

Quilliq Energy Corporation (QEC) is proposing to construct and operate a new power plant in the Hamlet of Gjoa Haven located in the Kitikmeot Region of Nunavut (the Project). This multi-year project will include a new four-engine power generation facility with installed capacity of 3,100 kilowatts. The power plant will be designed for a 40-year life and will incorporate new technology to improve reliability, efficiency, operation, and safety. Construction will include a fuel storage system consisting of two 90,000 litre horizontal fuel tanks, and fuel pumping facilities. Additionally, QEC plans to construct a Quonset garage, transformer storage, pole racks, and oil and glycol drum storage and waste disposal area with secondary containment berm. Space will be allocated for transient staff accommodations, sea cans for storage, and a back-up emergency generator. Upgrades to the existing distribution system will also be required to connect to the new power plant. An approximately 50-metre fuel pipeline will be constructed to connect to the Petroleum Products Division (PPD) bulk fuel facility located to the east.

Quilliq Energy Corporation (QEC) is a Government of Nunavut (GN) territorial corporation. Through the operation of 25 stand-alone diesel power plants with a total installed capacity of approximately 76,000 kilowatts, QEC is the sole provider of electricity to approximately 15,000 customers in the territory. QEC provides mechanical, electrical, and line maintenance services from three regional centers: Iqaluit, Rankin Inlet and Cambridge Bay. QEC's administrative activities are carried out at the Head Office in Baker Lake and the Corporate Office in Iqaluit.

QEC is committed to planning and developing cost effective and efficient ways to provide a safe, reliable and stable energy supply for all Nunavummiut.

Gjoa Haven is a community with increasing demand for electricity, reflecting its growing population. According to the Gjoa Haven Community Plan (By-Law No. 164), the population of Gjoa Haven is estimated to reach 1,750 by 2032 based on a medium growth projection. The existing Gjoa Haven power plant was constructed in 1977. Although the power plant's capacity can adequately meet the communities current and projected capacity requirements over the next decade, the power plant is 44 years old and has exceeded its design life.

The building structure and foundation are in poor condition, having started to deteriorate. Generator set 'G1' has significantly exceeded its engine life hours and needs to be replaced to maintain reliability of service in the community. The existing switchgear is obsolete, and not Arc resistant. This increases the fire and safety risk of the facility. As the systems continue to age and become more outdated, it will become more difficult to maintain the facility, and plant reliability will become an issue. Without reliable equipment, QECs customers are at risk of system failure.

A new power plant equipped with new fuel-efficient generators and plant automation is expected to increase fuel efficiency and overall plant reliability.

## Existing Environment

The community of Gjoa Haven is located on King William Island in the Kitikmeot Region of Nunavut. Schwatka Bay is located to the east, and Petersen Bay to the southwest. Generally, the topography of the Gjoa Haven area is flat, gently sloping toward Petersen Bay. The topography of the power plant location is also relatively flat.

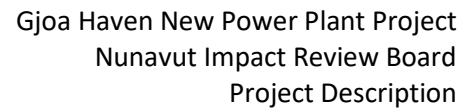
Gjoa Haven lies within the zone of continuous permafrost with medium to high ice content. The active layer thickness is estimated to be approximately 1.25 metres (Englobe 2021a). Surface drainage is moderately to well developed, with surface runoff generally flowing through the active layer in the summer to drainage channels, which then drain to Petersen Bay (Englobe 2021a). The bedrock geology of Gjoa Haven generally comprises of Lower Paleozoic sedimentary rocks of the Arctic Platform (dolostone, limestone, sandstone, shale, intraclast conglomerate and breccia). Bedrock outcrops are rare in and around the community. The surficial geology of the Gjoa Haven area generally comprises of glacial till, glaciomarine ice contact deposits (sand and gravel) and postglacial marine deposits (Englobe 2021a).

The project is located in the Northern Arctic Ecozone and is more specifically located within the Victoria Island Lowlands Ecoregion (Ecological Stratification Working Group 1995). Purple saxifrage, arctic willow, and *Dryas spp.* (e.g., mountain avens), along with alpine foxtail, wood rush, and other saxifrage are considered dominant, but discontinuous upland vegetation. Remaining upland areas are largely devoid of vegetation, a distinguishing characteristic of this ecoregion, and wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss (Ecological Stratification Working Group 1995). Characteristic wildlife includes caribou, muskox, polar bear, arctic hare, arctic fox, snowy owl, other raptors, seal, whale, seabirds, and waterfowl (Ecological Stratification Working Group 1995). There are no designated wildlife areas, marine protected areas, territorial or national parks or Inuit owned lands in conflict with the power plant location.

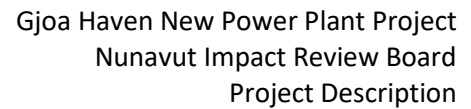
The *Species at Risk Act* (SARA) establishes Schedule 1, as the official list of wildlife species at risk. It classifies those species as being either extirpated, endangered, threatened, or a special concern. According to the Environment and Climate Change Canada (ECCC) Species at Risk Public Registry, there are 22 Schedule 1 species at risk protected under the *Species at Risk Act*, that may occur in or have ranges that overlap with portions of the Nunavut Territory (Government of Canada 2021). This includes species such as caribou, polar bear, ivory gull, buff-breasted sandpiper, red knot (islandica and rufa subspecies), barn swallow, and short-eared owl to name a few. Suitable habitat for some of these species at risk is likely to be present in the vicinity of Gjoa Haven. Species such as caribou and polar bear are known to occur. The potential for schedule 1 species at risk to be found within or immediately surrounding the proposed lot is anticipated to be low.

The proposed location for the power plant is within the municipal boundary of the community of Gjoa Haven, in an area designated for industrial land use. The vacant lot has been previously disturbed by surrounding land developments (e.g., the PPD bulk fuel facility is 50 metres to the east). A portion of the lot is currently being used by Canadrill and XYZ Contractor as a storage location for sea cans, construction materials, unmarked drums, and drilling supplies/equipment. The lot is primarily gravel and sand, limited to no vegetation present. There are no natural drainages, or watercourses within about 100 metres of the project location. The inferred groundwater flow direction in the vicinity of the power plant lot is likely southwest towards the community of Gjoa Haven and Petersen Bay, based on the topography of the Site (Englobe 2021b).

An archaeological impact assessment will be carried out in July 2021 to determine if archaeological sites are in potential conflict with the project.



July 17, 2021



- Following completion of site investigations and subsequent discussions with Hamlet Council regarding the results, the Hamlet issued a resolution, dated January 12, 2021, approving QEC to proceed with construction of the new power plant at the proposed “Option 1” location. A copy of this motion is included as Attachment A.

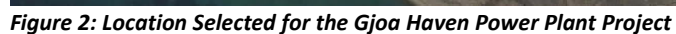


**Figure 1: Alternative Location Options Considered for the Gjoa Haven Power Plant Project (Image Source: Google Earth)**

## Project Location and Components

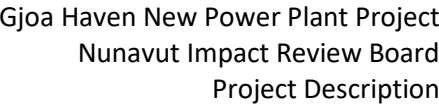
The results of the site investigations provided QEC with sufficient site specific information to confirm that “Option 1” would be technically feasible to support the construction and operation of the power plant and prepare a preliminary site layout. A land application and preliminary site layout was submitted to the Hamlet of Gjoa Haven on May 18, 2021. Subsequent to the application submission, QEC worked collaboratively with representatives of the Government of Nunavut (GN) Department of Community and Government Services (CGS) Planning and Lands Division to further refine the location. The resulting proposed location for the power plant considers the future plans of the Hamlet to resurvey the existing industrial zone to include an area for commercial development (Figure 2).

The proposed new lot is approximately 10,110 square metres located on unsurveyed, untitled municipal land, Sketch Plan # GJOA-415(40-2)21-002 along Nuvu Road (Road R36) and is approximately 200 metres west of the PPD bulk fuel facility. The proposed lot was presented to and approved by the Hamlet of Gjoa Haven on June 1, 2021 (motion number pending). The GN-CGS Planning and Lands Division issued a Sketch Plan Approval Report on June 18, 2021 (Attachment B).



The detailed design is anticipated to include the installation of industrial scrubbers and hospital grade silencers on the radiator and exhaust system to assist in the reduction of noise and exhaust emissions. The new plant will also be capable of integrating renewable energy sources. The main power plant building (40 metre by 23 metre) will include an office, electrical control room, mechanical room, and garage/workshop, in addition to the power generation hall. The specific location and orientation of these components within the area selected will be determined through detailed engineering; however, a preliminary site layout of the power plant is provided in Attachment C.

The project schedule is shown in Table 1.



| Task                                                      | Timeline                               |
|-----------------------------------------------------------|----------------------------------------|
| Secure Land and Complete Archaeological Impact Assessment | March 2021 to March 2022               |
| Detailed engineering design                               | April 2022 to March 2023               |
| Contracting and procurement                               | April 2023 to March 2024               |
| Construction                                              | April 2024 to December 2025 (seasonal) |
| Testing and commissioning                                 | January 2026 to March 2026             |
| Plant handover to QEC staff                               | March/April 2026                       |

Based on previous project statistics, the anticipated total number of workers during construction is shown in Table 2. The contractor awarded the construction tender will ultimately determine their required labour force to meet project requirements.

| Construction Phase                           | Estimated Number of Workers | Estimated Time On-Site (Days) |
|----------------------------------------------|-----------------------------|-------------------------------|
| Foundation and Land Development              | 15                          | 90                            |
| Civil Works, Building Structure, Fuel System | 35                          | 250                           |
| Mechanical and Electrical Installations      | 15                          | 180                           |
| Commissioning                                | 20                          | 60                            |

Construction of the Project will be completed through a request for tender (RFT) process. As per the Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Regulation, contractors will be obligated to meet mandatory Inuit labour levels for all construction work.

QEC has staff in the community of Gjoa Haven that are responsible for the day to day operation of the power plant. This includes a Plant Superintendent (full time), and two Assistant Operators (part time). It is expected that existing staff will transition over to the new power plant once it has been constructed and commissioned. No new staffing is anticipated to be required as a result of this project.

QEC has regionally based power line technicians and maintenance crews based in Cambridge Bay, Rankin Inlet, and Iqaluit that travel to and from communities to provide support to the operations staff in each community on an as needed basis and respond to emergencies (e.g., power outages, generator maintenance).

The majority of construction materials for the Project will be delivered to the community by sealift. Some materials may be sourced locally or delivered via cargo plane depending on size and quantity.

- Excavator
- Backhoe
- Bulldozer
- Grader
- Compactor machines
- Dump trucks/articulated trucks

- 
- |                                                                                                                                                                            |                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Tower crane</li> <li>• Pile boring/driving machine</li> <li>• Boom truck</li> <li>• Tele-handlers</li> <li>• Fork lift</li> </ul> | <ul style="list-style-type: none"> <li>• Trailer</li> <li>• Concrete Mixers</li> <li>• Welding/steel cutting machines</li> <li>• Testing, inspection and commissioning equipment</li> </ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The contractor awarded the construction tender will be responsible for sourcing the equipment. This may include a combination of sub-contracting locally available equipment or bringing equipment to the community through the annual sealift.

Water required during construction will be the responsibility of the construction contractor (e.g., sourcing and obtaining applicable permits). It is anticipated that a water use and deposit of waste licence will be required to complete a hydrostatic test on the QEC fuel system pipelines and pipeline connection between the QEC fuel tanks and the PPD bulk fuel facility prior to putting into service.

For operations, QEC will connect to the Hamlet's utility system for provision of water and sewer service.

### Construction Environmental Protection Plan

The contractor awarded the construction tender for the project will be required to have a project specific construction environmental protection plan. The construction environmental protection plan will outline the mitigation plans and procedures that will be implemented during construction to avoid or limit potential effects to the environment. It is anticipated that this plan will include, but is not limited to, the following areas of potential environmental concern:

- Air and Noise: strategies to reduce and control dust and construction related noise
- Sediment and Erosion Control: mitigation to limit the potential for erosion and sedimentation due to wind or water during construction
- Surface Water Management: plans to manage surface water on-site and around the construction site to limit unnecessary ponding water and effectively make use of existing community drainage corridors
- Wildlife Monitoring: strategies to avoid or limit interactions with wildlife by construction workers and avoid or limit potential effects on wildlife habitat should it be encountered (e.g., migratory bird nests)
- Spill Response: plans and procedures to respond to spills or other unplanned release of petroleum-based products as well as any other hazardous materials that may be stored onsite

### Fuel Management

Fuel storage and handling during construction will be the responsibility of the contractor. Details regarding the location and volume of fuel storage or equipment refueling during construction are not known at this time. The contractor will be required to provide appropriate secondary containment for fuel storage and/or refueling location and have a refueling procedure and spill response plan included as part of their Fuel Management Plan.

During operation, QEC will store fuel in two 90,000 litre tanks on-site. The remaining fuel supply required for power plant operation will be stored at the existing PPD bulk fuel facility. The final design of QECs fuel system

and the piping between the QEC power plant and the PPD bulk fuel facility will be determined as part of detailed engineering; however, the following specifications will be required.

- Two above ground, horizontal fuel storage tanks, each with a nominal capacity of 90,000 litres to operate 24 hours per day and 365 days per year with a minimum design life of 40 years.
- Fuel storage tanks will be shop fabricated as per the ULC S601 standard, will adhere to the National Fire Code of Canada (NFCC) and National Fire Protection Association (NFPA) 30 guidelines, and comply with Canadian Council of Ministers of the Environment (CCME) Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products and local, territorial and federal act and regulation requirements.
- Fuel storage tanks will be double-walled with 110% containment, an interstitial space monitoring system and will be skid mounted
- Suitable leak detection monitoring system in accordance with Part 6 of the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- Applicable corrosion protection and monitoring in accordance with Section 3.8 of the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
- Applicable overfill protection system with audible/visual alarm and automatic mechanism for shutting off the fuel supply such as per applicable standard.

The fuel tanks will be designed to operate 24-hours per day and 365-days per year. The tanks will connect directly with the PPD bulk fuel facility by 4-inch diameter pipeline for fuel transfers. The fuel tanks will also connect with the day tank inside the power plant by 2-inch diameter pipeline. The day tank will supply fuel to the generators. As with the storage tanks themselves, the pipeline system will be designed to meet the federal Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, and the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products. QEC will also work with PPD to confirm the pipeline connection is designed to meet facility specific requirements. This will include having a metering device to measure and record fuel delivery. Prior to operation, the QEC fuel system will be registered with the Federal Identification Registry for Storage Tank Systems.

In addition to being connected to the PPD bulk fuel facility, a truck refueling station will be constructed with applicable safety measures (e.g., bollards) and spill prevention. The truck refueling station will be used while the pipeline connection is constructed, and in the event pipeline maintenance is required.

The QEC environmental standard operating procedure (SOP) for bulk fuel transfers will be followed for the duration of any tank to tank or truck to tank fuel transfer. This includes regular dips to confirm fuel volumes and visual monitoring for the duration of the transfer.

## **Waste Management**

During construction, the contractor will be responsible for appropriately handling, storing, and disposing of all construction waste, including hazardous waste such as waste oil, in accordance with municipal and territorial requirements. This will be outlined in a Waste Management Plan as part of the overall construction environmental protection plan.

QEC has a number of environmental standard operating procedures (SOPs) that provide guidance on waste management during operations. Liquid waste (e.g., waste oil, waste fuel) is stored in drums or totes within secondary containment and disposed of as part of QEC's annual waste shipment from the community. Domestic waste during operations will be disposed of in accordance with municipal and territorial requirements; this may include disposal of some waste at the community landfill with permission from the Hamlet or shipment south for disposal at an approved facility.

### Anticipated Permit Requirements

The permits approvals anticipated to be required prior to starting construction of the project are listed in Table 3. Should additional permits or approvals be identified to be required throughout the process, QEC is committed to working with the applicable agency to obtain the necessary approvals in a timely manner.

**Table 3: Anticipated Permit Requirements**

| Agency                                                          | Permit Requirement                                          |
|-----------------------------------------------------------------|-------------------------------------------------------------|
| Nunavut Planning Commission                                     | Conformity Determination                                    |
| Nunavut Impact Review Board                                     | Screening Decision                                          |
| Hamlet of Gjoa Haven                                            | Development Permit                                          |
| Government of Nunavut – Community and Government Services       | Lease agreement for new lot (Planning and Lands)            |
|                                                                 | Building Permit (Safety Services)                           |
| Government of Nunavut – Economic Development and Transportation | Assessment Letter (Nunavut Airports)                        |
| NavCanada                                                       | Land Use Proposal Review                                    |
| Transport Canada                                                | Aeronautical Assessment                                     |
| Nunavut Water Board                                             | Water Use and Deposit of Waste Licence for Hydrostatic Test |

### Community Engagement

QEC presented four proposed location options for the new power plant during a meeting with Gjoa Haven Hamlet Council on July 30, 2020. Following completion of site investigations in the fall of 2020, representatives from QEC and Hamlet Council corresponded by telephone and email to discuss the results and confirm the most suitable location for project components. The Hamlet issued a resolution, dated January 12, 2021, approving QEC to proceed with construction of the new power plant at the proposed "Option 1" location.

To initiate the process of securing the land required for the project, a land application was submitted on May 18, 2021. Correspondence with representatives from the GN-CGS Planning and Lands Division assisted in optimizing the proposed lot location and on June 1, 2021 the proposed lot was approved by the Hamlet of Gjoa Haven.

QEC has also held conference calls and had email correspondence with the GN-CGS Planning and Lands Department and PPD to discuss plans QECs planning for the Gjoa Haven project.

### Potential Environmental and Socioeconomic Effects

Potential environmental and socioeconomic effects resulting from the project and the proposed mitigation that QEC will put in place is provided in Table 4.

**Table 4: Potential Environmental and Socioeconomic Effects Resulting from the Gjoa Haven Power Plant Project**

| Activity                                      | Potential Environmental or Socioeconomic Effect                                                                                                   | Positive or Negative Effect | Mitigation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction of all components of the Project | Construction of the power plant on a new lot may result in loss of space within the community for use by community members                        | Negative                    | <ul style="list-style-type: none"> <li>The area proposed for the power plant has been designated by the Hamlet as industrial land use and was the location previously identified by the Hamlet for the power plant, which suggests the Hamlet is interested in or willing to consider development of some kind in this area</li> <li>Location for the power plant is adjacent to an existing road and the PPD bulk fuel facility; community members using this area will already be accustomed to activity in the area (e.g., traffic)</li> <li>A portion of the selected location is currently being used by Canadrill and XYZ Contractor as a storage location for sea cans, construction materials, unmarked drums, and drilling supplies/equipment</li> <li>Surrounding development in this area is industrial in nature (e.g., PPD bulk fuel facility)</li> <li>Contractors will be required to have a construction environmental protection plan in place to limit the potential for adverse effects to the environment during construction activity</li> </ul>                                                                                                                                                                                                                                                              |
|                                               | Construction of the power plant on a new lot may result in loss of space for use by wildlife                                                      | Negative                    | <ul style="list-style-type: none"> <li>The location selected for the power plant is previously disturbed, generally flat terrain covered with gravel, little to no vegetation present</li> <li>Surrounding development in this area is industrial in nature (e.g., PPD bulk fuel facility)</li> <li>Limited suitable wildlife habitat as the location selected for the power plant is within the municipal boundary</li> <li>There are no natural drainages, or watercourses within 100 metres of the project location; Petersen Bay is approximately 450 metres west</li> <li>There are no designated wildlife areas, marine protected areas, territorial or national parks or Inuit owned lands in conflict with the power plant location; however, it is acknowledged that terrestrial and marine wildlife may be observed in the surrounding area</li> <li>Contractors will be required to have a construction environmental protection plan in place to limit the potential for adverse effects to the environment during construction activity</li> <li>Contractor will be required to include wildlife management in their construction environmental protection plan; this will include measures to avoid or limit unnecessary habitat loss, and prohibit harassment of wildlife</li> </ul>                                |
|                                               | Construction of the power plant on a new lot may result in the disturbance or destruction of cultural or archaeological artifacts                 | Negative                    | <ul style="list-style-type: none"> <li>An archaeological impact assessment will be carried out in July 2021 to determine if archaeological sites are in potential conflict with the project and identify any necessary avoidance or mitigation measures</li> <li>In the event that cultural or archaeological artifacts are encountered, construction activity will stop and the Government of Nunavut Department of Culture and Heritage will be contacted</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                               | Construction of all components of the Project may contribute to permafrost degradation                                                            | Negative                    | <ul style="list-style-type: none"> <li>Ice-poor sands with traces of gravel and fines were encountered at the surface of all borehole locations and extended to the maximum depths of drilling which ranged from 9.0 to 12.0 metres below ground surface (Englobe 2021a)</li> <li>Permafrost was encountered at a depth of approximately 2.25 metres (Englobe 2021a)</li> <li>Considering the prevailing subsurface conditions encountered in the exploratory boreholes, adfreeze piles with grout in conjunction with a thermosyphon system are considered a feasible deep foundation option for this project; however, this will be confirmed during detailed design (Englobe 2021a)</li> <li>Installing a thermosyphon system to preserve permafrost underlying the proposed building to maintain the integrity of the foundation soils in the face of warming climate trends</li> <li>Protection of permafrost and stability of the foundations/structural ground floor of the power plant shall be prime structural design considerations</li> <li>The foundation design for the power plant will be reviewed by a qualified professional with expertise in permafrost</li> <li>Piles will be used in structural supports where possible to limit ground/permafrost disturbance (e.g., pole and transformer racks)</li> </ul> |
|                                               | Construction of all components of the Project may contribute to additional dust and noise in the community                                        | Negative                    | <ul style="list-style-type: none"> <li>Contractors will be required to maintain equipment in good working order to reduce noise generation</li> <li>Construction will occur during typical working hours (e.g., 10 to 12-hour shift)</li> <li>Dust suppression (e.g., water) will be used on-site during construction as required</li> <li>Other development in the surrounding area is industrial in nature; likely that community members are accustomed to some level of dust and noise in this area from existing road and industrial activity</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                               | Contractor staff travelling in and out of the community during construction may impact the availability of community infrastructure and resources | Positive and Negative       | <ul style="list-style-type: none"> <li>Use of community businesses during construction for accommodations, equipment rental, meals and groceries may bring increased revenue to these businesses</li> <li>Use of community businesses during construction may limit the availability of these services to others that may require them (e.g., visitors, other travelling labour)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Activity                                                                     | Potential Environmental or Socioeconomic Effect                                                                                            | Positive or Negative Effect | Mitigation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                              |                                                                                                                                            |                             | <ul style="list-style-type: none"> <li>Reliance on restaurants and grocery stores in the community by construction staff may result in additional pressure on the food supply chain for the community; the contractor will be encouraged to work with food suppliers to accommodate the additional requirements of the construction laborers so as not to adversely impact the food supply for the community</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Fuel or hydraulic oil leak from equipment during construction                | Fuel or hydraulic oil could leak or spill on to the ground resulting in contaminated soil or surface water                                 | Negative                    | <ul style="list-style-type: none"> <li>Contractors will be required to use equipment in good working condition</li> <li>Contractors will be required to have a spill response plan as well as spill response equipment and materials available in the event of a leak or spill</li> <li>In the event of a spill or leak, contaminated soil will be collected for disposal at an approved facility</li> <li>Contractors will be required to have a fuel management plan in place that includes refueling procedures and proper bulk storage if applicable</li> <li>There are no natural drainages, or watercourses within 100 metres of the project location; Petersen Bay is approximately 450 metres west</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Fuel leak from the Fuel System during operation                              | Fuel stored within the QEC fuel system could leak on to the ground resulting in contaminated soil or surface water if it is not maintained | Negative                    | <ul style="list-style-type: none"> <li>Fuel tanks will be shop fabricated as per the ULC S601 standard, NFCC and NFPA 30 guidelines</li> <li>Fuel tanks and pipelines will be constructed and operated in compliance with Canadian Council of Ministers of the Environment (CCME) Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products</li> <li>Fuel storage tanks will be double-walled with 110% containment, an interstitial space monitoring system and will be skid mounted</li> <li>Suitable leak detection monitoring system in accordance with Part 6 of the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.</li> <li>Applicable corrosion protection and monitoring in accordance with Section 3.8 of the CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.</li> <li>Applicable overfill protection system with audible/visual alarm and automatic mechanism for shutting off the fuel supply such as per applicable standard.</li> <li>The QEC fuel system will be inspected by QEC personnel on a monthly basis</li> <li>The QEC fuel system will be inspected by a qualified third-party contractor in accordance with API 653 as required</li> <li>A spill contingency plan and community specific spill plan will be updated to reflect the location of the new power plant</li> <li>Spill response materials will be kept on-site during operations</li> </ul> |
| Fuel or oil leak from generators or other onsite activities during operation | Fuel or oil could leak or spill in the plant or on the ground resulting in contaminated soil or surface water                              | Negative                    | <ul style="list-style-type: none"> <li>There are no natural drainages, or watercourses within 100 metres of the project location; Petersen Bay is approximately 450 metres west</li> <li>Surface water will be diverted around project components and towards drainage ditches established adjacent to roadways</li> <li>In the event of a spill or leak, contaminated soil will be collected for disposal at an approved facility</li> <li>Environmental SOPs will be followed by operations staff</li> <li>A lined berm will be onsite for storage of new and waste hazardous products (e.g., fuel, oil, glycol)</li> <li>Surface water will be collected within the secondary containment berm and will be disposed of under the direction of a local wildlife officer or conservation officer</li> <li>A spill contingency plan and community specific spill plan will be updated to reflect the new power plant location</li> <li>Spill response materials will be kept on-site during operations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Fuel spill during fuel transfer                                              | Fuel could spill on the ground resulting in contaminated soil or surface water                                                             | Negative                    | <ul style="list-style-type: none"> <li>Fuel transfers will occur via pipeline connection with PPD Tank Farm (tank to tank)</li> <li>A truck fill station will be constructed as a back-up fuel transfer option; an appropriate secondary containment box will be included in the design of the truck fill station</li> <li>QEC Environmental SOPs will be followed for all fuel transfers; this includes visual monitoring for the duration of the transfer</li> <li>There are no natural drainages, or watercourses within 100 metres of the project location; Petersen Bay is approximately 450 metres west</li> <li>A spill contingency plan and community specific spill plan will be updated to reflect the new power plant location</li> <li>Spill response materials will be kept on-site during operation and will be readily available during fuel transfers</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Operation of the Power Plant                                                 | Operation of the new power plant may contribute to additional noise or dust in the community                                               | Negative                    | <ul style="list-style-type: none"> <li>The new power plant location is outside the community core; noise and dust that may be generated during operations is anticipated to have less effect on the community in comparison to the existing power plant located in the community core</li> <li>Prevailing wind is from the northwest; therefore, there is limited potential for dust or noise to be directed towards the community</li> <li>New, more efficient generators and equipment are anticipated to generate less noise and dust in comparison to the older equipment at the existing power plant</li> <li>The exhaust system will include industrial scrubbers to remove additional pollutants and dust from the exhaust before being released from the power plant.</li> <li>The design of the exhaust system will consider the use of hospital grade silencers to further reduce the noise produced during operations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Activity | Potential Environmental or Socioeconomic Effect                                                                                                                                                                                            | Positive or Negative Effect | Mitigation                                                                                   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------|
|          | The new power plant will be designed to meet the current and future energy needs of the community which will contribute to community growth                                                                                                | Positive                    | <ul style="list-style-type: none"> <li>None proposed as this is a positive effect</li> </ul> |
|          | The new power plant will be designed to be capable of incorporating power generation from renewable resources in the future that may contribute to further reductions in diesel fuel use                                                   | Positive                    | <ul style="list-style-type: none"> <li>None proposed as this is a positive effect</li> </ul> |
|          | Operation of more efficient generators may result in a reduction in the amount of fuel used during operation of the power plant.                                                                                                           | Positive                    | <ul style="list-style-type: none"> <li>None proposed as this is a positive effect</li> </ul> |
|          | Operation of more efficient generators and future incorporation of renewable resource generated power may reduce the amount of fuel used during operation of the power plant which may result in the reduction of greenhouse gas emissions | Positive                    | <ul style="list-style-type: none"> <li>None proposed as this is a positive effect</li> </ul> |



## Potential Cumulative Effects

Construction of the project is anticipated to occur over two years (2024 through 2026) and the power plant will be designed for an operational life of 40 years (2026 to 2066). During this time, it is likely that the community will grow. The project must also consider the potential effects that changing climatic conditions may have on the surrounding environment and on the project itself.

The Gjoa Haven Community Plan is projecting moderate growth over the next several years. To accommodate growth, the community will require that already developed lands be efficiently used and that open space and undeveloped lands be developed for residential and other land uses. The location of the new power plant will use land that is already zoned for industrial use outside of the community core and is not anticipated to adversely effect the overall plans for community growth and expansion in the future from a land use perspective.

To support the future growth of the community, QEC must have the infrastructure in place to provide safe and reliable power. The existing power plant has exceeded its operational life and within the next ten years will not be sufficient to meet the power demands of the growing community. Insufficient power generating infrastructure could become a limiting factor to future community growth. The proposed project is expected to address this concern until at least 2066. Additionally, should the community of Gjoa Haven consider the development of renewable resource energy production in the future, the new power plant will be designed to integrate with renewable energy sources.

Infrastructure in Nunavut is vulnerable to climate change, many of Nunavut's buildings, roads and airports were not built to sustain the environmental pressures that are now being expected (Government of Nunavut 2014). Going forward, infrastructure projects must be designed in the context of a changing climate; adaptation of infrastructure also acts as a risk-reduction mechanism to permafrost degradation, changes to precipitation patterns and more (Government of Nunavut 2014). A climate resilience assessment was completed for the proposed new power plant. The assessment considers projected changes to a number of climate variables such as: mean temperature, thawing degree days, permafrost and ground temperature, total annual precipitation, winds and storms, flooding, and relative sea level rise. The results suggest that climate change hazards present either negligible or low risk to the power plant's performance and reliability subject to following best practices in the power plant design (BBA 2021). The proposed project will have the ability to cope with upcoming climate change which will further strengthen the overall community resilience to climate change (BBA 2021).

## Closure

This project is anticipated to provide an overall benefit to the Hamlet of Gjoa Haven with more efficient use of diesel, a non-renewable resource, and the reduction of greenhouse gas emissions. It will also allow QEC to improve power generation infrastructure in the community, support continued community growth and achieve its mandate for the provision of safe, reliable electrical power to the communities it serves.

Should additional information be required please contact QEC's Health, Safety and Environment representative:

Megan Larose  
Health, Safety, and Environment Advisor  
Qulliq Energy Corporation  
Phone: 867 979 7553  
Email: [MLarose@qec.nu.ca](mailto:MLarose@qec.nu.ca)

## References

BBA. 2021. Climate Resilience Assessment Technical Report. Gjoa Haven Community Diesel Power Plant. Final Report. BBA Document No.: 3421024-005000-4E-ERA-002/R00. Prepared for: Qulliq Energy Corporation. 31 pages. 2021-01-29.

Canadian Council of Ministers of the Environment (CCME). 2003. Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (PN 1326). ISBN 1-896997-33-3. Available at: [https://www.ec.gc.ca/lcpe-cepa/61B26EE8-AFB3-47AC-91AC-12AFBB0B549B/CCME\\_eng.pdf](https://www.ec.gc.ca/lcpe-cepa/61B26EE8-AFB3-47AC-91AC-12AFBB0B549B/CCME_eng.pdf)

Ecological Stratification Working Group. 1995. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. 125 pages. Report and national map at 1:7,500,00 scale.

Englobe Corporation (Englobe). 2021a. Geotechnical Investigation Proposed Power Plant Location in Zone M Gjoa Haven, Nunavut – Option 01. Final Report. Reference Number: P0023273.000-0100-0000-02. Prepared for: Qulliq Energy Corporation. June 2021.

Englobe Corporation (Englobe). 2021b. Phase I Environmental Site Assessment Proposed Power Plant Location Gjoa Haven, Nunavut – Option 01. Final Report. Reference Number: P0023273.000-0100-0000-00. Prepared for: Qulliq Energy Corporation. February 2021.

Gjoa Haven Community Plan, By-Law No. 164. March 2013. Gjoa Haven Hamlet Council and Government of Nunavut Department of Community and Government Services.

Government of Canada. 2021. Species at Risk Public Registry. Available at: <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html> Accessed on: July 3, 2021.

Government of Nunavut. 2014. Climate Change Adaptation Resource Guide. Nunavut's Built Infrastructure. Department of Environment. 17 pages. Available at:  
<https://www.climatechangenunavut.ca/en/resources/publications>

Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. SOR/2008-197. Government of Canada. Last amended on October 26, 2020. Available at: <https://laws-lois.justice.gc.ca/PDF/SOR-2008-197.pdf>



ᓂᓄᓕᓐᓂᓄᓐ ᓂᓄᓕᓐᓂᓄᓐ ᓂᓄᓕᓐ  
Qulliq Energy Corporation  
Société d'énergie Qulliq  
Qulliq Alruyaktugtunik Ikumatjutiit

Gjoa Haven New Power Plant Project  
Nunavut Impact Review Board  
Project Description

# Attachment A

*Municipality of Gjoa Haven Motion #210112-009*



## HAMLET OF GJOA HAVEN

**Motion #:** 210112-009

**Date:** January 12, 2021

**Moved by:** Matt Gee

**Seconded by:** Salomie Qitsualik

**Whereas** the council, at a regular Council meeting called to consider the location and building of a new power plant in the Hamlet of Gjoa Haven received documents, plans and various options presented by the team from Qulliq Energy Corporation, and having reviewed in detail Qulliq Energy Corporation's plans and drawings showing the new power plant, to be built in Gjoa Haven;

**Therefore, be it resolved** that the Gjoa Haven Hamlet council through motion approves the Qulliq Energy Corporation to go ahead with constructing a new Power Plant on lots as indicated in option 1, in the presentation and sketch plans subsequently submitted and received by council.

\_\_\_\_\_  
Mayor

\_\_\_\_\_  
(Acting) Senior Administrative Officer

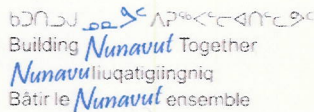


ᓂᓄᓕᓐᓂᓄᓕ ᓂᓄᓕᓐᓂᓄᓕ ᓂᓄᓕᓐᓂᓄᓕ  
Qulliq Energy Corporation  
Société d'énergie Qulliq  
Qulliq Alruyaktugtunik Ikumatjutiit

Gjoa Haven New Power Plant Project  
Nunavut Impact Review Board  
Project Description

# Attachment B

*Government of Nunavut Department of Community and Government Services  
Planning and Lands Division  
Sketch Plan Approval Report*

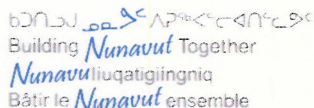


Department of Community and Government Services  
Nunalingni Kavamatkunnilu Pivikhaqautikkut  
Ministère des Services Communautaires et gouvernementaux

**Our File No: GJOA-415(40-2)21-002**

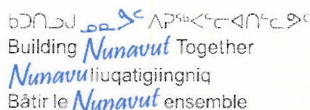
**Preliminary Sketch Plan Approval**  
**Untitled Municipal Land, Gjoa Haven, Nunavut.**

cc: Richard Leong, A/Senior Administrative Officer, Hamlet of Gjoa Haven  
Valerie Kogvik, Community Economic Development Officer, Hamlet of Gjoa Haven  
Corey Dimitruk, Sr. Community Planner, CGS Cambridge Bay  
Sophia Ohokanoak, Land Administrator, CGS Cambridge Bay



Department of Community and Government Services  
Nunalingni Kavamatkunnilu Pivikhaqautikkut  
Ministère des Services Communautaires et gouvernementaux

(867) 982-7653  
 (867) 982-7695  
[www.gov.nu.ca](http://www.gov.nu.ca)



Department of Community and Government Services  
Nunalingni Kavamatkunnilu Pivikhaqautikkut  
Ministère des Services Communautaires et gouvernementaux

1. A final survey plan must be prepared in accordance with the attached layout.

The number of lots that can be achieved in the final plan of subdivision may differ from those shown in the attached layout.

2. There is some potential for the proposed subdivision to contain archaeological sites protected by the *Archaeological and Palaeontological Sites Regulations* and *Historical Resources Act*. Please notify the Department of Culture and Heritage at (867) 934-2035 or Territorial Archaeologist at (867) 934-2040 should an archaeological site or specimen, or a Palaeontological site or fossil be encountered or disturbed by any land use activity.
3. Persons operating in and around the proposed subdivision shall comply in full with the relevant Federal, Territorial and Municipal Statutes and By-laws, Permits and Quarry Agreements.
4. Any alterations to the preliminary approval on the layout or the requirements of this letter must be confirmed in writing by the Planning and Lands Division.
5. The Sketch Plan Approval is VALID FOR ONE YEAR and the final approval of the subdivision must occur during this period. Failure to do so will result in this application being filed and a new application will be required.

  
Territorial  
Community Planner  
Date: June 17/21

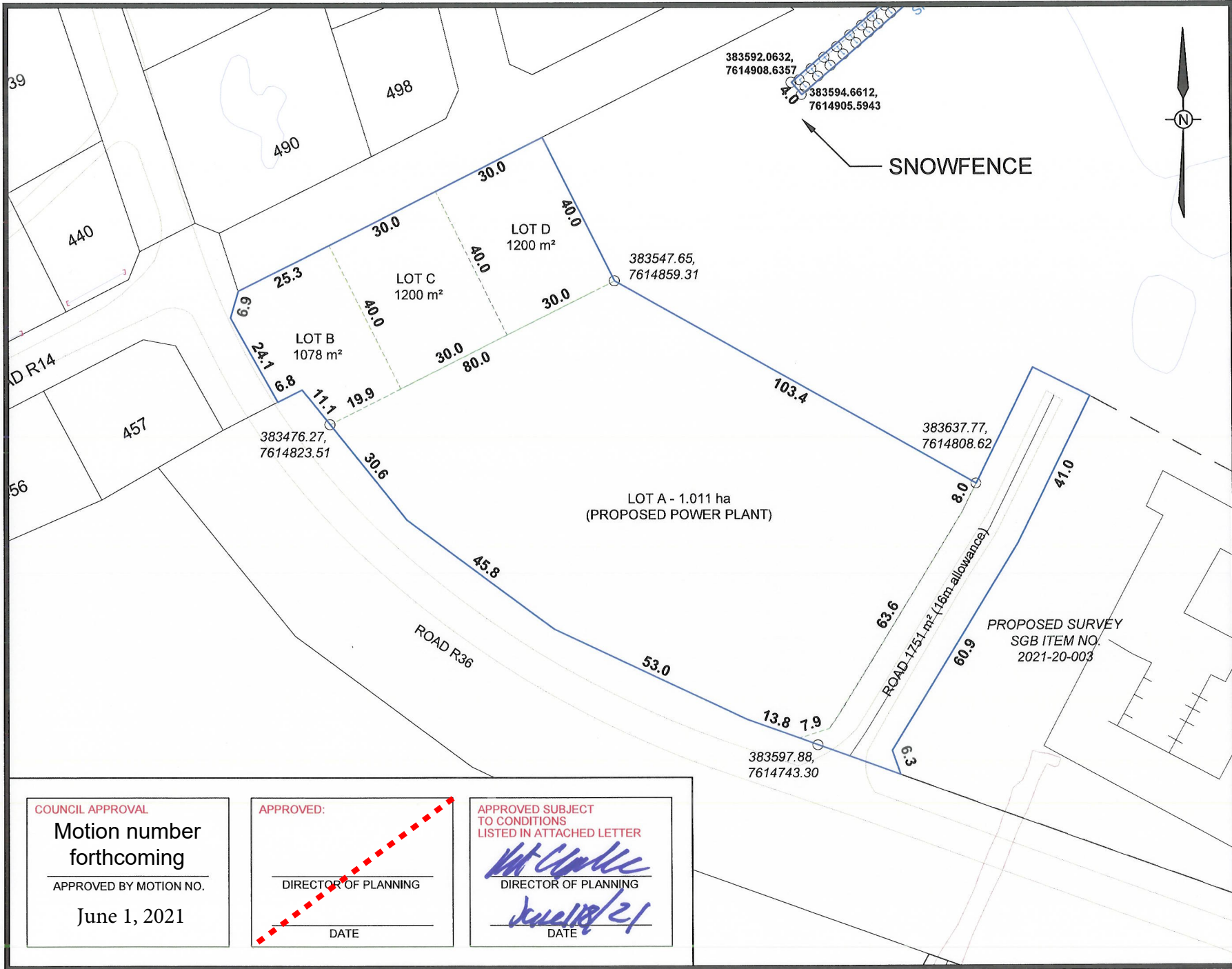
William Patch  
Manager,  
Community Planning  
Date: June 17, 2021

*Not Canceled*

---

Director,  
Planning and Lands

Date: *June 18/2*



### LEGEND

- EXISTING LEGAL SURVEY \_\_\_\_\_
- SURVEY BOUNDARY \_\_\_\_\_
- LINE TO BE SURVEYED - - - - -
- LINE TO BE REMOVED // //

## SKETCH SHOWING PROPOSED SUBDIVISION PROPOSED POWER PLANT AND SURROUNDING LANDS GJOA HAVEN, NU

### NOTE:

- SURVEY CONSISTS OF THREE LOTS AND ONE ROAD
- SURVEY TO BE TIED TO ALL CONTROL POINTS IN THE VICINITY
- TIES ARE REQUIRED TO ALL BUILDINGS AND IMPROVEMENTS, INCLUDING ROADS, LAKES, AND PONDS
- LANDS INVOLVED IN SURVEY ARE UNTITLED MUNICIPAL LANDS
- ALL SPLAYS ARE 5m
- FIT TO EXISTING ROADS

DATE: MAY 25, 2021

SCALE 1:1,250

INITIALS

GJOA-415(40-2)21-002  
SKETCH NUMBER

COUNCIL APPROVAL  
**Motion number forthcoming**  
APPROVED BY MOTION NO.  
June 1, 2021

APPROVED:  
\_\_\_\_\_  
DIRECTOR OF PLANNING  
\_\_\_\_\_  
DATE

APPROVED SUBJECT TO CONDITIONS LISTED IN ATTACHED LETTER  
*[Signature]*  
DIRECTOR OF PLANNING  
*[Signature]*  
DATE





Figure 1: excerpt from draft poster plan showing the purple industrial and nearby snow fence, the orange community commercial and yellow residential land uses. (GN-CGS, 2021)

During these 10 years the residential land use has grown eastwardly to R17 Plan 3813 which is the eastern edge of the Residential zone and the western edge of the existing Industrial zone. During this time many of the development related expenses in this area, such as roads and power, have been installed.

The Hamlet and CGS are presently conducting the 5-year statutory plan review and have an active land development request from QEC which signals it is appropriate to develop the proposed Industrial phase of the existing Community Poster Plan (Schedule 2A of By-Laws 164 & 165).

As part of the proposed survey 40m deep commercial lots (lots B,C&D) are proposed on the immediate east side of R17 Plan 3813. Combined with a 16m Road ROW, provides 56m between residential (Lot 498) and Industrial (Lot A) land use boundaries. (See figure 2 below). The existing snow fence constraint requires a, 100 m south and 50 m north, no development buffer which is respected by the proposed sketch plan.



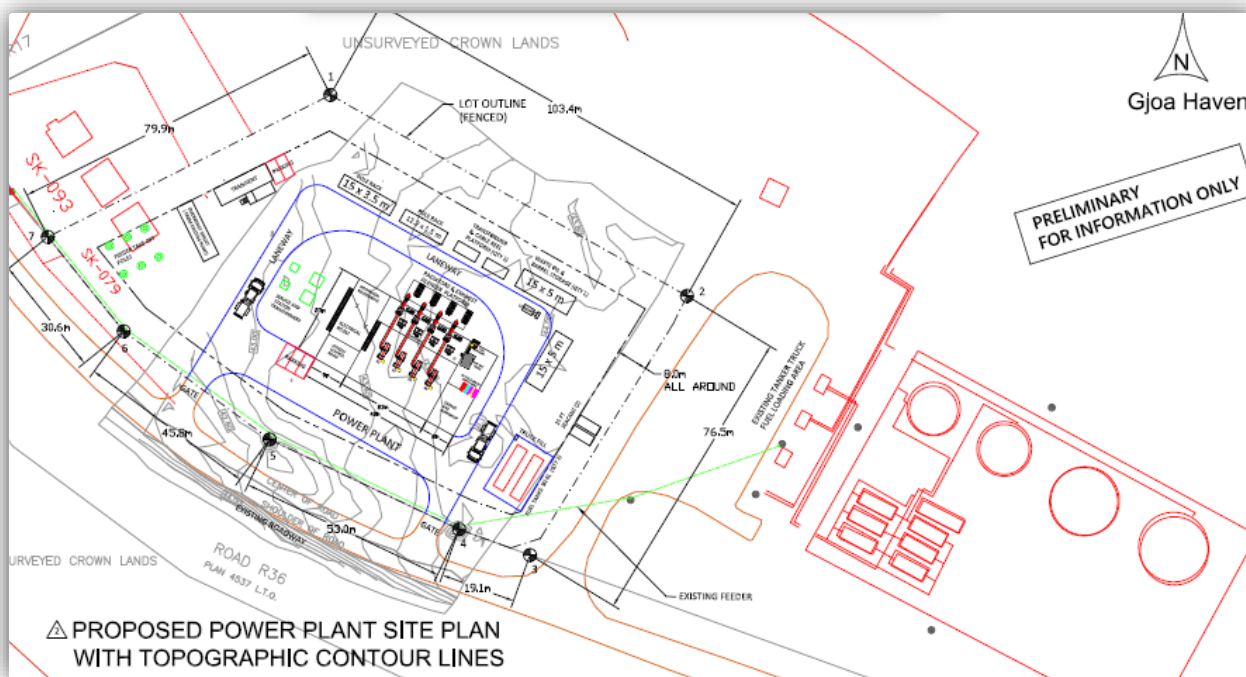


Figure 3: Site Plan depicting final orientation of the QEC Power Plant (GN-CGS, 2021)

## Hamlet Approval

Council approved the sketch plan (Figure 2 previous page) on June 1, 2021 [motion number pending], ahead of second read of the provisional by-laws 224 and 225 (replacement Community Plan and Zoning By-laws). The proposed subdivision is supported by the replacement Community Plan, and these by-laws are expected to soon replace By-laws 164 & 165. Because of Council's support of the sketch plan and their support of the replacement Community Plan, no separate by-law amendment for this proposed subdivision is being sought and no issues are expected.

## External Agency Approvals

- GN Building Official Department will review plans leading to a building permit once the development permit is approved by the Hamlet.
- Nunavut Airports approval – “may be required”. Smoke stack height and visual obstructions from emissions are things that Nunavut Airports should be consulted on.
- Environmental Health – “may be required”. Smoke stack height and air quality impacts from emissions are things that the Department of Health should be consulted on.
- NIRB/NWB – QEC’s Megan LaRose has already mentioned that she is in the process of obtaining a NIRB screening which is required under the zoning bylaw (section 4.4), which may trigger an NPC review.

- A council consultation was previously conducted in a special meeting of council 7pm to 9pm Tuesday August 21, 2020 to present the new power plant project funding and to look for location potentials. Hamlet Council has since approved the location as confirmed June 1, 2021.

**Access to Sketch Plan Area:** Legal Road Access to the Community Commercial lots occur from R17 Plan 3813 and legal road access to the Industrial Lot occurs from R36 CLSR 104189.

### Site Conditions

**Drainage:** at present is naturally occurring and follows to the pond behind the tank farm in a NE direction as seen in Figure 1 on second page of this report. Where development is introduced, the Hamlet will direct water over and through subdivision by designing swales and culverts into their choice of engineered solutions.

**Blasting required:** - no bedrock material requiring blasting. Site is majority sand with low volume streams of pit run and gravel throughout.

**Wind patterns:** NW

**Snowdrifting:** Occurs at SE end of buildings.

### D. ANALYSIS AGAINST TERRITORIAL DIRECTIVES AND POLICIES

This subdivision supports the orderly development of this community and hence contributes to Inuuqatigiittiarniq (healthy communities).

### E. RECOMMENDATION:

**APPROVAL, with conditions.**

- June 1, 2021 Signed Council Minutes confirming sketch plan approval and motion number; and
- June 1, 2021 Second Read approval and motion number for the passing of Gjoa Haven By-laws 224 & 225 prior to final survey plan approval.

#### SIGNATURES:



Community Planner

Date: June 16,2021



Manager, Land  
Administration

Date: June 16,2021



ᓂᓕᓕᓂᓂᓂ ᓂᓕᓕᓂᓂᓂᓂ ᓂᓕᓂᓂ  
Qulliq Energy Corporation  
Société d'énergie Qulliq  
Qulliq Alruyaktugtunik Ikumatjutiit

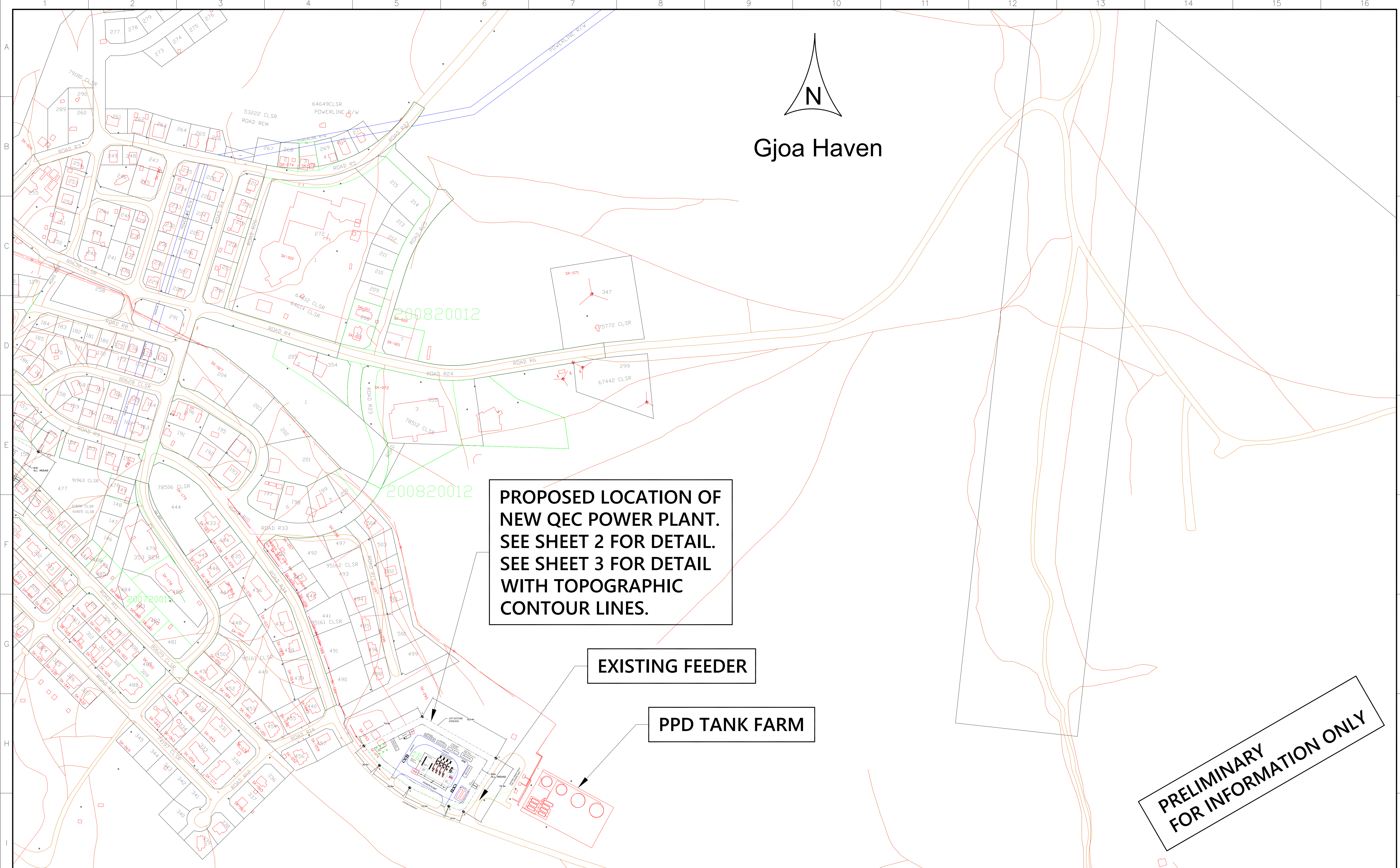
Gjoa Haven New Power Plant Project  
Nunavut Impact Review Board  
Project Description

# Attachment C

*Preliminary Site Layout of the Proposed Power Plant*

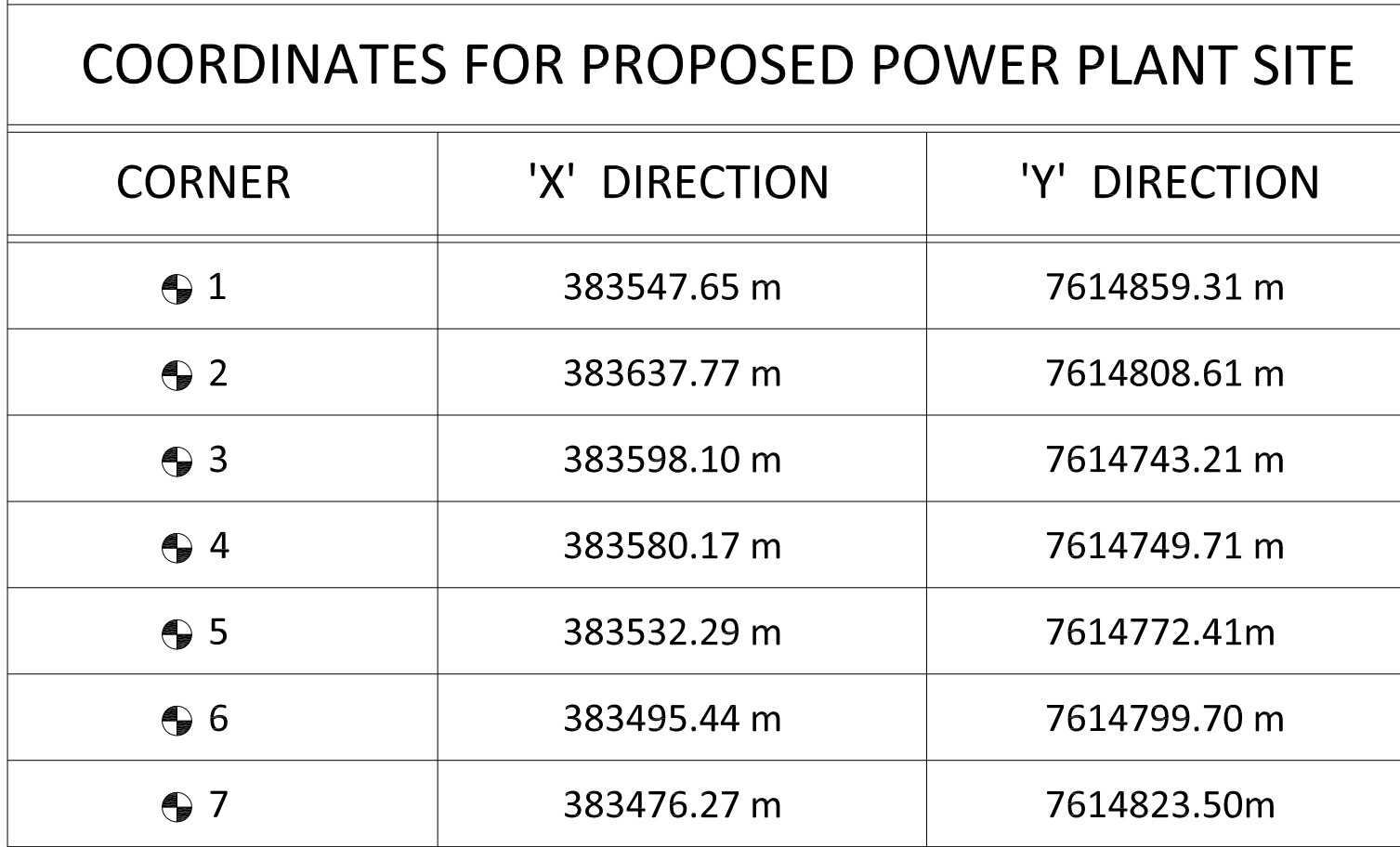
SAVE DATE: May/26/2021 4:37:58 PM

FILENAME: C:\USERS\BLOCKWOOD\DOCUMENTS\NEW PLANT LOT OUTLINES\GJOA HAVEN\GH-SK-01\_REV 3.DWG



**PRELIMINARY  
FOR INFORMATION ONLY**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|



1 COORDINATES ARE TAKEN FROM EXISTING AUTOCAD BASE MAP.  
FINAL COORDINATES TO BE VERIFIED BY AN ONSITE SURVEY.

**PRELIMINARY  
FOR INFORMATION ONLY**

[illegible]

