

Document Front Sheet

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LOWER CHURCHILL PROJECT

NE-LCP Contractor/Supplier

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- ☐ **01 – REVIEWED AND ACCEPTED – NO COMMENTS**
- ☐ **02 – REVIEWED – INCORPORATE COMMENTS, REVISE AND RESUBMIT**
- ☐ **03 – REVIEWED - NOT ACCEPTED**
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NE-LCP Management: [signature]	Date (dd-mmm-yyyy): 22 Mar 2018		

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REFERENCE: **Muskrat Falls: Targeted Mitigation Scenarios**

1 Introduction

This report follows the work completed in the report prepared in December 2017, "Muskrat Falls - Soil & Vegetation Removal from the Future Reservoir Area", MFA-SN-CD-0000-EN-RP-0014-01 RevA1 (herein referred to as the "Full Mitigation report"). The description of the site, the proposed timescales for the reservoir impoundment and other features of the site are provided there and not repeated here.

Further to an initial assessment of the removal of all organic soils and vegetation from the footprint of the Muskrat Falls Reservoir footprint, the IEC 'Reservoir Subcommittee (RSC)' is reviewing the possibility of targeted mitigation (removal or cover) scenarios that might help reduce the potential for methylmercury (MeHg) production after full inundation.

In general we should note that unless changed herein the assumptions for engineering, engineering rates and cost estimates remain as in the Full Mitigation report.

In this report we will indicate changes from the assumptions made in the first report and observations of the how the Scenarios have required changes or generated changes.

The following provides a preliminary summary of the calculated volumes and costs to address Scenarios A and B developed in the scope of work. A limited discussion of the methodology for the estimated is also provided.

This report does not make conclusions on the effectiveness of the scenarios in mitigating MeHg.

2 Scope of Work

The IEC proposed two "Targeted" Soil Mitigation Scenarios for consideration. These two scenarios are described below:

Scenario A

› Cap all fen and low shrub bog (but not marsh) wetland ELC (Ecological Land Classification) areas between 23.5 m above sea level (masl) and 39 masl with sediments that are low in total organic carbon (<2%), locally available and will be stable (resistant to erosion from water flow) on the reservoir bed.

Scenario B:

› Remove soil from areas that have been previously cleared of trees and vegetation and are accessible by existing roads, between the 23.5 masl contour and the 39 masl contour.

› Exclude areas of slopes greater than 30% and other areas that would require re-profiling

› Exclude areas that potentially contain sensitive clays (to avoid disturbance and re-profiling).

› Exclude riparian ELC areas.

A scoping document (Attachment 1) was developed by the committee with input from SNC-Lavalin.

3 Data Review

The data used in our analysis relies upon the same reports and GIS data as provided by the Project in the "Full Mitigation study".

The following files were provided by the committee to identify those areas that require capping (Scenario A) and removal (Scenario B) Files Received 1 February 2018.

› ELC_ScenarioB.dbf;

› ELC_ScenarioB.prj;

› ELC_ScenarioB.sbn;

› ELC_ScenarioB.sbx;

› ELC_ScenarioB.shx;

› ELC_ScenarioB.xml; and

› ELC Removal Scenario B_allglacioremoved_Jan31.xlsx,

In reviewing the data provided we have noted that (as in the previous assessments) the ELC's, the geology assessments of the soils and the topography suggest that there are inconsistencies between the data sets in identifying the areas to be mitigated. The differences between the various interpretations had a minor impact on the Full Mitigation. However, the differences are more significant for both of the targeted scenarios and may increase areas identified by more than 50%.

Amec Foster Wheeler/Wood Group (Amec) ELC data update

The AMEC 2018 analysis identified a larger area (270 ha) of wetland habitat compared with the earlier ecological land classification (ELC; Minuskuat 2008a) which estimated 219 ha of wetlands below the 39 masl contour level. Some of the wetland areas were smaller but the AMEC report was able to identify more areas as a result of the improved, higher resolution imagery that was available. The AMEC report does not provide a breakdown of the wetland area that has been cleared to compare with the previous ELC data. The only comparison available is the wetlands described as a Marsh. The ELC data had 117 ha of Marsh wetland whereas the AMEC report identifies 127 ha as Marsh. The wetland classification should be updated with the most recent AMEC data; this has particularly significant effect on Scenario A. It is anticipated that the wetland area to be covered will increase with the updated AMEC data. The data should be field verified to increase confidence in volumes and cost estimates, this will allow a less conservative pricing by contractors during contract procurement. We also advise the geological model should be verified prior to capping.

4 Assumptions

The assumptions for our analysis are included in Attachment 2 as Assumptions Scenario A and Assumptions Scenario B.

In reviewing the assumptions under the revised scopes for Scenario A and B and small number of the assumptions have a significant impact and these are noted below.

We have also noted some areas that may be particularly challenging to remove due to a site's physical constraints (e.g. narrow work areas or adjacent to potentially unstable slopes). The total area identified in the files is provided with estimated volumes to be removed and cost to complete the activity. The cost is based on an assumption of average cost to undertake the work. At this early stage and high level of assessment (and without ground truthing) a more detailed estimate of costs per site is not possible.

Any queries relating to boundaries or data sets have been ignored. For this high level assessment the report provides an adequate assessment of the estimated cost and schedule as the data set errors or non-conformances are assumed to be no net effect unless noted otherwise. We have noted that the data set may increase areas by up to 50% if the updated Amec ELC data is applied.

Detailed maps for each scenario are appended as Drawings at the end of the report.

Scenario A

As part of the capping operations we have assumed that only those areas identified in the supplied shape files are to be capped. We have a assumed a minimum cap of 0.5 m (calculated as the minimum to prevent buoyancy of up to 2 m of muskeg or peat, also a suitable thickness for placement by equipment in the conditions). For our quantities it has been assumed that to achieve the minimum an average of 0.7 m will be placed across each area mitigated to account for variations in surface profile and debris.

We note that areas which have not been cleared are not to be capped. This would include areas that were not cleared because there are no trees (possibly no substantial vegetation, brush or small trees unsuitable for harvesting) as represented in **Figure 4.1**. There are also wetland ELC's that have been cleared but have not been included in the targeted mitigation (**Figure 4.2**).

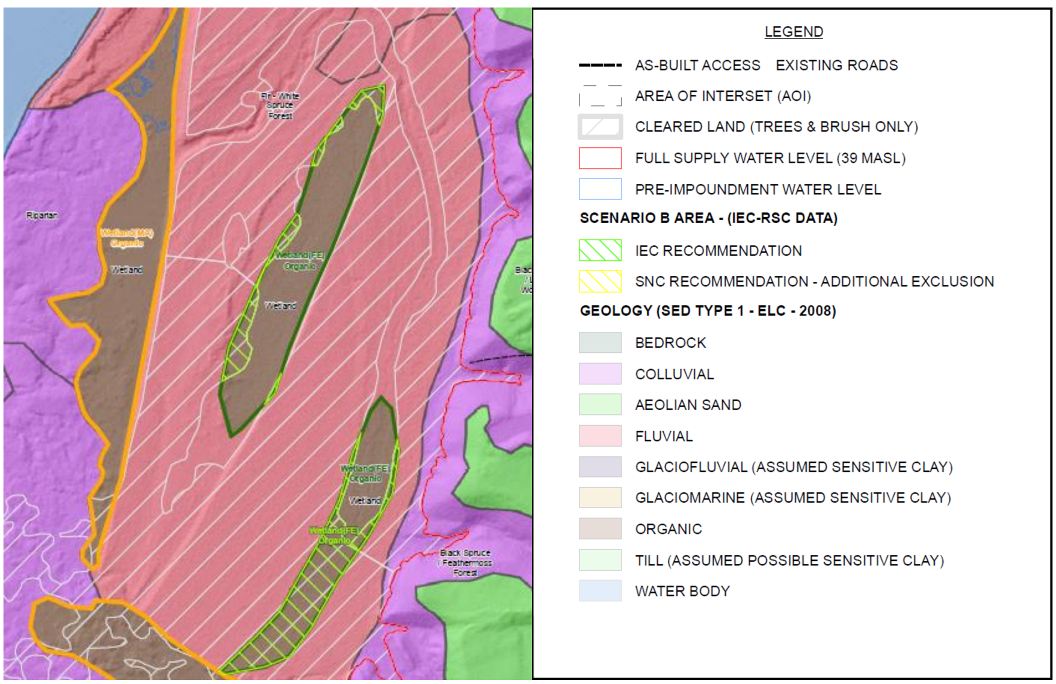

Figure 4.1 Example of wetland areas not cleared.

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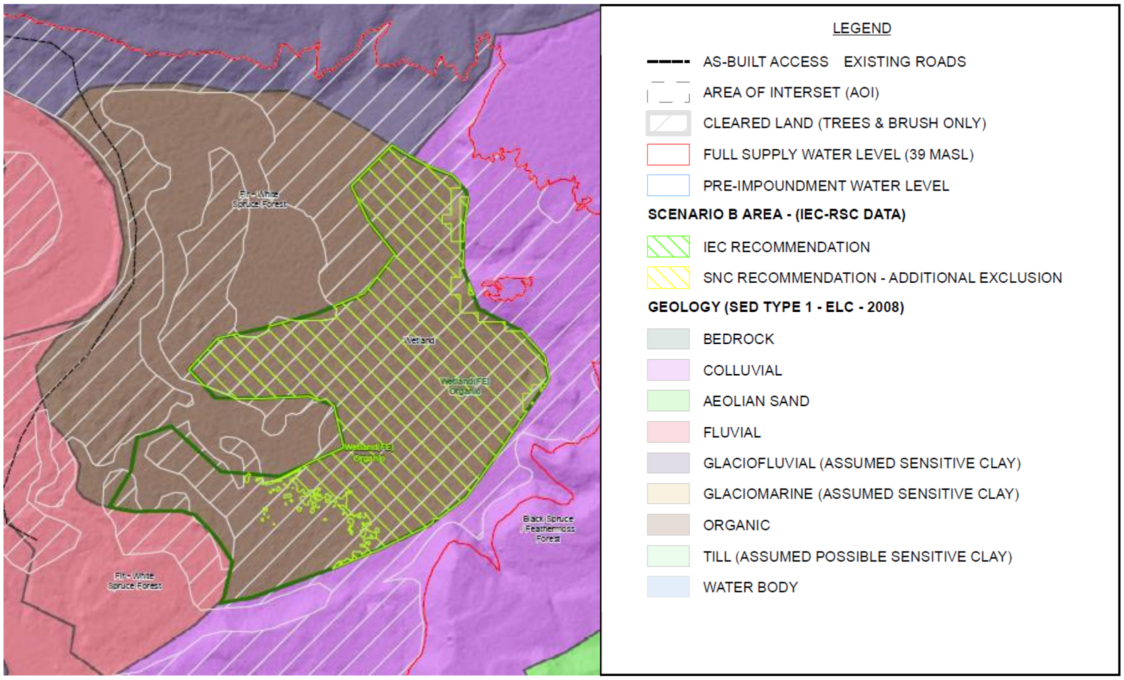

Figure 4.2 Example of cleared wetland not included in the targeted mitigation.

Scenario B

As for Scenario B we have assumed that only those areas identified to be cleared in the files provided will have the organics removed from the near surface.

5 Discussion Regarding Engineering Methods

The following provides supplemental explanation to the original Full Mitigation report.

Scenario A

The overall estimated areas for capping are small relative to the full mitigation of the original study while still a substantial engineering project (less than 1% of area in full mitigation).

Scenario A does not require the transportation of large volumes of materials. The material used in the capping operation for Scenario A are won from neighbouring deposits. The adjacent site is cleared of vegetation to reach inorganic soils with low carbon. The inorganic low carbon materials will be excavated and used to cap the adjacent identified organic area. Sand will be the preferred material for capping, although clay will be acceptable, and a minimum thickness of 0.5 m will be placed. It is noted that uneven ground and obstructions on the surface may require additional material to allow sufficient cover in general. In our cost estimate we have allowed for a nominal thickness of 0.5 m and an average depth of 0.7 m.

The capping materials do not have to meet specific engineering criteria except: depth of fill using low carbon sand or clay. For the purposes of placement trafficability during placement and cover of materials are the primary criteria. Regarding trafficability it should be noted that the materials will be excavated and placed quickly (short haul and no stockpiling and re-handling). The material will be spread using dozers and perhaps excavators. It is anticipated that (if not already frozen) the material placed will freeze soon after placement as work will be conducted from November to the end of February/early April.

Construction equipment is transported to the site of the capping but then works within the site with no transportation. Haulage is short haul. Also as the overall volume to be placed as capping in Scenario A is small, the schedule to achieve placement before spring is reasonable for a small number of work crews. With several small work sites operating the work can be limited to days only. Winter days are short and some light equipment will be required but not as many units as for 24 hr working. The contractor may decide that work will be limited to 10 hrs per day with more sites operating at once if this is deemed more cost effective. This would allow easier transportation of crews from camp and other benefits.

As previously identified, the materials for the capping have been assumed to be obtainable from the areas adjacent to the site and therefore local to the site. Transport would be <500 m with a tri-axle articulated haul vehicle ("wiggle wagon"). Should this not be possible, haul distances would increase and local improvement of roads may be required to access the higher ground sand deposits. Higher ground sand deposits have been identified (at a preliminary level based on existing geological data but are subject to field verification) to be less than 1000 m from the sites to be mitigated. Due to the cost of upgrading the whole network of roads, civil engineering equipment is likely to be the preferred option for haulage which will reduce or eliminate existing track upgrades to be suitable for such short hail operations.

Scenario B

Scenario B faces many of the same challenges of the full mitigation program. The area to be mitigated is roughly a third of that required in the original removal assessment. All of the material excavated is to be removed to above the 39 masl elevation and substantial land area must be disturbed outside of the reservoir to accommodate disposal. The movement of the material to above 39 masl will require new roads and road improvements to allow haulage.

However, some of the sites are very narrow (on colluvium at the toe of slopes). Also, the excavation of material near the toe of sensitive clays (the toe of steeper slopes, >30%) may result in a slope failure. The volumes removed are small but they are often narrow and difficult to work within for standard civil engineering equipment. In our assessment we have estimated the reduction in area that may occur by applying a 20m buffer from steep slopes (>30%) and glaciofluvial/glaciomarine deposits. The use of buffers creates some additional small areas for soil removal which are perhaps too small to be removed by civil engineering equipment effectively. We have not removed these volumes from the estimates at this stage as field verification could adjust the buffer and increase the size of these areas.

The areas to be mitigated in Scenario B are provided as originally outlined by the IEC and with the two buffers below in **Table 5.1**. Additional maps of the areas to be mitigated highlighting the small and harder to access areas are provided in Attachment 3. Cost estimates have not been provided for the reduced areas. The current cost estimates use a high and low range of costs and ±50% accuracy. It is advisable that further modification of the area, volumes and the cost estimate should not occur prior to field verification of geology and ELC's.

Table 5.1 Area to be mitigated

Scenario B as per IEC criteria (ha)	Small and harder to access areas removed (ha)	20 m buffer from steep slopes and sensitive clays removed (ha)
1031	962	782

The estimates of volumes to be removed have included options for 0.2 m, 0.5 m and 1.5 m. The 0.2 m represents an AMEC estimated depth of organics in some of the areas to be cleared with limited field verification. The value of 0.2 m is not considered a practical excavation depth of excavation by civil engineering particularly in cold weather (frozen ground) and where substantial root systems exist. Estimates for the 0.2 m removal option are not presented in this report; the removal option is not viable.

Constrained sites have a slower rate of removal, raising unit costs. We have at this high level applied an average rate to removal which should address the variation between more constrained sites and those that are more open. The rate applied will not address additional works where slope stability issues are triggered or may be triggered. We have presented a "screened" number where the narrower and smaller isolated areas are not cleared of organics. The screening consisted of a high level review of the areas identified for organic removal. Screening was conducted by an engineer. The criteria adopted for the screening (removing) were based on the following key factors (Example provided in **Figure 5.1**):

› Areas that appear to be functions of data (variations between, geology, topography and ELC datasets),

› Areas that are impractical for civil engineering equipment operations (e.g. narrower than 30 m wide),

› Isolated areas that are impractical to access less than 0.5 ha.

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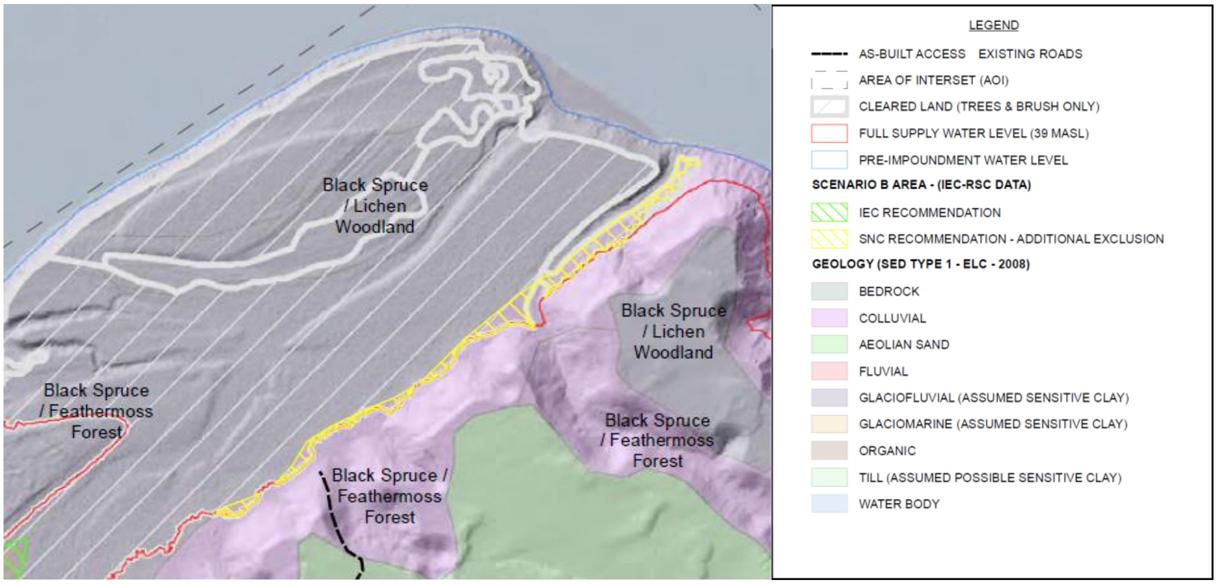

Figure 5.1 Additional data screening.

5.1 Access Roads and Culverts

Main roads along the reservoir to access local sites will be maintained during the operation. Water crossings will be achieved with temporary earthworks or ice bridges as all works will occur during the winter. An allowance has been made for a few culverts along the main access routes.

For Scenario A most sites to be mitigated will only be active for a few days or weeks. Haulage is not required for fills to or from each site and therefore access will be limited. We have therefore assumed that only limited road improvement and temporary reinstatement of water crossings will be required. All access will be in winter and therefore free water will not be present. Therefore we have made no allowance for culverts and have assumed that temporary crossing will be made with earthworks or ice bridges. The temporary crossings will be removed when a site access and mitigation is complete.

For Scenario B an allowance has been made for culverts within the sites mitigated and on approach roads, these will be removed when leaving the sites. The approach roads from the main spine will be upgraded to take triaxle articulated haulage traffic. The road upgrade required is a significant proportion of the road infrastructure.

5.2 Erosion of Capping Materials (Scenario A)

The rates of flow estimated for the reservoir do not allow for surface run off into the reservoir or flow near water course. In these areas, flows may be higher than estimated in the reservoir.

Using a conservative approach for open channel flow, the shear stress on the bed of the reservoir can be calculated by τ_b=gyS,

Where:

g is the unit weight of water (9810 N/m³),

y is the flow depth, and

S is the slope of the reservoir.

Assuming a flow depth of 2 m and a reservoir slope of 0.2% the shear stress on the bed would be 39.24 N/m². The allowable shear stress on the bed of the reservoir can be calculated by:

τ_c = 0.06g(SG-1)d_m,

where:

g is the unit weight of water (9810 N/m³),

SG is the relative density (usually 2.65 for most rocks and gravel), and

d_m is the mean particle diameter.

The mean particle diameter required to resist the shear stress on the bed would need to be 0.04 m (4 mm coarse sand).

To prevent erosion in storms when run off and waves could cause erosion would require protection of a large part of the surface. This would be similar to shore protection at the reservoir water line but at depth the flows would be slower and less likely to cause erosion.

Most (approx. 99%) of the areas targeted in Scenario A will be under more than 2 m of water. The flows at this depth are anticipated to be significantly lower than the surface predictions at full inundation. Sand and clays are adequate protection for the organic deposits below 2 m and in many of the remaining areas.

We anticipate some erosion will occur in shallow water (<2 m) but less than 1% of the area mitigated is in this category, detailed design of the mitigation may suggest removing these areas from mitigation or using other solutions such as clay or gravel.

Should a higher level of confidence be required we suggest that medium gravel to cobble sized granular cover would be required to control entrainment of sediments and prevent all capped organics being exposed.

5.3 Organic Soil Disposal

As noted in the full mitigation report, only a feasibility level design of the disposal areas above the FSL was conducted. Potential organic soil disposal locations are annotated on the Drawings for Scenario B. A typical soil disposal location would have the following dimension: 200 m long, 50 m wide and 6 m deep (approximately 2 football fields end to end). Depending on the organic soil removal depth approximately 100 to 200 disposal areas will be required. During the detailed design of the organic soil removal the locations and dimensions would be adjusted to suit the local need for disposal of organic. This is likely to decrease the number of disposal sites but may increase the median volume of a disposal location.

5.4 Equipment

We have assumed that the same equipment will be used for both scenarios and will consist primarily of: tri-axle articulated haul/dump trucks “wiggle wagons” (such as a CAT 740), dozers (such as a CAT D8 or D9), 360° excavators (CAT 320, 340 or larger) and full size pickup trucks (1/2 ton and above).

There are a number of reasons for the high rates used in the costs estimates for the work. The reasons have affected the rates applied for mobilisation and quantities for all of the cases considered but particularly for the original case (full clearance) and Scenario B. One particular issue is the numbers of equipment required for a relatively short construction programme.

Contractors tender cheaper rates for longer programmes of work which give surety of utilisation of equipment and staff. It allows them to negotiate better rates with equipment suppliers, banks and have lower turnover of staff.

Contractors tendering for this work would bid on the basis of equipment they have or purchasing/leasing used or new equipment to do the work. The smaller the project the more likely they can achieve it with existing fleet and crews. However, for larger volumes of earth movement and where the programme must be delivered before first power it is likely that plant and equipment may be purchased or leased for the duration of the project and at a premium. The costs are likely to be covered over the duration of the contract and not a longer 2 year (or longer) lease or write off period. This is a very significant cost to the project.

It should also be noted that Scenario B, as for the original study, requires a large mobilisation of plant and equipment. While it is perhaps a third of the size of the original study, the project would still constitute a major civil activity with a very challenging time scale for completion. The equipment numbers required to complete removal by the start of the inundation is still a substantial proportion of the civil engineering equipment of its type on the Eastern seaboard. It is likely that a contractor (or leasing company) will look to recover the cost of the equipment in the short time of the project as there would be uncertainty on future use of the equipment and they would assume that Nalcor will have few options when choosing suppliers.

Lead time in obtaining equipment and operators may be an issue. Other large projects on the eastern seaboard will generate competition with the site; these will attract some contractors, equipment and operators. The lead time for new equipment could be the greatest challenge. If contractors need to order new equipment or ship in equipment from outside Canada and the USA the lead time could be as much as one or two years.

In the original study we assumed the same equipment as here. We also noted that larger plant and equipment could be used. The larger equipment will more efficient on unit cost but may require more costly advance works (high standard roads and specialist maintenance facilities) and the lead time for ordering the largest equipment (797's and 785's for example) would have lead times of up to 2 years for construction. However, the larger plant and equipment could not be used in the smaller areas in Scenarios A or B. For Scenarios A and B we have allowed maintenance facilities. For Scenario B the scope (volume to be moved) has been reduced considerably from the very large programme required for the full mitigation (removal) scope, This has reduced the numbers of crews but the project still constitutes major civil engineering project, given its short duration it should be considered an extreme engineering project.

5.5 Schedule

It has been assumed that work is completed prior to reservoir flooding and the advent of spring (and freshet and the restrictions associated with the change): working in and near watercourses and wildlife restrictions (such as nesting birds).

There may be savings in delivering the work over a number of years but the incremental change (decrease in cost per year) is difficult to quantify at this stage and would have to be tested at procurement.

As discussed in **Section 5.1**, lead times for mobilisation of contractors and equipment may be an issue for a start date of November 2018. At the time of writing we suggest that the procurement and mobilisation of a contractor makes mobilisation before October unlikely. Even October will require a premium payment and may not be possible. Larger equipment, or more substantial numbers of equipment, may increase the lead time for equipment from the 6 months assumed to 2 years. It should be noted that for Scenario B over 300 pieces of civil equipment may be required on site and operational by November for period of only 5 months. Scenario A would require 2 or 3 crews (each crew formed up to 5 pieces of equipment).

5.6 Weather

As in the previous assessment we have assumed that at least 2 out 7 days of construction are lost due to poor weather. The allowance is a significant impact on the schedule but has been allowed for in the scheduling and cost estimate.

5.7 Working from water

Working from water has not been considered in our assessment of the scenarios. The change in scope (riparian removed and various soil types removed) limits the need to access from the water. As stated in the previous study it is likely that work will not commence during an open water period or extend beyond it.

The committee raised the question of capping occurring after the reservoir inundation. This has not been assessed in any detail but we can provide the following comments.

- Any work over water is inherently more dangerous.
- Work would be restricted to the open water season.
- All placement and removal operations that use tools (including arms and pipes) that come in near contact with the original ground or projection (trees, bushes etc.) from the new reservoir floor are at risk. The operation may be delayed (damage to equipment) and there is a risk of injury or loss of life to the operators.

5.7.1 Excavation Post Inundation

Excavation post inundation is challenging. It is attempted and sometimes successfully in various environments, often with specialist equipment to deal with trees and high organic materials. However, generally organic material (which is lighter than water) tends to float to the surface during the operation and obstructions (trees, cobbles and boulders) cause damage to equipment.

Dredging equipment would provide one method of removal of material from the reservoir. A directed cutter head with mechanic and hydraulic jetting capabilities cuts into the material to be removed and a suction system draws fluids and solids up through the cutter head up an intake hose (line) and to a pump and collection system where it is usually discharged to a disposal location or an awaiting barge.

However, large woody debris drawn in along with muskeg/peat (which has a high potential to float as it is lighter than water) can be drawn into the intakes causing the equipment to be impeded and often damaged – pumps are blocked and damaged. Cobbles and other hard obstructions also present similar (and much more damaging) consequences if drawn into the intake.

In similar operations in controlled Oil Sands tailings ponds the down time and damage to pumps has been high and costly, respectively. This has been true even where extensive robust multiple screen and boom systems have been used with up to 5 layers of filtering.

5.7.2 Capping Post Inundation

Capping post inundation could be considered. One aspect to consider in the capping is the nature of the material to be used to do the capping.

Clays would have to be placed as blocks but coverage may be variable requiring significantly more than 0.5m thickness to be confident of cover. Or extensive survey and controlled placement from barge mounted backhoe could be applied.

› Granular materials are preferable for capping the reservoir floor post inundation. The denser and heavier the materials the easier it is to deposit solids on the floor of a water feature, lighter particles tend to be entrained in currents and dispersed settling in locations other than the intended one. The aggregates available in the reservoir are primarily sands and these are a poor option for placement because of their low density and particle size. They do settle in still water but in currents may be carried away, due to the buoyancy of the water they tend to settle as a very loose (low density) deposit.

› For the physical activity of placement of a capping layer there are a number of options:

Excavator placement

An excavator could be used to place material on the reservoir floor. 99% of the targeted area in Scenario A is below 37 masl (2 m of water) and 76% below 35 masl (4m of water). This depth limits placement operation with a barge mounted excavator without switching to a long reach excavator with a smaller bucket will reduce progress.

Hydraulic or fall pipe placement

Placing fill to create land or to cap over buried objects (such as pipelines) is accomplished routinely in the North Sea for land reclamation in the Netherlands and to protect pipes and structures from trawling (and snagging).

› Sands can be slurried in a mix pit on land and transported (pumped and gravity assisted) on the site by pipe to a point of discharge. This would reduce costs of transportation of sands, if sand proves suitable as capping.

› Placement would be most effective with gravel which would be less affected by currents and less likely to be dispersed.

› Placement systems can include the use of discharge pipes whose position is controlled from the surface. They can be very effective in improving placement of materials: rate of production, accuracy and reduction in the potential to disperse in a water column (providing the discharge is near the base of the water column). Fall pipes are generally used for gravel materials (gravity is used to transport the material down – no pumping required). For Sand a hydraulic system may be employed with a diffuser system to reduce energy at the point of discharge.

5.8 Erosion Control

Erosion protection measures have been employed in the same form as for the full clearance study. This is intended as temporary measure to control water on surfaces and to catch sediments in settlement ponds before discharge. We note that for scenario A and B the majority of the work will be in low lying areas with shallow inclines and will be less susceptible to erosion by surface water runoff. The erosion control measures are therefore expected to be less significant.

5.9 Working Adjacent to Sensitive Clays

Working on sensitive clays has been removed from the scope. However, the operation will involve working near sensitive clays. Movements in these clays could be triggered by engineering works (access roads, capping or removal/excavation of organics at the toe of a slope). Of the three engineering that may induce movement, placement of material or construction of roads or the removal of material from the toe of the slope are more likely to cause movement. Roads have been aligned to reduce risk of failure which leaves excavation of organic material at the toe of a slope the most likely to cause of a failure. Should an unstable slope develop, additional costs will be incurred in stabilising the movement; this is likely to involve significant earthworks.

For Scenario B we have considered a buffer zone from the toe the slopes to reduce the risk of a slope failure. We have presented the volumes for Scenario B with and without a buffer. The buffer area removed from soil removal is included with the areas screened because of other challenges.

6 Estimated Quantities and Costs

Our estimates of quantities, equipment and a cost estimate for Scenarios A and Scenario B are included in Attachment 4. As previously stated the estimates are based on the original assumptions made for clearing of the organics within the reservoir footprint modified as required to confirm with Scenario A and Scenario B scope of work. A modification to the excavation rates were made at the request of Nalcor, the rates were increased to reflect the $15/m³ rates observed for the North Spur stabilization for the rate for excavation.

The range of the costs estimate (±50%) and the use of high and low rates for works provide broad ranges for the cost estimate. Generally on projects entirely working in or on the ground and relying assumptions about those areas uncertainty is high and costs estimates are perhaps accurate to +75%/25%. The quantity and cost summary tables for each scenario are provided below:

Table 6.1 – Scenario A Targeted Mitigation

	Area of wetland to be covered (ha)	Estimated Quantity (0.7m cover) (m^3)	Estimated Cost Low	Estimated Cost High
Total Wetland Area as per ELC	101.85	712,950	$20,302,864	$35,641,497
Excluded Area	62.35	436,450		
IEC Selected Area for Mitigation	**39.50**	**276,500**	**$11,693,888**	**$19,379,370**

Table 6.2 – Scenario B Targeted Mitigation

	Area of soil to be removed (ha)	Estimated Quantities 0.5m Removal (m^3)	Estimated Quantities Winter 1.5m Removal (m^3)
Total Cleared Area	1756	8,780,000	26,340,000
Excluded Area	725	3,625,000	10,875,000
IEC Selected Area for Removal	**1031**	**5,155,000**	**15,465,000**
Estimated Costs			
Low		$174,336,833	$409,062,083
High		$301,141,822	$742,300,222

As can be seen the volumes and cost have been substantially reduced for Scenarios A and B. Scenario A presents a significant engineering activity but it is one that can be accomplished within one winter season by 2-3 work teams. Scenario B is roughly a third of the volume of the full clearance and therefore equipment and personnel required are reduced. However, much of the road infrastructure improvement is still required for access and movement of material to above the 39 masl elevation.

7 Notice to Reader

This report has been prepared and the work referred to in this report has been undertaken by SNC-Lavalin Inc. (SNC-Lavalin), for the exclusive use of Nalcor Energy (the Client), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made with respect to the professional services provided to the Client or the findings, conclusions and recommendations contained in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered or project parameters change, modifications to this report may be necessary.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

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8 Closure

We trust the above meets the needs of the Committee. Should queries arise please contact the undersigned.

Prepared by:

LICENSED PROFESSIONAL ENGINEER
09264
ALISTAIR THOMAS JAMES
SIGNATURE
2018-03-21
DATE
NEWFOUNDLAND & LABRADOR

Alistair James, P.Eng.
Principal Geotechnical Engineer

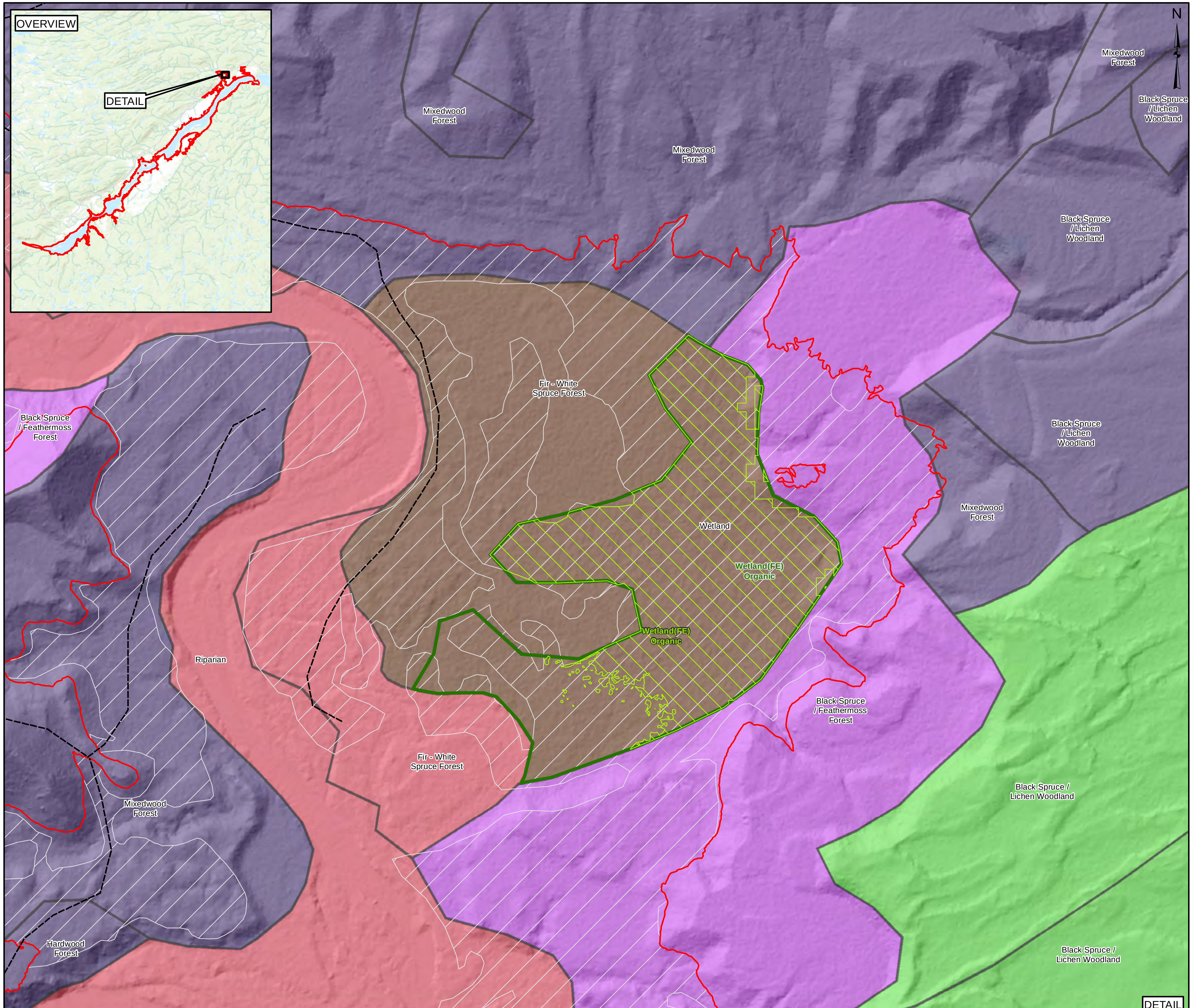
Environment & Geoscience
Infrastructure

Randal Osicki, M.Sc., P.ENg.
Senior Geotechnical Engineer

References

MFA-SN-CD-0000-EN-RP-0014-01 *Muskrat Falls – Soil and Vegetation Removal from the Future Reservoir Areas*, SNC-Lavalin, December 2017

Drawings



LEGEND

- AS-BUILT ACCESS *EXISTING ROADS*
- CLEARED LAND (TREES & BRUSH ONLY)
- ECOLOGICAL LAND CLASSIFICATIONS (ELC - 2008)
- FULL SUPPLY WATER LEVEL (39 MASL)
- MARSH - "MA"
- SCENARIO A - WETLAND ELC (IEC-RSC DATA SELECTION)
- SCENARIO A - WETLAND ELC (SNC DATA SLECTION)
  WETLAND TYPE:
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- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

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3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:4,500

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 1

DES BY	RI	DRN BY	WH	DATE	2018 01 25	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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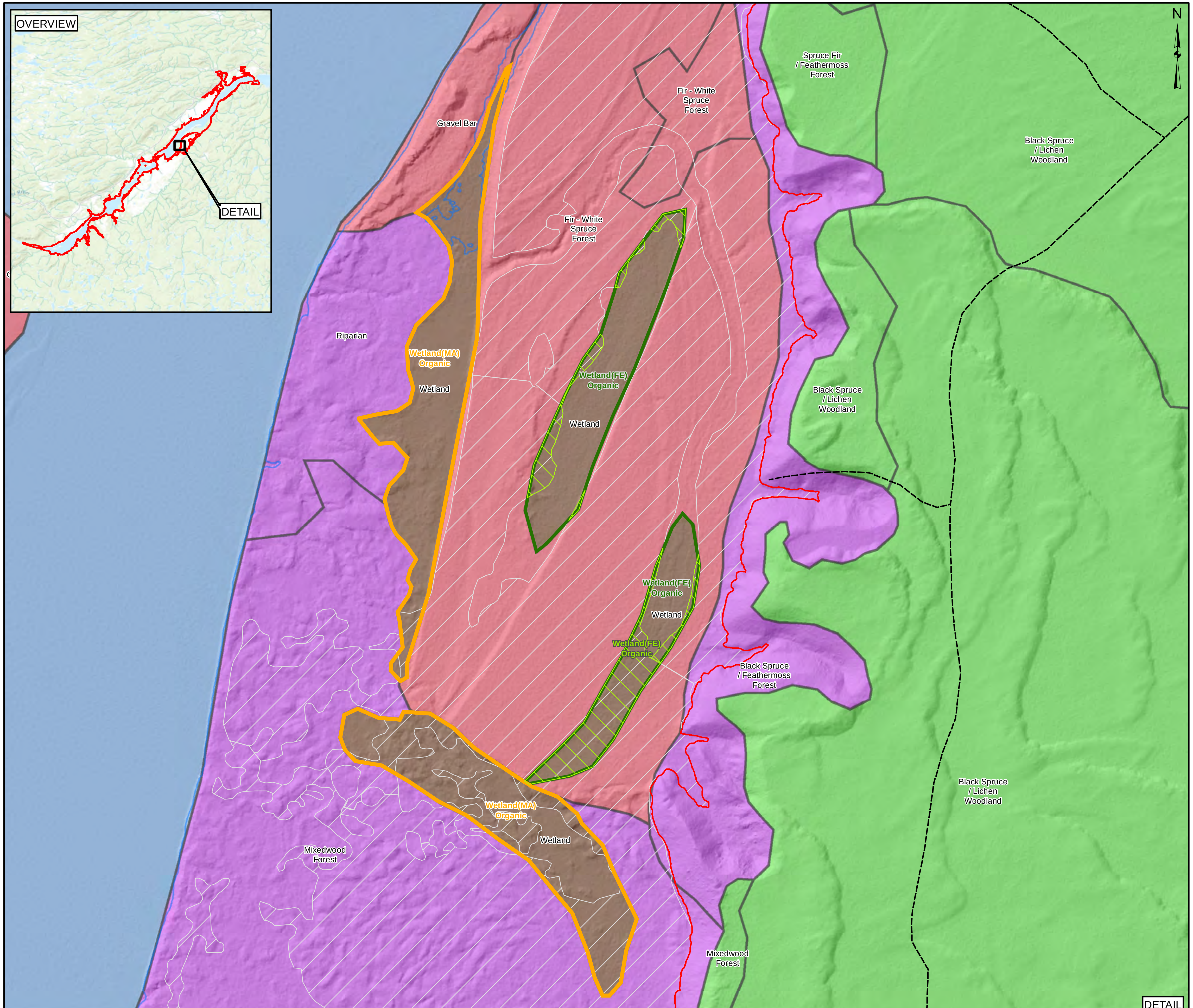

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

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SCALE: 1:6,500

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 2

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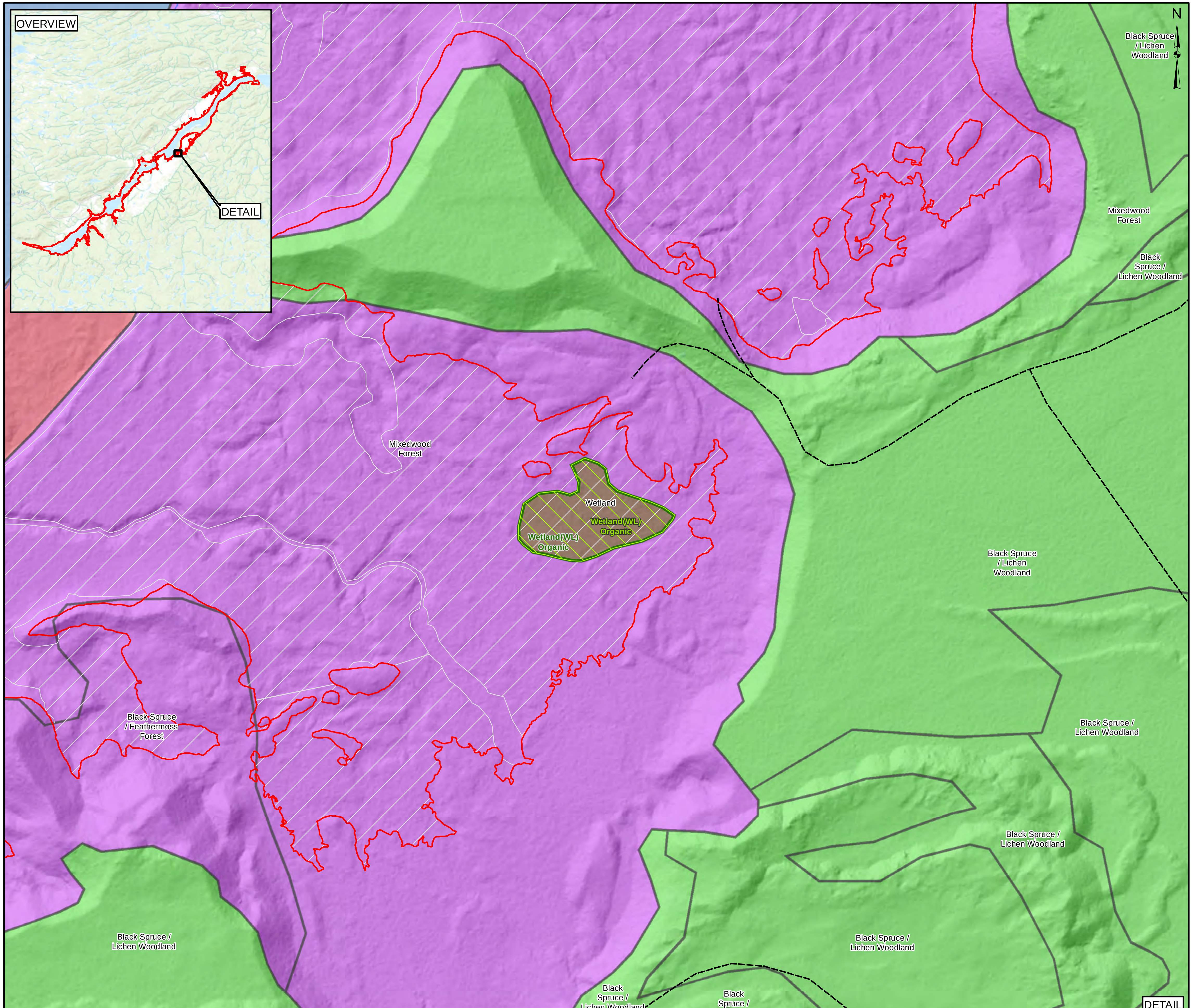

LEGEND

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:4,500

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 3

DES BY	RI	DRN BY	WH	DATE	2018 01 25	REV 0
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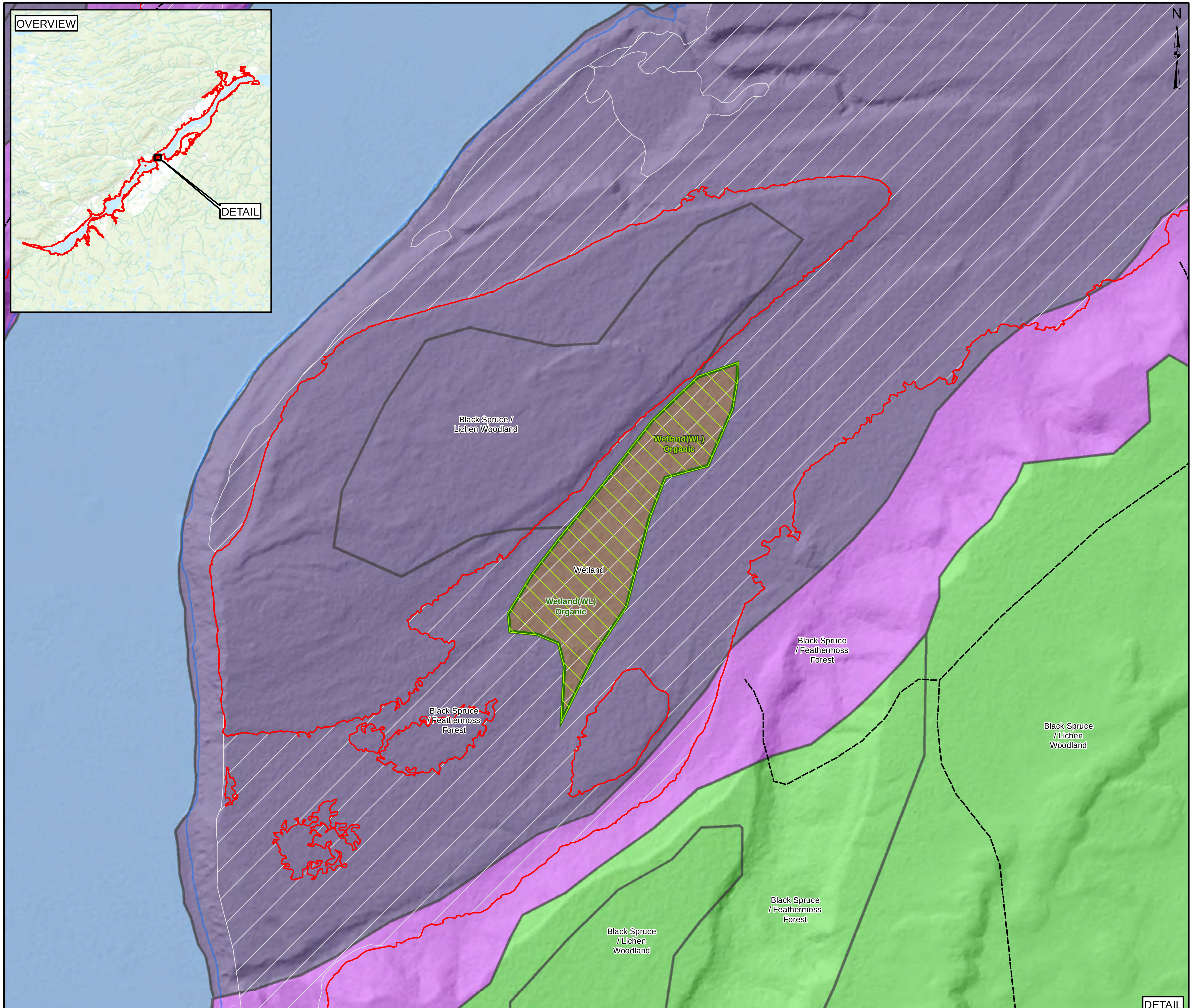

LEGEND

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- CLEARED LAND (TREES & BRUSH ONLY)
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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:4,000

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 4

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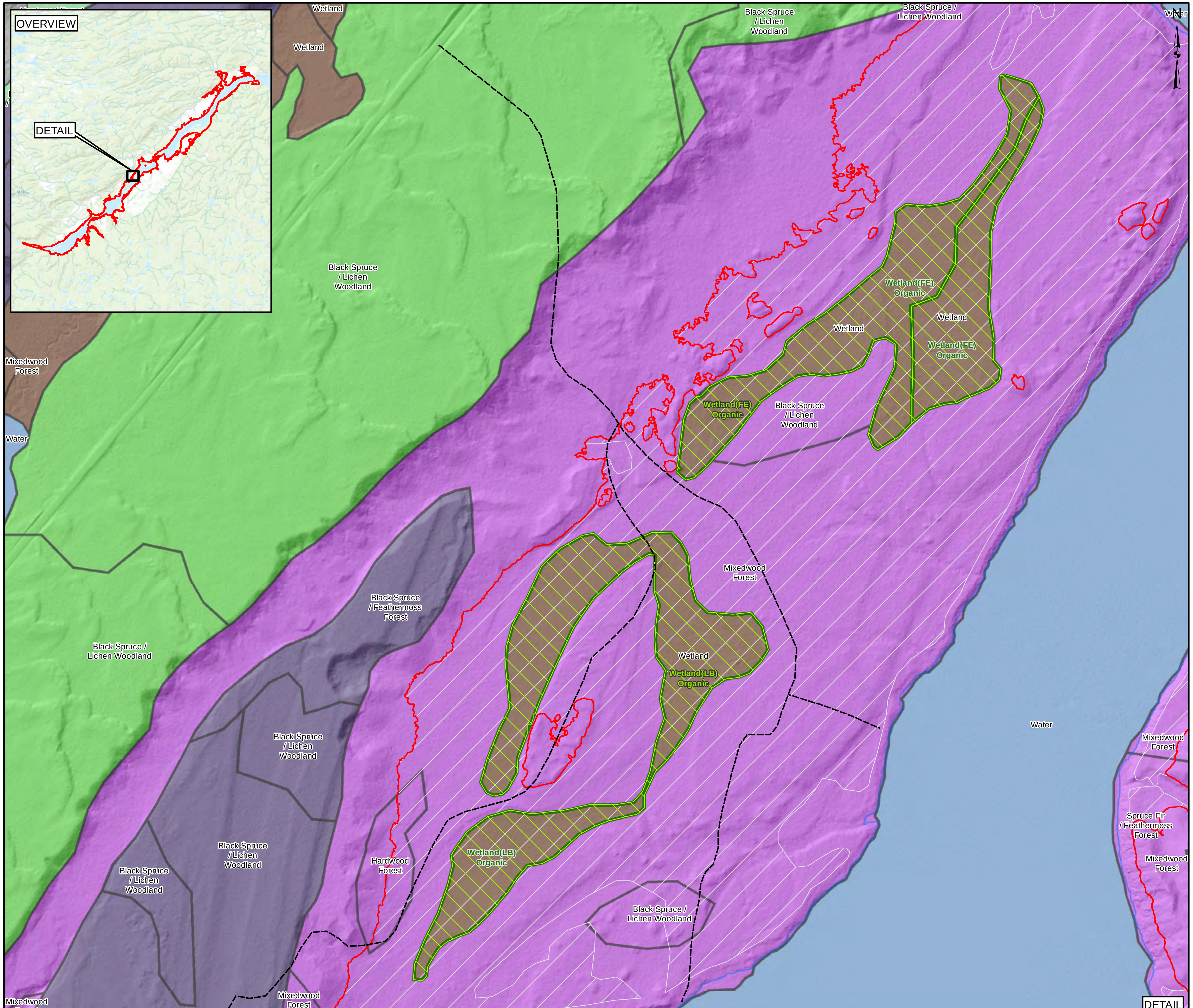

LEGEND

- AS-BUILT ACCESS *EXISTING ROADS*
- CLEARED LAND (TREES & BRUSH ONLY)
- ECOLOGICAL LAND CLASSIFICATIONS (ELC - 2008)
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NOTES

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:7,250

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 5

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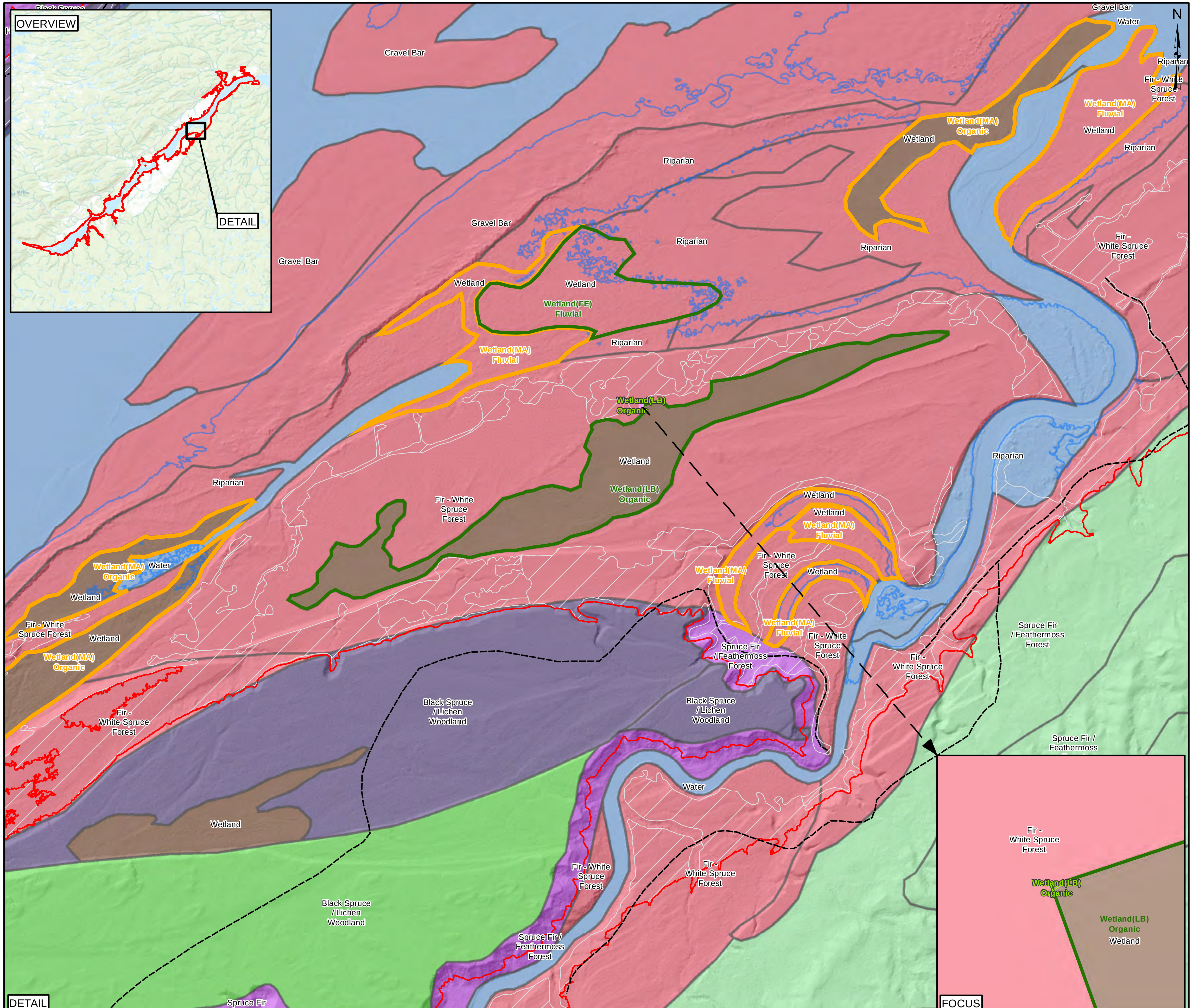

LEGEND

- AS-BUILT ACCESS *EXISTING ROADS*
- CLEARED LAND (TREES & BRUSH ONLY)
- ECOLOGICAL LAND CLASSIFICATIONS (ELC - 2008)
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NOTES

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 6

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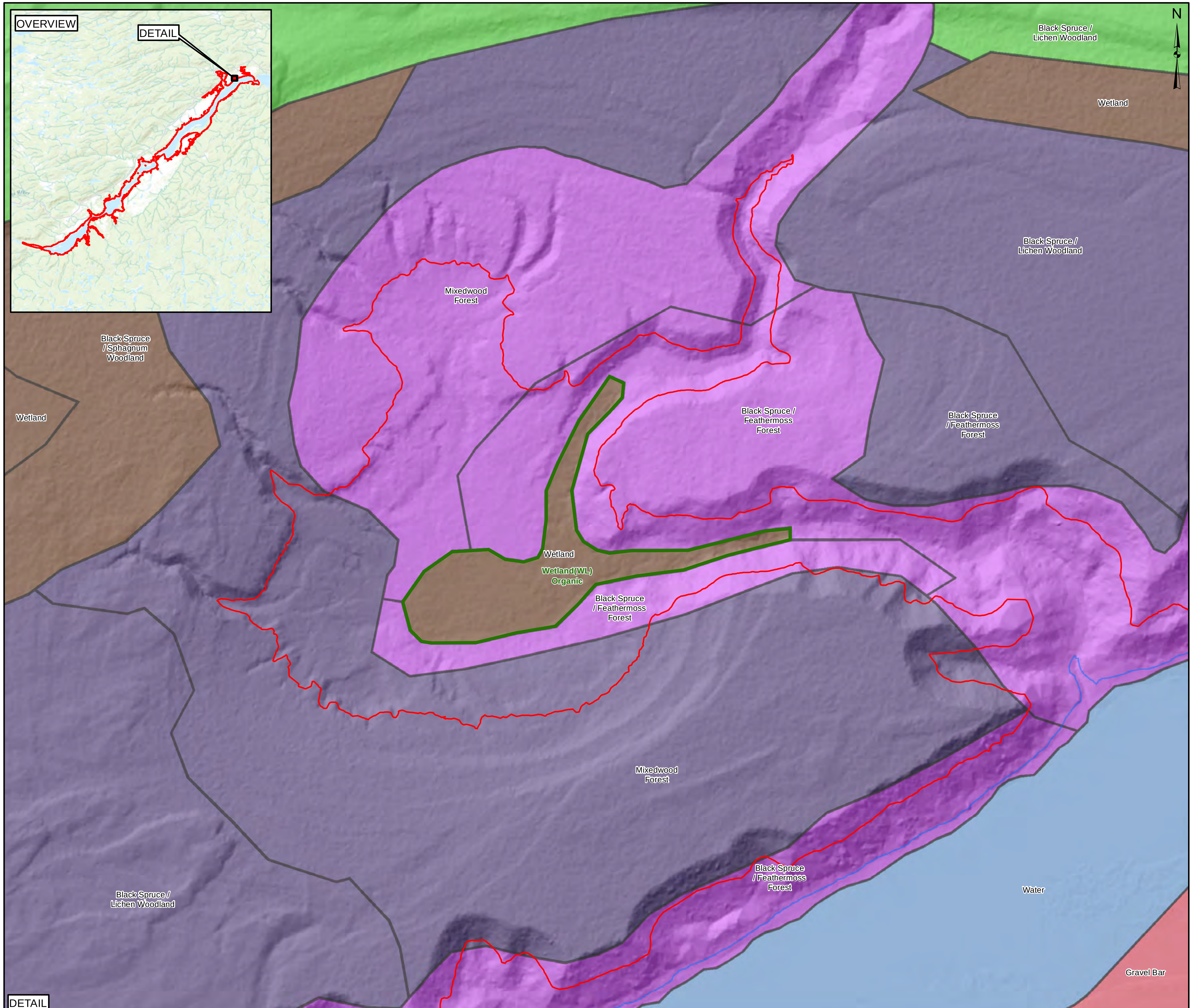

LEGEND

- AS-BUILT ACCESS *EXISTING ROADS*
- CLEARED LAND (TREES & BRUSH ONLY)
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- FULL SUPPLY WATER LEVEL (39 MASL)
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NOTES

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 7

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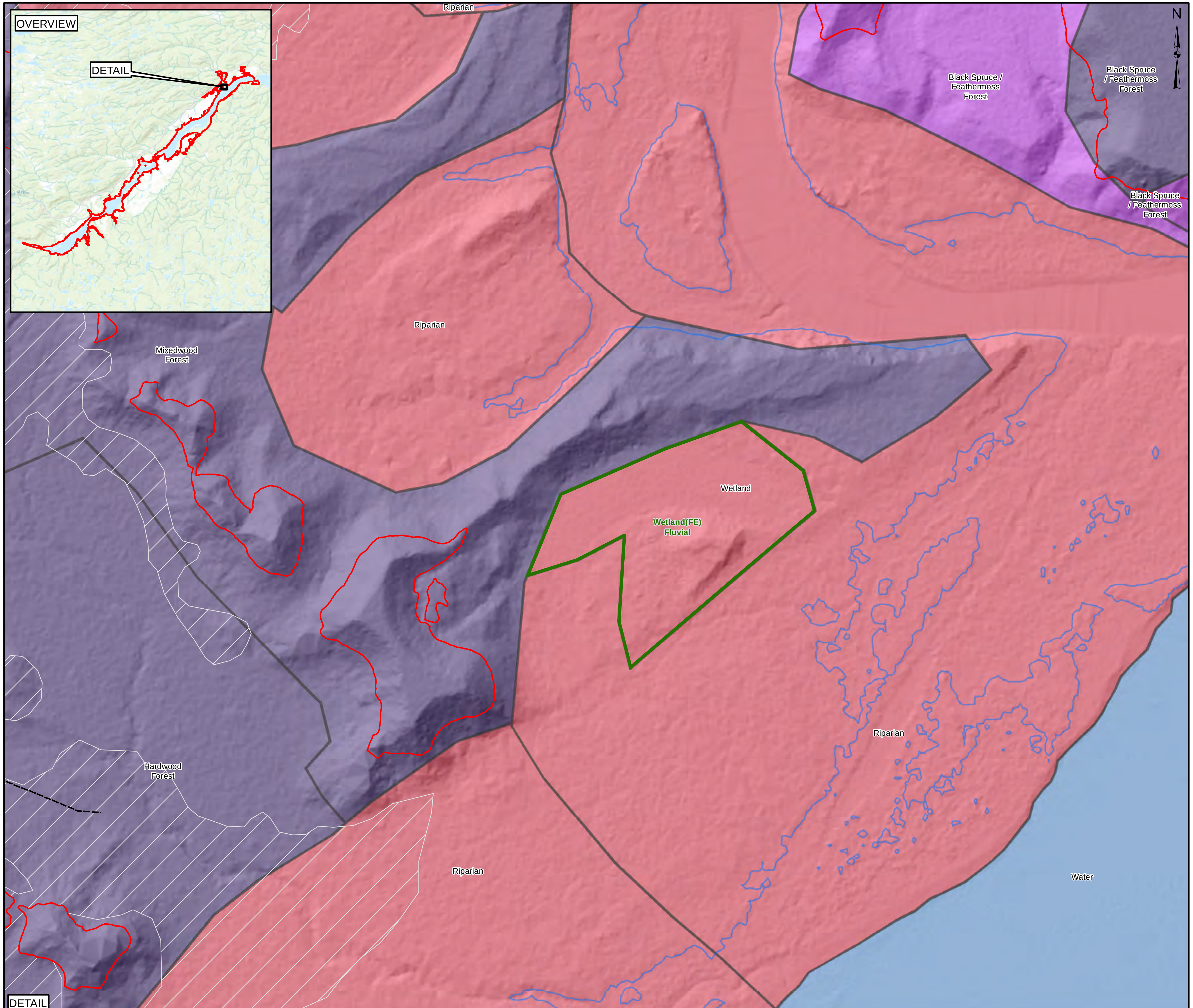

LEGEND

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DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 8

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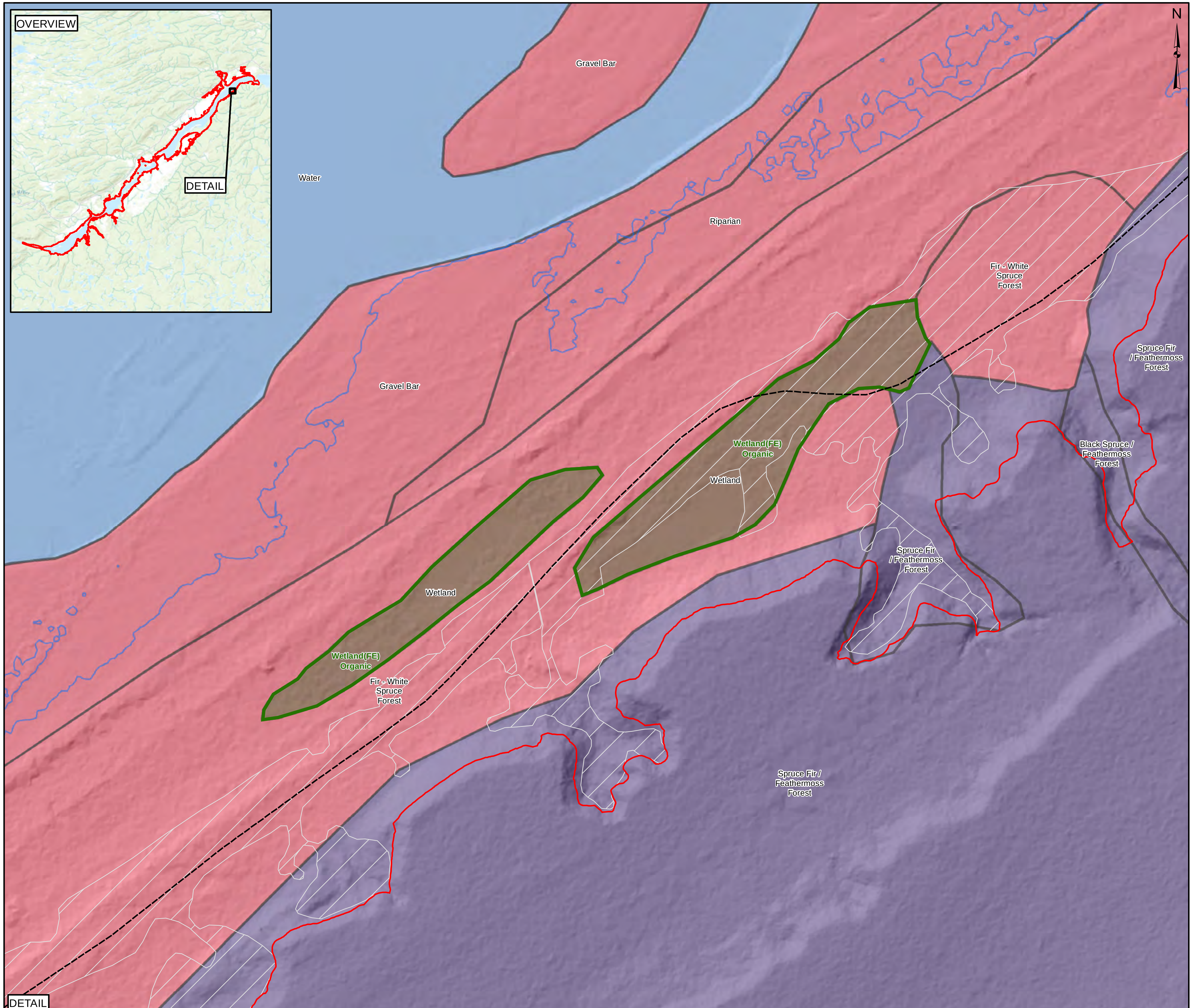

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REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:3,500

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 9

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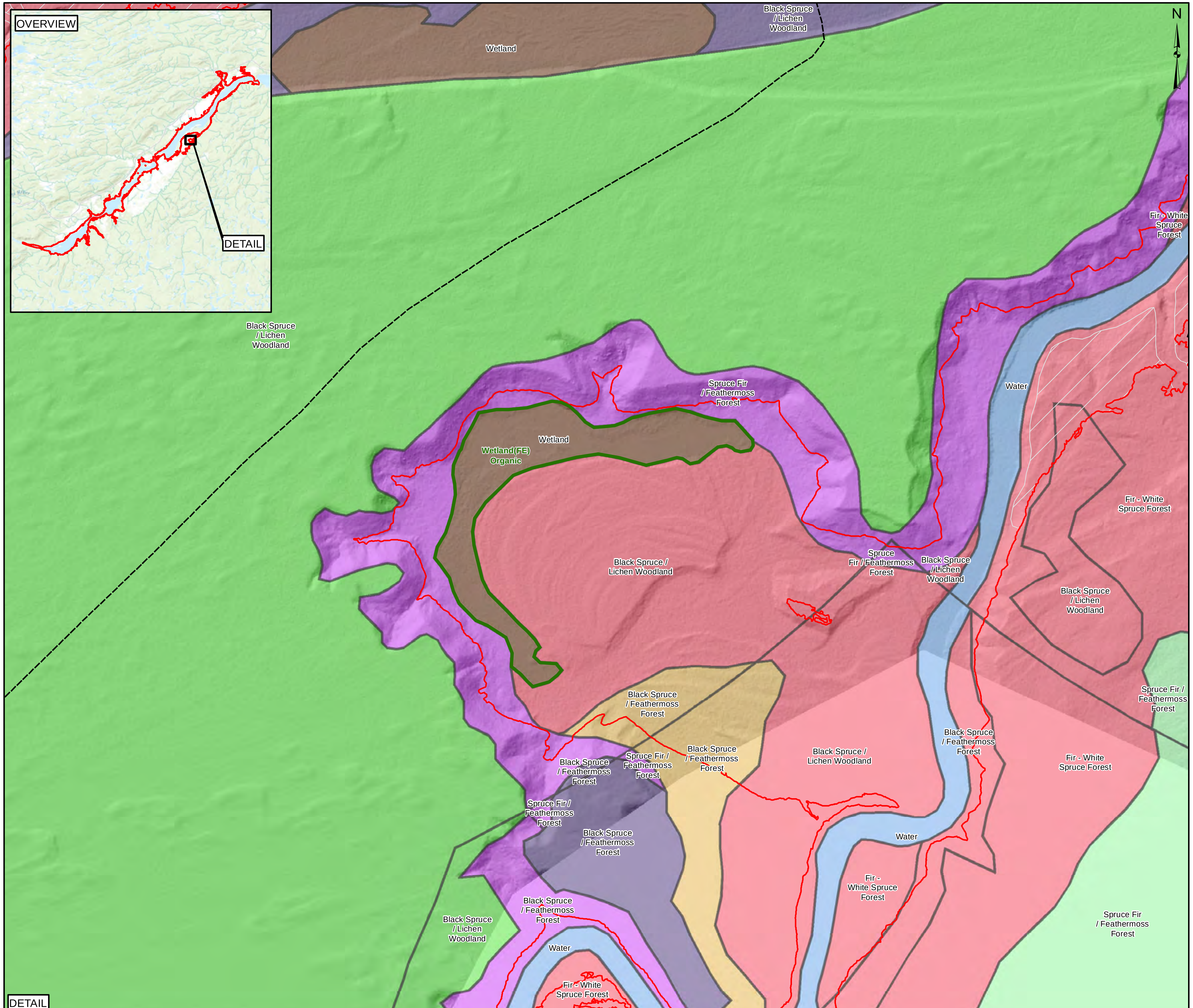

LEGEND

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DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:6,500

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO A - AREA OF INTEREST 9

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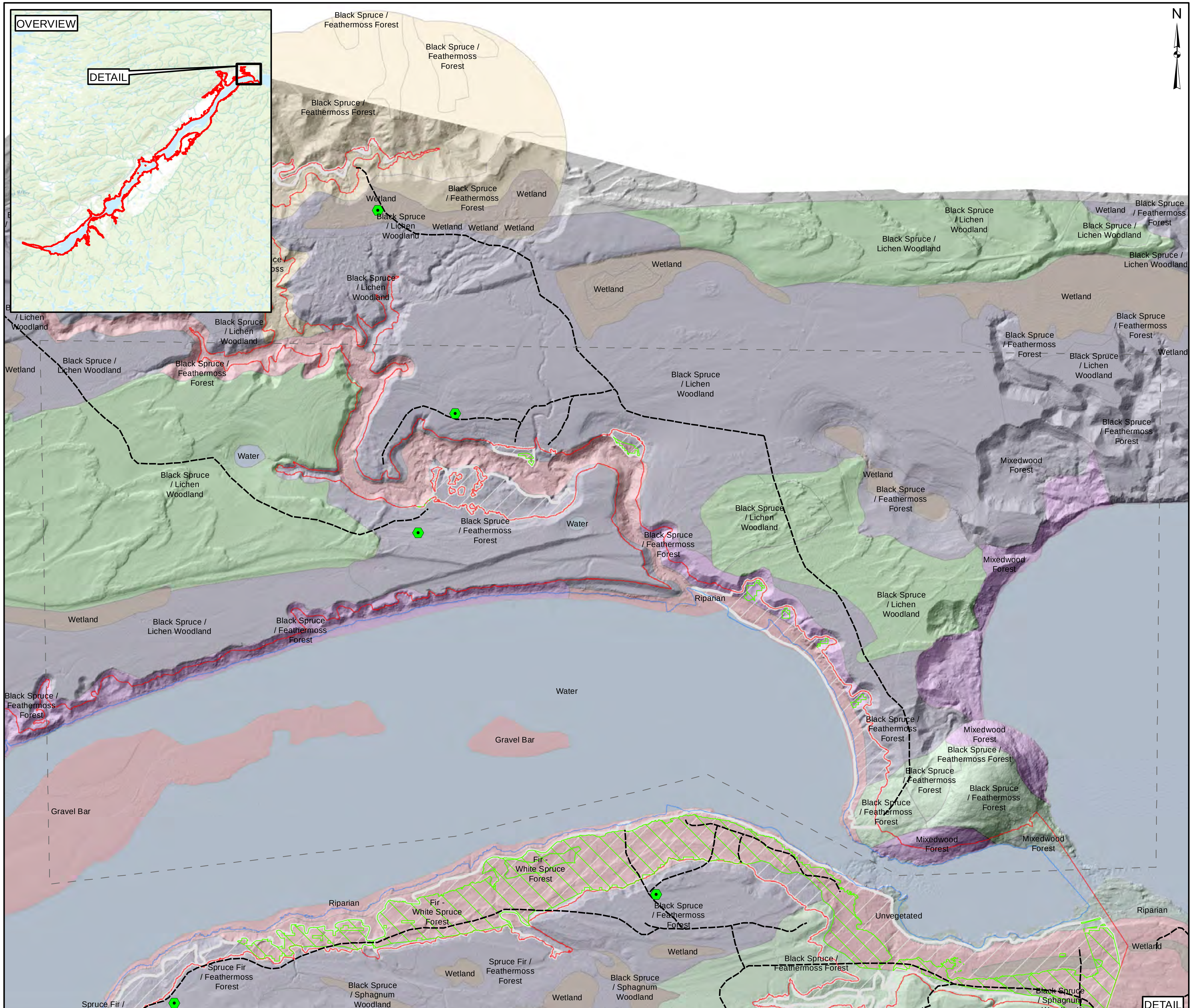

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTEREST (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:15,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 11

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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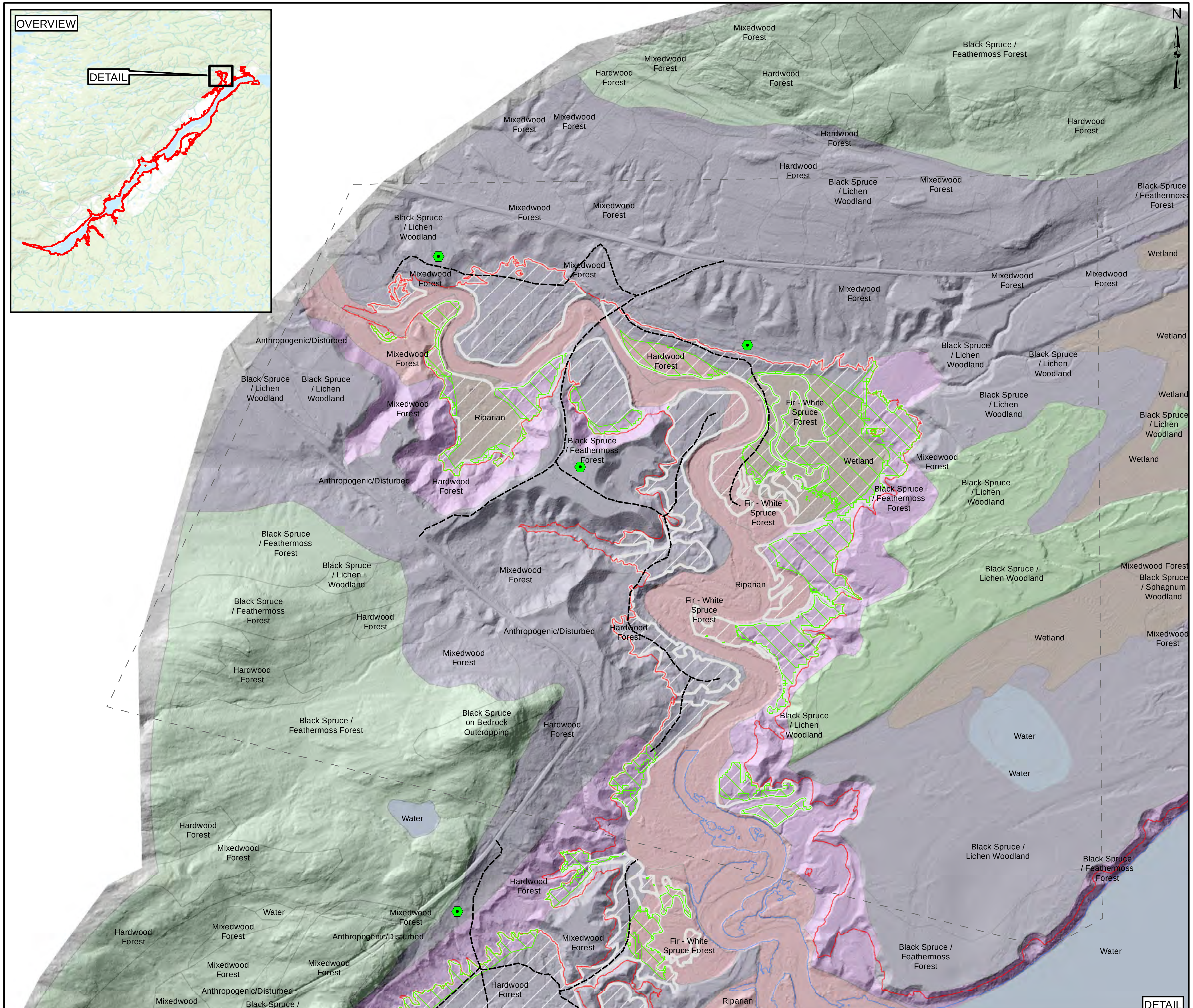

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:15,000

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 12

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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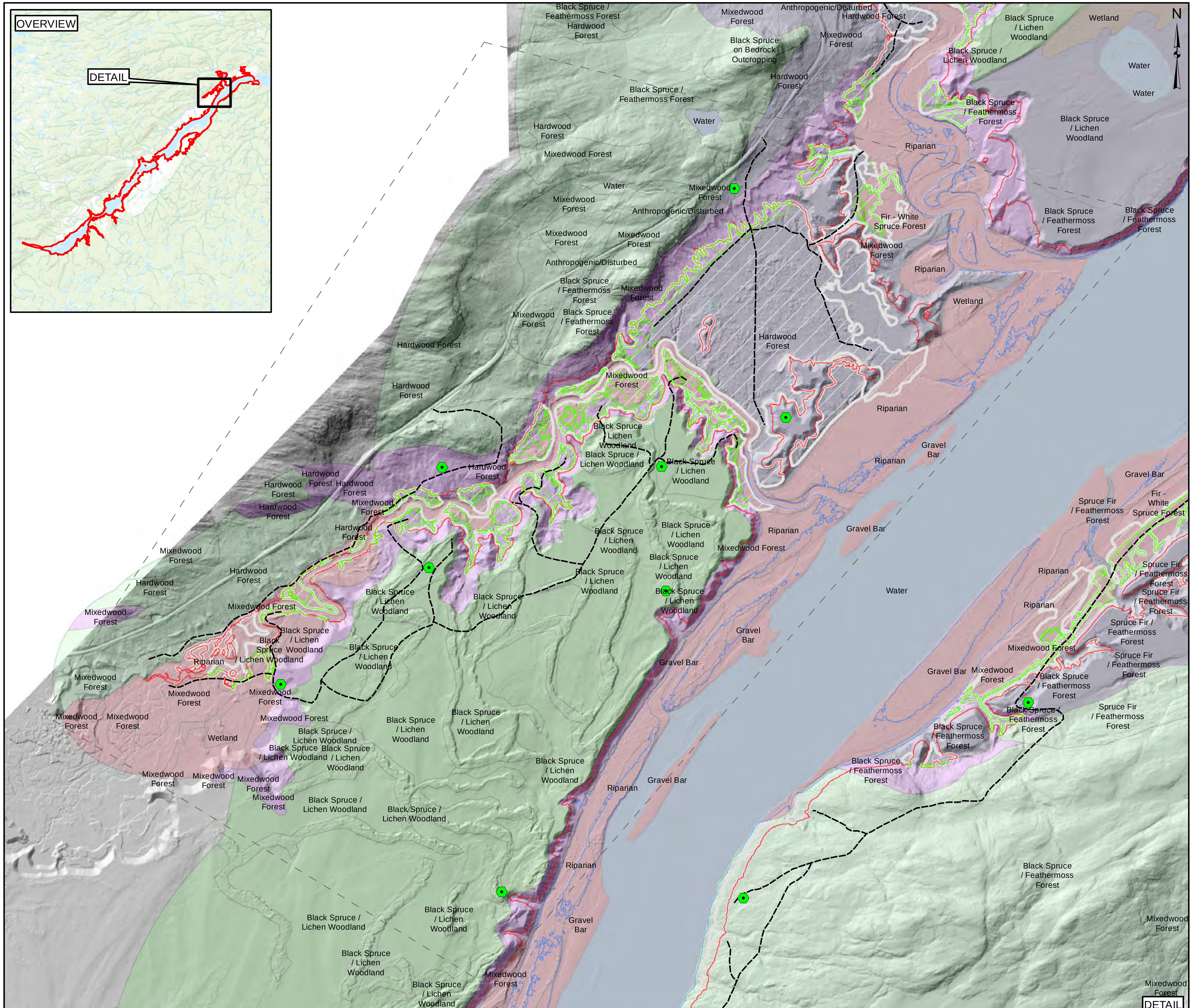

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:21,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 13

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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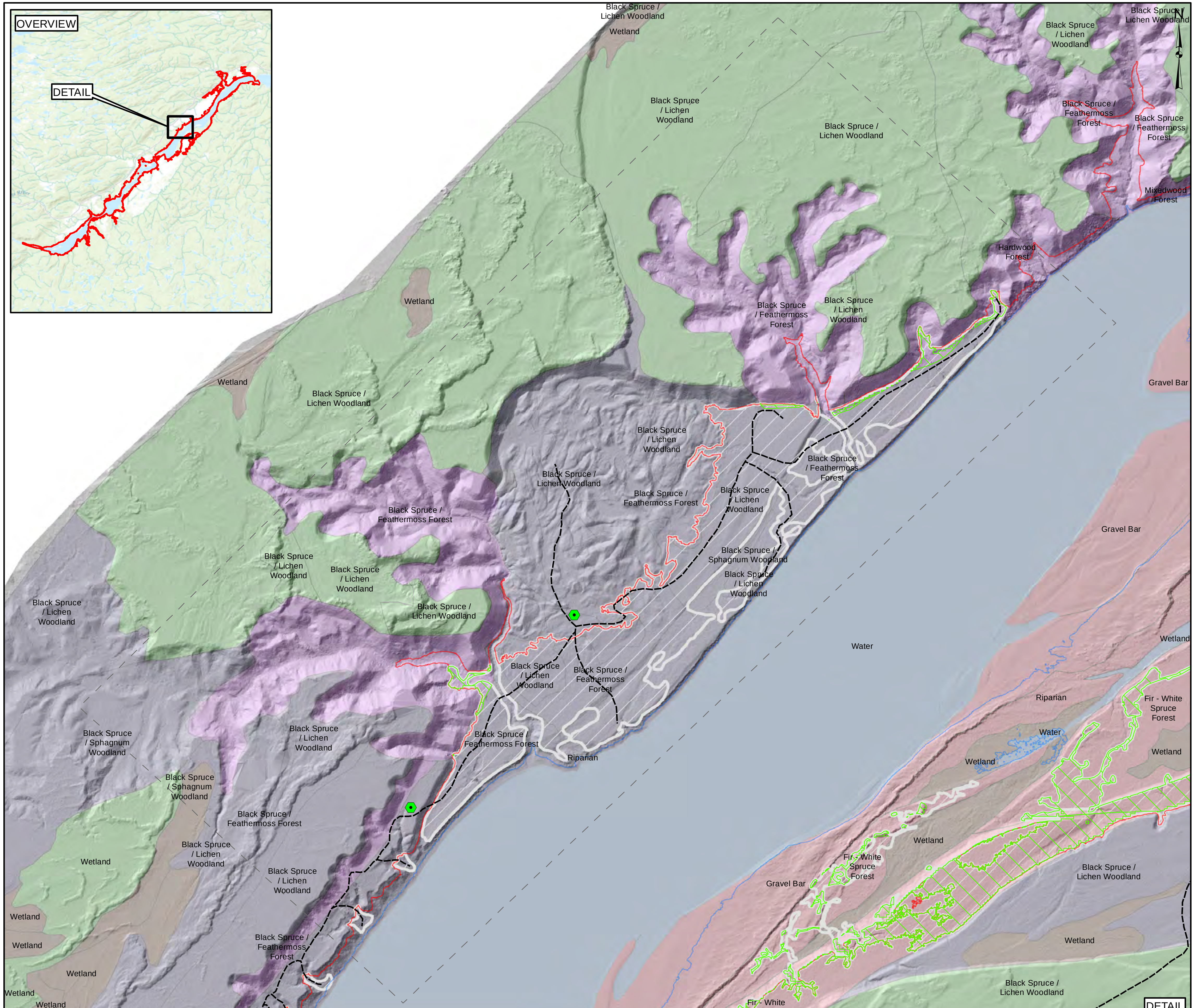

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 14

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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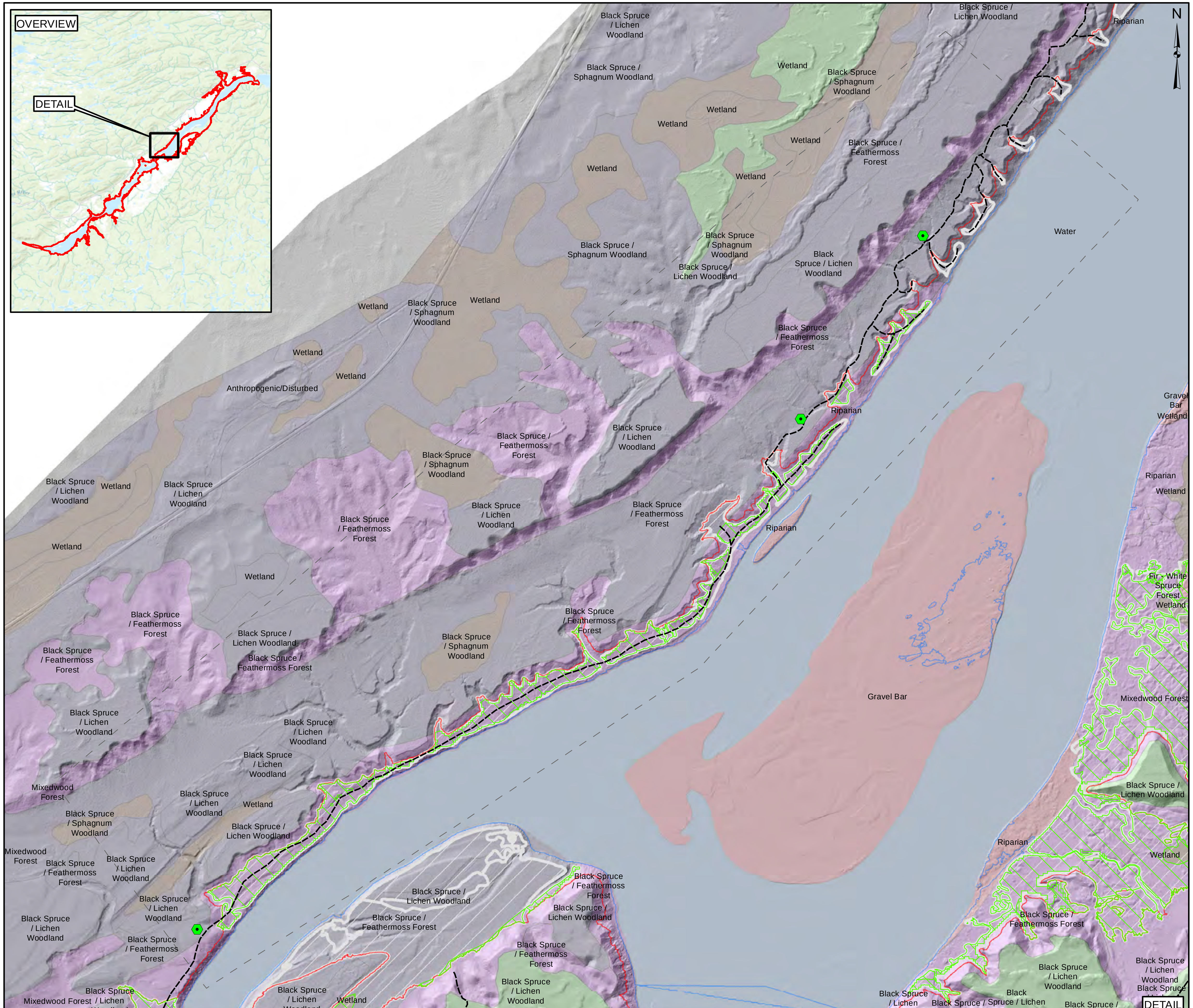

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:18,000

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 15

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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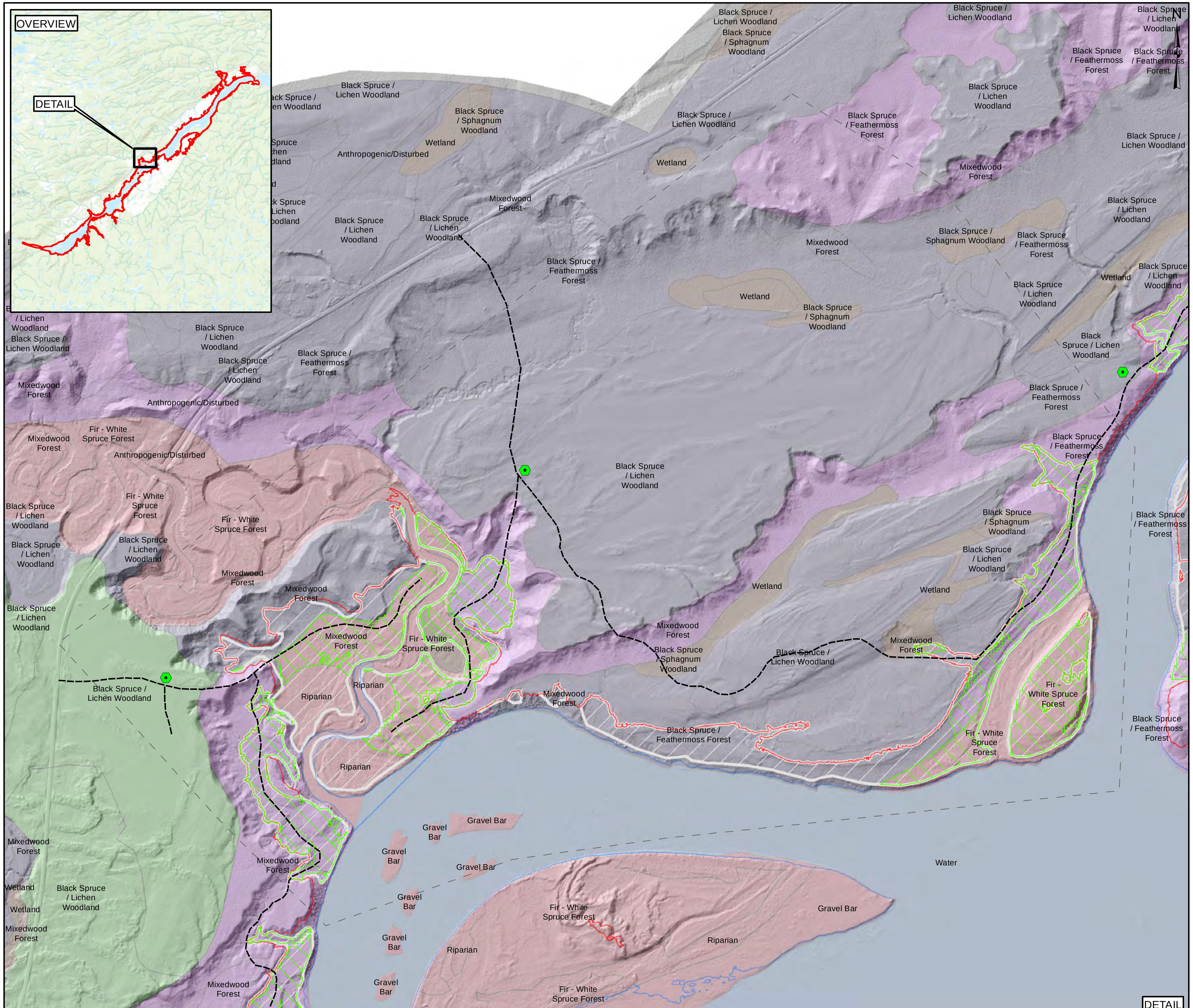

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTEREST (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 16

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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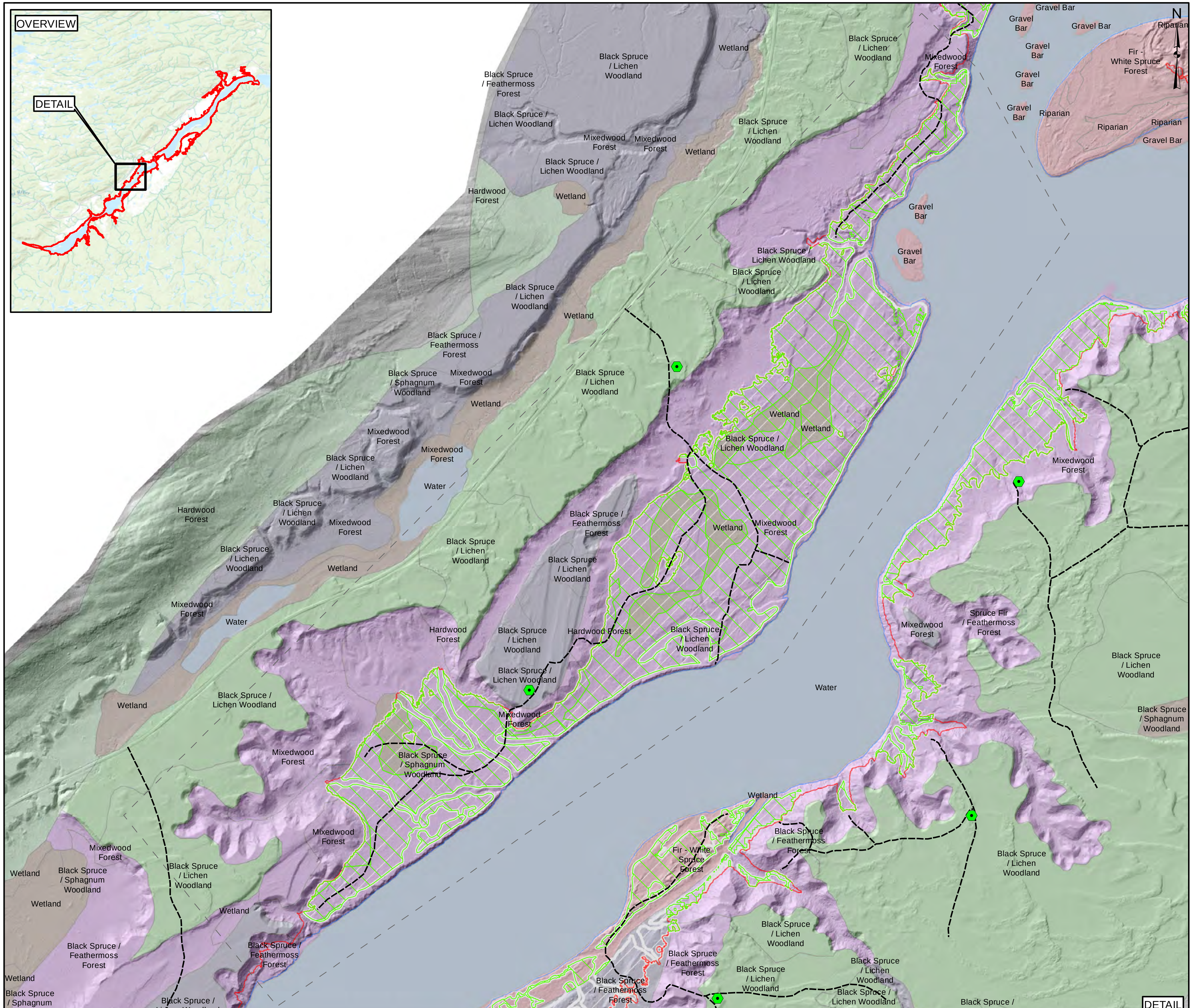

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 17

DES BY	RI	DRN BY	WH	DATE	2018 02 21	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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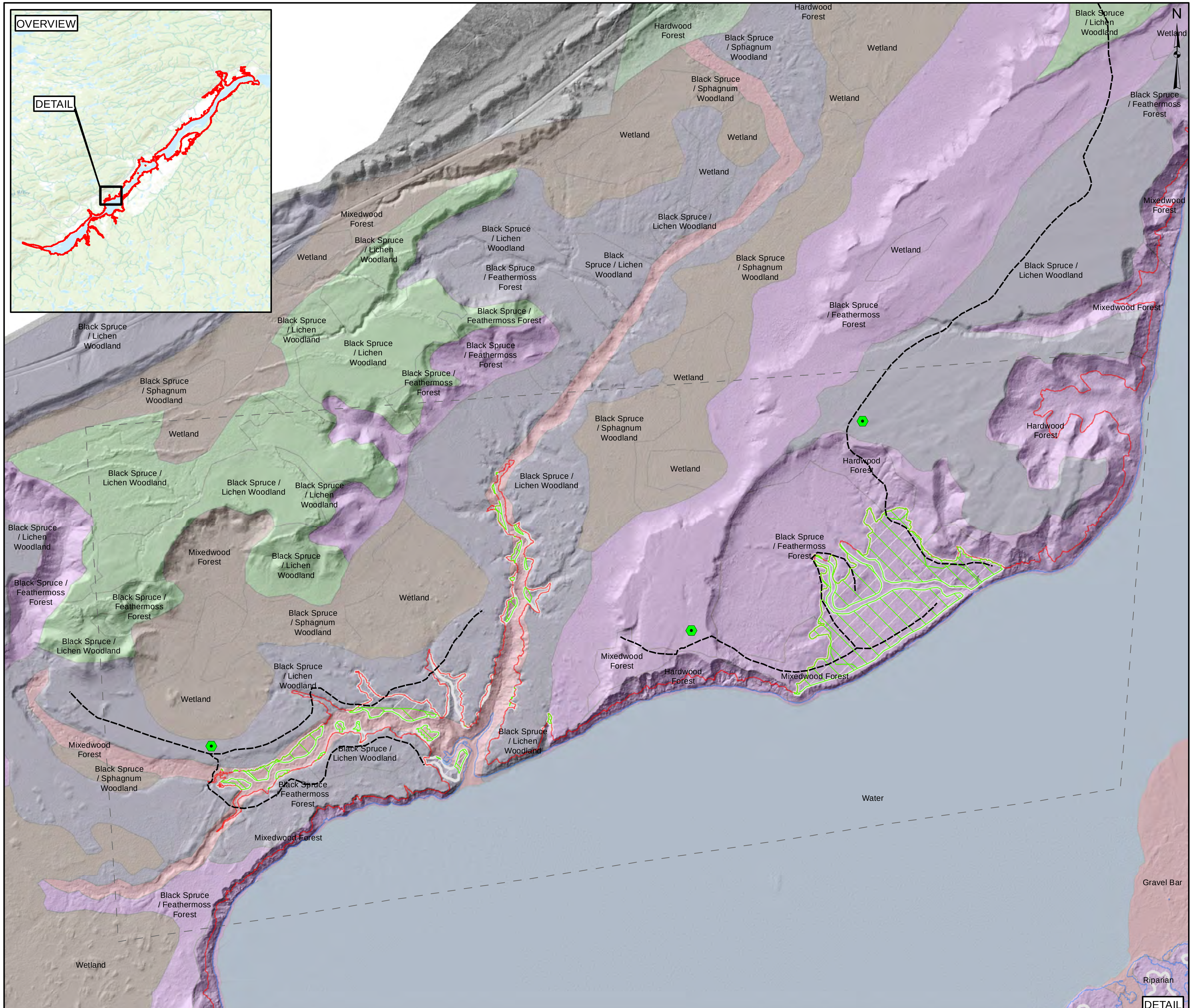

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 18

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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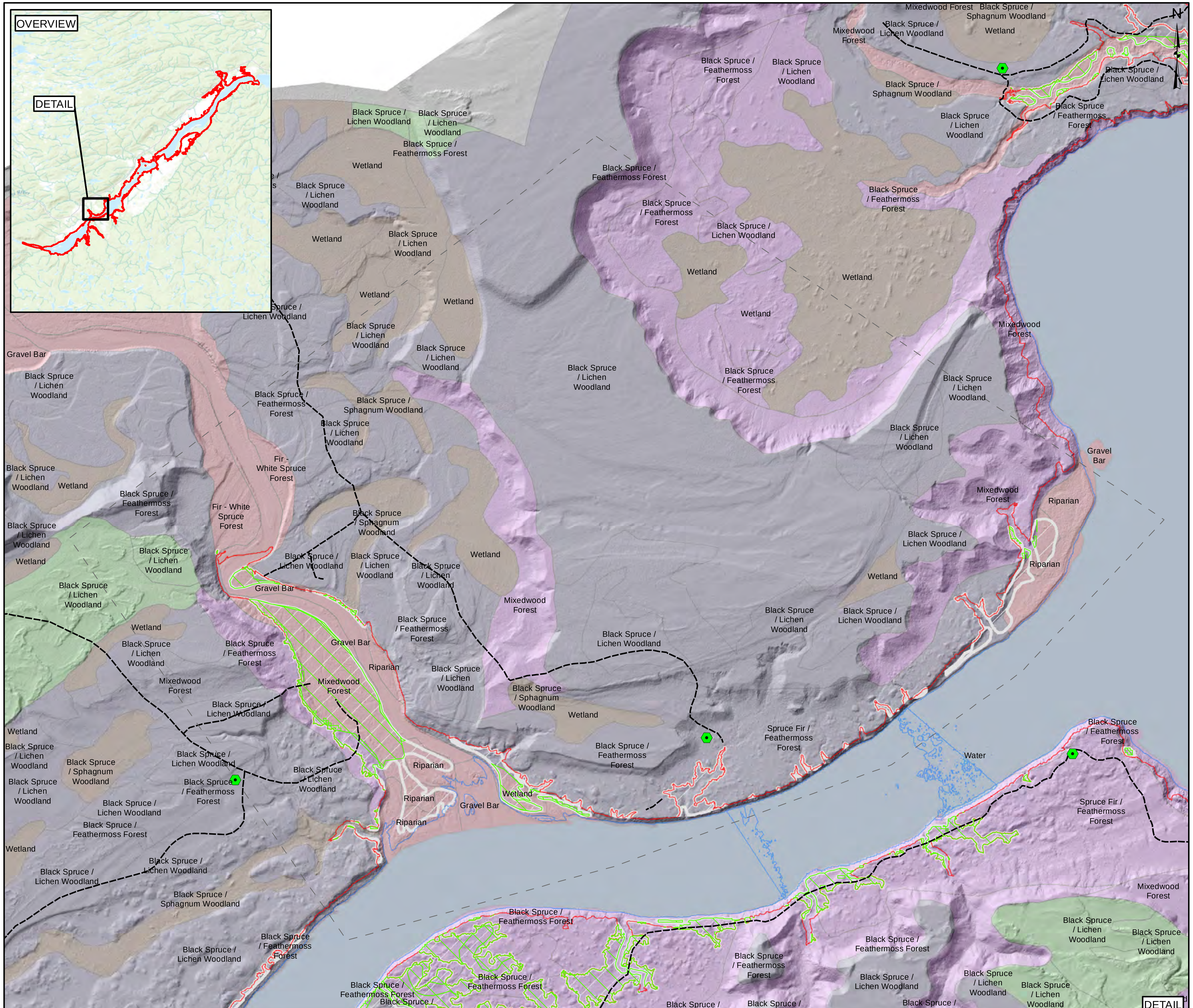

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,000

SNC • LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 19

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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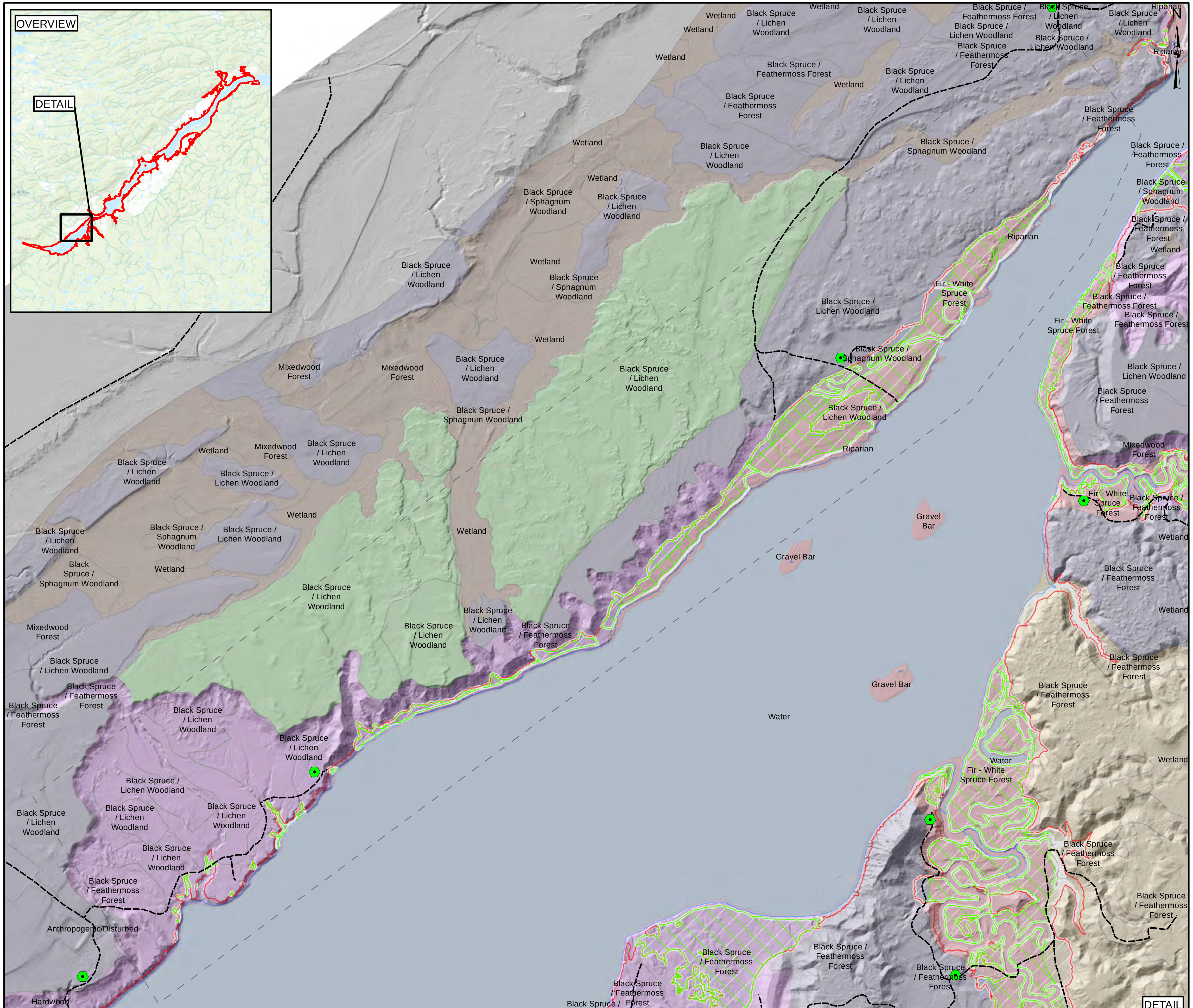

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:20,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 20

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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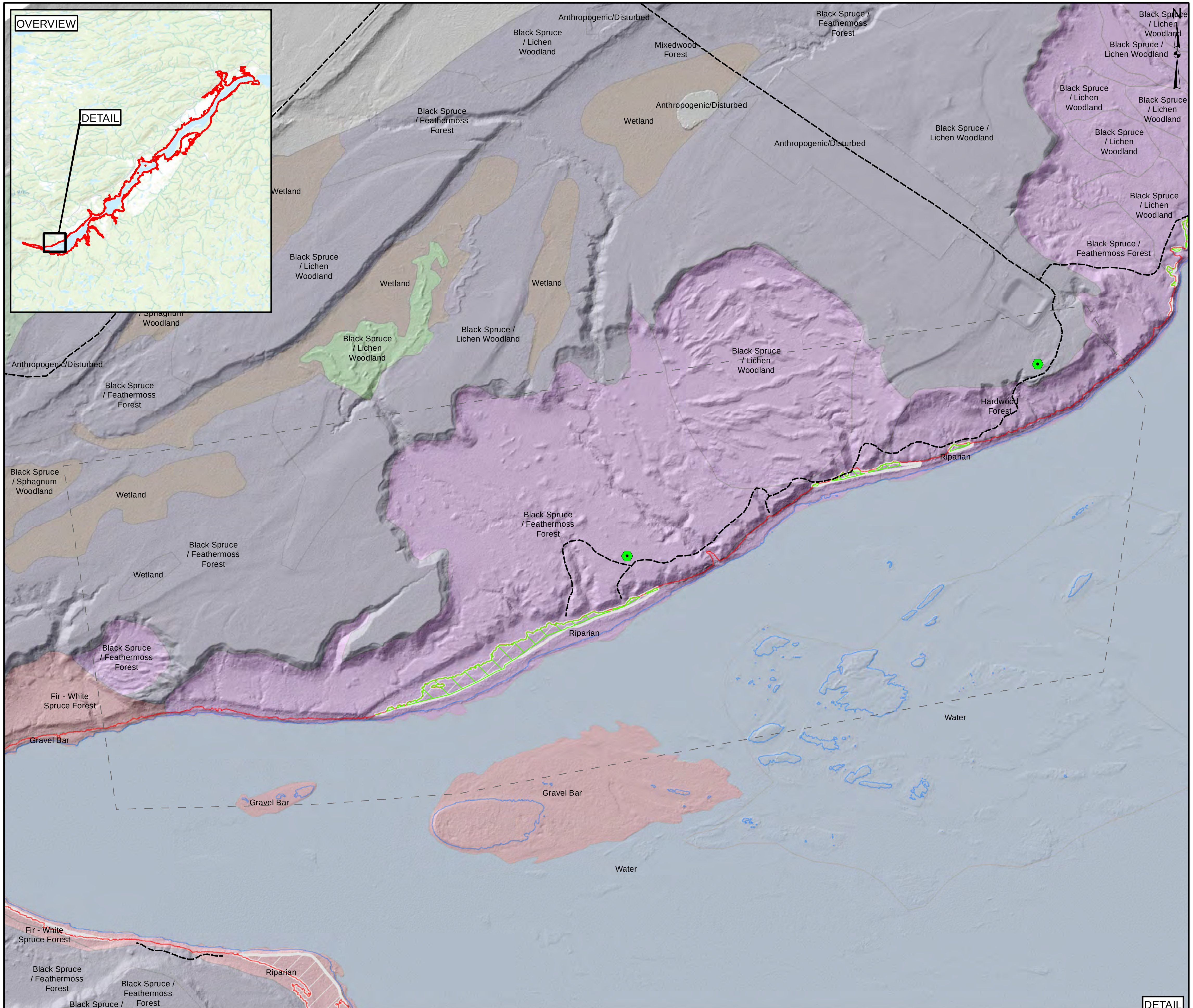

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:14,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 21

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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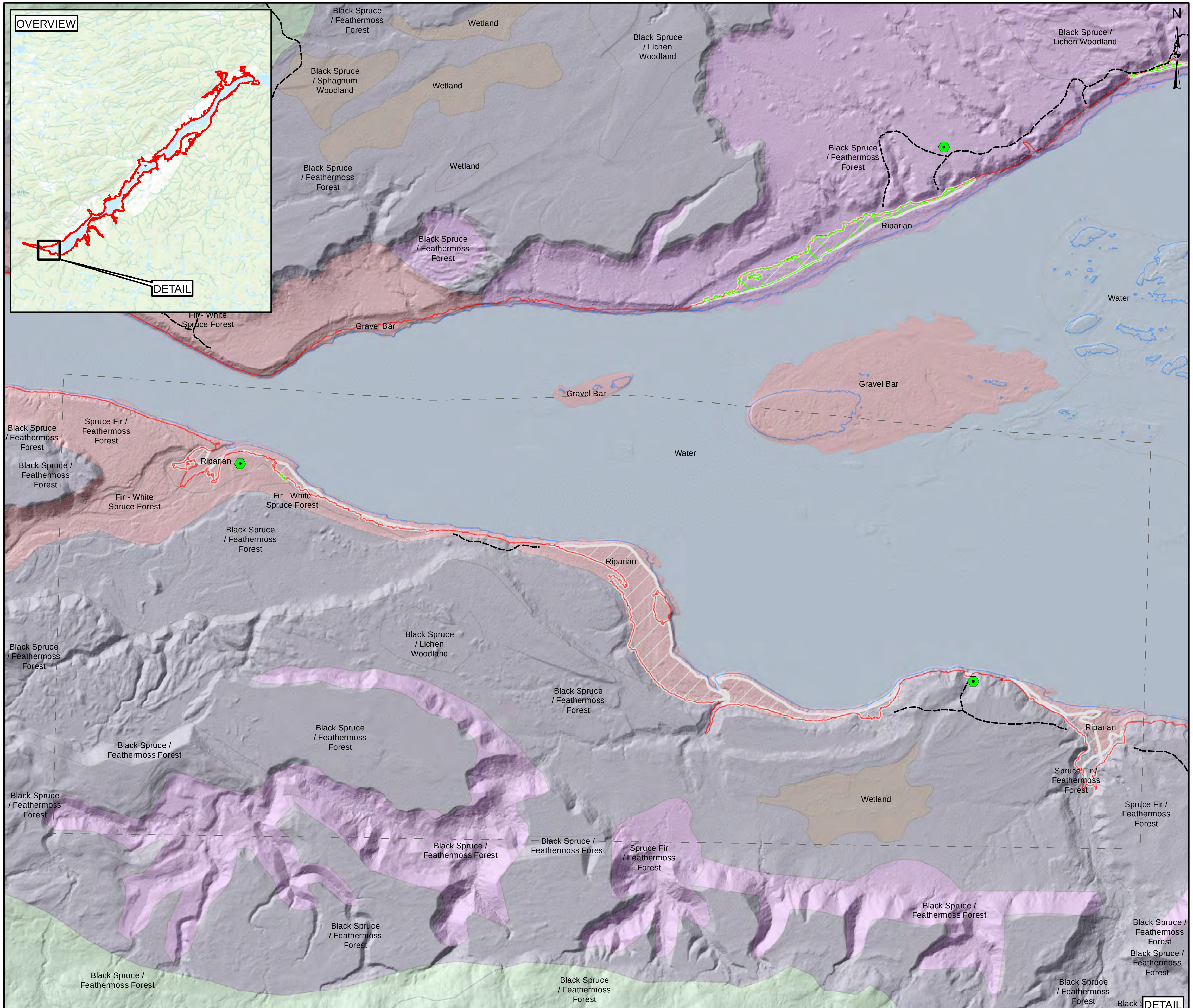


LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:14,000

SNC·LAVALIN

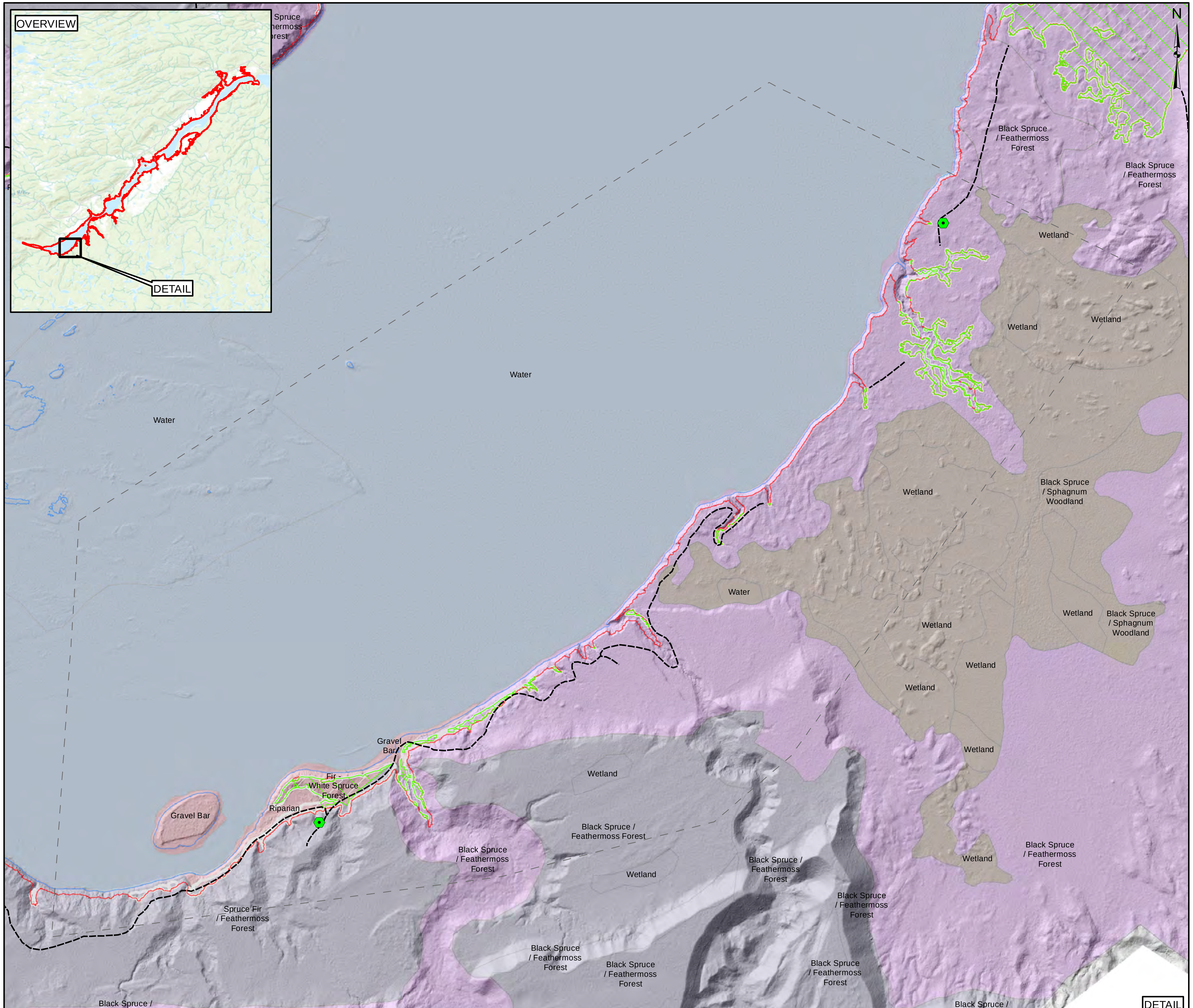
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 22

DES BY	AJ / RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY		APP BY		DWG No.				11x17	

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0022_00-Phase2-ScenarioB-IEC_(AOI22).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,500

SNC · LAVALIN

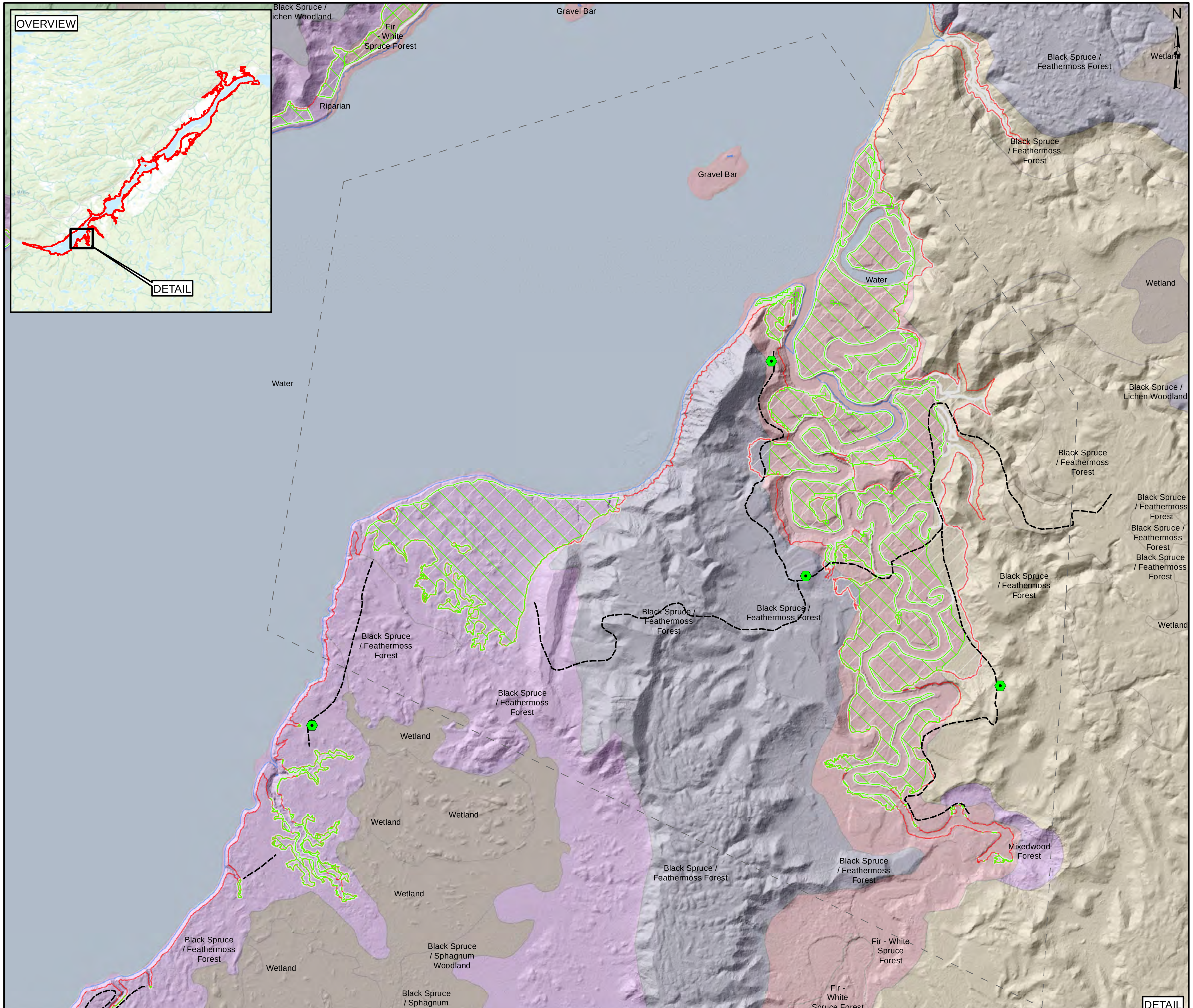
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 23

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0023_00-Phase2-ScenarioB-IEC_(AOI23).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,500

SNC · LAVALIN

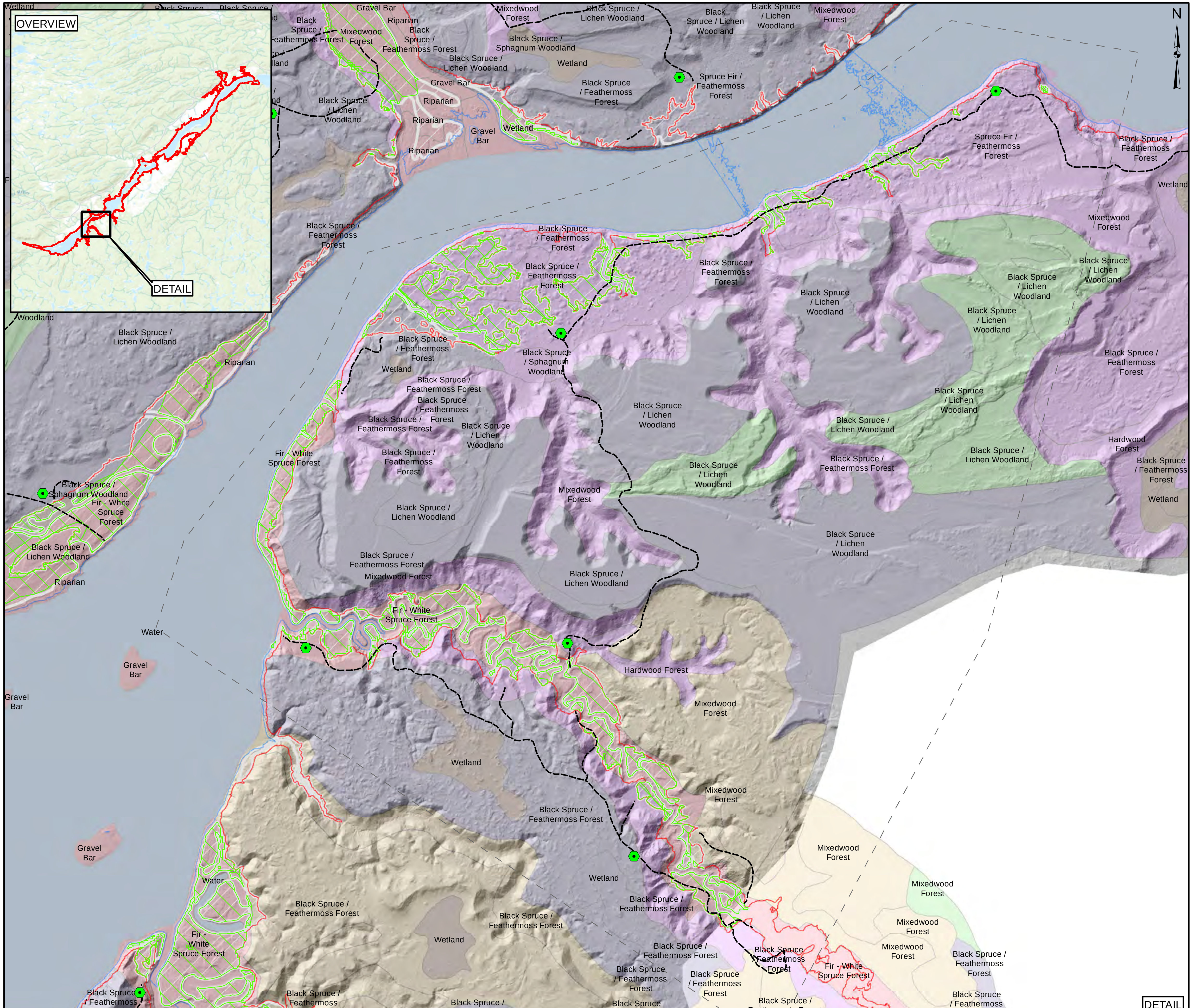
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 24

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0024_00-Phase2-ScenarioB-IEC_(AOI24).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:18,500

SNC·LAVALIN

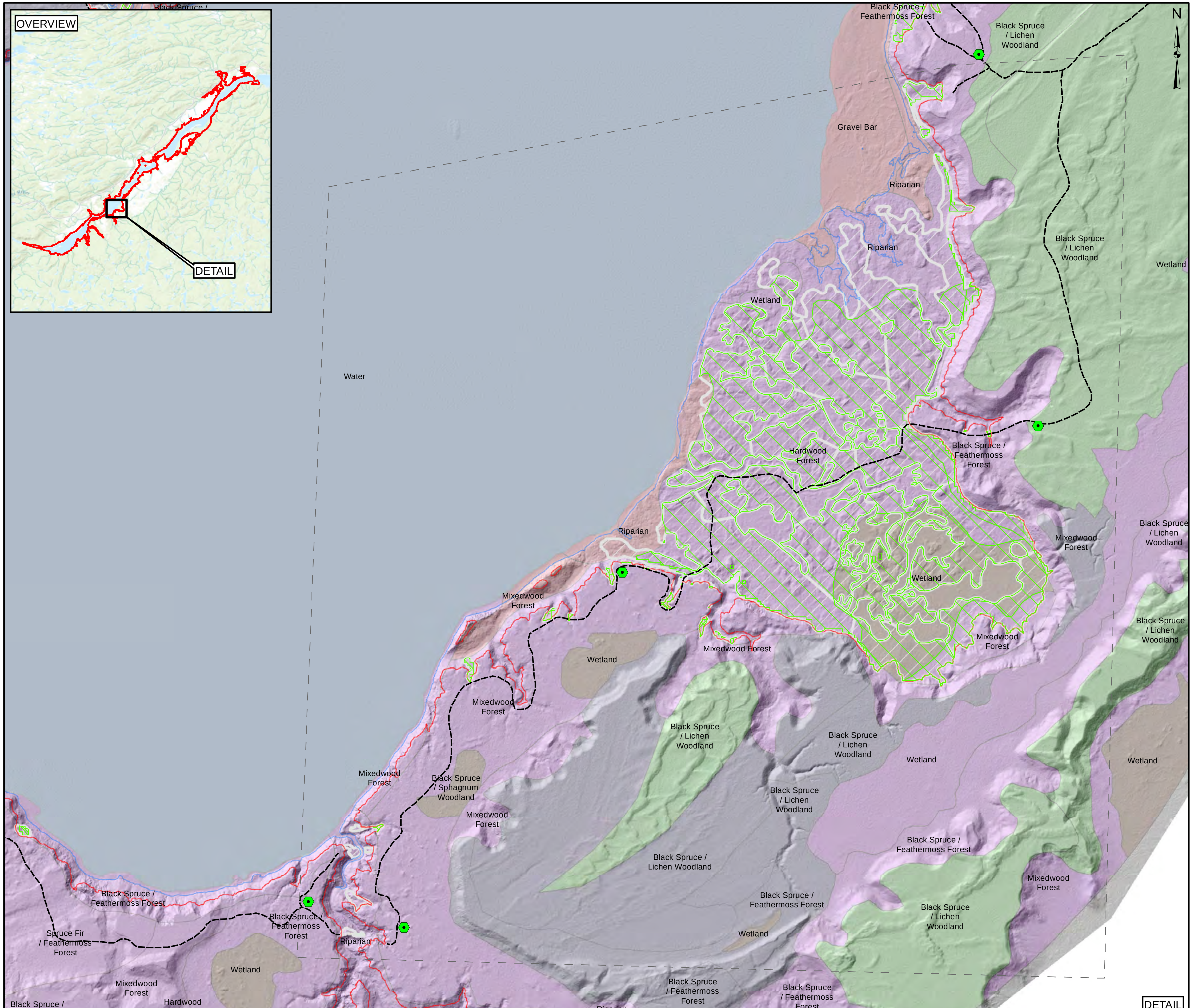
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 25

DES BY	AJ / RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY		APP BY		DWG No.				11x17	

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0025_00-Phase2-ScenarioB-IEC_(AOI25).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,000

SNC·LAVALIN

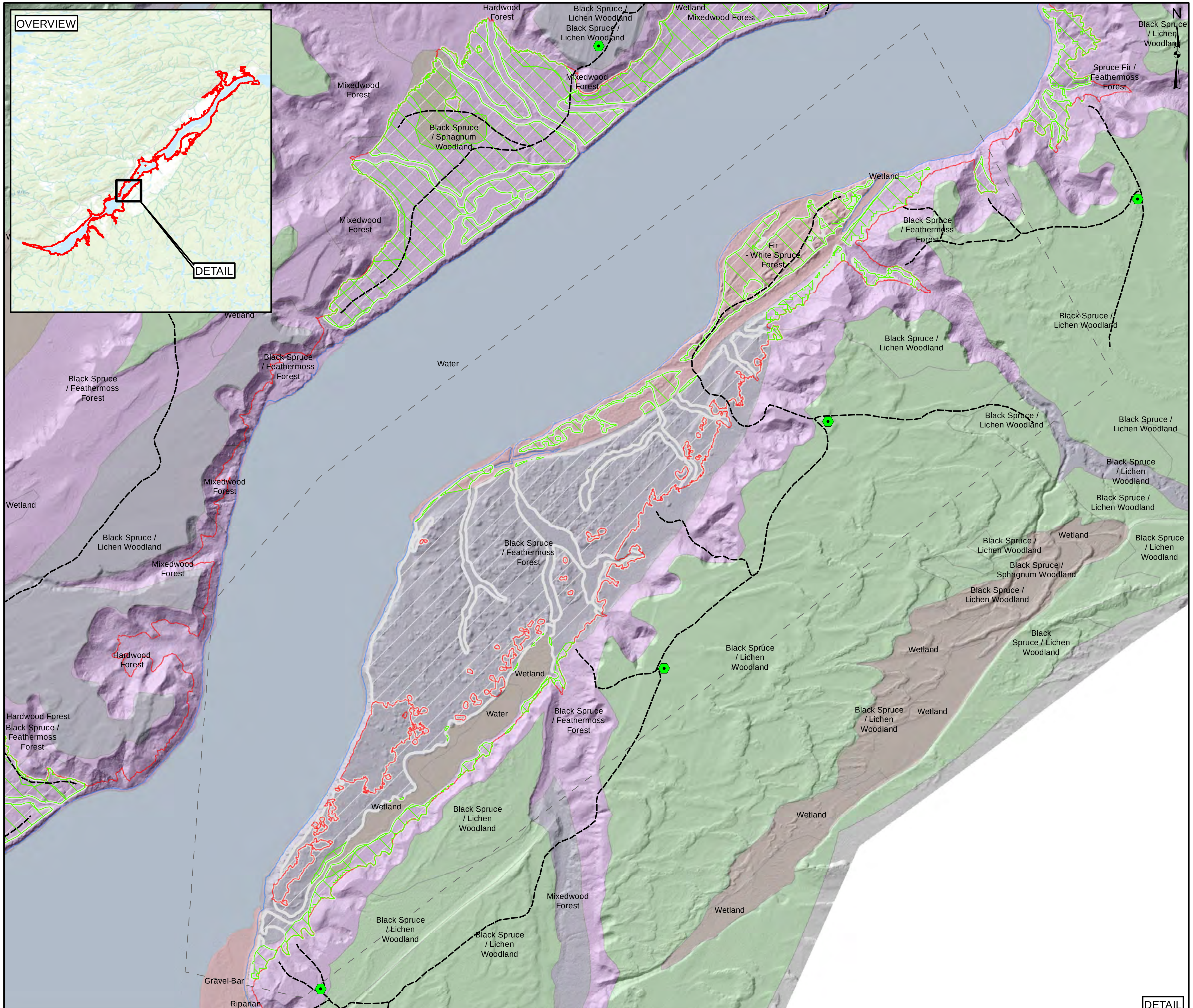
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 26

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0026_00-Phase2-ScenarioB-IEC_(AOI26).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,000

SNC · LAVALIN

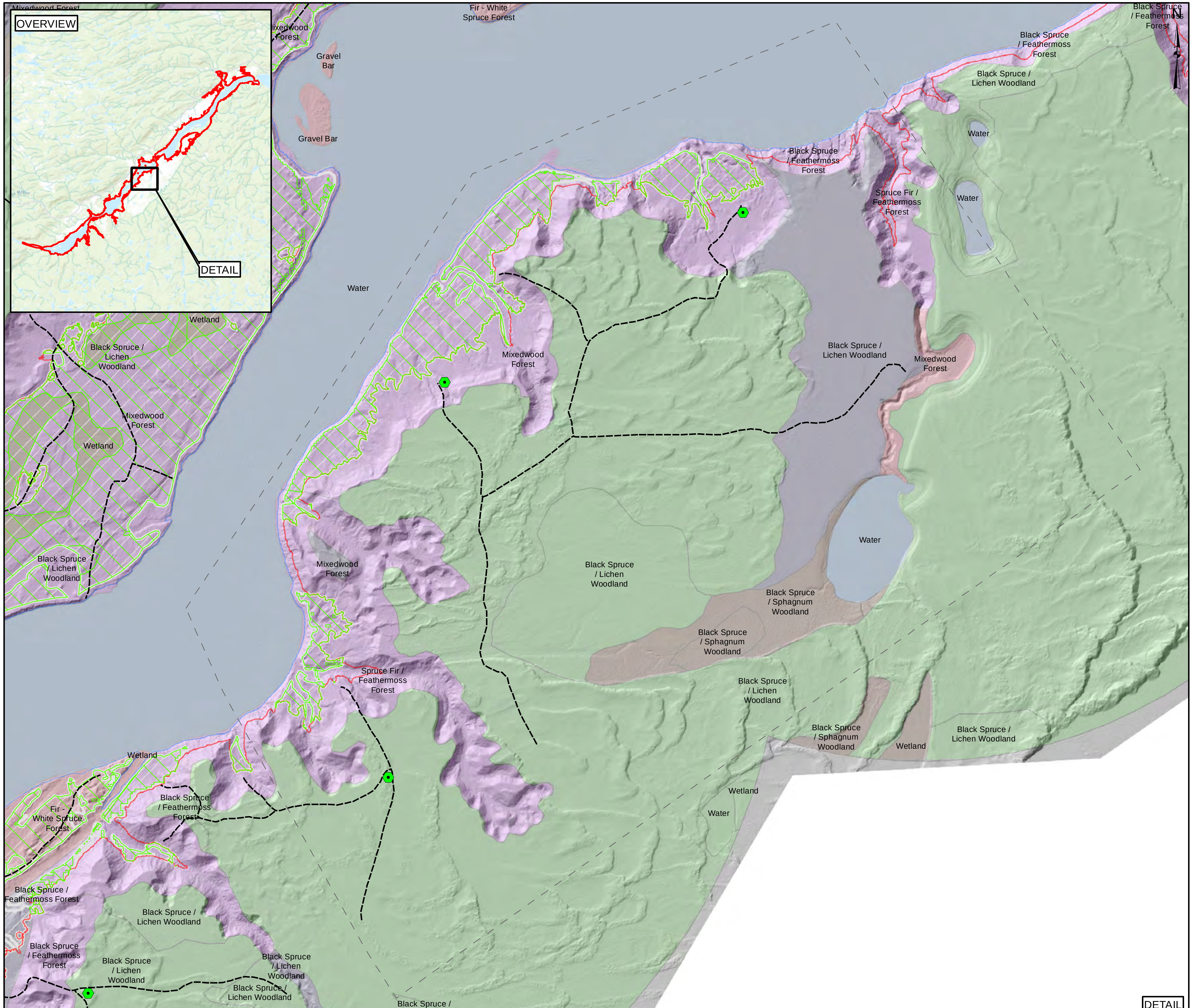
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 27

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0027_00-Phase2-ScenarioB-IEC_(AOI27).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 28

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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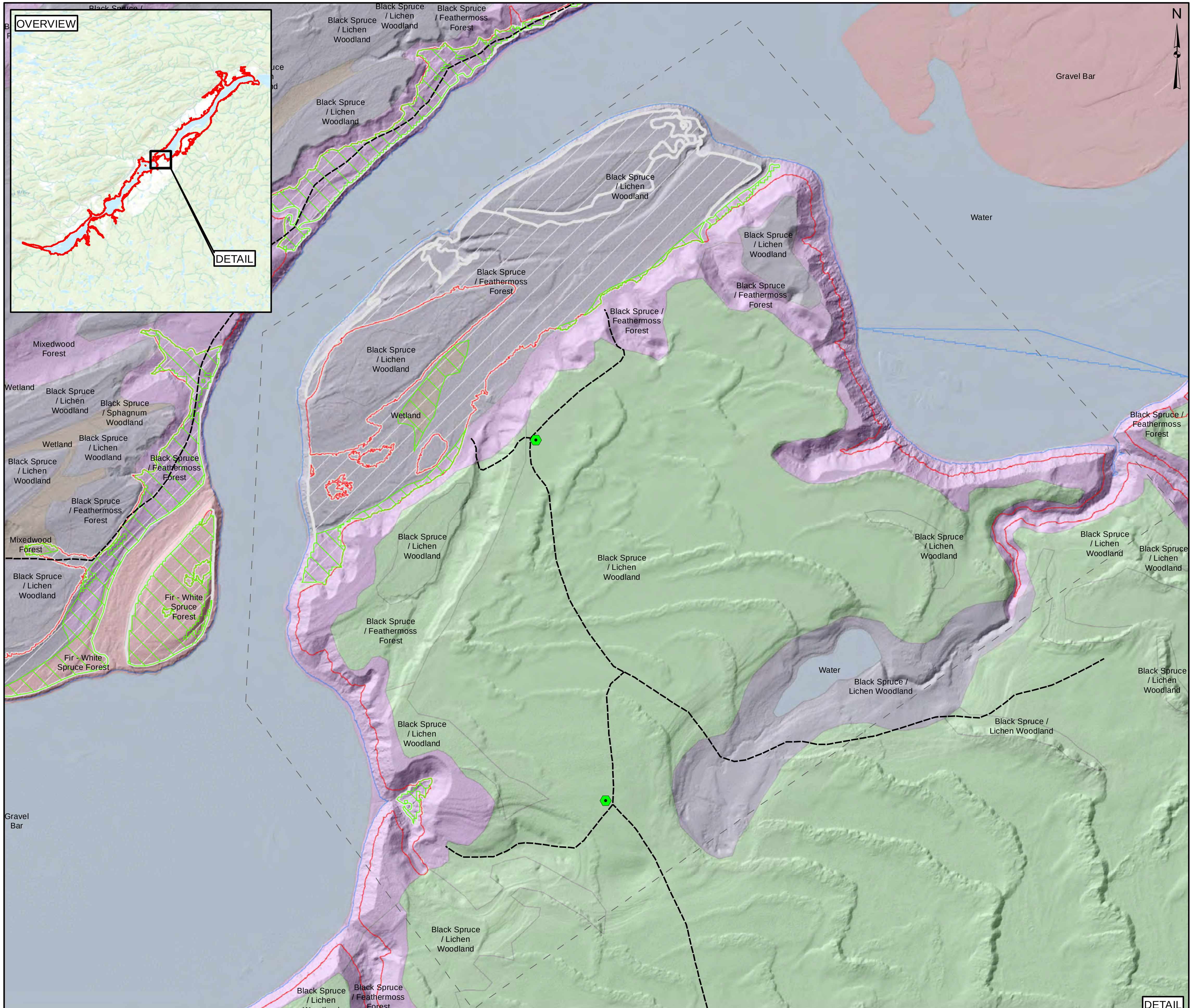

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 29

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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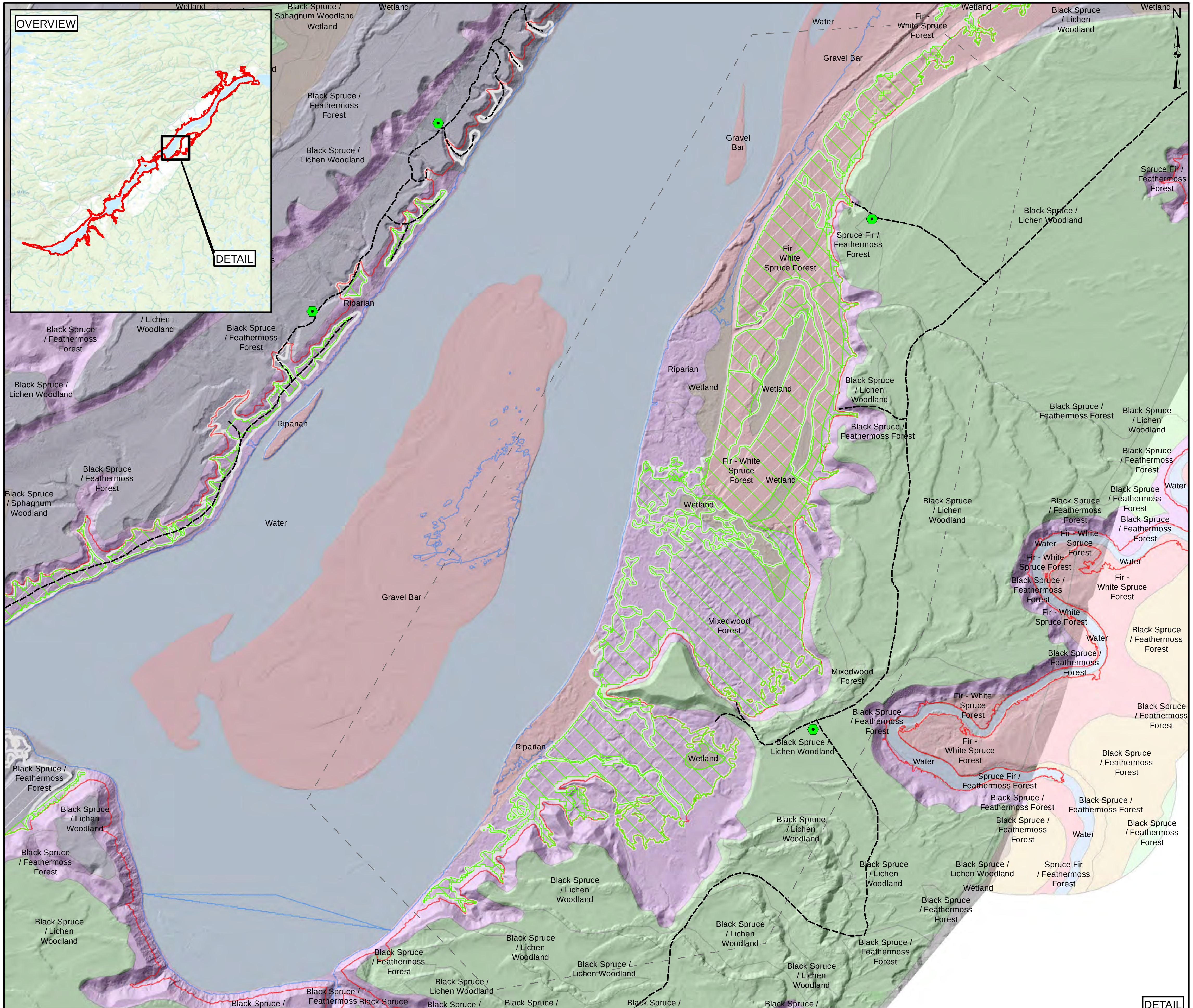

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:17,500

SNC·LAVALIN

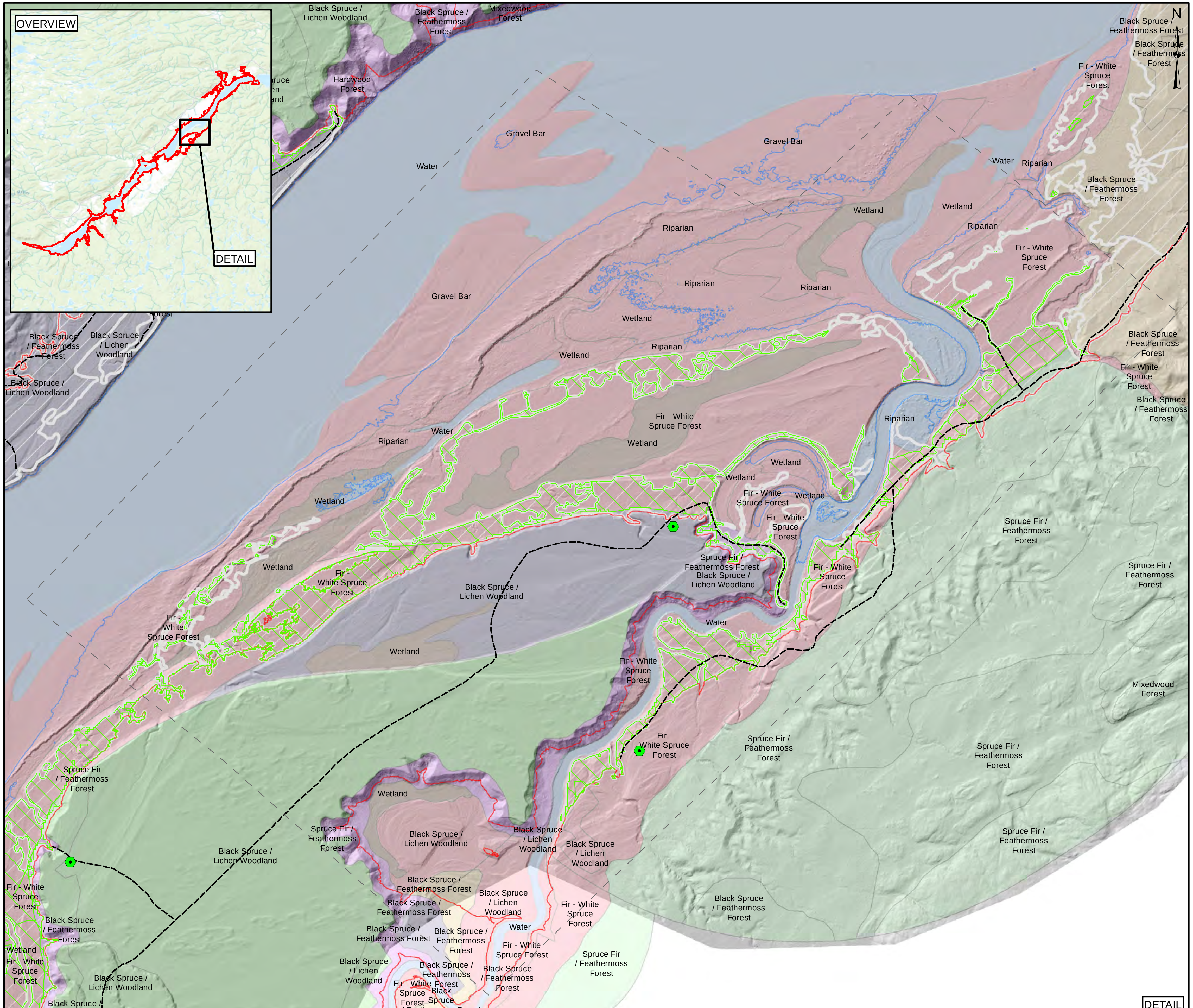
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 30

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17	

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0030_00-Phase2-ScenarioB-IEC_(AOI30).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:19,000

SNC · LAVALIN

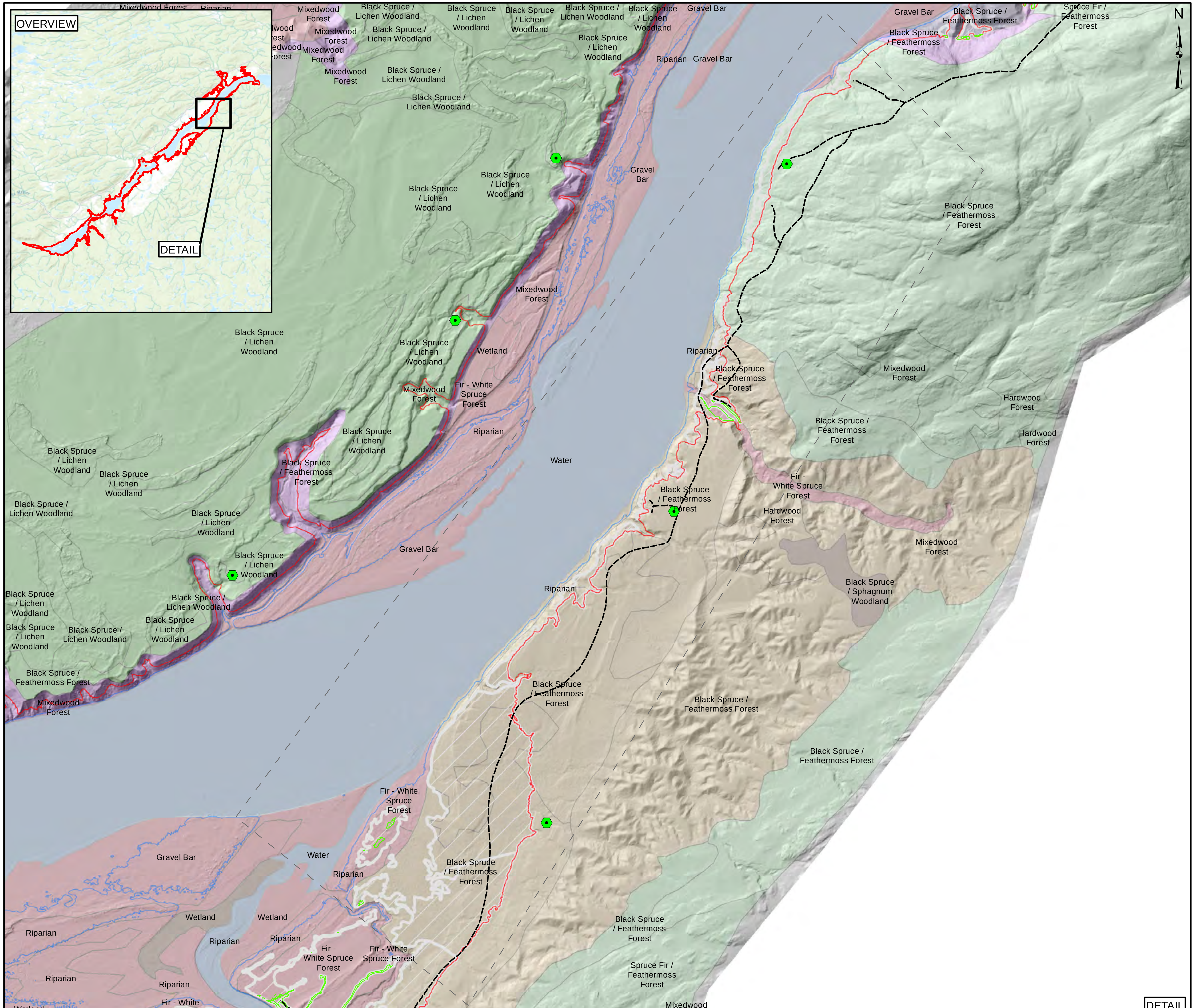
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 31

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

Path: \\SLI1653\Projects\Nalcor\505573 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0031_00-Phase2-ScenarioB-IEC_(AOI31).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:22,000

SNC·LAVALIN

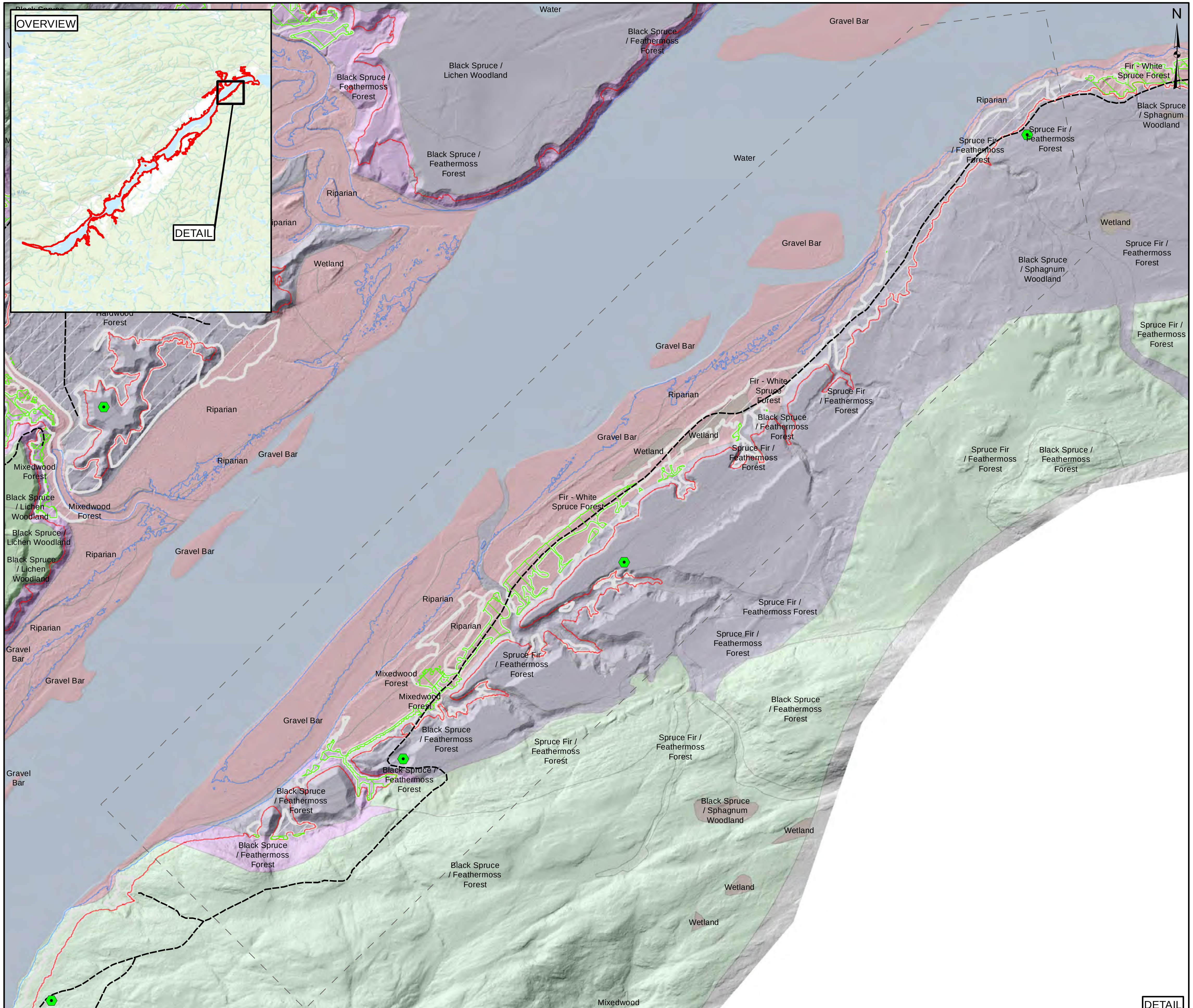
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 32

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\ARCHIVE\20180301_505573_0000_4G_DD_0032_00-Phase2-ScenarioB-IEC_(AOI32).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:17,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 33

DES BY	RI	DRN BY	WH	DATE	2018 02 21	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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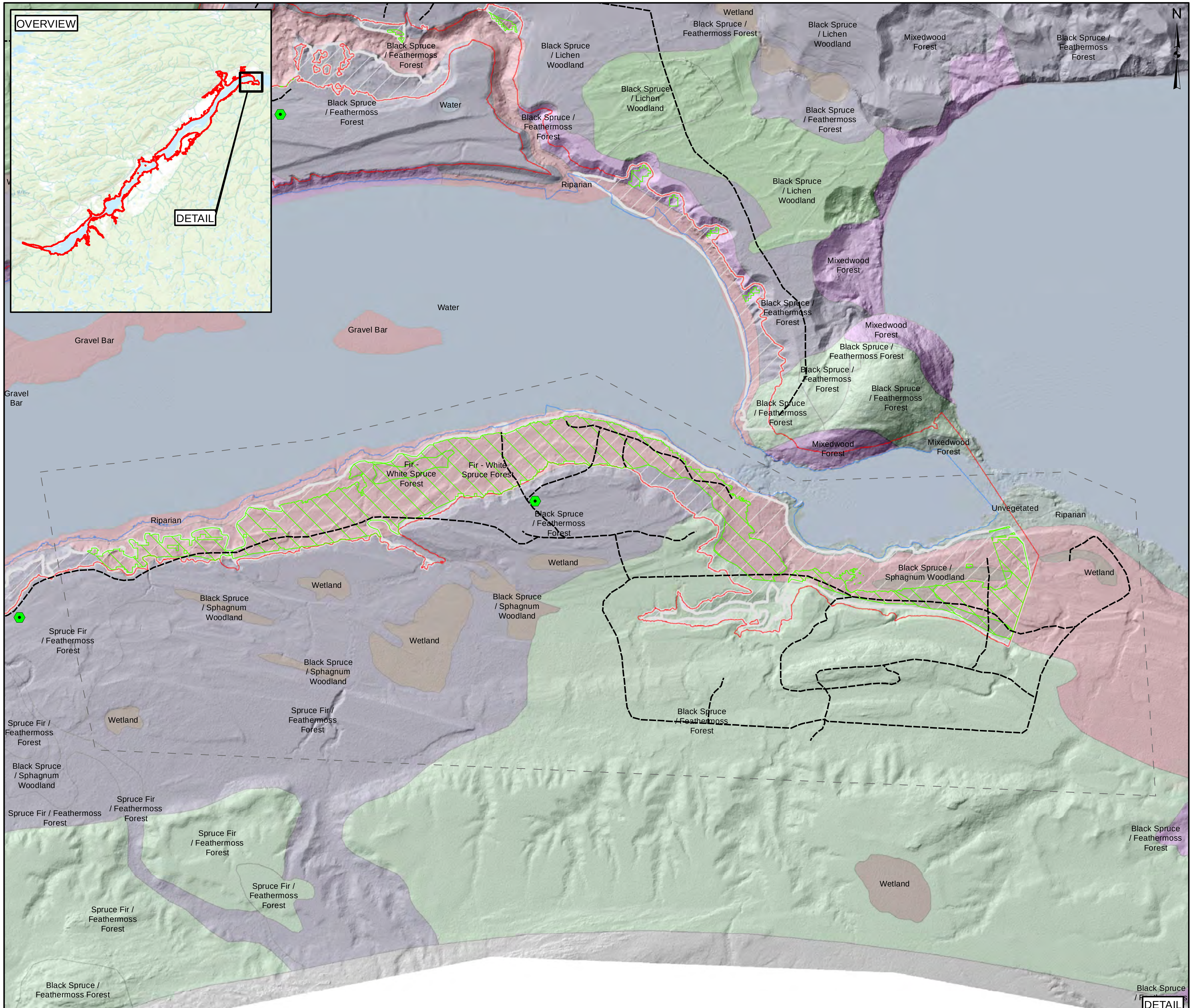

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL
- SCENARIO B AREA - (IEC-RSC DATA SELECTION)

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,500

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CLIENT: NALCOR ENERGY

PROJECT LOCATION: MUSKRAT FALLS, NL

TITLE: MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 34

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Attachment 1

Scoping Document

Independent Expert Advisory (IEC) Committee

Suggestions for Targeted Mitigation Action – Scenarios A and B dated 23 January 2018

(Revised to include Clarifications discussed during Sub-committee / Nalcor Telecom on 26 Jan 2018)

Background

The IEC 'Reservoir Subcommittee (RSC)' has been reviewing the possibility of targeted mitigation (removal or cover) scenarios that might help reduce the potential for methylmercury production after full inundation. These are considered a starting point and may be adjusted going forward. The group also welcomes suggestions from Nalcor as to modifications (including additions) to these scenarios. In order to facilitate the exchange of ideas and views it is recommended that the groups liaise frequently. It is also felt that these scenarios have to be 'verified' in that they should be run through the models developed by both Reed Harris and Ryan Calder to see how effective they might be in achieving their desired goal – i.e. of reducing future amounts of methylmercury and resulting bioaccumulation. IEC RSC: This was not discussed on our telephone call last week and in separate discussions the IEC has indicated that for now we are simply interested in how the mitigation scenarios may impact MeHg production in the reservoir – it is also a simpler task that can be completely quickly.

I fully support this approach and strongly recommend that we mutually develop realistic timelines for the execution of the work and establish an effective communication strategy.

K.J. Reimer

Chair, Independent Expert Advisory Committee
Muskrat Falls Project

Scenarios

The IEAC is proposing two "Targeted" Soil Mitigation Scenarios for consideration in the Constructability Study. These scenarios should be considered independently of each other but we ask that the contractor identify where mutual costs exist were both activities to occur simultaneously.

Scenario A:

- Cap all fen and low shrub bog (but not marsh) wetland ELC areas between 23.5 and 39 m asl with sediments that are low in total organic carbon (<2%), locally available and will be stable (resistant to erosion from water flow) on the reservoir bed. The reference to < 2 % to define low in total carbon sediments suitable for capping should not be taken as prescriptive/quantitative. The IEC subcommittee does not expect capping material to be imported, but will be sourced from areas adjacent to the target areas that are typically identified as lower in carbon. IEC has provided mapping that identifies the 8 fen/bog areas for the Scenario A work. File reference: Scenario A TF13104119_WetlandTypes_Jan2018s1.pdf IEC RSC: We expect that the abundant glaciofluvial and fluvial materials in the valley have low organic carbon content (<2%). Nevertheless, we anticipate that this will be verified once field conditions allow and before prospective sources are used.

- Stability of sediment cap is more important than thickness but assume 50 cm thick for this scenario. Cap should isolate the organic wetland soils, particularly peat accumulations, from the water column. We assume that sand or sandy clay (preferred) are locally available as a capping material. Please specify minimal requirements for textural content of capping materials and potential sources of available local material. Please justify selections based on modeled flow velocities on reservoir bed and documented surficial geology in ELC study, respectively.
- Nalcor to identify site-specific construction constraints associated with these 8 areas (Scenario A); for example, the constructability logistics to cap one site compared to the others, unique or particularly problematic sites from an access or stability perspective. IEC RSC: Yes, because this will allow the IEAC to make evidence-based decisions on targeted mitigation
- Conduct work during frozen ground conditions (to minimize access and nearby ground disturbance).

Scenario B:

- Remove soil from areas that have been previously cleared of trees and vegetation and are accessible by existing roads, between the 23.5 masl contour and the 39 masl contour. . IEC has provided mapping that identifies the areas for the Scenario B work. Nalcor shall confirm these areas considering the exclusion areas mentioned below. File reference: Scenario B TF13104119_QuantitySoil_Jan2018s1 r1.pdf
- Exclude areas of slopes greater than 30% and other areas that would require re-profiling
- Exclude areas that potentially contain sensitive clays (to avoid disturbance and re-profiling).
- Exclude riparian ELC areas.
- For the cost estimate, prioritize work on steeper slopes during frozen ground conditions, moving towards flatter areas during thawed ground conditions (to limit runoff from clearance activities).
- Also provide the cost estimate for scenario B where all soil removal is completed during frozen ground conditions only (the analysis shall focus on the pre-impoundment time available), IEC RSC: This request was made due to the additional ground disturbances that occur during thawed conditions (and the possibility of worsening the situation wrt MeHg). We do not recall agreeing to change this part of the SoW
- Nalcor to take the Phase 1 work and apply it to the cleared areas only, minus the list of constraints noted, Nalcor to identify where the reduction in overall area may result in improvements in overall feasibility as compared to overall clearing (Phase 1)... i.e. smaller fleet, different equipment types, changes in access requirements, etc.
- Nalcor to include, as an additional constraint, both sedimentary soil types that "may" contain sensitive clays. Clays as defined in the ELC (i.e. glaciofluvial and glaciomarine).
- Nalcor to highlight any additional constraints associated with area specific accessibility requirements, i.e. identify areas that access constructability logistics are unique, or particularly problematic (and costly).

For each scenario, please clearly explain how costs differ from those outlined for “Complete removal of all organic materials in frozen conditions”.

Nalcor shall provide an estimate completion schedule for the Phase 2 Targeted Scenarios as soon as practical.

Attachment 2

Assumptions

Cost estimates Assumption
±50% cost estimate
Use rates from original contract as initial basis for cost estimate
Used material volumes from files provided by IEC.
Assumed up to 10% of project time will be delays for environmental/archeological and weather. Allow in costing, schedule and resourcing.
Used a typical road cross-section to determine cost per lineal meter for road upgrade ($3m^3$ per meter)
Road construction within the work area is included in the excavation costs. Use Nalcor rates as base cost (Civil works Rates and Earthwork Rates
Check with Spon's Civil Engineering and Highway Works Price Book used to estimate basic earthworks
All equipment will have to be remobilized to site
Quantities calculated for El39 masl Temporary camp will be required (~75 person)
Contractor will require a compound closer to work area
Road maintenance will be required for the duration of the work (graders and haul trucks), Scenario B only
Excavation in winter will not be feasible to limit excavation depth to just A and O horizon (1.5m depth versus 0.2m) $90-$160 accommodation and food per day per person
5-8% of CAPEX for engineering support and supervision
Mobilization based on 10% to 15% of CAPEX

Schedule Assumption
Start in August/Sept 2018
Complete by April 2019
Increase equipment to meet schedule
Assumed high LD's for not meeting schedule
Assumed up to 15% of project time will be delays for environmental/archeological and weather Allow in costing, schedule and resourcing
0.2ha/day to 1ha/day of wetland covering– average 0.5 ha. Use 0.5ha/shift for costing and scheduling purposes. Scenario A

GIS data Assumption
All provided mapped environmental GIS features shall be field verified
Only these mapped inputs were considered for conceptual modelling, planning, and cost calculations
Disposal locations, roads, crossings etc. are conceptual and as needed and to be field verified

Construction (methods and materials) Assumption
All organics are to be removed from cleared areas up to elevation 39 masl. Scenario B
Disposal of organics shall be above the FSL (39 masl). Scenario B
Organic soil pushed in windrows to expose borrow material for wetland covering.
Wetland cover material to remain below an elevation of 39 masl.
Wetland cover material thickness assumed to be 0.5m
Use largest equipment feasible to reduce rate/m^3 moved
Use forest roads manual as guidance for roads
Assumed haulage by 3 axle articulated trucks
200 m max push with a dozer, ideal 100-150m
Existing roads from previous phases to be used. Water crossings from previous phases as still in place
Roads to min 10 m wide with turning areas and passing areas if required. Allow for 50% of roads to be widened to 15m for two way traffic by CAT 720 (or equivalent) articulated 3 axle dump trucks. Scenario B
Roads to be less than 8% slope wherever possible minimum road is 2% if possible abs. max 12% slope
Excavate material less than 1.5m with dozer and loader
Excavate with backhoe of any size bigger than 400mm
Transport of waste to be less than 5 km, aim for 3 km
Frozen ground containing organics assumed to be excavated to 1.5 m (over excavation due to frozen ground)
In non-frozen ground excavated material to be a minimum of 0.5 m - limitation of equipment, operators conducting rapid excavation and surface obstructions/features (e.g. root balls).
Wetland assumed to be excavated to 2.2 m – 0.3 m provided in AMEC ELC assessment but an allowance has been made for an average assuming deeper deposits
Follow slope contours where possible - Follow contours for roads
Use forest roads manual
Use mineral material from waste dump excavations and borrows near roads to build roads and earthworks
Only use geogrids to provide road support if required
All equipment will have to be remobilized to site
Day work only, work each shift has 10 hrs operation (assume vehicle 90% utilisation)

Geotechnical stability Assumption
Sensitive clays - avoid changes in stresses Avoid steep slopes
Avoid traffic
Follow contours for roads
Any unsuitable/soft ground, cracking, slope instability, etc. conditions encountered should be reported to the project geotechnical engineer during the clearing operation.

Soil and vegetation to be removed (soils containing carbon) Assumption
Any existing natural drainage should be protected.
ELCs such as Water, Gravel Bar, Anthropogenic and Riparian areas are not considered for the removal operation.
Environmental permit and archaeological permit assessments shall be completed prior to the operation
For budgeting purpose, excavation thickness in frozen ground to remove organic soil are as follows when : – Black Spruce/Feathermoss Forest – 1.5 m – Black Spruce/Lichen Woodland – 1.5 m – Black Spruce/Sphagnum Woodland – 1.5 m – Fir-White Spruce Forest – 1.5 m – Hardwood Forest – 1.5 m – Mixed wood Forest – 1.5 m – Riparian – 1.0 m – Spruce Fir/Feathermoss Forest – 1.5 m – Wetland – 2.2 m
For budgeting purpose, excavation thickness in non-frozen ground to remove organic soil are as follows when : – Black Spruce/Feathermoss Forest – 0.5 m – Black Spruce/Lichen Woodland – 0.5 m – Black Spruce/Sphagnum Woodland – 0.5 m – Fir-White Spruce Forest – 0.5 m – Hardwood Forest – 0.5 m – Mixed wood Forest – 0.5 m – Riparian – 0.0 m – Spruce Fir/Feathermoss Forest – 0.5 m – Wetland – 2.2 m

Water management Assumption
Surface drainage measures will be temporary (less than one year sept 2018 to Apr 2019)
Drains will be constructed once roads are and clearance is completed
No pipes/culverts to be left in place after completion of excavation in an area
Sedimentation ponds are temporary to deal with freshet and until reservoir fill
Sedimentation ponds every 1.5km minimum (range between 1km 3km)

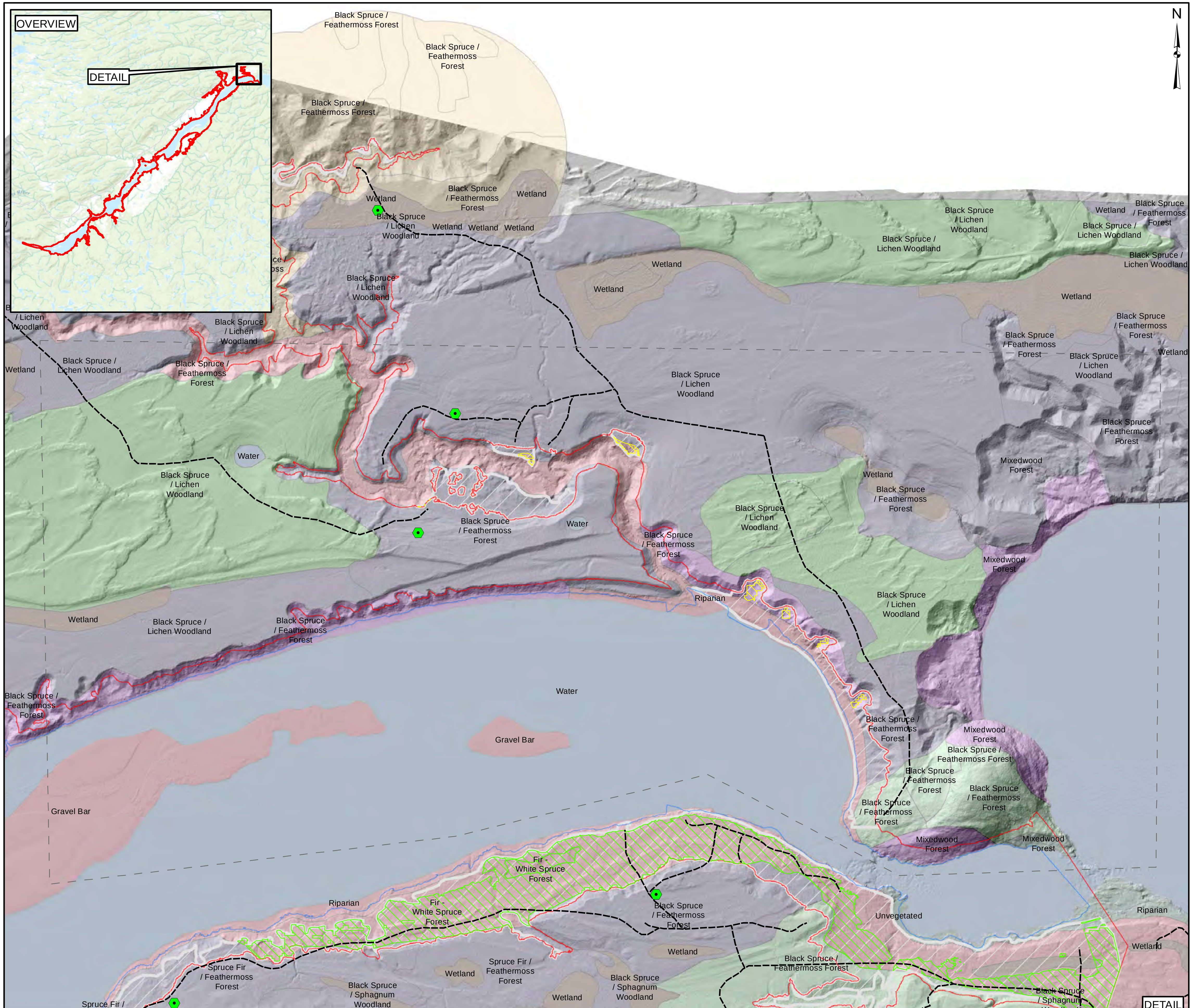
Resources Assumption
Assume new mobilization of equipment to site
Whatever is required can and will be mobilized
No aggregates available – or only what can be found on site
All materials used to build earthworks and roads will come from site except geosynthetics and culverts
Assumed up to 10% of project time will be delays for environmental/archeological and weather. Allow in costing, schedule and resourcing.

Disposal Assumption
Excavate out disposal hole and cap with clay or sand mineral (above the FSL)– surcharge to compress organics
Outline design for storage – assume borrow and backfill and permitting achievable
Disposal areas to be within 3km of extraction point – possibly further if along river
Permits can be obtained for disposal of organics in time scales

Equipment estimates Assumption
Excavation crew (1 excavator, 1 dozer, and 4 trucks) can move 1320m³/day
Road Construction crew (2 dozers, 1 excavator, 2 trucks and 1 grader) can construct 500m of road per day
General excavation crew (1 excavator, 4 trucks and 1 dozer) can mover 1320m³/day
Road maintenance crew (6 graders, 2 excavators, 4 trucks)

Attachment 3

Scenario B maps with additional areas excluded for removal



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

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3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 11

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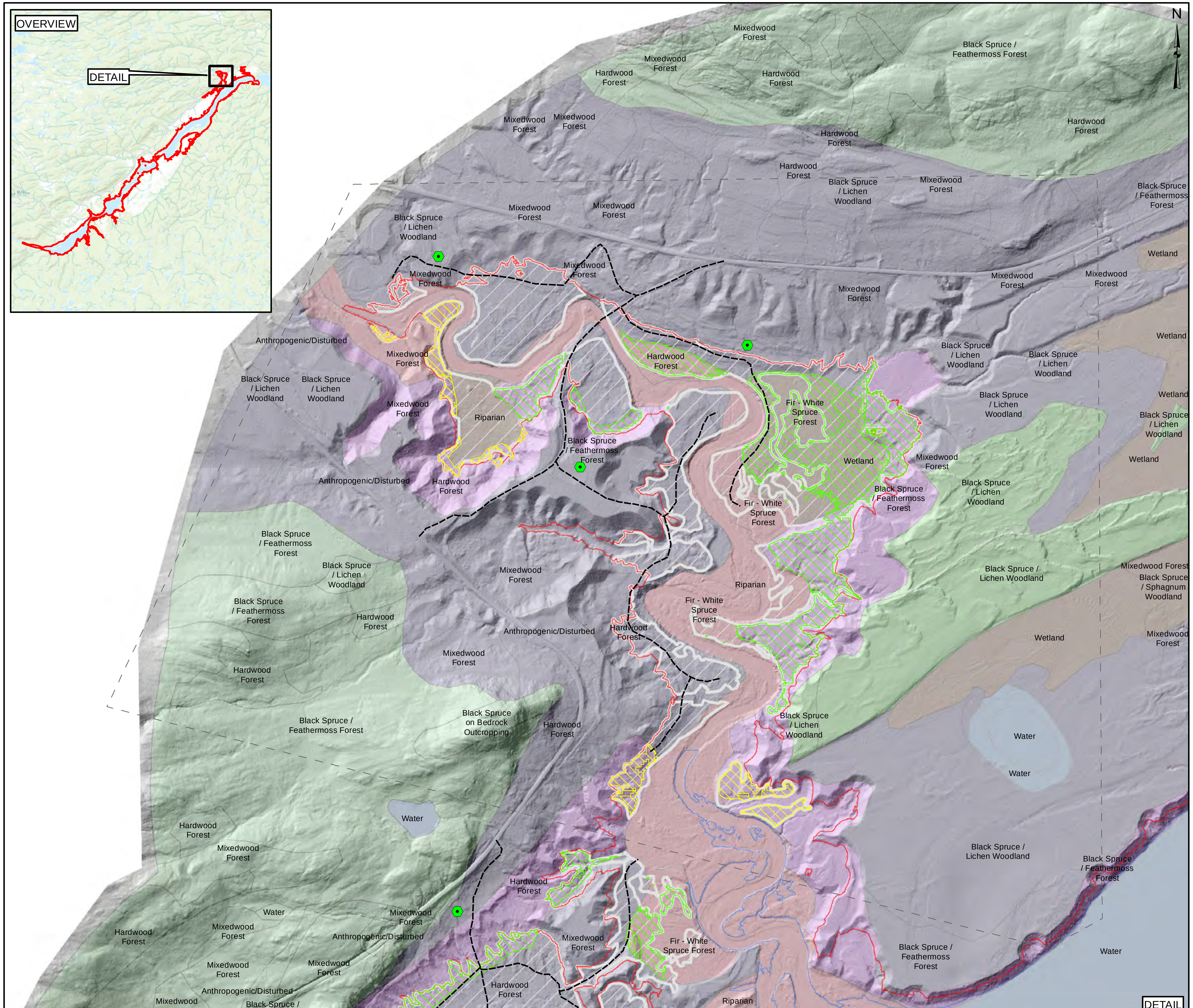

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
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- AREA OF INTERSET (AOI)
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- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
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- FLUVIAL
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- WATER BODY

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 12

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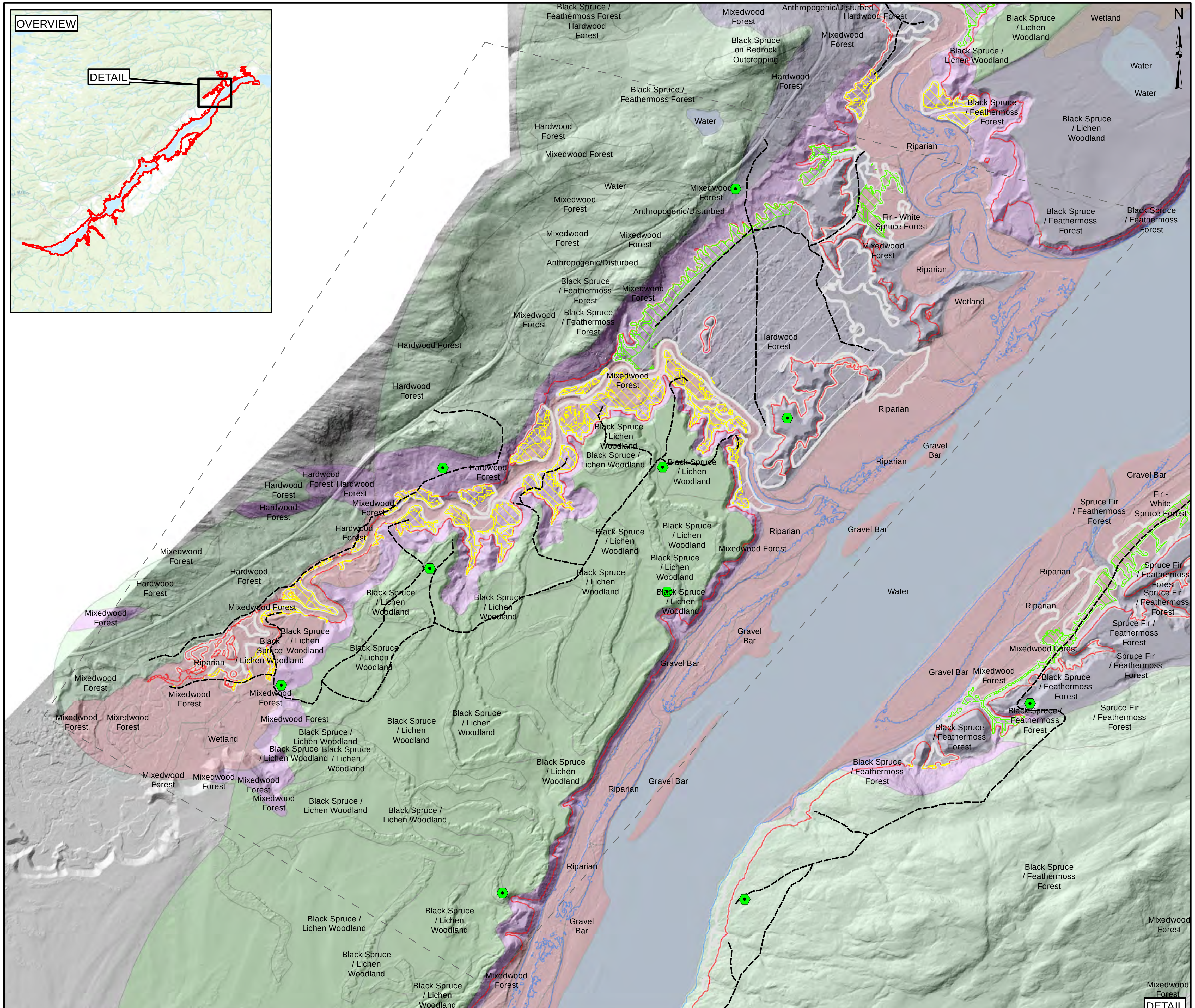

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
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- FLUVIAL
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- ORGANIC
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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 13

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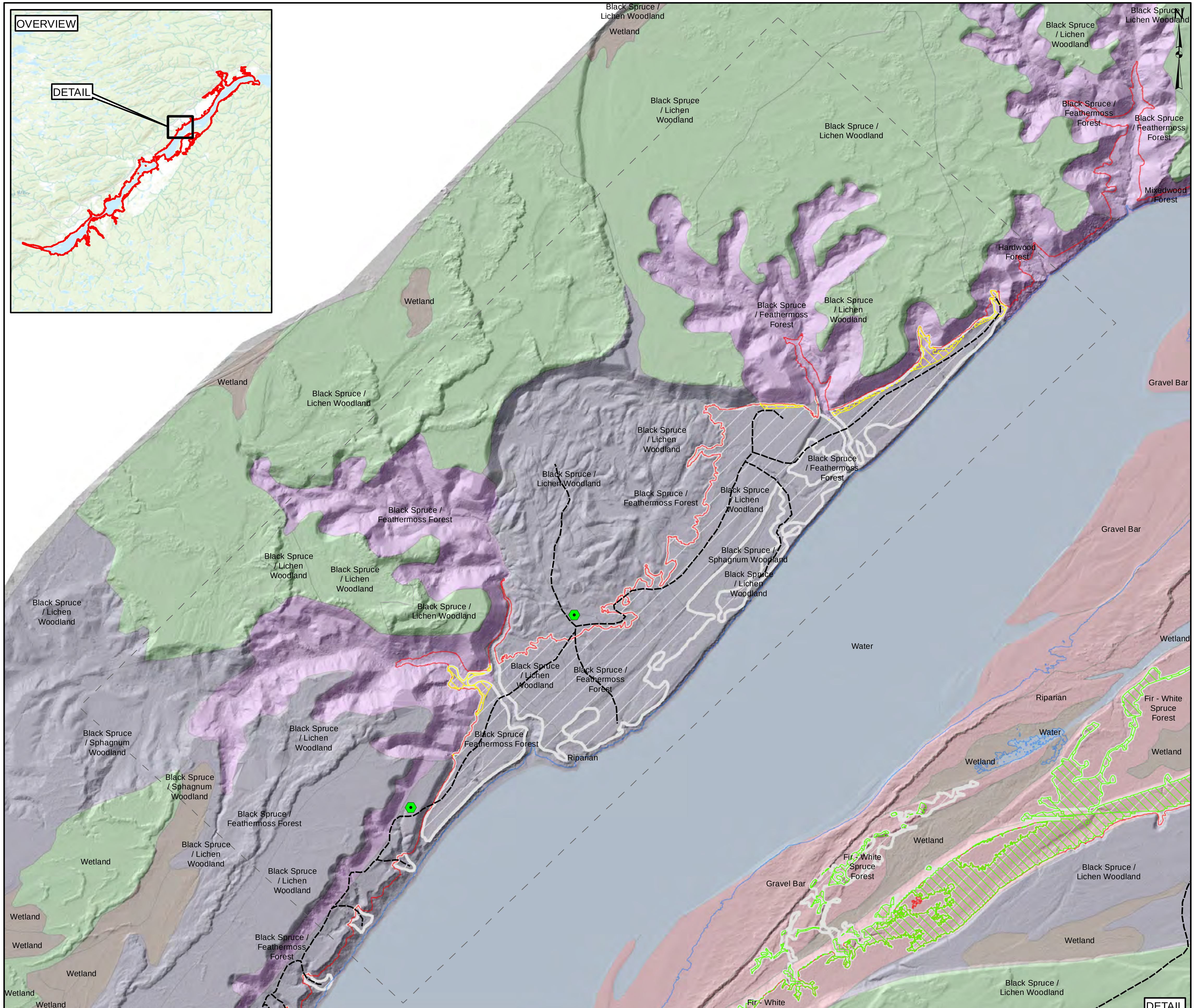

LEGEND

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- AREA OF INTERSET (AOI)
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SCENARIO B AREA - (IEC-RSC DATA)

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GEOLOGY (SED TYPE 1 - ELC - 2008)

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 14

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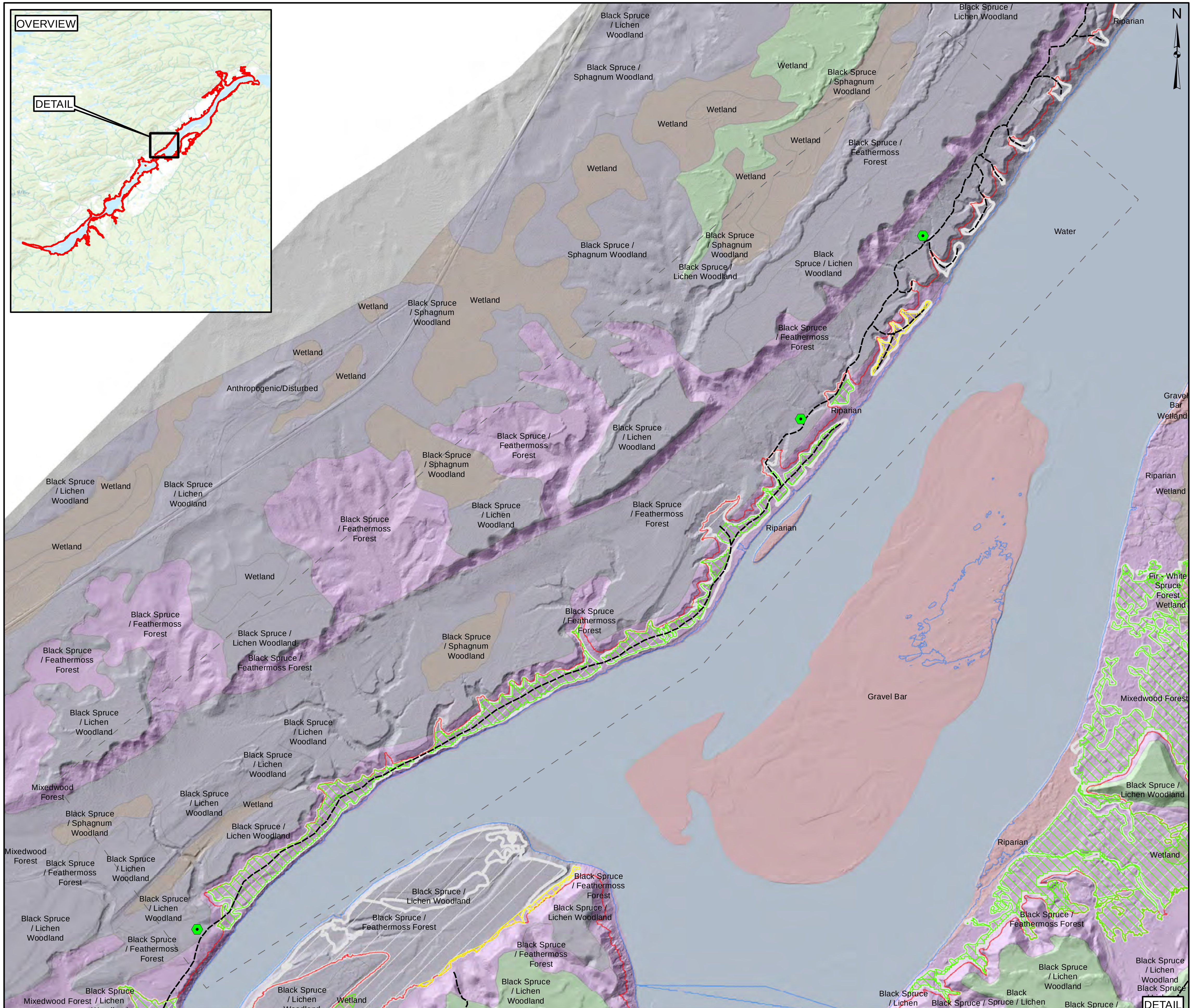

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SCENARIO B AREA - (IEC-RSC DATA)

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 15

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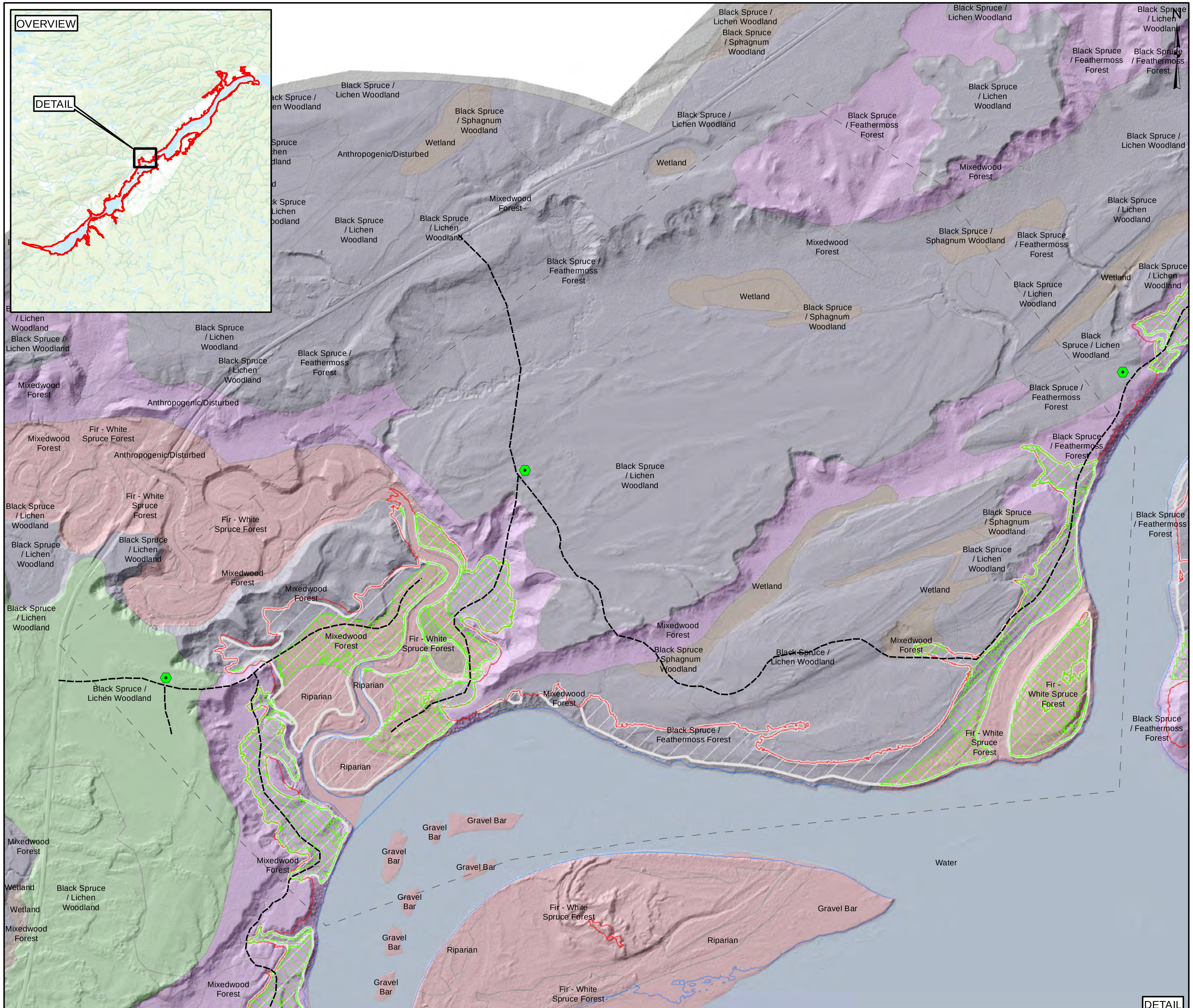

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SCENARIO B AREA - (IEC-RSC DATA)

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CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 16

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CHK BY	RO	APP BY	AJ	DWG No.					11x17

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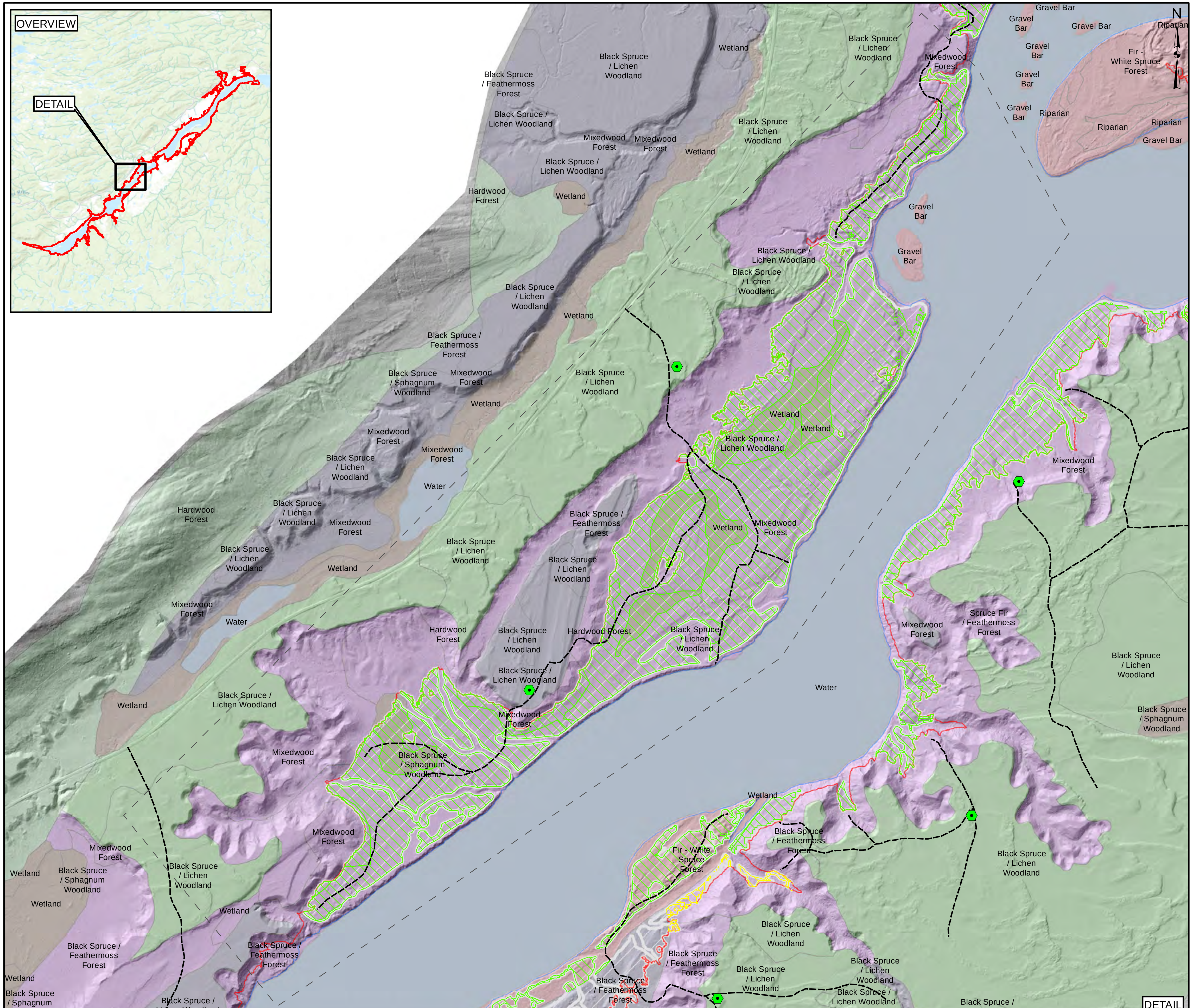

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:19,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 17

DES BY	RI	DRN BY	WH	DATE	2018 03 01	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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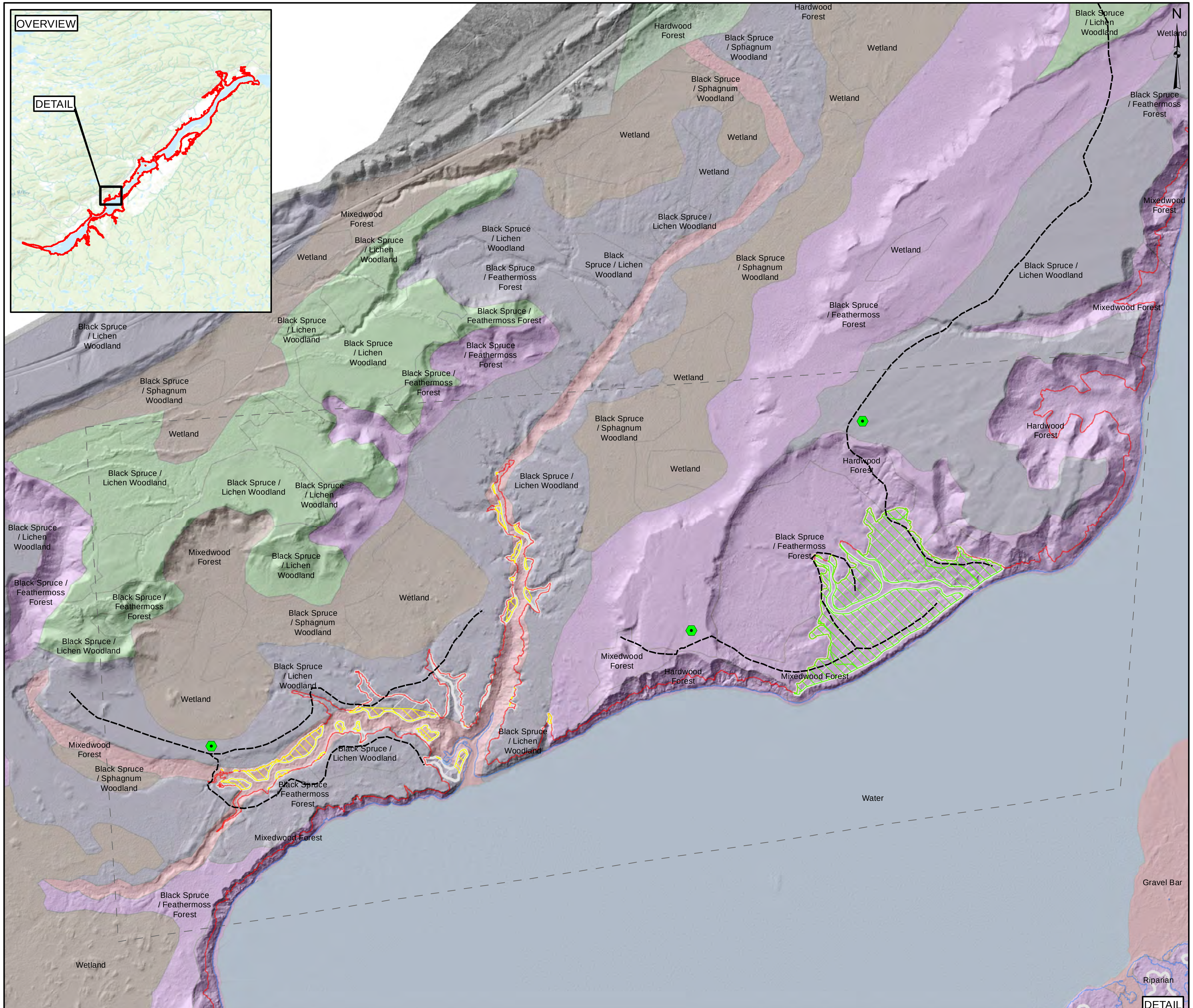

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,500

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 18

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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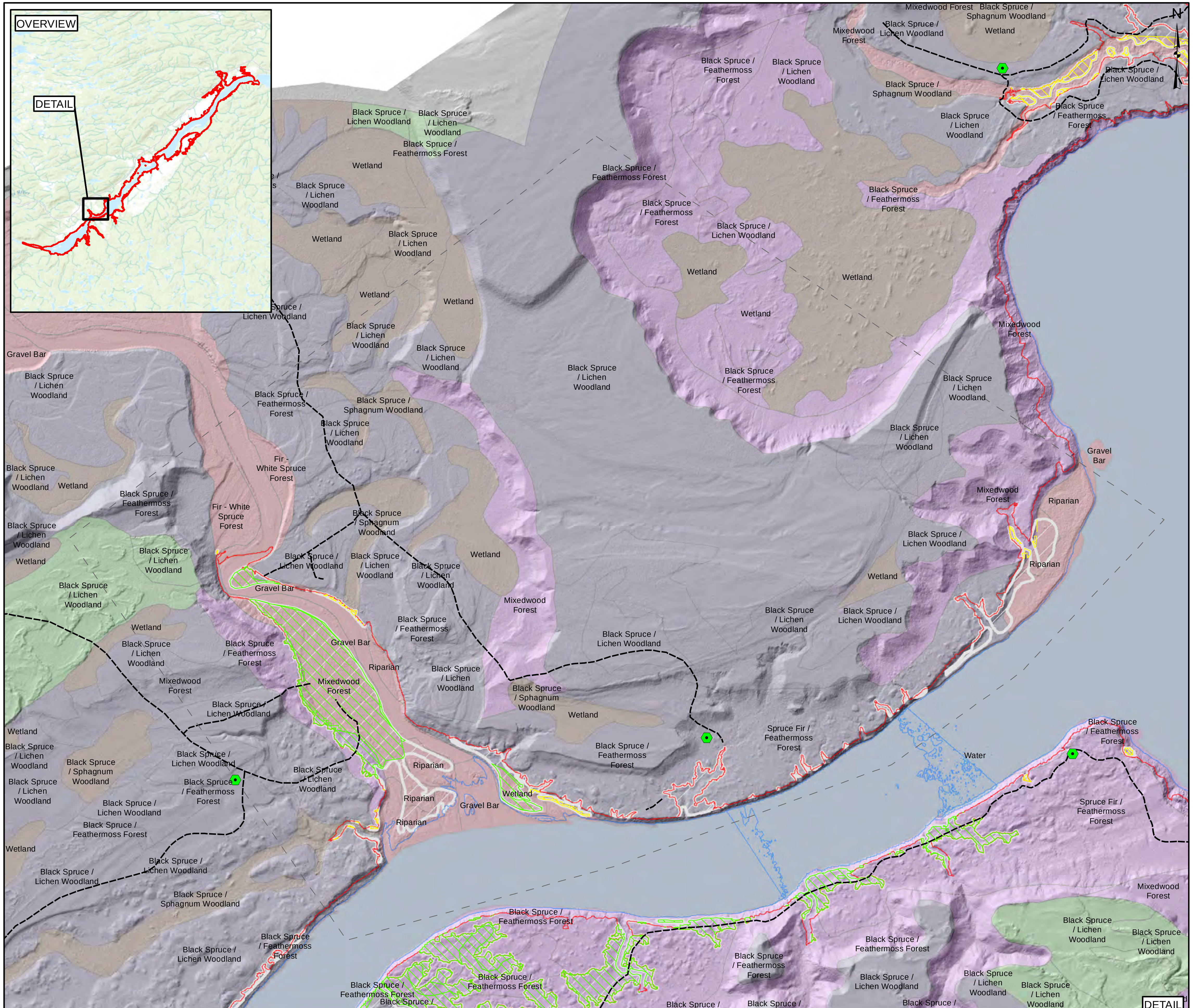

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTEREST (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 19

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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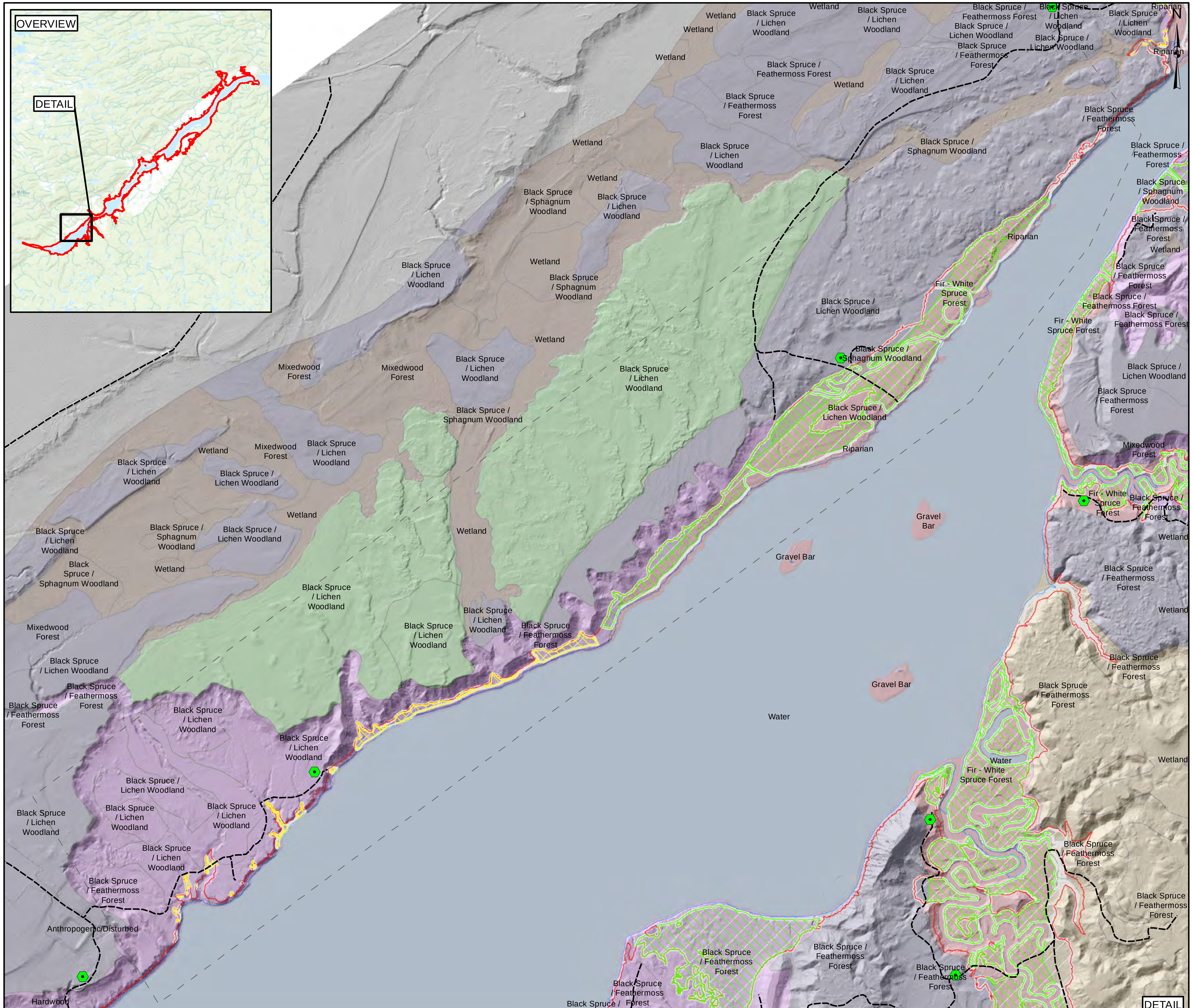

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:20,000

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 20

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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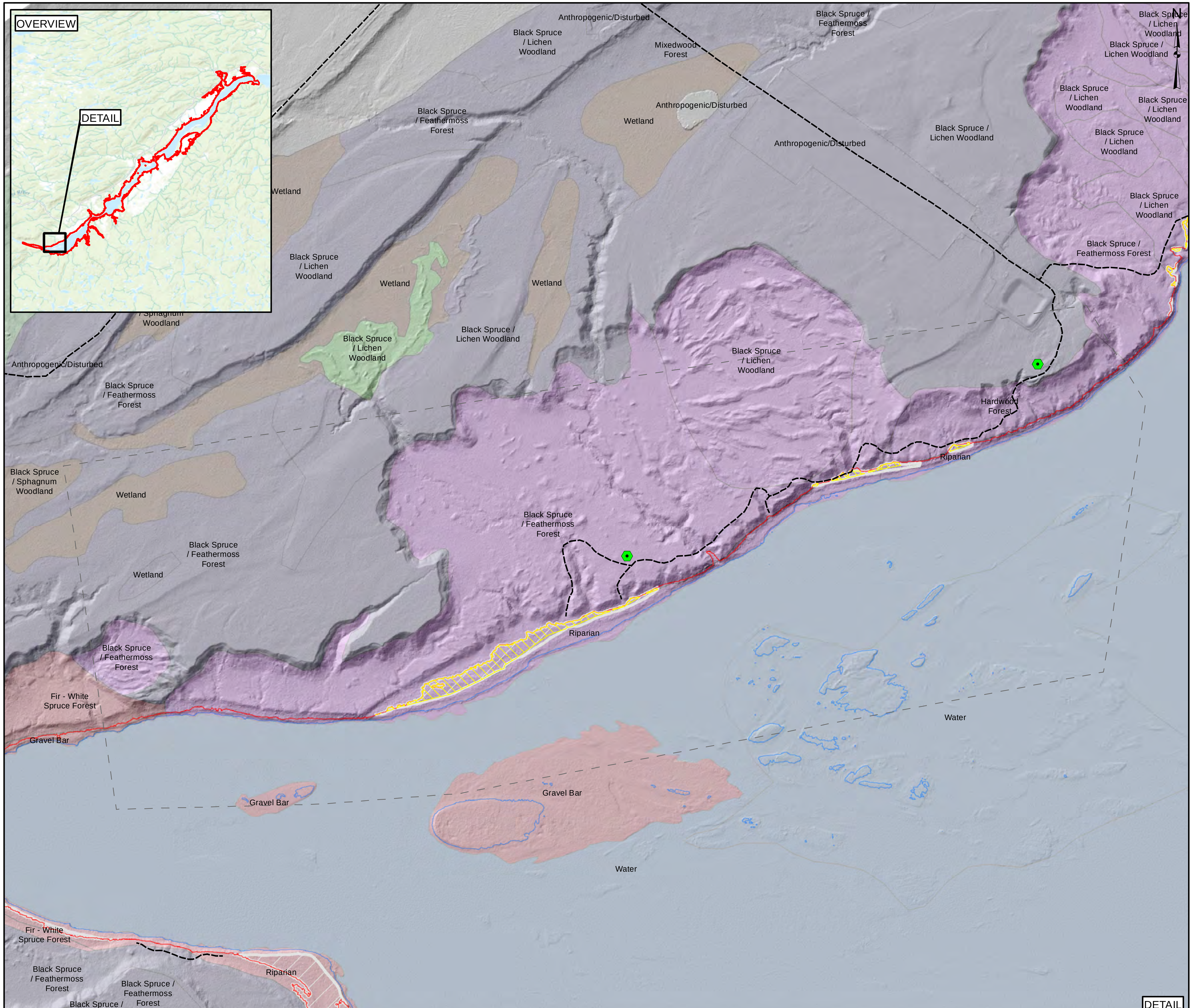

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 21

DES BY	RI	DRN BY	WH	DATE	2018 03 01	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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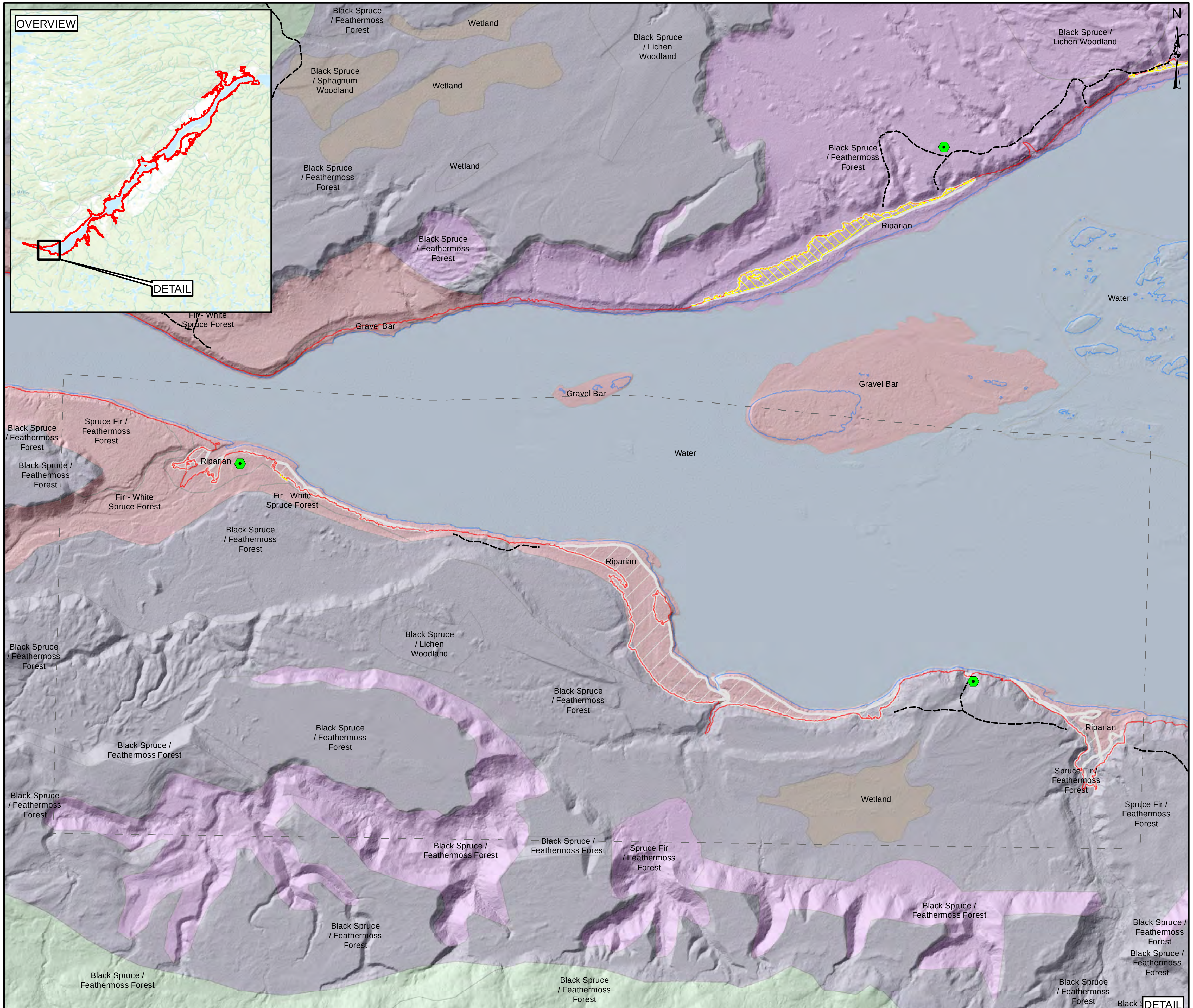

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,000

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 22

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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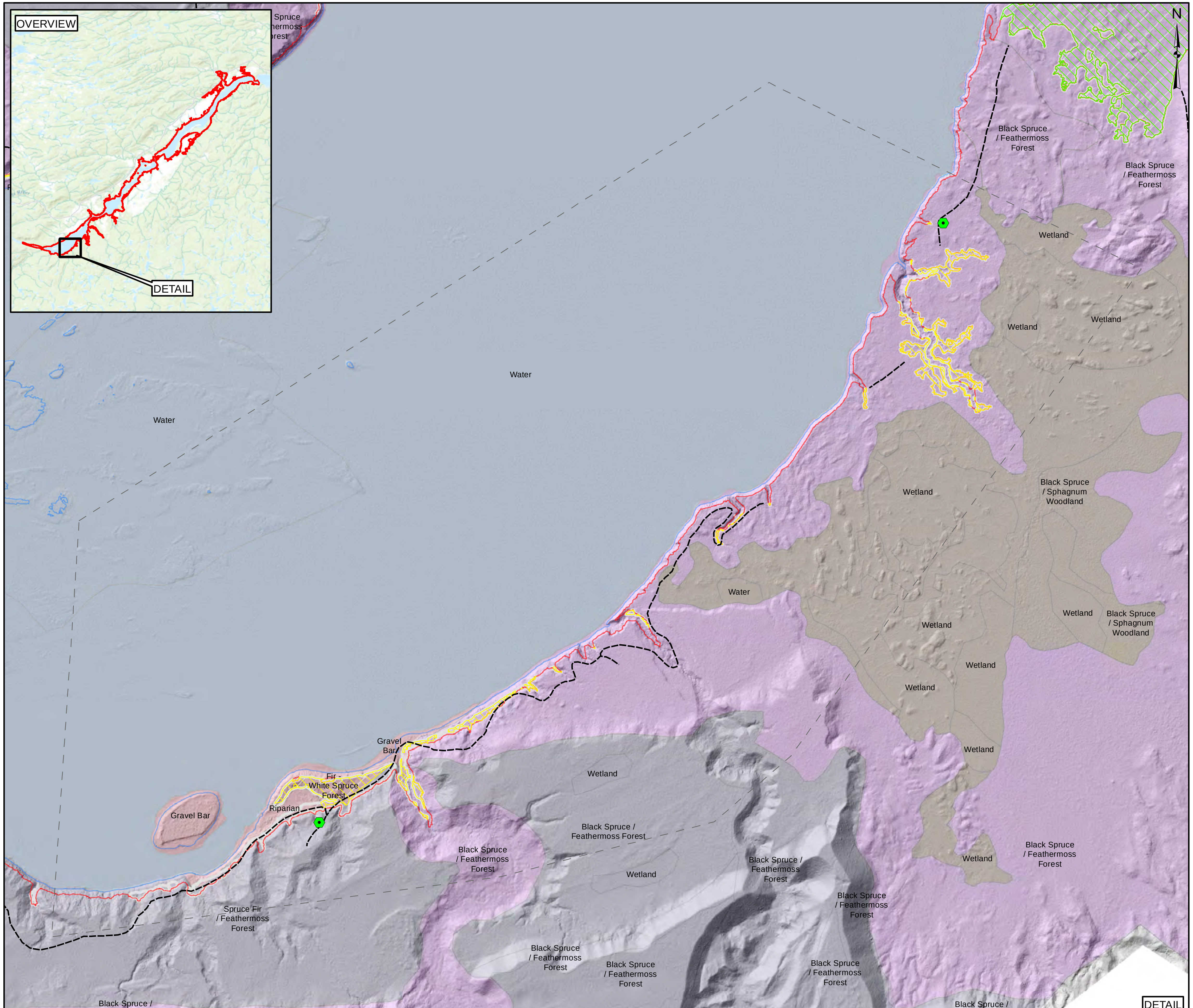

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,500

SNC·LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 23

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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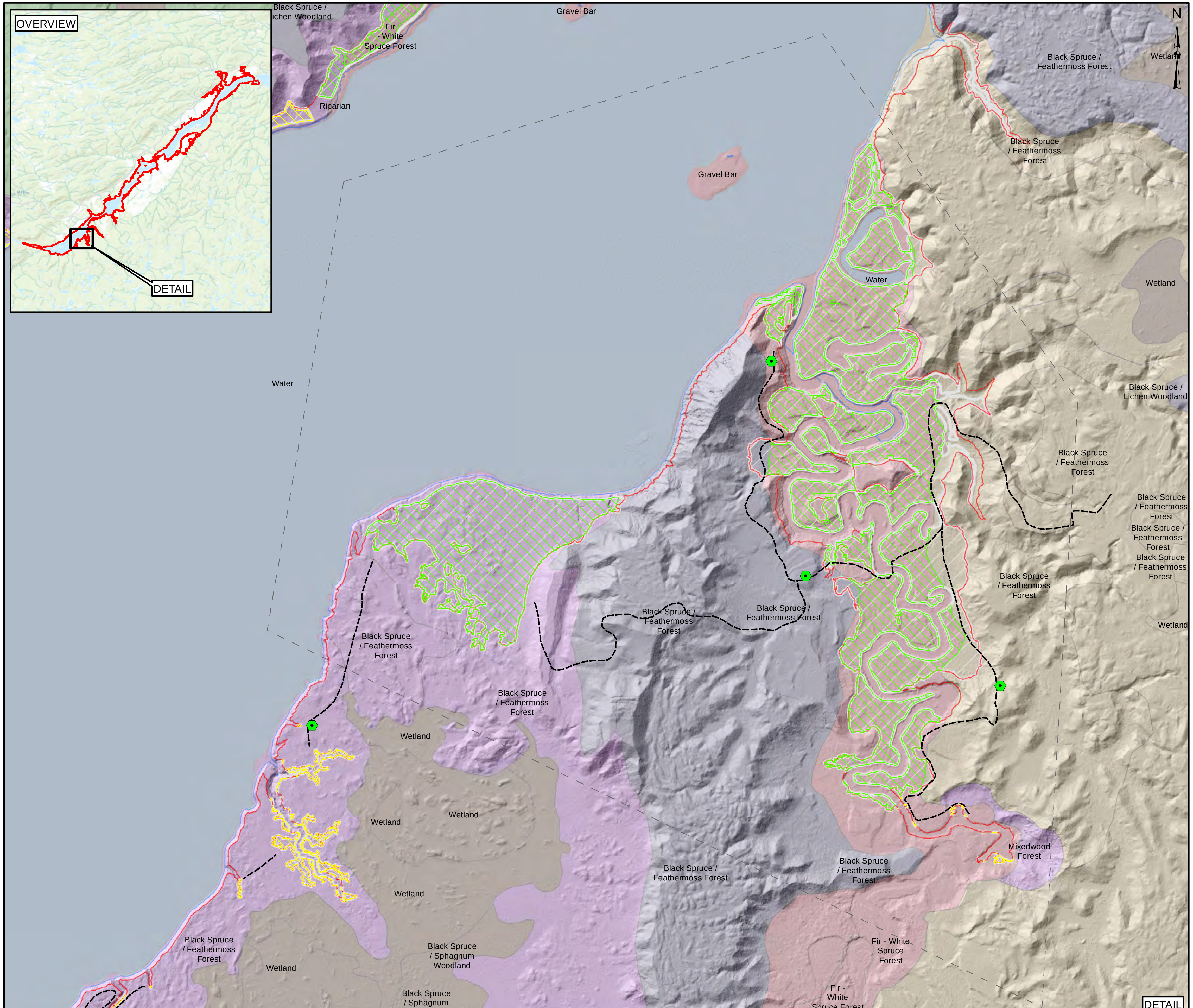

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 24

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.				11x17	

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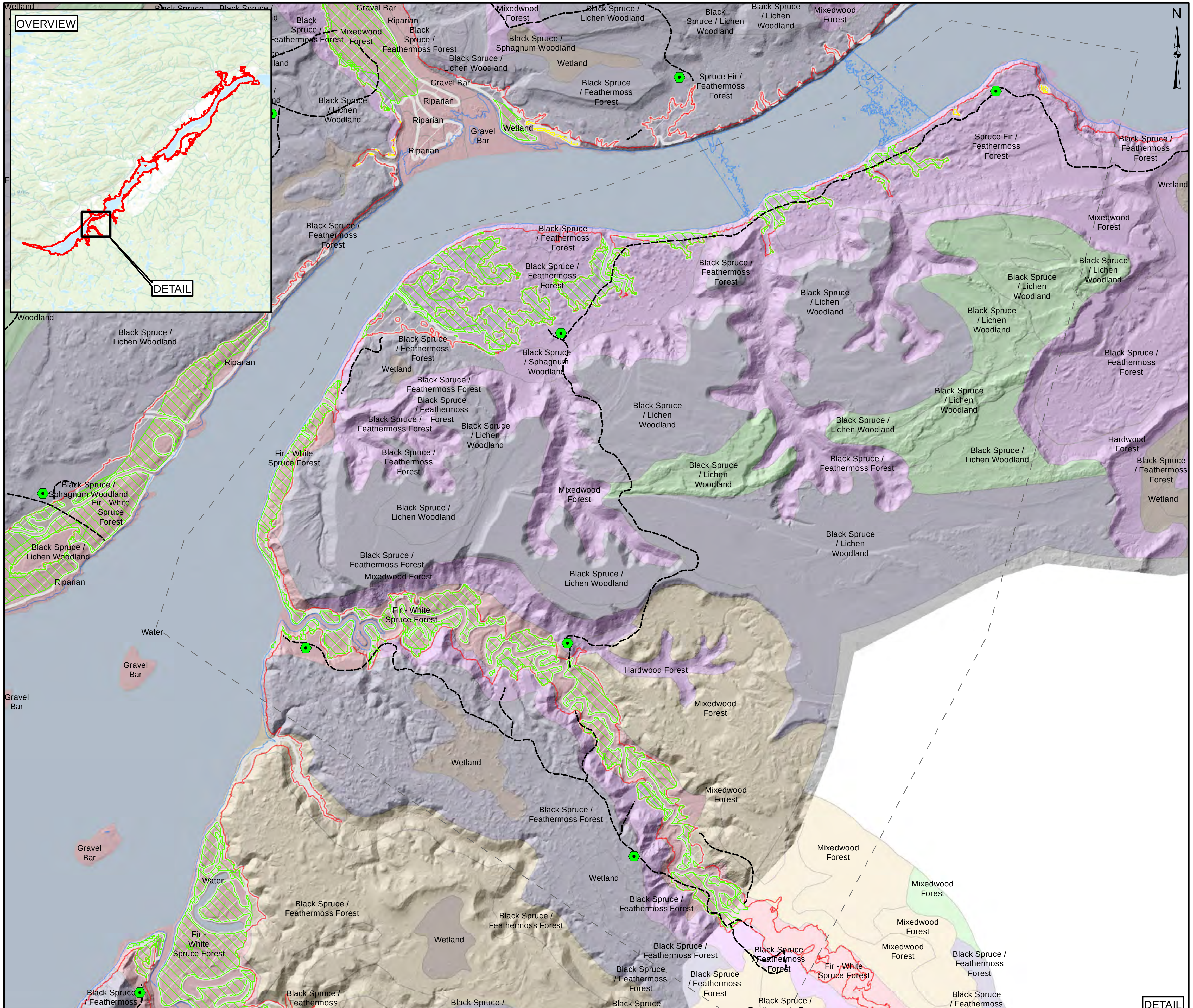

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:18,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 25

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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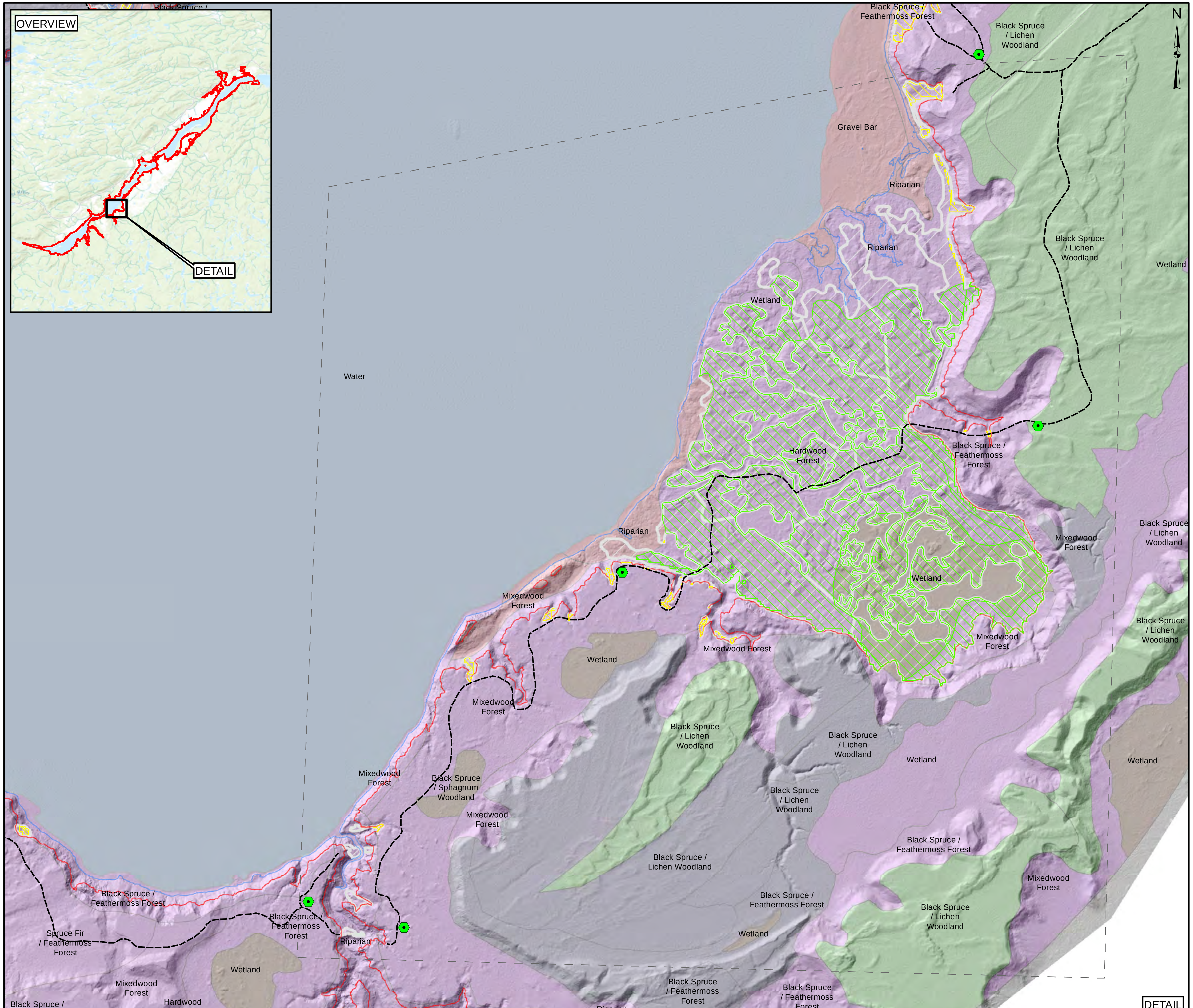

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:13,000

SNC • LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 26

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.	REV	0
CHK BY	RO	APP BY	AJ	DWG No.			11x17	

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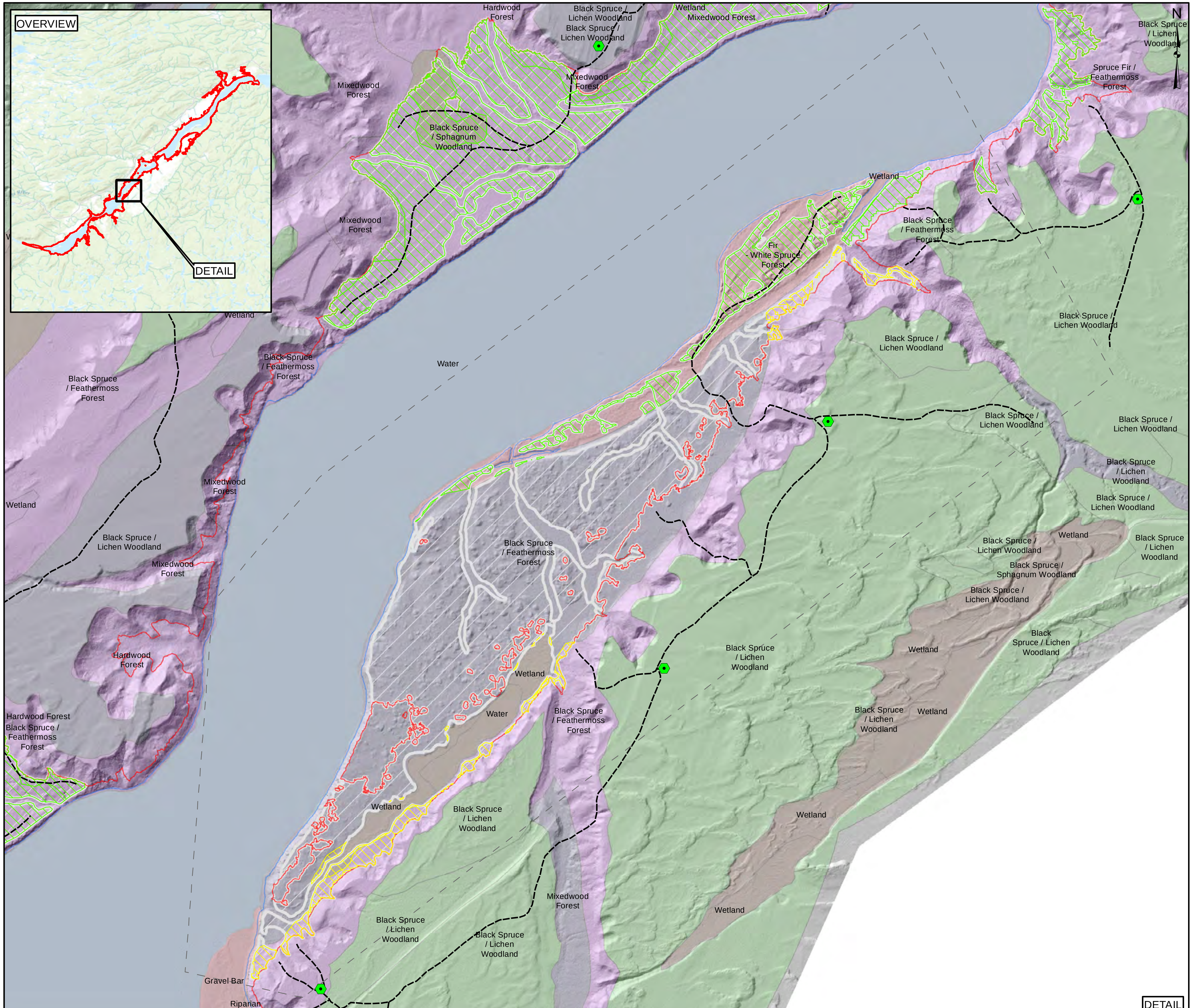

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:16,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 27

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

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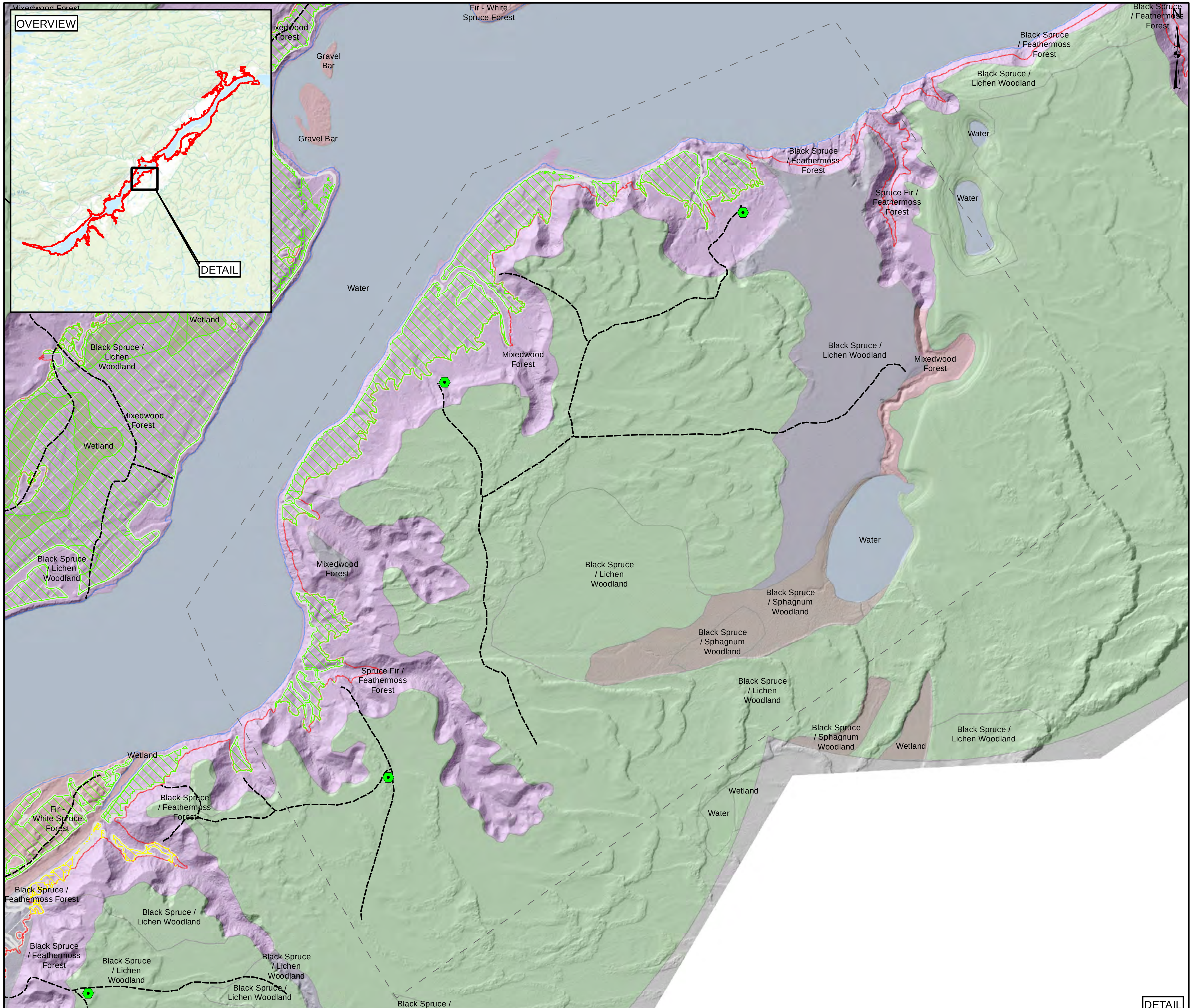

LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:16,500

SNC • LAVALIN

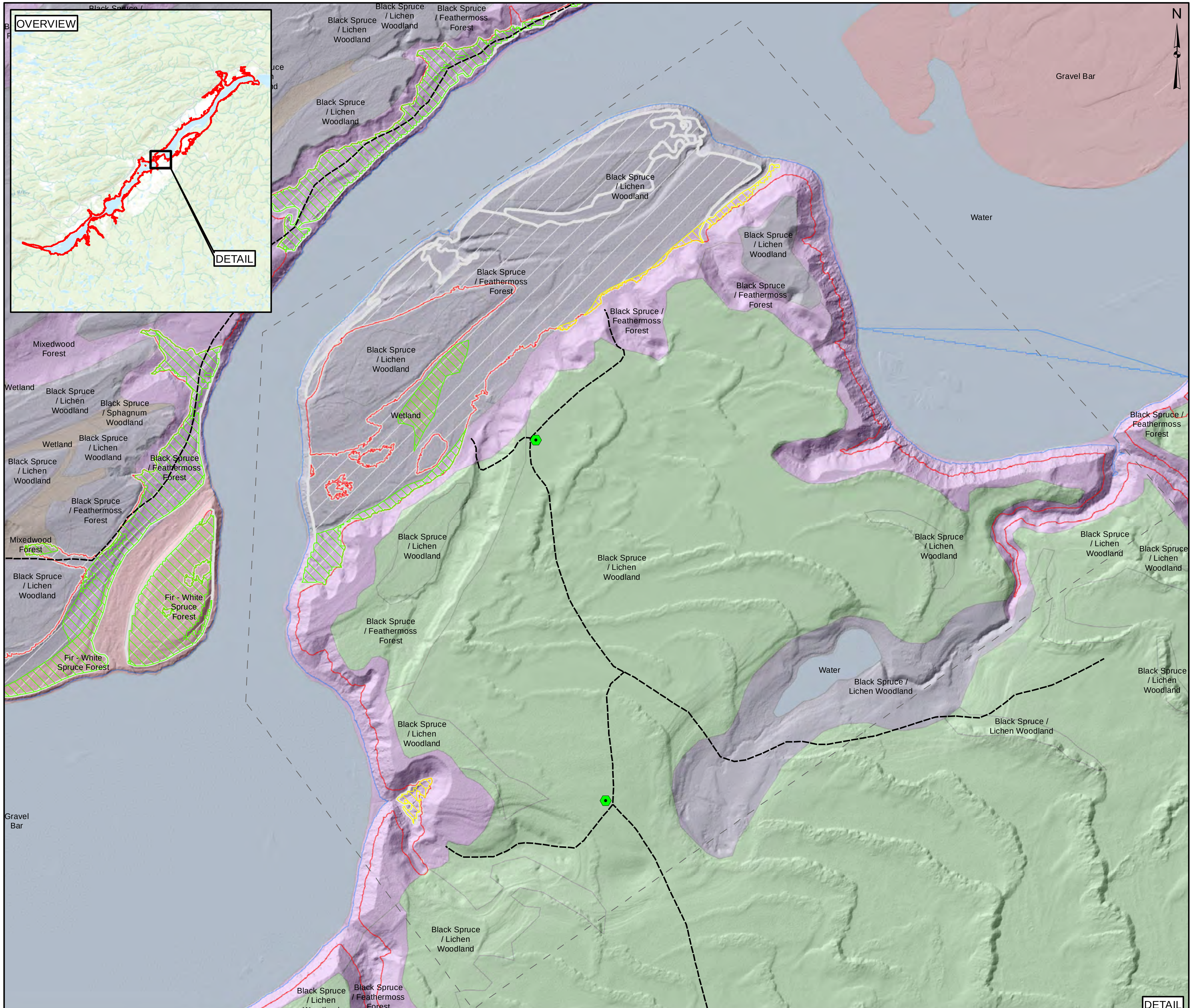
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 28

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0028_00-Phase2-ScenarioB-SNC_(AOI28).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:13,000

SNC · LAVALIN

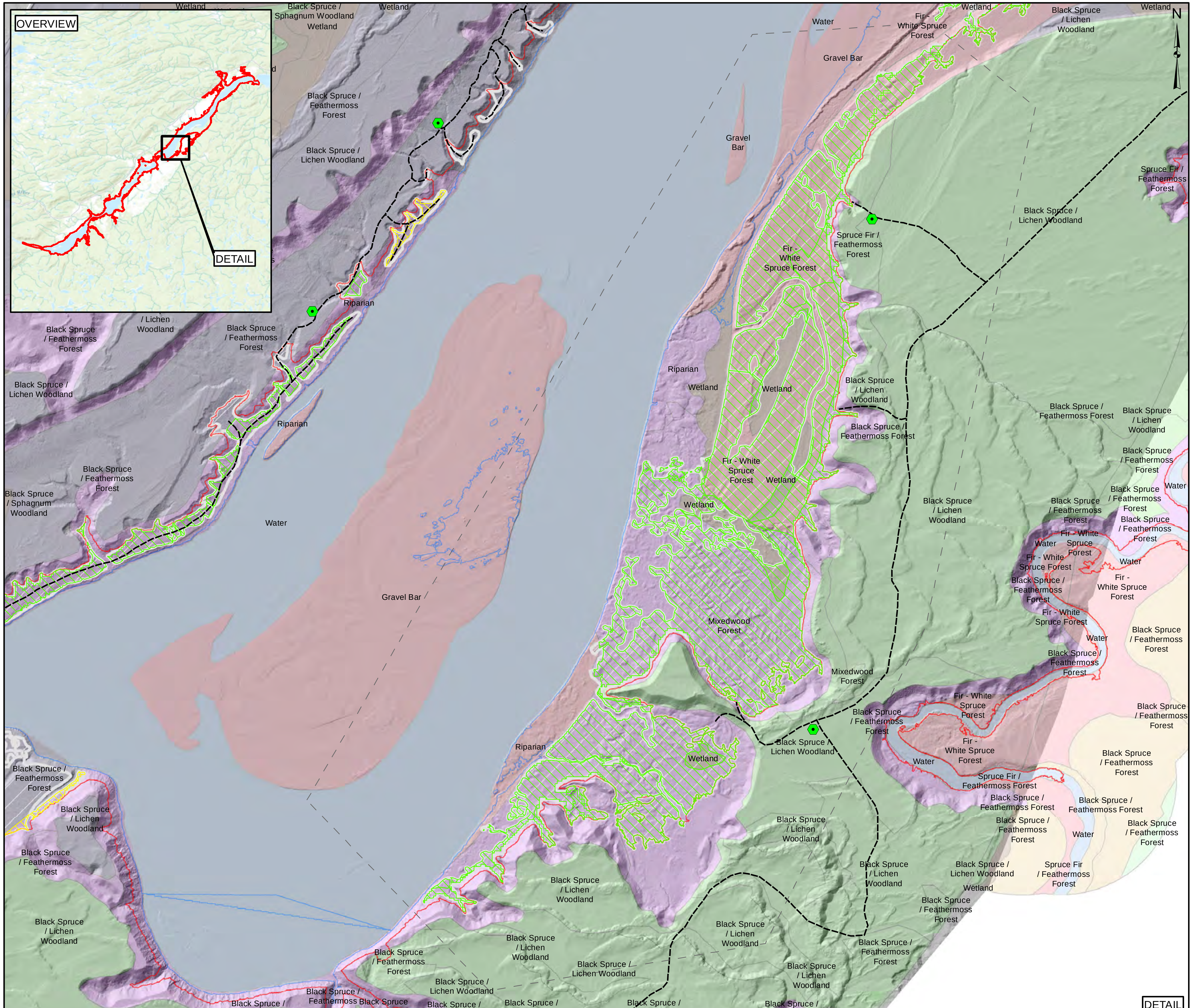
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 29

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0029_00-Phase2-ScenarioB-SNC_(AOI29).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:17,500

SNC · LAVALIN

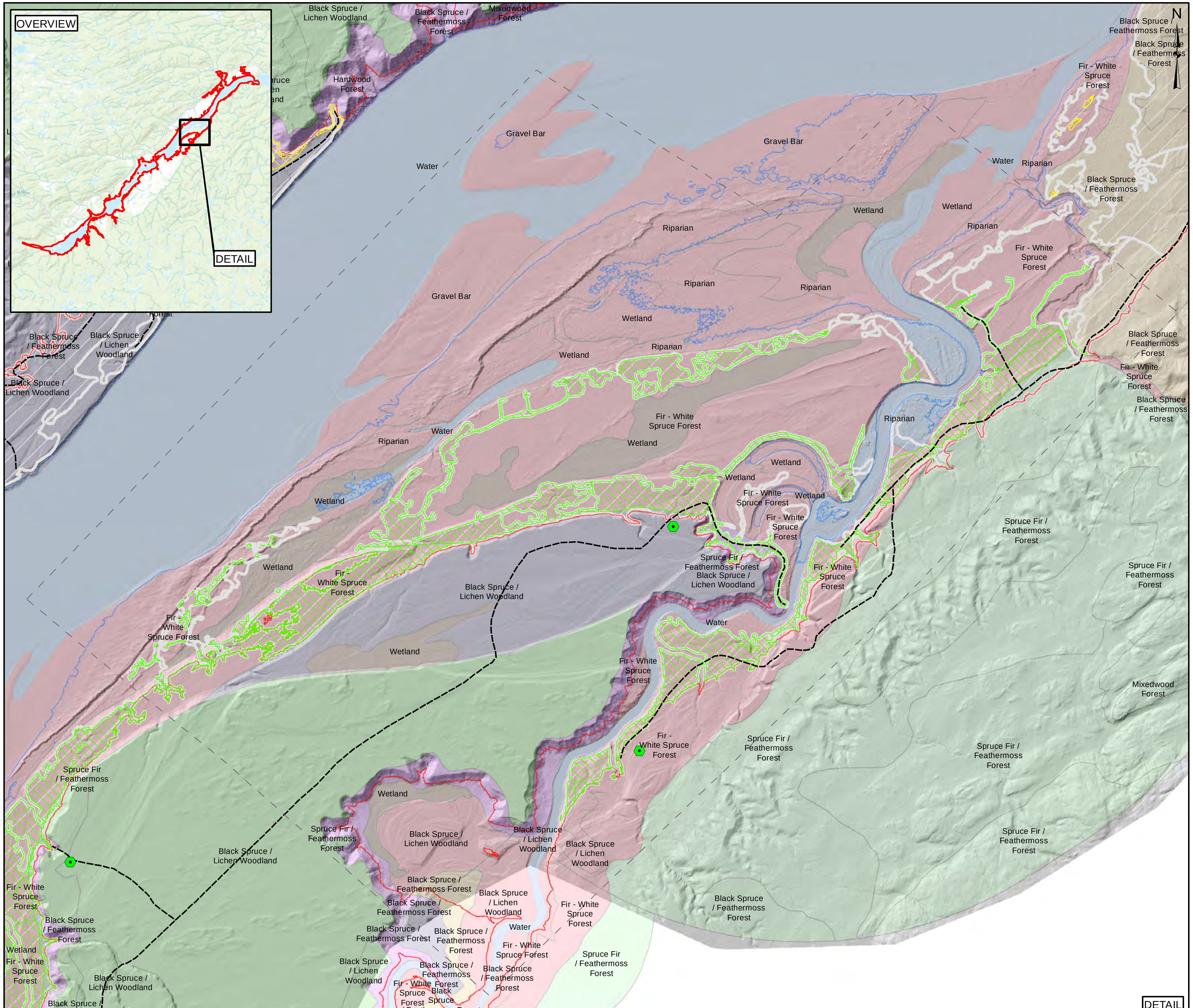
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 30

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0030_00-Phase2-ScenarioB-SNC_(AOI30).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:19,000

SNC · LAVALIN

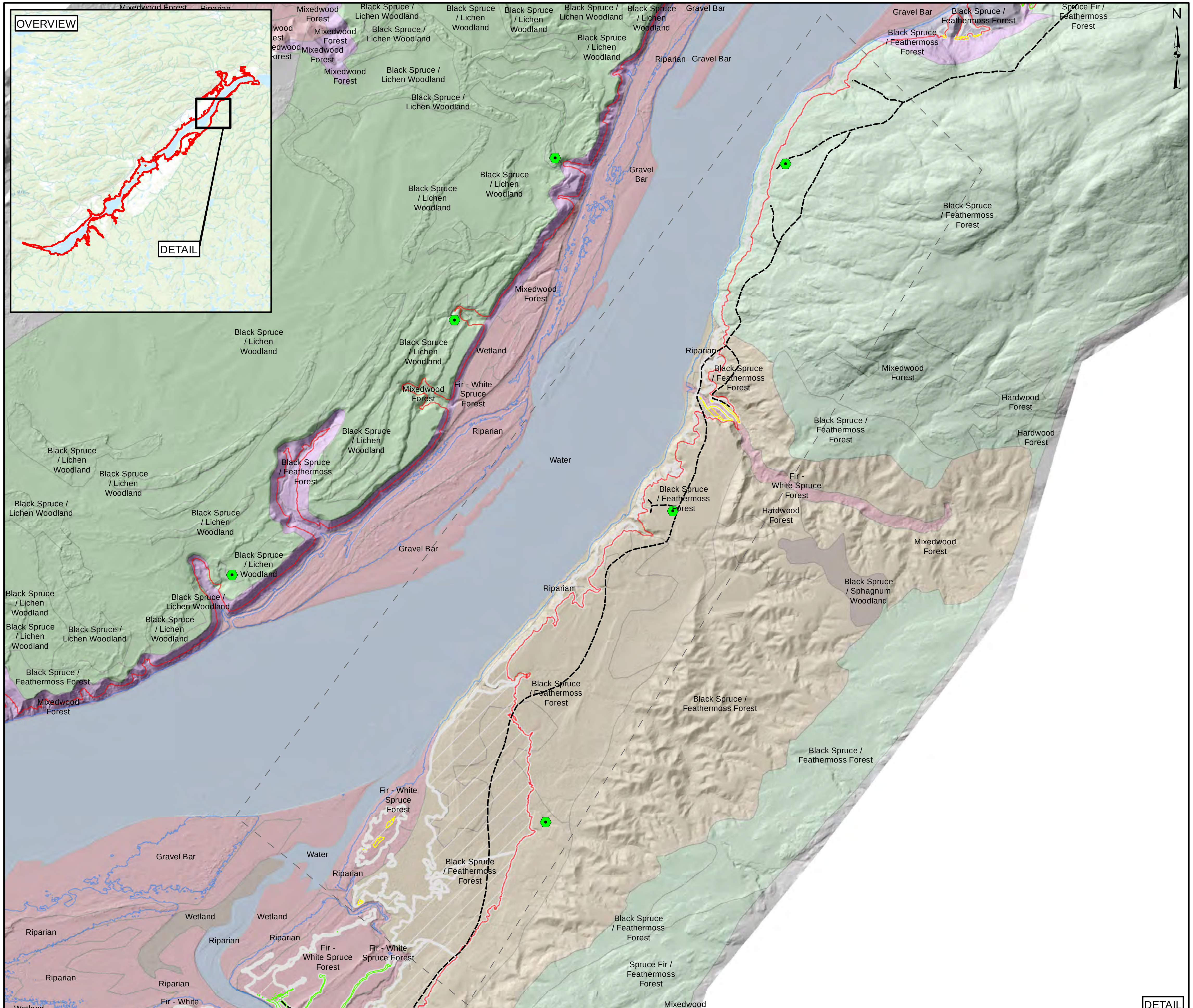
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 31

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0031_00-Phase2-ScenarioB-SNC_(AOI31).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:22,000

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 32

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

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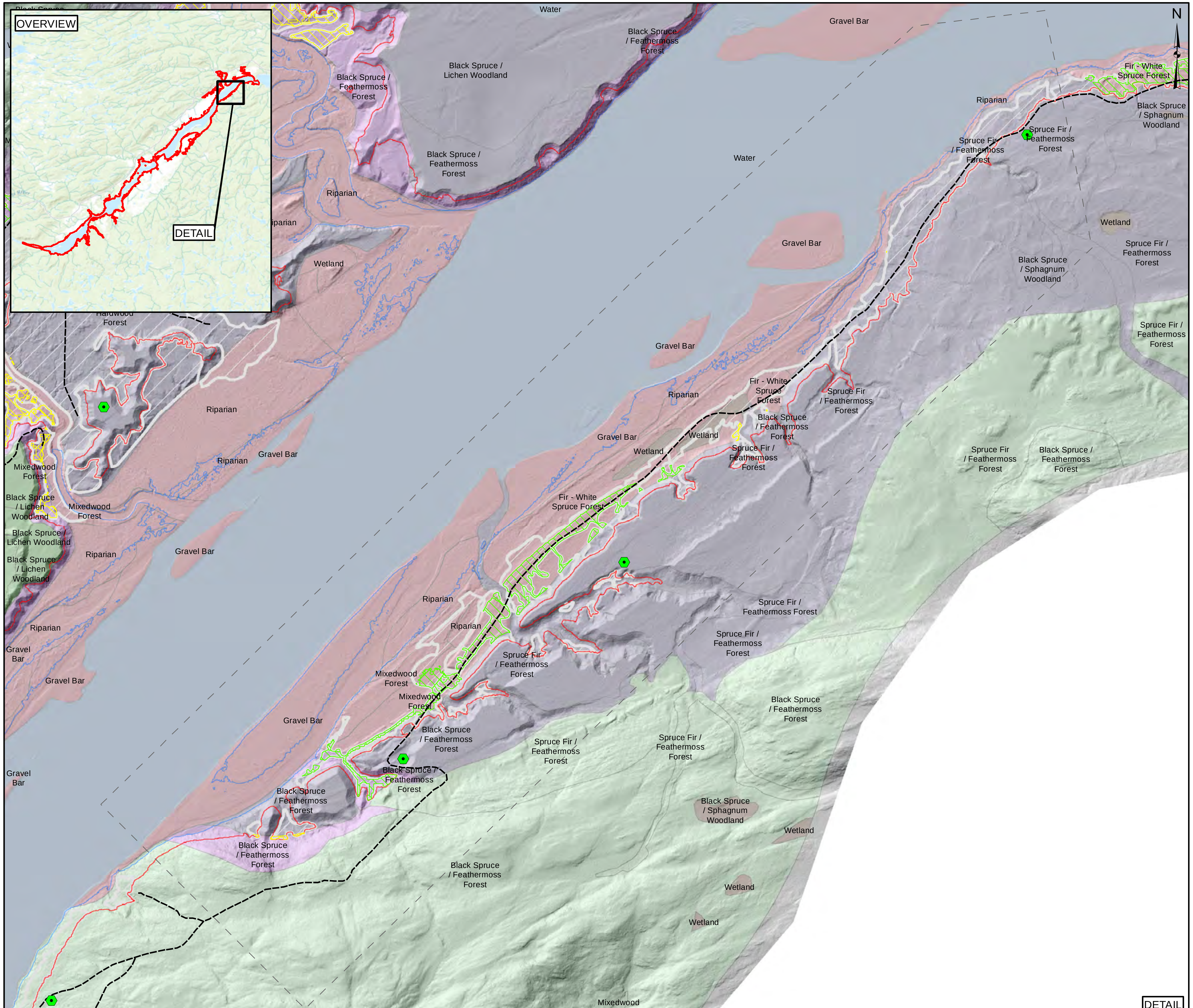


LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

0 250 500 1,000 Meters

SCALE: 1:17,000

SNC·LAVALIN

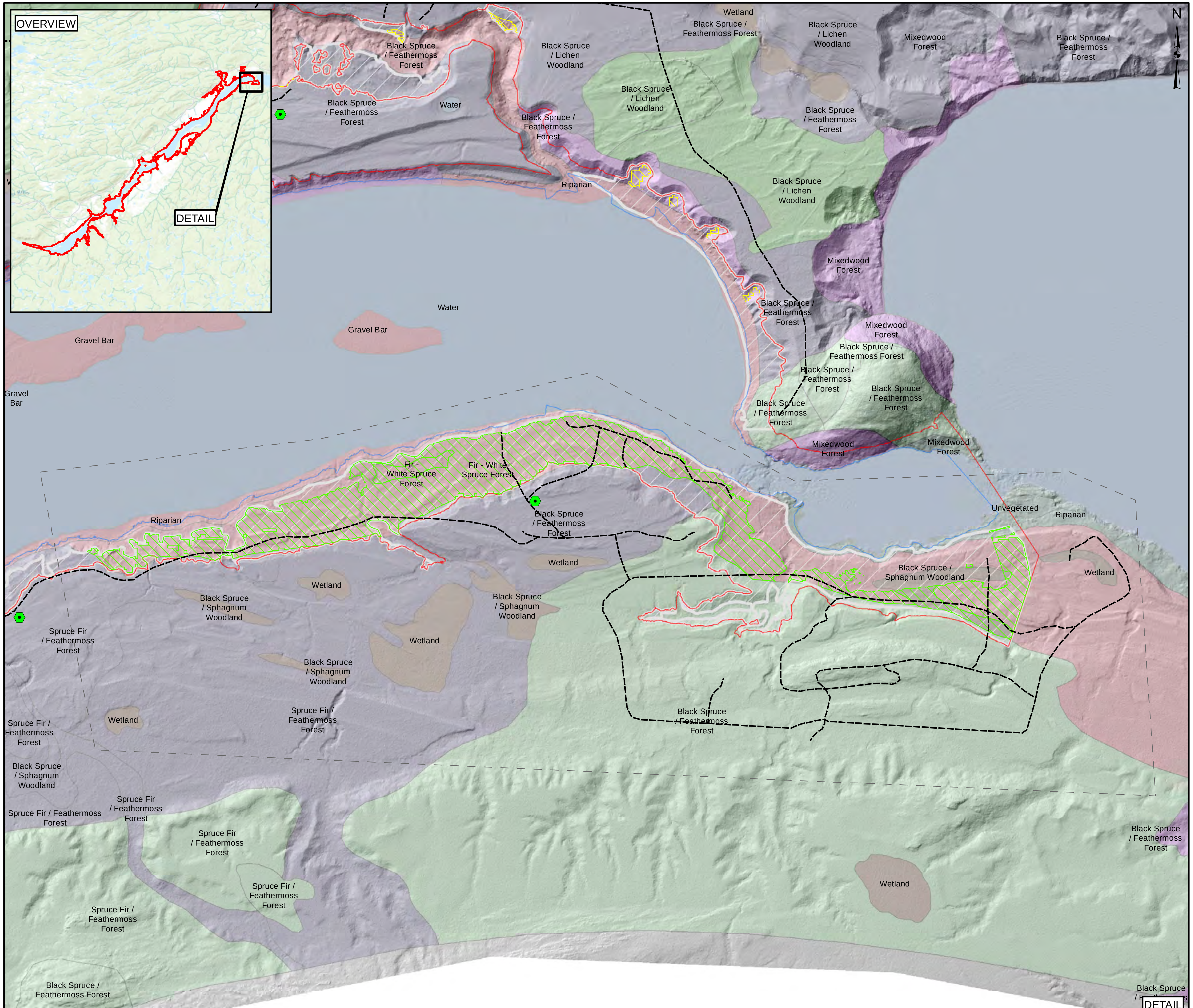
CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 33

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.	REV 0
CHK BY	RO	APP BY	AJ	DWG No.			11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0033_00-Phase2-ScenarioB-SNC_(AOI33).mxd



LEGEND

- POTENTIAL ORGANIC SOIL DISPOSAL LOCATION
- AS-BUILT ACCESS EXISTING ROADS
- AREA OF INTERSET (AOI)
- CLEARED LAND (TREES & BRUSH ONLY)
- FULL SUPPLY WATER LEVEL (39 MASL)
- PRE-IMPOUNDMENT WATER LEVEL

SCENARIO B AREA - (IEC-RSC DATA)

- IEC RECOMMENDATION
- SNC RECOMMENDATION - ADDITIONAL EXCLUSION

GEOLOGY (SED TYPE 1 - ELC - 2008)

- BEDROCK
- COLLUVIAL
- AEOLIAN SAND
- FLUVIAL
- GLACIOFLUVIAL (ASSUMED SENSITIVE CLAY)
- GLACIOMARINE (ASSUMED SENSITIVE CLAY)
- ORGANIC
- TILL (ASSUMED POSSIBLE SENSITIVE CLAY)
- WATER BODY

NOTES

1. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 20N.
2. **DRAWING NOT FOR CONSTRUCTION PURPOSES**
3. CLIENT SUPPLIED DATA LAYERS INCLUDE: ELC2008, FULL SUPPLY WATER LEVEL, CLEARED AREAS, AS-BUILT ACCESS, NATURAL CONDITIONS RESERVOIR LEVEL, DIGITAL ELEVATION MODEL
3. SERVICE LAYER CREDITS: ESRI AND ITS DATA SUPPLIERS

REFERENCE DRAWINGS

DWG No.	DATE	DESCRIPTION

REVISIONS

REV	DATE	DESCRIPTION	DRN BY	CHK

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SCALE: 1:14,500

SNC · LAVALIN

CLIENT	PROJECT LOCATION
NALCOR ENERGY	MUSKRAT FALLS, NL

TITLE

MUSKRAT FALLS: SCENARIO B - AREA OF INTEREST 34

DES BY	RI	DRN BY	WH	DATE	2018 03 01	FIG No.		REV	0
CHK BY	RO	APP BY	AJ	DWG No.					11x17

Path: \\SLI1653\Projects\Nalcor\505773 Vegetation removal\GIS\Drawing\PHASE_2\20180301_505573_0000_4G_DD_0034_00-Phase2-ScenarioB-SNC_(AOI34).mxd

Attachment 4

Quantities and Cost Estimates

Scenario A: Cover Wetland Organics

	IEC		SNC							
Wetland ID	Cleared area to be covered (ha)	Cover Material Volume (0.7m thick) (m^3)	Wetland area to be covered (ha)	Cover Material Volume (0.7m thick) (m^3)	Wetland cover ratio to cleared wetland	Precentage of wetland covered	Precentage of total wetland covered	Access	Availability of Cover Material	Comments
1	7.58	53,060	10.44	73,080	**73%**	**19%**	**10%**	Good	Cleared fluvial	Not all wetland area identified to be covered. 11.45 ha of Fir ELC with organic sediments on the surface immediately adjacent to the wetland not identified for covering.
2a	0.65	4,550	4.57	31,990	**14%**	**2%**	**4%**	Good	Cleared fluvial	Delineated limited covering as the wetland area has not been cleared of trees and shrubs.
2b	1.82	12,740	3.04	21,280	**60%**	**5%**	**3%**	Good	Cleared fluvial	Only 2/3 of the wetland area has been cleared of trees and shrubs
3	1.19	8,330	1.19	8,330	**100%**	**3%**	**1%**	Good	Cleared colluvial	No issues
4	2.46	17,220	2.46	17,220	**100%**	**6%**	**2%**	Good	Cleared glaciofluvial	No issues
5a	12.66	88,620	12.66	88,620	**100%**	**32%**	**12%**	Great	Cleared colluvial	Looks like an old camp/lay down area from tree clearing activities, barge access, how much wetland organics are still present?
5b	13.14	91,980	13.14	91,980	**100%**	**33%**	**13%**	Great	Cleared colluvial	Looks like an old camp/lay down area from tree clearing activities, barge access, how much wetland organics are still present?
6a	0	-	13.16	92,120	**0%**	**0%**	**13%**	Good	Limited cleared fluvial	Identified as a wetland ELC but with fluvial sediments on surface. The area has not been cleared of trees and shrubs. Are the fluvial sediments thick enough to act as a cover? No trees present, ground may be too soft.
6b	0	-	27.16	190,120	**0%**	**0%**	**27%**	Good	Limited cleared fluvial	Negligible area (<1 m2) identified to be covered. The wetland area has not been cleared of tress and shrubs. No trees present, ground may be too soft.
7	0	-	1.79	12,530	**0%**	**0%**	**2%**	Restricted	Material will need to be imported	The wetland area has not been cleared of tress and shrubs. No trees present, ground may be too soft. Restricted access.
8	0	-	2.68	18,760	**0%**	**0%**	**3%**	Limited	Cleared fluvial/glaciofluvial near by	Identified as a wetland ELC but with fluvial sediments on surface. The area has not been cleared of trees and shrubs. Are the fluvial sediments thick enough to act as a cover? No trees present, ground may be too soft.
9a	0	-	1.35	9,450	**0%**	**0%**	**1%**	Great	Cleared fluvial	Adjacent to main road along the south bank. How much of the organics are still present following the road construction?
9b	0	-	2.34	16,380	**0%**	**0%**	**2%**	Great	Cleared fluvial	Adjacent to main road along the south bank. How much of the organics are still present following the road construction?
10	0	-	5.87	41,090	**0%**	**0%**	**6%**	Restricted	Material will need to be imported	The wetland area has not been cleared of tress and shrubs. No trees present, ground may be too soft. Restricted access.
Total	**39.50**	**276,500**	**101.85**	**712,950**	**39%**	**100%**	**100%**			

Scenario B: Remove Soil from Cleared Areas

	IEC							SNC (Excluded Areas)		Excluded Area as per Scenario B Criteria					
ID	**Area of soil to be mitigated (ha)**	**Volume (0.2m thick) (m^3)**	**Volume (0.5m thick) (m^3)**	**Volume (1.5m thick) (m^3)**	**Total area cleared of trees and shrubs (ha)**	**Soil mitigation ratio to cleared area**	**Precentage of total soil mitigation**	**Small and harder to access areas removed (ha)**	**20 m buffer from steep slopes and sensitive clays removed (ha)**	**Excluded area of soil (Scenario B criteria) (ha)**	**Volume (0.2m thick) (m^3)**	**Volume (0.5m thick) (m^3)**	**Volume (1.5m thick) (m^3)**	**Access**	**Comments**
11	0.9	1,754	4,384	13,152	19.1	**5%**	**0%**	0.0	0.1	18.2	36,358	90,895	272,685	Good access to the general area, construction roads within the work area will need to be constructed to access the limited removal areas	Very limited removal of organics due to exclusion of riparian ELC and glaciofluvial geology
12	41.9	83,776	209,440	628,320	106.0	**40%**	**4%**	34.7	27.2	64.2	128,311	320,776	962,329	Good access to all removal areas	Majority of the removal volume is from the wetland. Limite removal is other areas due to the exlcusions
13	40.4	80,720	201,799	605,398	153.7	**26%**	**4%**	11.1	21.1	113.3	226,581	566,451	1,699,354	Good access to all removal areas	Large area of a cleared glaciofluvial deposit excluded fo removal. The smaller removal areas are accessible but are spread out.
14	2.5	4,967	12,417	37,251	79.9	**3%**	**0%**	0.0	0.5	77.4	154,755	386,887	1,160,660	Good access to all removal areas	Very limited removal of organics due to exclusion of glaciofluvia geology
15	23.1	46,104	115,260	345,779	31.1	**74%**	**2%**	22.1	10.2	8.0	16,010	40,025	120,076	Good access to all removal areas	Access road runs through the middle of the removal areas. The access road will need to be removed to get to the soil below or the soil may have been removed prior to constructing the road,
16	52.4	104,874	262,186	786,557	86.1	**61%**	**5%**	52.4	37.6	33.7	67,377	168,443	505,328	Good access to all removal area	Removal area excluded is mainly glaciofluvial geolo
17	205.0	410,096	1,025,241	3,075,724	208.0	**99%**	**20%**	205.0	186.1	3.0	5,964	14,910	44,730	Good access to all removal areas	Full removal of cleared areas. There is an old work camp laydown area present. Was the soil removed during the establishment of the work area? Soil volume may be less than estimated.
18	19.0	37,958	94,895	284,686	21.9	**87%**	**2%**	16.2	16.2	2.9	5,786	14,465	43,396	Good access to all removal areas	Good removal ratio, removal limited in some areas due exclusion of riparian ELC and glaciofluvial geology
19	18.1	36,254	90,634	271,902	30.1	**60%**	**2%**	17.6	14.6	11.9	23,888	59,720	179,160	Good access to most removal areas, small area to the ea has limited access	Good removal ratio, removal limited in some areas due exclusion of riparian ELC and glaciofluvial geology, excluded glaciofluvial geology has limited access
20	42.2	84,335	210,836	632,509	49.1	**86%**	**4%**	37.9	33.0	6.9	13,872	34,679	104,037	Good access to main removal area, limited access to sma removal areas to the southwest	Good removal ratio, removal limited along the clearing exten due to the delineation between the glaciofluvial and fluvial geology in the main removal area
21	3.4	6,829	17,073	51,220	4.3	**79%**	**0%**	0.0	2.7	0.9	1,818	4,544	13,633	Good access to all removal area	Good removal ratio, excluded area is riparian EL
22	0.0	6	14	42	13.6	**0%**	**0%**	0.0	0.0	13.6	27,108	67,770	203,309	Good access to all removal area	No soil removal, all cleared area is riparian EL
23	5.1	10,204	25,510	76,529	7.3	**70%**	**0%**	0.0	2.2	2.2	4,421	11,052	33,156	Good access to all removal area	Good removal ratio, excluded area is riparian EL
24	81.2	162,463	406,157	1,218,470	93.2	**87%**	**8%**	81.1	60.3	12.0	23,956	59,890	179,671	Good access to all removal areas	Good removal ratio, excluded areas are glaciomarine ar glaciofluvial geology
25	53.9	107,764	269,410	808,231	61.0	**88%**	**5%**	53.8	34.4	7.1	14,250	35,626	106,877	Good access to all removal areas	Good removal ratio, excluded areas are glaciomarine ar glaciofluvial geology, some small removal areas have limited access
26	78.1	156,245	390,613	1,171,838	88.3	**88%**	**8%**	76.8	70.7	10.2	20,417	51,043	153,128	Good access to all removal area	Good removal ratio, excluded area is riparian EL
27	25.1	50,133	125,332	375,995	120.6	**21%**	**2%**	17.2	12.3	95.5	190,976	477,440	1,432,319	Good access to all removal areas	Large area of a cleared glaciofluvial deposit excluded for removal. Some smaller removal areas have limited accessibility
28	38.8	77,508	193,769	581,307	40.2	**96%**	**4%**	38.8	27.2	1.4	2,835	7,088	21,264	Good access to all removal area	Full removal of cleared area
29	6.9	13,824	34,560	103,681	62.6	**11%**	**1%**	5.2	3.9	55.7	111,382	278,454	835,363	Good access to all removal areas	Large area of a cleared glaciofluvial deposit excluded fo removal. Limited removal confined to the clearing extents due to the delineation between the glaciofluvial and colluvial geology.
30	147.9	295,835	739,587	2,218,761	153.4	**96%**	**14%**	147.9	119.3	5.5	10,971	27,427	82,282	Good access to all removal area	Good removal ratio, excluded area is riparian EL
31	86.7	173,302	433,256	1,299,767	116.3	**74%**	**8%**	86.7	60.9	29.7	59,396	148,490	445,469	Good access to all removal areas	Good removal ratio, excluded areas are glaciomarine geolog some small removal areas have limited access
32	0.9	1,817	4,542	13,627	89.9	**1%**	**0%**	0.0	0.6	89.0	177,911	444,779	1,334,336	Good access to all removal areas	Poor removal ratio, most of the cleared area is glaciomarin geology
33	9.4	18,817	47,042	141,125	44.6	**21%**	**1%**	9.2	6.8	35.1	70,298	175,745	527,236	Good access to all removal areas	Access road runs through the middle of the removal areas. The access road will need to be removed to get to the soil below or the soil may have been removed prior to constructing the road.
34	47.9	95,784	239,459	718,378	75.6	**63%**	**5%**	47.9	34.2	27.7	55,435	138,589	415,766	Good access to all removal areas	Good removal ratio, removal limited in some areas due exclusion of glaciofluvial geology
Total	**1031**	**2,061,366**	**5,153,416**	**15,460,248**	**1,756**	**59%**	**100%**	**962**	**782**	**725**	**1,450,075**	**3,625,188**	**10,875,565**		

Muskrat Falls Vegetation Removal Scenario A (IEC Selected, 39.5 ha)

Date: 02-Mar-18

	Area of wetland to be covered (ha)	Estimated Quantities 0.7m cover Volume (m^3)
Total Wetland Area as per ELC	101.85	712,950
Excluded Area	62.35	436,450
IEC Selected Area for Mitigation	**39.50**	**276,500**

Construction Costs

Item	Description	Unit	Quantity	Low Estimate Unit Cost	High Estimate Unit Cost	Low	High
1	**Mobilization**						
1a	Contractor Mobilization/demobilization	% of Capex	1	$ 1,898,500	$ 2,847,750	$ 1,898,500	$ 2,847,750
1b	Contractor Compound	Lump	1	$ 150,000	$ 250,000	$ 150,000	$ 250,000
1c	Work Camp	Lump	1	$ 481,250	$ 700,000	$ 481,250	$ 700,000
1d	Engineering design and construction support	% of Capex	1	$ 1,091,638	$ 1,746,620	$ 1,091,638	$ 1,746,620
						$ 3,621,388	**$ 5,544,370**
2	**Wetland Covering**						
2a	Borrow Excavation/Placement	$/m3	276,500	$ 15.00	$ 30.00	$ 4,147,500	$ 8,295,000
						$ 4,147,500	**$ 8,295,000**
3	**Site Clearing (Barge) - Quantities 20% of total site clearing**						
3a	Overburden Excavation (includes O and A)	$/m3	-	$ 14.00	$ 30.00	$ -	$ -
						$ -	**$ -**
4	**Road Construction**						
4a	New Roads	$/lineal m	21,000	$ 150.00	$ 200.00	$ 3,150,000	$ 4,200,000
4b	Upgrade existing roads	$/lineal m	30,000	$ 51.00	$ 60.00	$ 1,530,000	$ 1,800,000
4c	Water crossing (900mm CSP)	Lump	20	$ 6,000	$ 12,000	$ 120,000	$ 240,000
4d	Road Maintenance (fall -winter- apr)	$/day	175	$ 13,000	$ 20,000	$ 2,275,000	$ 3,500,000
4e	Contingency for dualling of upto 50% of haul roads	$/lineal m	-	$ 101.00	$ 130.00	$ -	$ -
						$ 7,075,000	**$ 9,740,000**
5	**General Excavation**						
5a	Sedimentation Ponds	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5b	Clay Slope Cutback to 3:1	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5c	Clay Slope Protection	$/m2	-	$ 5.00	$ 10.00	$ -	$ -
5d	Disposal Site Clearing, Excavation and Cover	$/m3	-	$ 12.00	$ 24.00	$ -	$ -
						$ -	**$ -**
	Construction Total					**$ 11,693,888**	**$ 19,379,370**

Muskrat Falls Vegetation Removal Scenario A (ELC Selected, 101.85 ha)

Date: 02-Mar-18

	Area of wetland to be covered (ha)	Estimated Quantities 0.7m cover Volume (m^3)
Total Wetland Area as per ELC	**101.85**	**712,950**
Excluded Area	62.35	436,450
IEC Selected Area for Mitigation	39.50	276,500

Construction Costs							
Item	**Description**	**Unit**	**Quantity**	**Low Estimate Unit Cost**	**High Estimate Unit Cost**	**Low**	**High**
1	**Mobilization**						
1a	Contractor Mobilization/demobilization	% of Capex	1	$ 3,207,850	$ 4,811,775	$ 3,207,850	$ 4,811,775
1b	Contractor Compound	Lump	1	$ 150,000	$ 250,000	$ 150,000	$ 250,000
1c	Work Camp	Lump	1	$ 481,250	$ 700,000	$ 481,250	$ 700,000
1d	Engineering design and construction support	% of Capex	1	$ 1,844,514	$ 2,951,222	$ 1,844,514	$ 2,951,222
						$ 5,683,614	**$ 8,712,997**
2	**Wetland Covering**						
2a	Borrow Excavation/Placement	$/m3	712,950	$ 15.00	$ 30.00	$ 10,694,250	$ 21,388,500
						$ 10,694,250	**$ 21,388,500**
3	**Site Clearing (Barge) - Quantities 20% of total site clearing**						
3a	Overburden Excavation (includes O and A)	$/m3	-	$ 14.00	$ 30.00	$ -	$ -
						$ -	**$ -**
4	**Road Construction**						
4a	New Roads	$/lineal m	21,000	$ 150.00	$ 200.00	$ 3,150,000	$ 4,200,000
4b	Upgrade existing roads	$/lineal m	30,000	$ 51.00	$ 60.00	$ 1,530,000	$ 1,800,000
4c	Water crossing (900mm CSP)	Lump	20	$ 6,000	$ 12,000	$ 120,000	$ 240,000
4d	Road Maintenance (fall -winter- apr)	$/day	175	$ 13,000	$ 20,000	$ 2,275,000	$ 3,500,000
4e	Contingency for dualling of upto 50% of haul roads	$/lineal m	-	$ 101.00	$ 130.00	$ -	$ -
						$ 7,075,000	**$ 9,740,000**
5	**General Excavation**						
5a	Sedimentation Ponds	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5b	Clay Slope Cutback to 3:1	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5c	Clay Slope Protection	$/m2	-	$ 5.00	$ 10.00	$ -	$ -
5d	Disposal Site Clearing, Excavation and Cover	$/m3	-	$ 12.00	$ 24.00	$ -	$ -
						$ -	**$ -**
	Construction Total					**$ 20,302,864**	**$ 35,641,497**

Muskrat Falls Vegetation Removal Scenario B (0.5m)

Date: **02-Mar-18**

	Area of soil to be removed (ha)	Estimated Quantities 0.2m Removal Volume (m^3)	Estimated Quantities 0.5m Removal Volume (m^3)	Estimated Quantities Winter 1.5m Removal Volume (m^3)
Total Cleared Area	1756	3,512,000	8,780,000	26,340,000
Excluded Area	725	1,450,000	3,625,000	10,875,000
IEC Selected for Removal	**1031**	**2,062,000**	**5,155,000**	**15,465,000**

Construction Costs							
Item	Description	Unit	Quantity	Low Estimate Unit Cost	High Estimate Unit Cost	Low	High
1	**Mobilization**						
1a	Contractor Mobilization/demobilization	% of Capex	1	$ 24,649,100	$ 36,973,650	$ 24,649,100	$ 36,973,650
1b	Contractor Compound	Lump	1	$ 3,000,000	$ 4,500,000	$ 3,000,000	$ 4,500,000
1c	Work Camp	Lump	1	$ 3,850,000	$ 5,600,000	$ 3,850,000	$ 5,600,000
1d	Summer Season Road Maintenace	$/day	-	$ 3,000	$ 6,500	$ -	$ -
1e	Engineering design and construction support	% of Capex	1	$ 14,173,233	$ 22,677,172	$ 14,173,233	$ 22,677,172
						$ 45,672,333	**$ 69,750,822**
2	**Site Clearing**						
2a	Timber (all inclusive rate)	$/ha	-	$ 40,000	$ 65,000	$ -	$ -
2b	Overburden Excavation (includes O and A)	$/m3	5,155,000	$ 15.00	$ 30.00	$ 77,325,000	$ 154,650,000
						$ 77,325,000	**$ 154,650,000**
3	**Site Clearing (Barge) - Quantities 20% of total site clearing**						
3a	Overburden Excavation (includes O and A)	$/m3	-	$ 14.00	$ 30.00	$ -	$ -
						$ -	**$ -**
4	**Road Construction**						
4a	New Roads	$/lineal m	25,000	$ 150.00	$ 200.00	$ 3,750,000	$ 5,000,000
4b	Upgrade existing roads	$/lineal m	191,000	$ 51.00	$ 60.00	$ 9,741,000	$ 11,460,000
4c	Water crossing (900mm CSP)	Lump	143	$ 6,000	$ 12,000	$ 858,000	$ 1,716,000
4d	Road Maintenance (fall -winter- apr)	$/day	300	$ 13,000	$ 20,000	$ 3,900,000	$ 6,000,000
4e	Contingency for dualling of upto 50% of haul roads	$/lineal m	230,500	$ 101.00	$ 130.00	$ 23,280,500	$ 29,965,000
						$ 41,529,500	**$ 54,141,000**
5	**General Excavation**						
5a	Sedimentation Ponds	$/m3	480,000	$ 7.00	$ 15.00	$ 3,360,000	$ 7,200,000
5b	Clay Slope Cutback to 3:1	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5c	Clay Slope Protection	$/m2	-	$ 5.00	$ 10.00	$ -	$ -
5d	Disposal Site Clearing, Excavation and Cover	$/m3	850,000	$ 12.00	$ 24.00	$ 10,200,000	$ 20,400,000
						$ 13,560,000	**$ 27,600,000**
	Construction Total					**$ 174,336,833**	**$ 301,141,822**

Muskrat Falls Vegetation Removal Scenario B (1.5m)

Date: **02-Mar-18**

	Area of soil to be removed (ha)	Estimated Quantities 0.2m Removal Volume (m^3)	Estimated Quantities 0.5m Removal Volume (m^3)	Estimated Quantities Winter 1.5m Removal Volume (m^3)
Total Cleared Area	1756	3,512,000	8,780,000	26,340,000
Excluded Area	725	1,450,000	3,625,000	10,875,000
IEC Selected for Removal	**1031**	**2,062,000**	**5,155,000**	**15,465,000**

Construction Costs							
Item	Description	Unit	Quantity	Low Estimate Unit Cost	High Estimate Unit Cost	Low	High
1	**Mobilization**						
1a	Contractor Mobilization/demobilization	% of Capex	1	$ 60,169,100	$ 90,253,650	$ 60,169,100	$ 90,253,650
1b	Contractor Compound	Lump	1	$ 3,000,000	$ 4,500,000	$ 3,000,000	$ 4,500,000
1c	Work Camp	Lump	1	$ 8,181,250	$ 11,900,000	$ 8,181,250	$ 11,900,000
1d	Summer Season Road Maintenace	$/day	-	$ 3,000	$ 6,500	$ -	$ -
1e	Engineering design and construction support	% of Capex	1	$ 34,597,233	$ 55,355,572	$ 34,597,233	$ 55,355,572
						$ 105,947,583	**$ 162,009,222**
2	**Site Clearing**						
2a	Timber (all inclusive rate)	$/ha	-	$ 40,000	$ 65,000	$ -	$ -
2b	Overburden Excavation (includes O and A)	$/m3	15,465,000	$ 15.00	$ 30.00	$ 231,975,000	$ 463,950,000
						$ 231,975,000	**$ 463,950,000**
3	**Site Clearing (Barge) - Quantities 20% of total site clearing**						
3a	Overburden Excavation (includes O and A)	$/m3	-	$ 14.00	$ 30.00	$ -	$ -
						$ -	**$ -**
4	**Road Construction**						
4a	New Roads	$/lineal m	25,000	$ 150.00	$ 200.00	$ 3,750,000	$ 5,000,000
4b	Upgrade existing roads	$/lineal m	191,000	$ 51.00	$ 60.00	$ 9,741,000	$ 11,460,000
4c	Water crossing (900mm CSP)	Lump	143	$ 6,000	$ 12,000	$ 858,000	$ 1,716,000
4d	Road Maintenance (fall -winter- apr)	$/day	300	$ 13,000	$ 20,000	$ 3,900,000	$ 6,000,000
4e	Contingency for dualling of upto 50% of haul roads	$/lineal m	230,500	$ 101.00	$ 130.00	$ 23,280,500	$ 29,965,000
						$ 41,529,500	**$ 54,141,000**
5	**General Excavation**						
5a	Sedimentation Ponds	$/m3	480,000	$ 7.00	$ 15.00	$ 3,360,000	$ 7,200,000
5b	Clay Slope Cutback to 3:1	$/m3	-	$ 7.00	$ 15.00	$ -	$ -
5c	Clay Slope Protection	$/m2	-	$ 5.00	$ 10.00	$ -	$ -
5d	Disposal Site Clearing, Excavation and Cover	$/m3	2,500,000	$ 12.00	$ 24.00	$ 30,000,000	$ 60,000,000
						$ 33,360,000	**$ 67,200,000**
	Construction Total					**$ 409,062,083**	**$ 742,300,222**