Environment

Public Works and Government Services Canada

CAM-C, Matheson Point Remedial Action Plan Final Report

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Project Number:

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Date:

March 5, 2014

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March 5, 2014

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Dear Jessie:

Project No: **60299674 (505)**

Regarding: **Final Report – Remedial Action Plan (RAP)**
CAM-C, Matheson Point, NU Intermediate DEW Line Site

AECOM Canada Ltd. is pleased to submit our final report outlining the Remedial Action Plan (RAP) for CAM-C, Matheson Point Intermediate DEW Line Site. We thank you for the opportunity to complete this work on behalf of Public Works and Government Services Canada. We trust that this report is consistent with your expectations.

Should you have any questions or require additional information, please do not hesitate to contact the undersigned at (780) 486-7057.

Sincerely,
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Executive Summary

AECOM was retained by Public Works and Government Services Canada (PWGSC), on behalf of Aboriginal Affairs and Northern Development Canada (AANDC), Nunavut Regional Office Contaminated Sites Program, to complete a Phase III Environmental Site Assessment (ESA) and a Remedial Action Plan (RAP) with Class C Cost Estimate for the CAM-C, Matheson Point, a former Intermediate Distant Early Warning (DEW) Line site.

CAM-C Matheson Point is a former intermediate DEW Line site located at 68.8187^{o}N and 95.289^{o}W on the southeast coast of King William Island in Nunavut. The closest community is Gjoa Haven (estimated population of 1,279, Statistics Canada, 2011), which is situated approximately 30 kilometres (km) southwest of CAM-C.

The site was constructed in the 1950s and operated until 1963. At an unspecified time following its abandonment, site buildings were dismantled or relocated from the site. The total disturbed area at CAM-C is estimated to be 22.1 square kilometres or 8.54 square miles as per (DIAND, 1982).

This RAP is based on information from the 2013 ESA, as well as from the historical reports. The site includes a Station Area with an airstrip and a Beach Area used historically for barge landing and POL Storage. There is also a rough trail system between Gjoa Haven and CAM-C that is typically used by the local residents of Gjoa Haven for travel with ATV's.

Both the Phase III ESA and this RAP have been completed in accordance with the Abandoned Military Site Remediation Protocol (AMSRP; source: Indian Affairs and Northern Development Canada (INAC), now AANDC, 2009). Design and Specifications will be subsequently completed in preparation for tendering and site clean-up.

The following summarizes the site access and remediation implementation developed for CAM-C, Matheson Point:

- The remediation activities at CAM-C are anticipated to be completed in one full year with mobilization by barge in the late summer/fall of Season 1 and construction and demobilization in the summer/fall of Season 2.
- Five buried debris lobes were identified during the 2013 ESA: Airstrip Landfill, Station West Landfill, and Lobes C, D, and E. The buried debris areas requiring regrading represent an approximated total area of 1,900 square metres (m^2). Buried debris requiring excavation (Airstrip Landfill only) will result in an approximated volume of 200 cubic metres (m^3) non-hazardous debris, 200 m^3 of Tier I/II contaminated soil, and 10 m^3 hazardous material.
- A landfarm/treatment area is proposed for the treatment/storage of 570 m^3 of Type B hydrocarbon soil.
- Only minor demolition is required at the site: metal tanks, fallen radar tower, POL piping, and concrete foundations remain on site. Metal structures will be cut, crushed, and removed from the site with other non-hazardous debris. Concrete foundations will be either be buried in place, collapsed and buried in place, or demolished and buried in a site excavation.
- A total of 27 surface debris areas were identified on-site with an estimated crushed volume of 200 m^3 of non-hazardous debris and 4 m^3 of hazardous debris requiring off-site disposal.
- A total of 700 barrels were identified and assessed as surface debris. The barrels were empty and processing is not expected to require a significant effort (disposal volume included in surface debris total).
- Total non-hazardous containerization requirements for off-site disposal are 880 m^3, comprised of:
  - 610 m^3 of crushed non-hazardous waste (surface, demolition, and buried debris).
  - 270 m^3 of non-treatable contaminated soil (includes the 70 m^3 of Tier I/II impacted soil from known sources and 200 m^3 of potential Tier I/II soil from the Airstrip Landfill).
- Total hazardous containerization requirements for off-site disposal are 14 m^3, comprised of:
  - 4 m^3 of hazardous material surface debris.
  - 10 m^3 estimated hazardous material from Airstrip Landfill Excavation.

- A total of 20 borrow sources were identified at CAM-C of which 11 were classified as primary or preferred. The estimated total volume of granular material required for CAM-C remediation construction is 8,500 m^3 while the total volume of borrow material identified at the preferred sites is in excess of 116,000 m^3.
- Borrow materials have low ARD potential.
- Post-construction monitoring will be required for the low or medium risk WDA's left in place on site, as per the AMSRP. The specific monitoring program will be confirmed once remedial activities have been completed.

Table 1 – Summary of Recommended Remedial Actions

Buried Debris Areas						
Waste Disposal Area	**Area (m^2)**	**Depth (m)**	**Volume (m^3)**	**Environmental & Geotechnical Investigation**	**WDA Class**	**Recommended Remediation Strategy [1]**
Airstrip Landfill	672	1.5	1,008	• No evidence of contaminant migration. • Erosion has exposed debris. • Located in a drainage channel.	Class A	Excavate and package non-hazardous, non-combustible waste and containerize contaminated soil for off-site disposal.
Station West Landfill	1,558	1.2	1,870	• No evidence of contaminant migration. • No potential for surface contaminated soil identified. • Minimal vegetation. No erosion noted at lobes, some at Station West Landfill.	Class C	Place fill and regrade as needed to cover surface/increase stability.
Lobes C, D and E (collective totals)	320	1.0	320			

Demolition		
Structure	**Estimated Volume**	**Recommended Remediation Strategy**
Concrete Pads	-	Warehouse foundation will be collapsed and regraded in place.
		Garage foundation and radar foundations will be regraded in place.
		POL foundations will be regraded in place, except where they coincide with the contaminated soil excavations; those foundations in the way of excavation will be crushed and used as deep backfill in contaminated soil excavations.
Radar Towers, Tanks, POL Pipeline, Miscellaneous Metal Structures	210 m^3	Disassembly and crushing for packaging/containerization and off-site disposal is the recommended remedial option for these structures.

Surface Debris/ Excavated Debris Contents		
Material Type	**Estimated Volume**	**Recommended Remediation Strategy**
Non-Hazardous, Combustible Material	1 m^3	All non-hazardous, combustible waste will be incinerated on-site, pending the procurement of appropriate permits and licences. Significant amounts of combustible waste are not anticipated at the site, but more may be identified during buried debris excavation. Ash will be packaged for disposal as non-hazardous, non-combustible waste.
Non-Hazardous, Non-Combustible Material (including Barrels)	609 m^3	Barrels will be crushed, along with other crush-able metal tanks and structures (radar tower, beacons, etc.) to reduce the size for efficient packaging. Once crushed, all non-hazardous, non-combustible waste will be packaged and shipped off-site for disposal at an appropriate, licensed facility.
Hazardous Material	14 m^3	All hazardous, non-combustible waste will be containerized in compliance with TDG Regulations, and shipped off-site for disposal at an appropriate, licensed facility.
Contaminated Soil		
Soil Impact Class	**Estimated Volume**	**Recommended Remediation Strategy**
Type B PHC	570 m^3	Construct a landfarm facility in order to treat the soil on-site.
Tier I/II Metals/PCBs	270 m^3	Excavate, package and transport off-site for disposal at an appropriate facility.

[1] Based on engineering considerations.

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1. Introduction

AECOM was retained by Public Works and Government Services Canada (PWGSC), on behalf of Aboriginal Affairs and Northern Development Canada (AANDC), Nunavut Regional Office Contaminated Sites Program, to complete a Phase III Environmental Site Assessment (ESA) and a Remedial Action Plan (RAP) with Class C Cost Estimate for the CAM-C, Matheson Point, a former Intermediate Distant Early Warning (DEW) Line site.

The Final Phase III ESA was submitted to PWGSC in January, 2014. This RAP is based on information from the ESA, discussions with PWGSC and AANDC, as well as from the historical reports.

Both the Phase III ESA and this RAP have been completed in accordance with the Abandoned Military Site Remediation Protocol (AMSRP; source: Indian Affairs and Northern Development Canada (INAC), now AANDC, 2009). An Environmental Impact Assessment and an Archaeological Inventory and Assessment were also completed and submitted to PWGSC and AANDC (final versions February, 2014). Design and Specifications will be subsequently completed in preparation for tendering and site clean-up.

1.1 Scope of Work

This report discusses remedial options for site issues identified during the Phase III ESA, and provides recommendations for the preferred options. This report has been structured as follows:

- Section 2.0 outlines the background information that forms the basis of the remedial option evaluations and recommendations.
- Section 3.0 discusses remedial options for site waste disposal areas.
- Section 4.0 identifies remedial requirements for hazardous waste elements at the site.
- Section 5.0 summarizes the sources of non-hazardous waste at the site and provides recommendations for disposal.
- Section 6.0 summarizes the findings of the contaminated soil investigation and assesses remedial options for the various types of contaminated soil.
- Section 7.0 discusses issues related to the implementation of the recommended remedial options for waste disposal areas, demolition of buildings, surface debris pick-up, the construction of new containment facilities (landfills and/or landfarm), hazardous waste disposal, and availability of required granular borrow.

Site figures are presented in Appendix A.

2. Background

CAM-C Matheson Point is a former intermediate DEW Line site located at 68.819°N and 95.289°W on the southeast coast of King William Island in Nunavut. The closest community is Gjoa Haven (estimated population of 1,279, Statistics Canada, 2011), which is situated approximately 30 kilometres (km) southwest of CAM-C.

The site includes a Station Area with an airstrip and a Beach Area used historically for barge landing and POL Storage. There is also a rough trail system between Gjoa Haven and CAM-C that is typically used by the local residents of Gjoa Haven for travel with all-terrain vehicles (ATVs).

The site was constructed in the 1950s and operated until 1963. At an unspecified time following its abandonment, site buildings were dismantled or relocated from the site. The total disturbed area at CAM-C is estimated to be 22.1 square kilometres (km^2) or 8.54 square miles (as per DIAND, 1982).

2.1 Remedial Protocols and Criteria

The remedial recommendations provided herein are based primarily on the latest version of the AMSRP (INAC, 2009). This protocol provides assessment and remedial guidelines for Waste Disposal Areas (WDAs), disposal of barrel contents and provides clean-up criteria for contaminated soil. There are no criteria for the classification of hazardous waste at federal sites, except for materials regulated under the Canadian Environmental Protection Act (CEPA), including the Inter-provincial Movement of Hazardous Waste Regulations (1999). The classification and remedial recommendations for materials not covered under CEPA have been based on the Transportation of Dangerous Goods (TDG) Regulations and the Nunavut/NWT Guideline for the General Management of Hazardous Waste (1998), under the territorial Environmental Protection Act (R.S.N.W.T 1998 c.E-7). More detailed information related to remedial guidelines or requirements under the sources noted above is provided in the issue-specific sections below.

Wastewater and contact water will be required to be addressed as per a water licence that is issued by the Nunavut Water Board.

2.2 Site Specific Remedial Considerations

The following sections provide site specific considerations that have been applied in the development of this remedial action plan.

2.2.1 Off-Site Access

2.2.1.1 Barge Landing

The CAM-C site is located along the coast of the Rae Strait and barges have historically landed at the Beach Area. The ground at the beach is comprised of generally well-drained, coarse-grained beach deposits, which are not expected to pose a problem for beaching or using heavy equipment in the area for movement of materials upon landing. No significant change in the position of shoreline due to tidal influences (erosion) was noted during the 2013 site investigation, so the beach landing area appears stable. Tidal prediction rates for August and September of 2011 are available for Gladman Point (north end of King William Island), Taloyoak (northeast), and Shepherd Bay (east), from the Fisheries and Oceans Canada (DFO) website (http://www.waterlevels.gc.ca/eng/find/zone/37). For this time of year, tidal fluctuations at the closest points measured are in the order of approximately 0.1 to 0.4 metres (m) at Gjoa Haven and 0.3 to 0.8 m at Gladman Point (Fisheries and Oceans Canada, 1984).

One small potential issue is that empty barrel caches are located along the shoreline in the approximate location of the barge landing area and some of these barrels may need to be relocated during barge unloading activities. Barge access can also be hindered in the early summer by ice conditions, and barge availability can also be an issue.

AECOM has obtained a nautical chart for the area from Cambridge Bay to Shepherd Bay, published by the Canadian Hydrographic Service. The nautical chart indicates the presence of an anchorage area approximately 3 km off shore from the Beach Area and ocean depth information for access corridors to CAM-C through Rae Strait. This information is presented on Figure 2 of Appendix A.

Based on the above information, barge landing at Matheson Point is not expected to pose a significant challenge.

2.2.1.2 Air Access

An inspection of the airstrip at the site was completed during the 2013 Phase III ESA. The airstrip is about 900 m long and 28 m wide. The airstrip is constructed with granular fill material borrowed from adjacent areas north and south of the airstrip. The airstrip is generally in good condition, however, there may be areas which may need upgrading with the placement and compaction of additional granular fill.

The charter pilots from Summit Air considered the airstrip to be in good condition for the landing of the planes used for the 2013 site investigation and the bidders tour, where landing a Shorts Skyvan and a Dornier 228 did not present any difficulties. In 2011 and 1992, the site was also accessed by smaller aircrafts. The following aircrafts (with full loads) have previously been able to land at the airstrip during dry conditions at the site: Otter DHC-3, Twin Otter DHC-6, and Shorts Skyvan. However, because only visual inspection of the runway was completed, it is essential that the airstrip be inspected by aircraft crews familiar with the required airstrip landing support conditions prior to its use.

For the purposes of this RAP, it has therefore been assumed that aircraft access for grocery re-supply and personnel transport to the site will not be an issue, especially given the assumption that the primary mobilization of contractor equipment will be via barge. All landing at the site will be at the discretion of the pilot.

2.2.1.3 Road Access

The CAM-C site is 30 km northeast of Gjoa Haven and there is a network of trails from town to CAM-C over hummocky terrain. None of these paths are linear; all of them are subject to seasonal drainage limitations during spring freshet or periods with excessive precipitation, and none of these trails are known to be able to reliably sustain heavy equipment or trucks, either in width or grade. There is potential for the development of a road from Gjoa Haven to CAM-C to allow for access and potential support from Gjoa Haven during remediation construction activities.

2.2.1.4 Summary

It is expected that barge transport will be the most feasible and economical mode for the mobilization of the contractor's materials and supplies to the CAM-C site. For camp re-supply during remediation construction, there are regular commercial airline flights to Gjoa Haven and charter planes available at Cambridge Bay. Access from Gjoa Haven to CAM-C for re-supply runs could be provided by boat or overland with the development of an access road. It has been assumed for the preparation of this RAP, and its associated cost estimate, that access to the site for mobilization and demobilization of contractor equipment and supplies will be via barge transport.

2.2.2 On-Site Access

There are a number of gravel roads throughout the site connecting the Station Area with the Airstrip, Fresh Water Lake, Existing Landfills, and Beach Areas. All of the major roadways were surveyed during the site investigation. The roadway sections include Road Section 1 from the Station Area to the Freshwater Lake; Road Section 2 from the Airstrip to the Station Area and roads around the Station Area; Road Section 3 connects the south end of the Airstrip to the Beach POL. The road sections and the locations of culverts are shown on Figure 3.

The site roads are generally 5 to 6 m wide and were constructed with locally sourced granular material. All sections are generally in suitable condition to support heavy equipment.

Road Section 1 is approximately 1.7 km long, and towards the north end of the segment, there are two 650 mm diameter culverts side by side. The road section is generally in good condition, although regular maintenance and grading will be required to maintain access for heavy equipment during remediation activities. The only exception is at the lower reaches of the road near the water supply lake, where there are several erosion areas that will need to be addressed to maintain access for construction equipment. There is a turnaround point at the end of the road at the lake, but it may not be useable during wet site conditions.

Road Section 2 includes the roads in and around the Station Area, as well as the road that connects the Airstrip with the Station Area, comprising an overall roadway length of 467 m. The roadway subgrade is constructed with granular material and is generally considered to be in good condition for the support of heavy construction equipment. A 600 millimetre (mm) diameter culvert (located near airstrip) exists on this road section, as shown on Figure 3.

Road Section 3 extends from the south end of the airstrip to the Beach POL. This road section extends approximately 2 km and slopes downwards towards the Beach Area, passing over several intermittent drainage channels (based on erosion channels observed). Road Section 3 is in good to fair condition with some embankment sections elevated above surrounding grade and some sections level with surrounding grade. Small patches of vegetation are typical along this road section, but are of no concern with respect to trafficability. Two 550 mm diameter barrel culverts were observed in this roadway section, including one near the airstrip and one further along the road towards the Beach, as shown on Figure 3. At the location of the northern culvert, the road was partially washed out, and there were two other locations towards the middle of this road section with evidence of erosion (ridges) that will require upgrading. Road Section 3 is considered to be generally in fair to good condition for the support of heavy construction equipment; however, some upgrading and regular maintenance will be required. Pull-out sections may be required along the road to allow for two-way traffic.

There are two relatively level pad locations north of the Station Area, which provide two potential locations for the camp or construction laydown area (LF-1, and LF-2). They both are close to the airstrip and centrally positioned with respect to the site infrastructure. A minor amount of additional roadwork will be required to provide parking and facilitate access to the existing roads. It should be noted that LF-2 was identified as the preferred location for the camp in the Phase III ESA as there were more flexible options for camp layout at this site. The location of both of these sites is shown on Figure 3 in Appendix A.

2.2.3 Environmental Considerations

On-site discussions were completed with the wildlife monitors to discuss historical land use activities or other items that may have affected this site. Based on these discussions, there was very little information available regarding the former site use. The CAM-C site is only 30 km away from Gjoa Haven and is visited regularly by community members. According to the wildlife monitors, there is very little land use associated with the site, as most hunting and fishing occurs on the north side of King William Island.

The site is not within a protected area, and is not a regionally unique ecosystem. Characteristic wildlife of the region includes: muskox, Peary caribou, long-tailed Jaeger, glaucous gull, short-tail weasel (ermine), horned lark, collared lemming, black-bellied plover, ruddy turnstone, red phalarope, oldsquaw, brant, king eider, red-throated loon, snow goose, arctic hare, arctic fox, snowy owl, polar bear (Environment Canada, 1999). Previously noted wildlife included muskox, Arctic hare, lemmings, horned larks, ravens, snow buntings, and glaucous gulls (ESG, 1994).

Wildlife sighted or evidence identified during the 2013 site investigation included: Arctic fox, muskox, Canada geese, swans, caribou, loon (and chick), long-tailed Jaeger, plover (presumed to be a black-bellied with at least one chick), Arctic tern, one burrowing rodent (lemming or vole possibly), and unidentified small, brown songbirds. Insects identified included a spider and several bees, but black flies and mosquitoes are also seasonally expected.

Vegetation in the Victoria Island Lowlands ecoregion is sparse and stunted. Species present include: arctic poppy, purple saxifrage, mountain avens, moss campion, arctic bladder campion, arctic daisy, crustose lichens, arctic willow, white arctic heather, yellow oxytrope, cotton grass, mastodon flower, arctic lousewort, mountain sorrel, pygmy buttercup, river beauty, chickweed, and various sedges. (Environment Canada, 1999)

The re-establishment of vegetation was observed to be commencing over most of the previously disturbed areas of the site; there was very little topsoil, so most plant root systems were anchored in the sand.

More specific information related to vegetative cover is described in area-specific discussion in the following sections.

2.2.4 Geology/Geomorphology/Hydrology

This region's landscape is shaped by glaciers, which left wide, flat plateaus and gently rolling plains; coastal land is rising over time as it decompresses after the glacial pressure. Permafrost is evident throughout the region, where freeze/thaw cycles shape the soil and drainage channels, as well as degrade the limestone and sandstone bedrock. Some parts of the region have steep coastal cliffs, but CAM-C is situated in a small cove, with a somewhat protected and gently sloped beach.

King William Island is entirely aligned with a geological formation comprising Cambrian-Silurian carbonate and siliciclastic rocks (Geological Survey of Canada, Canada-Nunavut Geoscience Office, 2006). .

The geology of King William Island consists of Cambrian-Ordovician carbonate and siliciclastic rocks (Canada-Nunavut Geoscience Office, 2006). The surficial material consists of weathered bedrock with clasts composed primarily of carbonate and silica with a low probability of sulphide minerals.

Regional drainage would be towards Rae Strait for the east side of the site, but the portion west of the Station Area (high point) would be towards the Freshwater Lake.

2.2.5 Archaeological Features

An archaeological investigation has been completed by Thomson Heritage Consultants to identify heritage features needing protection or avoidance during site remedial activities. The conclusion of the "Archaeological Impact Assessment" (AIA) Report for this site was that PWGSC should be allowed to proceed with the remediation of the CAM-C DEW Line site area, with the provision that no impacts occur within 30 m of historic sites identified. The AIA is provided in Appendix E of this report and identifies a total of six historic sites at CAM-C. These six locations are shown on Figure 3 of Appendix A.

2.2.6 Site Assessment Information

The preparation of this RAP has been based on data from the following reports:

- Aboriginal Affairs and Northern Development Canada (AANDC). 2012. *The Big Picture, Contaminated Sites in Nunavut*
- AECOM. 2009. *Indicative Cost Estimates for the Remediation of Eight Nunavut Contaminated Sites*
- AECOM. 2013. *CAM-C, Matheson Point, Phase III Environmental Site Assessment Report*
- Andzans and Associates. 1984. *DEW Line Data File*. Department of Indian and Northern Affairs (referenced in WESA report; not reviewed for this report)
- Environmental Sciences Group (ESG). 1995. *Environmental Study of Abandoned DEW Line Sites III: Six Intermediate Sites in the Canadian Arctic. Volumes I, II and III*
- Public Works and Government Services Canada (PWGSC). 2003. *Environmental Review of DIAND Contaminated Sites in the Territory of Nunavut*
- WESA. 2012. Limited Environmental Investigation EK002, Matheson Point, CAM-C. February 2012

3. Waste Disposal Area Remediation

3.1 WDA Identification

Historical reports identified two landfills (South Landfill and West Landfill) at the site; an aerial photograph review identified five smaller locations with suspected buried debris in the Station Area (Lobes A to E). The Airstrip Landfill was identified through visual inspection during the 2013 site assessment.

The landfills and lobes were assessed visually and a geophysical survey was conducted at each to locate areas with buried metallic debris. Two of the lobes (Lobes A and B) that were initially classified as buried debris areas were reclassified as surface debris areas.

The South Landfill was also re-classified as a surface debris area. The West Landfill was renamed the Station West Landfill by AECOM to better describe its position on the site, and was confirmed to be WDA with buried debris. The geophysics survey also confirmed that the Airstrip Landfill was WDA with buried debris.

3.2 Waste Disposal Remedial Protocol

The assessment of dumps at CAM-C was completed with the goal of classifying the buried debris areas according to the three categories specified under the AMSRP, which are:

Class A: Waste disposal area (WDA or buried debris) is located in an unstable, high erosion location. Remediation will involve relocation of buried debris to an engineered landfill. A WDA located at an elevation of less than 2 m above mean sea level will be removed.

Class B: The WDA is in a suitable, stable location, but there is evidence of contaminant migration. Remedial solutions include the installation of an engineered containment system, or relocation, whichever is deemed more cost effective.

Class C: The WDA is in a suitable, stable location, and there is no evidence of contaminant migration. In such cases, the debris may be left in place, with the placement of additional granular cover to ensure erosion protection and proper drainage.

WDA assessment involved the collection of soil samples up and down-gradient of the WDAs, at surface and depth. Contaminant concentrations obtained from down-gradient samples were compared to those from up-gradient samples, and also to average levels of contaminants from all of the WDA assessment samples. Where down-gradient samples were consistently higher than up-gradient (by at least two times the concentration of average or up-gradient samples), and elevated concentrations were present over a significant proportion of the total sample locations (i.e. more than one isolated event), the WDA was evaluated to have evidence of contaminant migration. The potential for surface soil contamination was also assessed by noting any staining or the presence of types of debris that might act as contaminant sources (such as battery debris). In areas where contamination was suspected, surface and shallow depth soil samples were collected to assess and delineate the extent of contamination.

The following sections describe specifics related to the three recommended requirements for each of the three classes of WDAs. For all WDAs, it is recommended that any surface debris or surface contaminated soil be removed prior to initiating the WDA remediation remedial requirements outlined above.

3.2.1 Excavation/Relocation (Class A)

All WDAs have the potential to contain buried hazardous waste materials and contaminated soil, in addition to the expected non-hazardous waste debris. For this reason, where the recommended remedial action is excavation and relocation of WDA contents, the contents of the WDA will require segregation during excavation to allow classification of the various waste streams. Debris should be separated from soil, with segregation of hazardous and non-hazardous waste. Soil should be sampled to identify any contaminant levels. Contaminated soil identified during sampling should be disposed of according to the requirements outlined in the AMSRP.

Through work on the Department of National Defence (DND) DEW Line sites, AECOM has developed and maintained a database recording the breakdown in WDA excavation components. This database is currently comprised of WDA excavation information from 15 sites.

From this database, the average excavation volume breakdown is as follows:

- Tier I soil: 15%
- Tier II soil: 20%
- Non-hazardous debris: 15%
- Hazardous debris: 2%
- Below Criteria Soils: 48%

For excavation of WDAs on DND DEW Line sites, AECOM has typically applied these standard percentages during the design stage. However, where site-specific information suggests a higher or lower level of contaminated soil (based on the results of environmental sampling), a higher level of hazardous debris component (based on exposed debris observations), or different concentration of debris (i.e. higher or lower debris content based on extent of cover or a weak and/or spotty geophysical anomaly), the percentages have been modified accordingly.

Based on observations from other intermediate DEW Line sites under AANDC's jurisdiction, and on observations from historical air photo review completed at DND DEW Line sites, it was common during the early stages of site operation that debris disposal at WDAs did not, generally, involve the placement of cover over debris upon disposal. WDAs in these circumstances were typically comprised almost entirely of debris and oftentimes had contaminated soil associated with them as a result of the type of debris disposed, but there was little-to-no surface cover. At the DND sites, however, where the sites were in operation over a longer period of time, WDA operations gradually evolved such that debris began to be covered with granular fill. It became common implementation for excavation of existing ground, stockpiling of excavated granular material and placement of debris, with subsequent debris backfilling with the stockpiled granular material. The DND WDAs typically have reasonably good surface cover overlying debris, with the majority of debris exposure restricted to along the toe, where backfilling was not so thorough.

However, a review of the site and WDA-specific quantity breakdowns from the DND WDA excavation database was undertaken to further determine the appropriateness for applying these average concentrations to WDAs at CAM-C. It was noted during this review that the component breakdown from excavations, particularly related to contaminated soil quantities, could be fairly well correlated with the amount of contaminated soil identified at the landfill surface or down-gradient, and/or with the strength of evidence regarding contaminant migration. The results could also be well correlated with the other factors such as the strength of the geophysical anomaly (which is indicative of the density of debris within the WDA). This suggests that the average component concentrations noted above should be more strictly used as a starting point for evaluation, with ultimate component breakdown derived from much more consideration of WDA-specific information (where that information is available from the site investigations).

The results of the geophysical surveys at CAM-C WDAs (in terms of anomaly strength) suggest that a lower concentration of debris is present in these landfills, compared to typical DND site landfills, which is consistent with

their operation over a much shorter timeframe. However, a definitive comparison could not be completed because the geophysical method used at CAM-C was slightly different than that which has been used at DND sites.

Relatively little contaminated soil was identified at the CAM-C WDAs, and contaminant levels observed down-gradient were never at significantly high concentrations. These observations suggest that a lower level of contaminated soil should be expected from within landfill contents.

The standard component breakdown for WDAs at the CAM-C site has therefore been assumed as the following:

- Tier I soil: 10%
- Tier II soil: 10 %
- Non-hazardous debris: 20%
- Hazardous debris: 1%
- Clean fill: 59%

The volume of non-hazardous debris has been assumed to be the average breakdown from DND sites because of the inability to compare the geophysical survey results directly, but it is estimated to be a conservative measure. The percentages of Tier II and Tier I soils, and hazardous debris has been decreased, with a corresponding increase in the volume of clean fill. As noted above, these standard percentages have been further modified, where warranted, by WDA-specific information.

Class A WDAs should be excavated to the limits of debris. Where contaminated soil has been detected in the excavated contents, it is also recommended that confirmatory testing of the excavation base be completed to ensure no contaminated soil remains. The excavation area should be backfilled and graded to conform to surrounding terrain, and provide positive drainage.

Of the identified buried debris areas at CAM-C, one of them (Airstrip Landfill) was classified as Class A according to the AMSRP.

3.2.2 Leachate Containment (Class B)

The typical design that has been used for leachate containment at existing DEW Line WDAs involves the excavation of a trench just beyond the limits of the buried debris. The trench extends into either ice rich permafrost or saturated ground, which was typically observed at a depth of about 1.0 m at CAM-C. A geosynthetic liner system is placed extending from the base of the trench over the WDA area. The trench is then backfilled with low-permeability (Type 4) granular fill which may also extend upslope of the trench. Well graded sand and gravel (Type 2 fill) is placed and compacted over the surface to a thickness that will promote permafrost aggradation through the key trench and into the landfill contents. The primary long-term containment system is the saturated granular fill. Once the material freezes, it becomes a low-permeable containment barrier. The geosynthetic liner provides essential short-term containment until permafrost aggrades into the landfill and continues to provide longer-term containment following freeze back.

The closest DND DEW Line site where geothermal modelling has been completed for the purpose of leachate containment is the CAM-5, Mackar Inlet where a design fill thickness of 3.8 m of Type 2 fill has been identified for freeze back of an earth structure at this location. Geothermal modelling considered soil type, soil thermal properties, presence or absence of insulating cover (vegetation or snow drift), measured ground temperatures at the site or at nearby sites, measured air temperature and climatic data (from 1959-1999 from Environment Canada), an estimated 1 in 100 warm year air temperatures, and an estimate of the effect of global warming. The effect of global warming was estimated using the most recently published data summarizing global warming rate estimates for Arctic environments (ACIA 2005). The design cover thickness specified for CAM-5 has been used for consideration of remedial options at CAM-C.

While the specific requirements for long-term WDA monitoring at AANDC abandoned military sites have not yet been agreed upon, at DND DEW Line sites, this remedial option has initiated the need for significant post clean-up monitoring, with the installation of thermistors within the WDA to confirm that contents are frozen. To confirm that no further contamination migration is occurring, groundwater monitoring wells are installed up and down-gradient for the collection of groundwater samples and soil samples are collected adjacent to the monitoring wells. This monitoring has typically been done on a yearly basis for the first five years following site clean-up (which is the estimated time required to achieve thermal equilibrium), and then upon a reduced frequency after 5 years.

Of the identified buried debris areas at CAM-C, none of them were classified as Class B according to the AMSRP. As a result, there is no requirement for leachate containment at this site.

3.2.3 Regrading (Class C)

For WDAs located in a geotechnically stable location, with no evidence of contaminant migration, the recommended remedial action is to leave it in place. If required, additional granular cover is placed to provide erosion protection and positive drainage. It is typically recommended that the extent of regrading be extended slightly beyond the extent of the identified limits of debris (a 2 m offset has been used historically). The granular fill cover placed over the WDA should be well-graded (Type 2), erosion resistant, and well-compacted to limit infiltration of water. Where there is the potential for erosion from surface drainage, it is typical to strategically place armouring (rip rap) material. The placement of fill should be configured in such a way so as not to promote ponding of water, and graded to conform to surrounding terrain. Typically, a fill thickness of 0.75 m has been used, but for smaller areas, with no appreciable topographic expression, a smaller fill thickness of 0.5 m has been applied.

Four Class C dump sites/debris lobes were noted at CAM-C: Station West Landfill, and Lobes C, D, and E.

3.3 Waste Disposal and Buried Debris Areas

3.3.1 Station West Landfill

The Station West Landfill (formerly called the West Landfill) was the main waste disposal area used during CAM-C site operations and is located southwest of the Station Area, approximately 250 m south of the Station Area pad. This location was identified by the mound of granular material and the scattered surface debris (Debris Areas 7 and 8). A geophysical survey identified the anomaly associated with Station West Landfill to encompass an area of 1,558 m^2 with an estimated depth of 1.2 m for a total estimated volume is 1,870 m^3. The location of the Station West Landfill is indicated on Figure 3.

Exposed surface debris at this location included: batteries, barrels, tin cans, wood, pipe, strapping, steel mesh, cable, machine parts, wire. Several batteries were noted over the surface, and these are considered hazardous waste. The cover soil was predominantly comprised of coarse sand with some gravel, but it is estimated that only 75% of the surface of this buried debris area was covered. There is no vegetation cover over the slope of the landfill, but a small amount of vegetation (mostly willows and sedges) was noted at the toe. No evidence of water erosion was observed, but the location does have potential for wind erosion which could explain the lack of vegetative re-establishment. The closest drainage path is approximately 75 m to the south.

The Station West Landfill was assessed according to the landfill evaluation matrix and scored as a low potential risk or Class C WDA. The low score is due mainly to the lack of evidence of contamination migration, the relative stability of the lobes, and the lack of down-gradient receptors. As a result, the remedial recommendation is to leave the landfill in place and place additional granular cover to a thickness of 0.75 m over the surface, following the removal of surface debris.

3.3.2 Airstrip Landfill

The Airstrip Landfill is located approximately 130 m southeast of the Airstrip, immediately adjacent to the west side of Road Section 3. This landfill is situated in a drainage area that gently slopes toward the south and east towards Rae Strait. There is a drainage channel immediately downgradient of where the Airstrip Landfill is situated, which continues for approximately 2 km and outlets into the Rae Strait. The location of the Airstrip Landfill is shown in Figure 3 in Appendix A.

The geophysical survey identified the anomaly associated with the Airstrip Landfill as having an area of 672 m^2. Empty fuel barrels and other miscellaneous metal debris were noted on the surface of this landfill and downgradient of this area along the drainage channel. It should be noted that ice was observed in the drainage channel at the time of the assessment (July 28 to August 2, 2013).

Consistent with the other disturbed areas at the CAM-C site, there was minimal organic material observed and, as such, minimal vegetative cover was noted (5%). The surficial soil was predominantly comprised of coarse sand with some gravel, and approximately 90% of the landfill surface was covered with this material. Any sparse vegetation that was observed generally consisted of willows, sedges, and mosses.

The Airstrip Landfill was classified as a high potential risk (Class A), due to the presence of the drainage channel immediately downgradient of this landfill. As a result, the remedial recommendation is to excavate the contents of the Airstrip Landfill and reclaim the slope to accommodate the drainage channel. No contaminated soil was identified up or down-gradient of the channel, so no additional excavation beyond buried material should be required. Some minor reshaping and armouring of the channel with rip rap will be required.

3.3.3 Lobes C, D and E

During the site assessment, three lobes (Lobes C, D & E) of buried debris were identified north of the Station Area. The anomaly perimeters of each location are shown on Figure 3. The overall area of buried debris comprising these lobes was determined to be 320 m^2 by the geophysical survey and the depth was estimated to be 1.0 m below surface.

A piece of partially buried metal debris was observed at Lobe E, but otherwise the lobes were generally clear of surface debris. The cover soil was predominantly comprised of coarse sand with some gravel. Only trace amounts of organic material were noted over the area with the lobes, and there was minimal vegetation cover (5%). The primary vegetation cover was willows and sedges, with trace amounts of lichen. In general, there was minimal evidence of erosion in this area and some seasonal overland flow is expected in this relatively flat location.

Based on the landfill evaluation matrix, the lobes all scored as a low potential risk or Class C buried debris area. The low score is due mainly to the lack of contamination, the stability of the lobes, lack of down-gradient receptors, and the relatively small size. As a result, the remedial recommendation is to leave the lobes in place and place additional granular cover to a thickness of 0.75 m, following the removal of surface debris.

3.3.4 Buried Debris Summary

Overall, CAM-C has less buried debris than is typically encountered at other intermediate DEW Line site. Relatively little hazardous material has been encountered, but quantities have been bulked based on experience with similar sites. Table 3-1 provides a summary of the buried debris areas.

Table 3-1: CAM-C Buried Debris Area Summary

Name	Location	Surface Area Extent (m2)	Estimated Depth (m)	Estimated Volume (m3)	Estimated Volume of Hazardous Material (m3)	Recommended Remedial Strategy
Airstrip Landfill	Southwest of Station Area	1,558	1.2	1,008	19	Cover and regrade
Station West Landfill	Southeast of Airstrip	671.5	1.5	1,870	10	Excavate and backfill
Lobe C	Station Area	95	1	10	0	Cover and regrade
Lobe D	Station Area	144.5	1	145	0	Cover and regrade
Lobe E	Station Area	80.3	1	80	0	Cover and regrade

3.3.5 Monitoring Requirements

Post-construction monitoring will be required for the low or medium risk WDA's left in place on site, as per the AMSRP. The specific monitoring program will be confirmed once remedial activities have been completed. If no issues are identified, monitoring events can be discontinued; otherwise the monitoring program may be extended.

4. Hazardous Waste Remediation

4.1 Protocols and Regulatory Requirements

The AMSRP defines hazardous waste materials as: *'any materials, which are designated as "hazardous" under Nunavut Territorial or Federal legislation; or as "dangerous goods" under the Transportation of Dangerous Goods Act (TDGA) and regulations.'* (INAC, 2009)

As part of the assessment of CAM-C Matheson Point, an inventory of hazardous waste materials was compiled and supplemented with sampling during the 2013 site investigation. Hazardous waste materials identified during the survey included site debris consisting of Asbestos-Containing Materials (ACM's) and lead acid batteries. No specific hazardous contaminated soils were identified as a result of the 2013 site investigation; however, hazardous contaminated soil may be encountered during landfill excavation.

No lead or Polychlorinated Biphenol (PCB) -amended painted material was identified during the site investigation. The radar tower was the only painted structure remaining at CAM-C and it was determined that this structure was painted with similar paint observed at other intermediate DEW Line sites, which have been tested to show below criteria PCB and leachable lead content.

Projects that will result in the disturbance of ACMs, including vermiculite, must satisfy the regulatory requirements under the Canada Labour Code - Part II and the Nunavut Environment Protection Act. In addition, the Canadian Occupational Safety and Health Regulations, Part X - Hazardous Substances would be applicable to asbestos-containing materials. The Environmental Guideline for Waste Asbestos (GN 2002) defines asbestos-containing materials as: '*any type of material with greater than 1% asbestos by weight'*.

Treated creosote-impregnated waste materials (poles) are only considered "toxic", as defined under Section 11 of CEPA, if the waste creosote or its component compounds enter or are likely to enter the environment in a concentration or quantities or under conditions that could lead to exposure of humans or other biota at levels that could cause adverse effects. At DEW Line sites, these components have been determined to be non-hazardous as the components leach at a very slow rate and as such, do not present a threat to the environment if properly contained.

4.2 Surface Debris Component

At CAM-C, there are essentially two large scattered debris areas, one of which encompasses the Station pad and surrounding area and one which encompasses the Beach Area. A surface debris inventory was completed by collecting hand-held GPS waypoints where debris was visible or where debris fields appeared to terminate. The approximate perimeters of the larger debris areas were also picked up by the site survey. Two areas previously identified as buried debris lobes (Lobes A and B) were re-classified to be surface debris, upon further inspection. A total volume and description of debris types was recorded for each debris area. No surficial impacts were identified, so no further environmental investigation was conducted at these locations. Where debris was identified sporadically within a large area, an individual description will be provided on the drawings as a reference to aid in locating these locations during site clean-up.

The surface debris survey identified approximately 4 m^3 of hazardous material. However, upon further consideration, the tank frames in the Station Area could potentially be painted with PCB-amended paint and further sampling/analysis will be required prior to confirm disposal requirements of these structures (2 to 3 structures; same

paint assumed). A summary of hazardous waste components identified from the surface debris inventory is provided in Table C1 of Appendix C. Specifics related to barrels are discussed below.

4.3 Barrel Component

The classification of barrel contents and remedial requirements is based on the Barrel Protocol outlined in the AMSRP. This protocol provides specifics related to when the contents of hydrocarbon-containing barrels may be safely incinerated on-site, may be safely discharged (in the case of aqueous contents), and where contents require off-site disposal. The specifics of the protocol are provided in Appendix D.

Approximately 700 barrels were identified at CAM-C during the 2013 assessment. Most of the barrels were concentrated within the East and West Barrel Caches, along the POL Line, (which were used as markers); and within the extents of the debris area. All of the barrels identified at CAM-C were empty, including those located at the Barrel Storage Areas. No barrel samples were collected.

4.4 Demolition Component

The demolition investigation was conducted to provide an inventory of all site buildings and other facilities that would require dismantling for disposal. The investigation noted their construction, and any anticipated special disposal requirements, with the collection of samples for applicable analysis to confirm disposal requirements. All locations of asbestos were identified, and it was noted, in particular, where asbestos was covered with PCB-containing paint. Based on paint analytical data, and observations related to asbestos content, the hazardous and non-hazardous component of the demolition materials was determined.

There are no buildings that remain standing at the CAM-C site. Only the concrete foundations of the Garage and Warehouse buildings remain. Facilities that were inventoried at the CAM-C site in 2013 include: the radar tower, the foundations, culverts, the POL line and markers, sewage outfall pipe and markers. The areas and volumes of the demolition materials were included within the debris inventory. Aside from these facilities, a few other large pieces of metal debris (such as the boiler) may require some disassembly if they cannot be crushed on-site.

In areas of PCB-oil storage or in the vicinity of transformers, it is common that the concrete floor may be contaminated with PCBs. No concrete samples were obtained because no staining was noted on the concrete pads. All PCB-containing instruments on the surface of the site appear to have been removed during previous remediation efforts (ESG, 1995).

Four asbestos samples were collected, all from the debris associated with the Station Area: two from the warehouse debris (painted wall board and floor tile), one from the building train imprint (weathered pipe wrap), and one from the garage (weathered tank wrap). The results indicated that each of the four samples contained chrysotile asbestos in a sufficient concentration to classify each sample as an ACM. Specific asbestos testing results have been provided in the Phase III ESA. More of the same floor tiles were noted within Debris Area 10, and these tiles may be present in the buried debris areas. Details of ACM composition are noted in the *CAM-C Phase III Environmental Site Assessment* (AECOM, 2013). All ACM's must be segregated and proper handling techniques must be followed during packaging for off-site disposal to allow for proper handling at the off-site disposal facility.

While potential PCB-containing electrical equipment, including transformers, capacitors and fluorescent light ballasts are commonly present on DEW Line sites, a dedicated removal of these materials had been completed at an earlier date (ESG, 1995). No additional PCB-containing electrical equipment was identified during the 2013 investigation.

There is the potential for mercury-containing switches and thermostats at DEW Line sites, but none were identified at CAM-C during the 2013 investigation. A summary of hazardous materials identified during demolition inventory is provided in Table C2 of Appendix C. The total volume of identified hazardous surface debris material is estimated to be 4 m^3; this includes ACM's and batteries.

4.5 Estimated Buried Debris Excavation Component

With the exception of the Airstrip Landfill, all of the WDA's with buried debris identified at CAM-C were evaluated to be Class C and therefore do not require excavation.

Nominal volumes of hazardous material are typically encountered during dump excavation, including but not limited to battery waste, electrical components, asbestos, and petroleum products. As noted in Section 3.1.1, based on experience from other DEW Line sites, it is anticipated that a small quantity of hazardous soil will be encountered during excavation of dump sites, generally in the range of 1% of the overall excavation volume.

Based on the volume of dumps where the recommended remedial action is excavation, the estimated volume of hazardous waste to be derived is 10 m^3 (Airstrip Landfill).

4.6 Remedial Requirements

Generally, all hazardous materials identified at the site will be collected and transported off site. Packaging and transportation of these materials will be completed in accordance with the TDGA (TC 2002) and Regulations, and the CEPA Inter-provincial Movement of Hazardous Waste Regulations (SOR/2002-301), to a licensed hazardous waste disposal facility.

Particulars are described below:

- Asbestos: Asbestos waste will be collected, double bagged and disposed of off-site at a licensed non-hazardous waste disposal facility, in accordance with the appropriate legislation.
- Petroleum Products: Petroleum products, such as gasoline or diesel, which do not contain other hazardous products according to the Barrel Protocol (chlorine, PCB, heavy metals, etc.) will be incinerated on-site under appropriate emissions controls. Heavier petroleum products such as lubricating oil will be disposed of off-site or mixed with lighter petroleum products and incinerated on-site under appropriate emissions controls.
- Compressed Gas Cylinders: Compressed gas cylinders with known contents will be vented. Once empty, the metal cylinder will be disposed of off-site at a licensed non-hazardous waste disposal facility.
- Creosote Treated Timbers: Timbers will be wrapped in polyethylene sheets, sealed in plastic, and disposed at an off-site licensed waste disposal facility.

Other hazardous materials may be encountered during remediation activities and would require the following disposal considerations:

- PCB Paint on Building Components: PCB paint and PCB painted components, which are regulated under the CEPA, will be collected and transported off-site, in accordance with the TDGA and CEPA, to a licensed PCB disposal facility
- Lead-Based Paint on Building Components: Lead-based painted components which are classified as hazardous material will be collected and transported off-site, in accordance with the CEPA Inter-provincial Movement of Hazardous Waste Regulations, to a licensed hazardous waste disposal facility

5. Non-Hazardous Waste Remediation

5.1 Surface Debris Component

Based on the 2013 ESA inventory, the majority of surface debris was identified as non-hazardous. The estimated crushed volume of non-hazardous debris is 200 m^3. A summary of surface debris areas and volumes is provided in Table C1 of Appendix C.

5.2 Demolition Component

The results of this investigation indicate that the crushed volume of non-hazardous waste materials from demolition is approximately 210 m^3. A summary of demolition quantities is provided in Table C2 of Appendix C.

Concrete foundations have also been identified for demolition and will be addressed in following type-specific manners:

- The elevated Warehouse foundation will be collapsed and regraded,
- The Garage foundation and the radar foundations will be regraded, and
- The POL foundations will be regraded in place, except where they coincide with the contaminated soil excavations; those foundations in the way of excavation will be crushed and used as deep backfill (>0.5 m) in contaminated soil excavations.

5.3 Estimated Buried Debris Excavation Component

With the exception of the Airstrip Landfill, all WDA's with buried debris identified at CAM-C were evaluated to be Class C and therefore do not require excavation.

As noted above, the estimated volume of non-hazardous waste from dump excavations has been based on site-specific modification of average values obtained from dump excavations at other DEW Line sites. In this case, the estimated non-hazardous debris proportion from the Airstrip Landfill would be 20% or approximately 200 m^3.

5.4 Remedial Recommendations

The total crushed volume of material identified as non-hazardous waste during the 2013 Phase III ESA is approximately 600 m^3. According to the AMSRP, the assessment of the need for construction of an on-site Non-Hazardous Waste (NHW) Landfill should consider primarily the availability of suitable locations to build such a facility at the site. Additional considerations include the availability of appropriate granular borrow materials and the volume of non-hazardous waste identified for disposal. Based on the volume of non-hazardous waste, the quantities and types of granular materials identified during the 2013 investigation, and the identification of several suitable sites for new landfill development, favourable conditions for constructing a NHW Landfill exist. Despite this, once long-term monitoring costs are factored in to the overall site remediation cost, as well as the negative aesthetic modification to a frequently visited location, outstanding liability, and the additional disruption to an already slow to re-vegetate site, it was concluded that AANDC prefers to ship non-hazardous waste off-site rather than construct a NHW Landfill at CAM-C.

All non-hazardous, combustible waste will be incinerated on-site, pending the procurement of appropriate permits and licences. Significant amounts of combustible waste are not anticipated at the site, but more may be identified during buried debris excavation.

All non-hazardous, non-combustible waste will be crushed, packaged and shipped off-site for disposal.

6. Contaminated Soil Remediation

6.1 Remedial Criteria and Clean-up Protocols

The investigation and delineation of contaminated soil at CAM-C was completed for the contaminants of concern identified under the AMSRP: copper, lead, PHCs, and PCBs. The protocol identifies two levels of contamination: Tier I soil, which is considered an environmental risk only when located at surface, and Tier II soil, which is considered an environmental risk at any depth of impact. Delineation of PHC impacts was completed using the 2009 AMSRP.

Total Petroleum Hydrocarbon (TPH) soil analyses are typically completed using a methane extraction method, and measure concentrations of carbon chain sizes between C_6 and C_{34}. Type A hydrocarbons are defined as impacts comprised of 70% or more of the heavier fractions (F3 and F4), which corresponds to impacts derived from lubricating (lube) oil or grease spills. Type B hydrocarbons are defined as those impacts comprised primarily of lighter end components (F1-F3), derived from fuel spills. The AMSRP process specifies different numerical cleanup criteria based on the type of hydrocarbon impacts (Type A versus Type B), proximity to significant water bodies, and depth of impacts.

Table 6-1 below provides a summary of contaminated soil remedial criteria and volumes identified during the Phase III ESA and evaluated based on the 2009 INAC criteria. Estimated volumes of contaminated soil from WDA excavations have also been noted, as these volumes have also been considered for evaluation of contaminated soil disposal options below. The options noted below combine the volumes from these two sources with the volume derived from WDA excavation estimates noted in parentheses below.

Table 6-1 – Summary of Contaminated Soil: Remedial Criteria and Quantities

Designation	Description/Criteria	Soil Volume (m^3)	Remedial Options (as per AMSRP)
Tier I Contaminated Soil	Soils containing concentrations of any or all contaminants listed: • **Lead** 200 to 500 ppm • **PCBs** 1 to <5 ppm	**63 m^3**	Cap in place with a minimum of 0.3 m of granular fill, or dispose in engineered territorial or provincial landfill.
Tier II Contaminated Soil	Soils containing concentrations equal to or greater than any or all contaminants listed: • **Arsenic** 30 ppm • **Cadmium** 5 ppm • **Chromium** 250 ppm • **Cobalt** 50 ppm • **Copper** 100 ppm • **Lead** 500 ppm • **Mercury** 2 ppm • **Nickel** 100 ppm • **Zinc** 500 ppm • **PCBs** >5 to <50 ppm	**8 m^3**	Dispose in Secure Soil Disposal Facility (SSDF) or transport off-site for disposal in engineered territorial or provincial Landfill.
TPH Type A Soil (F3 and F4 fractions)	Soils contaminated with PHCs consisting primarily of oil and grease at concentrations equal to or greater than: TPH, Sum of F3 and F4 fractions 20,000 ppm.	**n/a**	Scarify and leave in place if under criteria, or dispose in engineered territorial or provincial landfill.
TPH Type B Soil (F1-F3 fractions) – Protection of (*) Freshwater Aquatic Life	Soils contaminated with PHCs consisting primarily of fuel oil, and/or diesel, and/or gasoline, with concentrations equal to or greater than the following: • **F1 fraction** 1,290 ppm* • **F2 fraction** 330 ppm* Station Area: Surface soils to 0.5 m depth ≥2,500 ppm (TPH, sum of F1 through F3 fractions) for the Protection of Terrestrial Wildlife Subsurface soils below 0.5 m in depth ≥5,000 ppm (TPH, sum of F1 through F3 fractions) for the Management Limit.	**570 m^3**	Excavate and treat ex-situ through landfarming, treat in-situ with landfarming, or dispose of in SSDF. Note that disposal in the SSDF is only considered appropriate if concentrations are sufficiently low that there are no concerns for inhibiting freezing of contents and/or with free-product development, which could compromise the liner integrity at the facility.

Notes: Source: Table 5.1 Summary of Remedial Options – Contaminated Soil (INAC AMSRP, 2009)

6.2 Tier I Contaminated Soil

The 2013 site investigation identified the following Tier I contaminated soil areas:

- Tier I (PCB) Contaminated Soil (60.9 m^3)
  - 20 m^3 of Tier I contaminated soil was identified on the west side of the Warehouse Foundation to an estimated depth of 0.8 m
  - 7.5 m^3 of Tier I contaminated soil was identified on the east side of the Warehouse Foundation to an estimated depth of 0.3 m
  - 2.2 m^3 of Tier I contaminated soil was identified around the Garage Foundation; co-impacted with Tier I metals to an estimated depth of 0.3 m
  - 21.5 m^3 of Tier I contaminated soil was identified at Debris Area #10 to an estimated depth of 0.3 m

- Two localized occurrences along the POL line; one of 7.5 m^3 and one of 2.2 m^3, both to a depth of 0.3 m

- Tier I (Metals) Contaminated Soil (2.2 m^3)
  - 2.2 m^3 of Tier I contaminated soil was identified around the Garage Foundation impacted with Tier I metals to an estimated depth of 0.3 m

- Airstrip Landfill Tier I Contaminated Soil Component:
  - 100 m^3 estimated (10%) from excavation of the Airstrip Landfill

The total volume of Tier I soil identified for remediation is 163 m^3, which has been delineated from contaminated soil areas. A detailed breakdown showing area-specific volumes of Tier I soil is provided in Appendix B.

The AMSRP indicates that all soils with metal and/or PCB concentrations exceeding the DLCU Tier I Criteria (but not regulated by CEPA) will be disposed of according to the following options:

- On-site disposal in an on-site NHW Landfill
- Cap in place with a minimum of 0.3 m of clean granular fill if in a stable location.

Due to the relatively small amount of Tier I contaminated soil at CAM-C, and the preference against constructing an on-site NHW Landfill, all Tier I soil will be containerized and shipped off-site for disposal.

6.3 Tier II Contaminated Soil

The 2013 site investigation identified the following Tier II contaminated soil areas:

- Tier II Metals (7.5 m^3)
  - 7.5 m^3 of Tier II impacted soil (estimated to 0.3 m depth) down the slope from the Station Area pad, near the Module Train imprint

- Airstrip Landfill Tier II Contaminated Soil component:
  - 100 m^3 estimated (10%) from excavation of the Airstrip Landfill

The total volume of Tier II contaminated soil identified for remediation is 108 m^3.

The AMSRP indicates that all soils with metal and/or PCB concentrations exceeding the DLCU Tier II Criteria (but not regulated by CEPA) will be disposed of according to the following options:

- On-site disposal within an Secure Soil Disposal Facility (SSDF) consisting of double containment within permafrost encapsulation and a geosynthetic liner system in the base and cover of the facility
- Off-site disposal at a licensed southern disposal facility

The decision criteria to determine if a SSDF is required at a DEW Line Site are outlined in Table 5.3 of the AMSRP. The site is not landlocked and the estimated Tier II soil volume is 108 m^3, which is less than the decision criteria volume of 300 to 500 m^3. The risk of overrun for the estimated Tier II soil fraction in the Airstrip Landfill is considered to be low. Therefore, the remedial recommendation is to ship Tier II contaminated soil off-site.

6.4 Type A Soil

There has been no Type A contaminated soil identified as a result of the site investigations at CAM-C.

6.5 Type B Soil

Several locations with Type B impacted soil requiring remedial action were identified as part of the 2013 investigation including:

- Type B Hydrocarbon (570 m^3)
  - 185 m^3 of Type B hydrocarbon impacted soil was identified at the Beach POL
  - 375 m^3 of Type B impacted soil was identified at the Station POL
  - 10 m^3 of Type B impacted soil was identified in the imprint of the Module Train

The total volume of PHC Type B soil identified for remediation is 570 m^3. A summary of contaminated soil volumes by area is presented in Appendix B.

Remedial options applicable to the hydrocarbon impacted soil include:

- In-situ biological treatment or chemical oxidation
- Ex-situ, on-site aeration and biological treatment (landfarming)
- Ex-situ, on-site aeration (using an excavator equipped with a standard or “Allu” type bucket)
- Ex-situ, off-site treatment and/or disposal in a Licensed Disposal Facility

Advantages and disadvantages of each treatment option are described in Table 6-2. Based on the applicability of the various treatment options at the CAM-C site, the recommended remedial option is on-site ex-situ aeration (an excavator equipped with a standard or “Allu” type bucket) or on-site ex-situ aeration and biological treatment (landfarming).

Based on the volume of impacted soil and moderate hydrocarbon concentrations observed during the 2013 investigation, it is anticipated that ex-situ biological treatment may be completed within a one year period provided site conditions are monitored and optimized where possible (i.e., moisture conditioning, nutrient amendment). It may be more appropriate to apply more intense aeration methods for the relatively small volume of soils requiring treatment at CAM-C in order to allow this work activity to be completed within the expected short overall construction period for this project.

Soils contaminated with Type B fractions should be excavated and treated ex-situ by aeration or aeration with biological treatment methods in an on-site treatment or landfarm facility. Soils concentrations should be reduced, as required, to meet the 2009 AMSRP Criteria.

Table 6-2 – Summary of Remedial Options – Hydrocarbon Contaminated Soil

Remedial Option	Description/Requirements	Applicability	Advantages	Disadvantages/Limitations	Implementation
On-Site, Ex-situ Landfarming / Bioremediation	• Hydrocarbon contaminated soils are excavated and placed within bermed treatment area. • Soils are periodically turned and nutrients added to optimize treatment conditions.	• Hydrocarbon contaminated soils, including F1, F2 and F3 fractions.	• Contaminant concentrations reduced. • No environmental risks associated with potential spills during off-site transport.	• More effective on lighter end hydrocarbons. • Generally requires 1-2 treatment seasons for contaminant reduction to criteria. • Restricts use of the site during treatment operations. • Impermeable membrane/low permeable soils required for containment.	• Adequate location and granular materials identified for construction. • Geosynthetic liner required for perimeter containment if permeable soils are used. • Primary TPH constituent is F2.
On-Site, Ex-Situ Aeration by Allu Bucket	• Hydrocarbon contaminated soils are excavated and placed within contained treatment area. • Soils are frequently turned for aeration.	• Hydrocarbon contaminated soils, including F1, F2 and F3 fractions.	• Contaminant concentrations reduced. • No environmental risks associated with potential spills during off-site transport. • Generally suitable for more intense treatment of small soil volumes.	• More effective on lighter end hydrocarbons. • May be difficult to aerate soils with excessive moisture, fine-grained soils and rock using the Allu system. • Impermeable membrane/low permeable soils required for containment.	• Adequate location and granular materials identified for construction of treatment area. • Geosynthetic liner required for perimeter containment. • Primary TPH constituent is F2.
Off-Site Treatment and Disposal	• Contaminated soils are transported off-site for treatment or disposal.	• All contaminated soil types.	• Contaminated soils removed from site eliminating risk of exposure.	• Considerable costs associated with off-site transport. • Project costs are very sensitive to contaminated soil volumes. • Potential environmental risks during transport.	• Shipment and disposal off-site is technically appropriate, but at considerable costs. • Small amount of impacted soil at site.
In-situ Biological Treatment / Chemical Oxidation	• Application of ozone, peroxide or permanganate through instrumentation within the impacted area.	• Amendable to light and medium end hydrocarbons (F1, F2, F3 fractions).	• Under optimal conditions can reduce concentrations below criteria. • Minimize excavation and disturbance of existing vegetation.	• Monitoring required. • Difficult to confirm that target concentrations are met throughout the contaminated area. • Not applicable to metal contaminated soil.	• Not appropriate for hydrocarbon areas located in close proximity to water bodies. • More successful for shallow contamination.

6.6 Summary

Remedial options evaluations for the remediation of contaminated soils were completed as part of the 2013 investigation. Based on the estimated volumes of contaminated soils and technical considerations, it is recommended that all PHC soils at CAM-C be treated on-site, while Tier I and II soils be containerized and disposed of off-site. Based on the applicability of the various disposal and treatment options, the following recommendations are made:

- Soils contaminated with Type B fractions should be excavated and treated ex-situ by aeration or aeration with biological treatment methods in an on-site landfarm facility/"allu" treatment area. The total volume of hydrocarbon impacted soil requiring treatment is estimated at 570 m^3.
- Soils contaminated with Tier I levels of PCBs and inorganic elements should be excavated and placed in containers for off-site disposal. The total volume of Tier I soil is estimated at 161 m^3.
- Soils contaminated with Tier II levels of PCB and/or inorganic elements should be excavated and disposed of off-site. This includes co-contaminated soils (most conservative treatment option selected). The total volume of Tier II soil is estimated at 108 $m^{3.}$
- There were no soils identified with Type A contamination.

7. Implementation

7.1 Schedule

Assuming barge access will be possible, it is expected that the contractor would mobilize to the site in the late summer/early fall of Season 1. During this timeframe, it is reasonable to assume that the contractor would be able to set-up their camp, potentially investigate recommended borrow sources, and upgrade roadways, as required. It should be made clear to the contractor that if any nests or dens are encountered, that work in these areas will be avoided.

Based on the recommended remedial actions outlined above, construction activities will require at least one full season of clean-up activity, following contractor mobilization to site. Specifics related to timing and prioritization of contractor activities is described in the sections below.

7.2 Waste Streams

The manner by which hazardous and non-hazardous materials will be identified and specifically addressed is outlined in previous sections. The following is a summary of the expected waste streams and methodology that will be applied to all surficial and excavated buried debris, as well as structures requiring demolition.

7.2.1 Non-Hazardous Waste Material

PWGSC has elected not to have an on-site non-hazardous waste landfill, so the non-hazardous surficial and buried debris will be compacted and packaged for off-site disposal.

All non-hazardous, combustible waste will be incinerated on-site, pending the procurement of appropriate permits and licences. Significant amounts of combustible waste are not anticipated at the site, but more may be identified during buried debris excavation. Ash will be packaged for disposal as non-hazardous, non-combustible waste.

All barrels identified on site are empty (no paint on surface, generally rusted through – no contents or coatings remain), and will be crushed, along with other crush-able metal tanks and structures (radar tower, beacons, etc.) to reduce the size for efficient packaging.

Once crushed, all non-hazardous, non-combustible waste will be packaged and shipped off-site for disposal at an appropriate, licensed facility.

It should be noted that not all non-hazardous material will be removed from the site. Stable and minimal risk structures (such as concrete foundations) will not be removed from the site. Further details will be outlined in the following sections about specific instances and conditions for this to occur.

7.2.2 Hazardous Material

All hazardous, non-combustible waste will be containerized in compliance with TDG Regulations, and shipped off-site for disposal at an appropriate, licensed facility.

7.3 Waste Disposal Area Remediation

Table 7-1 below summarizes the recommended remedial requirements for WDAs at CAM-C. Only the material contained in the Airstrip Landfill will be excavated under the remediation program; all other buried debris areas were classified as 'low environmental risk', so the recommended remediation is regrading by placing additional granular cover over the areas.

Table 7-1 – Summary of Recommended Waste Disposal Area Remedial Requirements

Waste Disposal Area	Area (m^2)	Depth (m)	Volume (m^3)	Environmental & Geotechnical Investigation	WDA Class	Recommended Remediation Strategy [1]
Airstrip Landfill	672	1.5	1,008	• No evidence of contaminant migration. • Erosion has exposed debris. • Located in a drainage channel.	Class A	Excavate and package non-hazardous, non-combustible waste and containerize contaminated soil for off-site disposal.
Station West Landfill	1,558	1.2	1,870	• No evidence of contaminant migration. • No potential for surface contaminated soil identified. • Minimal vegetation. No erosion noted at lobes, some at Station West Landfill.	Class C	Place fill and regrade as needed to cover surface/increase stability.
Lobes C, D and E (collective totals)	320	1.0	320			

[1] Based on engineering considerations.

Post-construction monitoring will be required for the low or medium risk WDA's left in place on site, as per the AMSRP. The specific monitoring program will be confirmed once remedial activities have been completed.

7.4 Demolition

The demolition requirements at CAM-C are relatively minor and straightforward. The fallen tower, the POL pipeline, and a couple of the larger metal structures (boiler, tanks) may need to be cut up and crushed to facilitate transport and disposal. Disassembly and crushing for packaging/containerization and off-site disposal is the recommended remedial option for these structures. An approximated volume of this non-hazardous material is 209 m^3. Some hazardous material was noted in the vicinity of the demolition items and these materials have been included in the surface debris inventory.

Concrete foundations remain from the warehouse, garage and POL tanks and will be addressed in type-specific manners as follows:

- The elevated Warehouse foundation will be collapsed and regraded,
- The Garage foundation and the radar foundations will be regraded, and
- The POL Tank foundations will be regraded in place, except where they coincide with the contaminated soil excavations; those foundations in the way of excavation will be crushed and used as deep backfill in contaminated soil excavations.

7.5 Surface Debris

A total of 27 surface debris locations were identified during the 2013 Phase III ESA, with an estimated volume of 197 m^3 of non-hazardous material and 4 m^3 of hazardous material. A detailed breakdown of surface debris points and debris volumes is provided in Table C1 of Appendix C.

In addition to the identified surface debris areas, it is also typically noted in clean-up specifications that all debris within 50 m of existing pads and roadways is picked up. The surface debris investigation generally covered off all of the areas near roadways, and the existing perimeters were drawn to include debris identified in this vicinity. Nonetheless, it is recommended that a small contingency for additional volume of debris to be collected under the 50 m from roadway criterion be carried for disposal costs.

7.6 Barrel Remediation

The 2013 inventory of barrels at CAM-C indicates there are an estimated 700 barrels on-site. Most of the barrels were concentrated within the East and West Barrel Caches (Beach Area), along the POL Line (used as markers), and within the extents of the debris areas. There were no liquid contents observed in any of the barrels at CAM-C. The recommended remedial option is to crush all empty barrels and package for disposal off-site. These will be shipped to an off-site disposal facility with the remainder of the non-hazardous, non-combustible waste collected at the site.

7.6.1 Landfarm/"Allu" Treatment Area

The total volume of Type B soil identified for remediation is approximately 570 m^3. The Type B soil is distributed between the Beach Area and the Station Area. It would be preferable to locate the landfarm facility or "allu" treatment area within easy access to both the Beach Area and Station Area. The most efficient location proposed is LF-3, as it is a suitable and central site for a landfarm/treatment area. The site is at least 1.5 km from the closest water body, it meets siting requirements for a landfarm, and is close to borrow sources where Type 2 Granular Fill material is located.

The construction of the landfarm/treatment area should be made a priority, as the treatment of soil could potentially delay contractor's demobilization from site.

7.7 Borrow Sources

Remedial work at CAM-C will require borrow material for the following:

- Regrades (estimated 4,000 m^3 for WDA's – including Airstrip Landfill drainage - and 1,000 m^3 for regrading concrete foundations)
- Backfill of contaminated soil excavations (estimated 1,000 m^3)
- Landfarm construction (estimated 2,500 m^3)
- Armouring of drainage channel at Airstrip Landfill (estimated at 52 m^3)

Total estimated fill requirements (all types combined): 8,500 m^3.

To confirm that sufficient sources of the various granular material types were identified during the Phase III ESA, an estimate of the required granular material volumes was completed for the recommended remedial options discussed above. The following summarizes the estimated volumes for each granular material type:

- Type 1: Estimated volume of Type 1 material required for the armouring of the Airstrip Landfill channel and Station West Landfill regrades is 1,200 m^3)
- Type 2: The estimated volume required is approximately 3,800 m^3, which includes construction of the regrades and landfarm levelling course
- Type 3: The estimated volume required is in the order of 1,000 m^3, which includes backfilling of contaminated soil excavations
- Type 4: The estimated volume of Type 4 Granular Fill is 2,000 m^3 , which is required for construction of Landfarm berms
- Type 5: No requirement for Type 5 Granular Fill since there will be no construction of a SSDF or leachate containment system
- Type 6: No intermediate fill requirements, since there will be no construction of a NHW Landfill

Based on these estimates, it is anticipated that sufficient granular material sources were identified during the Phase III ESA. The soil types encountered in the borrow areas generally comprise Type 2 and Type 4 Granular Fills. A summary of granular material that can be obtained from the potential borrow areas at CAM-C is presented in Table 7-2 below. Although all of the identified Borrow Areas are acceptable for use, the ones that have the highest quality fill with the most diverse options (number of types or rare types) have been grouped into primary options and secondary options. Disturbed areas should be used first and undisturbed locations should only be used in the event a less-available type of Granular Fill is required. The Borrow Area locations are shown on Figure 3.

Table 7-2 – Summary of Borrow Areas

Borrow Area	Available Granular Fill Types	Area (m^2)	Depth (m)	Volume (m^3)	Comments
Primary Options					
BA-2	Type 2, Type 3, Type 6	4,700	1	4,700	Disturbed
BA-4	Type 2, Type 3, Type 6	2,400	0.75	1,800	Disturbed
BA-5	Type 2, Type 3, Type 6	6,100	1	6,100	Disturbed Excessive sloughing of sand
BA-6	Type 6, possibly Type 3	4,000	1	4,000	Disturbed
BA-8	Type 2, Type 3, Type 6	4,900	1	4,900	Disturbed
BA-9	Type 2, Type 3, Type 6	16,400	1	16,400	Likely Disturbed
BA-15	Type 2, Type 3, Type 6	53,000	1	53,000	Disturbed
BA-16	Type 4	4,800	0.5	2,400	Disturbed
BA-17	Type 2, Type 3, Type 6	14,700	0.75	11,000	Disturbed
BA-18	Type 3, Type 5	18,000	0.5	9,000	Disturbed Sloughing and water ingress
BA-20	Type 2, Type 3, Type 6	4,400	0.75	3,300	Disturbed Refusal due to boulders
Secondary Options					
BA-1	Type 2, Type 3, Type 6	12,600	1	12,600	Disturbed
BA-3	Type 2, Type 3, Type 6	17,600	1	17,600	Disturbed
BA-7	Type 5	8,400	1	8,400	Disturbed Excessive sloughing of sand
BA-10	Type 5	15,700	1	15,700	Disturbed
BA-11	Type 2, Type 3, Type 6	34,000	1	34,000	Disturbed Excessive sloughing of sand
BA-12	Type 2, Type 3, Type 6	3,900	1	3,900	Disturbed
BA-13	Type 2, Type 3, Type 6	1,900	1	1,900	Undisturbed
BA-14	Type 2, Type 3, Type 6	2,100	1	2,100	Undisturbed
BA-19	Type 2, Type 3, Type 6	10,000	1	10,000	Disturbed

7.8 Summary

The following summarizes the site access and remediation implementation developed for CAM-C, Matheson Point:

- The remediation activities at CAM-C are anticipated to be completed in one full year with mobilization by barge in the late summer/fall of Season 1 and construction and demobilization in the summer/fall of Season 2.
- Five buried debris lobes (geophysical anomalies) were identified during the 2013 ESA: Airstrip Landfill, Station West Landfill, and Lobes C, D, and E. The buried debris areas requiring regrading represent an approximate total area of 1,900 m^2. WDA's recommended for excavation (Airstrip Landfill only) are estimated to generate an approximated volume of 200 m^3 non-hazardous material, 200 m^3 of Tier I/II contaminated soil, and 10 m^3 of hazardous material.
- A landfarm/treatment area is proposed for the treatment/storage of 570 m^3 of Type B hydrocarbon contaminated soil.
- The priority for contaminated soil excavation is dependent on the disposal or treatment requirements. The priority from high to low is as follows: 1. Type B (requires sufficient time for treatment), 2. Tier I and II and Hazardous Soil (requires suitable container volume).

- Only minor demolition is required at the site: metal tanks, fallen radar tower, POL piping, and concrete foundations remain on site. Metal structures will be cut, crushed, and removed from the site with other non-hazardous debris. Concrete foundations will be addressed in type-specific manners:
  - The elevated Warehouse foundation will be collapsed and regarded.
  - The Garage foundation and the radar foundations will be regarded.
  - The POL foundations will be regraded in place, except where they coincide with the contaminated soil excavations; those foundations in the way of excavation will be crushed and used as deep backfill in contaminated soil excavations. The estimated volume (crushed) of demolition waste is 210 m^3 (non-hazardous).
- A total of 27 surface debris areas were identified to have an estimated crushed volume of 197 m^3 of non-hazardous debris and 4 m^3 of hazardous debris requiring off-site disposal.
- A total of 700 barrels were identified and assessed as surface debris. The barrels were empty and processing is not expected to require a significant effort (disposal volume included in surface debris total).
- Total non-hazardous containerization requirements for off-site disposal are 880 m^3, comprised of:
  - 610 m^3 of crushed non-hazardous waste (surface, demolition, and buried debris).
  - 270 m^3 of non-treatable contaminated soil (includes the 70 m^3 of Tier I/II impacted soil from known sources and 200 m^3 of potential Tier I/II soil from the Airstrip Landfill).
- Total hazardous containerization requirements for off-site disposal are 14 m^3, comprised of:
  - 4 m^3 of hazardous material surface debris.
  - 10 m^3 estimated hazardous material from Airstrip Landfill Excavation.
- A total of 20 borrow sources were identified at CAM-C of which 11 were classified as primary or preferred. The estimated total volume of granular material required for CAM-C remediation construction is 8,500 m^3 while the total volume of borrow material identified from the preferred sites is in excess of 116,000 m^3.
- Borrow materials have low ARD potential.
- Post-construction monitoring will be required for the low or medium risk WDA's left in place on site, as per the AMSRP. The specific monitoring program will be confirmed once remedial activities have been completed.

8. References

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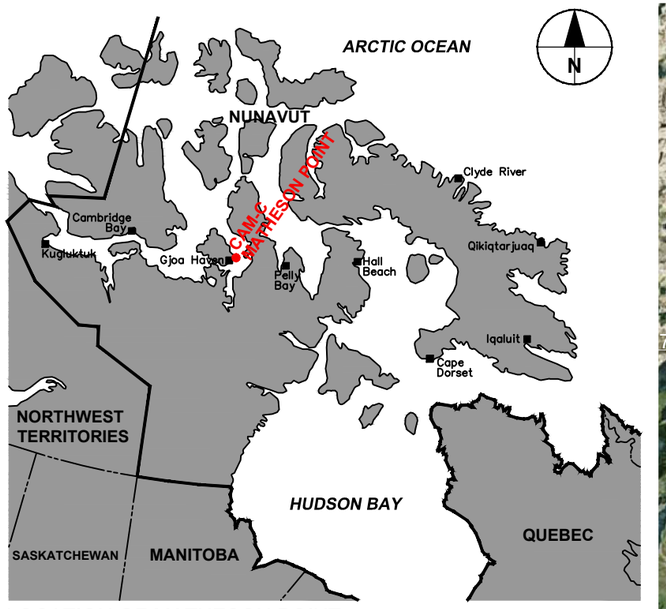
Appendix A

Figures

Project Management Initials: Designer: JK Checked: WK Approved: JM ANSI B 279.4mm x 431.8mm



LOCATION OF MATHESON POINT
WITHIN NUNAVUT TERRITORY

SCALE: N.T.S.

PLAN

IMAGE SOURCE: BING MAPS AERIAL
DATUM: NAD83 (CSRS)
PROJECTION: UTM ZONE 15

0 3750 7500 m

1:150000

Issue Status: FINAL

SITE LOCATION

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

AECOM

Figure: 1

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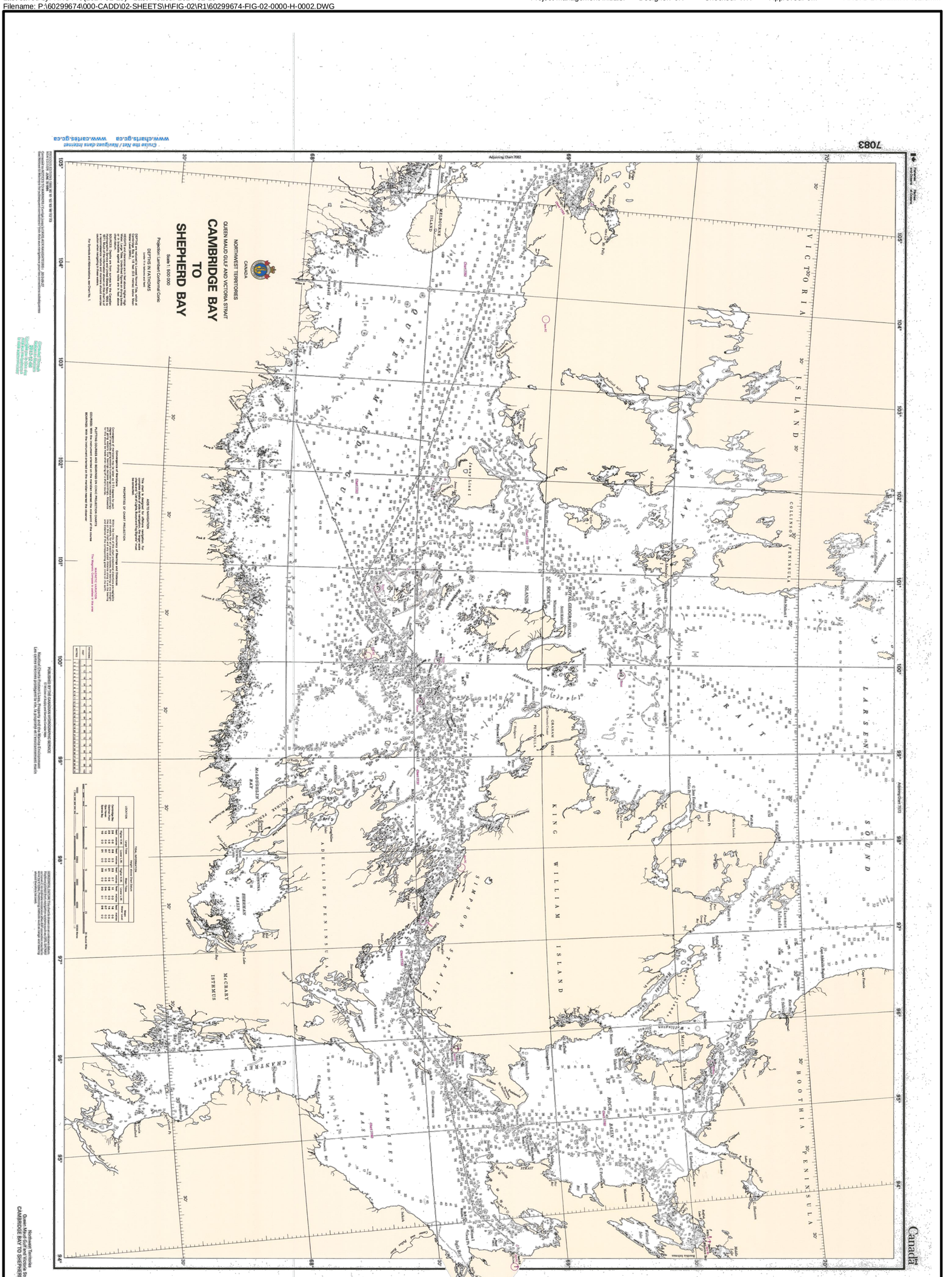


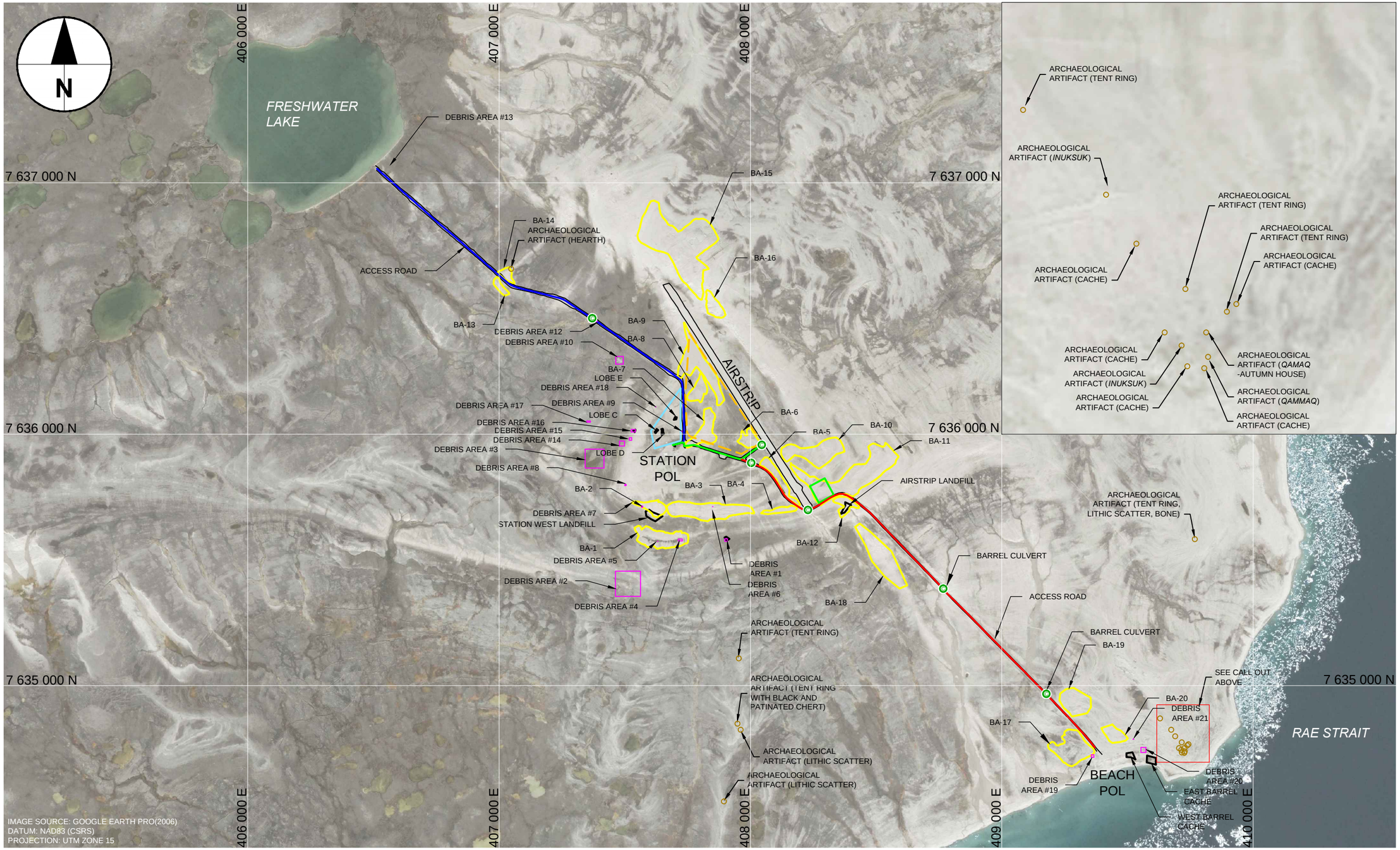
Issue Status: FINAL

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

NAVAGATIONAL MAP

AECOM

Figure: 2



LEGEND

- CULVERT
- ARCHAEOLOGICAL SITE
- BORROW AREA
- DEBRIS AREA
- PROPOSED LANDFILL LOCATION (LF-1)
- PROPOSED CAMP LOCATION (LF-2)
- PROPOSED LANDFARM LOCATION (LF-3)
- ROAD SECTION 1
- ROAD SECTION 2
- ROAD SECTION 3

0 375 750 m

1:15000

Issue Status: FINAL

OVERALL SITE PLAN

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

AECOM
Figure: 3

Project Management Initials: Designer: JK Checked: WK Approved: JM ANSI B 279.4mm x 431.8mm

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N

407 600 E

407 650 E

407 700 E

407 750 E

7 635 950 N

7 635 900 N

STATION PAD DEBRIS AREA

FOUNDATION

ACCESS ROAD

ACCESS ROAD

BORROW AREA 7

TOWER

PROPOSED LANDFILL LOCATION

FOUNDATION

LOBE B

TP13-62

ESG: G3108

TP13-48

TP13-52

TP13-51

ESG: G3107

WESA: C-SS-005

ESG: G3101

TP13-50

TP13-47

TP13-40

TP13-23

WESA: CAM-C-SS-006

TP13-41

AREA=25m²

ESG: G3106

ESG: G3109 (0.15m)

TP13-22 (0.8m)

AREA=25m²

TP13-42

TP13-46

AREA=7m²

TP13-49 (0.3m)

ESG: G3102 (SURFACE)

WESA: CAM-C SS-007

AREA=7m²

TP13-44

TP13-45

TP13-43

TP13-60

TP13-21

WAREHOUSE FOUNDATION

GARAGE FOUNDATION

ESG: G3103

ESG: G3120

ESG: G3119

TP13-61

AREA=25m²

ESG: G3104 (0.15m)

TP13-01

POL LINE

MODULE TRAIN IMPRINT

ESG: G3118

TP13-64

TP13-63

TP13-20

STATION PAD DEBRIS AREA

ESG: G3117

TP13-59

TP13-58 (0.3m)

AREA=20m²

TP13-53 (0.45m)

TP13-54

TP13-02

AREA=7m²

TP13-56

ESG: G3105 (0.15m)

TP13-03

ESG: G3114

SEWAGE OUTFALL LINE

TP13-04

FOUNDATION

TP13-57

ESG: G3115

ESG: G3110

ESG: G3116

DATUM: NAD83 (CSRS)
PROJECTION: UTM ZONE 15

FIGURE 4

KEY MAP
N.T.S

LEGEND

- CLEAN TEST PIT
- PCB IMPACTED
- PHC IMPACTED
- METALS IMPACT
- VALVE
- TIER I PCB EXCEEDANCES
- TYPE B HYDROCARBON PLUMES
- TIER II METALS EXCEEDANCE (COPPER)
- TIER I METALS EXCEEDANCE (LEAD)

0 12.5 25 m

1:500

Issue Status: FINAL

AECOM

Figure: 4

STATION POL CONTAMINATED SOIL AREA

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

N

7 635 850 N

7 635 800 N

407 650 E

407 700 E

407 750 E

TP13-57

ESG: G3115

ESG: G3116

60

WOOD CRIBBING SUPPORT FOR LINE

FOUNDATION

SEWAGE OUTFALL LINE

59

TP13-04

ESG: G3110

POL TANK FOUNDATION

AREA=375m²

PUMPHOUSE FOUNDATION

WESA:CAM-C-SS-004

TP13-09

ESG: G3112

POL LINE

WESA:CAM-C-SS-001

TP13-11

WESA:CAM-C-SS-002

TP13-13 (0.7m)

TP13-10 (0.6-1.24m)

TP13-05

POL TANK FOUNDATION

58

ESG: G3113

WESA:CAM-C-SS-003

TP13-08

ESG: G3111

TP13-07

TP13-06

TP13-12

57

STATION PAD DEBRIS AREA

TP13-19

ESG: O3100

TP13-14

58

TP13-15

FOUNDATION

ESG: O3101

57

BARREL

SEWAGE OUTFALL DRAINAGE AREA

TP13-17

TP13-18

TP13-16

SO1

ESG: O3102

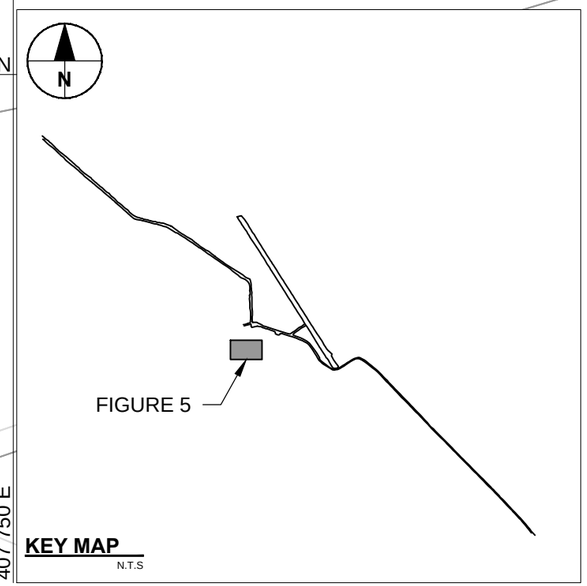
SO2

56

SO3

55

DATUM: NAD83 (CSRS)
PROJECTION: UTM ZONE 15



KEY MAP
N.T.S

LEGEND

- CLEAN TEST PIT
- PHC IMPACTED
- TYPE B HYDROCARBON PLUME

0 12.5 25 m

1:500

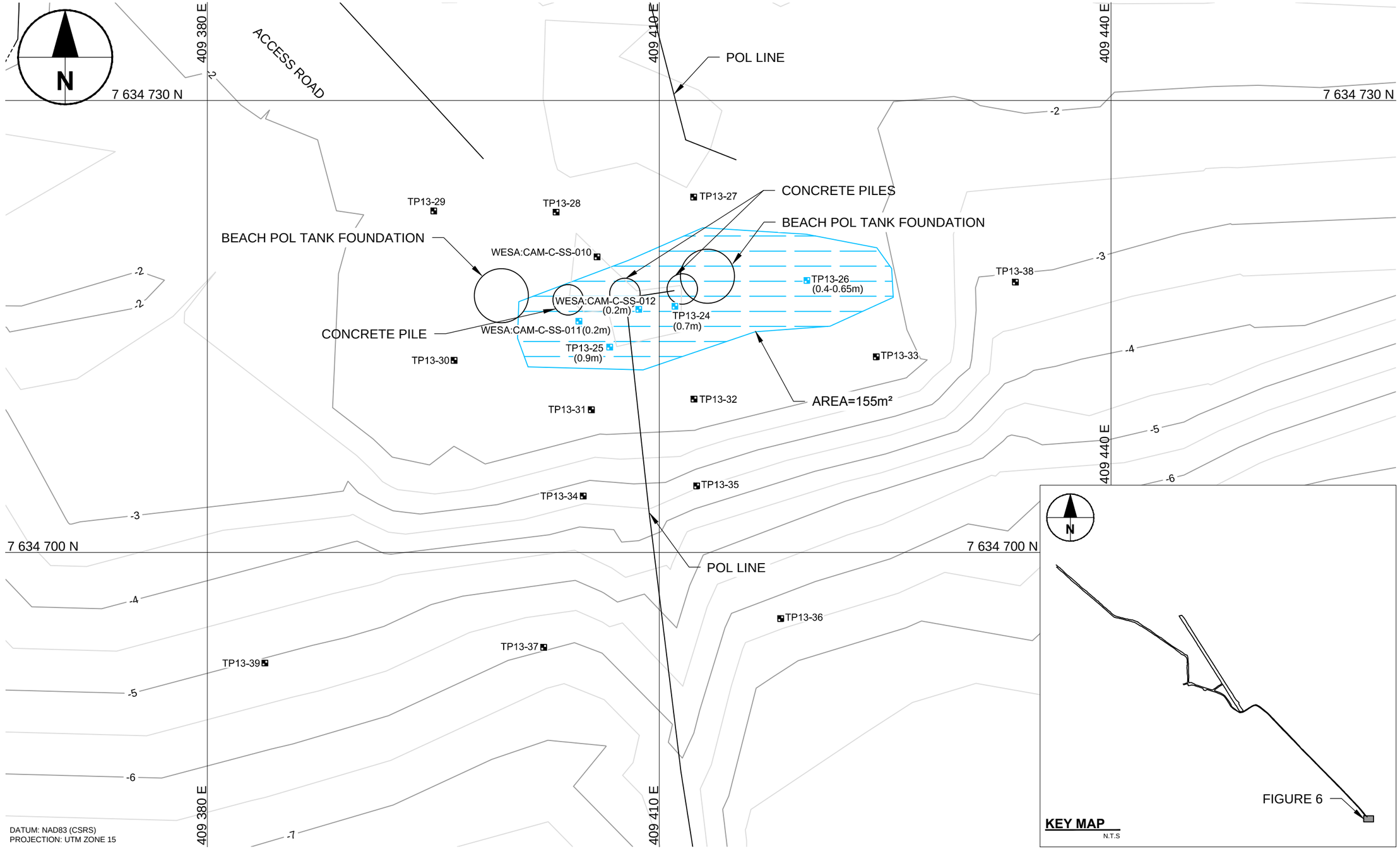
Issue Status: FINAL

AECOM

Figure: 5

STATION AREA POL
CONTAMINATED SOIL AREA

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20



LEGEND

- CLEAN TEST PIT
- PHC IMPACTED
- TYPE B HYDROCARBON PLUME

0 6.25 12.5 m

1:250

Issue Status: FINAL

BEACH SITE
CONTAMINATED SOIL AREA

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

AECOM

Figure: 6

7 636 350 N

407 450 E

407 500 E

407 550 E

7 636 300 N

7 636 250 N

ESG: G3122

ESG: G3123

DEBRIS AREA 10

AREA=71m²

DEBRIS AREA #10 (0.05m)

TP13-65 (0.15m)

68

37

38

ACCESS ROAD

39

39

39

40

DATUM: NAD83 (CSRS)
PROJECTION: UTM ZONE 15

LEGEND

- CLEAN TEST PIT LOCATION
- PCB IMPACTED
- WAYPOINT
- TIER I PCB IMPACT

FIGURE 7

KEY MAP
N.T.S

0 12.5 25 m

1:500

Issue Status: FINAL

AECOM

Figure: 7

DEBRIS AREA 10

CAM-C, MATHESON POINT INTERMEDIATE DEW LINE SITE
REMEDIAL ACTION PLAN
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
Project No.: 60299674 Date: 2014-02-20

Appendix B

Summary of Contaminated Soil Areas

Table B1 - Summary of Contaminated Soil Areas at CAM-C

Location	Figure #	Contaminants	Tier I			Tier II			Type B			Delineation Comments
			Area	Depth	Volume	Area	Depth	Volume	Area	Depth	Volume	
			m^2	m	m^3	m^2	m	m^3	m^2	m	m^3	
Beach POL	9	Type B PHCs							155	1.2	186	Delineated laterally, not vertically. Assumed depth of 1.2 m.
Garage	7	Tier I PCBs	7	0.3	2.1							No delineation. Assumed depth of 0.3 m.
		Tier I Metals (Pb)	7	0.3	2.1							Partial lateral delineation. No depth delineation, assumed depth of 0.3 m.
Warehouse	7	Tier I PCBs (west side)	25	0.3	7.5							Partial lateral delineation. No depth delineation, assumed depth of 0.3 m.
		Tier I PCBs (east side)	25	0.8	20							No delineation. Assumed depth of 0.8 m.
Module Train	7	Type B PHCs				25	0.3	7.5				No delineation. Assumed depth of 0.3 m.
		Tier II Metals (Cu)							20	0.5	10	Partial lateral delineation. Depth delineation.
Station Area POL	8	Type B PHCs							375	1	375	Not delineated. Assumed depth of 1.0 m.
South of Station Pad	7	Tier I PCBs	25	0.3	7.5							No delineation. Assumed depth of 0.3 m.
		Tier I PCBs	7	0.3	2.1							Partial lateral delineation. No depth delineation, assumed depth of 0.3 m.
Debris Area #10	10	Tier I PCBs	71	0.3	21.3							No delineation. Assumed depth of 0.3 m.
Total Volumes (m^3)			**63**			**7.5**			**571**			**641.5**

Appendix C

Summary of Debris and Demolition

Table C-1 - Summary of Surface Debris at CAM-C

Area	Photos	Description	Location	Estimated Areal Extent (m^2)	Estimated Crushed Volume (m^3)	Hazardous Uncrushed Volume Component (m^3)	Comments
Station Area Pad	084, 0.85, 104, 105 107	Weathered pipe wrap, heating oil burner, heat registers, water tank, 2 building train water tanks, 2 500 US gallon diesel tank, I-beams (3), piping, wood, cable, communication cable, metal mesh, weathered formerly painted plywood, metal framing, boiler, metal sheeting, tile, wood	Station Pad - includes: former building train, garage, warehouse and station POL area - includes old building components	31,372	20	1.5	Weathered asbestos
Barrel markers for each end of airstrip	None available	Five barrels each off the north and south end of the airstrip	Each end of airstrip	400 (200 m^2 at each end)	2	n/a	
Debris Area #1	IMG 0701/0702/ 0705	9 empty barrels, cans, 1 gallon cans (20-30), wood, culvert, garage metal mesh, wire	South/Southeast of Station	100	5	n/a	
Debris Area #2	P8010087/8010089/8010093/8010097, IMG 0709/ 0710/ 0715/0720/ 0722, DSCN0082	10 empty barrels, at least 1 battery, 1 gallon cans, machine parts, wood	South of the Station West Landfill	10,000	10	1	Battery debris
Debris Area #3	76	Very scattered, wood, barrel strapping, cable, barrels, metal grating	West of Station Pad at the base of pad near seasonal pond	5,625	3	n/a	Likely this was what was considered the West Landfill
Debris Area #4	IMG 0707	Single piece of pipe	South of Station Area	1	<1	n/a	
Debris Area #5	IMG 0708	Tire	South of Station Area, west of Debris Area #4	0.25	<1	n/a	
Debris Area #6 (Lobe A)	IMG 0713, SAM 1142/1143	Barrel; Shallow buried debris (0.25 mBGS) picked up during geophysical survey (metallic content).	Southwest of Station Area, northeast of Debris Area #4	46.3	2	n/a	Surface debris and shallow buried debris (Lobe A)
Debris Area #7	IMG 0723	Cat tracks	Station Area, west of Debris Area #6	25	2	n/a	
Debris Area #8	IMG 0724	3 sets of cat tracks	West of Station Area	25	3	n/a	
Debris Area #9	IMG 0730	POL valve	North of Station Area	1	1	n/a	
Debris Area #10	SAM 1137/1138	Appears to include parts of the old building train. Very weathered painted plywood, metal cans, 'train' heating fan, metal staircase from tower, metal vents, red compressed CO_2 cylinder, very weather pipe wrap	West of Station Pad	900	3	<0.5	Asbestos-amended tiles and insulation.
Debris Area #11	SAM 1138 (background)	Piece of metal	North of Station Area beside road to Freshwater Lake	1	<1	n/a	
Debris Area #12	SAM 1136	Metal, wood (miscellaneous debris)	Very scattered debris along road to Freshwater Lake	400	1	n/a	
Debris Area #13	SAM 1131/1132	7 empty barrels, wood and floating structure	At Freshwater Lake, west side of road	5,625	2	n/a	
Debris Area #14	SAM 1142, IMG 0707	Metal strapping, some wood along slope	West of Station and Radar Tower	400	1.5	n/a	
Debris Area #15	SAM 1143	Wood strapping and 2 small barrels	West of Station and Radar Tower (north of Debris Area #14)	100	1	n/a	
Debris Area #16	None available	Partly buried wood and metal on slope	West of Station and Radar Tower (north of Debris Area #15)	100	1	n/a	
Debris Area #17	SAM 1144	Snow fencing	Northwest of the Station Area	75	1.5	n/a	
Debris Area #18	SAM 1140/1141	Barrel in drainage path	Northwest of the Station Area	1	<0.5	n/a	
Debris Area #19	IMG 0805	Small barrel cache - 17 barrels and 4 wood pallets	South side of the Beach POL pad -	100	6	n/a	
Debris Area #20	P7310052/53/54	Former storage area - 4 barrels, 2 pallets, sink, stove, furnace, machine parts, hot water tank	Lower portion of East Barrel Cache	400	7	n/a	
Debris Area #21	P7310055	Metal garbage bin	Upper portion of East Barrel Cache	4	2	n/a	
Station West Landfill Surface Debris	DSCN0082, IMG 0709, IMG 0710	Barrels, scrap metal, wood, wire, piece of culvert, batteries	Surface of Station West Landfill	1,558	20	1	Battery debris
Airstrip Landfill Surface Debris	P7310053, P7310062	Barrels, wire, culvert pieces, metal strapping.	Surface and within drainage channel through Airstrip Landfill	-	-	n/a	Included in buried debris volumes
East Barrel Cache	P7310050	Empty barrel cache - approx. 300 barrels	East Barrel Cache adjacent to Beach	10,000	60	n/a	
West Barrel Cache	P7310048	Empty barrel cache - approx. 200 barrels	West Barrel Cache adjacent to Beach	5,625	40	n/a	
		Totals		72,885	197	4	

Table C-2 - CAM-C Demolition Quantities

Structure	Description of Components	Hazardous Material	Non-Haz. (m^3) Crushed Volumes	Hazard. (m^3) Crushed Volumes	Comments
Radar Tower	Painted steel pipe and triangular cross beam construction antenna.	-	165	0	**Uncrushed volume=1,650 m3**
		Total	165	0	
Station Area Pad	Warehouse Concrete floor	-	0	0	**Regrade**
	Garage concrete floor	-	0.0	0	**Regrade**
		Total	0.0	0.0	
Station Area	Tower foundations	-	0	0.0	**Regrade**
	POL foundation		0	0.0	**Regrade**
	Pumphouse foundation		0	0.0	**Regrade. Assumed 0.4 m x 0.4 m x 0.5 m (depth) = 1 m^3.**
	Beacon foundation	-	0.0	0	**Regrade**
		Total	0.0	0.0	
POL Line Pipes and Barrel Markers	POL Lines: 1,260 m in length		25.0	0	**Metal pipe**
	Wood cribbing and barrel markers: approx. 101 barrels		15.0		**Empty barrels; wooden cribbing (if any) will be incinerated**
		Total	40	0	
Culverts Four culverts on site.	Airstrip: 600mm barrel culvert, 28m in length Road Sec. 2: 600mm barrel culvert, 6m long Road Sec. 3: 600mm CSP culvert, 6m long Road Sec. 4: 600mm barrel culvert, 6m long Lobe B: buried culvert	-	4	0	
		Total	4	0	
POL Foundations Located at the beach and at the station.	Beach POL Foundations: Two concrete ring footings 0.6 m wide with outside diameter of 6 m. Three associated concrete piles each 1m x 1m Station POL Foundations: Two concrete ring footings 0.6m wide with outside diameter of 6m.	-	0.0	0	**Foundations and slabs to be left in place and regraded. Beach POL foundations and square slabs will be demo'd and placed in TP13-24. Assumed 13 m3 volume not included in demo volume.**
		Total	0	0	
		Total	209	0	

Table C-3 - Buried Debris Areas and Existing Landfills at CAM-C

	Station West Landfill (formerly called West Landfill)	Airstrip Landfill	Lobe C	Lobe D	Lobe E
Reference Drawing	4	5	3	3	3
Photo Reference	img 0710/0711/P8010077-84	P7310056; 062; 065	DSCN0070/0073	DSCN0065	DSCN0062
Estimated Landfill Extent (m^2)	1,558	672	95	144.5	80.3
Estimated Depth (m)	1.2	1.5	1	1	1
Estimated Volume (m^3)	1,870	1,008	95	144.5	80.3
Estimated Volume of Hazardous Material (m^3)	19	10	0	0	0
Estimated Volume of Non-Hazardous Material (m^3)	374	202	10	15	8
Estimated Volume of Tier II Contaminated Soils (m^3)	187	101	5	7	4
Estimated Volume of Tier I Contaminated Soils (m^3)	187	101	5	7	4
Samples Collected	SLF-1-10	Airstrip LF-1-7	No visual indication of impact.	No visual indication of impact.	No visual indication of impact.
Presence of Contaminants	There may be surface contaminants associated with the battery debris. There was no evidence of contaminant migration from the landfill.	There was no evidence of surface contamination and no evidence of contaminant migration from the landfill.	There was no evidence of surface contamination and no samples were collected.	There was no evidence of surface contamination and no samples were collected.	There was no evidence of surface contamination and no samples were collected.
Presence of Exposed Debris	Exposed debris includes: batteries, barrels, tin cans, wood, pipe, strapping, garage mesh, cable, machine parts, wire.	There were exposed barrels and other metal debris.	None.	None.	There was a piece of metal sticking out of the ground.
Topography	There is a very slight grade on the north side of the landfill (2-3%), with the south face being steeper, approximately 15%.	The landfill is located in a ravine at the south end of the airstrip along the road to the beach. It is a drainage channel that was filled in. Water runs through the landfill and there was ice in the area at the time of the assessment.	The area is flat.	The area is flat.	The area is flat.
Cover Material	Sand and gravel with approximately 75% cover.	Sand and some gravel with approximately 90% cover.	Cover consists of sand and some gravel.	Cover consists of sand and some gravel.	Cover consists of sand and some gravel.
Vegetative Cover	There is no vegetation on the surface of the landfill, only at the toe.	There is minimal vegetation in the area, approximately 5%.	There is minimal vegetation in the area, approximately 5%.	There is minimal vegetation in the area, approximately 5%.	There is minimal vegetation in the area, approximately 5%.
Evidence of Erosion	There is no evidence of water erosion, although there is potential for some wind erosion.	Yes - it is a filled in drainage channel and some of the debris has washed out.	There is minimal evidence of erosion.	There is minimal evidence of erosion.	There is minimal evidence of erosion.
Annual Precipitation	200 mm	200 mm	200 mm	200 mm	200 mm
Distance to Downgradient Waterbodies	There is a small, seasonal drainage channel approximately 75 m to the south.	A drainage channel runs through the landfill.	It is > 200 m to any water bodies.	It is > 200 m to any water bodies.	It is > 200 m to any water bodies.
Distance to Freshwater / Marine Habitat	The marine environment is ~2 km to the south.	It is >2km to the marine environment.	It is >2km to the marine environment.	It is >2km to the marine environment.	It is >2km to the marine environment.
Terrestrial Habitat	There is minimal usage. Evidence of caribou and muskox, but none seen during site visit.	There is minimal usage. Evidence of caribou and muskox, but none seen during site visit.	There is minimal usage. Evidence of caribou and muskox, but none seen during site visit.	There is minimal usage. Evidence of caribou and muskox, but none seen during site visit.	There is minimal usage. Evidence of caribou and muskox, but none seen during site visit.
Land Use	The site is only 30 km from Gjoa Haven. Although there is minimal hunting in the area, based on discussions with the bear monitors/Arctic Rangers, the site is frequently visited.	The site is only 30 km from Gjoa Haven. Although there is minimal hunting in the area, based on discussions with the bear monitors/Arctic Rangers, the site is frequently visited.	The site is only 30 km from Gjoa Haven. Although there is minimal hunting in the area, based on discussions with the bear monitors/Arctic Rangers, the site is frequently visited.	The site is only 30 km from Gjoa Haven. Although there is minimal hunting in the area, based on discussions with the bear monitors/Arctic Rangers, the site is frequently visited.	The site is only 30 km from Gjoa Haven. Although there is minimal hunting in the area, based on discussions with the bear monitors/Arctic Rangers, the site is frequently visited.
Comments	Several batteries were identified on the surface of this landfill.		Debris consists of buried cable spools.	Debris consists of cable spools and barrels.	There was a piece of metal on the surface
WDA Classification	Class C	Class A	Class C	Class C	Class C

Appendix D

Abandoned Military Site Protocol (INAC, 2009) (On DVD)

Appendix E

Thompson and Associates Archaeological Report

FINAL REPORT

ARCHAEOLOGICAL INVENTORY AND ASSESSMENT AT CAM-C, MATHESON POINT, KING WILLIAM ISLAND, KITIKMEOT, NU

Cover Photo: AECOM field crew unloading Summit Air Skyvan at CAM-C airstrip

REPORT PREPARED FOR

AECOM Canada Limited
17007 17 Avenue, Edmonton, AB T5S 1G3

FINAL REPORT ON ARCHAEOLOGICAL INVENTORY AND ASSESSMENT AT CAM-C, MATHESON POINT, KING WILLIAM ISLAND, KITIKMEOT, NU

PROJECT NO.
THC2013-2

REPORT PREPARED BY

Callum Thomson, Sandra Ratch and Jane Sproull Thomson
Thomson Heritage Consultants, Inc.

February 14, 2014
Nunavut Permit: 2013-23A

EXECUTIVE SUMMARY

CAM-C, Matheson Point, is one of a string of radar and communications stations that were built in the 1950s as part of North America's defence against air attack during the Cold War. CAM-C is an intermediate site between the larger DEW Line stations of CAM-2, Gladman Point and CAM-3, Shepherd Bay, and is situated on the northeast coast of King William Island on the Gibson Peninsula between Brands Point and Mount Matheson. The station faces out across Rae Strait towards the Saattuq Peninsula and Boothia Peninsula on the famed Northwest Passage. The station was abandoned in 1963, leaving debris fields from the shore of Rae Strait to the main facility area on the summit of a 70 m high plateau. The purpose of the visit to CAM-C was for AECOM Limited Canada (AECOM) to assess clean up and remediation needs, and for Thomson Heritage Consultants, Inc. (THC) to conduct an archaeological inventory and assessment of mitigation requirements during the AECOM assessment and the planned clean up. The study area between the shore of Rae Strait and the top of Mount Matheson consists largely of old beach terraces left as land rebounded relative to sea level after the last deglaciation, and a 70 m high sandy plateau (Mount Matheson) on which the CAM-C station facilities were built.

The archaeological inventory and assessment began on July 29 and extended over three full days until July 31. The survey and evaluation of mitigation needs was successful in that all of the known areas of previous disturbance at the Station Area and Beach Area and other terrain between and around the station were surveyed, resulting in the recording and assessment of eighteen archaeological or recent cultural sites. Of these, ten sites date to the last few decades, so may not meet the Government of Nunavut definition of an archaeological site, which is defined as containing evidence of human activity that is more than 50 years old. Eight date to the early historic or pre-contact period, including three Palaeoeskimo sites that may date back to the early exploration and settlement of the Canadian Arctic around 4,000 years ago. Avoidance of the recent sites, as well as the archaeological sites, is recommended due to their significance to local Inuit, their contribution to knowledge of traditional land use, and the difficulty in assigning an exact date to their earliest period of use.

It seems likely that all recorded sites can be preserved through avoidance (M. Yetman, 2014, personal communication). However, we recommend that once a final cleanup plan is available, the distribution of archaeological and recent site locations be overlain on the site plans and a final review of mitigation requirements be undertaken by an archaeologist. Meanwhile, this report contains details on the location and contents of all sites found and a tentative evaluation of mitigation needs should project cleanup plans change and any of the sites be at risk of disturbance. The potential for additional sites to be present around CAM-C is considered to be moderate; additional archaeological surveys are recommended in any new project areas.

Recommended Mitigation For Sites Recorded in 2013 at CAM-C, Matheson Point, King William Island, NU			
Borden No.	**Location**	**Nature of Disturbance noted in 2013**	**Recommended Mitigation**
Beach Area			
NeJv-1	On ridge top east of Beach Area	None	Avoidance within 30 m buffer zone
CAM-C 1	On access road to beach	Site features removed from beach access road	None required
CAM-C 2	West of end of beach access road	None	Avoidance within 30 m buffer zone
CAM-C 3	East of end of beach access road	None	Avoidance within 30 m buffer zone
CAM-C 4	Below barrel dump east of access road	None	Avoidance within 30 m buffer zone
CAM-C 5	Below south end of ridge	None	Avoidance within 30 m buffer zone
Station Area			
CAM-C 9	Adjacent to northeast end of airstrip	Minor past disturbance by bulldozer	Avoidance within 30 m buffer zone
Higher Beach Terraces			
NeJv-2	High beach ridge between Station Area and Water Supply Lake	None	Avoidance within 30 m buffer zone
NeJv-3	High beach ridge south of Station Area	None	Avoidance within 30 m buffer zone
NeJv-4	High beach ridge south of Station Area	None	Avoidance within 30 m buffer zone
NeJv-5	High beach ridge south of Station Area	None	Avoidance within 30 m buffer zone
NeJv-6	High beach ridge south of Station Area	None	Avoidance within 30 m buffer zone
NeJv-7	High beach ridge south of Station Area	None	Avoidance within 30 m buffer zone
NeJv-8	High beach ridge north of Beach Area ridge	None	Avoidance within 30 m buffer zone
CAM-C 6	Just west of POL Line, south of Station Area ridge	None	Avoidance within 30 m buffer zone
CAM-C 7	South of Station Area ridge adjacent to small landfill	None	Avoidance within 30 m buffer zone
CAM-C 8	At northwest end of Water Supply Lake access road	None	Avoidance within 30 m buffer zone
CAM-C 10	On flat plain east of beach access road	None	Avoidance within 30 m buffer zone

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1 Introduction

1.1 Proponent's Activities

Aboriginal Affairs and Northern Development Canada (AANDC) has responsibility through the Contaminated Sites Program (CSP) to manage a number of contaminated properties that are no longer maintained by the original occupant. CAM-C, an intermediate radar and communication site along the Distant Early Warning line (DEW Line) on the east side of King William Island, Kitikmeot, Nunavut is one such site, abandoned in 1963. Public Works and Government Services Canada (PWGSC), on behalf of AANDC, contracted AECOM Canada Ltd. (AECOM) to undertake in July-August 2013 an evaluation of remediation and mitigation needs at CAM-C. This involved the deployment of a team of scientists and engineers under the watchful eye of local wildlife monitors to collect samples, evaluate aggregate occurrences, map areas of contamination and undertake other tasks around the facility area. Thomson Heritage Consultants, Inc. (THC) was subcontracted by AECOM to prepare an archaeological inventory and assessment of the project area.

CAM-C is divided into a Beach Area, where materials were landed and stored during construction and operation of the station, and the Station Area, which contained the accommodations, warehouse, communication tower and other buildings and facilities related to the operation of the station. Connecting the two areas was a gravel access road. A second access road was built 1.5 km from the Station Area to a small lake where fresh water was extracted. A third road ran southeast from the Station Area to the coast north of the Beach Area, used as an aggregate source. A POL (Petroleum, Oils and Lubricants) Line ran north from the Beach Area to the Station Area, to carry fuel from holding tanks at the beach (Figure 1-1).

CAM-C is situated between the larger DEW Line stations of CAM-2, Gladman Point and CAM-3, Shepherd Bay (Thomson 2006), on the northeast coast of King William Island on the Gibson Peninsula between Brands Point and Mount Matheson (Figure 1-2). The station was abandoned in 1963, leaving debris fields from the shore of Rae Strait to the main facility area on the summit of a low rise. The purpose of the visit to CAM-C was for AECOM Limited Canada (AECOM) to assess clean up and remediation needs, and for Thomson Heritage Consultants, Inc. (THC) to conduct an archaeological inventory and assessment of mitigation requirements during the AECOM assessment and the planned clean up. The study area between the shore of Rae Strait and the top of Mount Matheson consists largely of old beach terraces left as land rebounded relative to sea level after the last deglaciation, and a 70 m high sandy plateau (Mount Matheson) on which the CAM-C station facilities were built.

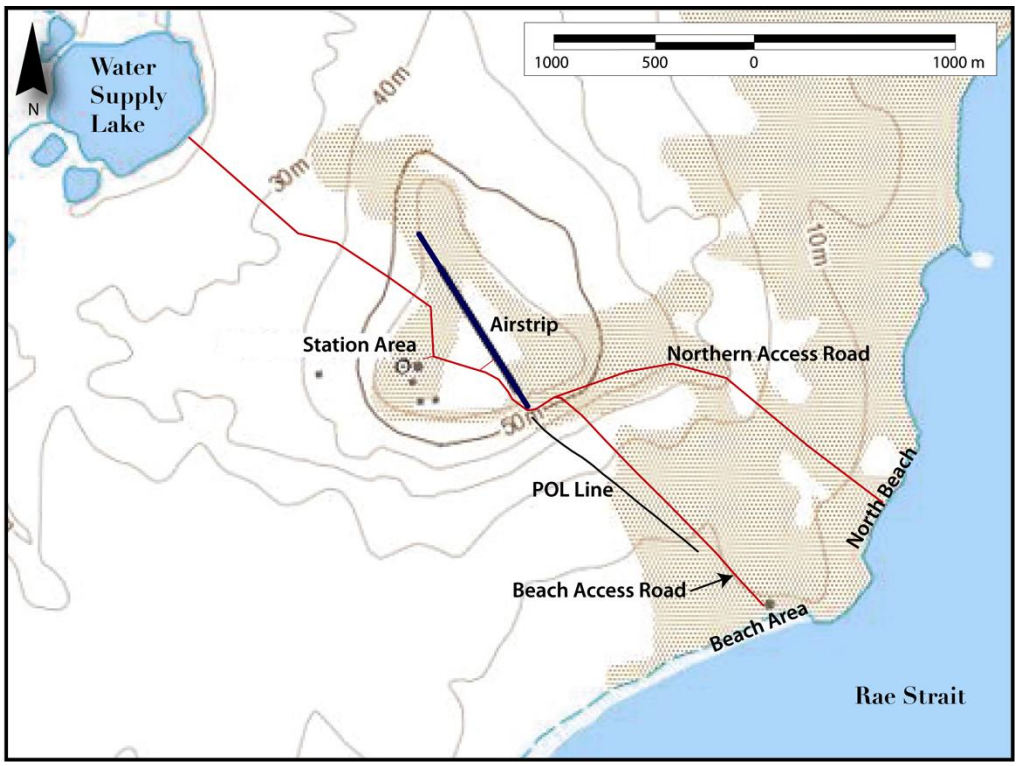


Figure 1-1 CAM-C Project Layout

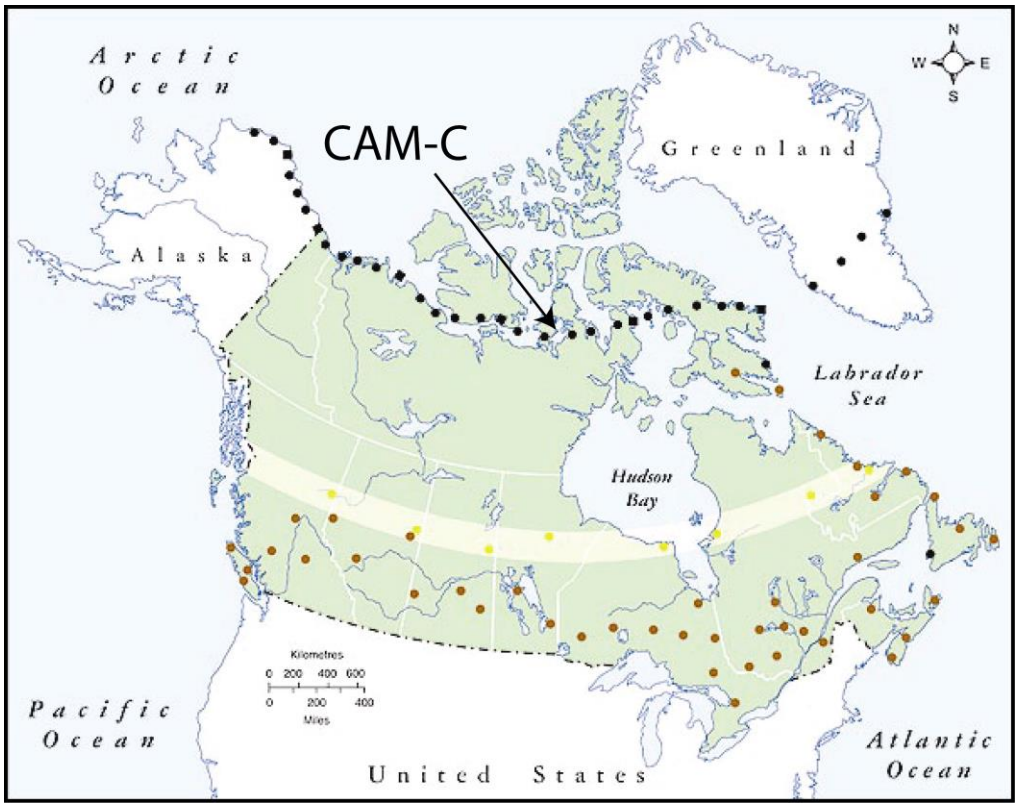


Figure 1-2 Dew Line Sites

1.2 Archaeological Project Activities

Clean up and remediation activities may include the excavation of contaminated soil, collection of fuel lines and barrels, excavation of landfills, clearing of site debris, removal of materials from site, and other tasks in order to transform CAM-C and vicinity to a cleaner and safer state. As no previous archaeological work had been conducted in the project area and the extent and location of contaminated soil and debris areas was incompletely known, archaeological surveys were conducted on foot around the core camp, airstrip, tower, beach landing and landfill areas. This involved the identification, recording, interpretation, mapping, assessment of significance and evaluation of mitigation requirements of all sites encountered.

Table 1-1 CAM-C Facility Areas Inspected for Archaeological/Recent Sites, 2013

Facility	Location	Results (recent historic and archaeological sites)
Station Area and Airstrip	Summit of Mount Matheson (ca. 70 m asl)	1 recent site
Beach Area	1.5 km southeast of south end of airstrip	1 archaeological site 4 recent sites
Water Supply Lake	At northwest end of road from Station Area	1 recent site
Access Roads	To Water Supply Lake, 1.6 km northwest of Station Area; From Station Area-Beach Area, 1.6 km southeast from Station Area to Beach Area west of headland; To North Beach Area aggregate sources 3 km southeast from south end of airstrip, north of Beach Area	1 recent site
POL Line	1.7 km from Beach Area to Station area, roughly parallel to and west of main access road	1 recent site
Adjacent Beach Ridges	Prominent Beach ridges south of Station Area, northwest of Station Area, north of Beach Area, and northeast of Beach Access Road	7 archaeological sites 2 recent sites

1.3 Report Organization

This report is intended to provide AECOM and regulators with details on the distribution and significance of archaeological sites in the project area, measures instituted to ensure the safety of sites encountered during the duration of the archaeological field project, and recommendations for continuing site protection into the future. No archaeological sites were previously known within the project area; however, five recent campsites are shown on the Rae Strait page of the Nunavut Atlas on the Gibson Peninsula, including one at the CAM-C Beach Area (Riewe 1992: 126). Brief summaries are included below of the environmental setting, past and present land use, regional historical notes and previous archaeological investigations (Section 2); the methodology employed in the field (Section 3); the results of the field investigations (Section 4); conclusions including data gaps, potential project effects and mitigation options (Section 5); a summary and recommendations (Section 6); and references and a glossary (Section 7). A copy of archaeological and historic site forms for each site found, a copy of the research permit and a

photo catalogue follow in the appendices. A CD attached to the back cover of the report contains labelled copies of all photographs taken.

2 STUDY AREA

2.1 Environmental Setting

CAM-C (Matheson Point) is located on the Gibson Peninsula, which forms the easternmost extent of King William Island in the Kitikmeot Region of Nunavut (Figure 2-1). Gibson Peninsula faces eastward across 20-km wide Rae Strait to the Saattuq Peninsula, southward to Chantrey Inlet and the mouth of the Back River, and northwards over the St. Roch Basin and James Ross Strait towards Boothia Peninsula. The Gibson Peninsula rises from the sea over a series of parallel beach ridges formed of gravel to a 70-m high sandy summit (Mount Matheson) extending southeast-northwest for approximately 1.25 km. West of the summit, the land drops to elevations below 30 m above sea level (asl) and becomes dotted with numerous ponds. Gjoa Haven, the only community on King William Island, is situated near the southeastern corner of the main body of the island. The Station facilities are located west of the airstrip on a level, sand and gravel plain. The Beach Area facilities are located close to and parallel to the shore of Rae Strait on level terraces. Vegetation in the study area is sparse to non-existent.

Banfield's Mammals of Canada lists many species of terrestrial and marine mammals present in and around the study area. No animals other than a few seals were observed during the course of the archaeological survey. Mammals that would have been and in some cases continue to be exploited for food and other resources by Inuit and, to a lesser extent, explorers in the region include arctic hare, brown lemming, collared lemming, wolf, arctic fox, polar bear, ermine, wolverine, walrus (extra-limital record), bearded seal and ringed seal. No whales are present in the region, no doubt due to the shallow waters, distance from the Beaufort Sea, and risk of being trapped by sea ice, and Banfield does not record the presence of either caribou or muskox (Banfield 1974). In addition to mammals, resources available for food include waterfowl, gulls, birds' eggs, Arctic char, cod, whitefish and clams. Driftwood is plentiful along the shorelines, where it is deposited by currents and ice flow carrying material from Russian and Canadian rivers out of the Arctic Ocean via the many southward-leading channels.

Figure 2-1 Location of CAM-C and Regional Setting

Riewe presents additional information on resources and land use in the Rae Strait section of the Nunavut Atlas. Seals, polar bear and waterfowl are present in the vicinity of Gibson Peninsula and arctic char and lake trout fishing sites are shown to the west. Five recent camp sites are illustrated on the north and east shore of the peninsula, including one in the CAM-C area. Winter travel routes between Gjoa Haven and Spence Bay follow the Gibson Peninsula; fox traps are set along the route. Hunters cross Rae Strait and Rasmussen Basin in winter and summer to hunt caribou on the mainland and seals on ice and in the water; arctic char, lake trout and whitefish are harvested on the Back River and its associated lakes; white-fronted and snow geese are taken in summer by Gjoa Haven hunters at the mouth of the Inglis and Murchison rivers on Shepherd Bay and many other waterfowl spend part of the summer on land around Rasmussen Basin. White whale (beluga) have also been observed and hunted recently in Rasmussen Basin (Riewe 1992: 126, 127, 232-236).

Barren-ground caribou are summer migrants on King William Island, crossing the narrow straits from the mainland over the sea ice. Population numbers dropped drastically with the

introduction of the rifle in the 1930s and 1940s, to the point of cessation of the migration; major Thule archaeological sites are associated with these landing points, suggesting that the migrations were well-known and exploited by at least the Thule over several centuries prior to European contact. Muskoxen are now present on King William Island, suggesting that a local pre-contact population may also have been eliminated during the late historic period, but is now repopulating the island (Dyke and Savelle 2009).

This summary of resources indicates that King William Island and its marine and ice environs has, or has had in the past, a broad variety of food resources available in the form of mammals, birds and fish, which also provided many of the other necessities of life including materials for clothing, boat and tent covers, fuel, tools and utensils.

2.2 Past Land Use

King William Island lies on the transitional zone between the Netsilik Inuit to the east and the Copper Inuit to the west, part of a group known collectively as the Central Eskimos, whose territory extended from Committee Bay to eastern Victoria Island and north to Bellot Strait and whose inhabitants depended largely on caribou, seals and fish (Mathiassen 1927; Balikci 1970). Prehistorically, King William Island and its surrounding waters and ice were on the eastward travel route of the two main migrations across the Canadian Arctic towards Greenland, Quebec and Labrador, beginning with the Palaeoeskimos leaving the Bering Strait area around 4500 years ago (Maxwell 1985; McGhee 1996) and followed at around 1000 A.D. by the Neoeskimos, the ancestors of today's Inuit (Mathiassen 1927). Many archaeological sites have been recorded on the northwest and northeast coasts of King William Island spanning both the Early (Pre-Dorset) and Late (Dorset) Palaeoeskimo phases between about 4500-800 years ago (Dyke and Savelle 2009), and Thule sites (early Neoeskimo) are present along the south coast of the island (Mathiassen 1927).

Dyke and Savelle paint a picture of this region as one of the harshest in the Canadian Arctic, suffering through a dramatic human population crash following the initial occupation between about 4500-3600 BP (BP: years before present), a modest recovery between 3100-2500 BP, and a final recovery of the Palaeoeskimo population during the Late Dorset period until as late as 800 BP. They suggest that this cycle might relate more to overharvesting of limited local resources than climate change during this period (Dyke and Savelle 2009).

Thule populations in the region may have been more successful than their Palaeoeskimo predecessors, with adaptations such as dog teams and larger sleds, large skin boats to assist in camp moves, as well as kayaks, the bow and arrow for more accurate hunting, particularly of land mammals, and metal-working. Their descendants, the Copper and Netsilik Inuit, devised different strategies to help them cope with the diverse environments and fauna and climate/weather, and inhabited areas where they felt comfortable and capable of making a living. Thus, several dozen individual but shifting bands of Copper and Netsilik Inuit, identifying themselves with particular areas and seasonal movements, occupied this region (Balikci 1970; Jenness 1970; McGhee 1972; Bennett and Rowley 2004).

In 1923, Knud Rasmussen spent several weeks on the south coast of King William Island investigating early Thule sites. One site, called Malerualik, meaning "the place where one

follows the caribou", is located at one of the most important crossing sites for caribou travelling between the mainland and the island, and is also adjacent to a good sealing ground and salmon (char) river. The location of the winter houses on beach terraces 15-22 m above sea level and the nature of the artifacts indicated to Rasmussen that this site fell relatively early in the Thule chronology, suggesting initial occupation during the continuing migration of this people from the Bering Strait eastward through the Northwest Passage. Rasmussen's analysis of the type and quality of artifacts recovered suggested to him that people here depended mostly upon caribou for food, skins, and materials for making tools and utensils, *i.e.*, antler and bone, whereas groups further west and east had access to more varied resources including walrus, narwhal and whale, with their richer supply of materials (Mathiassen 1927: 305-327).

2.3 Historical Notes

King William Island has been occupied for more than 4,000 years by Palaeoeskimo, Neoeskimo and Inuit and has been visited or noted by European explorers for almost 180 years. In 1830, James Clark Ross crossed a body of water from Boothia Peninsula to land that he named after reigning British monarch King William IV, although it was not clear at the time that the land was in fact an island. Nine years later, Dease and Simpson noted King William Island from Chantrey Inlet, but were also unaware that it was an island. It wasn't until 1854 that John Rae was able to prove its insular nature (Berton 1988). The following discusses some of the possible derivations of other place names and geographic features in the vicinity of the study area as shown on current topographic maps – Inuit names are not so readily available but might provide more instructive indications of features' actual importance (Figure 2-2).

Rae Strait is named for John Rae, a Scottish doctor hired by the Hudson's Bay Company who made three journeys along the Arctic coast between 1848 and 1851, discovering and reporting the fate of the Franklin Expedition. Matheson Point was named by John Rae during his Arctic travels. Mount Matheson was named after John Rae's Matheson Point by a later explorer. St. Roch Basin, between James Ross and Rae Straits, was named in 1960 after the RCMP vessel that successfully traversed the Northwest Passage in 1941. Rasmussen Basin honours Knud Rasmussen, famed Danish-Greenlandic explorer and ethnographer, who wintered in this area during the Fifth Thule Expedition, 1923-24, and conducted archaeological investigations on the south coast of King William Island. Luigi d'Abruzzi Cape was named for Prince Luigi Amedeo Giuseppe Maria Ferdinando Francesco of Savoy-Aosta, Duke of the Abruzzi (January 29, 1873 - March 18, 1933), an Italian mountaineer and a grandson of King Vittorio Emanuele II of Italy. His polar expedition of 1899-1900 under the leadership of Umberto Cagni reached farthest north and stopped 237 miles short of the Pole. His was the first ascent of Mount Saint Elias in 1897. Schwatka Bay was named for Lieutenant Frederick Schwatka, a U.S. cavalry officer trained in medicine and law who undertook a search expedition for the American Geographical Society and found evidence from the Franklin Expedition on King William Island in 1878. Like Amundsen nearly fifty years later, he adopted the practice of Arctic travel with a small party using Inuit diet, clothing, equipment and techniques. Gjoa Haven was named after Roald Amundsen's ship, *Gjøa*, which was the first vessel to transit the Northwest Passage in one continuous voyage. With a small crew of only six and using Inuit knowledge, Roald Amundsen traversed the passage in a three year journey, finishing in 1906. Chantrey Inlet may be named for devotions completed by relatives back home for the safety and survival of one of the many expeditions that passed through this area at the mouth of the Back River, given the difficult exploration history of the

area. A chantry is an endowment to cover expenses for the saying of masses and prayers, usually for the soul of the founder of the endowment, or an altar or chapel built with such an endowment. Admiral Sir George Back FRS (6 November 1796 – 23 June 1878) was a British naval officer, naturalist and artist who served with John Franklin on three of his expeditions to the Canadian Arctic between 1818 and 1826. The Back Expedition of 1833-34 traversed the Back River and explored Chantrey Inlet. The Inuktitut *saattuq* means *to be thin*, and probably refers to the thin ice around the Saattuq Peninsula on the east side of Rae Strait. No information was found on the derivation of Beads Island, Brands Point, or Gibson Peninsula.

Figure 2-2 Map of Place Names Associated with CAM-C, King William Island

3 METHODOLOGY

The 2013 field survey team consisted of Callum Thomson, principal of Thomson Heritage Consultants, Inc. and permit holder, accompanied on occasion by Jessie Hoyt, PWGSC. The archaeological survey and assessment began on July 29 and extended over three full days until July 31. The AECOM field team, consisting of 11 individuals, was flown daily from our base in Gjoa Haven to CAM-C by a Summit Air Shorts Skyvan, landing on the gravel airstrip atop Mount Matheson and returning the same way. As no quad (ATV) was available, the archaeological survey was conducted entirely on foot, over a 12 km² area measuring approximately 4 x 3 km.

An account of each day's activities as background to how the investigations were conducted was presented in an Interim Report prepared and updated daily in the field and submitted to the AECOM team leader prior to departure from Gjoa Haven on August 1; a revised version was sent to the project manager in Edmonton on August 2 (Thomson 2013). All known project activity areas such as debris areas, borrow areas, storage areas, the station area and the beach area were surveyed. En route to or between some of these areas, numerous beach ridges were also inspected.

Plate 3-1 AECOM field crew unloading Summit Air Skyvan on CAM-C airstrip, King William Island

The terrain between the Station Area and the Beach Area consists largely of old beach ridges, some parallel to the present beach, others curving around former now relict bays, with the access road and a POL Line crossing them from the Station to the beach. Additional surveys were conducted around the Station Area and northwest of the Station to the water supply lake.

Plate 3-2 Aerial view to northeast of CAM-C Beach Area. CAM-C 1 site on ridge at centre top of photo. Beach access road left to right across centre.

4 ARCHAEOLOGICAL AND HISTORIC SITES RECORDED

Ten sites dating to the recent historic period and eight sites from the early historic or pre-contact periods were recorded during the three-day archaeological survey (Figure 4-1). Locations range from the beach area to the upper station area at 70 m asl and on beach ridges between the active beach and the water supply lake, 4 km northwest of the Beach Site. All eighteen sites are described in detail and assessed for mitigation needs below. Site record forms are contained in Appendix 1 and site photographs are contained in the attached CD-ROM.

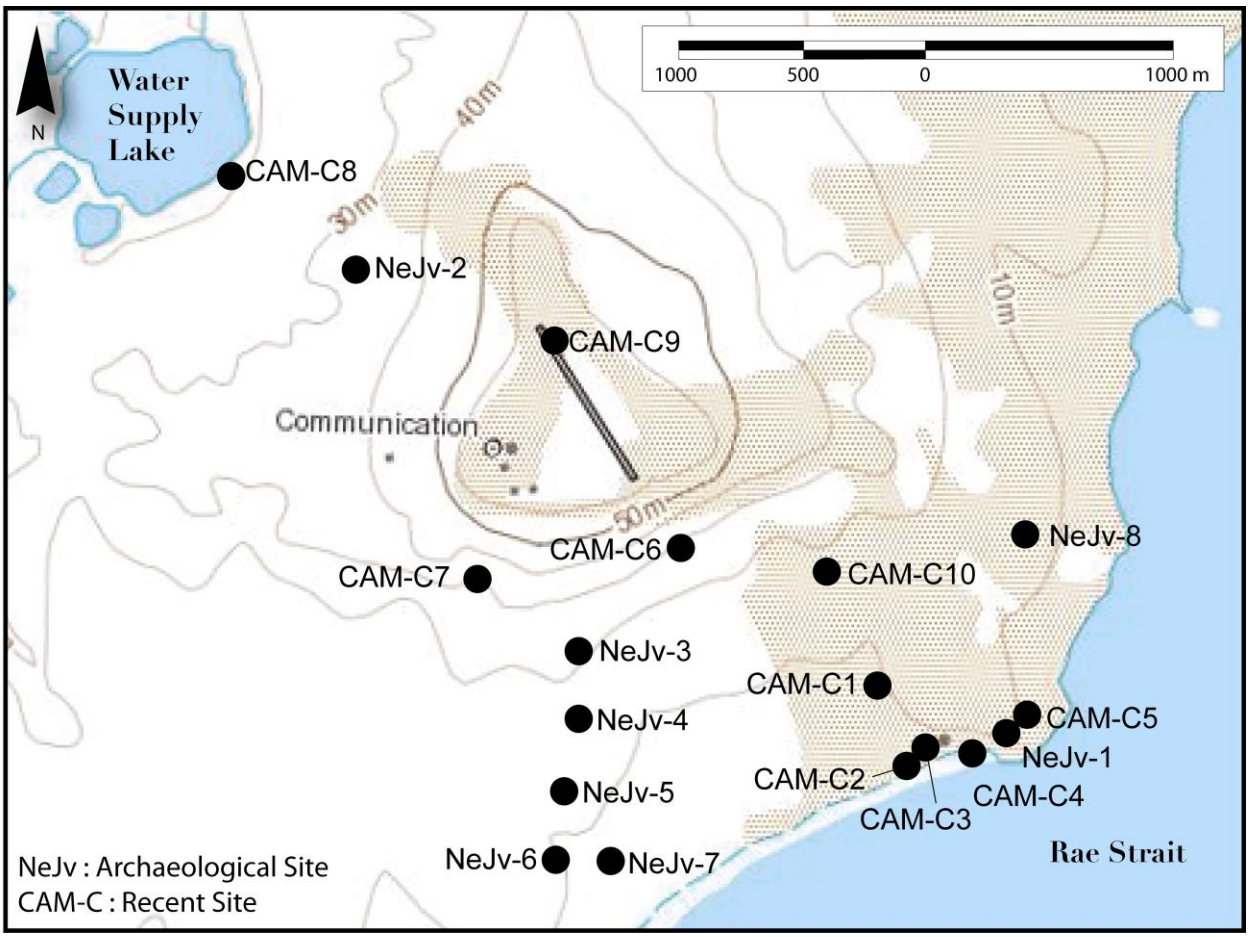


Figure 4-1 Archaeological and Recent Historic Sites Recorded at CAM-C, King William Island, 2013

CAM-C 1

Description

CAM-C 1 was located on the main road from the airstrip/Station Area to the Beach Area and consisted of five small tent rings, some with discarded tea bags still looking quite fresh, so obviously very recent. Each of the tent rings had an outer ring of guy rope rocks as well as the inner tent ring.

Table 1 Feature Data Recorded at CAM-C 1, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	573	Tent ring	409122	7635018	2 x 2	Beach	July 29
2	574	Tent ring	409138	7635006	2 x 2	Beach	July 29
3	575	Tent ring	409159	7634988	2 x 2	Beach	July 29
4	576	Tent ring	409191	7634949	2 x 4	Beach	July 29
5	577	Tent ring	409179	7634962	3 x 2	Beach	July 29

Discussion
Paul Ikuallak later told me that CAM-C 1 was a Ranger camp occupied last October, accessed from Gjoa Haven by quad or snowmobile during a training exercise.

Recommendations
This site was dismantled by one or more of the wildlife monitors some time after it was recorded as it interfered with quad travel on the access road, so no longer exists or requires any further mitigation beyond that already obtained: photographs, site sketches, GPS co-ordinates and description.

CAM-C 2
Description
CAM-C 2 was located about 100 m west of the south end of the Station-Beach access road on a sandy terrace behind the beach. One tent ring was found, containing recent materials such as wooden stakes and a rusted tin can.

Table 2 Feature Data Recorded at CAM-C: 1, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	578	Tent ring	409285	7634642	2 x 3	Beach	July 29

Discussion
Recent sites along this seaward side of Gibson Peninsula, facing out over Rae Strait, are most likely associated with the hunting of seal and/or waterfowl, and were/are most likely occupied by residents of Gjoa Haven. Some may also have been occupied prior to or following a crossing of Rae Strait by sea or over the ice.

Recommendations
This site is unlikely to be affected by any clean up operations, but should be left intact and not disturbed by vehicle traffic.

CAM-C 3
Description
CAM-C 3 was located on a rectangular gravel storage pad, most likely used for the storage of POL (Petroleum, Oils and Lubricants) containers above the beach northeast of the south end of the access road. The site consists of one rectangular tent ring with recent tin cans inside.

Table 3 Feature Data Recorded at CAM-C 3, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	579	Tent ring	409362	7634717	23 x 3.5	Beach	July 29

Discussion
This site may also be associated with hunting or travel on Rae Strait.

Recommendations
This site is unlikely to be affected by testing and clean up operations on the POL pad. The feature should be left intact and not disturbed.

CAM-C 4
Description
CAM-C 4 was located on a terrace below the fuel tank storage pad east of the lower end of the beach access road and extending northeastward about 200 m. Seven tent rings were found, most containing recent materials.

Table 4 Feature Data Recorded at CAM-C 4, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	580	Tent ring	409451	7634687	2.5 x 3	Beach	July 29
2	581	Tent ring	409559	7634719	2 x 3	Beach	July 29
3	582	Tent ring	409596	7634694	2 x 3	Beach	July 29
4	583	Tent ring	409629	7634686	2.5 x 2.5	Beach	July 29
5	584	Tent ring	409637	7634681	4 x 3.5	Beach	July 29
6	585	Tent ring	409648	7634667	2.5 x 2	Beach	July 29
7	586	Tent ring	409656	7634685	2.5 x 2.5	Beach	July 29

Discussion
As with the other recent sites along this shoreline, these camps were most likely occupied for access to resources on Rae Strait and possibly also for travel to or from the communities of Taloyoak or Kugaaruk on Boothia Peninsula and Pelly Bay, respectively.

Recommendations
This site is unlikely to be affected by testing and clean up operations. The habitation features should be left intact and not disturbed.

NeJv-1
Description
THC2013-2:1, attributed the Borden site number NeJv-1 by the Sites Office, Archaeological Survey of Canada, Canadian Museum of Civilization in Gatineau, PQ (L. Johanis 2013, pers. comm.), is a mostly-older site that was found on top of a high ridge between the elevations of about 17-21 m above sea level (asl), above the beach northeast of the end of the beach road. Six boulder features were initially recorded; two recent-looking *inuksuit* apparently used to mark suitable crossing points for an access road between the Beach Area and a series of beach ridges used as aggregate sources to the north were not initially recorded. The top of the ridge is littered with animal bone: caribou, muskox and seal, and some bird bone, much of it covered with lichen or partially overgrown by vegetation and soil. A few rusted tin cans and other recent debris were also found. The site was revisited on two later occasions during which an additional seven

features were recorded; these have been added to the table below. Note that features 11 and 12 are located on either side of the same boulder; inadvertently, no co-ordinates were obtained for #11, which is 1 m north of #12.

Table 5 Archaeological Feature Data Recorded at NeJv-1, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	587	*Qammaq* (autumn house)	409726	7634751	2.5 x 2.5	Beach	July 29
2	588	Tent ring	409715	7634774	3 x 4	Beach	July 29
3	589	Cache	409689	7634798	4 x 3	Beach	July 29
4	590	Tent ring	409629	7634869	1.5 x 2	Beach	July 29
5	591	Tent ring	409737	7634762	1.5 x 2.5	Beach	July 29
6	592	Cache	409742	7634766	3 x 3	Beach	July 29
7	617	*Inuksuk*	409673	7634824	1	Beach	July 30
8	618	*Inuksuk*	409704	7634751	1	Beach	July 30
9	618	*Qammaq*	409727	7634738	3 x 3	Beach	July 30
10	619	Cache	409725	7634732	4 x 4	Beach	July 30
11		Cache			1.5 x 1.5	Beach	July 31
12	636	Cache	409713	7634744	2 x 1.5	Beach	July 31
13	637	Cache	409716	7634733	2 x 2	Beach	July 31

Discussion

This site occupies the highest landform along this part of Gibson Peninsula, rising to about 20 m asl, and has been used as a habitation and hunting site in summer and fall, for storage, most likely of meat, and as a travel route for trucks transporting gravel from an aggregate source to the north to the Beach Area. Faunal materials and the elevated nature of the ridge suggest that it was also used as a hunting lookout place for observation of seals and land mammals. Due to the nature of the ridge – covered in places by boulders – additional features may be present.

Recommendations

This site does not appear to be at risk of disturbance from clean up operations. Vehicles traversing the ridge should stay on the established trail, not disturb any of the archaeological features (which include faunal material and other contents as well as the more visible boulders), and operate outside a 30 m buffer zone around this site.

CAM-C 5

Description

CAM-C 5 is a larger modern site extending for more than 200 m along the first terrace above the beach, at about 10 m asl, from the southeast end of the high ridge described above. The terrace is littered with modern debris. Nine tent rings were recorded; other features may be present.

Table 6 Feature Data Recorded at CAM-C 5, King William Island, Map Sheet 57 B/13E, Zone 15W							
Feature No.	**GPS Record No.**	**Feature Type**	**Easting**	**Northing**	**Size (m)**	**Work Area**	**Date Recorded**
1	593	Tent ring	409755	7634772	2.5 x 3	Beach	July 29
2	594	Tent ring	409779	7634777	2.5 x 2.5	Beach	July 29
3	595	Tent ring	409785	7634779	3 x 3	Beach	July 29
4	596	Tent ring	409807	7634815	2.5 x 2	Beach	July 29
5	597	Tent ring	409825	7634824	2 x 2	Beach	July 29
6	598	Tent ring	409844	7634857	3 x 4	Beach	July 29
7	599	Tent ring	409846	7634900	2.5 x 4	Beach	July 29
8	600	Tent ring	409798	7634915	2.5 x 3	Beach	July 29
9	601	Tent ring	409794	7634924	2.5 x 2.5	Beach	July 29

Discussion
CAM-C 5 is located north of the Beach Area so is not likely to be at risk from cleanup activities. The tent rings are modern and may still be in use periodically by hunters and people travelling across Rae Strait.

Recommendations
This site does not appear to be at risk of disturbance from clean up operations. Vehicles should avoid the site within a 30 m buffer zone around the site perimeter, and not disturb any of the cultural features.

CAM-C 6
Description
CAM-C 6 is a small goose hunting camp consisting of two tent rings, one with a buckshot cartridge inside. The site is located adjacent to the Station-Beach road immediately west of the POL line from the beach to the station area on a 30 m asl terrace with abundant goose droppings.

Table 7 Feature Data Recorded at CAM-C 6, King William Island, Map Sheet 57 B/13E, Zone 15W							
Feature No.	**GPS Record No.**	**Feature Type**	**Easting**	**Northing**	**Size (m)**	**Work Area**	**Date Recorded**
1	602	Tent ring	408368	7635527	2 x 2.5	POL line	July 29
2	603	Tent ring	408355	7635533	2.5 x 2	POL line	July 29

Discussion
This site is located near the POL alignment that runs from the Beach Area to the Station Area, and was used to transport fuel from the bulk tanks at the beach to the station facilities. The fuel line was supported in places by empty or rock-filled barrels.

Recommendations
The tent rings and associated cultural materials should be avoided during removal of the line and clean up of associated debris.

CAM-C 7
Description
CAM-C 7 was reported by DMT Geosciences staff member, Adam Peake, near a small landfill and consists of a circular tent ring on largely undisturbed tundra below the southwest corner of the Station plateau, at an elevation of 30 m asl. The contents, including a battery and several wooden tent stakes, and the location suggest a fairly recent occupation, possibly taking advantage of the shelter offered by the Station ridge.

Table 8 Archaeological Feature Data Recorded at CAM-C 7, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	604	Tent ring	407542	7635401	2 x 2	Station	July 30

Discussion
The tent ring is quite recent so not of archaeological value, but as with many of the similar structures recorded around the Station Area and Beach Area and elsewhere, it may be re-occupied by Inuit from Gjoa Haven or elsewhere so should be left intact if possible.

Recommendations
The tent ring, associated cultural materials, and a buffer zone of 30 m around the feature should be avoided during any soil testing in the vicinity or clean up of the nearby landfill.

CAM-C 8
Description
CAM-C 8 is located at 40 m asl 55 m southeast of the water supply lake, which is 1.5 km northwest of the station. The tent ring is situated directly on the access road so must post-date the station era as the access road to the water supply lake would have been in almost-daily use. One wooden tent stake was noted.

Table 9 Feature Data Recorded at CAM-C 8, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	605	Tent ring	406541	7637037	3 x 3	Station	July 30

Discussion
This tent ring is not at risk of any clean up-related activities. However, there is some potential for the water supply to be used during any prolonged clean up of CAM-C.

Recommendations
The tent ring and associated cultural material should be avoided by any vehicle traffic using the access road to the water supply lake.

NeJv-2
Description
NeJv-2 is an early historic period hearth or foxtrap anchor consisting of flat limestone slabs on a high, undisturbed beach ridge 50 m north of the water supply lake road at approximately 30 m asl. A cut wood stake is present under the limestone slabs; heavy vegetation cover including arctic heather over some of the component slabs indicates an old site.

Table 10 Archaeological Feature Data Recorded at NeJv-2, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	606	Hearth or foxtrap anchor	407048	7636657	1 x1	Station	July 30

Discussion
No lithic materials indicating pre-contact use of this hearth were found in or around the feature or elsewhere on the same beach ridge. The wooden stake possibly indicates re-use of the collapsed hearth in recent times, placement of the stake as a marker for some unknown reason, or most likely as an anchor for a leg-hold foxtrap, no longer present.

Recommendations
This site is not at risk from any clean up operations at CAM-C, but should be avoided and not disturbed by any vehicle traffic.

NeJv-3
Description
NeJv-3 is a circular tent ring on a beach ridge 28 m asl about 500 m west of the north end of the beach access road. The structural rocks are well buried in the sand and vegetation, and no historic materials are associated. A probable hearth is located inside and a gap in the rock alignment may be a possible entrance.

Table 11 Archaeological Feature Data Recorded at NeJv-3 , CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	607	Tent ring	407953	7635108	2 x 2	Beach	July 30

Discussion
This feature may date to the Palaeoeskimo period, judging by the 28 m asl elevation of the beach ridge and the proximity of a Palaeoeskimo site several hundred metres to the south on another beach ridge. However, no chert or other lithic materials typically found in Palaeoeskimo habitation sites were found in association. While the structure is more reminiscent of a Neoeskimo than a Palaeoeskimo tent ring, with a possible entrance on the east side and a hearth structure in the southeast corner, circular and oval tent rings were found in the large Palaeoeskimo sites, including the Pre-Dorset components, at Peel Inlet and Cape Jane Franklin on King William Island (Dyke and Savelle 2009: 379).

Recommendations
This site is not at risk from any clean up operations at CAM-C, but should be avoided and not disturbed by any vehicle traffic.

NeJv-4
Description
NeJv-4 is a Palaeoeskimo site comprising two separate loci. The site is located on the front edge of a long high beach that curves inland around a large relict marine bay, about 250 m west of NeJv-3, at an elevation of 28 m asl. Locus 1 is a rectangular tent ring with a scatter of patinated and black chert inside the structure, which has a central mid-passage aligned north-south. Locus 2, about 30 m southwest of Locus 1 on the same beach ridge, was found by Jessie Hoyt, and consists of a scatter of patinated chert and one piece of grey chert, with no discernible structure associated. One tool fragment was located: the midsection of a patinated chert biface missing both its distal tip and proximal end. A slight indication was noted of side-notching, suggesting use as an endblade.

Table 12 Archaeological Feature Data Recorded at NeJv-4, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Locus No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	608	Tent ring with black and patinated chert	407948	7634848	2 x 2.5	West of Beach Area	July 30
2	609	Lithic scatter	407961	7634824	25 x 5	West of Beach Area	July 30

Plate 4-1 Palaeoeskimo patinated chert endblade fragment, NeJv-4

Discussion

This site most likely dates back to the Pre-Dorset phase of the Palaeoeskimo tradition, which begins about 4500 years ago in the Canadian Arctic. No collections were made; all lithic materials were left in situ pending a potential, more controlled, investigation of the site as part of a more widespread survey. Dyke and Savelle used reservoir-corrected radiocarbon dates from marine shells, whale bones and driftwood to produce a relative sea level curve to date a cluster of Palaeoeskimo sites found in similar beach-ridge locations on the north and northwest coasts of King William Island at 30 m asl between 3500-4500 BP (Dyke and Savelle 2009: 375). These sites contain stone structure types ranging from isolated box hearths to rectangular tent rings with or without midpassages, to midpassages without tent rings, and circular or oval tent rings. All are interpreted as having been occupied at or within a few metres of the active beach. Pre-Dorset sites on King William island were found at as low elevations as 10 m asl, and subsequent Dorset Palaeoeskimo and Neoeskimo sites below that elevation.

Recommendations

NeJv-4 is significant because of its age and the knowledge that Early Palaeoeskimo people (*i.e.*, Pre-Dorset) occupied higher (10-30 m asl) beach ridges in the vicinity of CAM-C, at some distance from the present shoreline, and their successors, the Dorset Palaeoeskimo and Thule Neoeskimo beach ridges below10 m. This indicates that potential exists for disturbance of these and other sites not yet recorded, which are extremely difficult for untrained laypersons to see due to the general absence of robust habitation and other structures and the paucity of preserved

animal bone and other cultural materials. Quads being driven across or along these flat beach ridges could easily displace structural elements and crush the fragile stone tools and flakes, animal bone and wood fragments which could help with dating and interpretation of seasonality and function. It is recommended that all beach ridges between about 5-40 m asl, which may contain Palaeoeskimo sites, be avoided by vehicular traffic. In the event of discovery of additional sites, under no circumstances should any lithic or organic materials be collected or moved or structural rocks moved.

NeJv-5

Description

NeJv-5 is another Palaeoeskimo scatter of patinated chert found by Jessie Hoyt on the front edge of a long high beach ridge that curves inland around a large relict marine bay at about 12 m asl. No structures were identified; several locations were noted where flat limestone slabs occurred but could not be interpreted as elements within a dwelling structure.

Table 13 Archaeological Feature Data Recorded at NeJv-5, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	610	Lithic scatter	407894	7634539	20 x 10	West of Beach Area	July 30

Discussion

This site has potential to be quite informative given the relatively large number of lithic fragments, none of which were identified as tools or tool fragments in a cursory inspection, and the possibility of interpreting the limestone slabs as parts of a habitation structure using precise mapping techniques.

Recommendations

As with NeJv-4, NeJv-5 is significant because of its apparent age and the knowledge that Palaeoeskimo people occupied higher (10-30 m asl) beach ridges in the vicinity of CAM-C, at some distance from the present shoreline. This indicates that potential exists for disturbance of these sites, which are extremely difficult for untrained laypersons to see due to the general absence of robust habitation and other structures and the paucity of preserved animal bone and other cultural materials. Quads being driven over or along these flat beach ridges could easily displace structural elements and crush fragile stone tools and flakes and organic materials. It is recommended that all Palaeoeskimo sites around CAM-C and beach ridges between about 5-40 m asl, including NeJv-5, be avoided by vehicular traffic. In the event of discovery of additional sites, under no circumstances should any lithic or organic materials be collected or moved or structural rocks moved.

NeJv-6

Description

NeJv-6 is a large boulder meat cache on a terrace near the Palaeoeskimo beach ridges, at approximately 15 m asl and 1.4 km from the shore of Rae Strait, probably dating to the Thule period.

Table 14 Archaeological Feature Data Recorded at NeJv-6, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	611	Cache	407860	7634261	1.5 x 2	West of Beach Area	July 30

Discussion

The location of this cache, probably built to contain surplus seal meat for winter use, so far from the sea might indicate that it was built early in the Neoeskimo period or that it was built where suitable construction materials were present. Rather than hauling rocks to where the seals were brought ashore, the seals could more easily be dragged by dogsled to where the cache was built.

Recommendations

This site should not be at any risk from clean up operations, and should be avoided.

NeJv-7

Description

NeJv-7 is located on a lower beach terrace 9-11 m asl approximately 800 m from the shore and consists of three recent tent rings and an older meat cache, possibly dating to the Thule period given its degree of lichen cover and surrounding vegetation and the distance of the beach ridge from the present shoreline**.**

Table 15 Archaeological Feature Data Recorded at NeJv-7, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	612	Tent ring	408033	7634240	2.5 x 3	West of Beach Area	July 30
2	613	Cache	408046	7634213	4 x 4	West of Beach Area	July 30
3	614	Tent ring	408098	7634262	3 x 3	West of Beach Area	July 30
4	615	Tent ring	408126	7634293	4 x 3	West of Beach Area	July 30

Discussion
The cache is built on a high point on the beach ridge so is prominently visible from a long distance. The tent rings contain recent materials such as a 6″ nail, tin cans, wire and wood, so possibly post-date the original construction and use of the tent rings, and certainly that of the cache.

Recommendations
This site does not appear to be at any risk from cleanup activities, and should be avoided.

CAM-C 9
Description
CAM-C 9 is a large tent ring site located on top of the Station Area plateau immediately east of the airstrip near its north end, at an elevation of about 64 m asl. The site was recorded after Adam Peake reported seeing a possible grave beside the runway. The "cross" interpreted by Adam as a grave marker is more likely to be a T-shaped wooden sign with the cross piece nailed to the upright, possibly originally displaying the name of the person or family who occupied a large rectangular tent adjacent to the sign, as interpreted from the rock and gravel used to hold down the bottom of the tent walls. Additional features associated included a ring of larger rocks used to anchor guy ropes, a paved entrance to the tent area and a raised, walled bed of soil that may have been used as a garden for local flora. An additional eleven smaller tent rings were also recorded in the vicinity, on the east side of the runway, southeast of the larger tent ring.

Table 16 Feature Data Recorded at CAM-C 9, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	621	Tent ring	407848	7636399	5 x 5	Station	July 31
2	622	Tent ring	407831	7636379	3 x 4	Station	July 31
3	623	Tent ring	407827	7636370	3 x 3	Station	July 31
4	624	Tent ring	407837	7636375	3 x3	Station	July 31
5	625	Tent ring	407837	7636367	3 x 3	Station	July 31
6	626	Tent ring	407850	7636365	4 x 4	Station	July 31
7	627	Tent ring	407853	7636355	3 x 3	Station	July 31
8	628	Tent ring	407846	7636355	4 x 4	Station	July 31
9	629	Tent ring	407849	7636361	4 x 4	Station	July 31
10	630	Tent ring	407861	7636352	3.5 x 3	Station	July 31
11	631	Tent ring	407867	7636359	3 x 3	Station	July 31
12	632	Tent ring	407863	7636340	3 x 3	Station	July 31

Plate 4-2 Tent ring, Feature 12, CAM-C 9, view south to Skyvan on airstrip

Discussion

The features are all contained within the eastern margin of the airstrip and a parallel alignment of boulders possibly cleared from the vicinity of the airstrip to provide a level apron or winter alternate runway. If so, it is possible that the features all post-date the abandonment of CAM-C in 1963. To counter this, at least one of the tent rings has been disturbed by bulldozer cuts, suggesting that they may pre-date the use of CAM-C, the tent ring boulders are mostly well-seated in the soil rather than perched on top as in recent structures, and no historic materials were found in association, all suggesting some antiquity beyond the CAM-C period. The site, on top of the ridge, provides a good viewpoint to the north and east. CAM-C 9 has been recorded as a recent historic site based on interpretation of the age of F-1. The other 11 tent rings may be older, as discussed above, in which case the site should more accurately be described as archaeological rather than recent in nature, or may have been occupied by Inuit visiting or working at CAM-C.

Recommendations

This site should not be affected by clean up operations. Its location adjacent to the airstrip should be protected from any potential use as a laydown and storage area during the clean up. The question on the age of occupation could be addressed by consultation with residents of Gjoa Haven who may have worked at CAM-C.

CAM-C 10

Description

CAM-C 10 consists of a recent alignment of rocks, most likely a disturbed tent ring, and a hearth containing some broken bottle or jar glass. The site is located on a flat, vegetated plain at 18 m asl on the east side of the beach access road.

Table 17 Feature Data Recorded at CAM-C 10, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	634	Tent ring, hearth	408961	7635431	2 x 2	Beach	July 31

Discussion

The site's location does not give any ready information on why it is located there, other than the presence of a small trickle of water nearby.

Recommendations

This site does not appear to be at any risk from clean up operations and should be avoided.

NeJv-8

Description

NeJv-8 is another Palaeoeskimo tent ring with associated patinated chert found on a beach terrace approximately 1 km east of the beach access road, just east of a secondary, northernmost access road from the Station Area to an area used for aggregate extraction, at an elevation of 18 m asl. En route from CAM-C 9 to CAM-C 1 on the ridge above the landing beach, a prominent beach terrace was noted that was similar in characteristics and elevation to those on which we had previously found several Palaeoeskimo sites. The survey route was diverted to inspect part of the beach ridge. This site contains a tent ring built largely of now badly eroding flat limestone slabs in a rectangular shape with an apparent midpassage. Several fragments of patinated chert and a large piece of green chert were present inside the structure and old sea mammal bone was scattered inside and outside the structure.

Table 18 Archaeological Feature Data Recorded at NeJv-8, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	635	Tent ring, lithic scatter, bone	409767	7635582	2.5 x 2.5	Beach	July 31

Plate 4-3 Patinated chert flakes, NeJv-8

Discussion

The terrace curves around what was likely an old marine bay several thousand years ago when this beach ridge would have been at or near sea level. Other similar sites may well be present on this beach ridge and adjacent ones upslope and downslope from this approximately 15 m asl elevation, running northwards to Matheson Point and the northern tip of Gibson Peninsula on St. Roch Basin.

Recommendations

As with NeJv-4 and NeJv-5, JeNv-8 is significant because of its apparent age and the knowledge that Palaeoeskimo people occupied higher (10-30 m asl) beach ridges in the vicinity of CAM-C, at some distance from the present shoreline. This indicates that potential exists for disturbance of these sites, which are extremely difficult for untrained laypersons to see due to the general absence of robust habitation and other structures and the paucity of preserved animal bone and other cultural materials. Quads being driven over or along these flat beach ridges could easily displace structural elements and crush the fragile stone tools and flakes and organic materials. It is recommended that all Palaeoeskimo sites around CAM-C and beach ridges between about 5-40 m asl, including NeJv-8, be avoided by vehicular traffic. In the event of discovery of additional sites, under no circumstances should any lithic or organic materials be collected or moved or structural rocks moved.

Summary of Archaeological Site Findings
Eighteen sites were found during the three full days at CAM-C: ten recent sites most likely all post-dating the closure of CAM-C in 1963 and thus not considered to be or at least not proven to be archaeological sites (*i.e.*, more than 50 years old), and eight other sites with at least one feature dating to prior to the construction of CAM-C in the 1950s and thus more than 50 years old and therefore classified as archaeological sites. Of these, three are from the Palaeoeskimo period that dates from 4500-800 years ago in this area, and the other five are from the Thule period or early Inuit period. None of the sites appears to have been disturbed by any site activities other than CAM-C 9, where one tent ring may have been truncated by a bulldozer; however, the extent of site disturbance around the Station and Beach areas, particularly in the seemingly endless search by bulldozer for suitable aggregate sources by Station employees, most likely destroyed some sites.

Recommendations for preservation of the ten recent sites has been included for reasons stated previously: precise dating of the original occupation of the sites is impossible and thus some of those judged to be less than 50 years old (the Nunavut Government definition of an archaeological site is one that contains evidence of human activity more than 50 years old) may well have been occupied prior to 1963; some sites may be in active use and thus their disturbance might be viewed by Inuit as disrespectful; and all habitation sites contribute to knowledge of Inuit land use in the region. Thus, as long as there are no plans for clean up operations or other activities that may result in site disturbance, our recommendation is to avoid all of the recent sites as well as the archaeological sites.

Additional Inuit sites are no doubt present both north of the Beach Area towards Matheson Point and southwest of the Beach Area towards the deep bay and Luigi d'Abruzzi Cape, as well as on beach ridges between 5-40 m asl, and in the interior. The Gibson Peninsula appears to have been a location favoured by Inuit and their Palaeoeskimo and Neoeskimo predecessors, and continues to be used for hunting and as a crossing point on Rae Strait.

5. CONCLUSIONS

5.1 Introduction

The CAM-C radar and communication site was occupied from the late 1950s until 1963, when it was abandoned. Debris fields, small landfills and isolated surface debris are present throughout the site area, along with a 750 m long airstrip, formal access roads, informal trails, aggregate extraction areas and contaminated soil. Prior to the occupation of Mount Matheson and the adjacent area, Palaeoeskimo, Thule and Inuit used this land and the adjacent sea and sea ice for travel, hunting, trapping, fishing and gathering. Habitation sites such as tent rings and fall *qammat* and their contents and meat caches relate part of the story of this land use, which continues today with Inuit from the settled communities of Gjoa Haven and elsewhere travelling, camping and exploiting the resources around CAM-C (Figure 5-1).

CAM-C is in the early stages of clean up and remediation. It can be expected that this will involve relatively small scale terrain disturbance (compared to the much larger full DEW Line sites, which were occupied for much longer by many times the number of people present at

CAM-C) in the form of excavation, aggregate extraction, activities associated with demolition and removal of built and buried materials, removal of surface debris, vehicle traffic, and construction of a work camp and storage areas. All of these activities have the potential to disturb known and any currently unknown archaeological and recent historic sites, without appropriate mitigation.

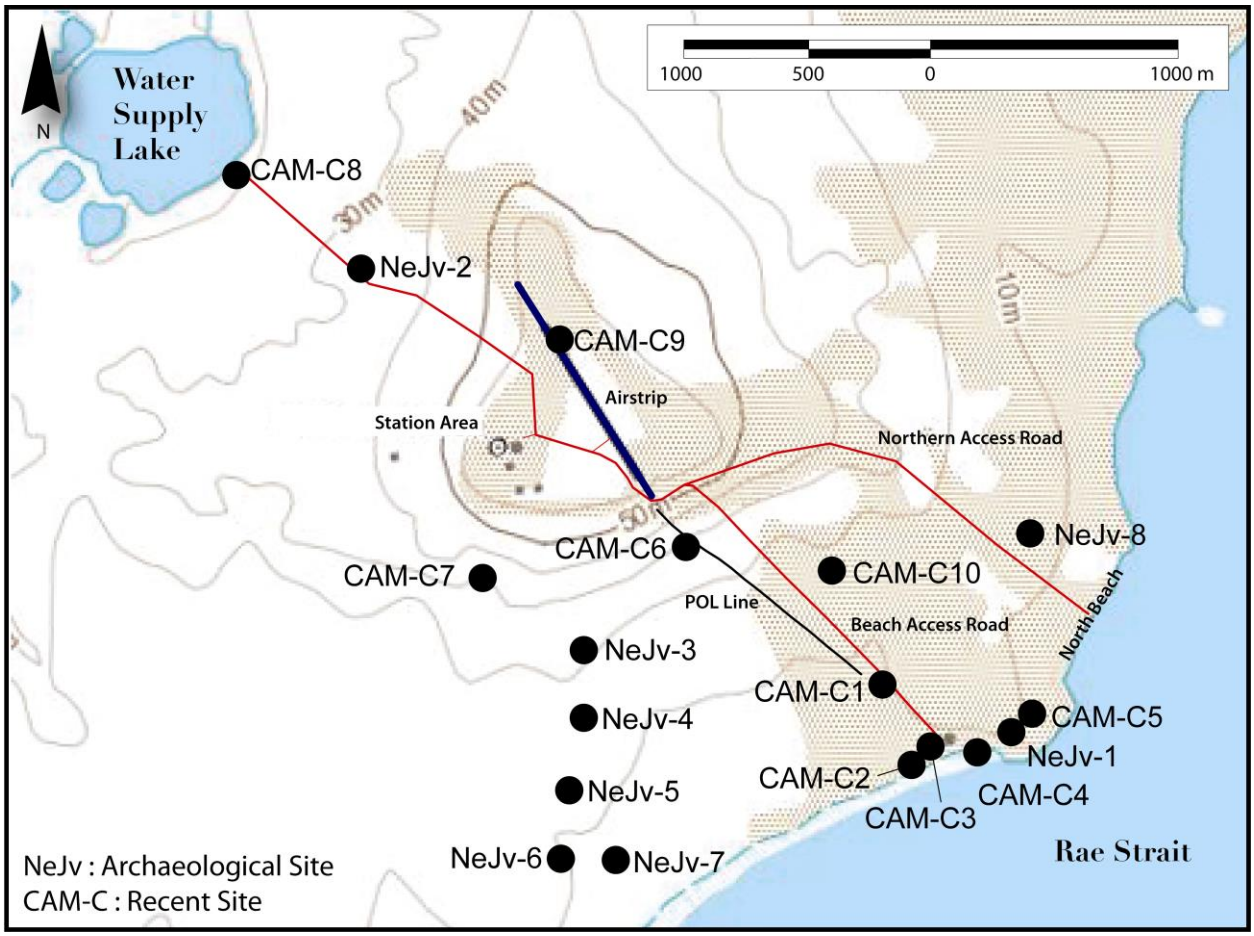


Figure 5-1 CAM-C Facilities and Archaeological/Historic Sites

5.2 Data Gaps

Ideally, archaeological baseline surveys should focus on a wide variety of landforms and environmental zones to understand past human site location preferences and needs. The surveys conducted at CAM-C over three days attempted to include this diversity, as well as visiting all known areas of previous disturbance and planned scientific and engineering investigations and a selection of areas judged to be of high archaeological potential.

Although 18 separate sites were recorded, including 64 individual structures, some sites may contain additional features that were not immediately apparent, some may contain lithic material that was not noted, and some areas not inspected may contain archaeological or recent sites and materials.

5.3 Site Prediction

The most likely areas where additional precontact sites may be present are the beach ridges between about 5-40 m above sea level that for the most part parallel the present shoreline and would have been occupied during the Palaeoeskimo (both Pre-Dorset and Dorset) and early Neoeskimo periods, when sea level was higher than present relative to land elevation. The sites, as many Inuit habitation sites are today, primarily would have been adjacent to the then active shoreline for ready access to the resources of sea and ice, although if land mammals such as caribou, muskox and arctic fox were available on the island during this period they and fish in the numerous streams and lakes would have been exploited also, with associated camps, caches, hunting blinds, traps and other features located further inland. Inuit sites dating from the last few decades right up to the present were found in a wide range of environments and locations, with many close to the present shoreline but others as far as 2-3.5 km distant and some at relatively high elevation. This inconsistency perhaps reflects the broader spectrum of adaptations and resource gathering techniques developed during the Neoeskimo period and passed on to the present-day Inuit of Gjoa Haven and other central arctic communities nearby.

5.4 Heritage Resources Values

All archaeological sites are unique and provide some information on human use and occupation of the environment of which they are a part. Archaeological sites are protected under Government of Nunavut and Federal legislation; sites and their contents must not be disturbed except under the terms and provisions of a permit issued by the Nunavut Department of Culture and Heritage following the submission of a mitigation plan and review of the permit application by affected local communities and agencies. Sites dating to the past 50 years are not considered to be archaeological sites so do not normally have the same status; however, out of respect for the people who left the remains and in some cases may return to use them again, if possible they should not be disturbed unless absolutely necessary. The relatively large number of sites found in the study area, including many quite distant from the marine shoreline as well as the expected proliferation along the coast, is a finding that could influence decisions by proponents and regulatory agencies on the necessity for archaeological inventories and assessments in similar environments and in the early stages of development or other project activity.

The archaeological sites found, particularly those from the Palaeoeskimo period, help to illustrate the passage taken by the first people to enter Arctic Canada from the Bering Strait area about 4500 years ago, travelling through what is now known as the Northwest Passage, or at least through one of its alternate avenues. The subsequent migration of Thule Neoeskimos about 1000 years ago followed much the same route. In both cases, groups had the option to remain in a particular region where they found adequate resources and an environment in which they felt comfortable rather than pressing on eastward (the possible impetus for these migrations is still under debate but may include population pressure, climate change, search for exotic resources such as copper and other stimuli). By about 4000 years ago, Pre-Dorset people had reached northern Labrador and spread down the coast into Newfoundland, meeting First Nations Maritime Archaic populations. A new migration of Dorset Palaeoskimos entered Labrador and Nunavik about 2500 B.P., and survived in both areas until about 600 B.P., when the Thule ancestors of today's Inuit arrived from Baffin Island and possibly assimilated teh last of the Dorset (Fitzhugh 1980: Plumet and Badgley 1980; Thomson 1988). King William Island was periodically occupied by both the Pre-Dorset and Dorset Palaeoeskimos between at least 4000-

800 years ago (Dyke and Savelle 2009). In historic times, the traditional lands of the Copper Inuit to the west and the Netsilik Inuit to the east overlapped at King William Island and both groups exploited its resources.

Of the 18 sites recorded during the CAM-C survey, 10 were judged on the basis of preliminary examination to be of low significance, three of medium significance, and five of high significance (Table 5-1). However, as mentioned above, while some sites are considered significant because of the number of features, the age, or some other attribute, each site is significant in that it contributes either individually or in combination with other nearby or similar sites to an increase in knowledge of land use in the immediate area and the broader region around it.

Table 5-1 Site Significance, Sites Recorded in 2013 at CAM-C, Matheson Point, King William Island, NU

Borden or Site No.	Location	No. of Features	Significance		
			High	Medium	Low
Archaeological Sites					
NeJv-1		13	√		
NeJv-2		1			√
NeJv-3		1	√		
NeJv-4		2	√		
NeJv-5		1		√	
NeJv-6		1			√
NeJv-7		4			√
NeJv-8		1	√		
Recent Historic Sites					
CAM-C1		5			√
CAM-C2		1			√
CAM-C3		1			√
CAM-C4		7		√	
CAM-C5		9		√	
CAM-C6		2			√
CAM-C7		1			√
CAM-C8		1			√
CAM-C9		12	√		
CAM-C10		1			√
Totals		**64**	**5**	**3**	**10**

5.5 Potential Project Effects

With the exception of Thule and Dorset Palaeoeskimo winter villages, often re-occupied over several generations and thus accumulating large deposits of organically-rich artifacts and food waste which nourish soil and sod development, archaeological sites in the Canadian Arctic occur primarily on the surface, in immediate subsurface soil deposits, or below vegetation cover. In the event that sites are present on or in the near vicinity of areas undergoing environmental testing or where clean up will be required they could be affected by:

- their relative invisibility to the untrained eye, as with the Palaeoeskimo sites on the higher beach ridges, and likelihood of inadvertent disturbance;
- concealment by soil or vegetation;

- soil testing during site evaluation;
- aggregate testing;
- aggregate extraction;
- clearing of surface and subsurface debris;
- remediation;
- disturbance by vehicle traffic, including pressure through snow cover;
- construction and use of site clean up camp and storage areas; and
- other related activities

The effects of project activities on archaeological and historic resources are normally predictable, given accurate project description details and adequate time and resources for an archaeological investigation of project areas. Nunavut regulations prohibit the disturbance of archaeological resources. Most potential project effects can be mitigated by avoidance or, when this is not practicable, by collaboration between project managers and the archaeologist at the planning stage, with approval by the regulator.

5.6 Mitigation Options

Impact management options are available which will minimize risk to known heritage resources. Territorial land use regulations include requirements for land use permittees, which prohibit land use operations within 30 m of a known or suspected archaeological site. Should project plans change, and archaeological or recent land use sites become subject to risk of disturbance, mitigation options at CAM-C could include, subject to approval from Nunavut Department of Culture and Heritage:

- avoidance of known archaeological and recent historic sites and, ideally, a buffer zone of at least 30 m around them, during clean up operations;
- prohibition of vehicle traffic in or within 30 m of heritage resource sites;
- placement of barriers around sites to more clearly identify them;
- hand collection of any CAM-C related surface debris associated with archaeological sites;
- development of a specific mitigation plan in the event that surface or subsurface debris must be collected within an archaeological site.

There are eighteen recorded archaeological and recent historic sites in the vicinity of CAM-C; others may be present in areas not visited during the 2013 archaeological survey. Each requires some form of mitigation to help in preservation (Table 5.2). More detailed mitigation recommendations are presented in the summary and recommendations section (Section 6) below. If none of these strategies apply, a site specific mitigation plan can be developed in collaboration with the regulator and local authorities which could permit the partial or complete destruction of a heritage resource at risk. This would include complete and detailed documentation of the resource.

Table 5-2 Summary Recommendations for Site Facility Areas and Related Archaeological or Recent Historic Sites			
Facility	**Location**	**Results**	**Recommendations**
Beach Area: POL pad, tank farm pad, access road, trails, surface and buried debris, barrel dumps, POL line, contaminated soil	1.5 km southeast of Station at end of access road	1 archaeological site 5 recent historic sites	Avoidance
Station Area: buildings, communication tower, cables, POL line, other surface and buried debris, contaminated soil	Mount Matheson	1 recent historic site	Avoidance
Higher Beach Ridges: water supply lake and access road, informal trails, aggregate sources	Surrounding Mount Matheson	7 archaeological sites 4 recent historic sites	Avoidance

The scope of work as understood from AECOM was fully completed. All areas being evaluated for aggregate sources, tested for contaminants and surveyed were walked over and sites present were recorded. Within the time available and in the absence of an available quad, areas identified as former borrow areas, debris areas, the south end of the water supply lake, the Station Area and the Beach Area were all inspected and sites recorded as encountered. Two sites were reported by DMT Geosciences crew member, Adam Peake, and were followed up, and Jessie Hoyt (PWGSC) also located archaeological features and lithic scatters during our walk on July 30. Archaeological sites identified were inventoried and assessed so that any mitigation measures necessary could be instituted during the course of the project and beyond. Potential risks to the safety of archaeological resources could occur from vehicle traffic, excavation of contaminated soil and buried debris, construction of landfills and use of borrow pits, for example. Mitigation other than avoidance currently did not appear to be necessary; however, co-ordinates for all features recorded are included in this report and could be transferred to a cultural resources overlay on the site plans so that no future disturbance occurs.

Recommendations for the remainder of this evaluation project pertaining to heritage resource preservation were presented to AECOM in the form of an Interim Report left with the team leader on August 1, and included:

- Vehicles should avoid any site features;
- Co-ordinates for all site features should be plotted on revised site plans for guidance of project management and site workers;
- New crew members should receive a briefing on archaeological site conservation on arrival in camp; and

- Any further sites or site features should be reported to AECOM along with a brief description of contents and precise location so that it can be determined whether this is a new find and appropriate measures taken for preservation (Thomson 2013).

No further investigations appear to be necessary at CAM-C; however, when firm plans are made for development of landfills, borrow pits and other areas of disturbance or should additional archaeological sites or features be encountered during the remainder of the project, consideration should be given to a follow-up archaeological assessment so that any cultural resources can be professionally verified and recorded, mitigation requirements assessed, and the sites added to the list and map of archaeological resources in the area.

6. SUMMARY AND RECOMMENDATIONS

Eighteen archaeological (8) and recent historic (10) sites were found on the CAM-C property during extensive but not complete pedestrian surveys in 2013. The sites range in time from the early Palaeoeskimo period, perhaps 4,000 years ago, through the historic period to the very recent Inuit era, with some features being only a year or two old. Our preliminary conclusion is that the potential for additional archaeological and historic sites is moderate. Depending on future clean up and remediation activities, potential risks to heritage resources are low to moderate. Should additional areas be identified for investigation or clean up, additional site inventory and assessment is recommended. As clean up and remediation plans proceed, the tentative mitigation recommendations contained in this report should be reviewed and, if necessary, modified.

We inferred from the location and content of the 18 recorded sites that most were situated for access to resources such as seals, polar bear, waterfowl and fish in the marine environment, with a few interior sites more likely situated for access to terrestrial resources such as caribou, muskox, waterfowl and fish. The Palaeoeskimo sites are today situated at some distance from the active shoreline, but the beach ridges on which they were found would have been just above or close to sea level when occupied for easy access to the sea and sea ice and associated resources. Some or all of the following attributes, among others, were present at most of the sites:

- a relatively level gravel or vegetated gravel terrace or beach ridge, with good drainage;
- proximity to and a view of the sea or sea ice;
- presence of materials for building habitation structures, caches, hearths and other features, *e.g.*, boulders and slabs; and
- accessibility to a breeze in summer.

Proximity to fresh water does not seem to have been a high priority for site location. In two cases, NeJv-1 and CAM-C 9, elevation for a view of the surrounding terrain and/or access to breeze seemed to have contributed to the rationale for site location.

6.1 Assessment

Several sites were considered during the survey to lie within areas of likely disturbance from clean up and remediation activities (Table 6-1); however, it has been stated by PWGSC that no

disturbance will occur or require specific mitigation measures (M. Yetman, 2013, personal communication). One site (CAM-C 9) exhibited evidence of disturbance from site activities, adjacent to the airstrip. Additional survey should be conducted of any new camp locations, aggregate sources and other facilities once selected.

6.2 Recommendations

Because of the potential for accidental site disturbance during future clean up and remediation activities, it is recommended that mitigation measures be implemented at all of the sites found, mostly involving avoidance (Table 6-1).

Measures to help site workers at CAM-C continue to abide fully by applicable heritage legislation include:

- use of a desktop or field archaeological evaluation of any new areas of intensive land use around CAM-C, such as new camp areas that have not previously been intensively surveyed, new areas of proposed clean up not previously identified and new aggregate sources;
- provision of an education programme for field personnel on how to recognize and report archaeological features and avoid disturbance, including a training session for field workers by an archaeologist;
- annual review of project plans to assess the need for additional field surveys and/or modifications to mitigation plans;
- continuing interaction with residents of Gjoa Haven familiar with resources and resource use in the study area to help interpret site seasonality and function; and
- continuing access to archaeological advice in the event that field personnel continue to encounter features that requires interpretation in the absence of the project archaeologist (*i.e.*, temporary remote identification and recording as an archaeological site pending inspection by an archaeologist).

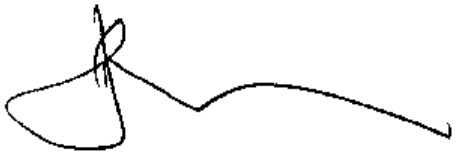
Table 6-1 presents mitigation recommendations for the sites found in 2013. In the event of any potential future conflict between heritage resources and project activities, the avoidance option proposed as the principal means of mitigation could be re-considered in consultation with the Department of Culture and Heritage by evaluation of the site's significance, the significance of loss of all or part of the site and the availability of other mitigation options. These might include temporary protection during the project activity or detailed investigation and site recording prior to disturbance.

Table 6-1 Recommended Mitigation For Sites Recorded in 2013 at CAM-C, Matheson Point, King William Island, NU			
Borden No.	**Location**	**Nature of Disturbance noted in 2013**	**Recommended Mitigation**
Beach Area			
NeJv-1	On ridge top east of Beach Area	None	Avoidance
CAM-C 1	On access road to beach	Site features removed from beach access road	Avoidance
CAM-C 2	West of end of beach access road	None	Avoidance
CAM-C 3	East of end of beach access road	None	Avoidance
CAM-C 4	Below barrel dump east of access road	None	Avoidance
CAM-C 5	Below south end of ridge	None	Avoidance
Station Area			
CAM-C 9	Adjacent to northeast end of airstrip	Minor past disturbance by bulldozer	Avoidance
Higher Beach Terraces			
NeJv-2	High beach ridge between Station Area and Water Supply Lake	None	Avoidance
NeJv-3	High beach ridge south of Station Area	None	Avoidance
NeJv-4	High beach ridge south of Station Area	None	Avoidance
NeJv-5	High beach ridge south of Station Area	None	Avoidance
NeJv-6	High beach ridge south of Station Area	None	Avoidance
NeJv-7	High beach ridge south of Station Area	None	Avoidance
NeJv-8	High beach ridge north of Beach Area ridge	None	Avoidance
CAM-C 6	Just west of POL Line, south of Station Area ridge	None	Avoidance
CAM-C 7	South of Station Area ridge adjacent to small landfill	None	Avoidance
CAM-C 8	At northwest end of Water Supply Lake access road	None	Avoidance
CAM-C 10	On flat plain east of beach access road	None	Avoidance

In general, it is strongly recommended that archaeological inventories and assessments should be incorporated at an early stage in all similar clean up and remediation projects in the Canadian Arctic, prior to the development of camps, construction and use of all-season and winter access routes, and environmental testing. While no disturbance was noted from the site investigations at any of the sites recorded during this project, the potential is present for conflict between archaeological sites and such activities without prior archaeological inventory and assessment and development of any required mitigation measures.

6.3 Closure

It is our professional opinion that the likelihood of disturbance of archaeological and more recent heritage sites and features by continuing environmental and engineering investigations and subsequent clean up and remediation at CAM-C is low, given the above mitigation recommendation (*i.e.,* avoidance, 30 m buffer zone, and previous site recording), and that approval should be given to the project as proposed in 2013, from a cultural resources perspective. Should clean up and remediation activities expand away from the locations as currently known, and in order to better understand and document regional land use, additional archaeological surveys and assessment should be conducted as the potential for additional sites being present is moderate. A programme of informant interviews should be initiated to gather additional information on land use in the CAM-C area, particularly pertaining to the 18 sites recorded in 2013.



J. Callum Thomson,
Principal, Thomson Heritage Consultants, Inc.
Pictou Landing, NS, February 14, 2014

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7.3 Glossary

a.s.l. Above sea level, elevation expressed in metres.
Archaeology. The branch of anthropology devoted to studying the material remains of past human events.
Artifact. An object of human manufacture or use.
B.P. Before present, with "present" being defined as A.D. 1950.
Borden System. An alpha-numeric classification system used in Canada to identify the location of **archaeological sites**, based on the 1: 50,000 topographic map system, *e.g.*, NeJv-1.
Cache. A structure used to store meat, blubber and fish for later planned or emergency use, or to store clothing, tools, utensils for use in a future season; may be built above ground out of boulders and slabs or dug partly into a cobble or boulder beach ridge.
Caribou. Herd animal essential in northern cultures for food and materials such as hide, antler, bone, and sinew. Commonly obtained in large numbers at water or ice crossing routes. Sometimes driven in desired direction by use of **inuksuit** or fences of aligned spaced boulders; often hunted on trails used by caribou as travel routes.
Dorset. A **prehistoric Palaeoeskimo** culture present in the Canadian Arctic and Labrador from approximately 2500 **B.P.** to 500 B.P. Descended from **Pre-Dorset.**
Faunal. Pertaining to animals, as in **faunal** remains. Animal (and bird, fish, *etc.*) bone provides information on the season(s) in which a **site** was occupied and which animals were exploited.
Feature. A term used to include evidence such as a stone habitation structure, **hearth**, buried layer of food bone, charcoal or **flaking** debris, a discoloured soil layer, or some other collection of cultural material assembled within a usually small, restricted area.
Flake. A thin flat fragment of stone removed by pressure- or percussion-**flaking** during the process of stone tool manufacture or repair. **Flakes**, removed from **preforms**, are often the desired end product and are formed into tools.
Foxtrap. A stone structure used to trap small fur-bearing mammals such as foxes and wolves. May be built around a narrow rectangular chamber in which the animal is trapped by a falling drop rock or a beehive-shaped hollow chamber out of which the animal cannot climb due to the corbelled construction. After European contact and access to trade goods, steel leghold traps

generally replaced the stone versions, using a chain attached to a piece of wood anchored under stone slabs or boulders.
Hearth. Fireplace.
Inuit. The preferred term for the aboriginal occupants of the Arctic descended from people of the **Thule** tradition, whose origins are in the Alaska/Bering Strait area.
Inuksuk, pl**. Inuksuit.** A cairn or carefully-built stack of rocks and slabs resembling a person (**inuk**, pl. **Inuit**).
Inuktitut. The traditional **Inuit** language.
Lithic. Of stone.
Locus, pl. **Loci**. A discrete location within a larger **site.**
Mitigation. The process whereby negative impacts on an archaeological site can be eliminated, reduced or controlled.
Neoeskimo. An **archaeological** term used to define the **prehistoric Thule** culture and early historic ancestors of today's **Inuit.**
Palaeoeskimo. The original occupants of the Arctic, who spread west from Alaska approximately 4500-5000 years ago across the Canadian Arctic to Greenland, Labrador, Quebec and Newfoundland. Divided into **Pre-Dorset** and **Dorset**. Replaced by Neoeskimos after 1000 B.P. in the western and central Arctic and as late as 500 B.P. in the eastern Arctic, Nunavik and Labrador.
Pre-contact. The period prior to the arrival or influence of European/Euro-Canadian culture in the Arctic.
Pre-Dorset. The original occupants of much of Arctic Canada, 4500-2500 **B.P.** Noted for manufacture of tiny finely-made stone tools. **Dorset** culture evolved from **Pre-Dorset.**
Preform. A partially-made stone tool.
Prehistory. The period prior to the invention or adoption of writing: in the Arctic, prior to the arrival of Europeans and Euro-Canadians and the development of syllabics and, later, written **Inuktitut**.
***Qammaq*,** pl**. *Qammat*.** A stone house built up with multiple courses and covered with skin, used in fall before snow houses can be built.
Semi-subterranean. House dug partially into the ground for additional shelter and stability, or into a sloping bank as a labour-saving method, then walled up with stone and sod and roofed with bone or wood, skin and sod. Commonly used in late fall to early spring by **Dorset Palaeoeskimo**, **Thule** and **Inuit.**
Site. Location **of archaeological** remains.
Subsistence. The means of providing food and other essentials of life.
Tent ring. The outline formed by rocks formerly used to hold down the walls and guy ropes of a tent-like structure made of skin or canvas.
Thule. The ancestors of today's **Inuit** who arrived in the western arctic around 1000 B.P. and spread rapidly across the Arctic to Nunavut, Greenland, Quebec and Labrador over the next few centuries, gradually replacing the incumbent Late Palaeoeskimos.
***Umiaq*,** pl**. *umiat*.** Large open boat made of sealskin or split walrus hide stretched over frame of wood and/or bone used for camp moves and whaling.

Appendix 1

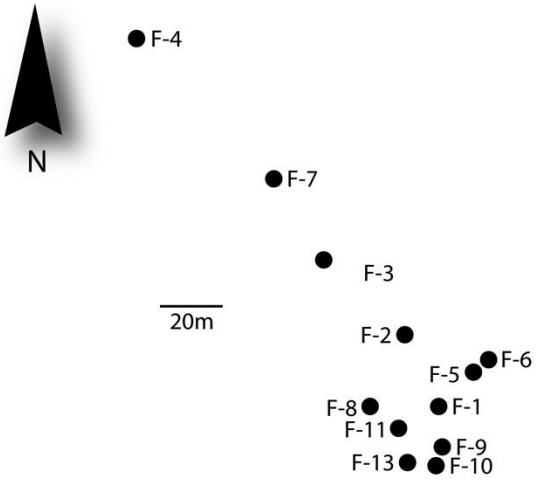
New Archaeological Site Record Forms, CAM-C, King William Island, NU

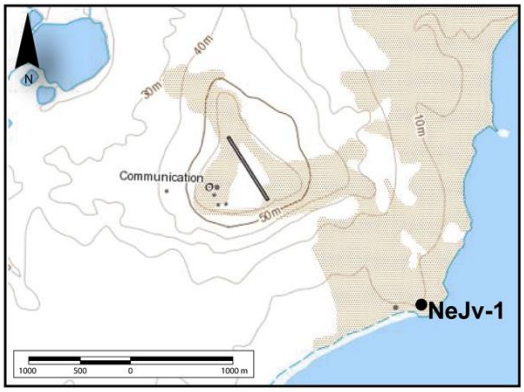
BN= NeJv-1
NAM=
RN= THC2013-2: 1
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a ridge 500 m east of the south end of the beach access road on the CAM-C Matheson Point communication site.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409726E 7634751N, at approximate centre of site
AIR=
EL= 20 m est.
SIZ= 5000 m²
CON= Stable, with roads crossing from the Beach Site to gravel sources on the east side
TYC= Historic; possibly prehistoric
TY= Camp
FE= Qammaq (2), tent ring (3), cache (3), inuksuk (2)
CU= Inuit
PER= 19th-20th centuries, possibly earlier Inuit components
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Archaeological Feature Data Recorded at NeJv-1, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

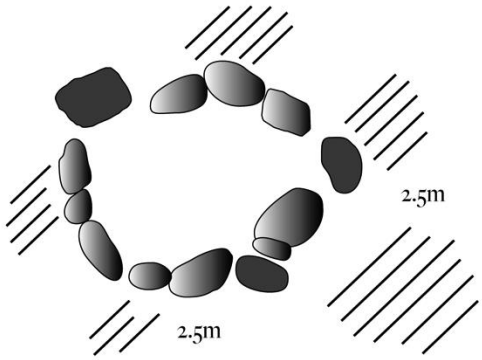
Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	587	*Qamaq* (autumn house)	409726	7634751	2.5 x 2.5	Beach	July 29
2	588	Tent ring	409715	7634774	3 x 4	Beach	July 29
3	589	Cache	409689	7634798	4 x 3	Beach	July 29
4	590	Tent ring	409629	7634869	1.5 x 2	Beach	July 29
5	591	Tent ring	409737	7634762	1.5 x 2.5	Beach	July 29
6	592	Cache	409742	7634766	3 x 3	Beach	July 29
7	617	*Inuksuk*	409673	7634824	1	Beach	July 30

8	618	*Inuksuk*	409704	7634751	1	Beach	July 30
9	619	*Qammaq*	409727	7634738	3 x 3	Beach	July 30
10	620	Cache	409725	7634732	4 x 4	Beach	July 30
11		Cache			1.5 x 1.5	Beach	July 31
12	636	Cache	409713	7634744	2 x 1.5	Beach	July 31
13	637	Cache	409716	7634733	2 x 2	Beach	July 31



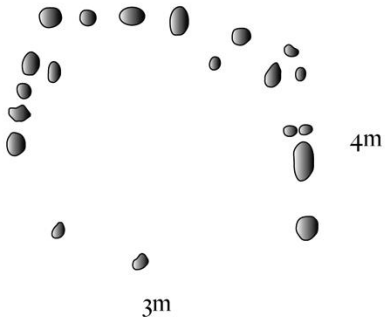


SITE MAP



Feature 1 - Qammaq

Feature 1 - Qammaq - view W



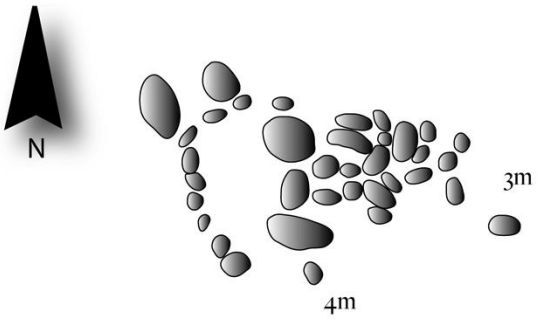
Feature 2 - Tent Ring

Feature 2 - tent ring - view S

FEATURES
(scale approximate)

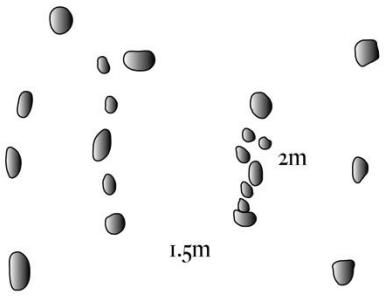
NeJv-1

LEGEND fallen stone stone
scatter of old mammal bone, wood and rusted metal

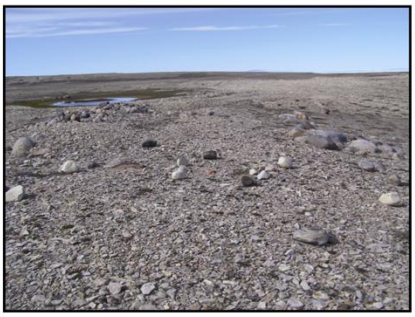


Feature 3 - Cache

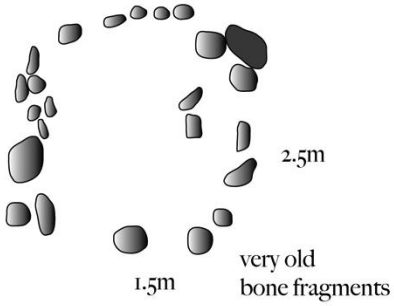
Feature 3 - cache - view NW



Feature 4 - Tent Ring

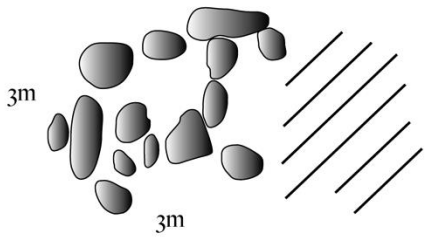


Feature 4 - tent ring - view N



Feature 5 - Tent Ring

Feature 5 - tent ring - view N



Feature 6 - Cache

Feature 6 - cache - view W

NeJv-1 cont'd

LEGEND fallen stone stone bone

N

No Drawing Available

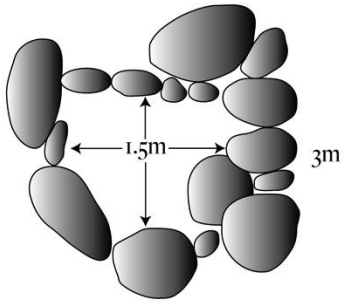
Feature 7 - Inuksuk

Feature 7 - inuksuk - view NE

No Drawing Available

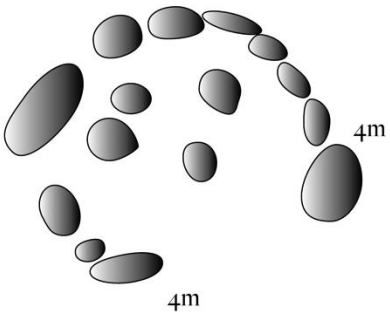
Feature 8 - Inuksuk

Feature 8 - inuksuk - view SW



Feature 9 - Qammak

Feature 9 - qammak - view



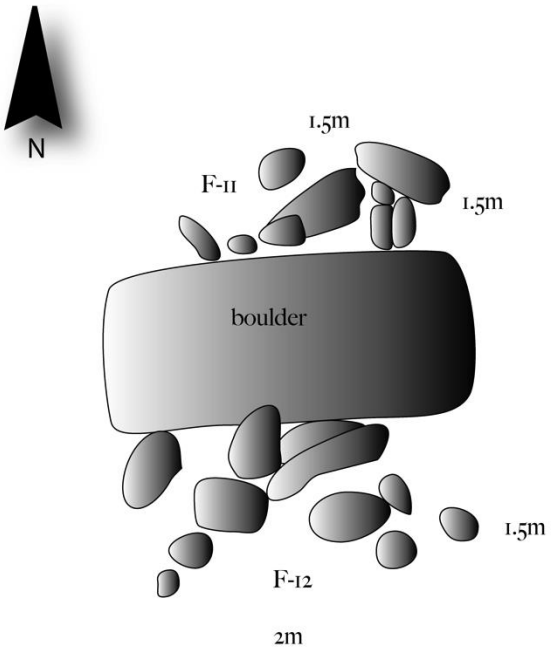
Feature 10 - Cache

No Photo Available

NeJv-1 cont'd

LEGEND

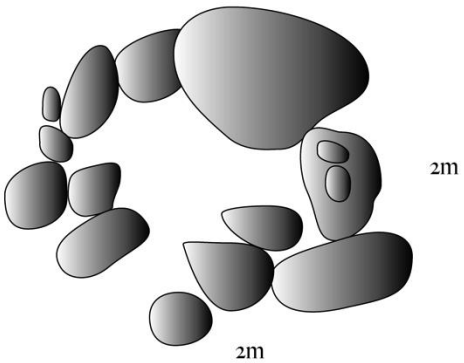
stone



Features 11 and 12 - Caches

Feature 11 - cache - view S

Feature 12 - cache - view N



Feature 13 - Cache

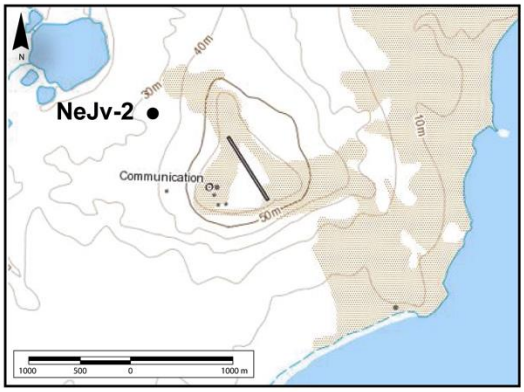
LEGEND

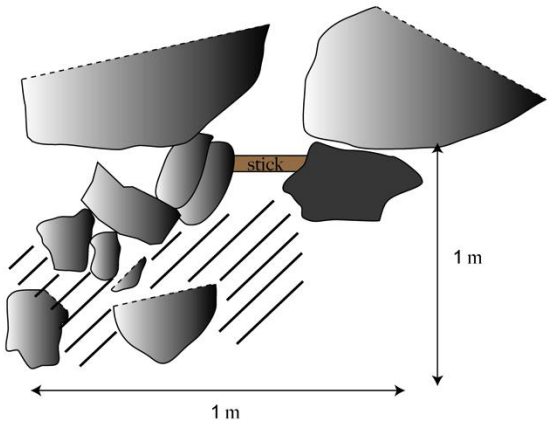
stone

BN= NeJv-2
NAM=
RN= THC2013-2: 2
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a beach ridge 50 m northeast of the access road to the water supply lake, which is 2 km northwest of the CAM-C Matheson Point communication station site.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407048E 7636657N
AIR=
EL= 30 m est.
SIZ= 100 m²
CON= Stable
TYC= Prehistoric
TY= Camp
FE= Hearth or foxtrap
CU= Inuit
PER=
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= The wood may have been used as an anchor for a leghold foxtrap chain, held in place beneath the limestone slabs.

Archaeological Feature Data Recorded at NeJv-2, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	606	Hearth or foxtrap	407048	7636657	1 x 1	Station	July 30





Feature 1 - Hearth

Feature 1 - hearth - view N

FEATURES
(scale approximate)

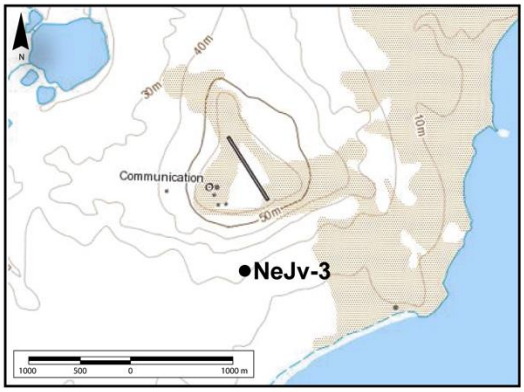
NeJv-2

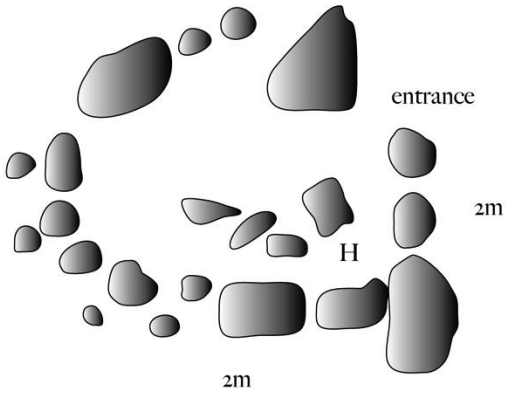
LEGEND fallen stone stone
heather

BN= NeJv-3
NAM=
RN= THC2013-2: 3
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a beach ridge 500 m west of the access road to the Beach Area and south of the Station Area.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407953E 7635108N
AIR=
EL= 28 m (Garmin eTrex GPS)
SIZ= 100 m²
CON= Stable
TYC= Prehistoric
TY= Camp
FE= Tent ring
CU=
PER=
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

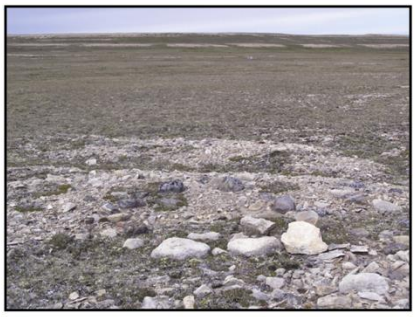
Archaeological Feature Data Recorded at NeJv-3, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	607	Tent ring	407953	7635108	2 x 2	Station	July 30





Feature 1 - Tent Ring



Feature 1 - tent ring - view N

FEATURES
(scale approximate)

NeJv-3

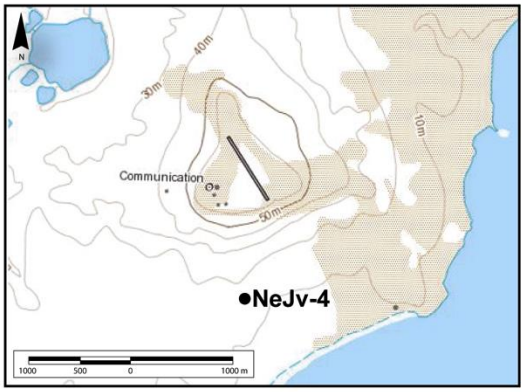
LEGEND

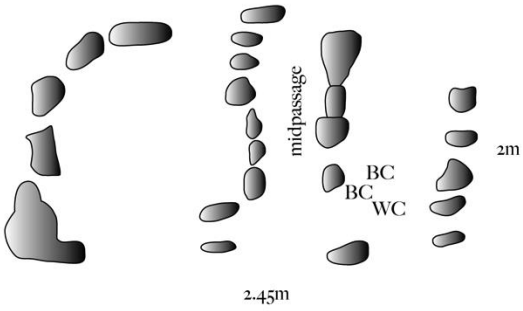
H = hearth stone

BN= NeJv-4
NAM=
RN= THC2013-2: 4
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a high, old beach ridge south of the Station Area, west of the beach access road.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407948E 7634848N
AIR=
EL= 28 m (Garmin eTrex GPS)
SIZ= 1000 m²
CON= Stable
TYC= Prehistoric
TY= Camp
FE= Tent ring with midpassage, lithic scatter
CU= Palaeoeskimo
PER= Pre-Dorset
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS, and Jessie Hoyt, PWGSC
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Archaeological Feature Data Recorded at NeJv-4, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	608	Tent ring with black chert and patinated chert	407948	7634848	2 x 2.5	West of Beach Area	July 30
2	609	Lithic scatter	407961	7634824	25 x 5	West of Beach Area	July 30





Feature 1 - Tent Ring

Feature 1 - tent ring - view N

Feature 1 - tent ring - view overhead showing chert

NeJv-4

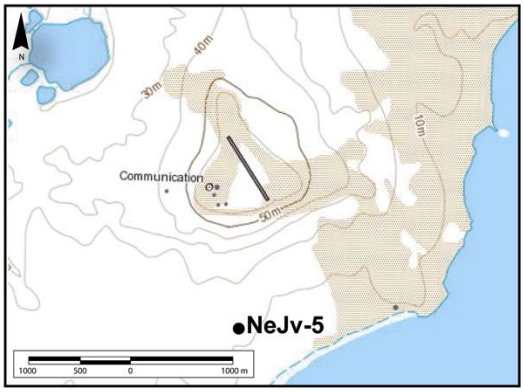
LEGEND fallen stone stone

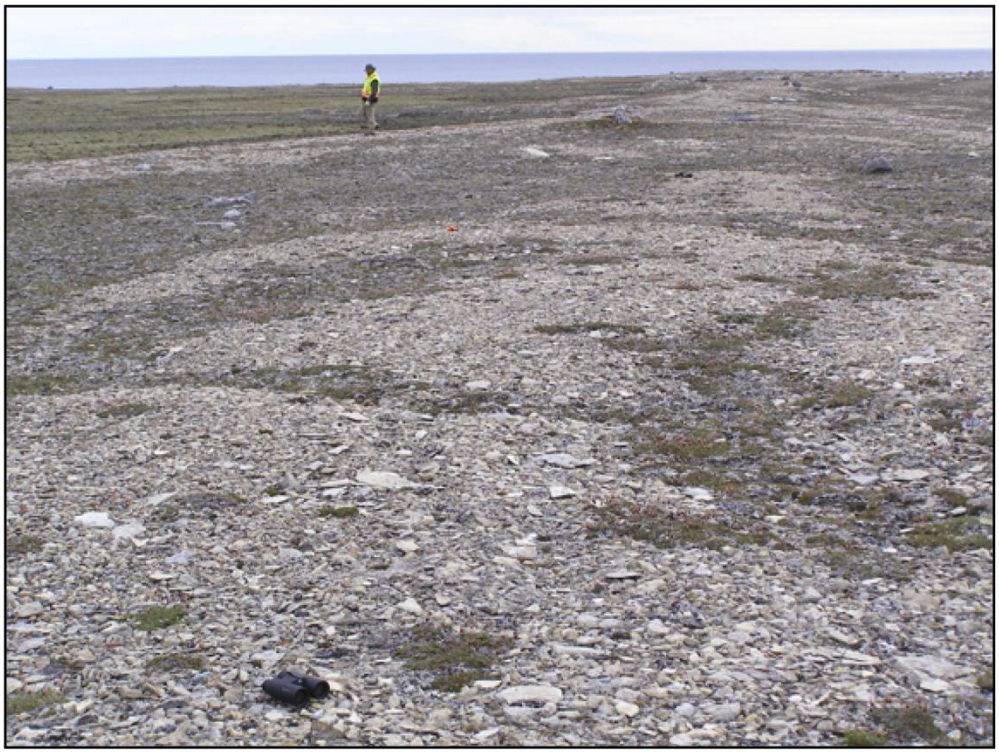
H = hearth WC = white chert BC = black chert

BN= NeJv-5
NAM=
RN= THC2013-2: 5
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a high, old beach ridge south of the Station Area, west of the beach access road.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407894E 7634539N
AIR=
EL= 12 m (Garmin eTrex GPS)
SIZ= 500 m²
CON= Stable
TYC= Prehistoric
TY= Lithic scatter
FE= Scatter of patinated chert, limestone slabs possibly tent ring hold down rocks
CU= Palaeoeskimo
PER= Pre-Dorset
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS, and Jessie Hoyt, PWGSC
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Archaeological Feature Data Recorded at NeJv-5, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	610	Lithic scatter	407894	7634539	20 x 10	West of Beach Area	July 30



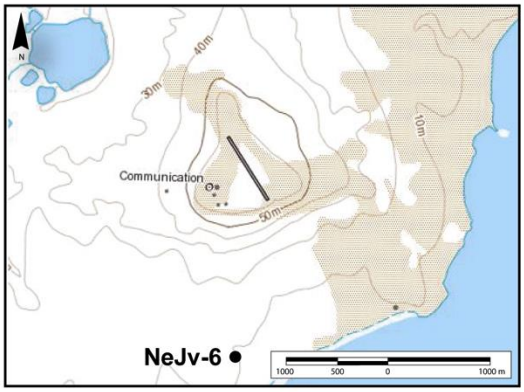


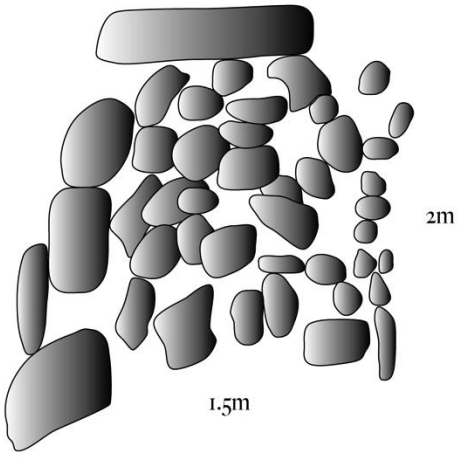
Feature 1 - chert scatter - view S

BN= NeJv-6
NAM=
RN= THC2013-2: 6
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a high, old beach ridge south of the Station Area, below the Palaeoeskimo ridge, west of the beach access road.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407860E 7634261N
AIR=
EL= 15 m (Garmin eTrex GPS)
SIZ= 100 m²
CON= Stable
TYC= Prehistoric
TY=
FE= Cache
CU= Neo-Eskimo
PER= Possibly Thule
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS, and Jessie Hoyt, PWGSC
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Archaeological Feature Data Recorded at NeJv-6, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	611	Cache	407860	7634261	1.5 x 2	West of Beach Area	July 30





Feature 1 - Cache

Feature 1 - cache - view N

FEATURES
(scale approximate)

NeJv-6

LEGEND

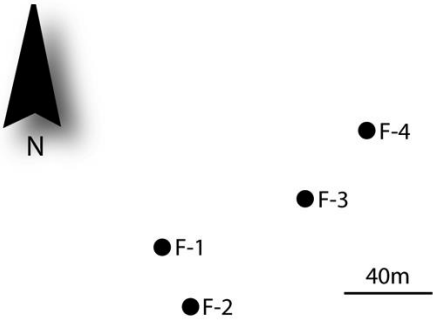
stone

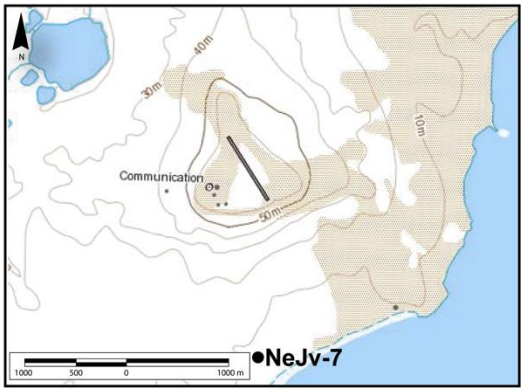
BN= NeJv-7
NAM=
RN= THC2013-2: 7
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a beach ridge south of the Station Area, below the Palaeoeskimo ridge, west of the beach access road.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 408046E 7634213N
AIR=
EL= 10 m (Garmin eTrex GPS)
SIZ= 1000 m²
CON= Stable
TYC= Prehistoric
TY= Camp
FE= Tent ring (3), cache
CU= Neo-Eskimo
PER= Possibly Thule, Inuit
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS, and Jessie Hoyt, PWGSC
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Archaeological Feature Data Recorded at NeJv-7, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

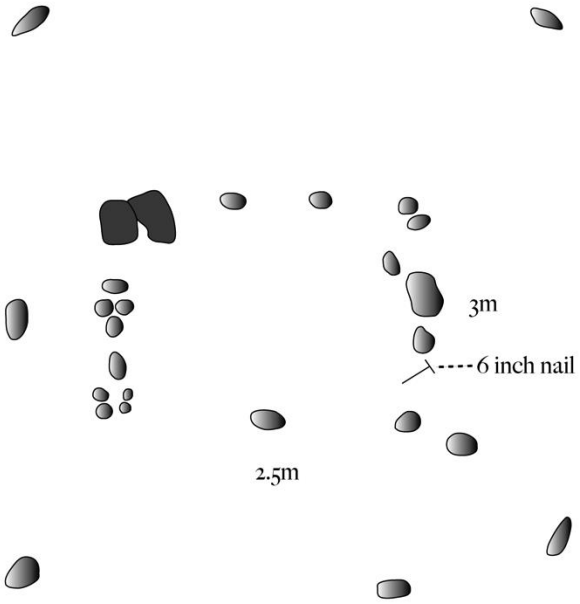
Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	612	Tent ring	408033	7634240	2.5 x 3	West of Beach Area	July 30
2	613	Cache	408046	7634213	4 x 4	West of Beach Area	July 30
3	614	Tent ring	408098	7634262	3 x 3	West of	July 30

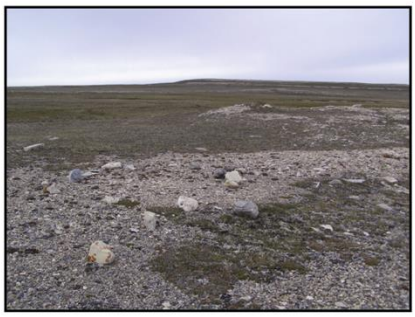
						Beach Area	
4	615	Tent ring	408126	7634293	4 x 3	West of Beach Area	July 30





SITE MAP





Feature 1 - tent ring - view N

Feature 1 - Tent Ring

FEATURES
(scale approximate)

NeJv-7

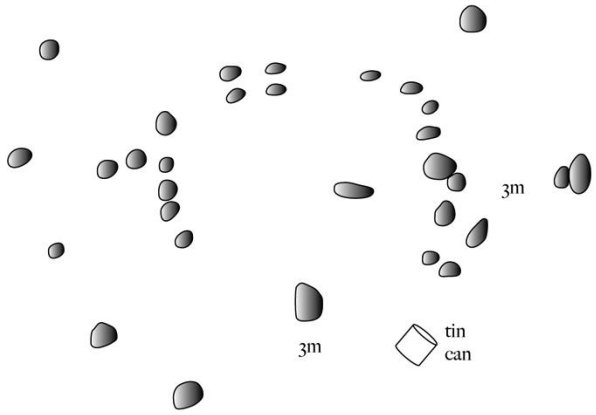
LEGEND
fallen stone
stone

N

No Drawing Available

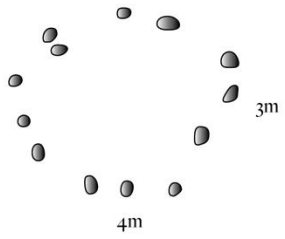
Feature 2 - Cache

Feature 2 - cache - view NE



Feature 3 - Tent Ring

Feature 3 - tent ring - view N



Feature 4 - Tent Ring

Feature 4 - tent ring - view N

NeJv-7 cont'd

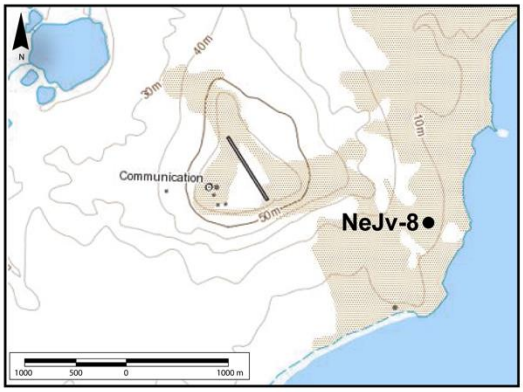
LEGEND

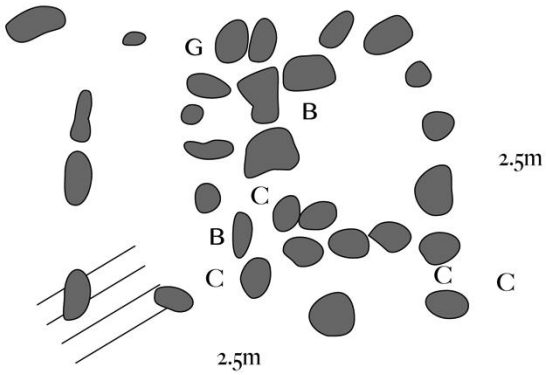
stone

BN= NeJv-8
NAM=
RN= THC2013-2: 8
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a beach ridge north of the Beach Area and 100 m north of the northernmost access road from the Station Area to gravel sources near the shore.
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409767E 7635582N
AIR=
EL= 18 m (Garmin eTrex GPS)
SIZ= 100 m²
CON= Stable
TYC= Prehistoric
TY= Camp
FE= Tent ring, lithic scatter
CU= Palaeoeskimo
PER= Pre-Dorset
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

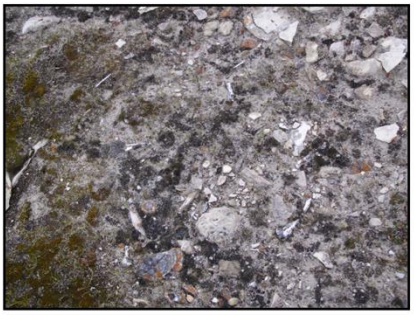
Archaeological Feature Data Recorded at NeJv-8, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	635	Tent ring, lithic scatter, bone	409767	7635582	2.5 x 2.5	Beach	July 31





Feature 1 - Tent Ring



Feature 1 - tent ring - detail

Feature 1 - tent ring - view E

NeJv-8

LEGEND
C = patinated chert
B = bone
G = green chert
flat limestone slab
bone scatter

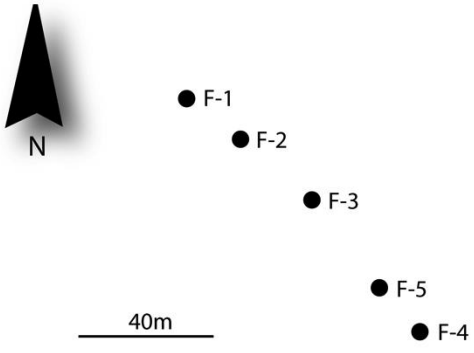
Appendix 2

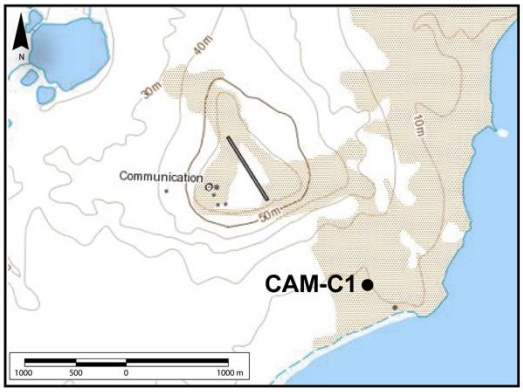
Recent Cultural Site Record Forms (not registered as archaeological sites)

BN=
NAM=
RN= CAM-C 1
PN= 2013-0223A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on the main access road between the Station Area and the Beach Area
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409159E 7634988N, at approximate centre of site
AIR=
EL= 10 m est.
SIZ= 2000 m²
CON= At risk of and to quad traffic. Tent rings were subsequently removed from the road as an unnecessary hazard by the wildlife monitors.
TYC= Very recent
TY= Camp
FE= Tent ring (5)
CU= Inuit
PER= 21st century
DAT= October 2012
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= This camp was used by Rangers from Gjoa Haven on a training exercise in October 2012

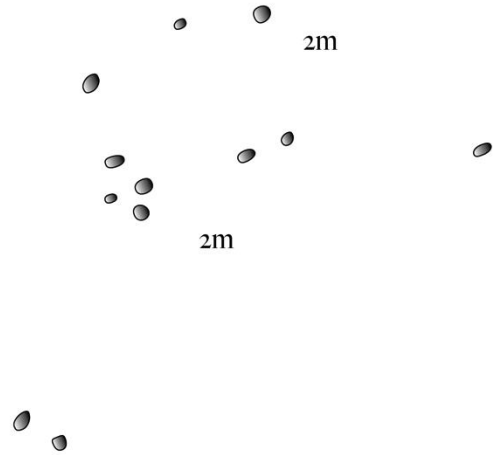
Feature Data Recorded at CAM-C 1 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	573	Tent ring	409122	7635018	2 x 2	Beach	July 29
2	574	Tent ring	409138	7635006	2 x 2	Beach	July 29
3	575	Tent ring	409159	7634988	2 x 2	Beach	July 29
4	576	Tent ring	409191	7634949	2 x 4	Beach	July 29
5	577	Tent ring	409179	7634962	3 x 2	Beach	July 29



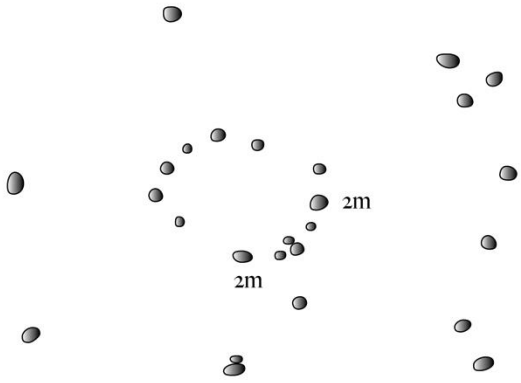


SITE MAP



Feature 1 - Tent Ring

Feature 1 - tent ring - view NW



Feature 2 - Tent Ring

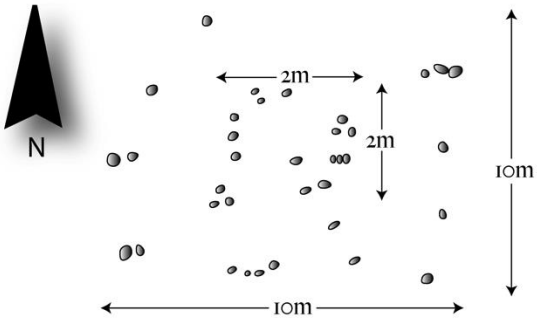
Feature 2 - tent ring - view NW

FEATURES
(scale approximate)

CAM-C1

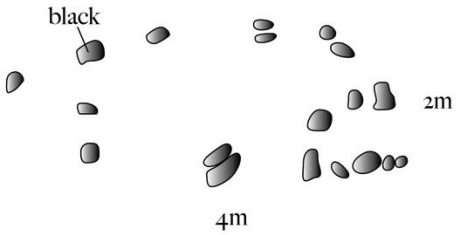
LEGEND

stone



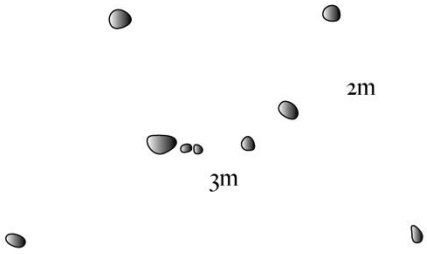
Feature 3 - Tent Ring

Feature 3 - tent ring - view NW



Feature 4 - Tent Ring

Feature 4 - tent ring - view NW



Feature 5 - Tent Ring

Feature 5 - tent ring - view NW

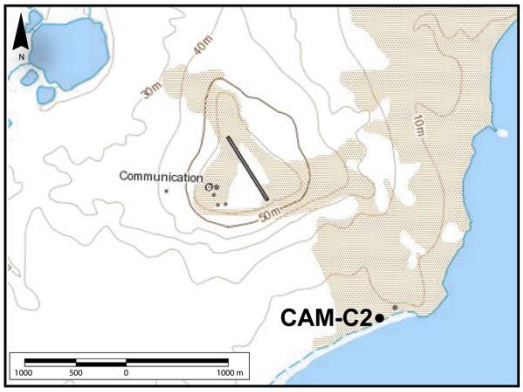
LEGEND

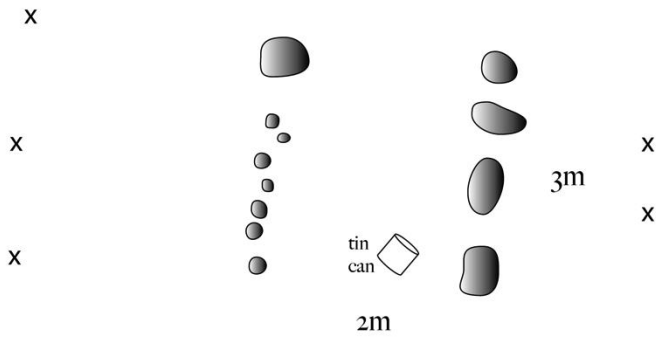
stone

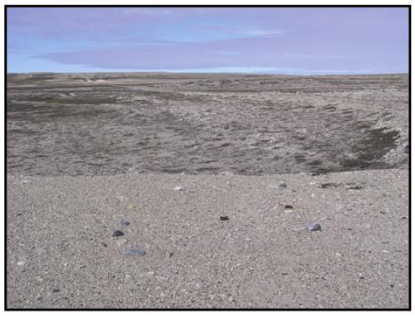
BN=
NAM=
RN= CAM-C 2
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, west of the end of the Beach Area access road on sand behind the active beach
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409285E 7634642N
AIR=
EL= 2 m est.
SIZ= 100 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring
CU= Inuit
PER= 20th- 21st century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Feature Data Recorded at CAM-C 2 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	578	Tent ring	409285	7634642	2 x 3	Beach	July 29







Feature 1 - tent ring - view N

Feature 1 - Tent Ring

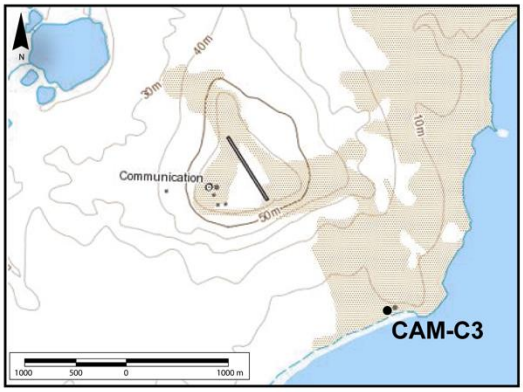
FEATURES
(scale approximate)

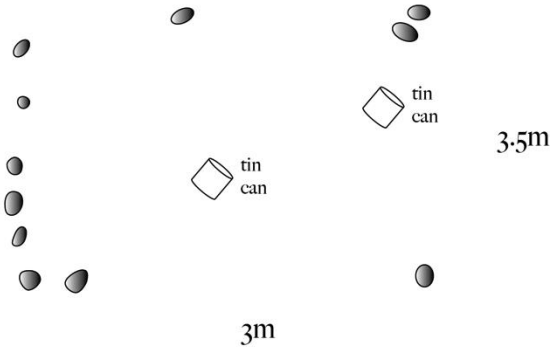
CAM-C2

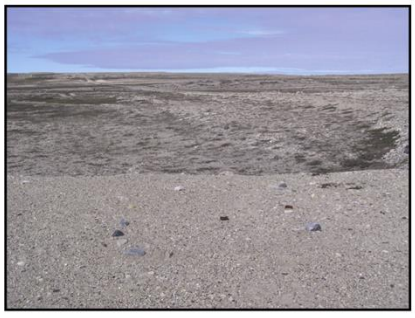
LEGEND
x = stake
stone

BN=
NAM=
RN= CAM-C 3
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on a rectangular gravel pad (POL Area?) above the beach at the end of the Beach Area access road
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409362E 7634717N
AIR=
EL= 4 m est.
SIZ= 100 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring
CU= Inuit
PER= 20th- 21st century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

Feature Data Recorded at CAM-C 3 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W							
Feature No.	**GPS Record No.**	**Feature Type**	**Easting**	**Northing**	**Size (m)**	**Work Area**	**Date Recorded**
1	579	Tent ring	409362	7634642	23 x 3.5	Beach	July 29







Feature 1 - tent ring - view N

Feature 1 - Tent Ring

FEATURES
(scale approximate)

CAM-C3

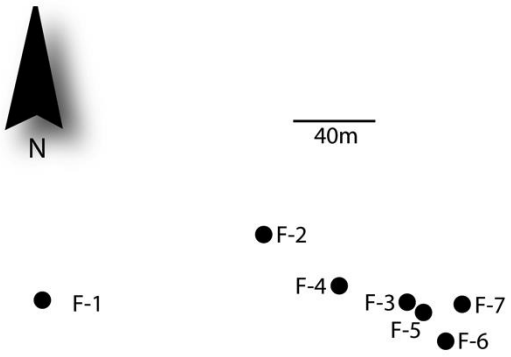
LEGEND

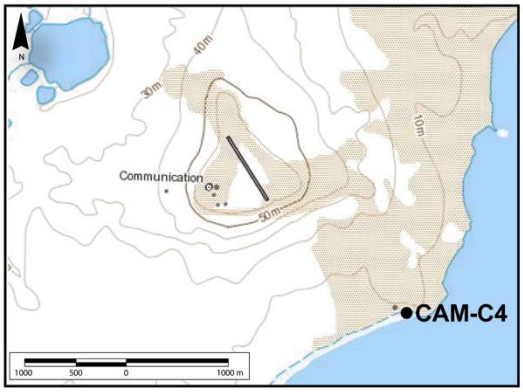
stone

BN=
NAM=
RN= CAM-C 4
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on the first terrace above the beach extending north around the seaward end of a high ridge, north of the end of the Beach Area access road
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409629E 7634686N
AIR=
EL= 2-4 m est.
SIZ= 1000 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring (7)
CU= Inuit
PER= 20th- 21st century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

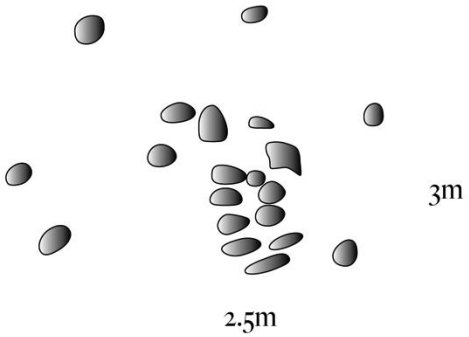
Feature Data Recorded at CAM-C 4 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	580	Tent ring	409451	7634687	2.5 x 3	Beach	July 29
2	581	Tent ring	409559	7634719	2 x 3	Beach	July 29
3	582	Tent ring	409596	7634694	2 x 3	Beach	July 29
4	583	Tent ring	409629	7634686	2.5 x 2.5	Beach	July 29
5	584	Tent ring	409637	7634681	4 x 3.5	Beach	July 29
6	585	Tent ring	409648	7634667	2.5 x 2	Beach	July 29
7	586	Tent ring	409656	7634685	2.5 x 2.5	Beach	July 29





SITE MAP



Feature 1 - Tent Ring

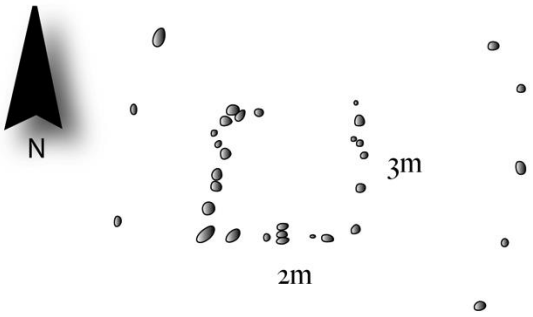
Feature 1 - tent ring - view N

FEATURES
(scale approximate)

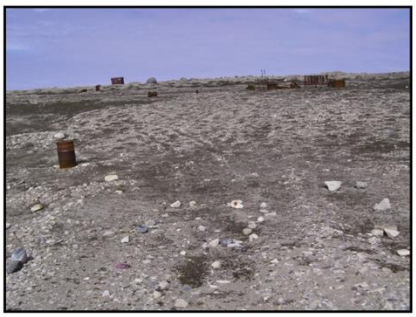
CAM-C4

LEGEND

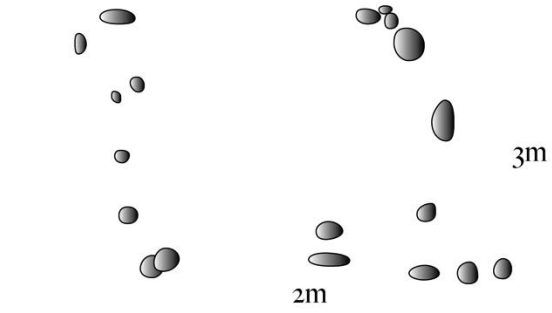
stone



Feature 2 - Tent Ring

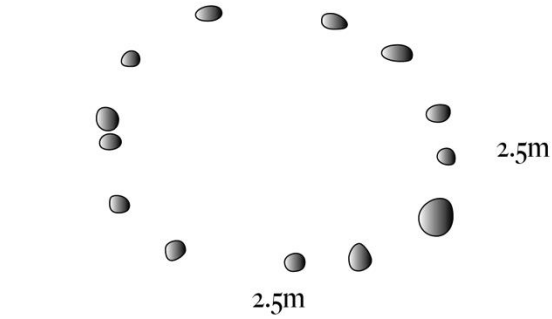


Feature 2 - tent ring - view N



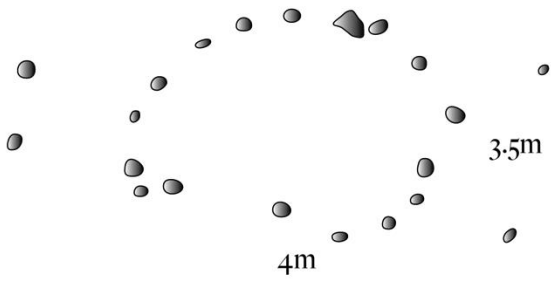
Feature 3 - Tent Ring

Feature 3 - tent ring - view N



Feature 4 - Tent Ring

Feature 4 - tent ring - view NW



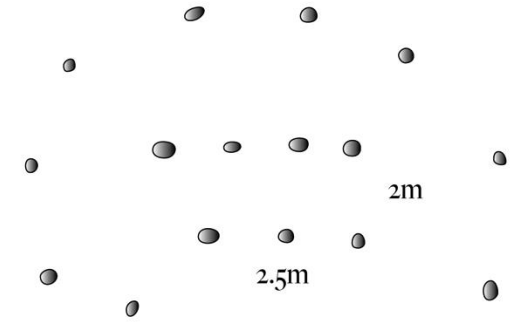
Feature 5 - Cache

Feature 5 - cache - view NW

CAM-C4 cont'd

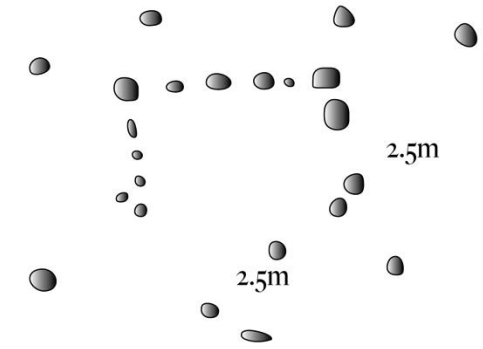
LEGEND

stone



Feature 6 - Tent Ring

Feature 6 - tent ring - view NW



Feature 7 - Tent Ring

Feature 7 - tent ring - view NW

CAM-C4 cont'd

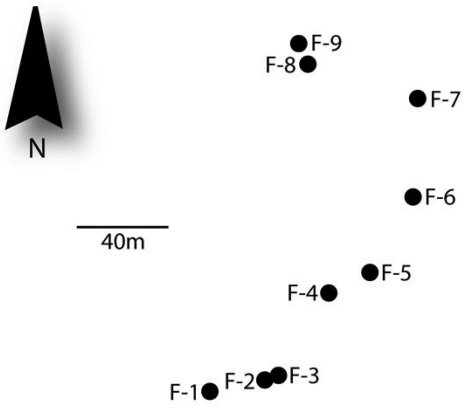
LEGEND

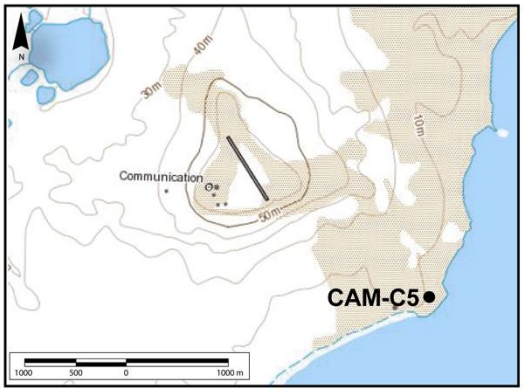
stone

BN=
NAM=
RN= CAM-C 5
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on the first terrace above the beach to the north of the east end of the high ridge above the Beach Area
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 409844E 7634857N at approximate centre of site
AIR=
EL= 2-4 m est.
SIZ= 5000 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring (9)
CU= Inuit
PER= 20th- 21st century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE=

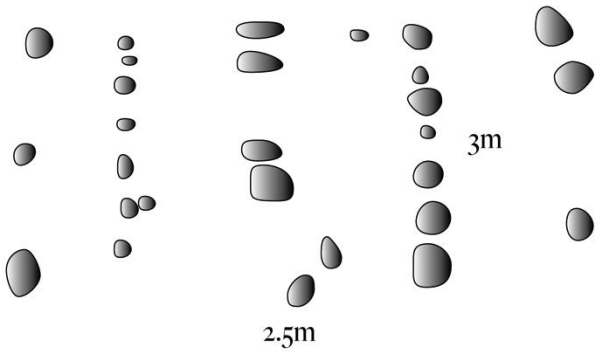
Feature Data Recorded at CAM-C 5 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	593	Tent ring	409755	7634772	2.5 x 3	Beach	July 29
2	594	Tent ring	409779	7634777	2.5 x 2.5	Beach	July 29
3	595	Tent ring	409785	7634779	3 x 3	Beach	July 29
4	596	Tent ring	409807	7634815	2.5 x 2	Beach	July 29
5	597	Tent ring	409825	7634824	2 x 2	Beach	July 29
6	598	Tent ring	409844	7634857	3 x 4	Beach	July 29
7	599	Tent ring	409846	7634900	2.5 x 4	Beach	July 29
8	600	Tent ring	409798	7634915	2.5 x 3	Beach	July 29
9	601	Tent ring	409794	7634924	2.5 x 2.5	Beach	July 29





SITE MAP



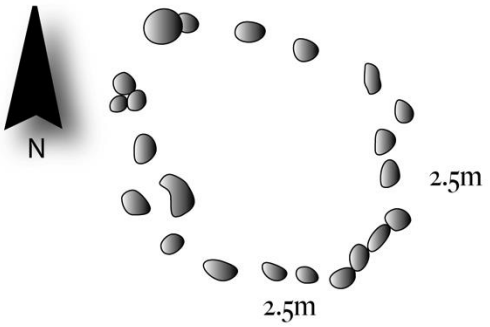
Feature 1 - Tent Ring

Feature 1 - tent ring - view N

FEATURES
(scale approximate)

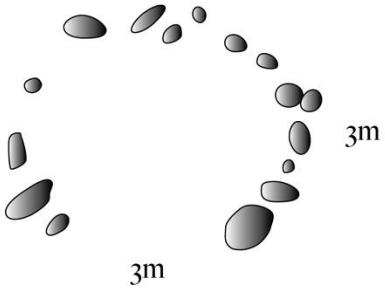
CAM-C5

LEGEND
stone



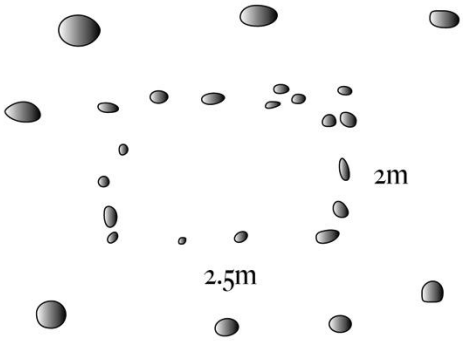
Feature 2 - Tent Ring

Feature 2 - tent ring - view NW



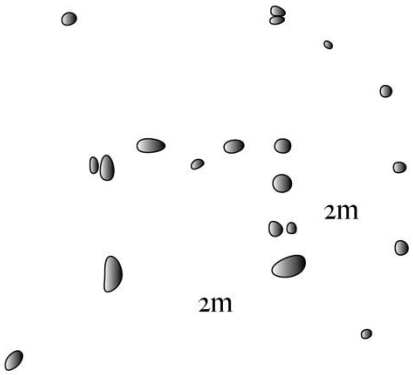
Feature 3 - Tent Ring

Feature 3 - tent ring - view NW



Feature 4 - Tent Ring

Feature 4 - tent ring - view NW



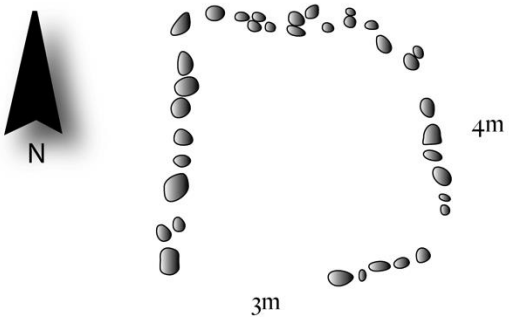
Feature 5 - Cache

Feature 5 - cache - view NW

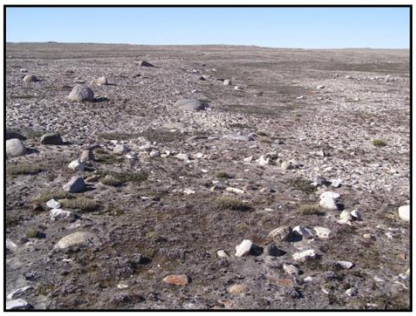
CAM-C5 cont'd

LEGEND

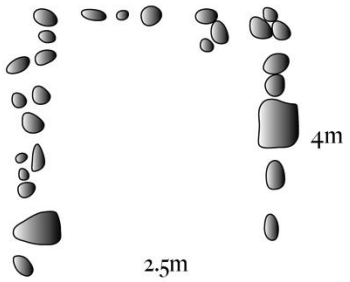
stone



Feature 6 - Tent Ring

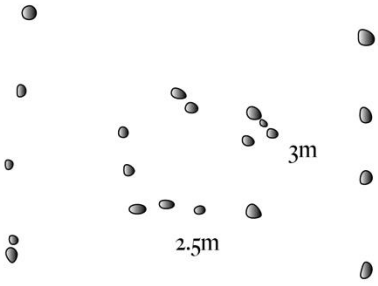


Feature 6 - tent ring - view NW



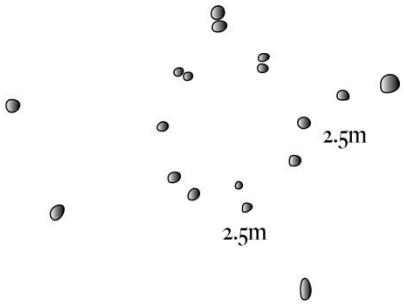
Feature 7 - Tent Ring

Feature 7 - tent ring - view NW



Feature 8 - Tent Ring

No Photo Available



Feature 9 - Tent Ring

No Photo Available

CAM-C5 cont'd

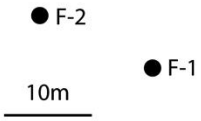
LEGEND

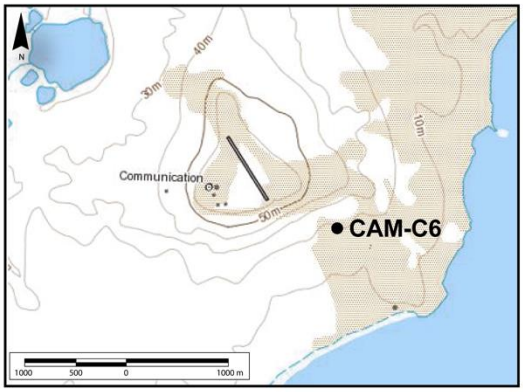
stone

BN=
NAM=
RN= CAM-C 6
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on POL Line west of the Beach Area access road just below the south end of the airstrip
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 408368E 7635527N
AIR=
EL= 25 m est.
SIZ= 200 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring (2)
CU= Inuit
PER= 20th century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= Shotgun shell in one of the tent rings suggests occupation in the 1980s. Goose droppings on the tundra around the tents suggest goose hunting as the reason for the location.

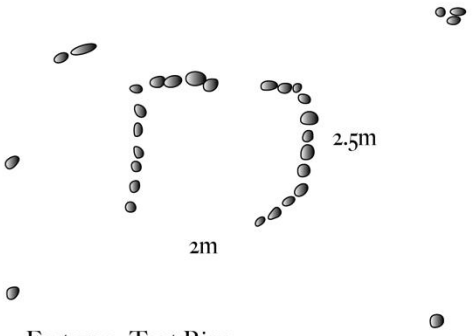
Feature Data Recorded at CAM-C 7 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	602	Tent ring	408368	7635527	2 x 2.5	POL line	July 29
2	603	Tent ring	408355	7635533	2.5 x 2	POL line	July 29



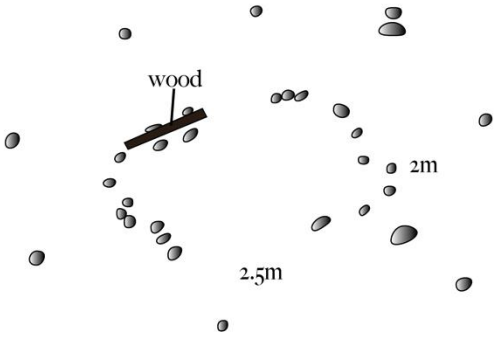


SITE MAP



Feature 1 - Tent Ring

Feature 1 - tent ring - view N



Feature 2 - Tent Ring

Feature 2 - tent ring - view NW

FEATURES
(scale approximate)

CAM-C6

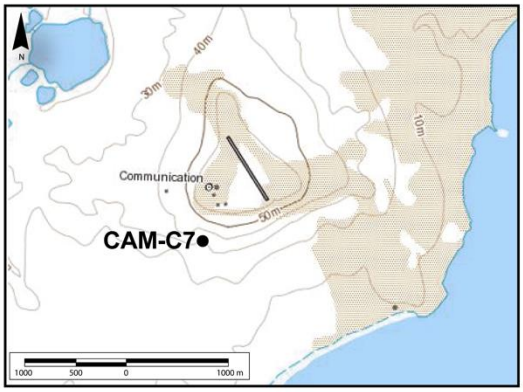
LEGEND

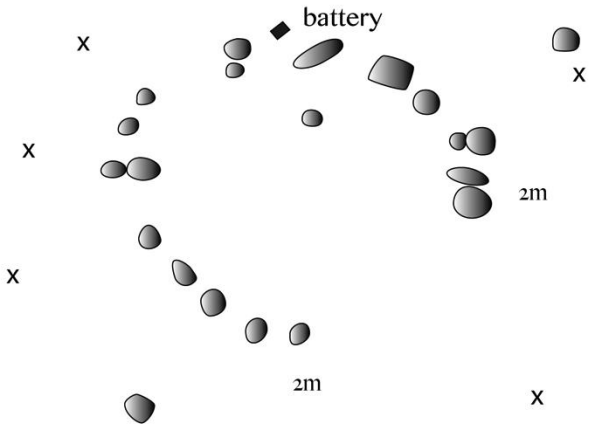
stone

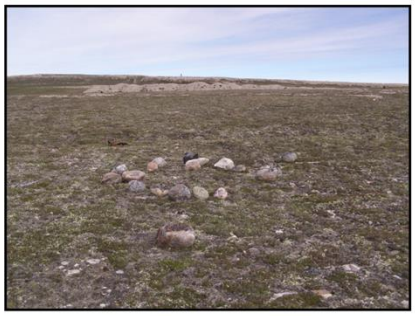
BN=
NAM=
RN= CAM-C 7
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, in the vicinity of a large debris area southwest of the Station Area on largely undisturbed tundra below the slope from the Station Area plateau. Site reported by DMT Geosciences crew member Adam Peake
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407542E 7635401N
AIR=
EL= 25 m est.
SIZ= 100 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring
CU= Inuit
PER= 20th century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= Battery and wood fragments in association

Feature Data Recorded at CAM-C 7 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	604	Tent ring	407542	7635401	2 x 2	Station	July 30







Feature 1 - Tent Ring

CAM-C7

LEGEND

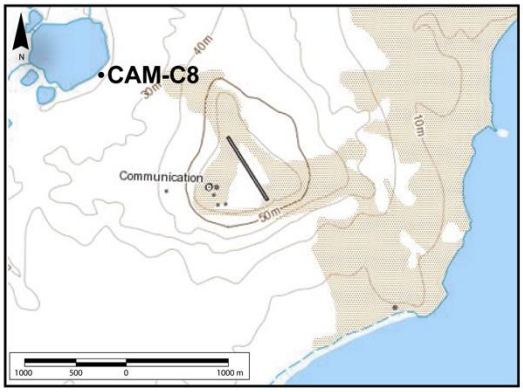
x = stake

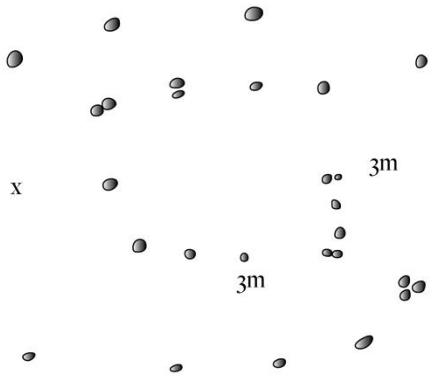
stone

BN=
NAM=
RN= CAM-C 8
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, 55 m north of the access road to the former water supply lake northwest of the Station Area on a high beach ridge
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407541E 7637037N
AIR=
EL= 25 m est.
SIZ= 100 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring
CU= Inuit
PER= 19th-20th century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= Wooden stake, outer ring of guy rope boulders

Feature Data Recorded at CAM-C 8 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	605	Tent ring	406541	7637037	3 x 3	Station	July 30





Feature 1 - Tent Ring

Feature 1 - tent ring - view NW

FEATURES
(scale approximate)

CAM-C8

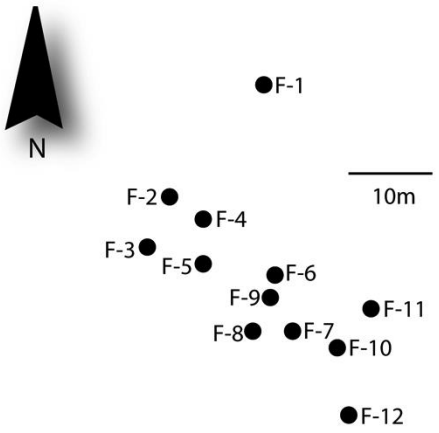
LEGEND
x = stake
stone

BN=
NAM=
RN= CAM-C 9
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on northeast side of northwest end of airstrip in cleared area on summit of Station Area plateau
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 407853E 7636355N
AIR=
EL= 60 m est.
SIZ= 5000 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring (12)
CU= Inuit
PER= 20th century
DAT= Post-airstrip construction
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= Very few recent artifacts in association with the tent rings, but this terrace appears to have been levelled during construction of the airstrip. Site reported by DMT Geosciences crew member, Adam Peake.

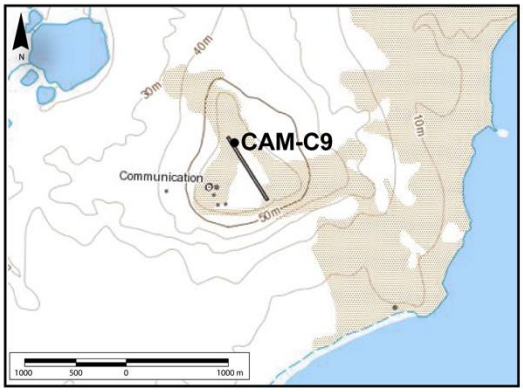
Feature Data Recorded at CAM-C 9 Recent Site, CAM-C, King William Island, Map Sheet 57 B/13E, Zone 15W

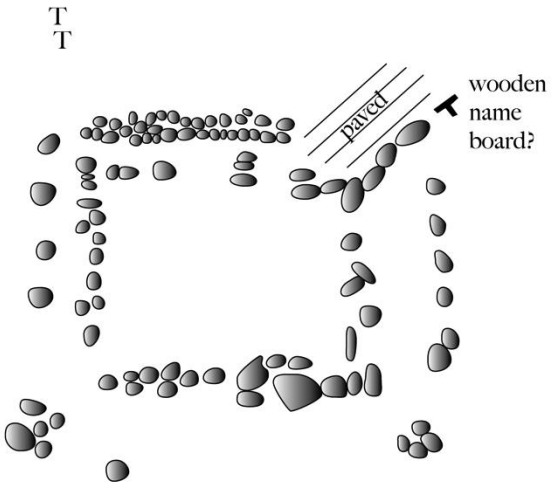
Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	621	Tent ring	407848	7636399	5 x 5	Station	July 31
2	622	Tent ring	407831	7636379	3 x 4	Station	July 31
3	623	Tent ring	407827	7636370	3 x 3	Station	July 31
4	624	Tent ring	407837	7636375	3 x3	Station	July 31
5	625	Tent ring	407837	7636367	3 x 3	Station	July 31
6	626	Tent ring	407850	7636365	4 x 4	Station	July 31
7	627	Tent ring	407853	7636355	3 x 3	Station	July 31

8	628	Tent ring	407846	7636355	4 x 4	Station	July 31
9	629	Tent ring	407849	7636361	4 x 4	Station	July 31
10	630	Tent ring	407861	7636352	3.5 x 3	Station	July 31
11	631	Tent ring	407867	7636359	3 x 3	Station	July 31
12	632	Tent ring	407863	7636340	3 x 3	Station	July 31

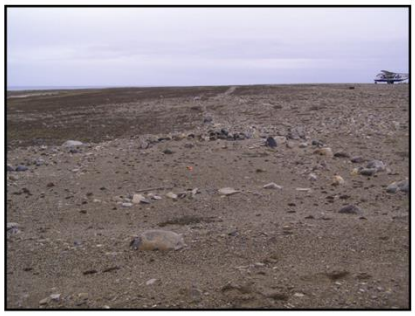


SITE MAP





Feature 1 - Tent Ring

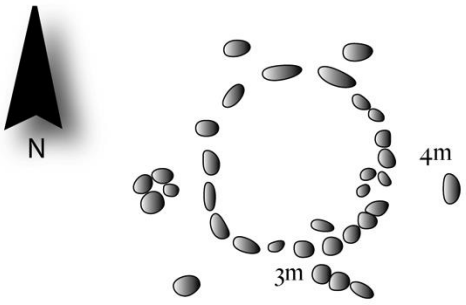


Feature 1 - tent ring - view N

FEATURES
(scale approximate)

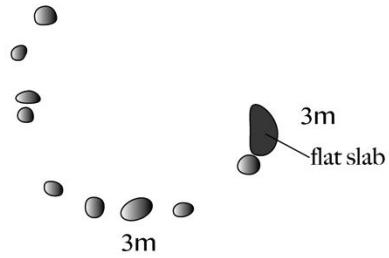
CAM-C9

LEGEND
T = fox trap
stone



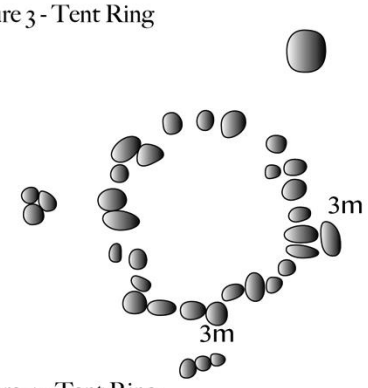
Feature 2 - Tent Ring

Feature 2 - tent ring - view N

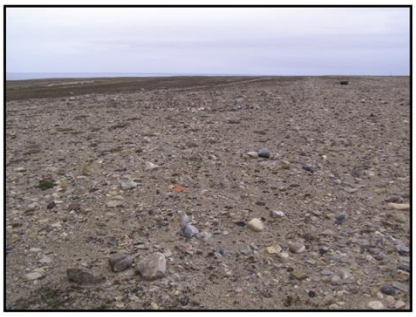


Feature 3 - Tent Ring

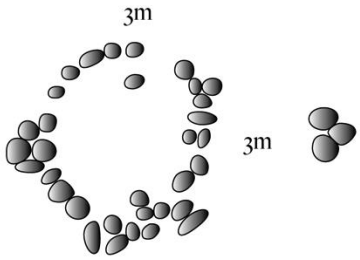
Feature 3 - tent ring - view N



Feature 4 - Tent Ring



Feature 4 - tent ring - view N



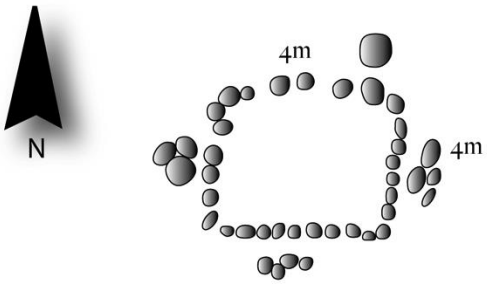
Feature 5 - Tent Ring

Feature 5 - tent ring - view N

CAM-C9 cont'd

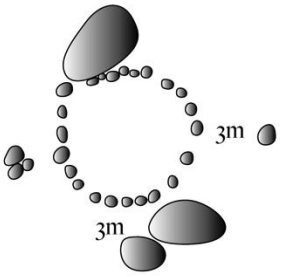
LEGEND

stone



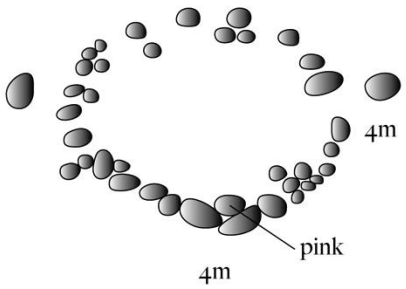
Feature 6 - Tent Ring

Feature 6 - tent ring - view N



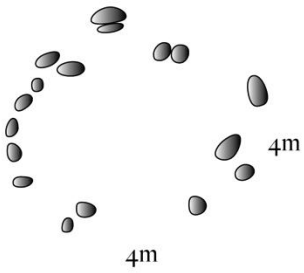
Feature 7 - Tent Ring

Feature 7 - tent ring - view N



Feature 8 - Tent Ring

Feature 8 - tent ring - view N



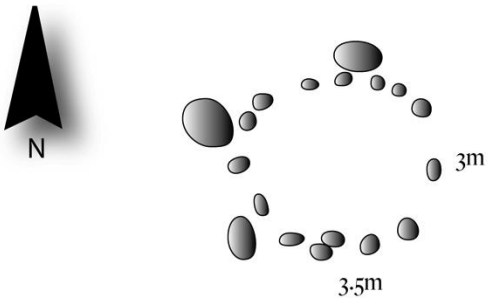
Feature 9 - Tent Ring

Feature 9 - tent ring - view N

CAM-C9 cont'd

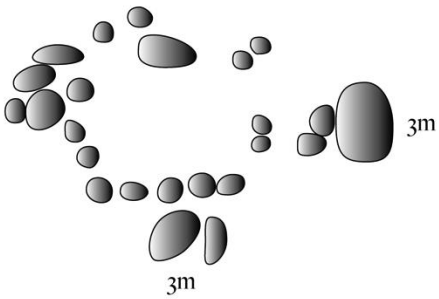
LEGEND

stone



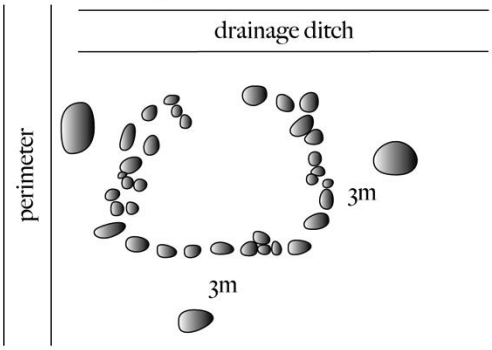
Feature 10 - Tent Ring

Feature 10 - tent ring - view N

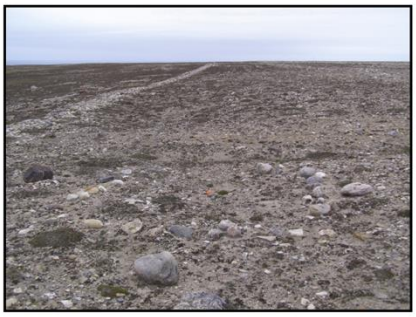


Feature 11 - Tent Ring

Feature 11 - tent ring - view N



Feature 12 - Tent Ring



Feature 12 - tent ring - view N

CAM-C9 cont'd

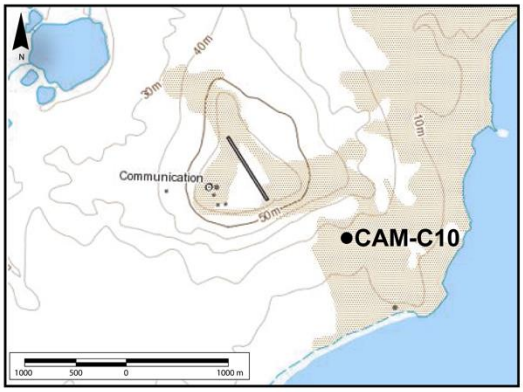
LEGEND

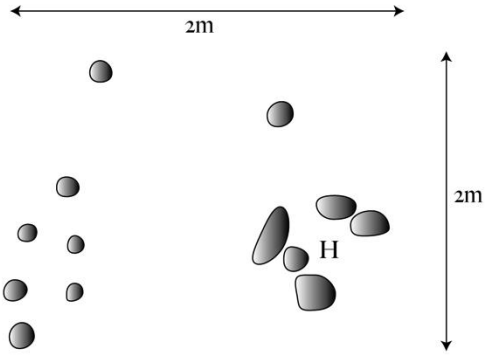
stone

BN=
NAM=
RN= CAM-C 10
PN= 2013-023A
PRO= Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut, 2013
LOC= East coast of King William Island overlooking Rae Strait, on north side of access road to the Beach Area on undisturbed tundra
TER= Nunavut
DST= Kitikmeot
MR= 57 B/13E
JUR= Federal
LAT=
LNG=
UTM= Zone 15 408961E 7635431N
AIR=
EL= 15 m est.
SIZ= 100 m²
CON= Stable
TYC= Recent
TY= Camp
FE= Tent ring, hearth
CU= Inuit
PER= 20th century
DAT=
RES= Callum Thomson, Thomson Heritage Consultants, Inc., Pictou Landing, NS
OD= July 2013
COL= None
PRE=
UPRE= Report on Archaeological Inventory and Assessment at CAM-C Matheson Point, King William Island, Kitikmeot, Nunavut
RE= Glass fragments in hearth

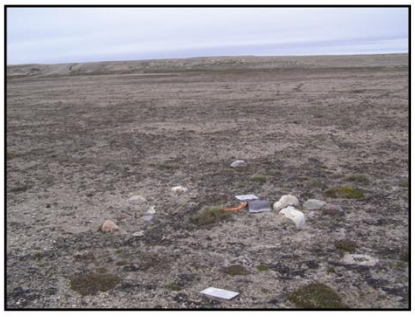
Feature Data Recorded at CAM-C 10 Recent Site, King William Island, Map Sheet 57 B/13E, Zone 15W

Feature No.	GPS Record No.	Feature Type	Easting	Northing	Size (m)	Work Area	Date Recorded
1	621	Tent ring, hearth	408961	7635431	2 x 2	Access Road	July 31





Feature 1 - Tent Ring



Feature 1 - tent ring - view N

FEATURES
(scale approximate)

CAM-C10

LEGEND
H = hearth
stone

Appendix 3

Nunavut Archaeological Permit 013-023A

NUNAVUT ARCHAEOLOGIST PERMIT

Permit Number	Permit Year	Permit Class
2013-23A	2013	Class 2

Under the authority of the *Nunavut Act* and the *Nunavut Archaeological and Palaeontological Sites Regulations*, authorization is granted to:

Permit Holder: Callum Thomson

Affiliation: Thomson Heritage Consultants

Name of Project: *Inventory, Assessment and Mitigation Study at CAM-C, King William Island*

For the purpose of: Archaeological inventory, assessment and mitigation of the former intermediate radar and communication site at CAM-C, Matheson Point, for Public Works and Government Services Canada. The collection of artifacts or specimens is authorized under this permit.

Permit Period: This Permit is valid from 21 June, 2013 to 31 December, 2013.

Conditions:

1. *The Permittee shall abide by the Nunavut Archaeological and Palaeontological Sites Regulations*
2. *The Permittee shall abide by the Guidelines for Nunavut Archaeological and Palaeontological Sites*
3. *The Permittee shall comply with all conditions attached to this permit.*
4. *The Permittee shall distribute materials and documentation to the agencies identified below according to this schedule:*

	Government of Nunavut Department of Culture and Heritage Box 310 Iqaluit, NU X0A 0H0	Canadian Museum of Civilization Box 3100, Station 'B' Hull, PQ J8X 4H2	Canadian Museum of Nature PO Box 3443, Stn D Ottawa, ON K1P 6P4	Inuit Heritage Trust Box 2080 Iqaluit, NU X0A 0H0
Required by September 30, 2013:				
One-page non-technical summary and two (2) colour photographs	X			
Required 60 days after return from field:				
Site Forms and Maps	X	X		
Required by March 31, 2014:				
1. Report	X	X		X
2. Field Notes	X			
3. (1) Artifacts, (2) Catalogue and (3) Loan Arrangements			**(1), (2), (3)**	

Approved by:

Minister
Department of Culture and Heritage
Government of Nunavut

Issued at: Iqaluit, Nunavut

Date of Issue: 21 June, 2013

Appendix 4

Project Photograph Catalogue

Photo Catalogue CAM-C, King William Island, July 29-31 2013, Project no. THC2013-2, NU Permit No. 2013-23A					
Photo No.	**View**	**Site/ Scene**	**Feature**	**Feature description**	**Date**
107		Skyvan		Gjoa Haven	July 29 2013
108		Skyvan		Gjoa Haven	July 29 2013
109		Skyvan		Interior	July 29 2013
110		Skyvan		Unloading at CAM-C airstrip	July 29 2013
111	NW	CAM-C 1	1	Tent ring	July 29 2013
112	NW	CAM-C 1	2	Tent ring	July 29 2013
113	NW	CAM-C 1	3	Tent ring	July 29 2013
114	NW	CAM-C 1	4	Tent ring	July 29 2013
115	NW	CAM-C 1	5	Tent ring	July 29 2013
116				deleted	
117	NW	CAM-C 1	View from 5 to 1	Tent rings, view NW to Station Area	July 29 2013
118		Arctic poppies			July 29 2013
119				Deleted	July 29 2013
120		Arctic poppy			July 29 2013
121	N	CAM-C 2	1	Tent ring with stakes	July 29 2013
122	N	CAM-C 3	1	Tent ring on former POL pad	July 29 2013
123	N	CAM-C 4	1	Tent ring with interior paving	July 29 2013
124	N	CAM-C 4	2	Small rectangular tent ring with outer guy rope boulders	July 29 2013
125	N	CAM-C 4	3	Tent ring and barrel dump on trail to borrow area	July 29 2013
126	NW	CAM-C 4	4	Small circular tent ring	July 29 2013
127	NW	CAM-C 4	5	Tent ring	July 29 2013
128	NW	CAM-C 4	6	Tent ring	July 29 2013
129	NW	CAM-C 4	7	Tent ring	July 29 2013
130	NW	CAM-C 4	7	Tent ring	July 29 2013
131	NW	NeJv-1	1	*Qammaq*	July 29 2013
132	SW	NeJv-1	1	*Qammaq*	July 29 2013
133	N	JeNv-1	2	Rectangular tent ring	July 29 2013
134	S	JeNv-1	2	Rectangular tent ring	July 29 2013
137	NW	JeNv-1	3	Cache	July 29 2013
138	SE	JeNv-1	3	Cache	July 29 2013
139	N	JeNv-1	4	Tent ring	July 29 2013
140	NE	JeNv-1	5	Rectangular tent ring	July 29 2013
141	NE	JeNv-1	5	Rectangular tent ring, view NE to F6	July 29 2013
142	W	JeNv-1	6	Cache, bone scatter	July 29 2013
143	N	CAM-C 5	1	Rectangular tent ring	July 29 2013
144	NW	CAM-C 5	2	Circular tent ring	July 29 2013
145	NW	CAM-C 5	3	Circular tent ring	July 29 2013
146	NW	CAM-C 5	4	Rectangular tent ring	July 29 2013
147	NW	CAM-C 5	5	Rectangular tent ring	July 29 2013
148	NW	CAM-C 5	6	Rectangular tent ring	July 29 2013
149	NW	CAM-C 5	7	Rectangular tent ring	July 29 2013
150				Deleted	
151	W	CAM-C 6	1	Rectangular tent ring	July 29 2013
152	NW	CAM-C 6	2	Circular tent ring	July 29 2013

153	NW	CAM-C 6		Tea break	July 29 2013
154	NW	CAM-C 6		Tea break	July 29 2013
155	N	CAM-C 6		View north over F-1 and F-2	July 29 2013
156	NW	CAM-C 6		View north over F-2	July 29 2013
157	NE	CAM-C Beach Area		Aerial photo	July 29 2013
158	NE	CAM-C Beach Area		Aerial photo	July 29 2013
159	N	CAM-C 7	1	Tent ring	July 30 2013
160	W	CAM-C 7	1	Tent ring	July 30 2013
161	NW	CAM-C 8	1	Circular tent ring	July 30 2013
162	SE	NeJv-2	1	Hearth	July 30 2013
163	NE	NeJv-2	1	Hearth on high beach ridge	July 30 2013
164				Deleted	
165				Deleted	
166	E	NeJv-3	1	Tent ring and interior hearth on high beach ridge	July 30 2013
167	N	NeJv-3	1	Tent ring and interior hearth on high beach ridge	July 30 2013
168				Deleted	
169	N	NeJv-4	1	Tent ring with midpassage and chert scatter on high beach ridge	July 30 2013
170	N	NeJv-4	1	Tent ring with midpassage and chert scatter on high beach ridge	July 30 2013
171	N	NeJv-4	Locus 2	Scatter of patinated and grey chert on high beach ridge	July 30 2013
172	N	NeJv-4	Locus 2	Scatter of patinated and grey chert on high beach ridge	July 30 2013
173	N	NeJv-4	Locus 2	Scatter of patinated and grey chert on high beach ridge	July 30 2013
174	N	NeJv-4	Locus 2	Scatter of patinated and grey chert on high beach ridge	July 30 2013
175	S	NeJv-5	Locus 1	Scatter of patinated chert and possible structure on high beach ridge below NeJv-3 and -4	July 30 2013
176	N	NeJv-6	1	Cache on lower beach terrace	July 30 2013
177	N	NeJv-7	1	Rectangular tent ring	July 30 2013
178	NE	NeJv-7	2	Old cache, Jessie Hoyt, and view along beach ridge	July 30 2013
179	N	NeJv-7	3	Circular tent ring	July 30 2013
180	N	NeJv-7	4	Recent circular tent ring	July 30 2013
181	NE	NeJv-1	7	Inuksuk on boulder	July 30 2013
182	SW	NeJv-1	8	Inuksuk on boulder	July 30 2013
183	E	NeJv-1	9	Qammaq	July 30 2013
184				Deleted	July 30 2013
185	N	CAM-C 9	1	Rectangular tent ring	July 31 2013
186	SE	CAM-C 9	1	Leghold fox traps and tent ring	July 31 2013
187	N	CAM-C 9	2	Circular tent ring	July 31 2013
188	N	CAM-C 9	3	Disturbed tent ring	July 31 2013
189	N	CAM-C 9	4	Circular tent ring	July 31 2013
190	N	CAM-C 9	5	Circular tent ring	July 31 2013
191	N	CAM-C 9	6	Rectangular tent ring	July 31 2013
192	N	CAM-C 9	7	Circular tent ring	July 31 2013

193	N	CAM-C 9	8	Circular tent ring	July 31 2013
194	N	CAM-C 9	9	Circular tent ring	July 31 2013
195	N	CAM-C 9	9	Circular tent ring	July 31 2013
196	N	CAM-C 9	10	Circular tent ring	July 31 2013
197	N	CAM-C 9	11	Circular tent ring	July 31 2013
198	N	CAM-C 9	12	Disturbed rectangular tent ring	July 31 2013
199	N			Raptor nest on boulder south of runway	July 31 2013
200	N	CAM-C 10	1	Circular tent ring and hearth	July 31 2013
201	E	NeJv-8	1	Midpassage tent ring	July 31 2013
202	W	NeJv-8	1	Midpassage tent ring	July 31 2013
203	Overhead	NeJv-8	1	Patinated chert core fragments	July 31 2013
204	Overhead	NeJv-8	1	Patinated chert fragments	July 31 2013
205	Overhead	NeJv-8	1	Green chert core	July 21 2013
206	N	NeJv-8	1	Midpassage tent ring	July 31 2013
207				Golden plover	July 31 2013
208				Golden plover	July 31 2013
209				Golden plover	July 31 2013
210				Golden plover	July 31 2013
211				Golden plover	July 31 2013
212				Golden plover	July 31 2013
213				Golden plover	July 31 2013
214				Golden plover	July 31 2013
215	W	NeJv-1	11	Cache	July 31 2013
216	E	NeJv-1	12	Cache	July 31 2013
217	N	NeJv-1	13	Cache	July 31 2013
218	N	NeJv-1	13	Cache	July 31 2013