

Λαλτλνδλγδλζις  
ςβωΔςζσςλ:

Scientific Research

**Period of operation:** from 0001-01-01 to 0001-01-01

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$\gamma_b \Delta^c \dot{\bar{O}} \Pi \sigma^b \quad \Lambda_{C-} n \nabla^{\gamma_b} \sigma \nabla n \nabla^{\alpha} L^{\alpha} \sigma^b$

The project is testing scientific and engineering work around the preservation and restoration of sea ice in the Arctic Ocean. The importance of the Arctic sea ice for global climate as well as for local populations is well documented scientifically. We want to demonstrate that sea ice can be thickened up using simple devices incorporating a submersible water pump, and only using zero-emission energy. This is our second field test, after we completed, in February 2023, a test in Nome, Alaska, using a battery powered pump. In this phase we introduce hydrogen, as energy storage and a fuel cell, to transform the hydrogen to electricity and power and electric water pump. With the use of hydrogen, we can extend the operating time of the water pump. The submersible pump will be lowered through an ice hole (drilled with an ice auger) into sea water, and will pump a large amount of water on top of existing sea ice. This sea water will quickly freeze to thicken up the existing ice layer, potentially flooding any existing snow, and increasing the conductivity between the cold air and the sea ice itself, which will support additional ice accretion over the following period. During the test we will track a number of metrics, including the extent of water displacement, the quality and conductivity of the sea-ice created, and sea-ice, snow and air temperatures. We will be requiring (exclusive, as much as possible) access to a sea-ice area of around 5 acres. 2.5 acres will be used for our experiments, and 2.5 will be used as control area for comparison purposes. Ideally we would want to continue to monitor this area for the following winter months, to see the impact of our operations. As an example, by flooding 20cm of snow with sea water at the beginning of winter, we would expect an extra 70cm of sea ice thickness to form, compared to areas where we haven't operated.

▷ΔΛ∩∫<sup>c</sup>: Le projet a pour but d'effectuer des tests scientifiques et d'ingénierie évaluant la préservation et la restauration de la banquise en Arctique. En effet, l'importance la banquise en zone Arctique et l'enjeu majeur écologique que cela représente pour les populations locales mais aussi à l'échelle mondiale est supportée par de nombreuses études scientifiques. Nous souhaitons démontrer que l'épaisseur de la banquise peut être améliorée grâce à un procédé que nous avons développé. Nous supposons, que l'immersion de neige existante dans de l'eau de mer résulterait par accroître la conductivité entre l'air froid et la banquise elle-même. Par la suite, nous sommes confiants que ce phénomène aiderait à développer une couche de glace supplémentaire. Durant notre test, nous rechercherons divers nombres de métriques, notamment afin d'étudier dans quelle mesure l'eau se déplace mais également la qualité et la conductivité de la nouvelle couche de banquise formée. Les températures de l'air, de la neige et de la banquise seront aussi enregistrées. Dans la poursuite de cet objectif, nous demandons l'accès aussi exclusif que possible à une zone de 5 acres (soit 20.235m<sup>2</sup>), de banquise afin d'entreprendre nos expériences tout en réservant 2.5 acres (environ 10.000 m<sup>2</sup>), comme zone de contrôle et d'analyse comparative des résultats obtenus. Idéalement, nous recherchons à maintenir la surveillance de cette zone durant l'hiver prochain afin d'observer l'impact de nos opérations. Par exemple, en immergeant 20cm de neige avec de l'eau de mer au début de l'hiver, nous espérons pouvoir atteindre la formation d'une épaisseur additionnelle de 70cm de banquise par comparaison avec les zones non incluses dans nos recherches.

[illegible]

Inuinnagtun: Havaagghakkut hapkua qauyihainiaqtut ayuqnaqtunik hanatuyullu havaagghainik talvani hapumihimanahuaqtunit pitquhianullu utiqittinahuaqlugu taryum hikua Ukiuqtaqtumi Taryuqmi. Aghuurnaqnia Ukiuqtaqtum Taryua nunaquyumi hilaamut taimaalu nunallaarmiunut inugiangiinut titiraqhimayut ayuqnaqtunik qauyihaiyinit. Ilittuqhitiyumayugut taimaa taryum hikua hilighilaaqtuq atuqhutik ayuqnaittunik ingilrutinik iliraiyumik kivitaqtumik imaqmik pakpautinik, taimaalu anialattihimaittumik amirnaqtunik. Hapkua tukliriyaaqtut maniqqami qauyihautikput, iniqhimaliqmat, lidjiruvia 2023-mi, qauyihaihimayut Nome-mi, Alaska-mi, paatuluqtumik pakpautiqahutik. Talvuuna havaaghaigut ilittuqhitihimayut hydrogen-mik, taimaa huanngautinik tutquumaviktut uqhiqhiviktullu, nuutittiyaamik hydrogen-mik alruyaqtuqtunut qulliqtuutinullu alruyaqtuqtumullu imaqmik pakpautimut. Atuqhutik hydrogen-mik, kingighivaalliinnarialik aulapkaiviat imaqmik pakpautinik. Kivitaqtuq pakpautik kivipkaqtitauniaqtuq aglukkut (ikuutaqhimayuuq ikuutakkut) talvani taryumi, imaqquqtuyumik pakpakkut imiqtarahuat qaanganut taryum hikua. Una taryum hikua qilamik qiqinniaqtuq hilighilugu hikuuyuuq, imaukkautilugu aputik aputiqaaqtut, hangutitaiplogu niklaumayuuq anuri taryuplu hikua, taimaa hakugighautauniaqtuq hikumik kinguani. Qauyihaitillugit paqittihimanahuaqtaqqut kititjutiit, taimaalu imaukkarnia, qanurininganianik hakugingnianiklu taryumi hikuliuqhimayuuq, taryuplu hikua, aputik hilaplu niklaumania. Atuqtitauyumayugut (anginiqhakkut, ayuqnaitpat) taryum hikuanik aktigiyumik 5 acres-mik. 2.5 acres atuqtauniaqtuq qauyihavighaaq, 2.5 acres-lu atuqtauniaqtuq munaqhiviktut aallatqiingniinik qauyihavighaat. Ayuqnaitpat munarihimmaarumayaqqut hamna atuqtughanit ukiumi tatqiqhiutinit, mihingnautait havaaqqut takuyumaplogu. Ilittuqhitiqaffuktut, imaukkautiplugu 20 cm aputik taryumik imaqmik ukiulihaaqtumi, taimaa naahuriniaqtugut 70 cm-mik hilingnianik hikunnguriamik, aallanngayunik nayugaqnit havakvigihimaitaptingnik.

Operations Phase: from 2023-11-14 to 2023-11-24

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Real Ice - CHARS Testing Area on Sea Ice (Exact area within polygon TBC by CHARS)	Scientific/International Polar Year Research	Marine	We will be seeking guidance from CHARS to operate at a site that does not present any disruption to residents or wildlife whilst also mitigating any damage to the environment. Guidance from local authorities will be needed to avoid known pathways/trails on the sea ice as well as hunting grounds for local residents.	We will operate in an area that not contain any archaeological/paleontological value.	Real Ice will be conducting research on the sea ice off the coast of Cambridge Bay within 10km of the CHARS facility.

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ᐱᑦᑭᓂᑦᑭᓂᑦᑭᓂᑦ	Robert Cooke & Rachel Mandel	Canadian High Arctic Research Station	2023-03-23

$\epsilon \Delta^{\alpha} j^{\beta} \wedge J^{\alpha} e^{\beta} \dot{N} \quad d^{\alpha} r^{\beta} C D P L \downarrow^{\gamma}$

$a^b r^c \wedge c d e f g h i j k l m n o p q r s t u v w x y z$

## Kitikmeot

$\Delta^{\alpha} \Gamma^{c} \wedge J^{\omega} e D \dot{N}$      $d^{\omega} r^{\epsilon b} C D F L R^c$

<b>ᐱᑦᓴᒃ ᐸᕈᖅ ᐳᔭᐹᕋᐻᐠᕆᕐ ᐵᕇᐢᕉᐰᕆᕐ ᐱᕏᕙᕍᕆᕐᓄᐤ ᐲᕗᕐ ᐱᕐᓂᕈᕎᕆᕐ ᑐᕛᕐᕈᕈᕐ ᐲᕗᕐ</b>	<b>ᕐᓂᕈᕈᕐ ᑐᕛᕐᕈᕈᕐ ᐱᕐᓂᕈᕎᕆᕐ ᑐᕛᕐᕈᕈᕐ</b>	<b>ᐬᕐᓂᕐᓂᕐᓂᕐ</b>	<b>ᐵᕇᐢᕉᐰᕆᕐ/ ᐳᔭᐹᕋᐻᐠᕆᕐ</b>	<b>ᐶᕇᐢᕉᐰᕆᕐ</b>
Hunters and Trappers Associations/Organizations	Will need authorization and guidance to ensure minimal impacts to local wildlife and environment that could harm food availability for the local community.	Not Yet Applied		
ᐱᕐᓂᕈᕎᕆᕐ	We have been advised to submit a research proposal with the NRI in order to conduct research in Nunavut.	Not Yet Applied		
ᕐᓂᕈᕈᕐ ᐳᔭᐹᕋᐻᐠᕆᕐ	We will need to meaningfully engage with local indigenous populations in Cambridge Bay before, during and after the research has taken place.	Not Yet Applied		

### Project transportation types

<b>Transportation Type</b>	<b>ᐱᕙᐅᐃᕈᓂᐅᑦᑎᐅᑦ</b>	<b>Length of Use</b>
Water	Snow-machine rented/used from the CHARS facility to travel on to the sea ice. Required licences & training to be acquired by team member(s) before conducting research.	
Land	Pick-up truck/ATV's. Suitable transport will be needed for 3 people and equipment when travelling on roads/land.	

### Project accomodation types

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$\triangleleft^b C d^c$ 
$$\Delta^b C j_c \sim \sigma \Delta^q \sigma^q$$
[illegible]
$$\Delta \nabla \cap \Gamma \triangleright C \dot{\div}^C \supset^C \quad \Delta^b \supset^{fb} C \triangleright \neg L \neg^C$$

Scale of Test - We designed this test to be on a scale small enough that does not present any impacts across any of the physical, biological and socio-economic elements. Noise Pollution affecting Wildlife - Our prototype is designed to run almost silently with the noise of water flooding the sea ice dominating. Hunting grounds disruption - Having a presence or conducting activities in known hunting grounds could disrupt food availability for the local community. Guidance from the local HTO will aid in the selection of a site with minimal impacts. Sea Ice Trails/Pathways - Blocking routes across the sea ice could disrupt local communities. By including the community and Kitikmeot Inuit Association in this process, we can choose a site that presents no impact on transportation across the sea ice.

## **Additional Information**

**SECTION A1: Project Info**

**SECTION A2: Allweather Road**

**SECTION A3: Winter Road**

**SECTION B1: Project Info**

**SECTION B2: Exploration Activity**

**SECTION B3: Geosciences**

**SECTION B4: Drilling**

**SECTION B5: Stripping**

**SECTION B6: Underground Activity**

**SECTION B7: Waste Rock**

**SECTION B8: Stockpiles**

**SECTION B9: Mine Development**

**SECTION B10: Geology**

**SECTION B11: Mine**

**SECTION B12: Mill**

**SECTION C1: Pits**

**SECTION D1: Facility**

**SECTION D2: Facility Construction**

**SECTION D3: Facility Operation**

**SECTION D4: Vessel Use**

**SECTION E1: Offshore Survey**

**SECTION E2: Nearshore Survey**

**SECTION E3: Vessel Use**

**SECTION F1: Site Cleanup**



## SECTION G2: Onland Exploration

### SECTION G4: Rig

## SECTION H2: Disposal At Sea

[illegible]

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[illegible]

### Miscellaneous Project Information

[illegible]

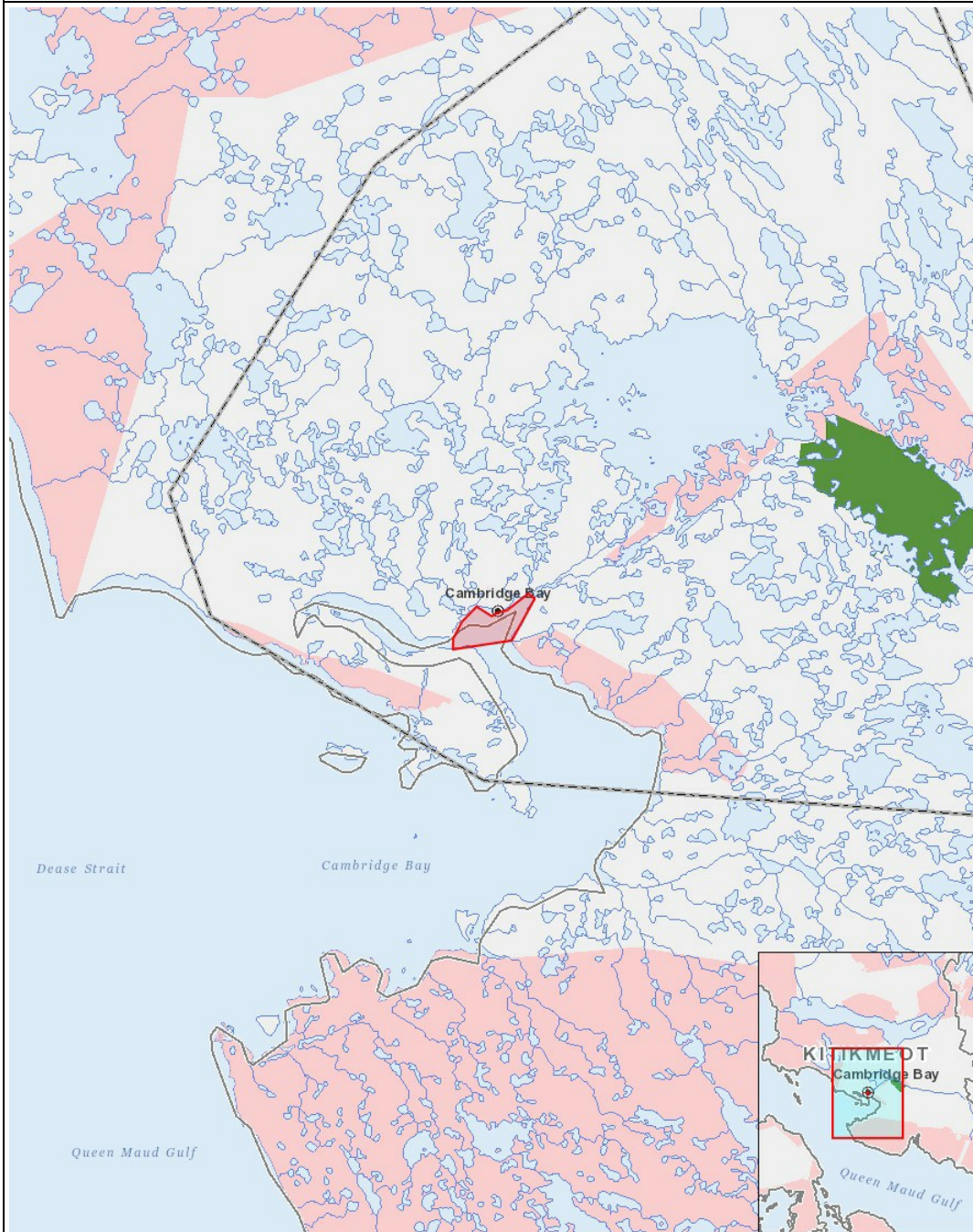
## Cumulative Effects

Our activities take place in a localised area to test sea ice thickening using a water pump and therefore would not generate any significant impacts on the environment.

## Impacts

$\Delta^{\epsilon_b} C D \sigma^{-\epsilon_b} r^C$      $\Delta^{\rho} O \Gamma D C \dot{\sigma}^C \gamma^C$      $\Delta^{b_j} \epsilon_b C D r_L r^C$

[illegible]
$$(P = \langle b \rangle_{\mathcal{A}} \cap \langle a \rangle_{\mathcal{B}})^c, N = \langle b \rangle_{\mathcal{A}} \cap \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c, M = \langle b \rangle_{\mathcal{A}} \cap \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c, U = \langle b \rangle_{\mathcal{A}} \cap \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c \langle \langle a \rangle_{\mathcal{B}} \rangle^c$$



# List of Project Geometries

1 polygon Real Ice - CHARS Testing Area on Sea Ice (Exact area within polygon TBC by CHARS)

