Slope (%)		1.5%
Approx. Depth of Cover (m)		290
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Cracking/slumping on road evident	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
14.7	15.1	14.42	14.82	15.25

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965218
Easting (m) [1]	546229

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		30.0
Approx. Barrel Slope (%)		0.5%
Approx. Depth of Cover (m)		1605
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	30
Other Comments	DS end blocked by rocks	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965265
Easting (m) [1]	546310

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.9	10.38	9.74	10.05	11.82

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-03
Type		Roof Drain
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		230
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		-
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Roof drain? No US end	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	8.44	8.75	-

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965287
Easting (m) [1]	546365

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

NO UPSTREAM END

Upstream Culvert End

NO UPSTREAM END

Downstream View

NO PHOTO

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-04
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		21.1
Approx. Barrel Slope (%)		2.4%
Approx. Depth of Cover (m)		1425
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Embankments material covering ends	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.53	8.97	8.03	8.4	10.11

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965303
Easting (m) [1]	546360

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		1.2%
Approx. Depth of Cover (m)		610
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	CSP. projecting both ends	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965316
Easting (m) [1]	546394

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.94	7.42	6.8	7.3	7.97

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-06
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		9.3
Approx. Barrel Slope (%)		0.3%
Approx. Depth of Cover (m)		510
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Scour US & DS, steel Culvert much smaller US than DS. PVC 230 mm DS	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.35	6.56	6.32	6.58	7.08

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965338
Easting (m) [1]	546413

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-07
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		18.1
Approx. Barrel Slope (%)		0.1%
Approx. Depth of Cover (m)		2210
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Slight DS perch, some scouring at DS end. US end elevated but wet	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965309
Easting (m) [1]	546475

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.88	6.49	5.86	6.47	8.69

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	2	1

Recommended Action(s):	Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

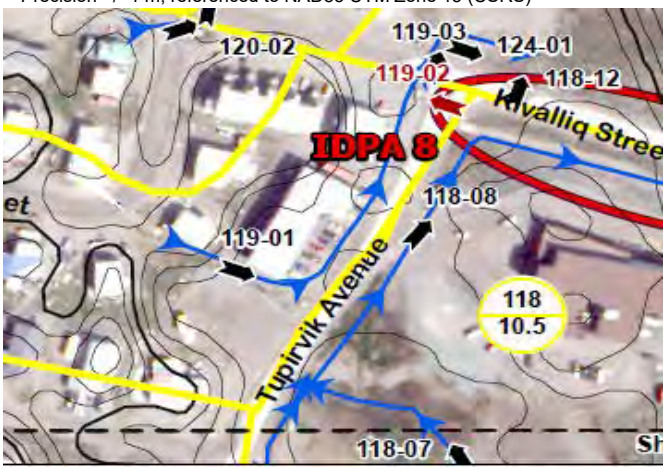
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-08
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450
Marker Post Present		N
Barrel Length (m)		23.2
Approx. Barrel Slope (%)		2.5%
Approx. Depth of Cover (m)		1430
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	100
Other Comments	Debris in US. Rill erosion on embankment	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965378
Easting (m) [1]	546524

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.41	5.78	4.84	5.24	6.94

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	3	1	2	0

Recommended Action(s):	Rusting, clear blockage, Investigate embankment scou	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-09
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		15.2
Approx. Barrel Slope (%)		3.0%
Approx. Depth of Cover (m)		1240
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	300
Other Comments	0	

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6965282
Easting (m) [1]	546636

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
2.64	3.06	2.18	2.6	4.07

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	2	2	1	1

Recommended Action(s):	Monitor Rusting, clean blockage and sediment	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-10
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		120
Marker Post Present		N
Barrel Length (m)		13.4
Approx. Barrel Slope (%)		1.6%
Approx. Depth of Cover (m)		285
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	South of 46, north of 48	

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6965285
Easting (m) [1]	546635

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
3.82	3.95	3.6	3.74	4.13

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-11
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		120
Marker Post Present		N
Barrel Length (m)		13.5
Approx. Barrel Slope (%)		0.3%
Approx. Depth of Cover (m)		315
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	North of 45	

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6965285
Easting (m) [1]	546635

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
3.67	3.81	3.63	3.76	4.1

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		118-12
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.9
Approx. Barrel Slope (%)		3.9%
Approx. Depth of Cover (m)		630
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6965391
Easting (m) [1]	546583

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
4.31	4.89	3.84	4.51	5.33

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

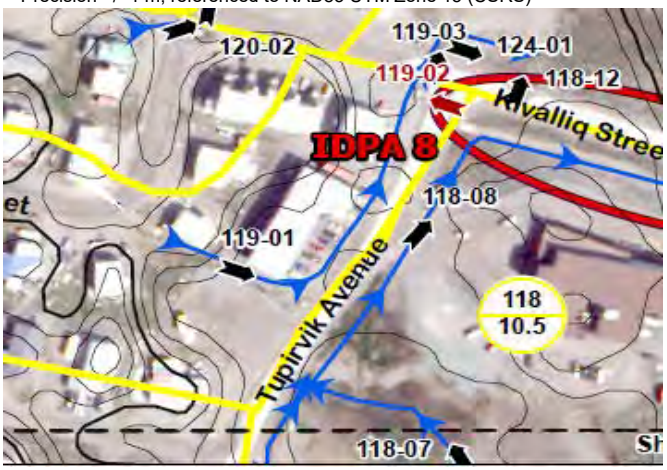
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		119-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		5.7
Approx. Barrel Slope (%)		1.4%
Approx. Depth of Cover (m)		215
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	.
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965411
Easting (m) [1]	546472

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.64	7.19	6.56	6.94	7.28

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		119-02
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		150
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		410
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	No US end	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	5.6	5.77	6.18

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tupirvik Ave
Northing (m) [1]	6965404
Easting (m) [1]	546564

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		119-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		3.2%
Approx. Depth of Cover (m)		680
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Flow under culvert. Culvert perched	

Culvert Location	
Street	Nuna St
Northing (m) [1]	6965417
Easting (m) [1]	546570

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.41	5.83	5.03	5.45	6.32

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	1	2

Recommended Action(s):	Remediate channel erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		120-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		13.8
Approx. Barrel Slope (%)		-0.1%
Approx. Depth of Cover (m)		400
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	350
	Downstream	250
Other Comments	Buried. Sedimentation	

Culvert Location	
Street	Uqquaq St
Northing (m) [1]	6965486
Easting (m) [1]	546521

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.79	7.01	6.8	7.05	7.43

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	2	0	0

Recommended Action(s):	Monitor Rusting, clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		120-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.3
Approx. Barrel Slope (%)		0.6%
Approx. Depth of Cover (m)		540
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	100
Other Comments	Sunken/buried. Sedimentation	

Culvert Location	
Street	Nuna St
Northing (m) [1]	6965485
Easting (m) [1]	546533

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.38	6.84	6.31	6.66	7.29

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		121-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		16.9
Approx. Barrel Slope (%)		-2.7%
Approx. Depth of Cover (m)		470
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	DS filled with debris	

Culvert Location	
Street	Tuapak Ave
Northing (m) [1]	6965510
Easting (m) [1]	546562

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.24	6.12	5.7	6.06	6.56

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		122-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		12.3
Approx. Barrel Slope (%)		-0.5%
Approx. Depth of Cover (m)		710
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Drainage from under house	

Culvert Location	
Street	Tuapak Ave
Northing (m) [1]	6965588
Easting (m) [1]	546626

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
3.85	4.34	3.91	4.24	5

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	2	1	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		122-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		11.3
Approx. Barrel Slope (%)		1.6%
Approx. Depth of Cover (m)		680
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	0	

Culvert Location	
Street	Tuapak Ave
Northing (m) [1]	6965611
Easting (m) [1]	546633

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
3.77	4.17	3.59	4.05	4.79

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		122-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		17.4
Approx. Barrel Slope (%)		2.9%
Approx. Depth of Cover (m)		1045
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	150
Other Comments	DS end has culvert used for embankment stability. Standing water & sediment at US end. Problem	

Culvert Location	
Street	Tugak St
Northing (m) [1]	6965649
Easting (m) [1]	546651

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
3.57	4.04	3.06	3.63	4.88

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	1	0	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		124-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		14.1
Approx. Barrel Slope (%)		3.1%
Approx. Depth of Cover (m)		-
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	200
Other Comments	Sedimentation in DS end	

Culvert Location	
Street	Ugjuk Ave
Northing (m) [1]	6965415
Easting (m) [1]	546582

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
4.64	4.94	4.21	4.4	-

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

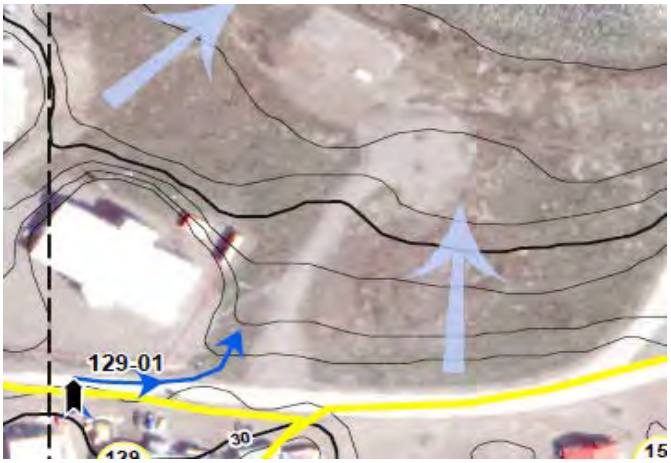
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		129-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.2
Approx. Barrel Slope (%)		1.1%
Approx. Depth of Cover (m)		335
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	300
	Downstream	0
Other Comments	Major scouring, perched DS end	

Culvert Location	
Street	Mivvik Ave
Northing (m) [1]	6964741
Easting (m) [1]	546020

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
28.92	29.13	28.8	29	29.4

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	2	2	2

Recommended Action(s):	. Investigate embankment scour/erosion, Remediate c	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		130-01
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		150
Marker Post Present		N
Barrel Length (m)		7.3
Approx. Barrel Slope (%)		0.7%
Approx. Depth of Cover (m)		185
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	DS perched 0.15 m	

Culvert Location	
Street	Unnamed Road
Northing (m) [1]	6964517
Easting (m) [1]	546320

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
27.17	27.33	27.12	27.24	27.47

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	0	1	0

Recommended Action(s):	Monitor Rusting	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

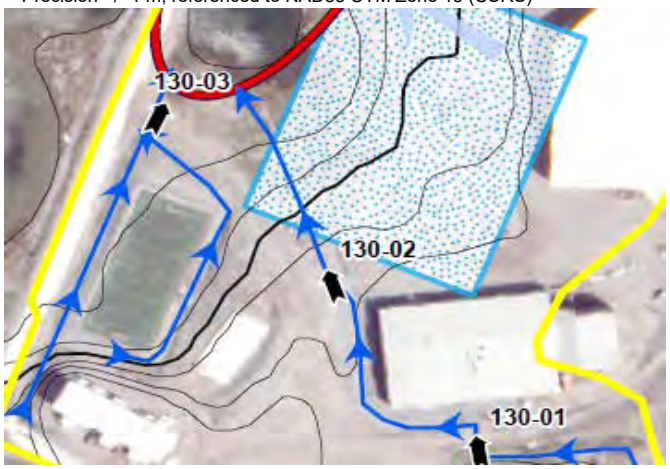
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		130-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		6.1
Approx. Barrel Slope (%)		3.0%
Approx. Depth of Cover (m)		395
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	400
	Downstream	250
Other Comments	Rill erosion on road crest & DS embankment	

Culvert Location	
Street	Sivulliq Ave
Northing (m) [1]	6964594
Easting (m) [1]	546329

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
25.8	26.31	25.62	25.82	26.46

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	1	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

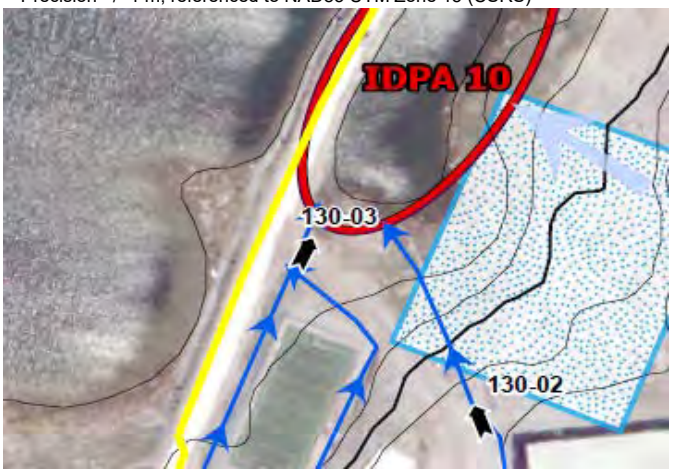
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		130-03
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		240
Marker Post Present		N
Barrel Length (m)		10.7
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		535
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	0
Other Comments	US blocked by rocks	

Culvert Location	
Street	Mivvik Ave
Northing (m) [1]	6964679
Easting (m) [1]	546331

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.97	22.19	21.87	22.02	22.64

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	1	0	0

Recommended Action(s):	Monitor Rusting, clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		131-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		1170
End Crushing	Upstream	N/A
	Downstream	N
Infill Depth (mm)	Upstream	N/A
	Downstream	0
Other Comments	US end not found	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	24.95	25.56	26.73

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Sivulliq Ave
Northing (m) [1]	6964813
Easting (m) [1]	546039

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

NO PHOTO

Upstream Culvert End

NO PHOTO

Downstream View

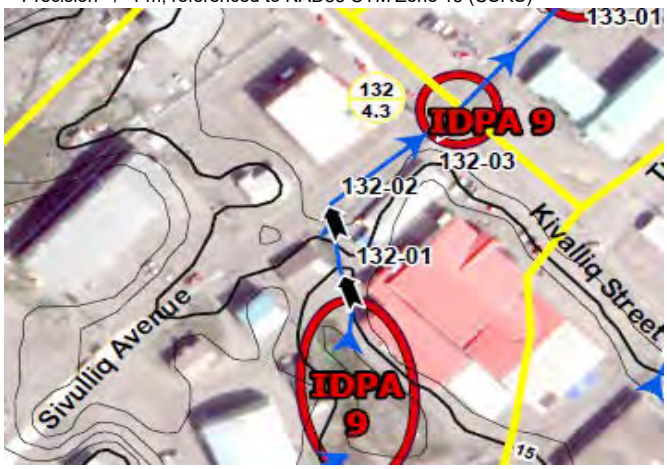
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		132-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		16.4
Approx. Barrel Slope (%)		1.7%
Approx. Depth of Cover (m)		330
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	250
	Downstream	0
Other Comments	Standing water DS	

Culvert Location	
Street	Backyard
Northing (m) [1]	6965018
Easting (m) [1]	546579

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.43	13.76	13.16	13.44	13.93

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

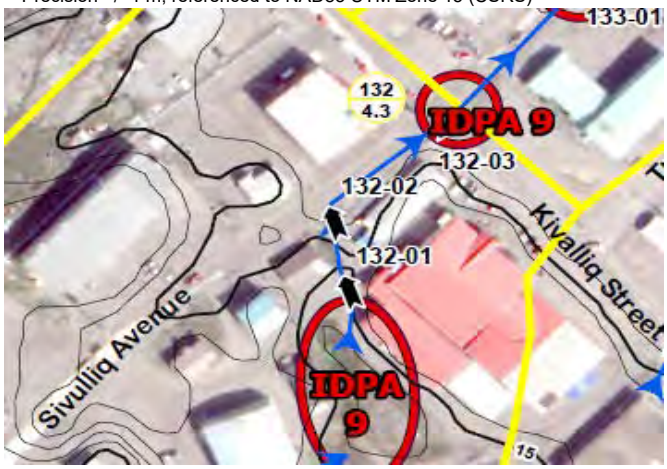
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		132-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		Y
Barrel Length (m)		6.0
Approx. Barrel Slope (%)		-0.8%
Approx. Depth of Cover (m)		100
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	200
	Downstream	50
Other Comments	Attempts made to protect ends (poles)	

Culvert Location	
Street	Sivulliq Ave
Northing (m) [1]	6965040
Easting (m) [1]	546594

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.22	13.66	13.27	13.66	13.76

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	1	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

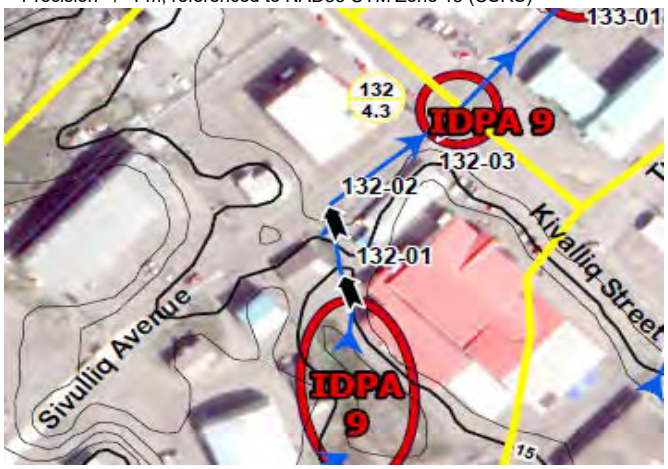
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		132-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		16.2
Approx. Barrel Slope (%)		1.4%
Approx. Depth of Cover (m)		160
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	0
Other Comments	DS badely blocked with debris	

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6965038
Easting (m) [1]	546646

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.71	13.07	12.49	12.91	13.15

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		133-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.4
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		315
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	50
Other Comments	Clogged by debris causing problems	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
11.38	11.62	11.28	11.59	11.92

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Sivulliq Ave
Northing (m) [1]	6965046
Easting (m) [1]	546714

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	1	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		133-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		8.8
Approx. Barrel Slope (%)		2.5%
Approx. Depth of Cover (m)		300
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	200
Other Comments	US end almost buried	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
11.43	11.52	11.21	11.46	11.79

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Sivulliq Ave
Northing (m) [1]	6965047
Easting (m) [1]	546737

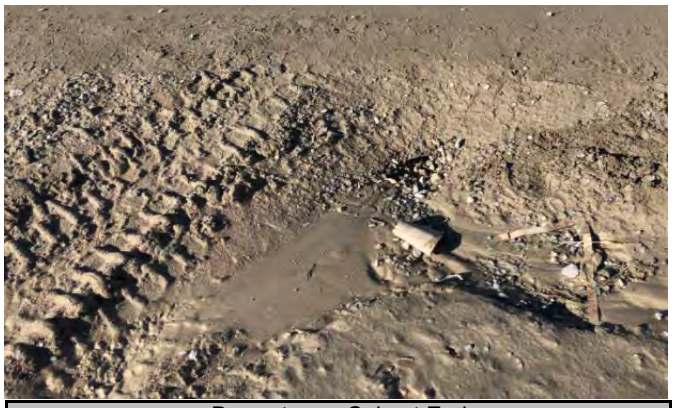
[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	1	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End



Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		133-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		6.0
Approx. Barrel Slope (%)		4.5%
Approx. Depth of Cover (m)		1165
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	US end almost blocked by roacks & sediment	

Culvert Location	
Street	Backyard
Northing (m) [1]	6965080
Easting (m) [1]	546739

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.67	9.96	9.4	9.67	10.98

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	2	2

Recommended Action(s):	gate embankment scour/erosion, Remediate channel	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		8.6
Approx. Barrel Slope (%)		1.5%
Approx. Depth of Cover (m)		380
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	250
	Downstream	250
Other Comments	DS pblocked by rocks	

Culvert Location	
Street	Driveway
Northing (m) [1]	6964838
Easting (m) [1]	546557

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
19.41	19.59	19.28	19.45	19.9

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.3
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		135
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	200
	Downstream	0
Other Comments	US very crushed. DS end perched	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.33	13.5	13.1	13.47	13.62

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Kivalliq St
Northing (m) [1]	6964930
Easting (m) [1]	546643

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	2	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		9.2
Approx. Barrel Slope (%)		-0.9%
Approx. Depth of Cover (m)		595
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	300
Other Comments	DS end burried	

Culvert Location	
Street	Arvinngak Ave
Northing (m) [1]	6964880
Easting (m) [1]	546731

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
10	10.48	10.08	10.29	10.98

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	2	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-04
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		10.0
Approx. Barrel Slope (%)		0.2%
Approx. Depth of Cover (m)		780
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	DS end perched	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.68	10.14	9.66	9.94	10.82

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Arvinngak Ave
Northing (m) [1]	6964870
Easting (m) [1]	546741

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	0	0	1

Recommended Action(s):	Repair culvert end	Priority:	Medium

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-05
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.6
Approx. Barrel Slope (%)		1.3%
Approx. Depth of Cover (m)		235
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Outlet perched	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
7.99	8.38	7.84	8.19	8.52

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Arvinngak Ave
Northing (m) [1]	6964860
Easting (m) [1]	546821

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	0	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		13.2
Approx. Barrel Slope (%)		1.6%
Approx. Depth of Cover (m)		530
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	0	

Culvert Location	
Street	Tugliq St
Northing (m) [1]	6964863
Easting (m) [1]	546831

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
7.7	8.2	7.49	8.02	8.64

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-07
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		240
Marker Post Present		N
Barrel Length (m)		24.5
Approx. Barrel Slope (%)		2.2%
Approx. Depth of Cover (m)		-
End Crushing	Upstream	Y
	Downstream	N/A
Infill Depth (mm)	Upstream	0
	Downstream	240
Other Comments	Couldn't locate DS end but flow was observed. Took CE point at invert of visible outflow.	

Culvert Location	
Street	Arvinngak Ave
Northing (m) [1]	6964847
Easting (m) [1]	546896

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
6.38	6.49	5.84	-	6.49

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	2	1

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		134-08
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		10.3
Approx. Barrel Slope (%)		4.5%
Approx. Depth of Cover (m)		320
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	400
	Downstream	0
Other Comments	DS end perched. Sedimentation @ US end. Almost at culvert top	

Culvert Location	
Street	Atausiq St
Northing (m) [1]	6964813
Easting (m) [1]	546910

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.31	5.72	4.84	5.4	5.88

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	2	2	0

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		135-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		1.9%
Approx. Depth of Cover (m)		265
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	200
	Downstream	200
Other Comments	Accepts drainage from 2 ditches. Infilled with sediment being washed down	

Culvert Location	
Street	Siku St
Northing (m) [1]	6964750
Easting (m) [1]	546643

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
17.13	17.39	16.9	17.12	17.52

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	2	1	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		135-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		10.9
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		325
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Debris US end. DS end twisted & perched	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
14.95	15.3	14.73	15.01	15.48

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Inulik St
Northing (m) [1]	6964748
Easting (m) [1]	546689

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	0	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		135-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		2.8%
Approx. Depth of Cover (m)		330
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Good condition	

Culvert Location	
Street	Attami St
Northing (m) [1]	6964755
Easting (m) [1]	546745

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.81	13.16	12.47	12.86	13.34

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	1

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		135-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.3
Approx. Barrel Slope (%)		4.4%
Approx. Depth of Cover (m)		235
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Likely overroad spillage during high flow due to low capacity	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.98	9.39	8.48	8.9	9.38

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Iglu St
Northing (m) [1]	6964768
Easting (m) [1]	546829

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	1	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		135-05
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		14.4
Approx. Barrel Slope (%)		3.8%
Approx. Depth of Cover (m)		415
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	200
Other Comments	Poor ditch def'n US	

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964764
Easting (m) [1]	546910

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
5.45	5.76	4.9	5.17	5.88

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	2	1	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		136-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		460
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Blocked. Only DS end located. Near 58	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	27.43	27.6	28.06

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Tikaq St
Northing (m) [1]	6964396
Easting (m) [1]	546393

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

NO PHOTO

Upstream Culvert End

NO PHOTO

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		136-02
Type		Cross
Shape		Circular
Material		SP
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		9.2
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		245
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	Flow conveyed South under road. Collects two ditches from NW. Eastern, near 58	

Culvert Location	
Street	Tikaq St
Northing (m) [1]	6964457
Easting (m) [1]	546476

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
25.55	25.76	25.47	25.63	25.94

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		136-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		9.5
Approx. Barrel Slope (%)		0.1%
Approx. Depth of Cover (m)		300
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	400
	Downstream	400
Other Comments	Debris & sediment blocking culvert	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.95	23.21	22.94	23.19	23.5

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Inukshuk St
Northing (m) [1]	6964300
Easting (m) [1]	546528

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	1	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		136-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		11.2
Approx. Barrel Slope (%)		0.3%
Approx. Depth of Cover (m)		250
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	300
	Downstream	300
Other Comments	Debris & sediment blocking culvert	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.86	23.12	22.83	23.14	23.38

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Ipiktuq St
Northing (m) [1]	6964298
Easting (m) [1]	546535

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	0	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-01
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		10.1
Approx. Barrel Slope (%)		2.2%
Approx. Depth of Cover (m)		105
End Crushing	Upstream	Y
	Downstream	-
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Likely bent path. Scouring DS end, perched 0.4 m	

Culvert Location	
Street	Taqiq Ave
Northing (m) [1]	6964263
Easting (m) [1]	546729

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
25.24	25.48	25.02	25.27	25.48

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	0	0	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.4
Approx. Barrel Slope (%)		0.8%
Approx. Depth of Cover (m)		260
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	Standing water @ DS, blockage US. Very crushed. Put in an extension US because it is crushed and	

Culvert Location	
Street	Aivilik St
Northing (m) [1]	6964325
Easting (m) [1]	546599

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.22	22.54	22.13	22.48	22.77

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.5
Approx. Barrel Slope (%)		0.1%
Approx. Depth of Cover (m)		270
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	50
Other Comments	Standing water @ US & DS ends, ditching improvements	

Culvert Location	
Street	Uqaqti St
Northing (m) [1]	6964355
Easting (m) [1]	546653

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.49	21.84	21.48	21.88	22.13

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-04
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.9
Approx. Barrel Slope (%)		4.5%
Approx. Depth of Cover (m)		505
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	0
Other Comments	US end blocked with vegitation, DS end blocked with debris	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.63	22.92	22.1	22.63	23.28

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964343
Easting (m) [1]	546736

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		5.1
Approx. Barrel Slope (%)		-0.4%
Approx. Depth of Cover (m)		70
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	0
Other Comments	Entrance culvert	

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964363
Easting (m) [1]	546722

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.77	22	21.79	21.96	22.05

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	2	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-06
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		6.0
Approx. Barrel Slope (%)		1.5%
Approx. Depth of Cover (m)		175
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	US end partial blockage by vegitation	

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964368
Easting (m) [1]	546717

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.63	21.86	21.54	21.75	21.98

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

NO PHOTO

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		137-07
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.2
Approx. Barrel Slope (%)		4.3%
Approx. Depth of Cover (m)		505
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Vegitation at DS end impacting conveyance	

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964394
Easting (m) [1]	546705

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.84	21.17	20.36	20.7	21.44

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	1	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-01
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		540
End Crushing	Upstream	N/A
	Downstream	N
Infill Depth (mm)	Upstream	N/A
	Downstream	200
Other Comments	US end not found. Likely under parking lot. DS buried, not functional	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	22.72	22.79	23.33

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Inukshuk St
Northing (m) [1]	6964316
Easting (m) [1]	546550

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-02
Type		Entrance
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		150
Marker Post Present		N
Barrel Length (m)		12.9
Approx. Barrel Slope (%)		2.6%
Approx. Depth of Cover (m)		310
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	50
Other Comments	Likely undersized causing ponding and rutted area US	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.32	22.45	21.99	22.19	22.63

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Aivilik St
Northing (m) [1]	6964340
Easting (m) [1]	546592

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	2	0	0

Recommended Action(s):	Monitor Rusting, clean blockage and sediment	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		6.4
Approx. Barrel Slope (%)		0.0%
Approx. Depth of Cover (m)		120
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	50
Other Comments	Poor ditching to DS end from problem area. Some of playground drains to US side of culvert. Poor	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.69	21.97	21.69	21.91	22.06

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Uqaqti St
Northing (m) [1]	6964363
Easting (m) [1]	546646

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.7
Approx. Barrel Slope (%)		2.7%
Approx. Depth of Cover (m)		385
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	100
Other Comments	Vegitation & sedimentation at DS end impacting conveyance	

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964403
Easting (m) [1]	546693

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.98	21.29	20.66	20.94	21.5

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	0	1

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-05
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		12.2
Approx. Barrel Slope (%)		2.5%
Approx. Depth of Cover (m)		280
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	100
	Downstream	150
Other Comments	0	

Culvert Location	
Street	Triganiaq St
Northing (m) [1]	6964488
Easting (m) [1]	546649

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.74	20.97	20.44	20.61	21.07

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

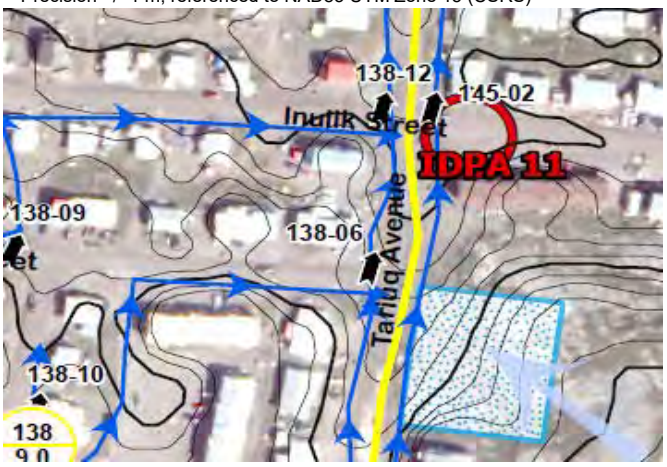
Culvert Information		
Culvert ID		138-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.6
Approx. Barrel Slope (%)		2.6%
Approx. Depth of Cover (m)		460
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	300
	Downstream	200
Other Comments	Reduced capacity due to infilling	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.49	16.89	16.19	16.51	17.16

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Ayaruaq St
Northing (m) [1]	6964477
Easting (m) [1]	546778

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

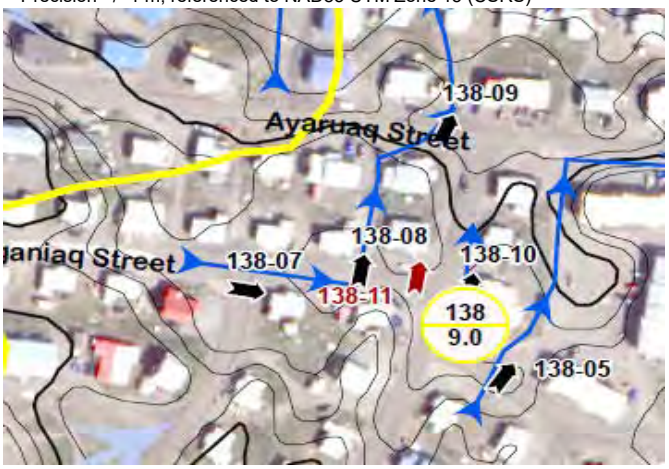
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-07
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		11.9
Approx. Barrel Slope (%)		1.3%
Approx. Depth of Cover (m)		200
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	100
Other Comments	0	

Culvert Location	
Street	Tuugaaq St
Northing (m) [1]	6964571
Easting (m) [1]	546612

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.89	21.12	20.74	20.88	21.2

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	2	1	0

Recommended Action(s):	Monitor Rusting, clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

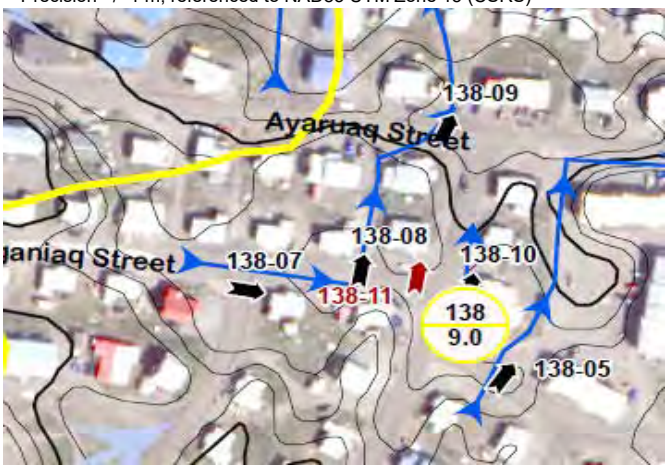
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-08
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.4
Approx. Barrel Slope (%)		2.9%
Approx. Depth of Cover (m)		315
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Backyard drainage	

Culvert Location	
Street	Tiriganiaq St
Northing (m) [1]	6964549
Easting (m) [1]	546643

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.23	20.49	19.9	20.08	20.6

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	1	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

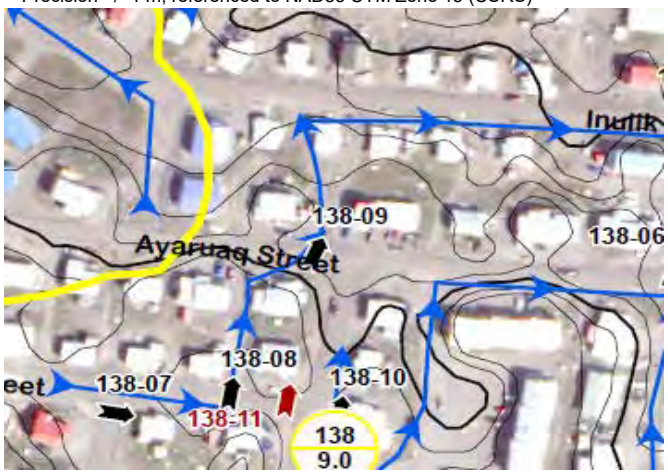
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-09
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.2
Approx. Barrel Slope (%)		4.7%
Approx. Depth of Cover (m)		440
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Debris in DS end. Backyard drainage	

Culvert Location	
Street	Ayaruaq St
Northing (m) [1]	6964565
Easting (m) [1]	546700

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.41	18.78	17.88	18.28	18.97

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

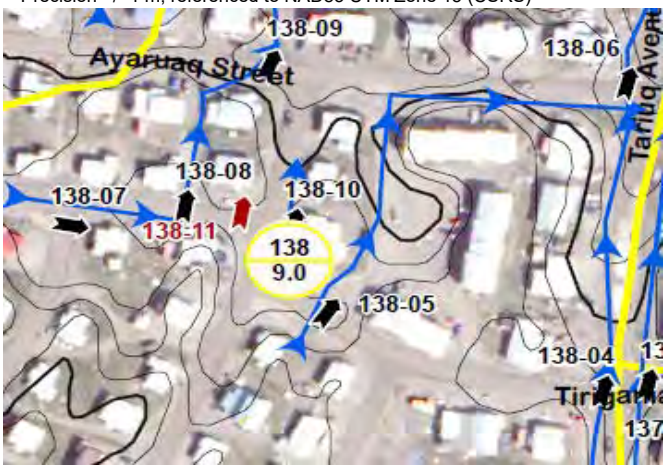
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-10
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		23.5
Approx. Barrel Slope (%)		2.2%
Approx. Depth of Cover (m)		165
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	100
Other Comments	0	

Culvert Location	
Street	Tikaq St
Northing (m) [1]	6964518
Easting (m) [1]	546664

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
20.65	20.81	20.14	20.26	20.7

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

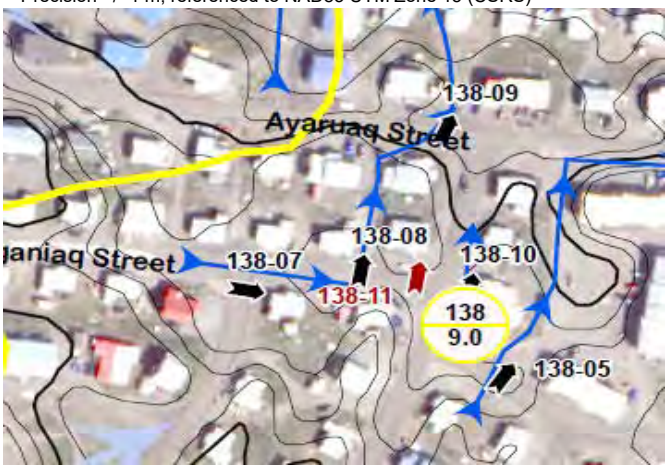
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-11
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		360
End Crushing	Upstream	N/A
	Downstream	Y
Infill Depth (mm)	Upstream	N/A
	Downstream	400
Other Comments	Couldn't locate US end - Likely buried	

Culvert Location	
Street	Tiriganiaq St
Northing (m) [1]	6964534
Easting (m) [1]	546655

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
-	-	20.12	20.31	20.67

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

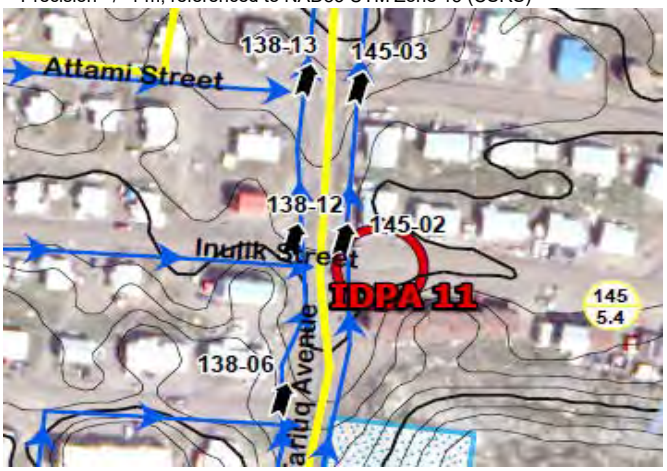
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-12
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.0
Approx. Barrel Slope (%)		3.2%
Approx. Depth of Cover (m)		145
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Partially blocked by debris. DS perched 0.4 m, scoured.	

Culvert Location	
Street	Inulik St
Northing (m) [1]	6964516
Easting (m) [1]	546823

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.99	14.4	13.64	13.99	14.34

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	0	2	0

Recommended Action(s):	vestigate embankment scour/erosion, repair culvert e	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		138-13
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		10.3
Approx. Barrel Slope (%)		4.2%
Approx. Depth of Cover (m)		870
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	Scouring on DS end. Debris	

Culvert Location	
Street	Attami St
Northing (m) [1]	6964554
Easting (m) [1]	546867

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
10.94	10.44	10.51	10.9	11.54

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	1	2	2

Recommended Action(s):	. Investigate embankment scour/erosion, Remediate c	Priority:	High

Upstream View

Upstream Culvert End

NO PHOTO

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-01
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		160
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Driveway culverts	

Culvert Location	
Street	Tariuq Ave
Northing (m) [1]	6964575
Easting (m) [1]	546893

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Planform map view

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.5	9.76	9.26	9.54	9.81

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	2	2

Recommended Action(s):	gate embankment scour/erosion, Remediate channel	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-02
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		12.2
Approx. Barrel Slope (%)		2.5%
Approx. Depth of Cover (m)		140
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Twinned 88/89. 1 set of photos	

Culvert Location	
Street	Tariuq Ave
Northing (m) [1]	6964574
Easting (m) [1]	546894

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.58	9.81	9.28	9.53	9.81

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	2	2

Recommended Action(s):	gate embankment scour/erosion, Remediate channel	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		9.6
Approx. Barrel Slope (%)		4.9%
Approx. Depth of Cover (m)		0
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Good condition	

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964600
Easting (m) [1]	546912

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.82	9.17	8.35	8.79	8.94

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

NO PHOTO

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-04
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		240
Marker Post Present		N
Barrel Length (m)		12.2
Approx. Barrel Slope (%)		2.1%
Approx. Depth of Cover (m)		260
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	150
Other Comments	0	

Culvert Location	
Street	Iglu St
Northing (m) [1]	6964650
Easting (m) [1]	546858

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.07	9.22	8.82	9.08	9.41

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	2	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-05
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		16.8
Approx. Barrel Slope (%)		2.6%
Approx. Depth of Cover (m)		605
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	50
Other Comments	0	

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964603
Easting (m) [1]	546927

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.28	8.76	7.84	8.31	9.14

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	1	1	1	1

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		139-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		17.3
Approx. Barrel Slope (%)		2.2%
Approx. Depth of Cover (m)		490
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Backyard drainage	

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964619
Easting (m) [1]	546922

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
7.68	8.23	7.3	7.85	8.53

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		142-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		2800
Marker Post Present		N
Barrel Length (m)		9.1
Approx. Barrel Slope (%)		0.9%
Approx. Depth of Cover (m)		580
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	20
Other Comments	0	

Culvert Location	
Street	Unnamed Road
Northing (m) [1]	6965395
Easting (m) [1]	547146

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
1.59	2.82	1.51	2.5	3.24

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	0	0

Recommended Action(s):	Clear blockage	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		145-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.0
Approx. Barrel Slope (%)		5.1%
Approx. Depth of Cover (m)		370
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Partially blocked by debris. DS slightly perched	

Culvert Location	
Street	Inulik St
Northing (m) [1]	6964504
Easting (m) [1]	546834

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Planform map view

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
13.87	14.06	13.31	13.7	14.25

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	4	0	2	1

Recommended Action(s):	Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

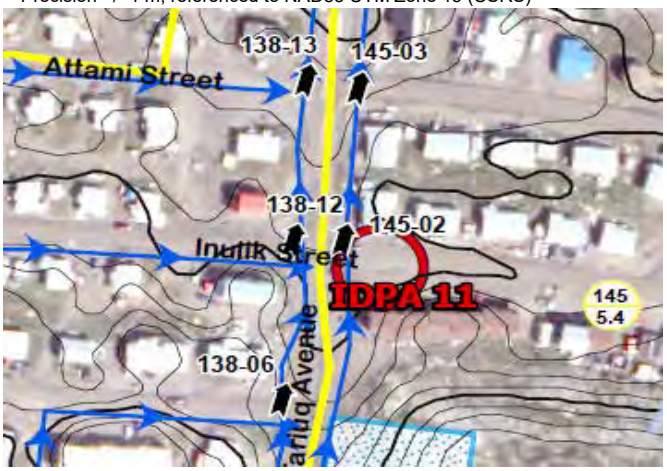
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		145-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.3
Approx. Barrel Slope (%)		4.0%
Approx. Depth of Cover (m)		380
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Slight DS perch, scouring at DS end. Debris	

Culvert Location	
Street	Attami St
Northing (m) [1]	6964540
Easting (m) [1]	546877

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
11.09	11.34	10.64	11.06	11.58

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	0	0	1

Recommended Action(s):	Repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		145-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		8.1
Approx. Barrel Slope (%)		-0.2%
Approx. Depth of Cover (m)		155
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	100
Other Comments	DS end very torn up. 2 pieces	

Culvert Location	
Street	Tariuq Ave
Northing (m) [1]	6964574
Easting (m) [1]	546916

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.97	9.49	8.99	9.36	9.58

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		145-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		17.8
Approx. Barrel Slope (%)		0.7%
Approx. Depth of Cover (m)		560
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	50
Other Comments	Debris pileup US end. DS end perched, scouring	

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964591
Easting (m) [1]	546938

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.31	8.88	8.18	8.58	9.29

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	2	1

Recommended Action(s):	Clear blockage. Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		146-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.3
Approx. Barrel Slope (%)		2.9%
Approx. Depth of Cover (m)		455
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	250
Other Comments	Takes drainage which cuts across road entrance from upslope ditch	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
9.31	9.84	8.96	9.37	10.06

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Pisugvik St
Northing (m) [1]	6964593
Easting (m) [1]	547043

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	3	2	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

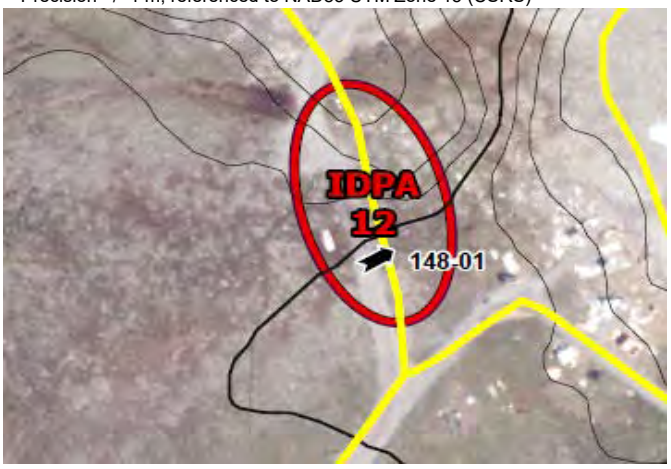
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		148-01
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		200
Marker Post Present		N
Barrel Length (m)		7.0
Approx. Barrel Slope (%)		1.6%
Approx. Depth of Cover (m)		180
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	100
	Downstream	100
Other Comments	Not working well. Road wet	

Culvert Location	
Street	Inulik St
Northing (m) [1]	6964107
Easting (m) [1]	547519

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
2.34	2.58	2.23	2.42	2.68

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	0	2	1	1

Recommended Action(s):	Monitor Rusting, clean blockage and sediment	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		151-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		1.7%
Approx. Depth of Cover (m)		720
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Makpah St
Northing (m) [1]	6963575
Easting (m) [1]	546869

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
30.26	30.87	30.06	30.65	31.48

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		151-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.1
Approx. Barrel Slope (%)		1.9%
Approx. Depth of Cover (m)		295
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Makpah St
Northing (m) [1]	6963546
Easting (m) [1]	546889

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
29.24	29.84	29.01	29.59	30.01

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

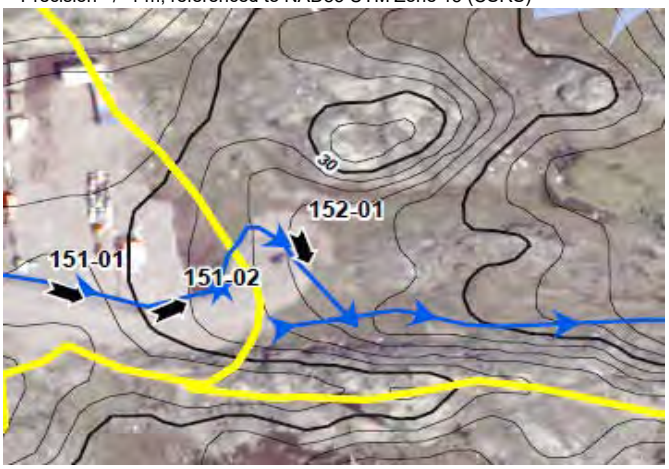
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		152-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		3.4%
Approx. Depth of Cover (m)		480
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Makpah St
Northing (m) [1]	6963531
Easting (m) [1]	546937

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
27.42	27.98	27.01	27.62	28.28

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

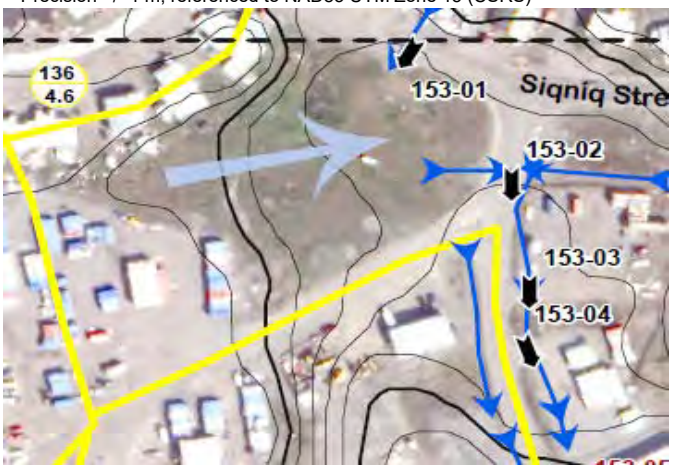
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		153-01
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		120
Marker Post Present		N
Barrel Length (m)		-
Approx. Barrel Slope (%)		N/A
Approx. Depth of Cover (m)		50
End Crushing	Upstream	Y
	Downstream	-
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	DS end buried	

Culvert Location	
Street	Siqiniq St
Northing (m) [1]	6964204
Easting (m) [1]	546491

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
23.07	23.16	-	-	23.21

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	0	1	1

Recommended Action(s):	Repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		153-02
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.6
Approx. Barrel Slope (%)		1.3%
Approx. Depth of Cover (m)		340
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	50
	Downstream	100
Other Comments	0	

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964146
Easting (m) [1]	546481

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22	22.26	21.85	22.1	22.52

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	1	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		153-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		9.2
Approx. Barrel Slope (%)		0.8%
Approx. Depth of Cover (m)		230
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	50
	Downstream	100
Other Comments	0	

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964114
Easting (m) [1]	546457

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.38	22	21.31	21.86	22.16

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	1	0	0

Recommended Action(s):	Clean blockage and sediment	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		153-04
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		9.1
Approx. Barrel Slope (%)		2.6%
Approx. Depth of Cover (m)		220
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964099
Easting (m) [1]	546441

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
21.29	21.89	21.05	21.65	21.99

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

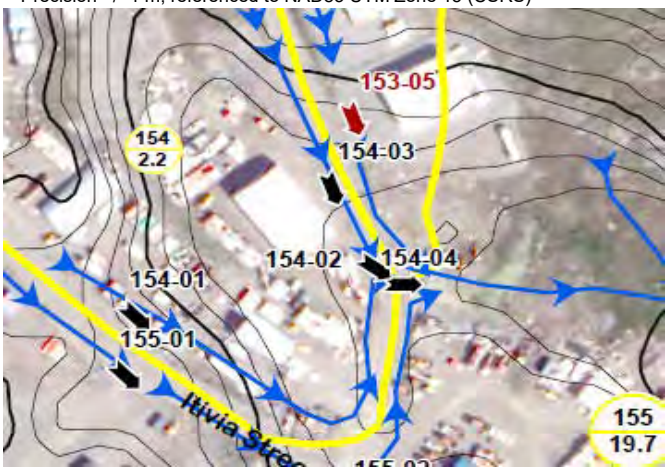
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		153-05
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		18.2
Approx. Barrel Slope (%)		4.6%
Approx. Depth of Cover (m)		475
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964045
Easting (m) [1]	546415

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.76	19.35	17.93	18.38	19.34

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	0	0	0

Recommended Action(s):	Repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

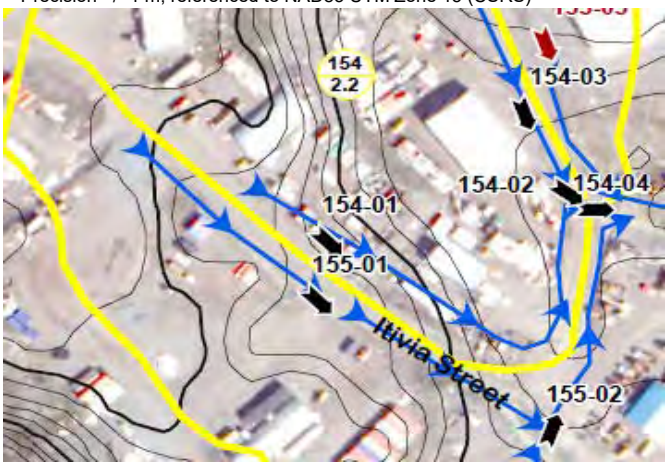
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		154-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		350
Marker Post Present		N
Barrel Length (m)		6.1
Approx. Barrel Slope (%)		1.3%
Approx. Depth of Cover (m)		130
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	150
	Downstream	150
Other Comments	Severly crushed. Two separate barrels	

Culvert Location	
Street	Itivia St
Northing (m) [1]	6964044
Easting (m) [1]	546313

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.1	22.28	22.02	22.3	22.42

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	3	2	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

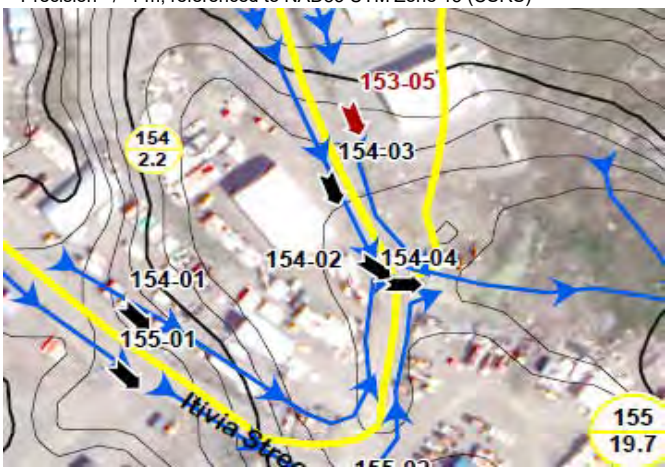
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		154-02
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		6.0
Approx. Barrel Slope (%)		0.3%
Approx. Depth of Cover (m)		285
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Flow overtop from property	

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964001
Easting (m) [1]	546382

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.24	16.44	16.22	16.57	16.79

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	0	0	1

Recommended Action(s):	Repair culvert end	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

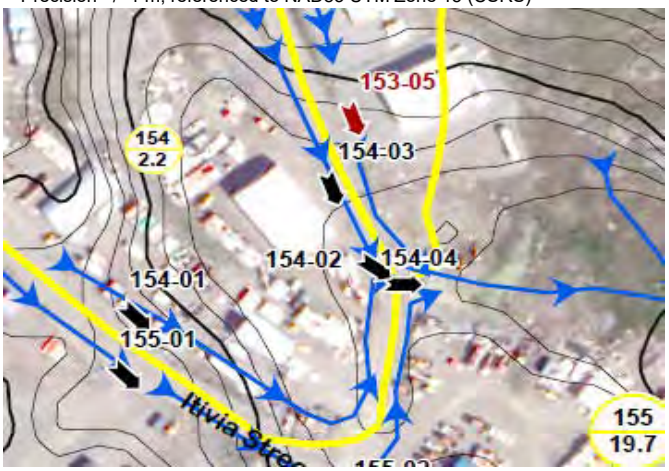
Culvert Information		
Culvert ID		154-03
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		450/300
Marker Post Present		N
Barrel Length (m)		36.6
Approx. Barrel Slope (%)		2.7%
Approx. Depth of Cover (m)		675
End Crushing	Upstream	Y
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	100
Other Comments	450 US end, 300 DS end	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
17.44	17.78	16.47	16.75	17.94

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6964031
Easting (m) [1]	546392

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	2	2	1	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

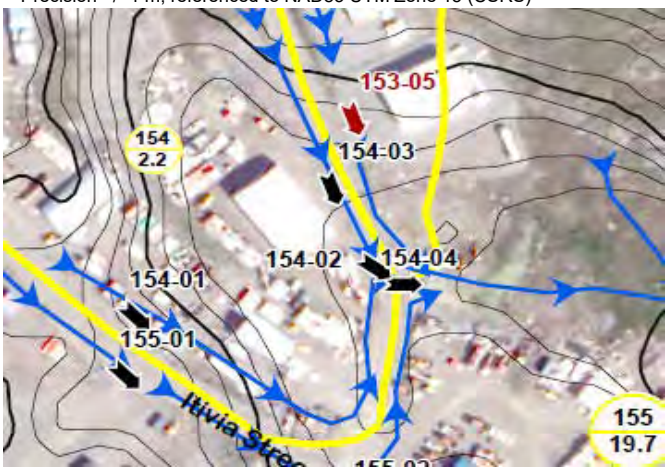
Culvert Information		
Culvert ID		154-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		11.1
Approx. Barrel Slope (%)		1.7%
Approx. Depth of Cover (m)		530
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	Accepts ditch flow from 2 directions, cross culvert, conveys under road	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
16.15	16.39	15.96	16.41	16.93

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	TikTaq St
Northing (m) [1]	6963990
Easting (m) [1]	546384

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	4	1	0	0

Recommended Action(s):	Replace culvert	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

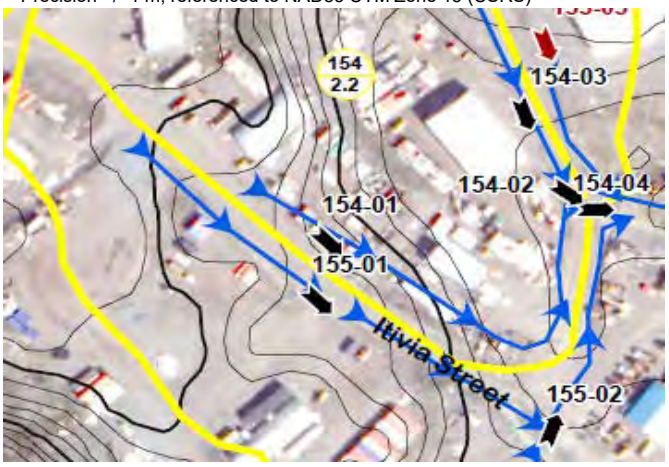
Culvert Information		
Culvert ID		155-01
Type		Entrance
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		17.9
Approx. Barrel Slope (%)		2.0%
Approx. Depth of Cover (m)		285
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	100
	Downstream	50
Other Comments	0	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
22.04	22.43	21.69	22.2	22.6

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Itivia St
Northing (m) [1]	6964031
Easting (m) [1]	546296

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	3	1	0	1

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

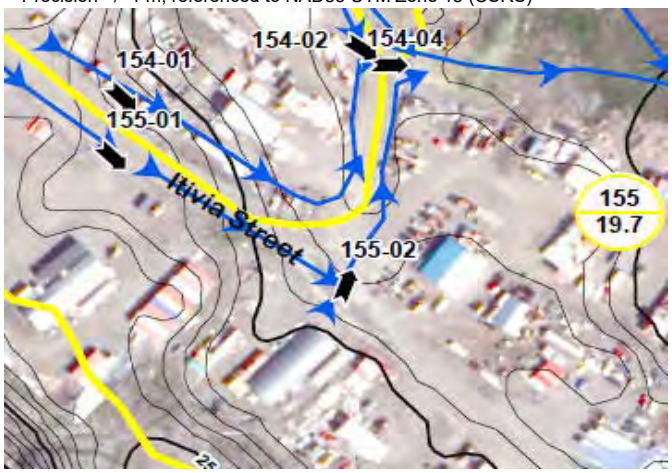
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-02
Type		Cross
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		15.5
Approx. Barrel Slope (%)		4.0%
Approx. Depth of Cover (m)		320
End Crushing	Upstream	N
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Perched DS end	

Culvert Location	
Street	Itivia St
Northing (m) [1]	6963943
Easting (m) [1]	546316

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
18.21	18.44	17.59	17.82	18.45

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
2	1	0	2	1

Recommended Action(s):	Monitor Rusting, Investigate embankment scour/erosio	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

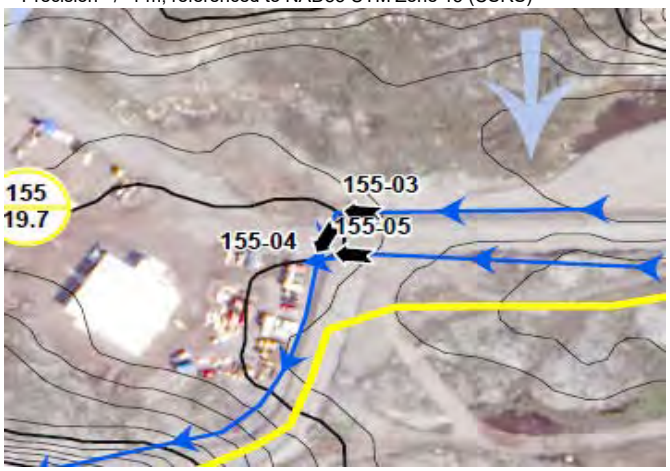
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-03
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		12.0
Approx. Barrel Slope (%)		0.6%
Approx. Depth of Cover (m)		525
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Makpah St
Northing (m) [1]	6963715
Easting (m) [1]	546720

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
30.67	31.31	30.6	31.24	31.8

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

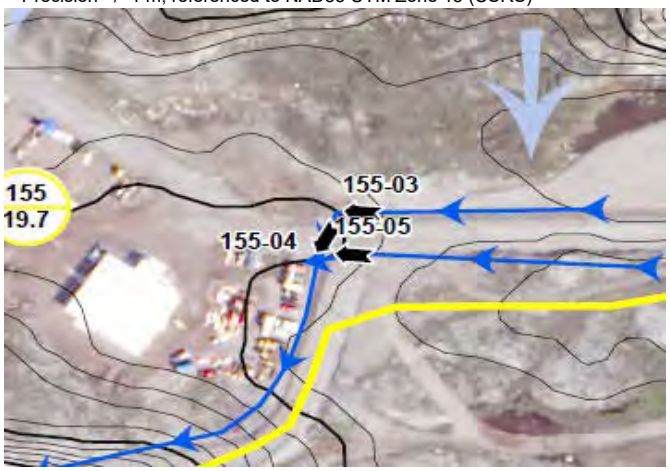
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-04
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		14.3
Approx. Barrel Slope (%)		0.4%
Approx. Depth of Cover (m)		665
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Makpah St
Northing (m) [1]	6963714
Easting (m) [1]	546713

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
30.59	31.2	30.53	31.13	31.83

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

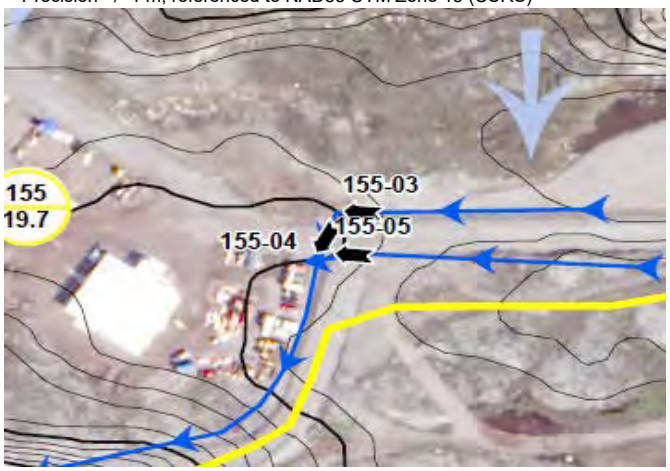
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-05
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		14.6
Approx. Barrel Slope (%)		2.4%
Approx. Depth of Cover (m)		620
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	0	

Culvert Location	
Street	Amarok St
Northing (m) [1]	6963707
Easting (m) [1]	546711

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
30.96	31.54	30.61	31.18	31.98

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-06
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		500
Marker Post Present		N
Barrel Length (m)		13.1
Approx. Barrel Slope (%)		1.1%
Approx. Depth of Cover (m)		320
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Debris blocking US end	

Culvert Location	
Street	Itivia St
Northing (m) [1]	6963723
Easting (m) [1]	546374

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
12.66	13.07	12.52	12.95	13.33

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	0	0	1	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

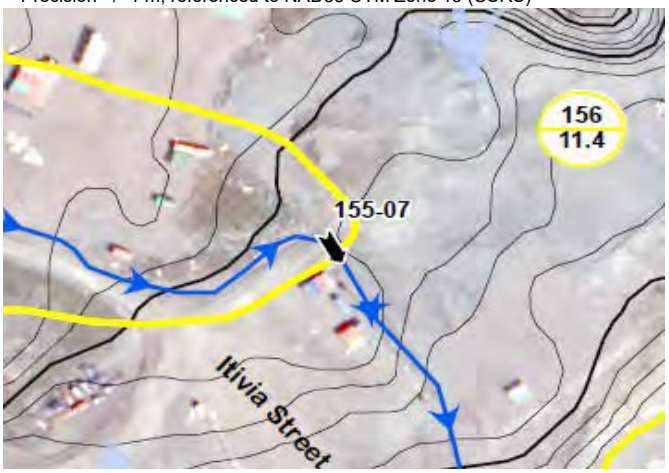
Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		155-07
Type		Entrance
Shape		Circular
Material		PVC
Diameter or Dimensions (mm)		250
Marker Post Present		N
Barrel Length (m)		15.1
Approx. Barrel Slope (%)		4.2%
Approx. Depth of Cover (m)		455
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Scouring on DS end	

Culvert Location	
Street	Itivia St
Northing (m) [1]	6963609
Easting (m) [1]	546459

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
8.9	9.13	8.27	8.52	9.28

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	2	2

Recommended Action(s):	gate embankment scour/erosion, Remediate channel	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

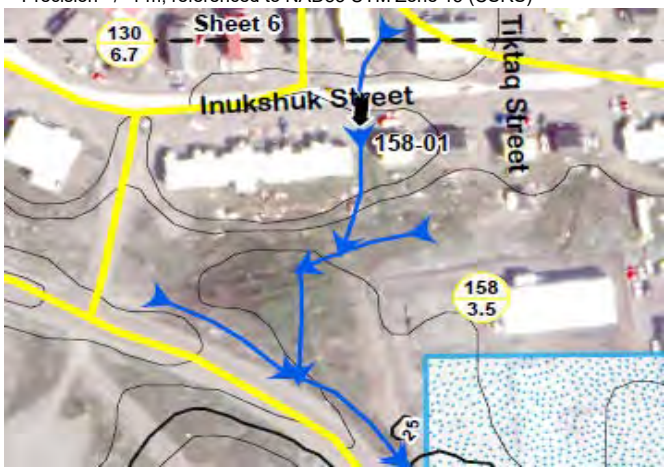
Culvert Information		
Culvert ID		158-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		400
Marker Post Present		N
Barrel Length (m)		11.1
Approx. Barrel Slope (%)		1.2%
Approx. Depth of Cover (m)		465
End Crushing	Upstream	Y
	Downstream	Y
Infill Depth (mm)	Upstream	0
	Downstream	150
Other Comments	cross culvert connecting 2 swales. Eventually discharges to the humanmade right angle swale	

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
27.26	27.63	27.13	27.36	27.96

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Location	
Street	Inukshuk St
Northing (m) [1]	6964372
Easting (m) [1]	546294

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)



Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
1	2	2	0	0

Recommended Action(s):	Clear blockage, repair culvert end	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		158-02
Type		Cross
Shape		Circular
Material		SWSP
Diameter or Dimensions (mm)		300
Marker Post Present		N
Barrel Length (m)		18.3
Approx. Barrel Slope (%)		2.4%
Approx. Depth of Cover (m)		350
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Perched outlet. Scouring	

Culvert Location	
Street	Itivia St
Northing (m) [1]	6964195
Easting (m) [1]	546192

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
23.15	23.45	22.71	23.05	23.6

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	2	1

Recommended Action(s):	Investigate embankment scour/erosion	Priority:	High

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

Culvert Information		
Culvert ID		159-01
Type		Cross
Shape		Circular
Material		CSP
Diameter or Dimensions (mm)		600
Marker Post Present		N
Barrel Length (m)		24.1
Approx. Barrel Slope (%)		2.1%
Approx. Depth of Cover (m)		1165
End Crushing	Upstream	N
	Downstream	N
Infill Depth (mm)	Upstream	0
	Downstream	0
Other Comments	Perched US end	

Culvert Location	
Street	Unataqtutsait St S
Northing (m) [1]	6964494
Easting (m) [1]	546116

[1] Precision +/- 1 m; referenced to NAD83 UTM Zone 15 (CSRS)

Culvert Elevations (masl) [2]				
Upstream		Downstream		Road Crown
Invert	Obvert	Invert	Obvert	
26.26	26.9	25.75	26.45	27.84

[2] Precision +/- 0.03 m; referenced to CLSR (1996) CCM 4, 9, 10, 11, 18

Culvert Condition Ratings (MTO 2013)				
Barrel Material (0-4)	Shape (0-4)	Capacity (0-2)	Erosion and Scour (0-2)	US/DS Channel (0-2)
0	0	0	0	0

Recommended Action(s):	No Action	Priority:	Low

Upstream View

Upstream Culvert End

Downstream View

Downstream Culvert End

NOTE: Information presented on this sheet is representative of conditions in September 2021. Current conditions may vary from what is provided on this sheet.

SANDBAG DIKE CONSTRUCTION

***Disclaimer**: This document provides information that may be insufficient in addressing all your concerns about sandbag dike construction. We suggest you contact your local municipal authorities for additional information and guidance.*

SAFETY TIPS FOR LEADERS AND VOLUNTEER WORKERS

- Individuals with a medical condition that would make it dangerous for him/her to participate should avoid taking part.
- Register all persons involved and deliver the registration sheet to the community Emergency Coordinator.
- Wear protective gear such as steel toed boots, hat, safety glasses, gloves, sunscreen, etc.
- Ensure there are sufficient potable water and bathroom facilities. Take regular water breaks.
- Be attentive of large equipment moving in the area.
- Be aware of floodwater dangers:
  - Contamination
  - Varying water flow and strong undercurrents
  - Floating debris
- Adhere to proper sandbag handling technique:
  - Do not bend more than 20 degrees in any direction while handling sandbags.

  - Keep heavy weights below shoulder height, above knees and close to the body. Limit reaching with arms when passing the sandbags.

  - Pivot feet and do not twist through the back while handling sandbags.
  - Do not throw sandbags.

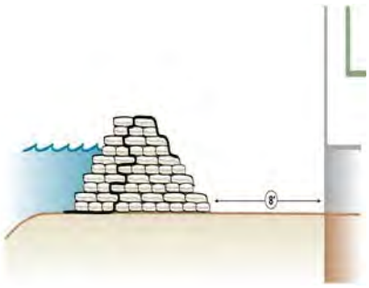
FILLING SANDBAGS

- Fill sandbag to half its capacity (no more than 40 lbs) with sand, clay or silt.
- Fold or tie the flap (tying or sewing is not necessary).
- Do not drag the bags (this could cause lower back injury and bag to weaken).
- When forming a line to pass sandbags, face each other and stand no more than one to two feet apart. If there are not enough people to form a continuous line, use a wheelbarrow to move sandbags.

BUILDING A SANDBAG DIKE

- Location:
  - Base area of dike should be clear of snow and ice.

- To avoid flood water moving under a dike, do not build a dike on porous land or on a septic field.
- The dike should be at least eight feet from building foundation. This prevents foundation damage and allows room for people and equipment to move. As well, this space allows more dike base width to be constructed should additional dike height be required.



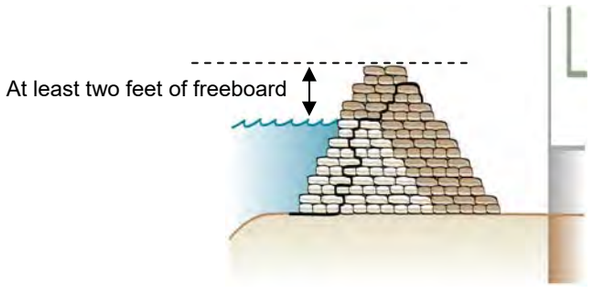
- To create a more secure dike, when possible, create a trench in the soil that is one sandbag deep by two sandbags wide.

- Construction:
  - Dike size:
    - Height: Sandbag dikes require at least two feet of freeboard. Freeboard is the area of the dike between the highest floodwater level and the top of the dike:

predicted floodwater rise above ground level + two feet of freeboard

= required dike height

For example, if floodwater is predicted to rise four feet above ground level, the required dike height is at least six feet. (4' + 2' of freeboard = 6' high dike)

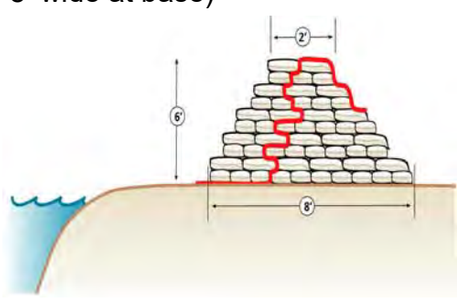


Sandbag dikes will compact when they get wet, which can reduce the available freeboard. The amount of compaction due to wetting increases with the size of the dike. Add at least five per cent to the required height of the dike to account for compaction. For example, add three to four inches for a six foot dike to account for compaction due to wetting.

- Width: The base of a sandbag dike is two feet wider than it's required height:

height* + two feet = *width at base

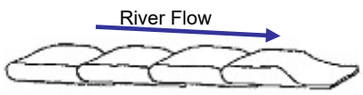
For example, a dike with a required height of six feet would have to be eight feet at its base. (6' + 2' = 8' wide at base)



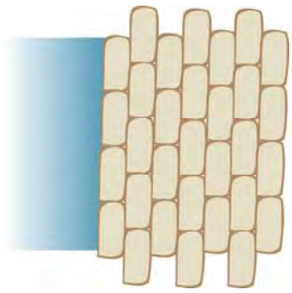
- Sandbag dikes must be at least two feet wide across the top of dike.
- Due to the high pressure water can exert, consult your local authority for additional advice for dikes higher than six feet.

- Polyethylene sheets
  - Proper use and placement of polyethylene sheets is important to reduce the rate of water seeping through the dike. Use six mil polyethylene in three meter wide rolls on the river side of the dike. Have the polyethylene sheet protrude over the ground on the river side of the dike. Be careful not to puncture the polyethylene sheet. (The polyethylene sheet will be weaved between the courses of sandbags.)

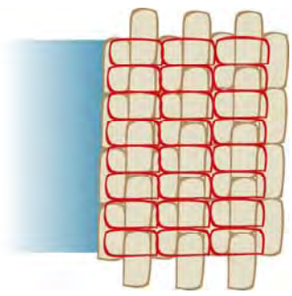
- First course/bottom layer:
  - Lay first course/bottom layer of bags parallel to river/water with the closed side of bag against river flow direction.
  - The filled portion of the second bag sits over the empty portion of the previously placed bag. This is known as lapping.



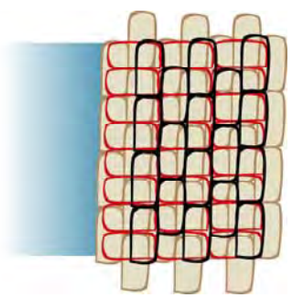
  - Drop the bags into place and tamp bags with feet to lodge them into place.
  - Offset the bags from the previous row in the same course to form a brick pattern.



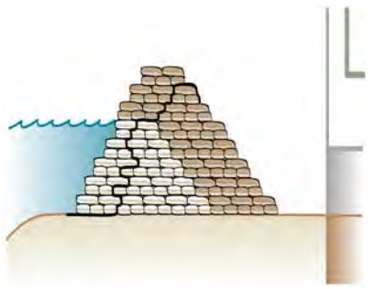
- Second and remaining courses:
  - Rotate bags 90 degrees when laying second course of sandbags. Keep seal side of bag towards water/river. Ensure sandbags are well packed against each other and firmly in place.



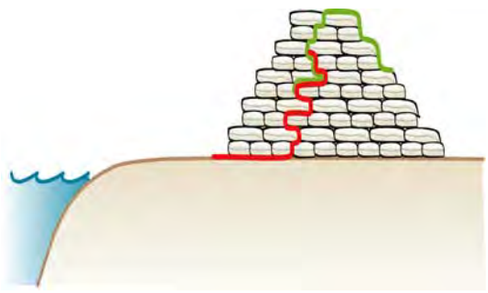
  - Change direction of bag from parallel to perpendicular to the river for each course of bags.
  - Every second course of sandbags should be set back a quarter (1/4) of a sandbag width, both on the river side and the land side of the dike, producing a step-like appearance.



- Weave the polyethylene sheet between the courses of sandbags as to have at least two layers of sandbags protecting the polyethylene sheet from debris punctures. Maximum depth of the polyethylene sheet should be three sandbags or a quarter (1/4) of the cross section of the dike, whichever is less.



- If more height of polyethylene sheet is required, make polyethylene sheets overlap at least two feet.



o No matter how well you build a dike, extreme water pressure may cause water to seep through the dike or bubble up through the ground. It is advisable to have pumps with sufficient fuel and oil readily available to last the duration of the flood event and an escape plan.

SANDBAG DIKE REMOVAL

- Sandbags should be removed with the same precautions as they were laid.
- Sand from sandbags should not be used for children's sand boxes or play areas, but could be used for landscaping purposes.

For further information or questions contact:

YOUR MUNICIPAL OFFICE OR **EMERGENCY MEASURES ORGANIZATION (EMO)**

1525 – 405 Broadway
Winnipeg, Manitoba R3C 3L6
Phone: 204-945-3050 Fax: 204-945-4929
Toll free: 1-888-267-8298
Website: www.manitobaemo.ca

From: Muirhead, Jeff
To: Low, Scott; Patch, William; lands@rankininlet.ca; admin@rankininlet.ca
Cc: Brown, Steve (Waterloo); Piraux, Olivier
Subject: Rankin Inlet Unnamed Lake - options for discussion
Date: Tuesday, July 13, 2021 11:58:00 AM

Hello Scott and William,

This is following up on our earlier discussion about options for Unnamed Lake in Rankin Inlet. I've had a look through your videos as well – thank you very much for taking the time to acquire and send those, they are very helpful! Both in giving context for the below, and for the overall drainage scope. I will be going over some of the main take-aways with Steve Brown (senior water resources engineer, cc'ed) in advance of our field work.

Below is a quick summary of our understanding of the unnamed lake issue:

- There is currently a water level concern in unnamed lake, as seasonal high water levels approach, and sometimes spill over, Eksusik Street.
- Stantec is also concerned that the Eksusik Street is currently informally functioning as a berm for the lake - whether it was designed for this is unknown. Risk of gradual road degradation due to seepage, road overtopping, and "berm breaching" exists which would result in a loss of significant parts of the lake in such an event.
- A snow fence is proposed at the northwest end of the lake, to capture snow prior to entry into the community
- Our preliminary calculations using the conceptual snow drift Snow-Water-Equivalent (SWE) schematic provided by SLR indicates that the snow fence could raise the WL by up to 0.37 m
- SLR has indicated that the snow fence can't be moved to another location without losing the intended function of the snow fence

The below table summarizes four high level options we discussed on our previous call. All have benefits and challenges, and a hybrid solution of one or more might be the right way to go. Survey of Eksusik Street, the outlet culverts and channels, and potentially the bathymetry of the lake are likely required to better inform option selection. With the exception of the bathymetric survey, Stantec can do these tasks in the drainage/geotech field visit that is tentatively planned for late summer/early fall.

Perhaps after everyone has a chance to review the below and discuss internally, we can have another group call to discuss a path forward?

Option	Details	Benefits	Challenges
Option 1: Lower the permanent pool of the lake	Lower the culvert invert of one of the three outlets of the lake, allowing the lake to draw down lower and therefore increasing how much water it can hold before spilling over Eksusik Street	Increases storage capacity of the lake Provides an opportunity for more intentional, formalized drainage plan for the lake, through a designated flow path May be able to supplement drinking water source if send water to Nipissak Lake Reduces the risk associated with the Eksusik Street informally functioning as a berm (lower water levels, less seepage) Involves work at a single preferred location based on cost and environmental impacts May be able to improve culvert/channel design to reduce risk of outlet icing/blockage	Per the area biologist, the lake is fish bearing. As littoral habitat would be lost by lowering of the lake, this option will require DFO permitting or, at minimum, review. Potential to offset in a "like for like" manner by creating littoral habitat - perhaps on south side of lake? The catchment to unnamed lake includes a portion of the airport, which in turn has risk of certain contaminants/spills which could impact the drinking water source if water is sent to Nipissak Lake. It is possible to control/divert the airport part of the catchment to mitigate this risk. Changes to flow and water level regimes - need to evaluate impacts of increases/reductions in receiving waterbodies (erosion threshold in channels, habitat impacts in fish bearing watercourses, water balances)
Option 2: Increase outflow capacity at lower water stages of the lake	Enlarge or add culverts or channels at lower elevations at the lake. More water can then be discharged at a lower water level, potentially reducing how high the water gets in the lake	Does not lower permanent pool, resulting in fewer enviromental/aquatic impacts Reduces the risk associated with the Eksusik Street informally functioning as a berm (lower seasonal water levels, less seepage) May be able to improve culvert/channel design to reduce risk of outlet icing/blockage	May require more involved construction works at multiple locations to achieve the desired effect Changes to flow and water level regimes - need to evaluate impacts of increases/reductions in receiving waterbodies (erosion threshold in channels, habitat impacts in fish bearing watercourses, water balances) DFO consultation, review, or permitting may be required, depending on changes to water level and flow regimes The catchment to unnamed lake includes a portion of the airport, which in turn has risk of certain contaminants/spills which could impact the drinking water source if water is sent to Nipissak Lake. It is possible to control/divert the airport part of the catchment to mitigate this risk.
Option 3: Seasonal Temporary Pumping	Pump from Unnamed Lake on a temporary, seasonal basis to reduce risk of road overtopping	Adaptable solution - temporary, seasonal approach that can be implemented in advance of, and during, high water conditions on a case-by-case basis Lower impact to lake and receiving waterbodies; regulatory considerations likely less	Recurrent costs associated with pumping operations Not a permanent solution Scale of pumping operation required is unknown; could be large or small depending on pump availability, inflows to lake during pumping, desired drawdown rate, etc.
Option 4: Raise the road	Raise Eksusik Street as to keep water from spilling over the road.	Water level and flow regime changes are likely less than to Option 1 and 2 Fewer DFO regulatory considerations	~600m of road works, raised by the anticipated amount of lake rise (est. 0.37m) + an appropriate freeboard for a road of this type. Road would need to be designed as a berm/levee capable of holding lake water. Likely expensive. Raising of road means grading out of embankments, which may require improvements/alterations to the outlet culverts and channels (as would be done in Option 1 and 2)

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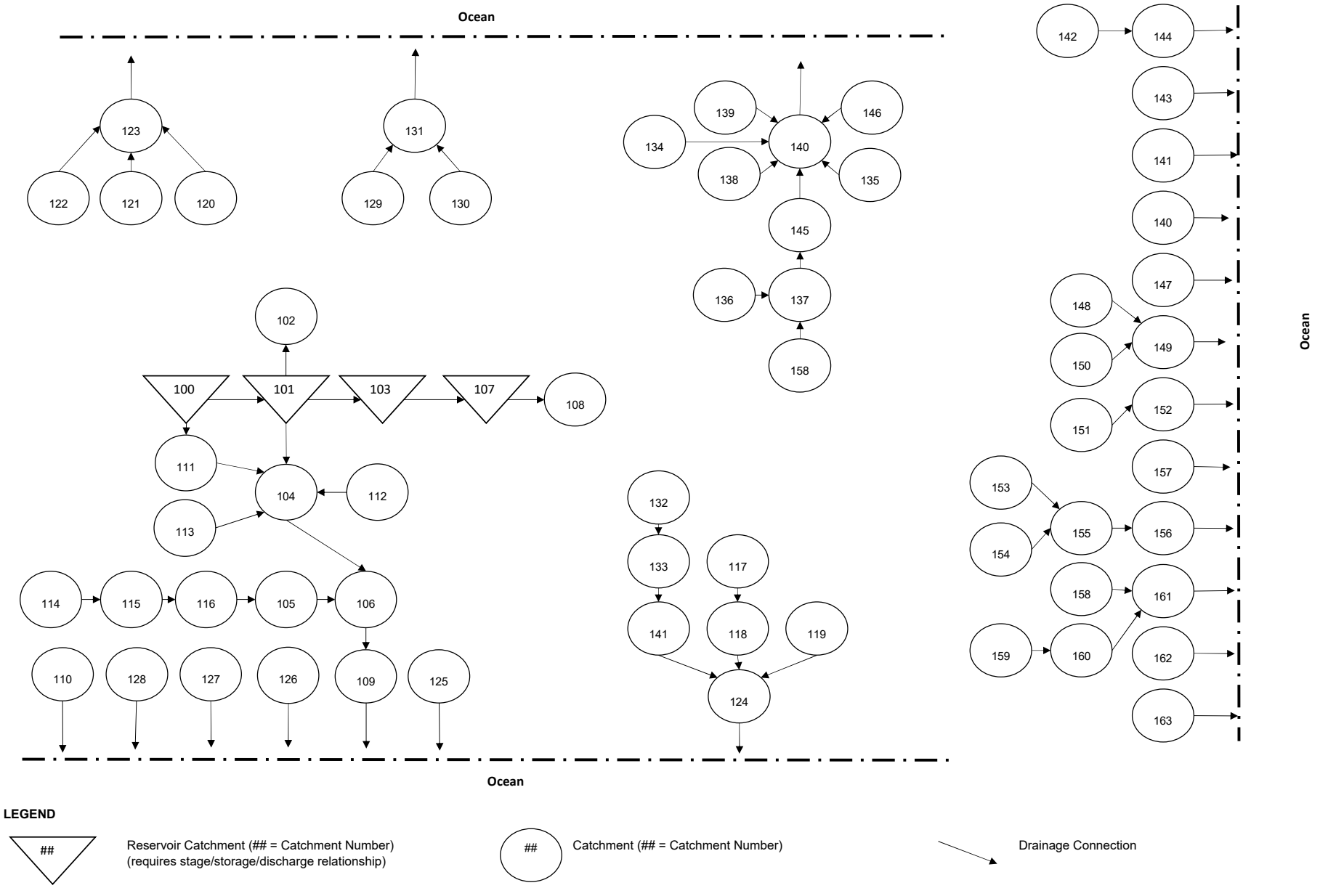

LEGEND

Reservoir Catchment (## = Catchment Number)
(requires stage/storage/discharge relationship)

Catchment (## = Catchment Number)

Drainage Connection

APPENDIX G Borehole Records

Stantec

BOREHOLE REPORT

Project:	Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut	Location :	Geo. System: UTM Zone: 15
Project No.:	144903107	X :	546 083
Client:	The Municipality of Rankin Inlet	Y :	6 965 615
Site:	Rankin Inlet, Nunavut	Type of borehole :	Diamond Core
Figure:		Equipment :	STIHL FB200
		Sampling type :	
		Corer :	HX

Borehole :	BH21-01
Page :	1 of 1
Start date :	2021-09-13
Inspector :	M. Verpaelst, M. Sc.
Depth :	2,13 m
Elevation UTM :	8,90 m

SAMPLE TYPE

SS	Split spoon
CS	Continuous sampling
DC	Diamond rock core
AS	Auger
TW	Thin wall sampler
ST	Shelby tube
MA	Manual sample

QUALITATIVE TERMINOLOGY

Clay	< 0.002 mm
Silt	0.002 - 0.08 mm
Sand	0.08 - 5 mm
Gravel	5 - 80 mm
Cobbles	80 - 200 mm
Boulders	> 200 mm

QUANTITATIVE TERMINOLOGY

Traces	< 10 %
Some	10 - 20 %
Adjective (...y)	20 - 35 %
and (ex: and gravel)	> 35 %
Main word	Dominant fraction

SYMBOLS

N	Standard penetration value (ASTM D 1586)
Nc	Dynamic cone penetration value (BNQ 2501-145)
RQD	Rock Quality Designation (%)

ACTIVE LAYER DEPTH

	Date	Depth
Reading 1	2021-09-13	1,20 m
Reading 2		m

Remarks :

SAMPLE STATE

- Remoulded (unfrozen sample)
- Intact (thin wall sampler)
- Lost
- Core (frozen core sample)

MECHANIC CHARACTERISTICS OF SOILS

COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)
Very loose	0 - 4	Very soft	< 12
Loose	4 - 10	Soft	12 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very dense	> 50	Very stiff	100 - 200
		Hard	> 200

ROCK QUALITY DESIGNATION

QUALIFICATIVE	RQD
Very poor	< 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

JOINTS SPACING

Very tight	< 20 mm
Tight	20 - 60 mm
Close	60 - 200 mm
Moderately spaced	200 - 600 mm
Spaced	600 - 2000 mm
Very spaced	2000 - 6000 mm
Wide	> 6000 mm

STRATIGRAPHY

DEPTH (m)	DEPTH (ft)	ELEVATION (m) / DEPTH (m)	DESCRIPTION OF SOILS AND ROCK
		8,90	
		0,00	Thin cover of mosses and sod over black TOPSOIL.
		8,80	
		0,10	Brown Silty and Gravelly SAND, some gravel, moist to saturated.
			- Presence of cobbles.
1			
		7,70	
		1,20	SILT and SAND, trace of gravel.
			- Limited sample recovery below 1.3 m. (May have melted from friction).
	5		
2			
		6,77	
		2,13	END OF BOREHOLE

SAMPLES

SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Grain size analysis (BNQ 2501-025)
		MA-01					
		DC-02					
		DC-03					G : 2,1 % S : 39,5 % F : 58,4 %
		DC-04					
		DC-05					

Active layer depth / Groundwater level: 0,30 m; 1,20 m

CRYOSTRUCTURES

Nf:	Poorly-bonded
Nbn:	Well-bonded no excess ice
Nbe:	Well-bonded excess ice
Vx:	Individual ice
Vc:	Ice coating
Vr:	Random ice
Vs:	Stratified ice
I+S:	Ice with soil inclusions
Ice:	Soil < 25 mm thick

0,30 m: Unfrozen

1,20 m: Nbe

TESTS

VIC: Volumetric Ice Content (%)
w: Water Content (%)
S: Salinity (ppt)

W: 29.4

20 40 60 80

REMARKS

General remarks:

Verified by : M. Verpaelst, M. Sc.

Date : 2021-12-01

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Stantec

BOREHOLE REPORT

Project:	**Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut**	Location :	**Geo. System: UTM Zone: 15**
Project No.:	**144903107**	X :	**546 086**
Client:	**The Municipality of Rankin Inlet**	Y :	**6 965 611**
Site:	**Rankin Inlet, Nunavut**	Type of borehole :	**Diamond Core**
Figure:		Equipment :	**STIHL FB200**
		Sampling type :	
		Corer :	**HX**

Borehole :	**BH21-02**
Page :	**1 of 1**
Start date :	**2021-09-13**
Inspector :	**M. Verpaelst, M. Sc.**
Depth :	**1,50 m**
Elevation UTM :	**8,90 m**

SAMPLE TYPE

SS	Split spoon
CS	Continuous sampling
DC	Diamond rock core
AS	Auger
TW	Thin wall sampler
ST	Shelby tube
MA	Manual sample

QUALITATIVE TERMINOLOGY

Clay	< 0.002 mm
Silt	0.002 - 0.08 mm
Sand	0.08 - 5 mm
Gravel	5 - 80 mm
Cobbles	80 - 200 mm
Boulders	> 200 mm

QUANTITATIVE TERMINOLOGY

Traces	< 10 %
Some	10 - 20 %
Adjective (...y)	20 - 35 %
and (ex: and gravel)	> 35 %
Main word	Dominant fraction

SYMBOLS

N	Standard penetration value (ASTM D 1586)
Nc	Dynamic cone penetration value (BNQ 2501-145)
RQD	Rock Quality Designation (%)

ACTIVE LAYER DEPTH

	Date	Depth
Reading 1	2021-09-13	1,20 m
Reading 2		m

Remarks :

SAMPLE STATE

- Remoulded (unfrozen sample)
- Intact (thin wall sampler)
- Lost
- Core (frozen core sample)

MECHANIC CHARACTERISTICS OF SOILS

COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)
Very loose	0 - 4	Very soft	< 12
Loose	4 - 10	Soft	12 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very dense	> 50	Very stiff	100 - 200
		Hard	> 200

ROCK QUALITY DESIGNATION

QUALIFICATIVE	RQD
Very poor	< 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

JOINTS SPACING

Very tight	< 20 mm
Tight	20 - 60 mm
Close	60 - 200 mm
Moderately spaced	200 - 600 mm
Spaced	600 - 2000 mm
Very spaced	2000 - 6000 mm
Wide	> 6000 mm

STRATIGRAPHY

DEPTH (m)	DEPTH (ft)	ELEVATION (m) / DEPTH (m)	DESCRIPTION OF SOILS AND ROCK
		8,90	
		0,00	Thin cover of mosses over black TOPSOIL.
		8,75	
		0,15	Brown to grey Silty and Gravelly SAND, saturated. - Presence of cobbles.
1			
		7,70	
		1,20	ICE WEDGE - Fractured cobbles with Silty SAND inclusions (DC-04). - Well-bonded cryostructures observed within soil inclusions.
		7,40	
5		1,50	END OF BOREHOLE
2			

SAMPLES

SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Grain size analysis (BNQ 2501-025)
			A				
		MA-01	B				
		DC-02					
		DC-03					
		DC-04					
		DC-05					

Active layer depth / Groundwater level: 0,15 m; 1,20 m

CRYOSTRUCTURES

Nf:	Poorly-bonded
Nbn:	Well-bonded no excess ice
Nbe:	Well-bonded excess ice
Vx:	Individual ice
Vc:	Ice coating
Vr:	Random ice
Vs:	Stratified ice
I+S:	Ice with soil inclusions
Ice:	Soil < 25 mm thick

Unfrozen

Ice

Nbn

Ice

TESTS

VIC: Volumetric Ice Content (%)
w: Water Content (%)
S: Salinity (ppt)

W: 20 40 60 80

REMARKS

General remarks:

Verified by : M. Verpaelst, M. Sc.

Date : 2021-12-01

Stantec

BOREHOLE REPORT

Project:	Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut	Location :	Geo. System: UTM Zone: 15
Project No.:	144903107	X :	545 879
Client:	The Municipality of Rankin Inlet	Y :	6 965 519
Site:	Rankin Inlet, Nunavut	Type of borehole :	Diamond Core
Figure:		Equipment :	STIHL FB200
		Sampling type :	
		Corer :	HX

Borehole :	BH21-03
Page :	1 of 1
Start date :	2021-09-14
Inspector :	M. Verpaelst, M. Sc.
Depth :	1,25 m
Elevation UTM :	13,30 m

SAMPLE TYPE

SS	Split spoon
CS	Continuous sampling
DC	Diamond rock core
AS	Auger
TW	Thin wall sampler
ST	Shelby tube
MA	Manual sample

QUALITATIVE TERMINOLOGY

Clay	< 0.002 mm
Silt	0.002 - 0.08 mm
Sand	0.08 - 5 mm
Gravel	5 - 80 mm
Cobbles	80 - 200 mm
Boulders	> 200 mm

QUANTITATIVE TERMINOLOGY

Traces	< 10 %
Some	10 - 20 %
Adjective (...y)	20 - 35 %
and (ex: and gravel)	> 35 %
Main word	Dominant fraction

SYMBOLS

N	Standard penetration value (ASTM D 1586)
Nc	Dynamic cone penetration value (BNQ 2501-145)
RQD	Rock Quality Designation (%)

ACTIVE LAYER DEPTH

	Date	Depth
Reading 1		m
Reading 2		m

Remarks :

SAMPLE STATE

- Remoulded (unfrozen sample)
- Intact (thin wall sampler)
- Lost
- Core (frozen core sample)

MECHANIC CHARACTERISTICS OF SOILS

COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)
Very loose	0 - 4	Very soft	< 12
Loose	4 - 10	Soft	12 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very dense	> 50	Very stiff	100 - 200
		Hard	> 200

ROCK QUALITY DESIGNATION

QUALIFICATIVE	RQD
Very poor	< 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

JOINTS SPACING

Very tight	< 20 mm
Tight	20 - 60 mm
Close	60 - 200 mm
Moderately spaced	200 - 600 mm
Spaced	600 - 2000 mm
Very spaced	2000 - 6000 mm
Wide	> 6000 mm

STRATIGRAPHY

DEPTH (m)	DEPTH (ft)	ELEVATION (m) / DEPTH (m)	DESCRIPTION OF SOILS AND ROCK
		13,30	
		0,00	Shallow cover of mosses over black
		13,24	TOPSOIL.
		0,06	Brown-grey GRAVEL.
		13,20	
		0,10	- Presence of cobbles. - Groundwater seepage. - Results from frost sorting processes.
1			Brown Gravelly SAND, some silt, moist. - Presence of cobbles.
		12,05	
		1,25	END OF BOREHOLE
2	5		

SAMPLES

SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Grain size analysis (BNQ 2501-025)
			A				
			B				
		MA-01	C				
		DC-02					

Active layer depth / Groundwater level

CRYOSTRUCTURES

Nf:	Poorly-bonded
Nbn:	Well-bonded no excess ice
Nbe:	Well-bonded excess ice
Vx:	Individual ice
Vc:	Ice coating
Vr:	Random ice
Vs:	Stratified ice
I+S:	Ice with soil inclusions
Ice:	Soil < 25 mm thick

Unfrozen

TESTS

VIC: Volumetric Ice Content (%)
w: Water Content (%)
S: Salinity (ppt)

W
20 40 60 80

REMARKS

General remarks:
- Corer refusal from material infilling the hole.
- Periglacial processes (sorting) observed at the surface.

Verified by : M. Verpaelst, M. Sc.
Date : 2021-12-01

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Stantec

BOREHOLE REPORT

Project:	**Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut**	Location :	**Geo. System: UTM Zone: 15**
Project No.:	**144903107**	X :	**546 155**
Client:	**The Municipality of Rankin Inlet**	Y :	**6 965 754**
Site:	**Rankin Inlet, Nunavut**	Type of borehole :	**Diamond Core**
Figure:		Equipment :	**STIHL FB200**
		Sampling type :	
		Corer :	**HX**

Borehole :	**BH21-04**
Page :	**1 of 1**
Start date :	**2021-09-14**
Inspector :	**M. Verpaelst, M. Sc.**
Depth :	**1,70 m**
Elevation UTM :	**6,90 m**

SAMPLE TYPE

SS	Split spoon
CS	Continuous sampling
DC	Diamond rock core
AS	Auger
TW	Thin wall sampler
ST	Shelby tube
MA	Manual sample

QUALITATIVE TERMINOLOGY

Clay	< 0.002 mm
Silt	0.002 - 0.08 mm
Sand	0.08 - 5 mm
Gravel	5 - 80 mm
Cobbles	80 - 200 mm
Boulders	> 200 mm

QUANTITATIVE TERMINOLOGY

Traces	< 10 %
Some	10 - 20 %
Adjective (...y)	20 - 35 %
and (ex: and gravel)	> 35 %
Main word	Dominant fraction

SYMBOLS

N	Standard penetration value (ASTM D 1586)
Nc	Dynamic cone penetration value (BNQ 2501-145)
RQD	Rock Quality Designation (%)

ACTIVE LAYER DEPTH

	Date	Depth
Reading 1	2021-09-14	1,40 m
Reading 2		m

Remarks :

SAMPLE STATE

- Remoulded (unfrozen sample)
- Intact (thin wall sampler)
- Lost
- Core (frozen core sample)

MECHANIC CHARACTERISTICS OF SOILS

COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)
Very loose	0 - 4	Very soft	< 12
Loose	4 - 10	Soft	12 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very dense	> 50	Very stiff	100 - 200
		Hard	> 200

ROCK QUALITY DESIGNATION

QUALIFICATIVE	RQD
Very poor	< 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

JOINTS SPACING

Very tight	< 20 mm
Tight	20 - 60 mm
Close	60 - 200 mm
Moderately spaced	200 - 600 mm
Spaced	600 - 2000 mm
Very spaced	2000 - 6000 mm
Wide	> 6000 mm

STRATIGRAPHY

DEPTH (m)	DEPTH (ft)	ELEVATION (m) / DEPTH (m)	DESCRIPTION OF SOILS AND ROCK
		6,90	
		0,00	Thin cover of mosses and sod over black TOPSOIL.
		6,85 / 0,05	Brown Gravelly Silty SAND, saturated. - Presence of cobbles. - Presence of roots.
1			
		5,50	
	5	1,40	SAND and GRAVEL, trace of silt. - Limited sample recovery below 1.45 m (may have melted from friction).
		5,20 / 1,70	END OF BOREHOLE
2			

SAMPLES

SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Grain size analysis (BNQ 2501-025)
			A				
		MA-01	B				
		DC-02					
		DC-03					G : 45,6 % S : 46,8 % F : 7,6 %
		DC-04					

Active layer depth / Groundwater level: 0,05 m; 1,40 m

CRYOSTRUCTURES

Nf:	Poorly-bonded
Nbn:	Well-bonded no excess ice
Nbe:	Well-bonded excess ice
Vx:	Individual ice
Vc:	Ice coating
Vr:	Random ice
Vs:	Stratified ice
I+S:	Ice with soil inclusions
Ice:	Soil < 25 mm thick

Unfrozen

Nbe

TESTS

VIC: Volumetric Ice Content (%)
w: Water Content (%)
S: Salinity (ppt)

W
20 40 60 80

13.3

REMARKS

General remarks:

Verified by : M. Verpaelst, M. Sc.

Date : 2021-12-01

Stantec

BOREHOLE REPORT

Project:	**Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut**	Location :	**Geo. System: UTM Zone: 15**
Project No.:	**144903107**	X :	**545 633**
Client:	**The Municipality of Rankin Inlet**	Y :	**6 965 659**
Site:	**Rankin Inlet, Nunavut**	Type of borehole :	**Diamond Core**
Figure:		Equipment :	**STIHL FB200**
		Sampling type :	
		Corer :	**HX**

Borehole :	**BH21-05**
Page :	**1 of 1**
Start date :	**2021-09-14**
Inspector :	**M. Verpaelst, M. Sc.**
Depth :	**1,10 m**
Elevation UTM :	**16,50 m**

SAMPLE TYPE

SS	Split spoon
CS	Continuous sampling
DC	Diamond rock core
AS	Auger
TW	Thin wall sampler
ST	Shelby tube
MA	Manual sample

QUALITATIVE TERMINOLOGY

Clay	< 0.002 mm
Silt	0.002 - 0.08 mm
Sand	0.08 - 5 mm
Gravel	5 - 80 mm
Cobbles	80 - 200 mm
Boulders	> 200 mm

QUANTITATIVE TERMINOLOGY

Traces	< 10 %
Some	10 - 20 %
Adjective (...y)	20 - 35 %
and (ex: and gravel)	> 35 %
Main word	Dominant fraction

SYMBOLS

N	Standard penetration value (ASTM D 1586)
Nc	Dynamic cone penetration value (BNQ 2501-145)
RQD	Rock Quality Designation (%)

ACTIVE LAYER DEPTH

	Date	Depth
Reading 1	2021-09-14	1,20 m
Reading 2		m

Remarks :

SAMPLE STATE

- Remoulded (unfrozen sample)
- Intact (thin wall sampler)
- Lost
- Core (frozen core sample)

MECHANIC CHARACTERISTICS OF SOILS

COMPACTION	INDEX "N"	CONSISTENCY	Cu OR Su (kPa)
Very loose	0 - 4	Very soft	< 12
Loose	4 - 10	Soft	12 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very dense	> 50	Very stiff	100 - 200
		Hard	> 200

ROCK QUALITY DESIGNATION

QUALIFICATIVE	RQD
Very poor	< 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

JOINTS SPACING

Very tight	< 20 mm
Tight	20 - 60 mm
Close	60 - 200 mm
Moderately spaced	200 - 600 mm
Spaced	600 - 2000 mm
Very spaced	2000 - 6000 mm
Wide	> 6000 mm

STRATIGRAPHY

SAMPLES

CRYOSTRUCTURES

Nf:	Poorly-bonded
Nbn:	Well-bonded no excess ice
Nbe:	Well-bonded excess ice
Vx:	Individual ice
Vc:	Ice coating
Vr:	Random ice
Vs:	Stratified ice
I+S:	Ice with soil inclusions
Ice:	Soil < 25 mm thick

TESTS

VIC: Volumetric Ice Content (%)
w: Water Content (%)
S: Salinity (ppt)

W
20 40 60 80

DEPTH (m)	DEPTH (ft)	ELEVATION (m) / DEPTH (m)	DESCRIPTION OF SOILS AND ROCK	SYMBOL	STATE	TYPE N°	SUB - SAMPLE	CALIBER	RECOVERY (%)	N - RQD	Grain size analysis (BNQ 2501-025)	Active layer depth / Groundwater level	CRYOSTRUCTURES	TESTS	REMARKS
		16,50													
		0,00	Brown to grey Gravelly Silty SAND, moist to saturated. - Presence of cobbles.			MA-01						0,50 m	Unfrozen		
1						D-02									
		15,40													
		1,10	END OF BOREHOLE									1,20 m			
5															
2															

General remarks:
- **Perglacial processes (sorting) observed at the surface.**
- **Borehole was drilled within a frost boil.**

Verified by : **M. Verpaelst, M. Sc.**

Date : **2021-12-01**

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APPENDIX H Laboratory Testing Results

Stantec

2273 Michelin Street,
Laval QC, H7L 5B8

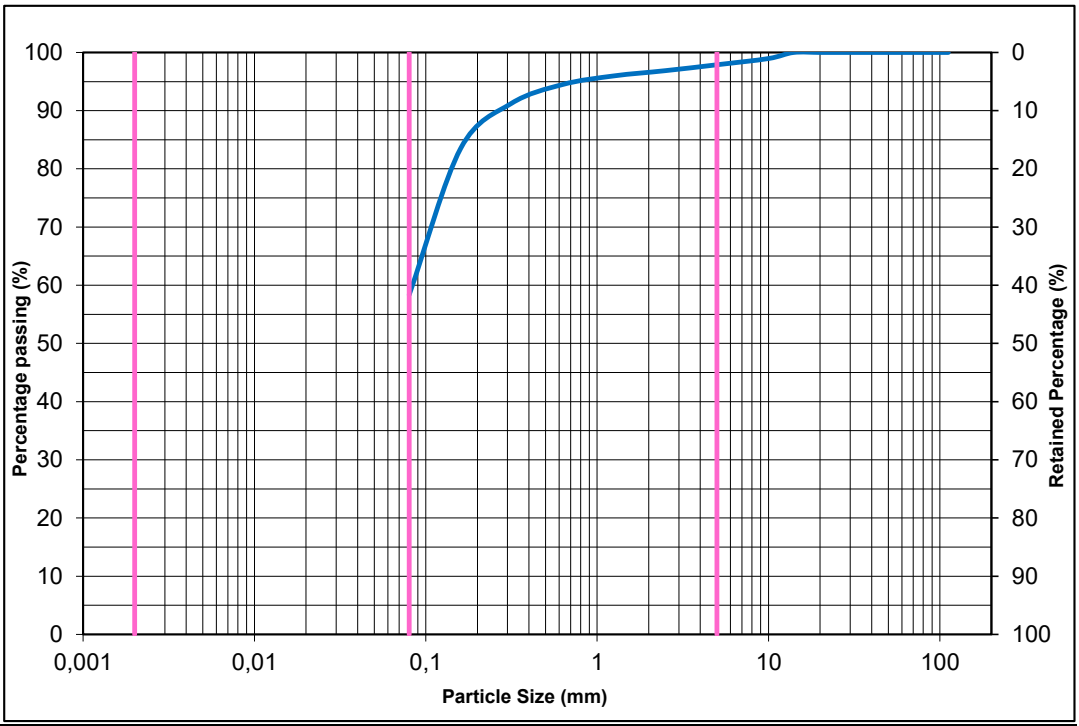
LABORATORY TESTING REPORT

Client : The Municipality of Rankin Inlet
Project : Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut
Project No : 144903107
Sample No : BH21-01 DC-03
Depth : 1,20 - 1,31m

Sampled by : Manuel Verpaelst
Sampling Date : September 13, 2021
Material Description : Fine particles and Sand, traces of Gravel

Grain Size Analysis (BNQ 2501-025)

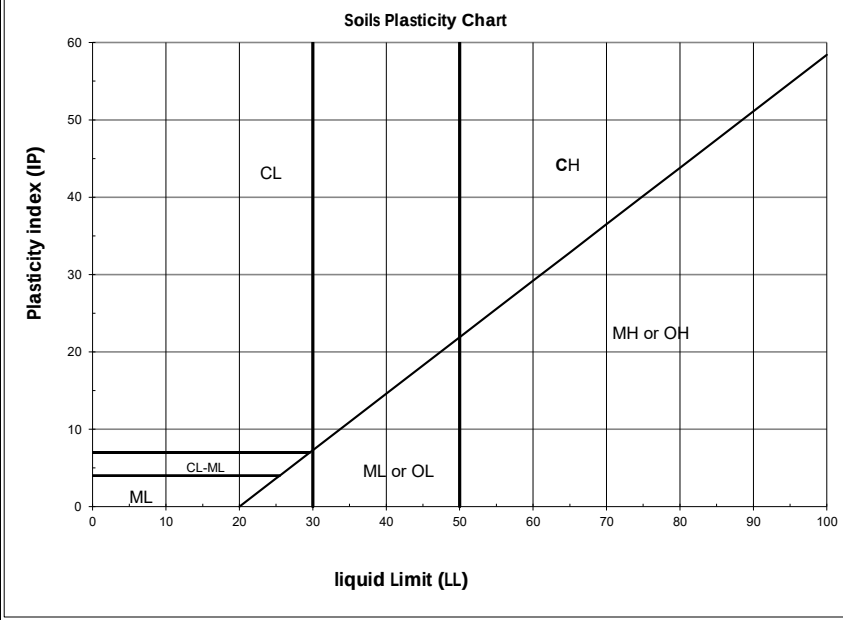
Openings Dimensions	Cumulative Results
mm	%
112	100
80,0	100
56,0	100
40,0	100
31,5	100
28,0	100
20,0	100
14,0	100
10,0	99
5,00	98
2,50	97
1,25	96
0,630	95
0,315	91
0,160	84
0,080	58,4



% Gravel : 2,1 % Sand : 39,5 % Fine particles : 58,4

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	29,4



Remarks :

Prepared by : Benoit Cyr, Geo.

Date : November 04, 2021

Stantec

2273 Michelin Street,
Laval QC, H7L 5B8

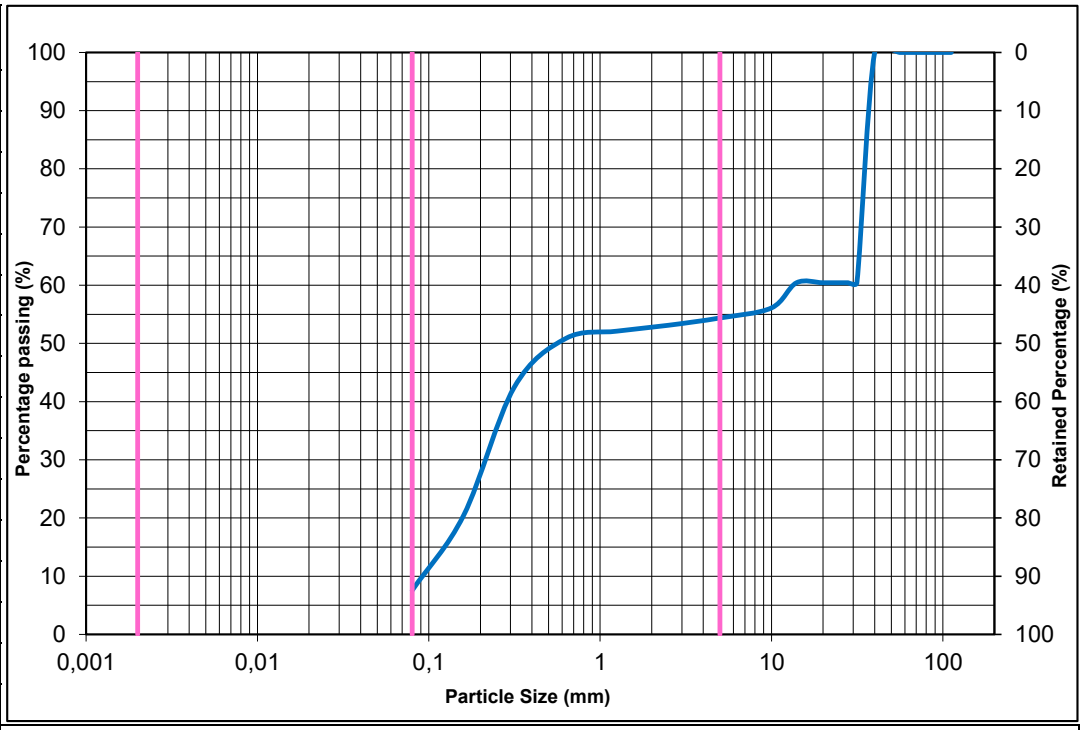
LABORATORY TESTING REPORT

Client : The Municipality of Rankin Inlet
Project : Geotechnical Evaluation and Drainage Planning in Rankin Inlet, Nunavut
Project No : 144903107
Sample No : BH21-04 DC-03
Depth : 1,40 - 1,45m

Sampled by : Manuel Verpaelst
Sampling Date : September 13, 2021
Material Description : Sand and Garvel, traces of fine particles

Grain Size Analysis (BNQ 2501-025)

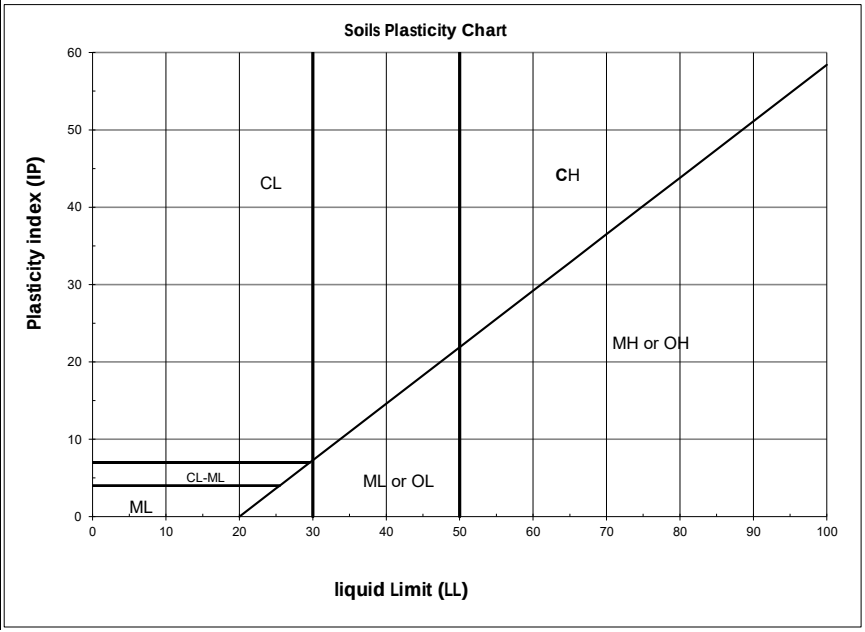
Openings Dimensions	Cumulative Results
mm	%
112	100
80,0	100
56,0	100
40,0	100
31,5	60
28,0	60
20,0	60
14,0	60
10,0	56
5,00	54
2,50	53
1,25	52
0,630	51
0,315	42
0,160	21
0,080	7,6



% Gravel : 45,6 % Sand : 46,8 % Fine particles : 7,6

Other tests

Test / Standard	Results
Water Content (NQ 2501-170) (%)	13,3



Remarks :

Prepared by : Benoit Cyr, Geo.

Date : November 04, 2021