SITE C CLEAN ENERGY PROJECT

QUARRY DEVELOPMENT PLAN

WUTHRICH QUARRY

Doc EIS-1A-010

[Final]

Prepared for BC Hydro by

Tetra Tech

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(by section)

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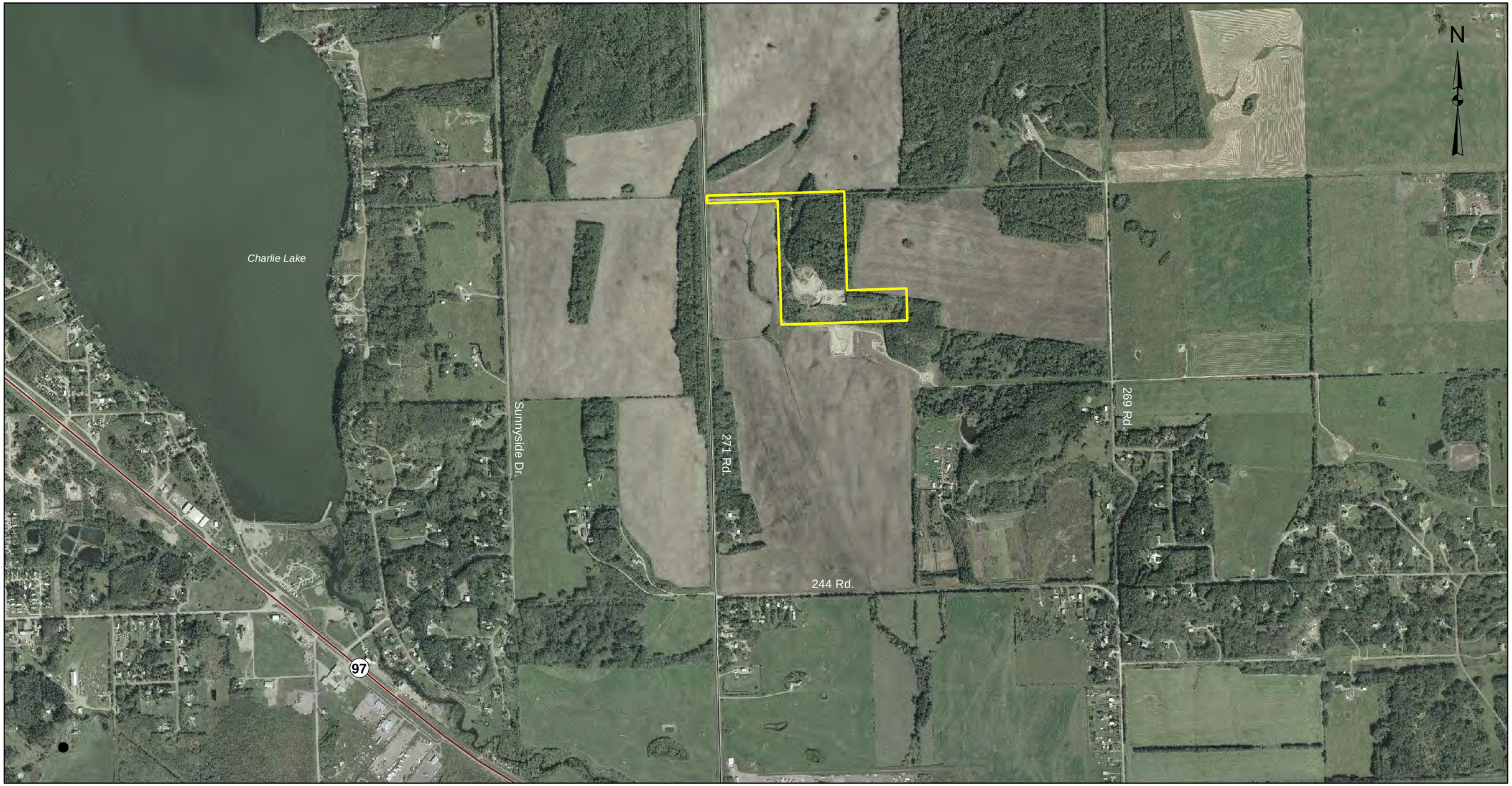
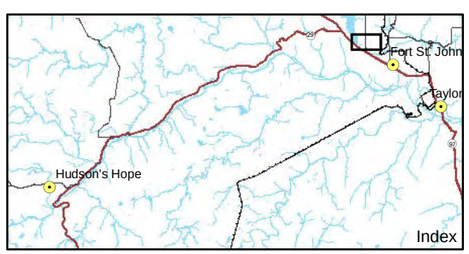
1.0 INTRODUCTION AND PURPOSE

If the Site C Clean Energy Project (the Project) proceeds, it would require temporary riprap material for constructing the temporary cofferdams, lining the inlet and outlet channels of the diversion tunnels, and installing erosion protection for the access road along the north bank of the Peace River. A source of this material in close proximity to the dam site is preferred to minimize transportation requirements. A detailed description of the Project components and activities is provided in the Project Description (Section 4.3)

Wuthrich Quarry, an existing riprap source operated by the BC Ministry of Transportation and Infrastructure (MOTI), has been identified as the preferred source of temporary riprap. The quarry is located seven kilometres northwest of Fort St. John, BC, along 271 Road, approximately three kilometres north of the Alaska Highway as shown in Figure 1.1 Key Plan – Location of Wuthrich Quarry

The objective of this plan is to: 1) facilitate environmental assessment approvals; 2) support permitting requirements; and 3) plan for guiding use of the quarry site during construction and operation.





Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos: TRIM

Legend

- Wuthrich Quarry Boundary
- Road
- Highway

1:15,000 0 500 m

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Figure 1.1: Key Plan
Location of Wuthrich Quarry

Date	Nov. 22, 2012	DWG NO	1016-C14-B062-1	R 0

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Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification

2.0 BACKGROUND

The Wuthrich Quarry is an existing quarry owned and operated by the MOTI. Geotechnical information from a November 1987 drill program conducted by the MOTI and a subsequent memorandum (MOTI 1988) had been initially used by MOTI to determine the viability of the quarry. The site is on a bedrock ridge which rises out of a field and runs back into higher ground to the northeast. The area is mostly treed, except for the active quarrying area, with small and large poplar trees along with low vegetation surrounded by agricultural lands. The rock formation is part of the Dunvegan formation of the upper Cretaceous period. The sandstone rock is fairly fine grained and interlaced with thin bedded planes. Existing large blocks (2 to 3 cubic metres) in size are present near the rock face. The quarry was activated to produce riprap materials for MOTI construction projects and became a source of rock for the MOTI Peace District for maintenance purposes.

An agreement in principle has been reached with MOTI that would allow BC Hydro to obtain temporary riprap material from the Wuthrich Quarry. Site C would require approximately 254,000 cubic metres of riprap and 97,000 cubic metres of riprap bedding for construction of temporary dam components. Most of the material would be required in the first four years of the dam construction schedule, with a smaller amount required after reservoir filling has commenced. This volume of material could be produced within the existing boundaries of the quarry.

In a normal quarrying operation, all material in the quarry is used; the larger rock (greater than 200 millimetres) for riprap, smaller rock (i.e., less than 200 millimetres) for riprap bedding, with smaller rock being processed through screens or crushed to produce other finer rock products. For the Project, only the larger riprap product and a smaller amount of riprap bedding would be used. All other rock material would be considered surplus. The surplus material and the remaining intact bedrock would be available for use by MOTI.

The quarry site would remain an active quarry under the control of MOTI so storage of the surplus material is an important consideration for MOTI.

3.0 DEVELOPMENT PLAN BASIS

This Plan has been developed based on the following information:

- The development plans for the quarry were based on the following: Approximately 350,000 cubic metres of temporary riprap and riprap bedding would be required for the Project
- The yearly riprap requirements beginning in Year 1 and ending in Year 4 would be 16,000 m^3, 89,000 m^3, 132,000 m^3, and 16,000 m^3 respectively;
- The yearly riprap bedding requirements would be approximately 32,000 m^3 in Year 3, 61,000 m^3 in Year 4 and 5,000 m^3 in Year 7;
- The yield of usable riprap from blasting operations is estimated to be 20 percent. Therefore, approximately 1.27 million cubic metres of rock would have to be excavated to produce the required riprap volume. The total surplus rock, net of the temporary riprap and bedding material, is estimated to have a volume of 915,000 cubic metres
- The riprap and bedding material used for the Project would be hauled from the quarry as it is produced
- The riprap bedding material would be taken from the coarser surplus material
- A test drill program by MOTI in 1987, drilled to a depth of 31 metres below original ground. The drill logs indicate overburden, then, interlacing between fair to good quality sandstone and more competent and massive sandstone
- Overburden depths range from 4.1 metres to 1.0 metres in the north to south direction of the site's southern panhandle, and ranged from 7.1 metres to 1.0 metres in the east to west direction of the main quarry
- The final pit floor base would be at an approximate elevation of 735 metres, 30 metres below original ground. This is consistent with the MOTI Report on Quarry Development Design for Wuthrich Rock Quarry
- Quarrying boundaries were determined from the MOTI Report on Quarry Development Design for Wuthrich Rock Quarry. Setback boundaries range from 5 to 44 metres from the property line.
- The quarry development design would include a wall slope of 0.25H:1V, and a 5 metre bench for every 10 metres of elevation change. This is consistent with the MOTI Report on Quarry Development Design for Wuthrich Rock Quarry report
- Overburden and surplus storage embankments would have a maximum slope of 2H:1V and a maximum elevation of 785 metres in both the panhandle and middle of the pit storage areas

Bulking factors were applied to excavated and quarried volumes. A bulking factor represents the volume increase (expressed as a percent) that a material undergoes when removed from its natural state, and is applied to estimate the total volume of quarried or

excavated material. Different materials have different bulking factors based on their ability to reconsolidate once excavated. A bulking factor of 1.2 means that a volume of naturally existing material would undergo an increase of 20 per cent once excavated and placed in its final location. Based on an understanding of similar materials within the province the following bulking factors were applied:

- Bedrock Bulking Factor would be 1.3
- Overburden Bulking Factor would be 1.0.

4.0 WUTHRICH QUARRY – OPERATIONS

4.1 PRODUCTION AND SCHEDULING ESTIMATES

In order to produce the amount of temporary riprap material that would be necessary for dam construction, areas for storage of surplus rock and overburden would need to be created within the quarry site. Figure 4.1 illustrates the current development of Wuthrich Quarry and the boundaries of the property. As the quarry site was developed, overburden would be cleared from areas of rock extraction and stockpiled for eventual quarry site reclamation. In addition to the overburden material, a significant volume of surplus rock would also need to be stored.

The Plan would be to remove the existing vegetation and excavate and stockpile the overburden so that the surplus rock stockpile is stored directly on the bedrock material. This would facilitate future operations of the quarry, once the surplus rock stockpile was depleted.

4.2 QUARRY OPERATIONS DURING CONSTRUCTION

The quarry is an existing operation run by MOTI and would be operated in a consistent manner. The Province's Aggregate Management Principles have been established to ensure that aggregate activities are undertaken in compliance with health and safety standards and environmental protection requirements. The reference documents are:

- Aggregate Operators Best Management Practices Handbook for British Columbia, 2002, Ministry of Energy and Mines (MOEM 2002)
- Health and Safety: A Practical Guide for Aggregate Operations, 2007, Ministry of Energy, Mines and Petroleum Resources, Mining and Minerals Division (MOEM 2007)

Following is a summary of quarry operation considerations:

- The main areas for excavation would be in the southern portion of the site and stockpiling would be in the northern half of the site as shown in Figure 4.2
- The maximum volumes proposed for extraction would be based on the suitability and quality of the materials as they were processed. The materials unsuitable for use for dam construction would remain within the site and would be stockpiled for future use by the MOTI
- The site would contain a trailer office, maintenance and storage area and sediment/erosion control measures
- Potable water for the office and service area and water for dust control would be brought to the site from an offsite location
- Extraction requires drilling, blasting and processing, such as screening, prior to riprap being removed from the site. More than one area would be active with room in between sites to maintain equipment manoeuvrability and production rates
- Blasting materials would be available from commercial material supply companies. Delivery would be by bulk mix and loading pump trucks and properly equipped trucks to

deliver the primary explosives. The materials would be delivered prior to loading the holes with the explosives, then the equipment would leave the site. No explosives would be stored on site. Blasting activities would be in accordance with WorksafeBC, the *Mines Act* (BC) the *Explosives Act* (Canada), the Transportation of Dangerous Goods Regulations (Canada) and the *Motor Vehicle Act* (BC)

- The material would be delivered to the dam using highway-legal haul trucks. Haul trucks or loaders would move between the areas on the site, as required
- The equipment required for operations would be as follows with the number of equipment pieces to be determined at a later stage:
    - Loaders (to loosen and remove material and process material at the screening and crushing plants, and stock pile)
    - Bulldozers (to push material for stripping stockpiles and loosen blasted materials)
    - Rock drills
    - Highway legal haul trucks (to transport the material to the dam site)
    - Water Trucks (to control dust as required)
    - Personnel Site Pick-ups (for onsite mobility)
    - Service vehicle (mechanic, fuel trucks)

4.3 ACCESS

Access to Wuthrich Quarry is currently restricted by MOTI by means of a gated access and signage. Access would continue to be closed to the public and/or controlled during the length of the extraction operations. Safety issues on the site would be related to the increased traffic and blasting within the quarry operation. Truck haul would be limited to the public roads near the quarry area to the dam site, namely 271 Road, Alaska Highway and Old Fort Road.

4.4 SAFETY AND ENVIRONMENTAL MANAGEMENT DURING OPERATIONS

Management measures to be implemented during quarry operation would include:

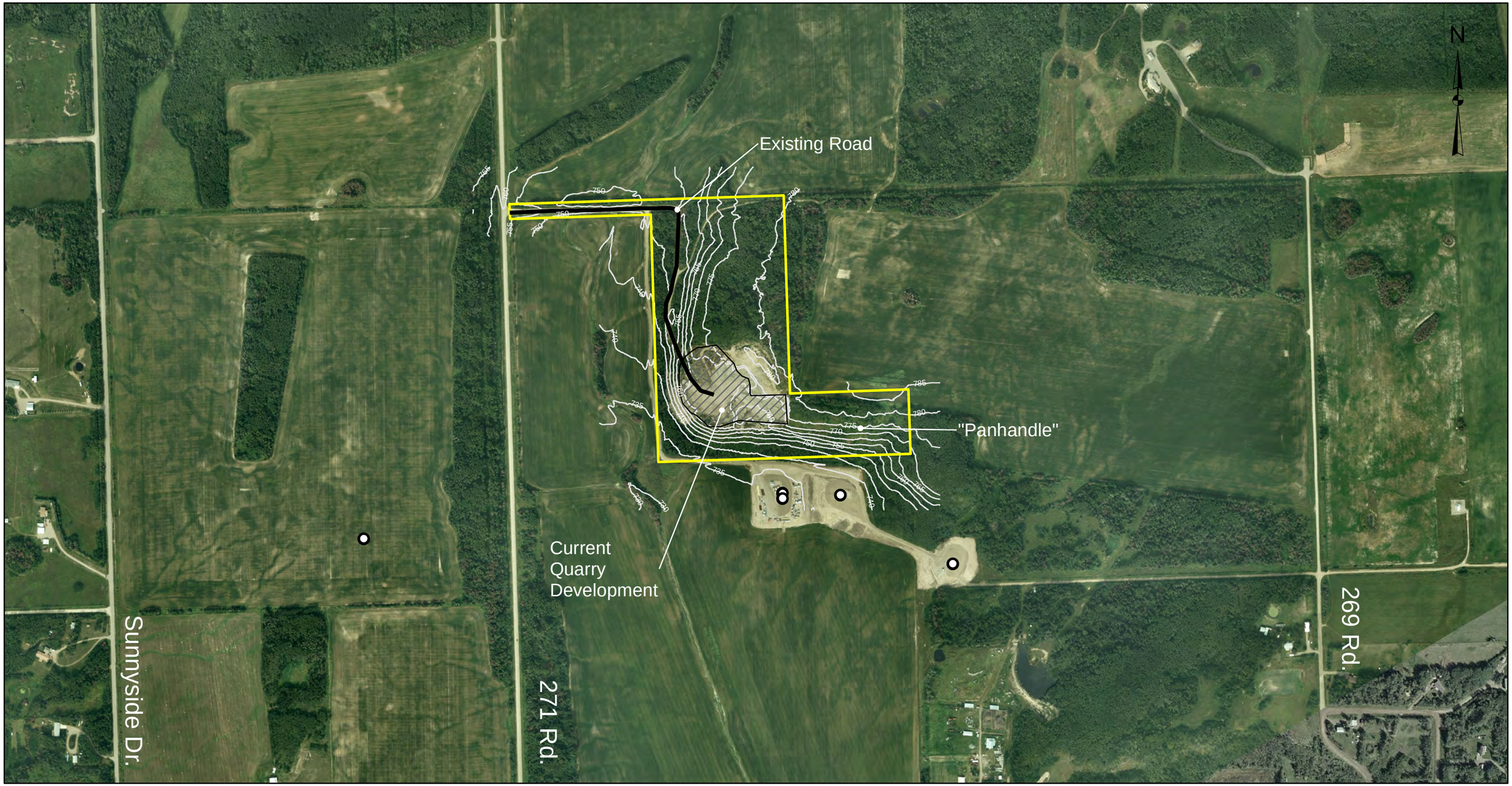
- Gate access would be maintained to control access
- Berms would be constructed at the top edges of excavations to control movement within the quarry
- Portable toilet facilities would be used within the quarry area and near the project site offices. These facilities would be maintained as required. If trailer type washroom stations were to be used onsite, the grey water created would be disposed of into a suitable tank and then pumped out and trucked to the municipal treatment location
- The planning and installation of a lighting system, if required, for the safe operation of the site would follow guidelines in the Aggregate Operators Best Management Practices

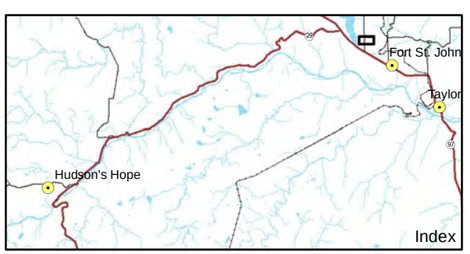
Handbook (MOEM 2002). The goal would be to facilitate safe and secure operations for the extraction, processing and stockpiling locations while minimizing offsite visual nuisance. Lighting would be needed for the quarry property, inside buildings and their entrances, extraction faces, haul roads, stockpiles, equipment, and vehicles. Lighting would be directed downward or shielded by buildings to minimize off-site spill and glare. The lighting of road junctions and site entrances would be kept to the minimum required for safety purposes

- Other site management features would include:
  - Sediment control, and oil control separation
  - Control of noxious weeds through vegetation cover or seeding where required
  - The provision of a truck wash for noxious weeds control
  - Maintenance of road surfaces to reduce vibration
  - Control of air emissions and wind generated dust

4.5 SITE RECLAMATION AND FUTURE USE

Wuthrich Quarry would continue to operate as a rock quarry under the jurisdiction of the MOTI. Slopes would be stabilized and drainage features would be established to control drainage. Seeding to control noxious weeds would be done on soil slopes and overburden stockpiles.





Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos created from 1:15,000 photos taken Aug. 26th 2011; TRIM

Legend

- Wuthrich Quarry Boundary
- Current Quarry Development
- Existing Road
- Well Sites
- Contour - Major 5m

1:7,500 0 250m

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Figure 4.1: Current Development Plan of Wuthrich Quarry

Date	Nov. 22, 2012	DWG NO	1016-C14-B6062-2	R 0

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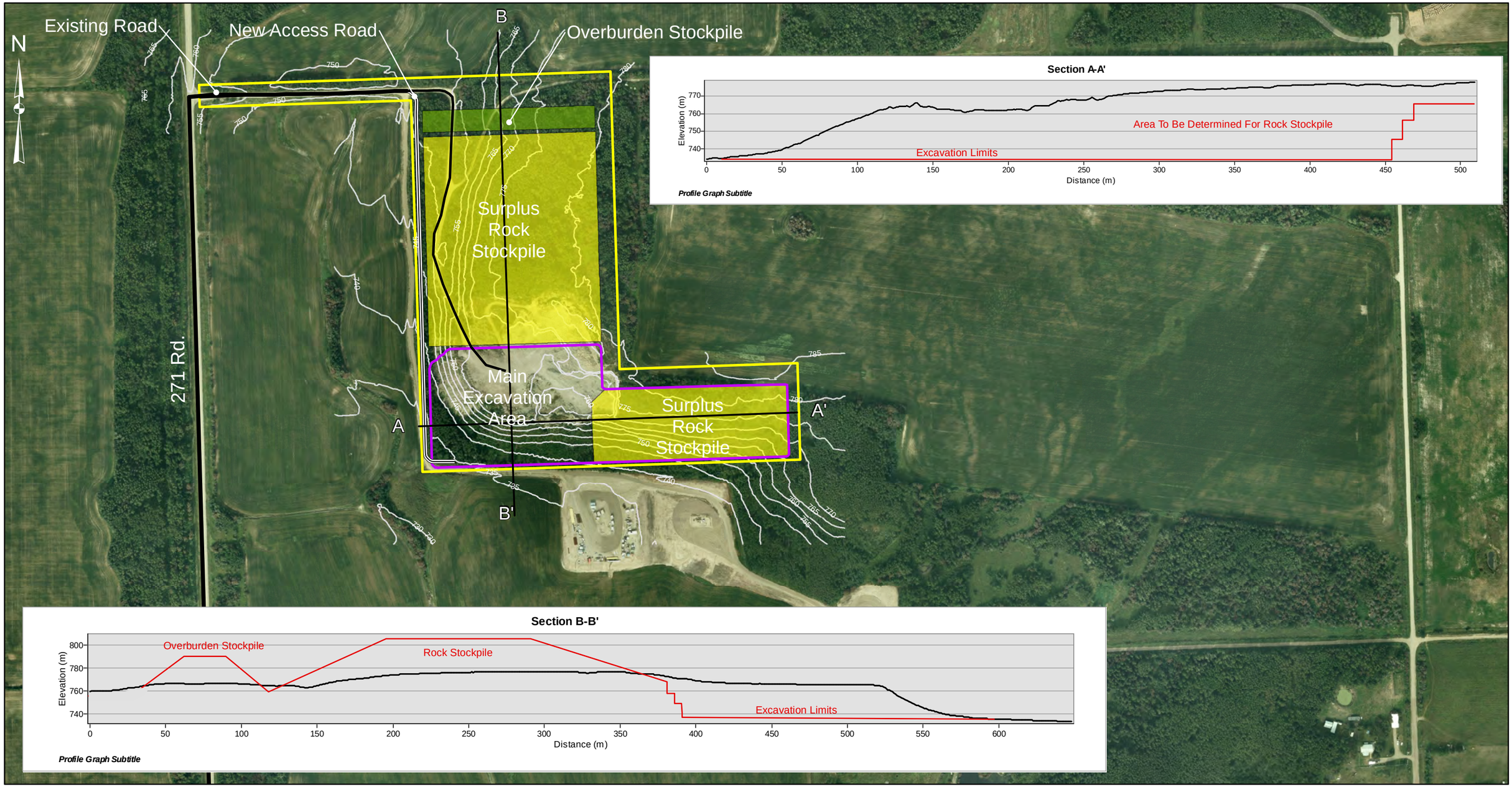

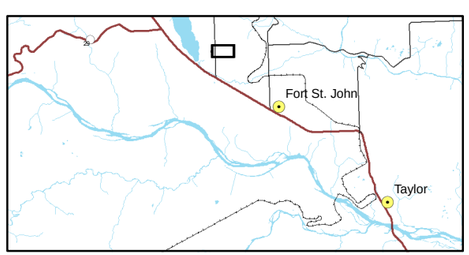

Map Notes:
1. Datum: NAD83
2. Projection: UTM Zone 10N
3. Orthophotos created from 1:15,000 photos taken Aug. 26th 2011

Legend

- Wuthrich Quarry Boundary
- Surplus Rock Stockpile
- Overburden Stockpile
- Main Excavation Area
- New Access Road
- Existing Access
- Contour - Major 5m

1:5,000 0 250m

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Figure 4.2: Proposed Development Plan of Wuthrich Quarry

Date	Dec. 5, 2012	DWG NO	1016-C14-B6062-3	R 0

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