

# SCIENTIFIC RESEARCH LICENCE APPLICATION

## LAND, FRESHWATER & MARINE BASED RESEARCH

NRI strongly recommends that applicants review the following documents prior to submitting an application: *Scientific Research Licencing Guidelines* and *Negotiating Research Relationships in Inuit Communities: A Guide for Researchers*.

For more information about the Nunavut Research Institute (NRI) please visit our web site [www.nri.nu.ca](http://www.nri.nu.ca)

### IMPORTANT

This application fulfills the requirements for the NIRB environmental screening. Please be advised that your application will not be processed until the application form, project summary, and maps are received.

## SECTION 1: APPLICANT INFORMATION

**1a. Project Title** Green Edge

**1b. Project Number**

Please indicate if applicant has submitted any previous application(s) to NRI Yes ☐ No ☒ X  
related to this project proposal? \_\_\_\_\_

If yes, please indicate the previous NRI licence number: \_\_\_\_\_

Please indicate if applicant has submitted any previous application(s) to NIRB Yes ☐ No ☒ X  
related to this project proposal? \_\_\_\_\_

If yes, please indicate the previous NIRB project number(s): \_\_\_\_\_

**2. Applicant's full name and mailing address:**

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Email: Joannie.Ferland@takuvik.ulaval.ca

**3. Field Supervisor's name and mailing address:**

Éric Brossier

Vagabond research vessel

Qikiqtarjuaq, Nunavut, X0A 0B0

Phone: +881 677 701 801 (irridium)

Fax: \_\_\_\_\_

Email: Eric@vagabond.fr

**4. Other Personnel list (name, position, affiliation)**

The full list of participants for field operations is still being finalized and will be forwarded to the NRI as soon as possible.

## SECTION 2: AUTHORIZATION NEEDED

### 1. Indicate all authorizations associated with the project proposal:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Regional Inuit Association (RIA)<br><input type="checkbox"/> Nunavut Water Board (NWB)<br><input checked="" type="checkbox"/> Nunavut Planning Commission (NPC)<br><input type="checkbox"/> Department of Indian And Northern Development (DIAND)<br><input checked="" type="checkbox"/> Department of Fisheries and Oceans (DFO)<br><input type="checkbox"/> Community Government & Services (CG&S)<br><input checked="" type="checkbox"/> Nunavut Research Institute (NRI/GN)<br><input type="checkbox"/> Department of Culture, Language, Elders, and Youth (CLEY/GN) | <input type="checkbox"/> Canadian Launch Safety (CLS)<br><input type="checkbox"/> Environment Canada (EC)<br><input type="checkbox"/> Department of Environment (GN)<br><input type="checkbox"/> Department of National Defense (DND)<br><input checked="" type="checkbox"/> Hamlet<br><input type="checkbox"/> Parks Canada (PC)<br><input type="checkbox"/> Canadian Wildlife Service (CWS)<br><input checked="" type="checkbox"/> Other (please specify):<br>Nattivak HTO |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 2. List the active permits, licences, or other rights related to the project proposal and their expiry date:

A marine-based component of this project will also be carried out from the CCGS Amundsen in 2016. The work conducted from the Amundsen as part of the ArcticNet marine-based research program is covered by the NRI license 05 012 14R-M. License expires on December 31, 2014 but will be renewed for operations in 2016.

### 3. Have you applied for all authorizations required to conduct the project proposal activities?

☐ YES    ☒ NO

## SECTION 3: PROJECT PROPOSAL DESCRIPTION

### 1. Indicate the activities related to the project proposal:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> Temporary camp (to be removed at end of field season)<br><input type="checkbox"/> Permanent camp (to remain for life of authorization)<br><input type="checkbox"/> Construction of recreational or safety cabin<br><input checked="" type="checkbox"/> Temporary fuel storage (to be removed at end of field season)<br><input type="checkbox"/> Permanent fuel storage (to remain for life of authorization)<br><input type="checkbox"/> Placement of structures for life of permit (other than camp or cabin – i.e. scientific instruments)<br><input type="checkbox"/> Placement of permanent structures (other than camp or cabin – i.e. scientific instruments)<br><input type="checkbox"/> Air surveys (i.e. geophysical, wildlife)<br><input checked="" type="checkbox"/> Use of aircraft/watercraft/land vehicle for personnel drop-off and pick-up to project location<br><input checked="" type="checkbox"/> Use of on-site mechanized vehicles (i.e. atv, snowmobile, truck, zodiac)<br><input type="checkbox"/> Sewage or grey water disposal via sump<br><input checked="" type="checkbox"/> Hazardous waste storage or disposal<br><input checked="" type="checkbox"/> Solid waste disposal<br><input checked="" type="checkbox"/> Chemical storage<br><input type="checkbox"/> Explosives storage<br><input type="checkbox"/> Soil testing | <input type="checkbox"/> Soil disposal/ soil storage<br><input type="checkbox"/> Incineration of combustible wastes and removal of non-combustible wastes<br><input type="checkbox"/> River/ stream/ lake crossing or work/ bridge<br><input type="checkbox"/> Drainage alteration<br><input type="checkbox"/> Geoscientific sampling by diamond drilling<br><input type="checkbox"/> Geoscientific sampling by soil sampling<br><input type="checkbox"/> Geoscientific sampling by trenching<br><input type="checkbox"/> Geoscientific sampling by borehole core<br><input type="checkbox"/> Blasting<br><input type="checkbox"/> Channeling<br><input type="checkbox"/> Excavation<br><input type="checkbox"/> Hydrological testing<br><input type="checkbox"/> Abandonment and restoration<br><input type="checkbox"/> Site restoration (fertilization/ grubbing/ scarification/ spraying/ recontouring)<br><input checked="" type="checkbox"/> Research<br><input type="checkbox"/> Ecological survey<br><input type="checkbox"/> Harvesting<br><input type="checkbox"/> Removal of vegetation for scientific purposes<br><input type="checkbox"/> Other: |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 2. Personnel

|                                      |                                |                                 |          |                                                   |
|--------------------------------------|--------------------------------|---------------------------------|----------|---------------------------------------------------|
| Total No. of personnel on site = (A) | 4 (Mar - May)<br>12 (May-July) | Total No. of days on-site = (B) | 63<br>63 | Total No. of Person days (A) × (B) = 252+756=1008 |
|--------------------------------------|--------------------------------|---------------------------------|----------|---------------------------------------------------|

## 3. Timing

|                                 |                 |    |                |
|---------------------------------|-----------------|----|----------------|
| Period of operation:            | March 9th, 2015 | to | July 13th 2015 |
| Proposed term of authorization: | March 9th, 2015 | to | July 13th 2015 |

Please outline the phases of the proposed project (construction/ operation/ decommissioning) including the timing and scheduling of each phase.

**We hope the project to be conducted in 2015 and in 2016.**

### ICE CAMP

#### → Construction

March 9th to March 15th, 2015 – Field camp and automated sensors to be installed (Helicopter sling may be used for transport of fuel, heavy cargo and sensitive sensors to camp site approximately 24 km distance)

#### → Operation

March 15 to May 15, 2015 – Visit field camp every three days to sample and monitor automated equipment.

May 15 to ice break up, 2015 – Visit field camp every two days to sample and monitor automated equipment.

A typical daily visit will include:

- 4 snowmobiles convoy with komatiks from Qikiqtarjuaq to camp site
- generators will be turned on as power needs is required
- oil furnace will be turned on to heat the working tent
- sea ice and ocean sampling conducted via personal observations, ice corers, ice augers and ocean sampling equipment
- automated meteorological station and ocean sensors will be cleaned and batteries re-charged via a generator (2000W) if necessary
- data from automated sensors will be downloaded to a computer
- part of the samples will be processed at the site and some will be brought back to Qikiqtarjuaq via snowmobile convoy and processed in the laboratory there

First week of June, 2015 or during advanced stages of sea ice melt, an inflatable zodiac boat will be transported to the camp for safety purposes. The working tent may be dismantled during this period.

#### → Decommissioning

June 15-25, 2015 – All camp material and installed automated equipment will be removed from the site. A helicopter will be used if necessary to transport equipment back to Qikiqtarjuaq.

### RESEARCH VESSEL

Ice break-up to July 13 2015 – The site will be visited with a small research vessel for ocean sampling at the ice edge (vessel to be selected but will not be CCGS Amundsen). The vessel will be moored at Qikiqtarjuaq dock weather and ice condition permitting.

A typical daily visit will include:

- stations visited along a transect between the eastern limit of the ice-edge bloom (i.e. the previous ice camp location), and the western limit of the under-ice phytoplankton bloom or

- within 50 km westward from the ice edge if there is no under-ice bloom
- ocean sampling conducted via personal observations and ocean sampling equipment
- part of the samples will be process on the vessel and some will be brought back to Qikiqtarjuaq for processing in the laboratory there

#### 4. Location(s) of data collection:

| Location Name | Region<br>North Baffin, South Baffin, Kivalliq, Kitikmeot | Co-ordinates<br>Lat (degree / minute), Long (degree / minute) | NTS Map Sheet # | Land Status<br>Crown, Commissioners', Inuit Owned |
|---------------|-----------------------------------------------------------|---------------------------------------------------------------|-----------------|---------------------------------------------------|
| Qikiqtarjuaq  | South Baffin                                              | 67° 29.23N and 63° 38.00W                                     | 026P09          |                                                   |
|               |                                                           |                                                               |                 |                                                   |

If the project proposal includes a **camp**, please provide the coordinates of the camp location

Lat (degree/minute) 67° 29.23N Long (degree/minute) 63° 38.00W  
 NTS Map Sheet # (if different from above) \_\_\_\_\_

The Nunavut Impact Review Board may require additional location information in a subsequent Project Specific Information Requirement (PSIR) submission. This may take the form of a digital Geographic Information Systems (GIS) file.

### SECTION 4: NON-TECHNICAL PROJECT PROPOSAL DESCRIPTION

Please attach a non-technical description of the project proposal, no more than 500 words, in English and Inuktitut (+Inuinnaqtun, if in the Kitikmeot). The project description should outline the following:

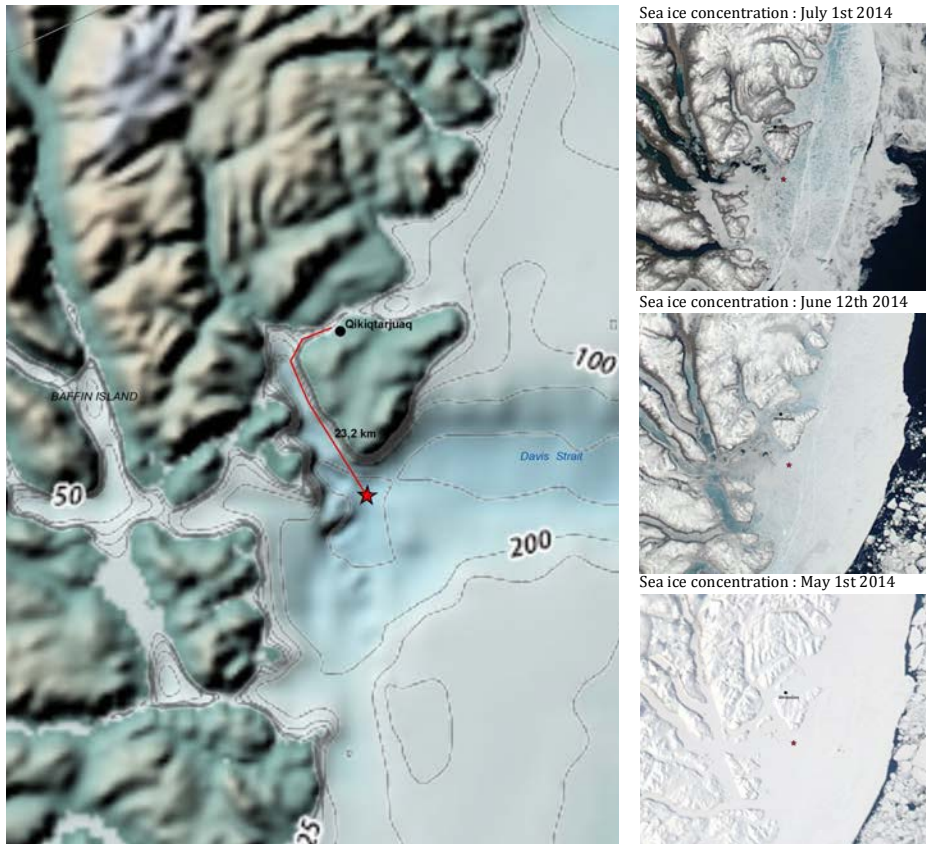
Title: Green Edge

Principal investigator: Marcel Babin, Professor, Laval University

The culture, health and economic capacity of northern communities are closely linked to marine resources supported by the phytoplankton spring bloom (PSB). Furthermore, timing, duration and magnitude of the PSB are strongly related to ice cover conditions. The warming climate has induced substantial changes to the sea ice cover in recent decades, including decreases in ice extent and thickness, and an earlier melt. Through control on the under-ice light environment, these changes will likely increase phytoplankton production under the ice cover, extending the period and thus, magnitude of production. Already, the decrease in the summer ice extent has lead to a 20% increase in pan-Arctic phytoplankton production. This project aims to improve our understanding of the processes that control the Arctic PSB as it expands northward and to determine its fate in the food web by investigating its related carbon fluxes.

Our plan is to conduct scientific research near Qikiqtarjuaq, this spring (2015) and next spring (2016). In 2014, Eric Brossier moored his sailing ship, Vagabond, close by Qikiqtarjuaq and lived there with his family during the winter and spring. He developed good relationships with the community and explored the surrounding region for the ice related work we plan to undertake with our project. Our team gathers researchers specialized in the study of sea ice and seawater ecosystems. Our goal is to undertake research in a site just over 20 km from Qikiqtarjuaq (see map below), for a period of four months (mid-March to mid-July). During this time, we hope to set-up one to two heated tents at a temporary on-ice sampling station to support our data collection. Sampling will involve installing automated electronic sensors on the ice that will monitor the weather and ocean properties and currents. Regular on ice sampling will involve the use of ice corers, augers, and ocean samplers. While at the camp, we will operate one to two generators for power supply and drip diesel furnaces for heating. The plan is to live in Qikiqtarjuaq and conduct laboratory work in a tent set up in the community. Our team will consist of two to four people from mid-March until mid-May, and ten to twelve people from mid-May until Mid-July. We will travel by snowmobile to the sampling site every 2-3 days. We will follow the same route to our on-ice site

The Green Edge project will contribute to the major societal challenge of efficient resource management and adaptation to climate change, through a better understanding and anticipation of environmental change. It will address significant knowledge gaps in Arctic marine biogeochemical cycles and the food web, and their linkages with local human populations. The results/findings will be communicated to the Qikiqtarjuaq council, HTO, the Inuksuit School and interested community members. These organizations/groups will be asked what is the preferred form of communication (e.g., in-person seminar, document, poster). It is also planned to produce publications in peer-reviewed scientific journals.



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Sea ice concentration : July 1st 2014



Sea ice concentration : June 12th 2014



Sea ice concentration : May 1st 2014



Sea ice concentration: July 1st, 2014

ᑕᓕᓄᓐ ᓴᓂᓐᓂᓐ: ᓴᑕᓄ 1, 2014

Sea ice concentration: June 12th, 2014

ᑕᓕᓄᓐ ᓴᓂᓐᓂᓐ: ᓴᓂ 12, 2014

Sea ice concentration: May 1st, 2014

ᑕᓕᓄᓐ ᓴᓂᓐᓂᓐ: ᓴᓄ 1, 2014

## SECTION 5: MATERIAL USE

### 1. List equipment (including drills, pumps, aircrafts, vehicles etc.):

| Equipment type               | number | Size – dimensions                              | Proposed use                                                 |
|------------------------------|--------|------------------------------------------------|--------------------------------------------------------------|
| Boat                         | 1      | 49'                                            | scientific cruise from Ice break-up to July 13th             |
| Air-ice boat                 | 1      | 15'                                            | transport to camp for safety during advanced stages of melt  |
| Snowmobile with sled         | 4      |                                                | travel between Qikiqtarjuaq and camp site                    |
| Small inflatable zodiac boat | 1      | 12'                                            | stored at camp for emergency purpose                         |
| Polar Haven/Parcoll          | 1 to 3 | 10' height x 20' x 16'                         | insulated tents for ice camp sampling and lab in the village |
| Tent for generators          | 1 to 2 | 137" x 55" x 43"                               | shelters to protect the generators from wind                 |
| Wind breakers                | 1      | 43" height x 30' long                          | shelter to work on the ice                                   |
| Generators 2000W and 5000W   | 3 to 5 | 24" height x 17" x 17"; 23" height x 27" x 21" | to power in ice camp and laboratory                          |
| Water sampling               | 5      | 32" height x 6"                                | to collect water samples                                     |

|                                                   |        |                                                   |                                                                                                |
|---------------------------------------------------|--------|---------------------------------------------------|------------------------------------------------------------------------------------------------|
| system (8L Niskin bottles)                        |        |                                                   |                                                                                                |
| Sediment gravity UVITECH                          | 1 to 2 | 39" height x 10"                                  | to collect ocean floor sediment samples                                                        |
| Ice augers                                        | 2 to 3 | 10" diameter                                      | to drill holes in the floe, to deploy the optical instruments in the water column              |
| Core barrels                                      | 2 to 3 | 47" x 11" x 5" (15 cm diameter)                   | to collect ice cores                                                                           |
| Drill - ice corer                                 | 2 to 3 | 11" x 13" x 15"                                   | to power the ice corer                                                                         |
| Drill                                             | 2      | 9" x 5" x 2"                                      | Used for basic repairs                                                                         |
| Ice saw                                           | 3      | 11" 7" x 1"                                       | to cut ice cores in smaller segments                                                           |
| High precision thermometer                        | 1      | 7" x 5" x 1"                                      | to measure the temperature of the ice with high precision                                      |
| Under ice arm                                     | 3      | 118' when unfolded                                | to guide the pump's tubing to collect under-ice water samples                                  |
| Winches                                           | 2 to 3 | 31" height x 19" x 23 "                           | to measure water column profile with a series of instruments                                   |
| Small portable winch (operated with a hand drill) | 1      | 22" x 20" x 20"                                   | to deploy the CTD profiler under the ice (with tripod)                                         |
| Tripod and its pulley                             | 3      | 98" x 19" x 19"; 98" x 70" x 70"; 59" x 47" x 47" | to hold the weight of the instrument while profiling in the water column                       |
| Chainsaw and ice pinchers                         | 1 each |                                                   | to make large holes during camp installation                                                   |
| Ice saw                                           | 1      | 49" long                                          | to make large holes during camp installation                                                   |
| Snow IR reflectance                               | 1      | 27" x 19" x 11"                                   | to measure snow specific surface area                                                          |
| Snow thermal conductivity measurement             | 1      | 27" x 19" x 11"                                   | to measure snow thermal conductivity                                                           |
| Snow pit kit                                      | 1      | 27" x 19" x 11"                                   | to study snow                                                                                  |
| Snow albedo spectrometer                          | 2      | 47" x 15" x 11"                                   | to measure of spectral albedo and transmission through ice                                     |
| Snow irradiance profiler                          | 2      | 31" x 23" x 23"                                   | to measure of the irradiance in the snow                                                       |
| Computers                                         | 1      | 31" x 23" x 23"                                   | maintenance                                                                                    |
| Eddy covariance system for T, S, and O2 fluxes    | 1      | 36" x 12" x 10"                                   | to measure temperature, salinity and oxygen fluxes at the boundary layer between ice and water |
| High Res ADCP                                     | 1      | 15" height x 9" diameter                          | to measure current direction and speed                                                         |
| SeaFET pH                                         | 1      | 16" height x 4" diameter                          | to measure pH in the water column                                                              |
| Franatech pCO2                                    | 1      | 16" x 20" x 7"                                    | to measure fluxes of CO2                                                                       |
| ASD or equivalent for spectral albedo             | 1      |                                                   | to measure albedo of the ice cover                                                             |
| Water PAM                                         | 1      | 12" x 6" x 13"                                    | to measure phytoplankton physiology                                                            |
| TriOS Ramses Scalar x2                            | 1      | 10" height x 1" diameter                          | to measure light under the ice                                                                 |
| "Ice-T" buoy: surface buoy                        | 1      | 5" diameter, 79" long                             | autonomous Ice mass balance buoy                                                               |
| "Fish": underwater                                | 2      | 15" height x 6" diameter                          | to measure temperature in snow                                                                 |

|                                                      |   |                                              |                                                                                          |
|------------------------------------------------------|---|----------------------------------------------|------------------------------------------------------------------------------------------|
| buoy attached to the surface "Ice-T" buoy            |   |                                              | and ice, ice thickness and current                                                       |
| SCAMP (Self Contained Autonomous Microprofiler)      | 1 | 27" height x 4" diameter                     | to measure microstructure in water motion                                                |
| Ring Nets (200 µm and 50 µm)                         | 1 | 31" x 31" x 4"                               | to sample zooplankton                                                                    |
| Lightframe On-sight Key species Investigation (LOKI) | 1 | 78" x 31" x 31"                              | to take profiles of pictures and sampling of zooplankton                                 |
| Sediment trap                                        | 4 | 39" x 7" x 7"                                | to collect sinking particles                                                             |
| Bio-Argo float equipped with optical sensors         | 2 | 86" height x 7" diameter                     | to be deployed for tests (clamped on a cable) one by one                                 |
| DIVING-PAM                                           | 1 | 23" x 15" x 9"                               | to measure fluorescence from phytoplankton in the water column                           |
| Photographic lander                                  | 1 | 79" x 79" x 39"                              | to be deployed on seabed through ice to take photographs. Recovered by ship              |
| Shipek grab                                          | 1 | 19" x 28" x 19"                              | to sample sediments                                                                      |
| Profileur CTD (conductivity, temperature, depth)     | 1 | 45" height x 7" diameter                     | to measure salinity, temperature, fluorescence, light, as a function of depth (100m)     |
| PARreference sensor                                  | 1 | 11" height x 11" diameter                    | to measure light radiation above ice                                                     |
| UVP (under water vide profiler) in a cage            | 1 | 55" height 16" x 16"                         | to measure particulate concentration and zooplankton abundance                           |
| Radiance Camera + cable 200m                         | 2 | 9" height x 3" diameter                      | to measure radiance light field above or under ice                                       |
| Reference Radiometer                                 | 1 | 9" height x 3" diameter                      | to measure irradiance above Ice                                                          |
| "IcePro" Optical Profiler                            | 1 | 1.5' height x 10" diameter                   | to acquire light profiles in the water down to 125 m, as well as atmospheric light level |
| tripod #1 (small)                                    | 1 | 3' triangular base, expandable up to 6' high | to install the "IcePro" atmospheric reference and GPS receiver                           |
| PURLs - calibration instrument for the IcePro        | 1 | 2' x 1.5' x 1.5'                             | to optically calibrate the IcePro optical heads                                          |
| "IOP" optical package                                | 1 | 70" height x 10" diameter                    | to acquire optical parameters in the water down to 300 m                                 |
| motorized pulley and its deck unit                   | 1 | 12" diameter                                 | to deploy the "IOP" optical package                                                      |
| Mini-ROV & Positioning system                        | 1 | 23" x 19" x 19"                              | to take image of the bottom of the ice and to deploy equipment                           |
| Under-ice trawl                                      | 1 | 71" x 11" x 11"                              | to sample sympagic biota                                                                 |
| Bottom Traps                                         | 2 | 27" x 27" x 1"                               | to sample sympagic biota                                                                 |
| Ring nets                                            | 3 | 19" diameter                                 | to sample sympagic biota                                                                 |
| Under-ice incubators                                 | 3 | 9" height x 9" diameter                      | to incubate isolated diatoms under the ice                                               |
| Meteorological tower                                 | 1 | Various size of equipment                    | to measure weather parameter during the project: T, Wind, snow                           |

|                                   |         |                           |                                                                             |
|-----------------------------------|---------|---------------------------|-----------------------------------------------------------------------------|
|                                   |         |                           | records                                                                     |
| Batteries                         | 2 to 4  | 15" x 10" x 10"           | to power instruments                                                        |
| POPS - Polar Ice Profiling System | 1       | 78" height x 23" diameter | to measure air and sea temperature continuously, GPS receiver               |
| Imaging FlowCytobot (IFCB)        | 1       | 32" height x 8" diameter  | to take phytoplankton images                                                |
| Inverted microscope               | 2       | 19" x 19" x 19"           | to identify and isolate phytoplankton                                       |
| Photosynthetron                   | 1       | 23" x 23" x 7"            | to perform incubation on phytoplankton under gradient of light intensities  |
| Cryo-circulating-waterbath        | 3       | 11" x 19" x 23"           | to cool and thermoregulate the photosynthetron                              |
| Light meter                       | 1       | 15" x 3" x 3"             | to measure light in the incubation system                                   |
| Orbital shaker                    | 1       | 19" x 19" x 7"            | to shake the samples                                                        |
| Fluorometer NH4                   | 1       | 13" x 11" x 9"            | to measure concentration of ammonium                                        |
| Spectrophotometer                 | 1       | 25" x 26" x 13"           | to measure absorption of light by particulate matter                        |
| Ultrapath                         | 1       | 39" x 12" x 12"           | to measure absorption by colored dissolved organic matter (CDOM)            |
| Hand vacuum pump                  | 1       | 7" x 3" x 1"              | to filtrate samples                                                         |
| Vacuum pump                       | 9       | 7" x 7" x 5"              | to filtrate samples                                                         |
| Peristaltic pump                  | 1       | 7" x 7" x 5"              | to filtrate samples                                                         |
| Filtration system                 | 7       | 23" x 15" x 7"            | to filtrate samples                                                         |
| Filtration systems                | 4       | 15" x 7" x 7"             | to filtrate samples                                                         |
| Computer                          | 6 to 10 | 11" x 11" x 3"            | to compute and log data from instruments/sensors                            |
| pure water system                 | 1       | 14" x 18" x 14"           | to calibrate instrument and rinse off salt water from equipment             |
| Spill kit                         | 1 to 2  | 24" x 24" x 24"           | absorbent material kept in camp to clean up accidental spills if they occur |

## 2. Detail fuel and hazardous material use:

| Fuel     | Capacity of Containers                                                 | Number of Containers                                 | Total Amount of Fuel (in Litres) | Proposed Storage Methods                                                                                                                                                                                                                             |
|----------|------------------------------------------------------------------------|------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diesel   | 4500L Vagabond vessel tank<br><br>45US Gal drums<br><br>25L Gerry Cans | 1<br><br>1 at camp site<br><br>2 for each expedition | ca 3500 L                        | We intend to purchase the diesel at the community gas station to fill all listed containers.<br><br>25L containers will be filled and brought to the camp site approximately every two days. The fuel will be used to power the for 5000W generator. |
| Gasoline | 25L Gerry Cans                                                         | 6                                                    | ca 6000L                         | We intend to purchase the gasoline from the community gas station.                                                                                                                                                                                   |

|                                          |                           |        |                                                                      |                                                                                                                                                                                                |
|------------------------------------------|---------------------------|--------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | 45 L snowmobile reservoir | 4      |                                                                      | Snowmobiles and 25L-containers will be filled and carried to the camp site approximately every two days. The extra fuel carried will be used to refuel snowmobiles, ice drills and generators. |
| Aviation fuel                            |                           |        |                                                                      |                                                                                                                                                                                                |
| Propane                                  |                           |        |                                                                      |                                                                                                                                                                                                |
| Other- Furnace oil                       | 170L drums                | 13     | 2160L                                                                | 45 US Gal drums will be used to feed oil furnace heating systems at camp site and in the laboratory tent in the community.                                                                     |
|                                          |                           |        |                                                                      |                                                                                                                                                                                                |
| <b>Hazardous Materials and Chemicals</b> |                           |        | <b>Total Amount of Hazardous Materials and Chemicals (in Litres)</b> |                                                                                                                                                                                                |
|                                          |                           |        |                                                                      |                                                                                                                                                                                                |
| <b>ACIDS/BASES</b>                       |                           |        |                                                                      | All containers will be stored in appropriate and locked cabinets                                                                                                                               |
| Phosphoric acid                          | 1L-bottle                 | 1      | 1                                                                    |                                                                                                                                                                                                |
| Hydrochloric acid 37%                    | 1L                        | 1      | 3                                                                    |                                                                                                                                                                                                |
| Hydrofluoric acid                        | 100 ml                    | 1      | 0,1                                                                  |                                                                                                                                                                                                |
| Hydrochloric acid 1N                     | 4L                        | 14     | 56                                                                   |                                                                                                                                                                                                |
| Sodium hydroxide                         | 500 ml                    | 1      | 0,5                                                                  |                                                                                                                                                                                                |
| Sulfuric acid 50%                        | 100 ml                    | 1      | 0,2                                                                  |                                                                                                                                                                                                |
| <b>SOLVENTS</b>                          |                           |        |                                                                      | All containers will be stored in appropriate and locked cabinets                                                                                                                               |
| Formaldehyde 37% + Borax, 11% methanol   | 20L                       | 1      | 20                                                                   |                                                                                                                                                                                                |
| Formaldehyde, solution 37-41%            | 4L                        | 2      | 8                                                                    |                                                                                                                                                                                                |
| Ethanol 95%                              | 4L                        | 4      | 16                                                                   |                                                                                                                                                                                                |
| Ethanol, absolute 99.5%                  | 0.5L                      | 1      | 0,5                                                                  |                                                                                                                                                                                                |
| Glutaraldehyde                           | 100 mL                    | 1      | 1                                                                    |                                                                                                                                                                                                |
| Polyethylene glycol 200                  | 1L                        | 4      | 4                                                                    |                                                                                                                                                                                                |
| Ethylene glycol                          | 4L                        | 3      | 12                                                                   |                                                                                                                                                                                                |
| Ethanolamine                             | 1L                        | 1      | 1                                                                    |                                                                                                                                                                                                |
| Methanol 50%                             | 4L                        | 8      | 32                                                                   |                                                                                                                                                                                                |
| Methanol 99%                             | 4L, 2,5L                  | 1 each | 6,5                                                                  |                                                                                                                                                                                                |
| DMSO                                     | 100 mL                    | 10     | 1                                                                    |                                                                                                                                                                                                |
| <b>POWDERS</b>                           |                           |        |                                                                      | All containers will be stored in appropriate and locked cabinets                                                                                                                               |
| Sodium Bicarbonate                       | 2.5 Kg                    | 4      | 10kg                                                                 |                                                                                                                                                                                                |
| Ammonium Chloride                        | 0,5349                    | 3      | 1,6047g                                                              |                                                                                                                                                                                                |
| Ammonium Chloride 15N                    | 0,0571                    | 2      | 0,1142g                                                              |                                                                                                                                                                                                |
| OPA                                      | 4g                        | 10     | 40g                                                                  |                                                                                                                                                                                                |
| Potassium nitrate                        | 1.0111g                   | 4      | 4,0444g                                                              |                                                                                                                                                                                                |
| Potassium nitrate 15N                    | 0.25g                     | 1      | 0,2042g                                                              |                                                                                                                                                                                                |
| Sodium bicarbonate 13C                   | 0.2g & 0.6                | 30     | 9g                                                                   |                                                                                                                                                                                                |

|                                           |               |    |      |                                                                  |
|-------------------------------------------|---------------|----|------|------------------------------------------------------------------|
| Sodium Sulfite                            | 1g            | 8  | 8g   |                                                                  |
| Tétraborate de sodium                     | 20g           | 10 | 200g |                                                                  |
| Mercury Chloride                          | 1.75g         | 2  | 3,5g |                                                                  |
| <b>RADIOISOTOPE</b>                       |               |    |      | All containers will be stored in appropriate and locked cabinets |
| <sup>32</sup> Si radioisotope             | 10 µCi (1 ml) | 1  | 0,01 |                                                                  |
| C14 labelled sodium bicarbonate           | 2 mL = 4 mCi  | 45 | 0,9  |                                                                  |
| <b>GAS CYLINDER</b>                       |               |    |      | Cylinder                                                         |
| Helium Ultra Pure                         | 1             | 1  |      |                                                                  |
| <b>OTHER</b>                              |               |    |      | All containers will be stored in appropriate and locked cabinets |
| RNA Later                                 | 500 mL        | 2  | 1    |                                                                  |
| Scintillation cocktail (ultima Gold XR)   | 2,5           | 2  | 5    |                                                                  |
| Citranox                                  | 2,5L          | 1  | 2,5  |                                                                  |
| Windex                                    | 1,5L          | 2  | 3    |                                                                  |
| NoCount                                   | 0.5L          | 3  | 1,5  |                                                                  |
| Ecolume                                   | 1 gal         | 10 | 40   |                                                                  |
| Mercury (II) Chloride, saturated solution | 250 mL        | 1  | 0,25 |                                                                  |
| Dimethylsulfide                           | 4 ml          | 1  | 0,04 |                                                                  |
| Dimethylsulfoniopropionate                | 25 ml         | 12 | 0,3  |                                                                  |
| Camping cartridge propane/butane          | 240 g         | 3  |      |                                                                  |
| Sealed battery                            | 32 kg         | 4  |      |                                                                  |
|                                           |               |    |      |                                                                  |
|                                           |               |    |      |                                                                  |

### 3. Detail daily water consumption rates

| Daily amount (in Litres) | Proposed water retrieval methods | Proposed water retrieval location |
|--------------------------|----------------------------------|-----------------------------------|
| 20 – 40L                 | Containers filled with tap water | From community                    |

### 4. Have you applied for a Class A License with the Nunavut Water Board?

☐ YES

☒ NO

## SECTION 6: WASTE DISPOSAL AND TREATMENT METHODS

### 1. List the types of waste:

| Type of waste             | Projected amount generated                 | Method of Disposal                                                 | Additional treatment procedures |
|---------------------------|--------------------------------------------|--------------------------------------------------------------------|---------------------------------|
| Sewage (human waste)      | 0 to 5 kg per day                          | Bring back to Qikiqtarjuaq when produced at the ice camp site      |                                 |
| Greywater                 |                                            |                                                                    |                                 |
| Combustible wastes        | 775L (17 x 1 garbage bag 12 Gal per week)  | Disposed of in Qikiqtarjuaq landfill                               |                                 |
| Non-Combustible wastes    | 775 L (17 x 1 garbage bag 12 Gal per week) | Recyclables will be taken to the recycling center (Police station) |                                 |
| Overburden (organic soil, |                                            |                                                                    |                                 |

|                           |                                                                                                                                                                                 |                                                                                                                        |  |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--|
| waste material, tailings) |                                                                                                                                                                                 |                                                                                                                        |  |
| Hazardous waste           | 45L Inorganic acids<br>5 L Inorganic bases<br>47 L Non-halogenated solvents<br>290 L <sup>14</sup> C (liquid)<br>154 L <sup>14</sup> C (vials)<br>45 L <sup>32</sup> S (liquid) | Stored in appropriate drums at a designated place in the community until recovery by the CCGS Amundsen in October 2015 |  |
| Other:                    |                                                                                                                                                                                 |                                                                                                                        |  |

**2. Will you be incinerating combustible waste, removing all solid waste, and removing the ash generated from incineration?**

☐ YES

☒ NO

## SECTION 7: COMMUNITY INVOLVEMENT & REGIONAL BENEFITS

**1. List the community representatives that have been contacted and provide the minutes of the meetings if available:**

| Community    | Name                      | Organization                                                     | Date Contacted              |
|--------------|---------------------------|------------------------------------------------------------------|-----------------------------|
| Qikiqtarjuaq | Mary Killiktee            | Mayor Qikiqtarjuaq community                                     | February 2014<br>April 2014 |
| Qikiqtarjuaq | Community council meeting | All representative of community council including elders and HTO | February 2014               |
| Qikiqtarjuaq | Daisy Nuqingaq            | Senior Administrative Officer                                    | February 2014               |
| Qikiqtarjuaq | David Grant               | Economic Development Officer                                     | March 2014                  |
| Qikiqtarjuaq |                           | Nattivak Hunter and Trappers Organization                        | May 2014                    |
| Qikiqtarjuaq | Arthur E. Nicomedes       | Director of Finance / Acting SAO                                 | April 2014                  |
| Qikiqtarjuaq | Jacopie Audlakiak         | Team Search and Rescue                                           | June 2014                   |

**2. How will the proposed project benefit Nunavut?**

Eric Brossier introduced the Green Edge project last February to the community council of Qikiqtarjuaq under the mayor's invitation. The elders, HTO board and other members of the community attended the meeting. Eric informed the members of the community about the project and opportunities for local involvement and collaboration.

The project will help increase knowledge on the importance of sea ice in the face of a rapidly changing Arctic climate. Green Edge will address significant knowledge gaps in Arctic marine biogeochemical cycles and the food web, and their linkages with local human populations such as Qikiqtarjuaq. The results will be directly applicable to the hamlet of Qikiqtarjuaq and the Nattivak HTO as they still depend on marine ecosystem for sustenance and commerce.

Food security analysis will be conducted from Inuit knowledge of the marine environment based on semi-directive interview process with Elders, hunters and identified local experts. The research will directly benefit northern communities, as the results will provide new knowledge for policy makers and local governance. A final report will be prepared for distribution to the local communities, to ArcticNet researchers and to policy makers.

There are communication activities planned under this project, namely the production of a 52-min documentary combined with an interactive platform presenting informative web-documentaries (2 to 5 min) and teaching tools to promote arctic research and oceanographic concepts in Canadian elementary,

junior-high and high schools. As part of the field research program in 2015 and 2016, we plan to contact the Inuksuit school to promote Arctic science using these educative tools and hopefully more interactive activities between scientists and students upon further discussion with the teachers.

Meetings will also be held during the field season to present preliminary results and exchange with community members. Furthermore, we plan to hire local guides and wildlife monitors to assist and oversee the installation, operation and removal of the camp. All Nunavut communities (HTOs) will be contacted via a fax outlining Green Edge's program and the 2015 scientific campaign. Part of this fax invites the communities to supply us with the names and contact information of high school and college students and of experienced wildlife monitors interested in employment. The list of students will be made available to scientists as potential research assistants in the field, whereas, the list of wildlife monitors will be used to hire monitors to be onboard the ship during the field project. These positions will be filled on an opportunity basis.

Since 2005, ArcticNet has been funding a full time Inuit Research Advisor (IRA) position for each of the four Inuit regions of Canada (i.e. Nunavut, Nunavik, Nunatsiavut and Inuvialuit). Part of the IRAs' mandate is to promote communication between researchers and community members and therefore facilitate the dissemination of results and information to and from the communities. For more information on Nunavut's Research Advisor, please visit <http://www.arcticnet.ulaval.ca/research/advisors.php>.

**4. Describe and attach documentation regarding community support or concerns for the proposed project:**

We have contacted both the Nattivak HTO and the community council of Qikiqtarjuaq. We are currently awaiting letters of support and, or concerns and will forward these to the Nunavut Research Institute as soon as we obtain them.

**5. Is there a traditional knowledge component to this research project? If yes, please explain:**

Traditional Inuit knowledge linking sea ice, climate change and the availability of marine resources (fish, marine mammals, seabirds) will also be used to infer on trends in ocean productivity. Just as the traditional knowledge will inform and complement the science, results obtained from the Green Edge project will provide local experts and Indigenous knowledge systems with a better understanding of the current Arctic environmental change.

A two-way exchange between marine scientists and local Indigenous Experts is to be a powerful approach to get a full appraisal of modifications in the biophysical regime of Arctic waters. As part of Green Edge, we will establish a solid connection with the coastal communities that populate western Baffin Island with the aim of documenting the links between climate change, fluctuations in vernal productivity, and the variability in marine resource density and diversity. This will take the form of a series of interviews and bilateral discussion between elders, middle-aged and young Inuit, as well as the group of scientists from Green Edge. We aim specifically at targeting the local communities of Clyde River, Pond Inlet and Qikiqtarjuaq. The results of the food security analysis will provide new knowledge for policy makers and local governance. A final report will be prepared for distribution to the local communities, to the ArcticNet researchers and to policy makers.

Moreover, 1 web-documentary will be dedicated to the northern communities and way of life: "Hunting, fishing and diet of Inuit living near the ice-edge".

## **SECTION 8: GENERAL QUESTIONS**

**1. Do you give NRI permission to publish project information in the Nunavut Research Institute Annual Compendium of Research Undertaken in Nunavut?**

■ **YES**

☐ NO

3. In addition to the application form, applicants are required to submit additional information in an electronic format to the Manager, Research Liaison, [cfilion@nac.nu.ca](mailto:cfilion@nac.nu.ca). Please check that the following have been submitted to NRI:

- ☒ **Project Summary** -in English and Inuktitut (+Inuinnaqtun, if in the Kitikmeot)  
☒ **NTS Maps** of the project

**Applicant: Marcel Babin**



Director of Takuvik

December 4, 2014

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**Signature**

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**Title**

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**Date**