

NEXT GENERATION HYDRO

Resources



Participant Package

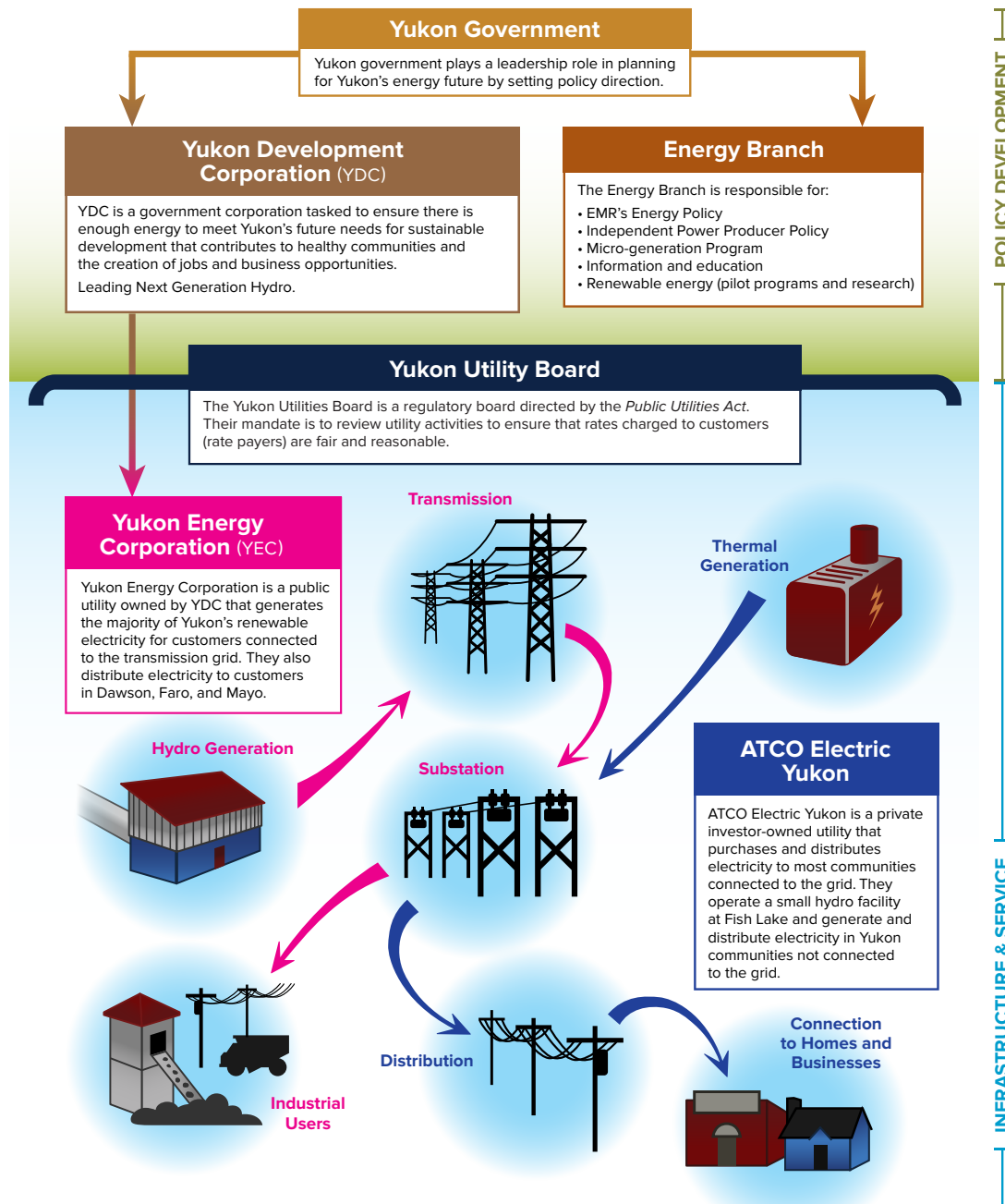
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YUKON'S ENERGY PARTNERS

Several key players have a role in ensuring that Yukon's electricity supply remains abundant, reliable, and cost effective for generations to come. Read more about each key organization and their role in the big picture.



YUKON HYDROELECTRIC POWER PLANNING DIRECTIVE CRITERIA

In early 2013, Yukon Government issued the Yukon Hydroelectric Power Planning Directive to Yukon Development Corporation (YDC).

The Directive tasks YDC to plan the development of one or more hydroelectric projects, to ensure together with supporting renewables and to the minimum extent feasible non renewable sources of electrical power, an adequate and affordable supply of reliable and sustainable electrical power in Yukon.



DIRECTIVE CRITERIA

1.0

“ Evaluate the expected growth in residential, commercial and industrial demand for electrical power in Yukon.”



DIRECTIVE CRITERIA

2.0

“ Plan for scalability, so as to allow for the increase of energy supply over time to meet projected demand growth.”



DIRECTIVE CRITERIA

3.0

“ Assess the project’s financial needs and risks, and evaluate options for project financing and financial risk mitigation.”



DIRECTIVE CRITERIA

4.0

“ Determine the anticipated positive and negative socio-economic and environmental effects of the project, and develop specific means of maximizing its benefits, minimizing its adverse effects and mitigating any unavoidable negative impacts.”



DIRECTIVE CRITERIA

5.0

“ In respect to the effects have particular regard to the impacts on and opportunities for, the First Nation or First Nations in whose traditional territory the project may be located.”



DIRECTIVE CRITERIA

6.0

“ Engage with First Nations to explore options for project locations as well as opportunities for partnership in project planning and execution.”



DIRECTIVE CRITERIA

7.0

“ Consider one or more specific possible locations for the project, taking into consideration the above criteria as well as proximity to the existing and expected future customer base.”

GLOSSARY OF TERMS

Energy Basics

Capacity (Demand): The supply (or consumption) of electrical power at a given instant in time. Usually measured in watts (W), kilowatts (kW) or megawatts (MW) depending on context. The annual peak demand is a key factor in sizing power lines and generators.

Kilowatt (kW) – 1000 watts

Megawatt (MW) – 1000 kW

Energy: The supply (or consumption) of electrical power over a period of time. Usually measured in kilowatt-hours (kWh) for residential usage or gigawatt-hours (GWh) for regional/territorial usage. The annual energy supply must at least cover the annual energy consumption.

Kilowatt hour (kWh) – amount of energy used or produced in an hour

Example: Energy is power x time (1 MW or 1000 kW x 8760 hours per year = 8.76 GWh)

Example: a 100 watt light bulb 10 hours consumes one kWh of electricity (100 watts x 10 hours = 1000 watts per hour (Wh) or 1 kWh)

Dispatchable Generation: Refers to sources of electricity that can be dispatched at the request of power grid operators; that is, generating plants that can be turned on or off, or can adjust their power output on demand. Also called “firm” energy.

Generation Resource: The primary energy source that is converted to electrical power. Common generation resources include hydro, wind, solar, or thermal (e.g. natural gas, coal or diesel).

Intermittent Energy: Any source of energy that is not continuously available due to some factor outside direct control (i.e. wind blowing, or sun shining).

Load: The electrical energy required to power homes, businesses and industrial processes. Sometimes referred to as demand.

Load Profile: A visualization of load (energy demand) over time.

Demand Side Management (DSM): The attempt to reduce overall electrical consumption at customer sites via initiatives, rate structures and or codes/standards. Demand side management, when used during peak demand periods, is useful to delay or avoid upgrading power infrastructure.

Electrical Grid or “The Grid”: The connected network of transmission lines, substations and distribution lines that brings power from sources (e.g hydro plants, wind turbines, diesel generators) to users (homes, businesses and industrial projects).

Transmission Lines: Conductors strung on overhead structures (wood pole or lattice steel towers) or placed underground that deliver electric power over long distances from power plants to substations.

Distribution Lines: Conductors strung on overhead structures or placed underground that deliver electric power from substations to user sites (e.g. homes, shopping centres, mines).

Resource Capacity: The quantity of a particular energy resource. It is usually reported on a site-by-site, regional or territorial basis in both capacity (MW) and energy (GWh) terms

Geothermal: The use of heat from the earth to generate electricity or provide space heating and cooling.

Biomass: Energy resources from organic matter, including wood, agriculture waste, and other living material that can be burned to produce electricity and heat.

Climate Change: A change in the average weather that a given region experiences. Climate change on a global scale includes changes to temperature, shifts in wind patterns, and changes to precipitation (from Climate Change Action Plan).

Independent Power Producer (IPP): An energy producer who generates electricity for sale to utilities or consumers such as the general public, businesses or industries.

Net Metering: When electricity consumers who own small, renewable energy generators such as wind or solar can receive a credit for a portion of the electricity they generate.

Renewable Energy: Energy that comes from sources renewed on an ongoing basis through natural processes. Examples include sun, wind, wood, flowing water, or relatively warm ground, air or water temperatures (from Climate Change Action Plan).

Sustainable Electricity: Is about pursuing innovative business strategies and operating activities that meet the needs of members, stakeholders and the communities in which we operate, while protecting and enhancing the legacy we leave for future generations (from Canadian Electricity Association).

The Public Utilities Act: Among other things defines a public utility as producing, generating, storing, transmitting, selling, delivering or furnishing electricity or gas to or for the public or a corporation for compensation. The act also defines the role of the Yukon Utilities Board (YUB) and the regulation of public utilities via a franchise. There are several Orders in Council that direct the YUB as well. One is the Rate Policy Directive (1995) O.I.C. 1995/090 that ensures ATCO Electric Yukon and Yukon Energy Corporation cannot charge

customers different rates and all Yukon residential customers who use 1000 kWh or less per month are charged the same no matter their location in Yukon.

Hydro Basics

Hydropower: A form of electrical power generated by converting the kinetic energy of moving water to electricity using a turbine. The capacity of the resource is influenced by the flow and elevation drop (head).

Storage Hydro: Is a type of hydroelectric generation where a storage reservoir is created to store water to accommodate fluctuating river flows.

Run of River Hydro: Is a type of hydroelectric generation where little or no water storage is used.

Micro Hydro: A category of very small hydropower generation that typically has a peak capacity of less than 100 kW and uses the natural flow of water.

Small Hydro: A category of hydropower generation that typically has a peak capacity of less than 10 MW and requires some form of weir in the stream or river.

Medium Hydro: A category of hydropower generation that typically has a peak capacity between 10 MW and 100 MW.

Generation: The source of electrical power be it hydro, wind, solar, or thermal (fossil fuel).

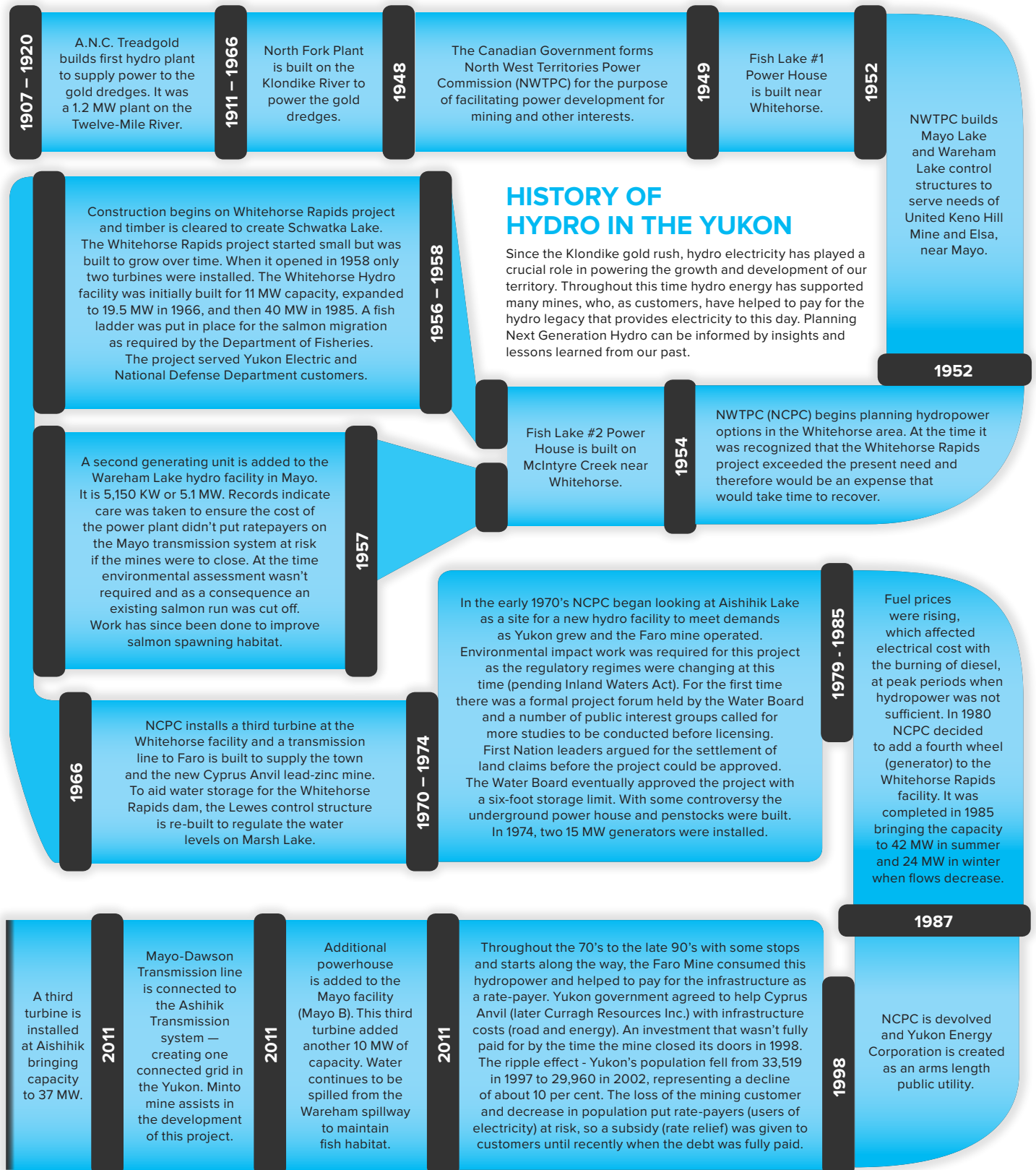
Yukon Hydroelectric Power Planning Directive: Yukon government issued 'The Directive' to Yukon Development Corporation (YDC) in 2013. It directs YDC to "plan one or more hydroelectric projects, together with supporting renewables and transmission." The directive has seven criteria for project selection.

Other

Sustainable Development: Beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent (Umbrella Final Agreement).

YESAB: Yukon Environmental and Socio-Economic Assessment Board

YESAA: Yukon Environmental and Socio-Economic Assessment Act



HISTORY OF HYDRO IN THE YUKON

Since the Klondike gold rush, hydro electricity has played a crucial role in powering the growth and development of our territory. Throughout this time hydro energy has supported many mines, who, as customers, have helped to pay for the hydro legacy that provides electricity to this day. Planning Next Generation Hydro can be informed by insights and lessons learned from our past.

HYDRO PROJECT DEVELOPMENT TIMELINE

A hydro facility is a large undertaking. It can take a minimum of 10-15 years to select, plan and build a hydro project. The chart below shows a typical development timeline for a hydro project. The timeline can shift when considering the development and exploration of several options at the same time.

Phase	Timeline
Project Identification Review of potential hydro sites and the development of a business case for one or more projects.	1-2 years
Pre-Feasibility Study Further explore selected options and refine technical analysis for decision-making.	2-3 years
Project Selection and Confirmation Select a project to move forward with.	1-2 years
Feasibility Study Further refine the technical analysis, examine business model options and partnerships.	2-3 years
Site Design and Planning Create a site plan and design for the hydro facility.	1-3 years
Assessment and Permitting Submit site plans to YESAA, affected First Nations and others for stakeholder consultation, assessment and permitting.	2-3 years
Construction & Commissioning Construct and commission the facility.	2-3 years
Operation	70+ years

MATCHING ENERGY NEED TO ENERGY AVAILABILITY

Electrical systems are built to continuously match the supply of electricity to customer demand. On a minute-by-minute, daily and seasonal basis our demand for electrical **energy peak** goes up and down depending on demand changes such as turning off and on lights, TVs, baseboard heating, stoves etc. To meet these changes in demand, the electrical system must have enough **capacity** to supply **energy** exactly when it is needed. As well, there needs to be enough stored energy to meet upcoming needs for future demand.

Energy and Capacity:

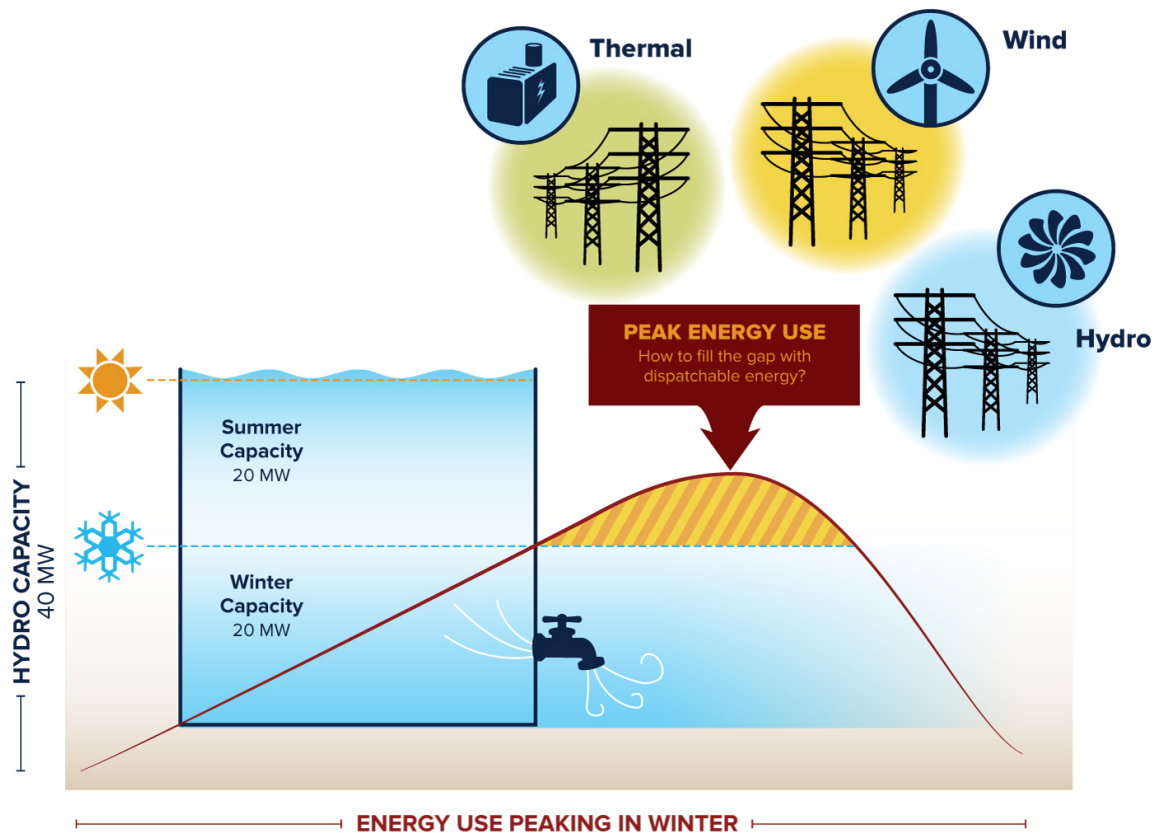
Electricity generation is measured via two related but different measures: **energy** and **capacity**.

Energy is a measure of power used over time and represents the “work” that could be done. For example, a 1 MW plant that operates for 1 hour is said to have produced 1 megawatt-hour (“MWh”) of energy.

Capacity is a measure of the ability of a given power source to produce power, typically measured in watts (“W”), kilowatts (“kW”), or megawatts (“MW”).

The difference between **energy** and **capacity** is important to understand and key to thinking about the requirements of an electrical generation source. Put simply, **energy** is what we consume to do work (e.g. cook food, light & heat our homes) and **capacity** is the assurance that the energy we want to use is instantly available when energy is required.

The image below (next page) shows a reservoir with 40MW total capacity. The bottom half of the tank represents winter capacity. In this case only 20MW of capacity is available in the winter and all 40MW is available in the summer. When capacity is released and put to use it turns into energy. When the energy needed exceeds the capacity (at peak times) held in the tank then other energy sources are needed. These energy sources must be dispatchable (see below) in order to meet the short-term peak need.



Dispatchable and Intermittent Energy sources:

Electric generation sources (hydroelectricity, wind, solar, diesel, natural gas) can be thought of in terms of their ability to supply energy on a longer-term basis, and their capacity to provide energy when the energy is needed (peak times).

Generation sources that can be called upon at any time to generate electricity are said to be **dispatchable**. These **dispatchable** generation sources have dependable capacity and deliver what is called firm energy because energy is consistently available when required. Examples of **dispatchable** generation sources that provide larger quantities of “firm” energy are hydroelectric projects with water storage, natural gas generation and diesel generation.

Generation sources that generate electricity only when their fuel supply is available, and not necessarily when the energy is needed, are called intermittent generators. Examples of intermittent generators are wind, solar power and some run of river hydro projects.

Turning Electricity On and Off

Another important characteristic to consider when comparing different generation options is the speed at which various power sources are able to turn on and off and to change generation levels (e.g. ramp up and ramp down).

For example, coal and nuclear plants need days or weeks to start-up and shut-down. These power sources are run to meet “base loads” or the constant amount of power needed on any given day.

Other generation options, such as hydro-with- storage, simple cycle gas turbines, and natural gas reciprocating engines, can be dispatched quickly to meet short-term changes in demand for power. For example, they can be ramped up to provide lots of power in the morning when everyone wakes up, and ramped down once everyone goes to work. These variable types of generators have the ability to change the amount of energy supplied frequently in response to short term (e.g. hourly, daily) changes in demand.

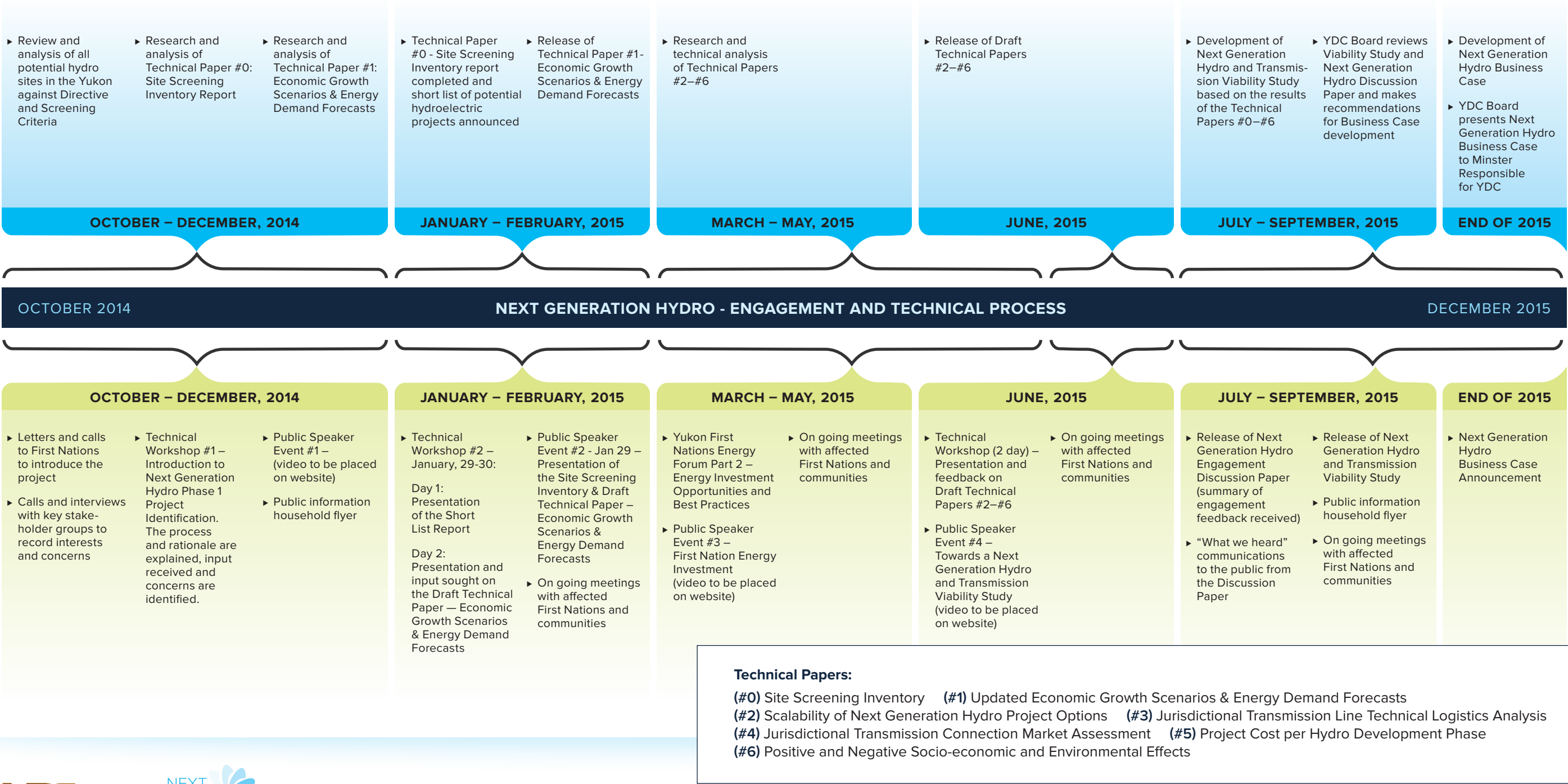
NEXT GENERATION HYDRO -
ENGAGEMENT AND TECHNICAL PROCESS OVERVIEW

Two teams, engagement and technical, are working together to achieve the work identified in the Next Generation Hydro Work Plan.

The chart below demonstrates the key activities in each stream of work over the course of 2015.

The **Technical Team** will work to the end of 2015 to narrow the number of potential hydro sites based on the criteria identified in the Yukon Hydroelectric Power Planning Directive. The team will draft a number of technical reports that will assess the feasibility of the short listed potential hydro projects against the Directive criteria.

The **Engagement Team** will work along-side the technical team to inform and receive input from First Nations, as well as stakeholders and the public, as technical papers are produced. Engagement feedback will be collected and reported in the Next Generation Hydro Discussion Paper and will be considered in the development of the Next Generation Hydro and Transmission Viability Study.



SITE SCREENING PROCESS

The technical team has reviewed, compared and ranked over 200 potential hydro sites in the Yukon to determine suitable sites to meet our electricity needs 20–50 years from now. Studies from the last 60 years were reviewed and compiled in this process. The methodology below provides an overview of how the sites were short listed.

PART 1

SCREEN 0 Reconciliation of Known Projects

Duplicate projects and projects with not enough detail of study were eliminated.

SCREEN 1 Fundamental Development Barrier Screen

Projects that had the following characteristics were eliminated:

- Main stem of the Yukon River
- Urban flooding
- Projects in a National Park
- Projects smaller than 10MW
- Incorrect project type (projects that were water diversion only, storage only, or pumped storage)

SCREEN 2 Fundamentally Uneconomic Screen

High-level project costing and energy production assumptions were used to eliminate projects that were fundamentally uneconomic. Any project expected to produce energy at a higher cost than the equivalent thermal generator (18.3¢/kWh) were screened out from further study.

16 PROJECTS OF INTEREST

PART 2

The 16 projects of interest were reviewed according to the four following areas.

AREA 1 Environmental Considerations	AREA 2 Surface / Subsurface Considerations	AREA 3 Constructibility Considerations	AREA 4 Economic Considerations
<ul style="list-style-type: none">• Fish Habitat• Aquatic Species at Risk• Terrestrial Species at Risk	<ul style="list-style-type: none">• Land Tenure (surface & subsurface)• First Nation Settlement Lands	<ul style="list-style-type: none">• Permafrost Classification• Terrain Hazards• Bedrock Faults	<ul style="list-style-type: none">• Value of Storage• Ability to Deliver Winter Energy

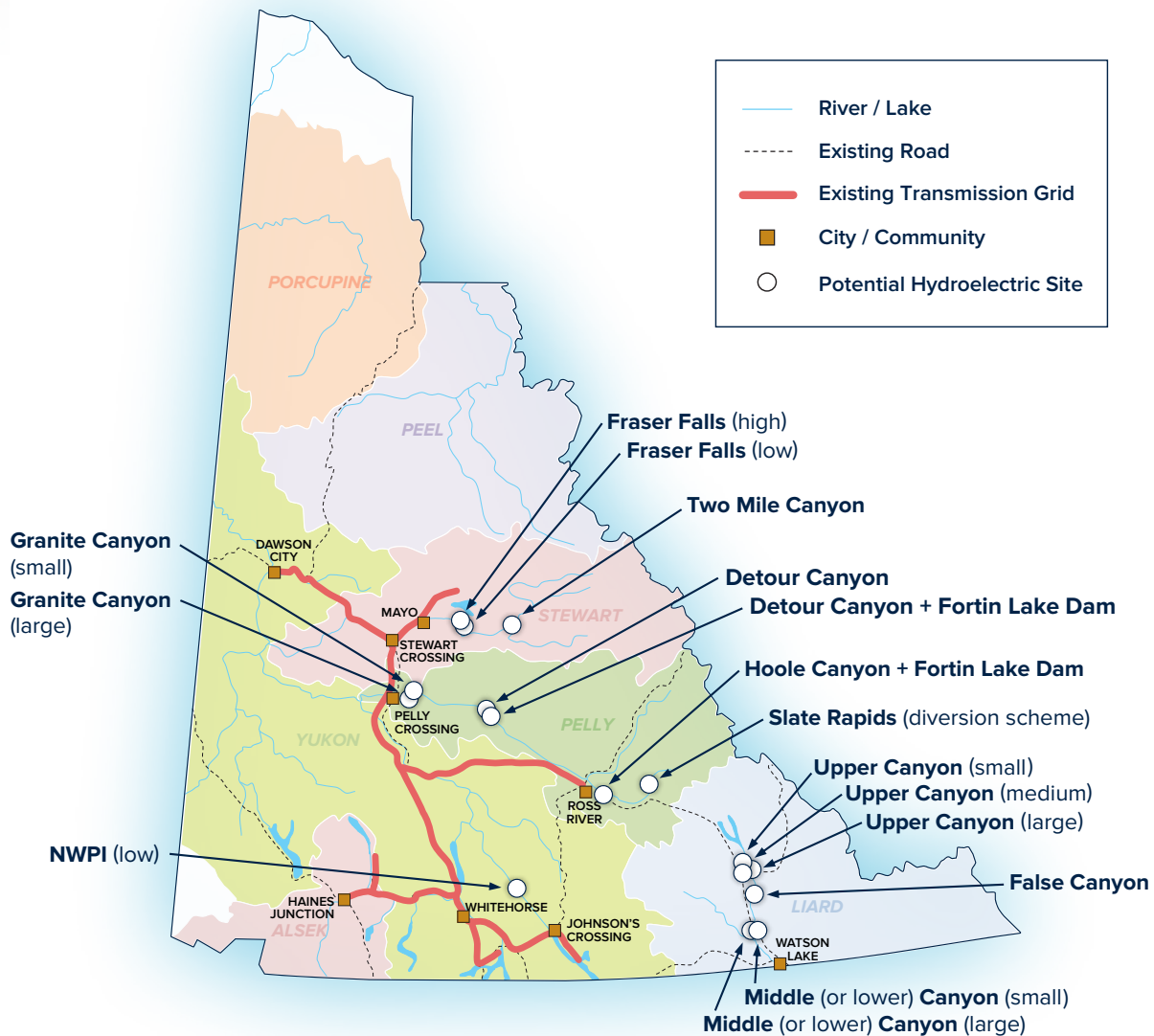
Based on this analysis short-listed sites were recommended to be reviewed as part of the viability study.

SHORT LIST

The next step is to assess the short listed sites against the technical criteria from the Yukon Hydroelectric Power Planning Directive and recommend one or more for business case development.

NEXT GENERATION HYDRO

SHORT LIST SITE MAP | JANUARY 2015



DETOUR CANYON

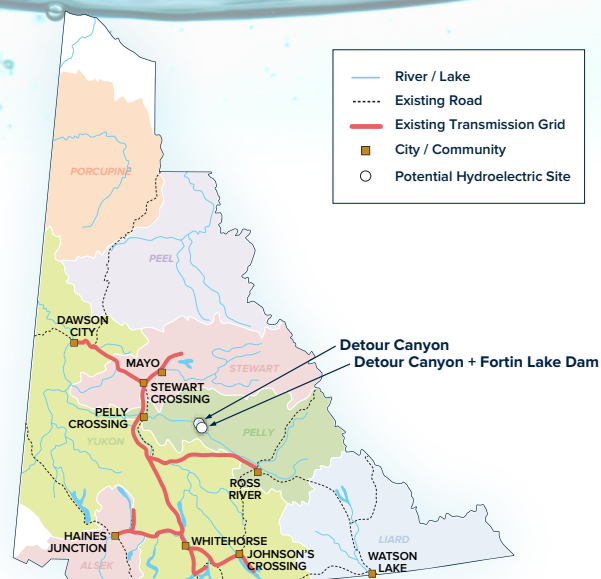
with or without FORTIN LAKE DAM

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
65-100 MW	80 km	Faro and Ross River	Acceptable
		RIVER	
		Pelly River	

PROJECT DESCRIPTION

Detour Canyon is a potential 65 MW hydroelectric project on the Pelly River, located in the Pelly River Basin approximately 80 km downstream (northwest) of Faro.

Detour Canyon + Fortin Lake Dam is a two dam project that expands on the above mentioned Detour Canyon project with the addition of a storage reservoir on Fortin Lake. The Fortin Lake dam is located approximately 95 km east of the community of Ross River and provides additional storage capability by flooding Fortin Lake and Pelly Lake. While the design and layout of the main power dam in Detour Canyon remains the same, the additional storage from the upstream Fortin Lake allows for an increased installed capacity of 100 MW.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Good ability to meet long term outlook (50 year) future energy gaps
- Terrestrial Species-at-Risk noted, but no major constraints expected

CONS:

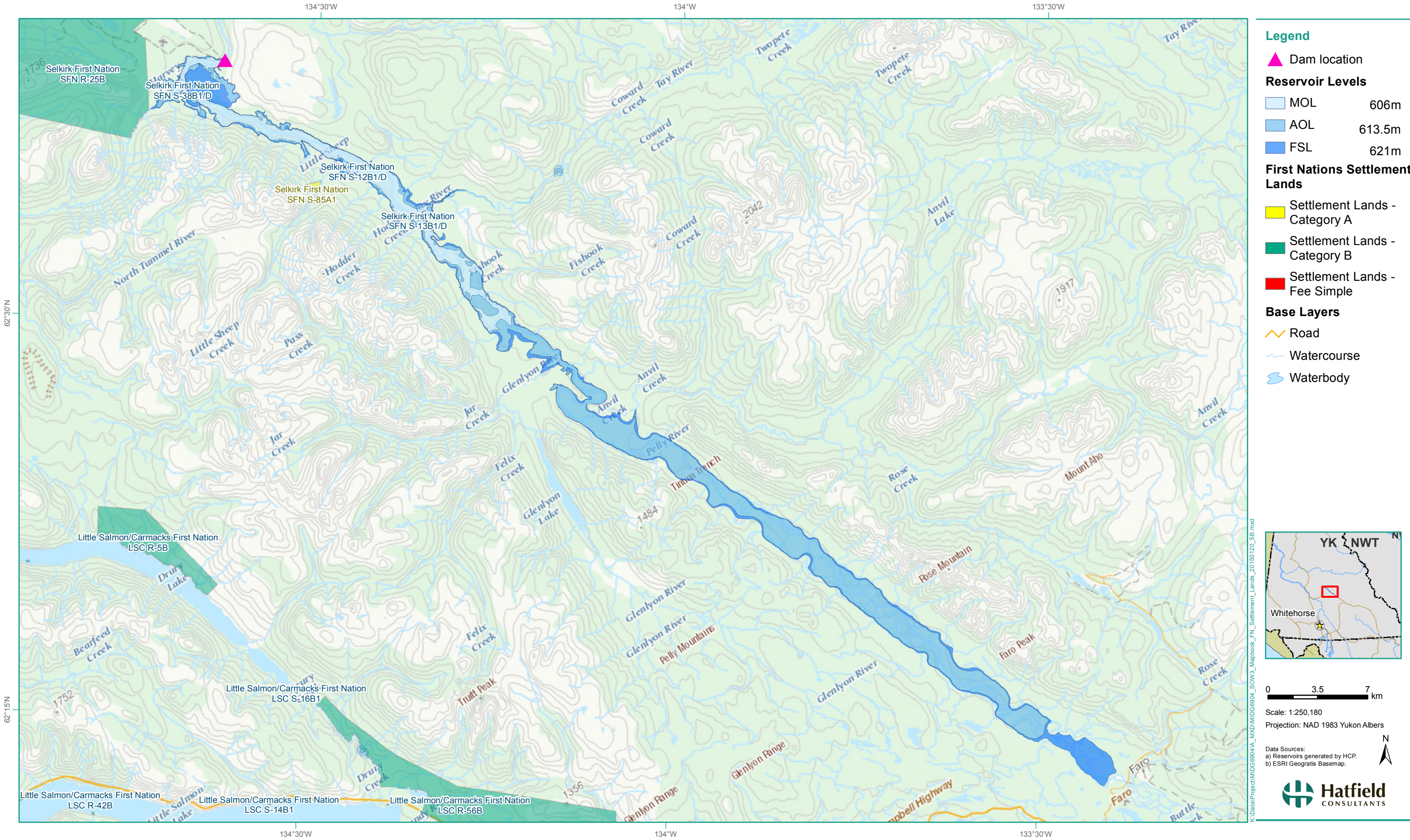
- River deemed as having a high suitability for fish habitat (in both the Detour Canyon and Fortin Lake areas)
- Anvil Creek (which is flooded) is a Special Consideration zone for fisheries
- Presence of Land Tenure, First Nations Settlement Lands, and Interim Projected Lands
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- The 100 MW version (with Fortin Dam) is likely oversized
- Fortin Lake Dam Only: Terrestrial SAR flagged as having moderate mitigation issues
- Fortin Lake Dam Only: Constructability risks deemed high

Recommendation: Study further, including scalability analysis to re-evaluate project size (likely resulting in a smaller project)

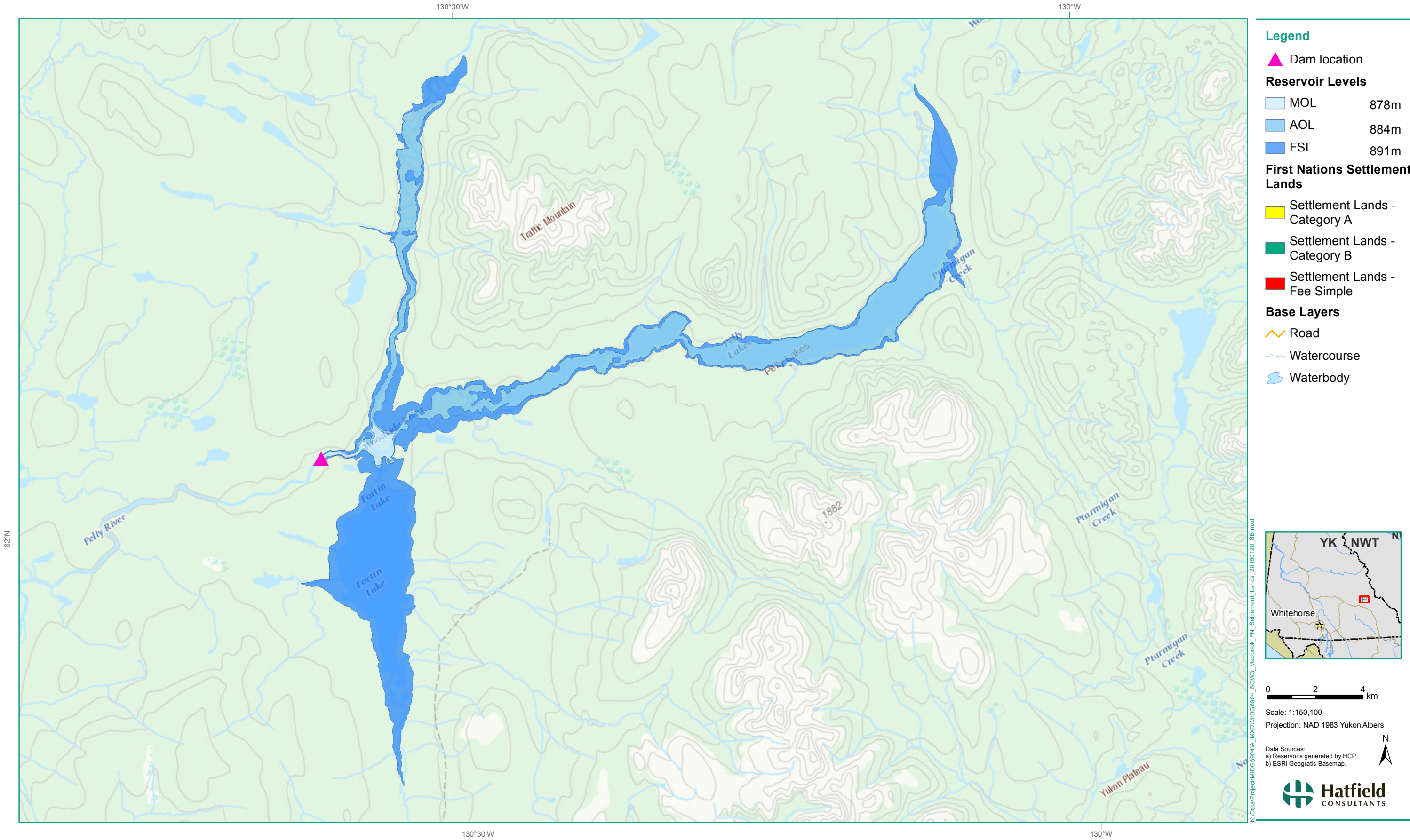
AREA OF STUDY	WITHOUT FORTIN DAM	WITH FORTIN DAM
Environmental (Fisheries)	H	H
Environmental (Aquatic SAR)	L	L
Environmental (Terrestrial SAR)	L	M
Surface/Subsurface Tenure	H	H
Constructability	M	H
Economic (Meeting Gap)	L	L
Economic (Size vs. Need)	M	H

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 1 – Detour Canyon [Site ID = PELLY-PELLY-0567-A & PELLY-PELLY-0567-B]
(Note: This map shows the main power dam location only. See Map 2 for the Fortin Lake Dam component of the 'Detour Canyon + Fortin Lake Dam' project.)



FIRST NATIONS SETTLEMENT LANDS
Map 2 – Fortin Lake Dam [Site ID = PELLY-PELLY-0567-B & PELLY-PELLY-0760-A]
(Note: This map shows the Fortin Lake Dam component of the 'Detour Canyon + Fortin Lake Dam' and 'Hoole Canyon + Fortin Lake Dam' projects. See Map 1 and Map 8 for the main power dam components of these projects.)



FALSE CANYON

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
58 MW	10 km to potential future transmission 310 km to existing transmission	Watson Lake	Acceptable
		RIVER	
		Frances River	

PROJECT DESCRIPTION

False Canyon is a potential 58 MW hydroelectric project on the Frances River, located in the Liard River Basin approximately 75 km north of Watson Lake. The project first appeared in T. Ingeldow & Associates Limited's report entitled "Power Survey of the Liard River Basin and Northwest Territories" in 1970.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- Constructability risks deemed low
- Good ability to meet long term outlook (50 year) future energy gaps

CONS:

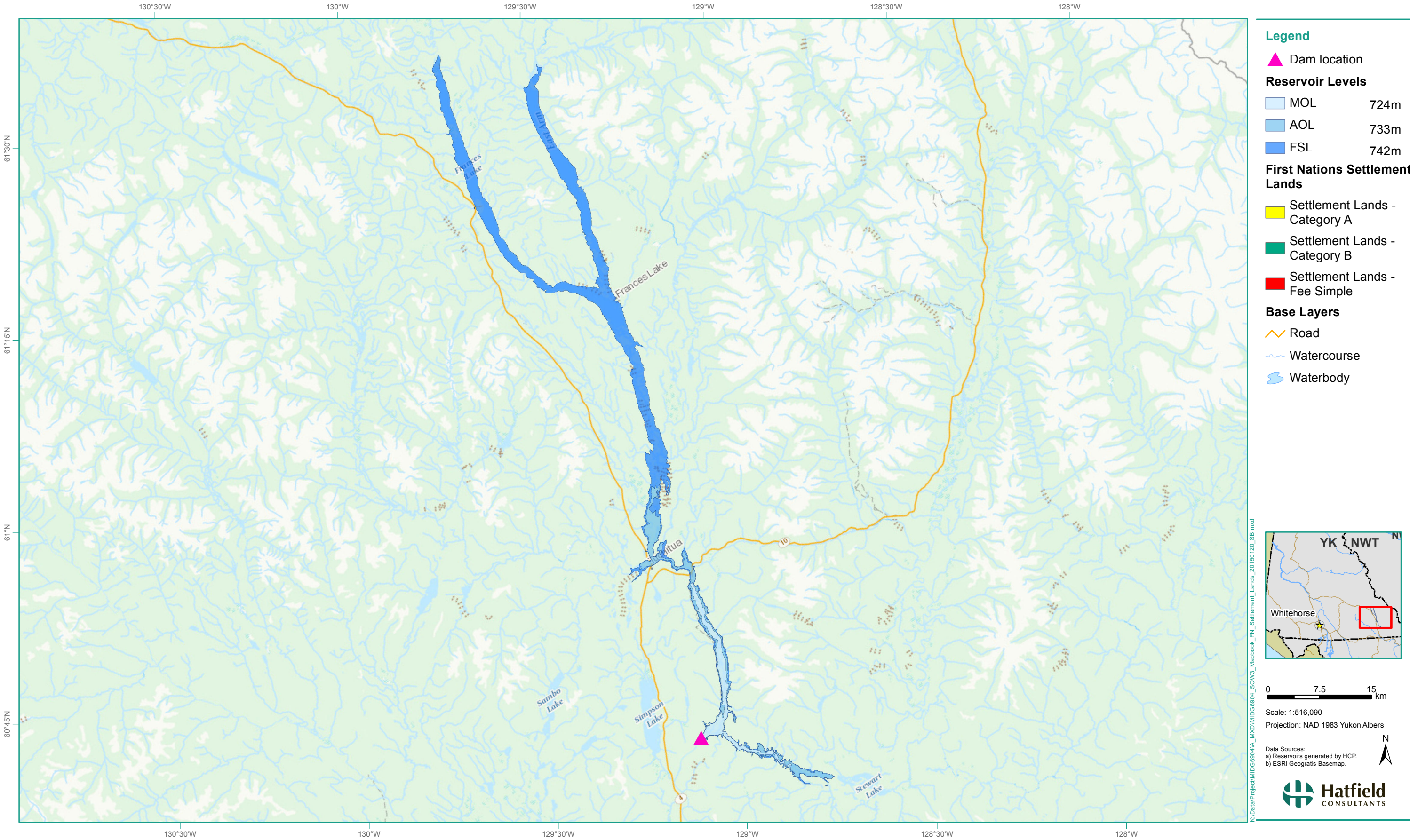
- Relocation of existing highways and bridges required
- Frances Lake (which is flooded) is noted as fisheries Conservation Waters with depressed fisheries stocks
- Frances River is flagged for potential Transboundary fisheries issues
- Aquatic Species-at-Risk present in watershed
- Terrestrial Species-at-Risk flagged as having moderate mitigation issues
- Presence of Land Tenure and Interim Projected Lands noted

Recommendation: Study further, including scalability analysis to re-evaluate project size

AREA OF STUDY	FALSE CANYON
Environmental (Fisheries)	H
Environmental (Aquatic SAR)	H
Environmental (Terrestrial SAR)	M
Surface/Subsurface Tenure	H
Constructability	L
Economic (Meeting Gap)	L
Economic (Size vs. Need)	M

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 3 – False Canyon [Site ID = LIARD-FRANC-0696]



FRASER FALLS

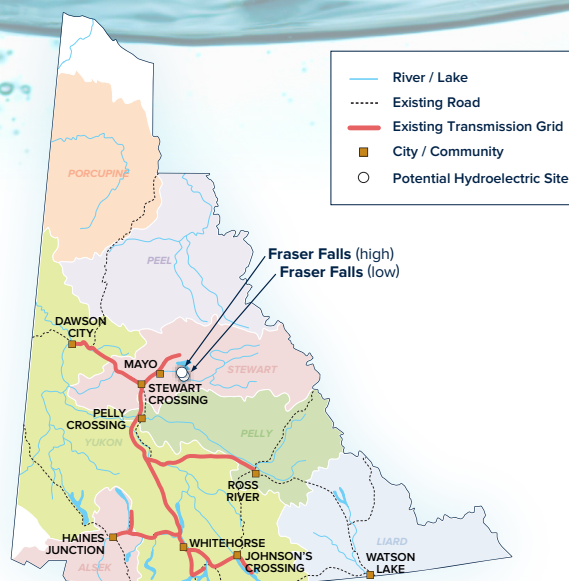
HIGH and LOW

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
100 - 300 MW	80 km	Mayo	Excellent
		RIVER	
		Stewart River	

PROJECT DESCRIPTION

Fraser Falls (High) is a potential 300 MW hydroelectric project on the Stewart River, located in the Stewart River Basin approximately 40 km upstream of Mayo.

Fraser Falls (Low) is a 100 MW hydroelectric project that is a smaller alternative to the above mentioned "Fraser Falls (High)" project. The Fraser Falls (Low) project is located at the same location (approximately 40 km upstream of Mayo on the Stewart River).



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Good ability to meet long term outlook (50 year) future energy gaps

CONS:

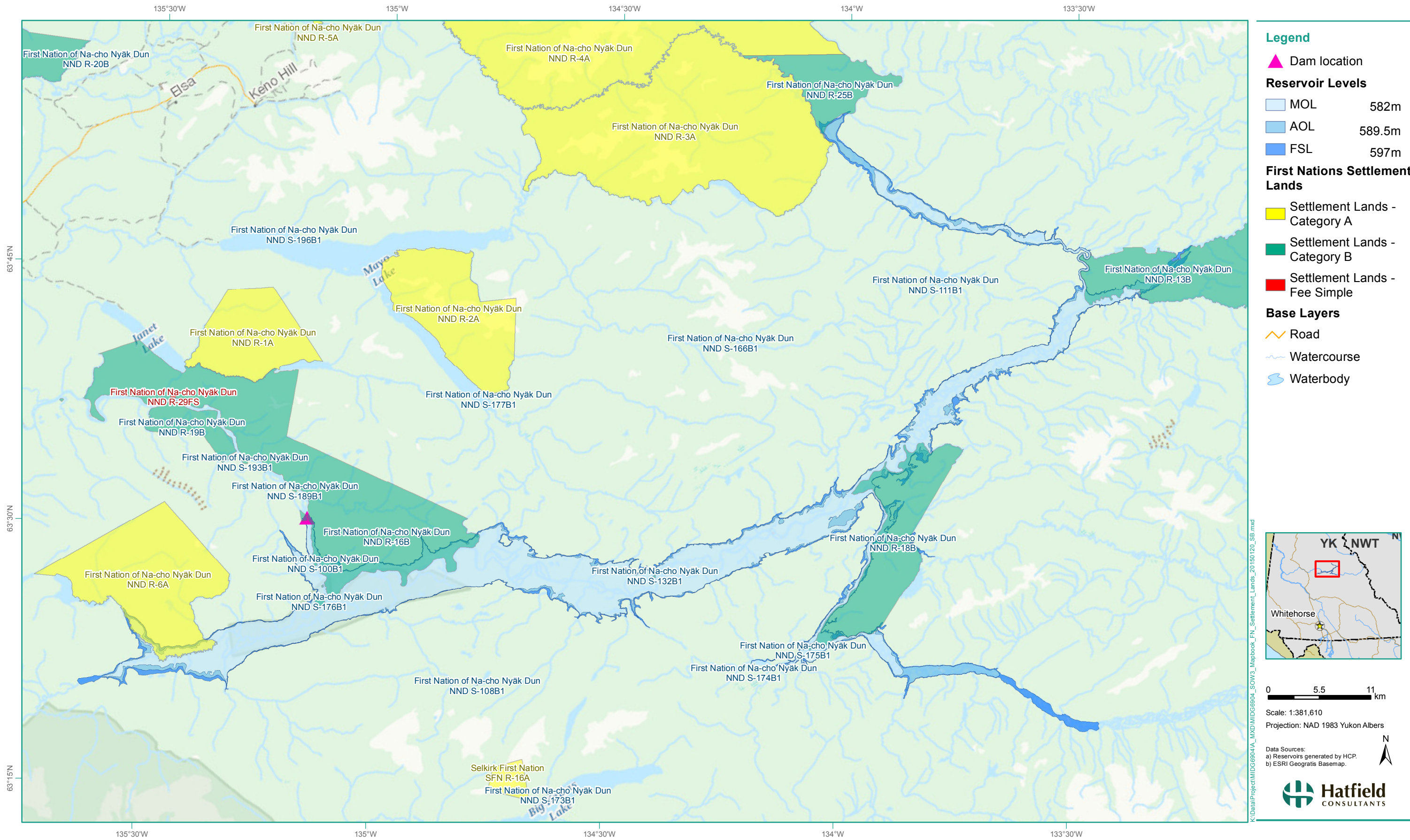
- River deemed as having a high suitability for fish habitat
- Horseshoe Slough (which is flooded) is deemed a Habitat Protection Area
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Terrestrial Species-at-Risk flagged as having moderate mitigation issues
- Presence of Land Tenure (for High option only) and First Nations Settlement Lands noted
- Constructability risks deemed high
- Both the 100 MW and 300 MW versions are likely oversized

Recommendation: Study further, including scalability analysis to re-evaluate project size (likely resulting in a smaller project)

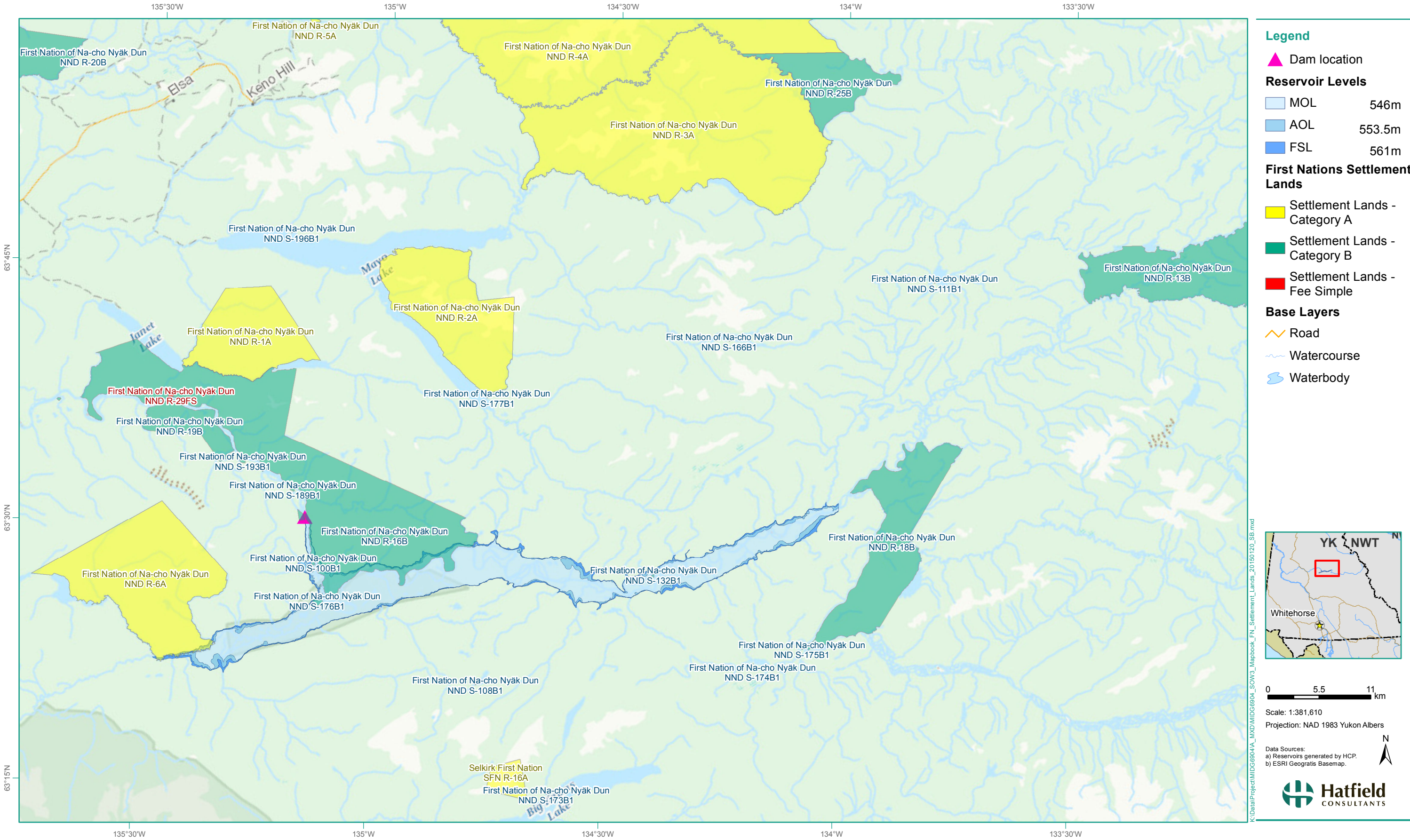
AREA OF STUDY	LOW VERSION	HIGH VERSION
Environmental (Fisheries)	H	H
Environmental (Aquatic SAR)	H	H
Environmental (Terrestrial SAR)	M	M
Surface/Subsurface Tenure	H	H
Constructability	H	H
Economic (Meeting Gap)	L	L
Economic (Size vs. Need)	H	H

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 4 – Fraser Falls (High) [Site ID = STEWA-STEWA-0519-B]




FIRST NATIONS SETTLEMENT LANDS
Map 5 – Fraser Falls (Low) [Site ID = STEWA-STEWA-0519-A]



GRANITE CANYON

LARGE and SMALL

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
 80-254 MW	 15 km	Pelly Crossing	 Acceptable
		RIVER	
		Pelly River	

PROJECT DESCRIPTION

Granite Canyon (Large) is a potential 254 MW hydroelectric project on the Pelly River, located in the Pelly River Basin approximately 20 km east of Pelly Crossing.

Granite Canyon (Small) is an 80 MW hydroelectric project that is a smaller alternative to the above mentioned "Granite Canyon (Large)" project. The Granite Canyon (Small) project is located at the same location (approximately 20 km east of Pelly Crossing.)



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Good ability to meet long term outlook (50 year) future energy gaps

CONS:

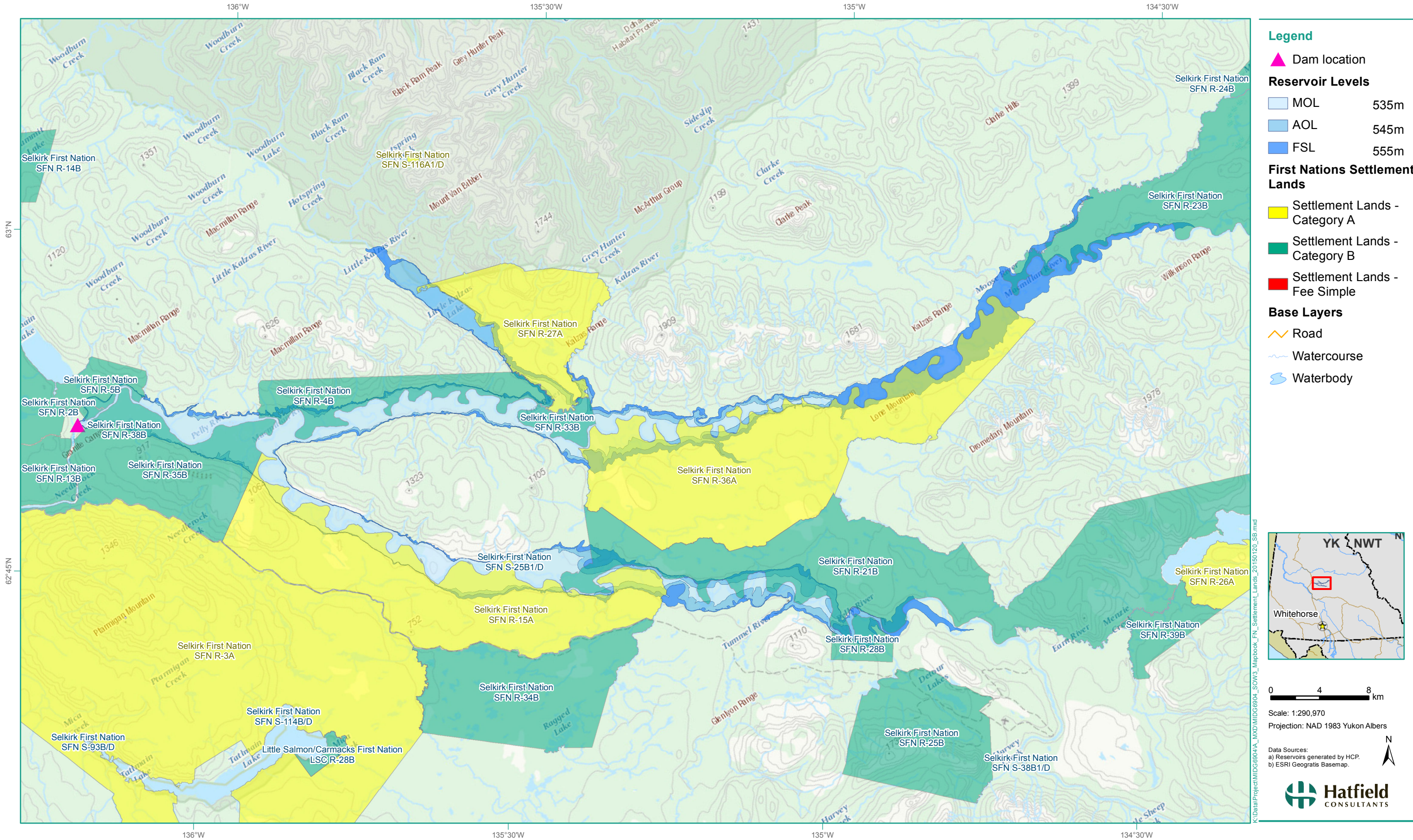
- River deemed as having a high suitability for fish habitat
- Needlerock and Mica Creek are Special Consideration Zones
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Terrestrial Species-at-Risk flagged as having significant mitigation issues
- Presence of Land Tenure and First Nations Settlement Lands noted
- Constructability risks deemed high
- Both the 80 MW and 254 MW versions are likely oversized

Recommendation: Study further, including scalability analysis to re-evaluate project size (likely resulting in a smaller project)

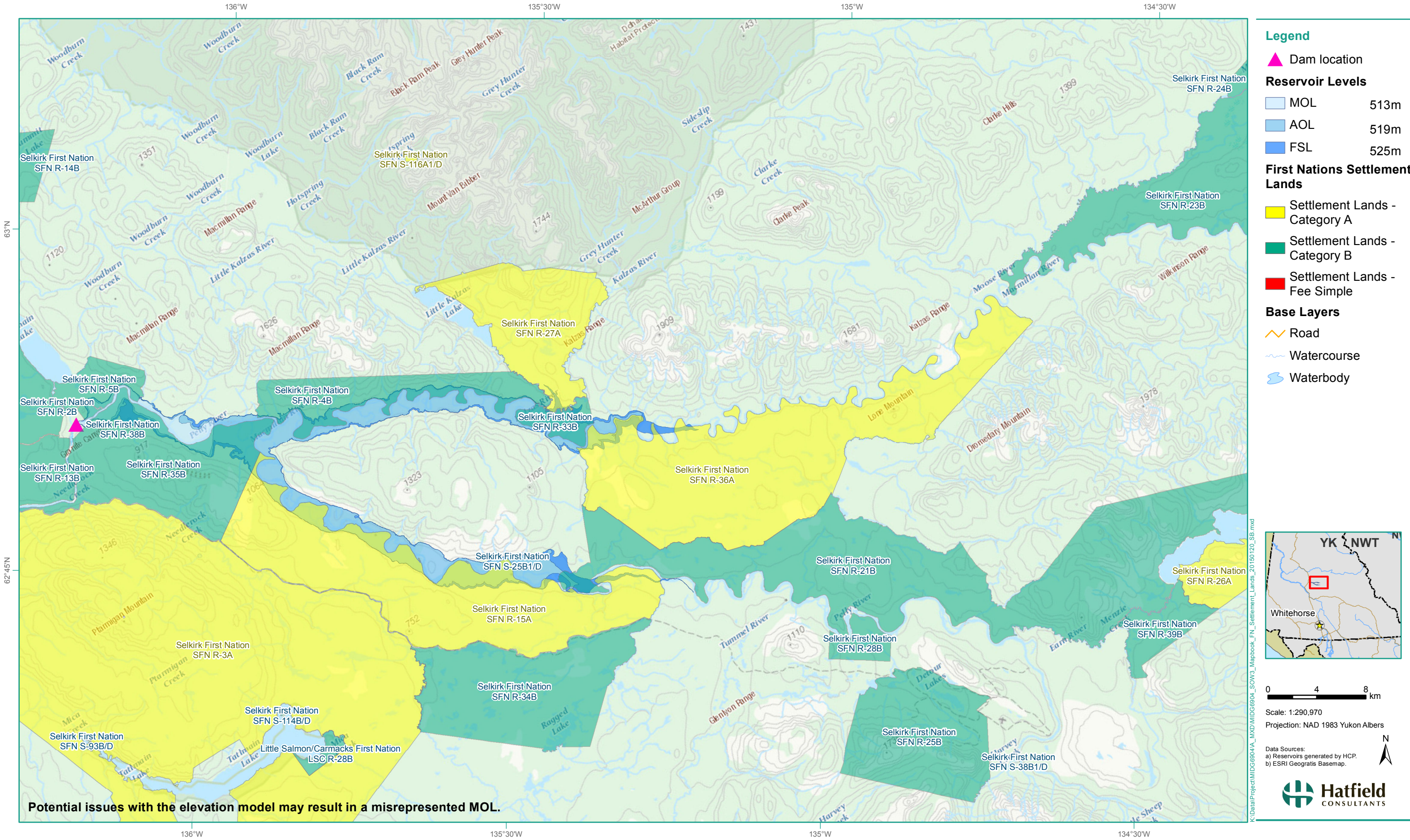
AREA OF STUDY	SMALL VERSION	LARGE VERSION
Environmental (Fisheries)	H	H
Environmental (Aquatic SAR)	L	L
Environmental (Terrestrial SAR)	H	H
Surface/Subsurface Tenure	H	H
Constructability	H	H
Economic (Meeting Gap)	L	L
Economic (Size vs. Need)	H	H

H = High effects M = Medium effects L = Low effects




FIRST NATIONS SETTLEMENT LANDS
Map 6 – Granite Canyon (Large) [Site ID = PELLY-PELLY-0480-B]



FIRST NATIONS SETTLEMENT LANDS
Map 7 – Granite Canyon (Small) [Site ID = PELLY-PELLY-0480-A]



HOOLE CANYON + FORTIN LAKE DAM

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
 40 MW	 10 km to potential future transmission 85 km to existing transmission	Ross River	 Acceptable
		RIVER	
		Pelly River	

PROJECT DESCRIPTION

Hoole Canyon + Fortin Lake Dam

is a potential 40 MW hydroelectric project on the Pelly River, with the main power dam located in the Pelly River Basin approximately 30 km upstream of the community of Ross River. The Fortin Lake storage dam is located upstream of the main power dam approximately 95 km east of the community of Ross River, providing additional storage capability by flooding Fortin Lake and Pelly Lake.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Able to meet majority of future energy gaps, although limitations noted when approaching 50 year outlook

CONS:

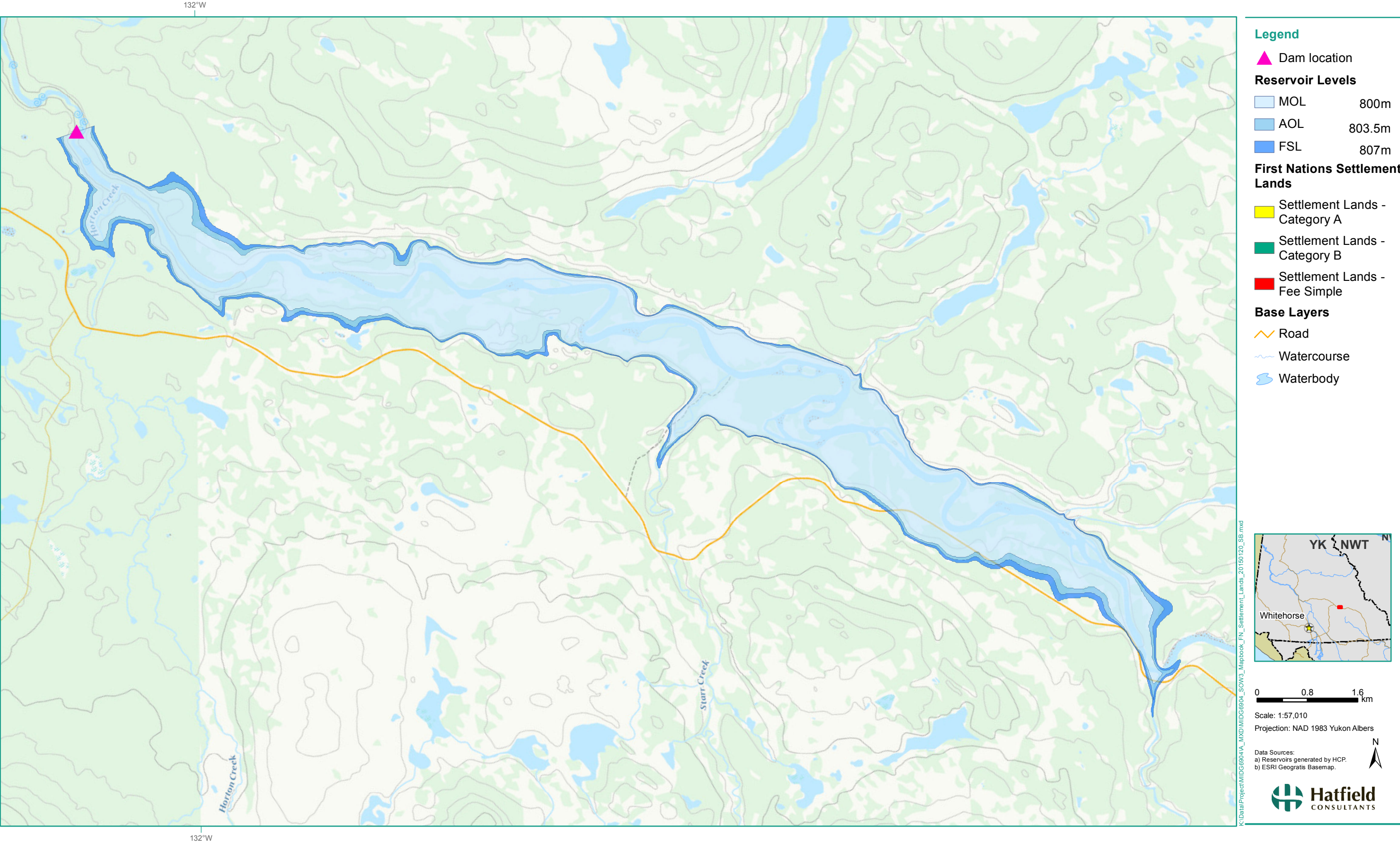
- River deemed as having a high suitability for fish habitat
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Terrestrial Species-at-Risk flagged as having moderate mitigation issues noted
- Presence of Land Tenure and First Nations Interim Protected Lands noted
- Constructability risks deemed high

Recommendation: Study Further, including analysis to re-evaluate the balance between project size, reservoir storage, and project impacts

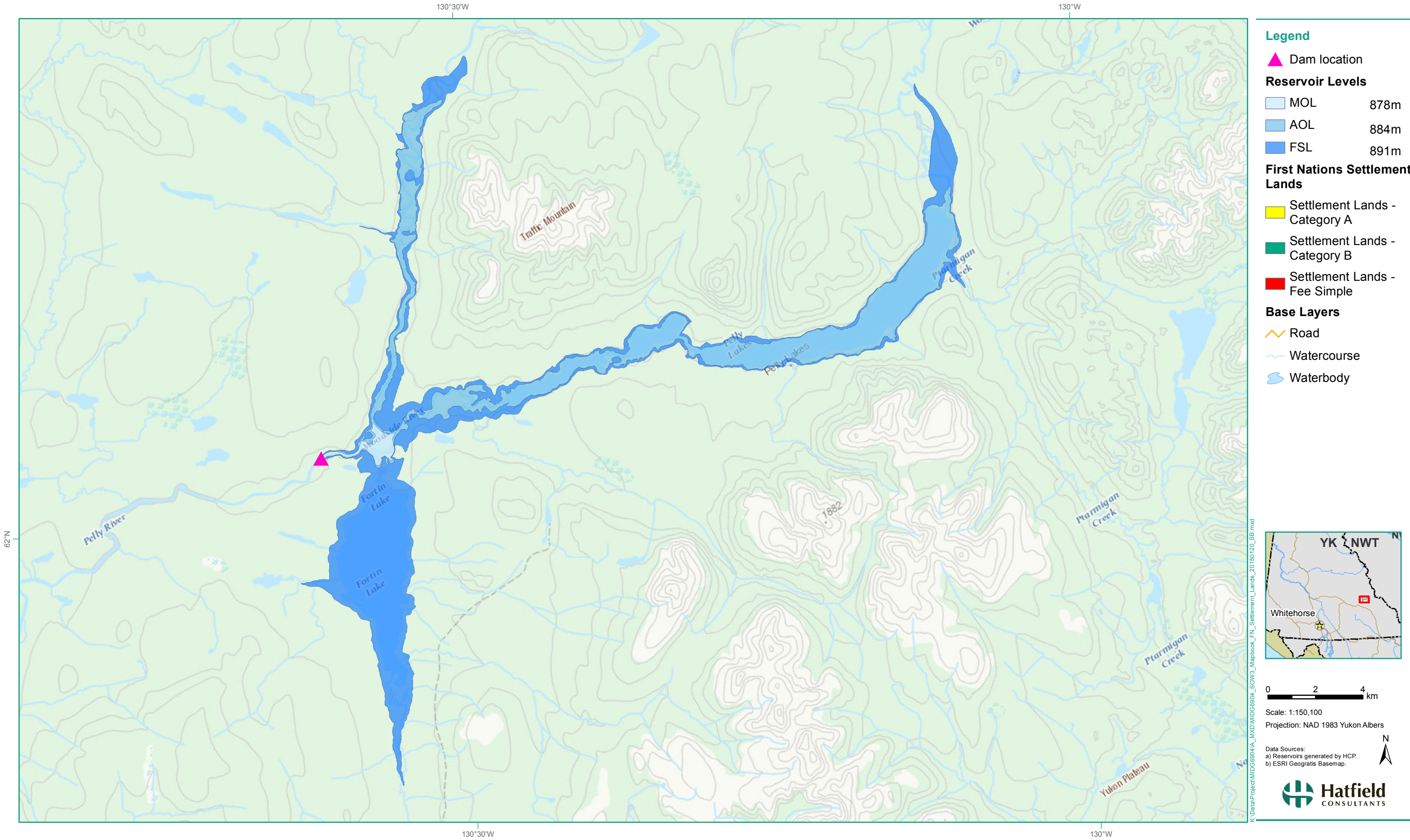
AREA OF STUDY	HOOLE CANYON + FORTIN LAKE DAM
Environmental (Fisheries)	H
Environmental (Aquatic SAR)	L
Environmental (Terrestrial SAR)	M
Surface/Subsurface Tenure	H
Constructability	H
Economic (Meeting Gap)	M
Economic (Size vs. Need)	M

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 8 – Hoole Canyon [Site ID = PELLY-PELLY-0760-A]
(Note: This map shows the main power dam location only. See Map 2 for the Fortin Lake Dam component of the 'Hoole Canyon + Fortin Lake Dam' project.)



FIRST NATIONS SETTLEMENT LANDS
Map 2 – Fortin Lake Dam [Site ID = PELLY-PELLY-0567-B & PELLY-PELLY-0760-A]
(Note: This map shows the Fortin Lake Dam component of the 'Detour Canyon + Fortin Lake Dam' and 'Hoole Canyon + Fortin Lake Dam' projects. See Map 1 and Map 8 for the main power dam components of these projects.)



MIDDLE (OR LOWER) CANYON

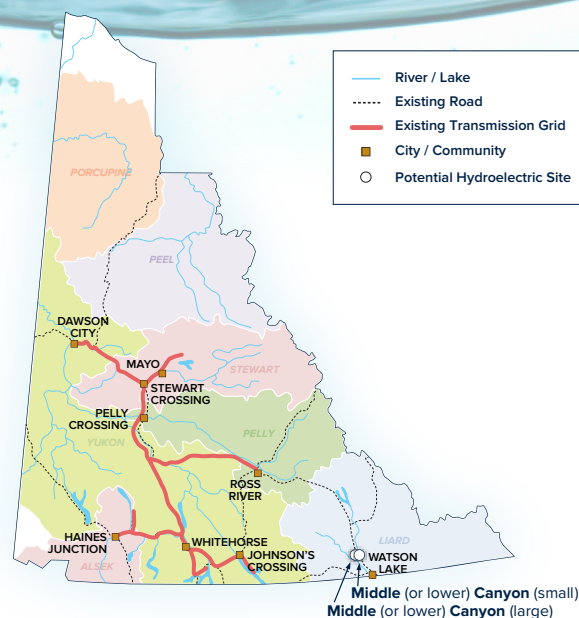
LARGE and SMALL

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
14-75 MW	10 km to future transmission 280 km to existing transmission	Watson Lake	Acceptable
		RIVER	
		Frances River	

PROJECT DESCRIPTION

Middle (or Lower) Canyon (Large) is a potential 75 MW hydroelectric project on the Frances River, located in the Liard River Basin approximately 40 km northwest of Watson Lake.

Middle (or Lower) Canyon (Small) is a 14 MW hydroelectric project that is a smaller alternative to the above mentioned “Middle (or Lower) Canyon (Large).” The Middle (or Lower) Canyon (Small) project is located at the same location (approximately 40 km northwest of Watson Lake.)



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- Constructability risks deemed low
- Terrestrial Species-at-Risk noted, but no major constraints expected
- Small Version Only: More efficient use of water available (not oversized in medium term outlook)
- Large Version Only: Better ability to meet long term (50 year) future energy gaps

CONS:

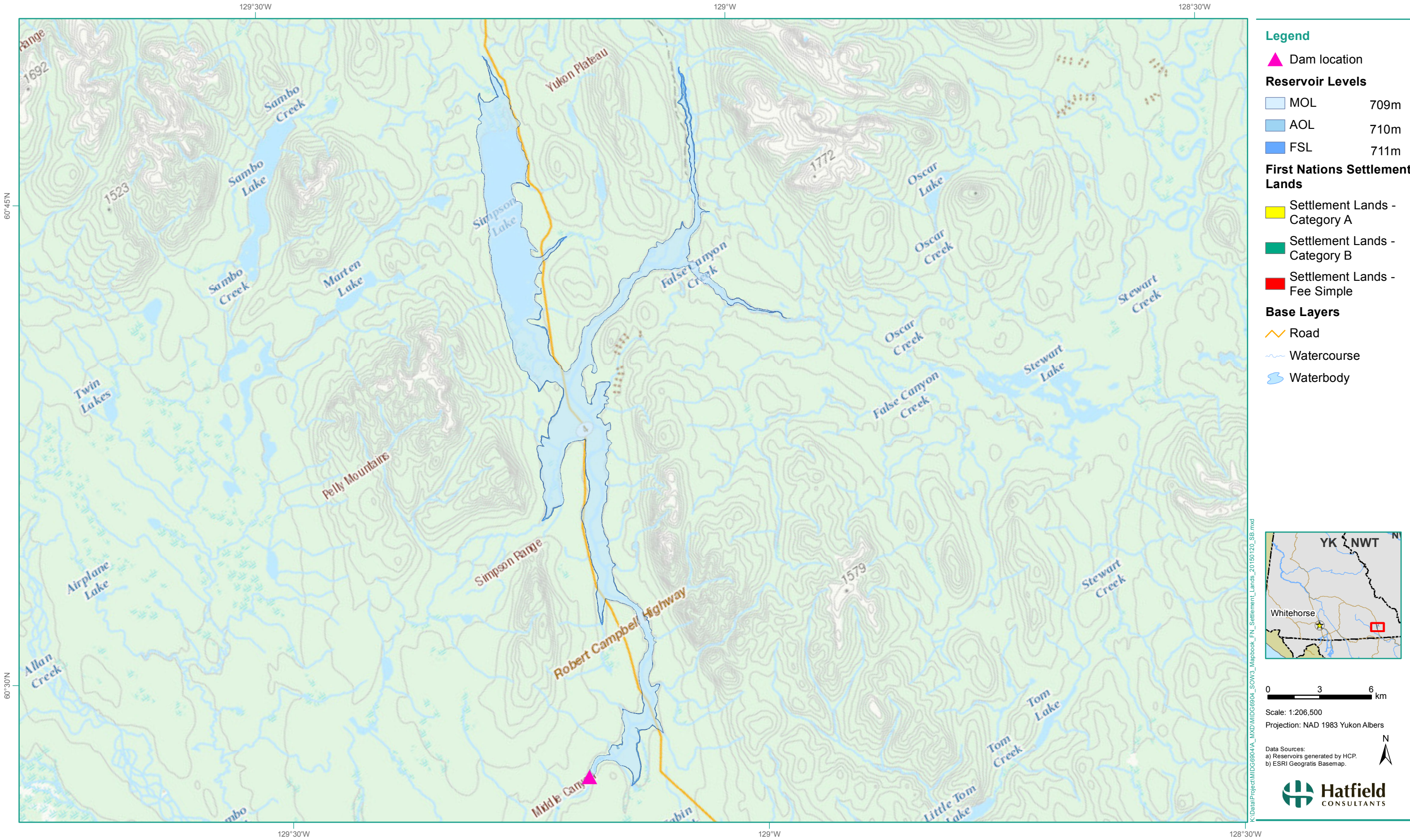
- Frances River is flagged for potential Trans-boundary fisheries issues
- Frances Lake (upstream) is noted as fisheries Conservation Waters and depressed fisheries stocks
- Aquatic Species-at-Risk present in watershed
- Presence of Interim Protected Lands noted
- Small version has lesser ability to meet all energy gaps in long term horizon (50 years)
- Large Version Only: Relocation of existing highways and bridges required

Recommendation: Study further, including scalability analysis to re-evaluate project size

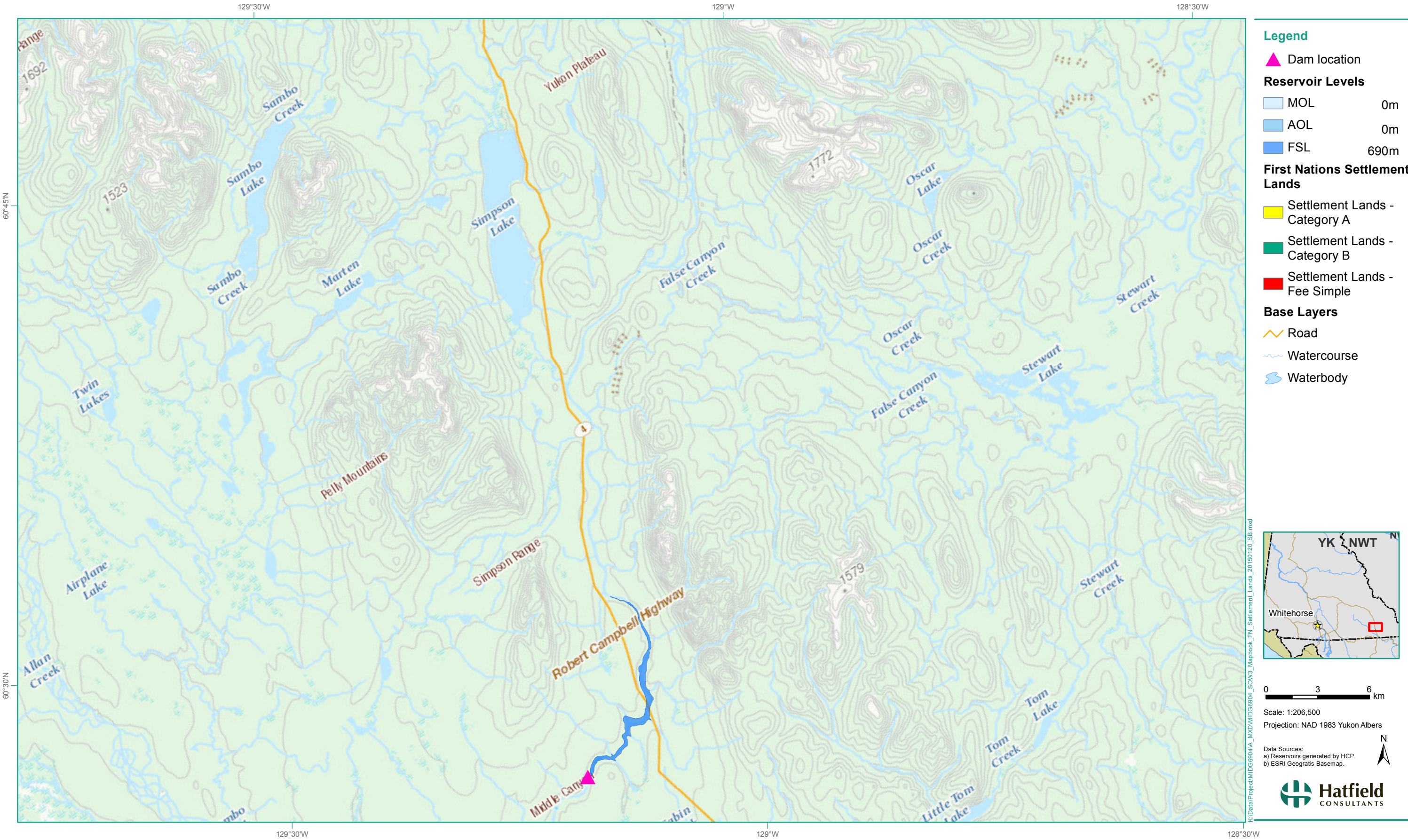
AREA OF STUDY	SMALL VERSION	LARGE VERSION
Environmental (Fisheries)	H	H
Environmental (Aquatic SAR)	H	H
Environmental (Terrestrial SAR)	L	L
Surface/Subsurface Tenure	H	H
Constructability	L	L
Economic (Meeting Gap)	H	L
Economic (Size vs. Need)	L	M

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 9 – Middle (or Lower) Canyon (Large) [Site ID = LIARD-FRANC-0670-B]



FIRST NATIONS SETTLEMENT LANDS
Map 10 – Middle (or Lower) Canyon (Small) [Site ID = LIARD-FRANC-0670-A]



NWPI (LOW)

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
 55 MW	 110 km	Whitehorse	 Acceptable
		RIVER	
		Teslin River	

PROJECT DESCRIPTION

NWPI (Low) is a potential 55 MW hydroelectric project on the Teslin River, located in the Yukon River Basin approximately 65 km downstream of Johnsons Crossing and 60 km east of Whitehorse. The project first appeared in T. Ingledow & Associates Limited's report entitled "Hydroelectric Resources Survey of the Central Yukon Territory" in 1968.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- Constructability risks deemed low
- Good ability to meet long term outlook (50 year) future energy gaps

CONS:

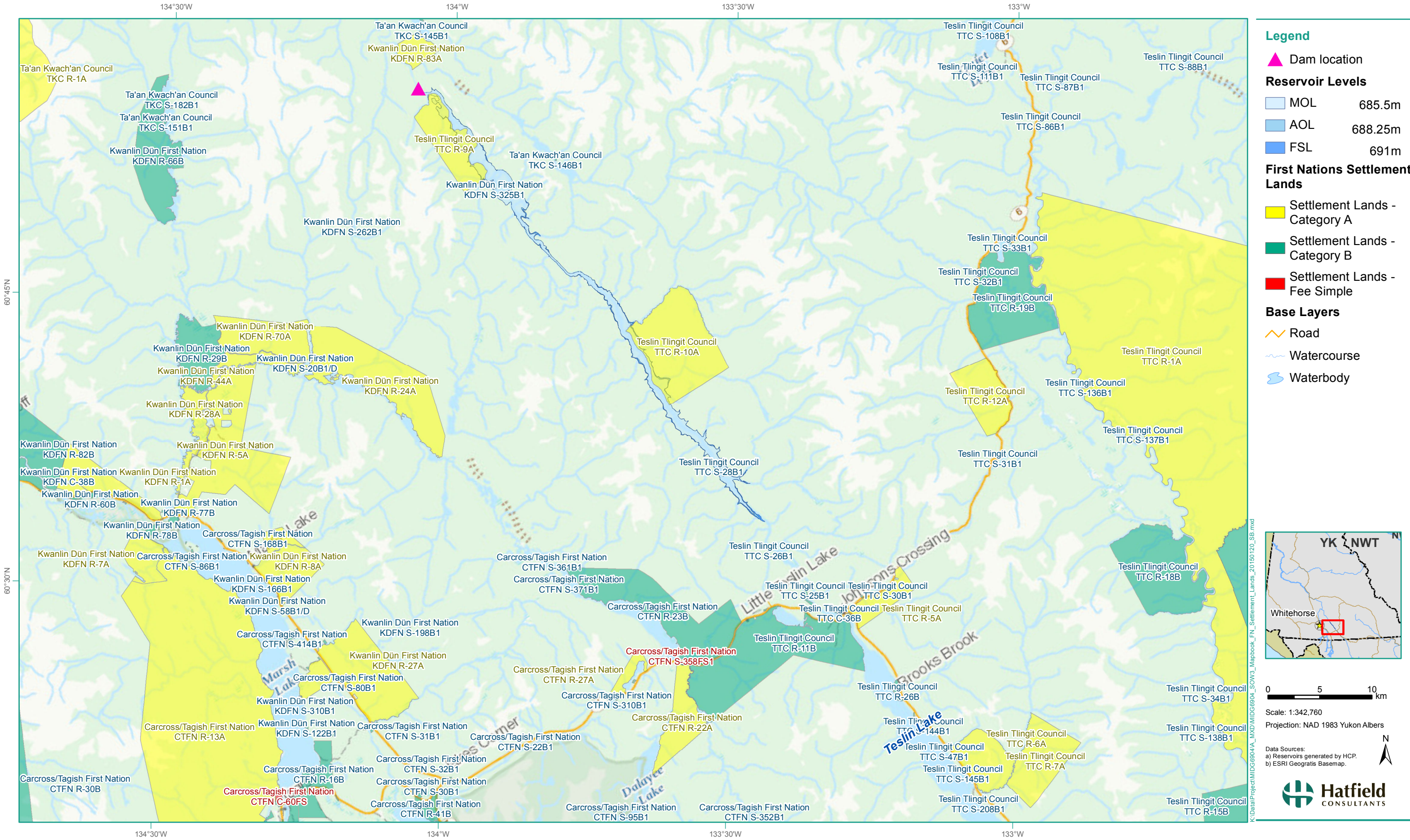
- River deemed as having a high suitability for fish habitat
- Teslin Lake is flagged for potential Transboundary fisheries issues and potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Possible Aquatic Species-at-Risk in watershed
- Terrestrial Species-at-Risk flagged as having significant mitigation issues noted
- Presence of Land Tenure and First Nations Settlement Lands noted

Recommendation: Study Further, including analysis to re-evaluate the balance between project size, reservoir storage, and project impacts

AREA OF STUDY	NWPI (LOW)
Environmental (Fisheries)	H
Environmental (Aquatic SAR)	M
Environmental (Terrestrial SAR)	H
Surface/Subsurface Tenure	H
Constructability	L
Economic (Meeting Gap)	L
Economic (Size vs. Need)	M

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 11 – NWPI (Low) [Site ID = YUKON-TESLI-0670-B]



SLATE RAPIDS

DIVERSION SCHEME

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
42 MW	10 km to future transmission 145 km to existing transmission	Ross River	Excellent
		RIVER	
		Pelly River	

PROJECT DESCRIPTION

Slate Rapids (Diversion Scheme) is a potential 42 MW hydroelectric project on the Pelly River, located in the Pelly River Basin approximately 75 km east of the community of Ross River. The project first appeared in Moneco Consultants Pacific Limited's report entitled "Slate Rapids Hydropower Development" in 1983.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Good ability to meet long term outlook (50 year) future energy gaps
- Project currently sized closed to long term need (not oversized)

CONS:

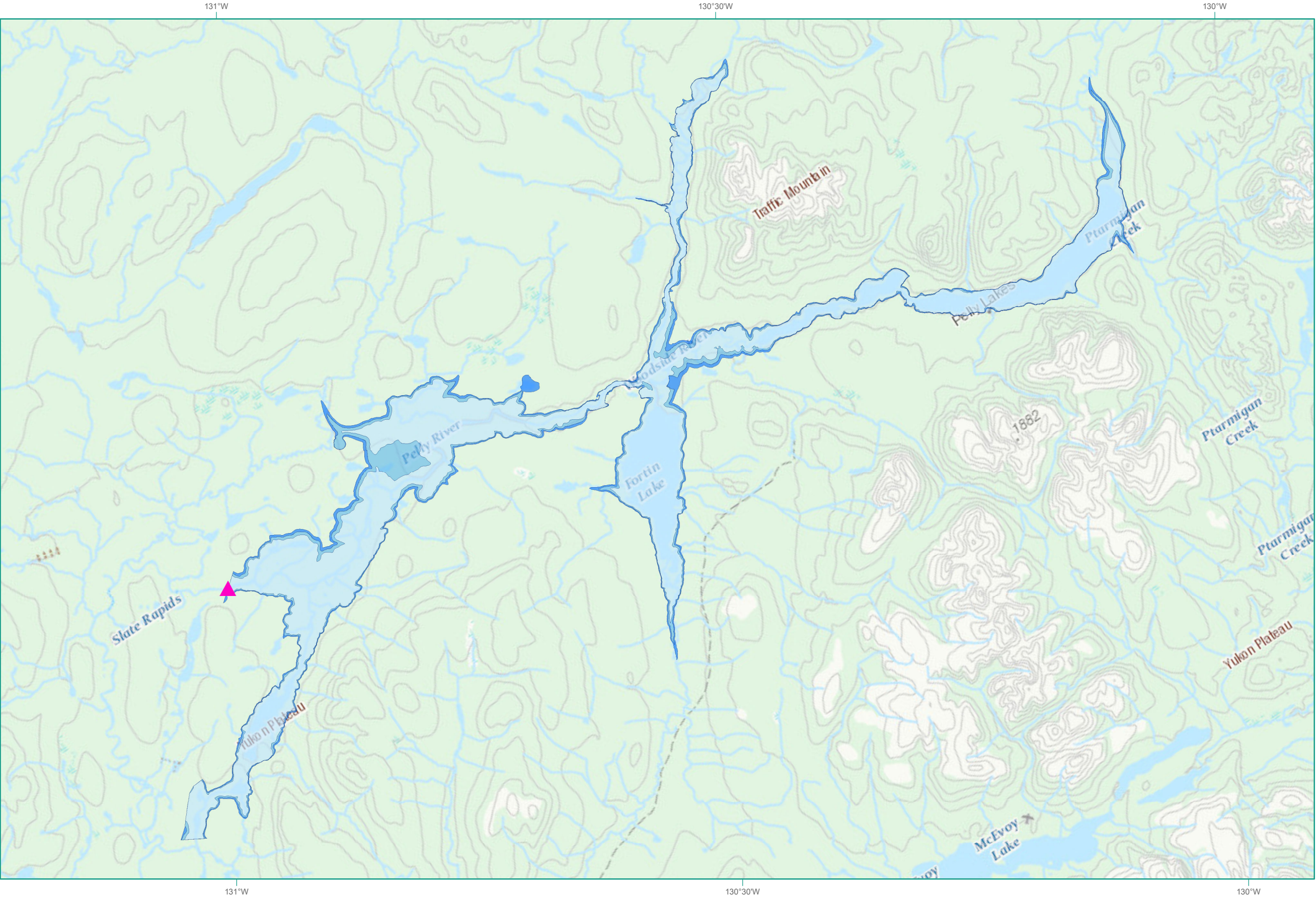
- River deemed as having a high suitability for fish habitat
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Terrestrial Species-at-Risk flagged as having moderate mitigation issues
- Presence of Land Tenure and First Nations Interim Protected Lands noted
- Constructability risks deemed high

Recommendation: Study Further, including analysis to re-evaluate the balance between project size, reservoir storage, and project impacts

AREA OF STUDY	SLATE RAPIDS (DIVERSION SCHEME)
Environmental (Fisheries)	H
Environmental (Aquatic SAR)	L
Environmental (Terrestrial SAR)	M
Surface/Subsurface Tenure	H
Constructability	H
Economic (Meeting Gap)	L
Economic (Size vs. Need)	L

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 12 – Slate Rapids [Site ID = PELLY-PELLY-0847-B]



Legend

▲ Dam location

Reservoir Levels

MOL	887m
AOL	889.5m
FSL	892m

First Nations Settlement Lands

- Settlement Lands - Category A
- Settlement Lands - Category B
- Settlement Lands - Fee Simple

Base Layers

- Road
- Watercourse
- Waterbody



0 2.5 5 km


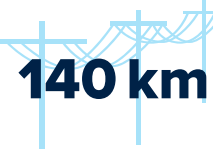

Scale: 1:198,360

Projection: NAD 1983 Yukon Albers

Data Sources:
a) Reservoirs generated by HCP.
b) ESRI Geogratis Basemap.

Hatfield
CONSULTANTS

TWO MILE CANYON

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
 53 MW	 140 km	Mayo	 Excellent
		RIVER	
		Hess River	

PROJECT DESCRIPTION

Two Mile Canyon is a potential 53 MW hydroelectric project on the Hess River, located in the Stewart River Basin, approximately 100km east of Mayo. The project first appeared in T. Ingledow & Associates Limited's report entitled "Hydroelectric Resources Survey of the Central Yukon Territory" in 1968.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- No Aquatic Species-at-Risk noted
- Good ability to meet long term outlook (50 year) future energy gaps
- Terrestrial Species-at-Risk noted, but no major constraints expected

CONS:

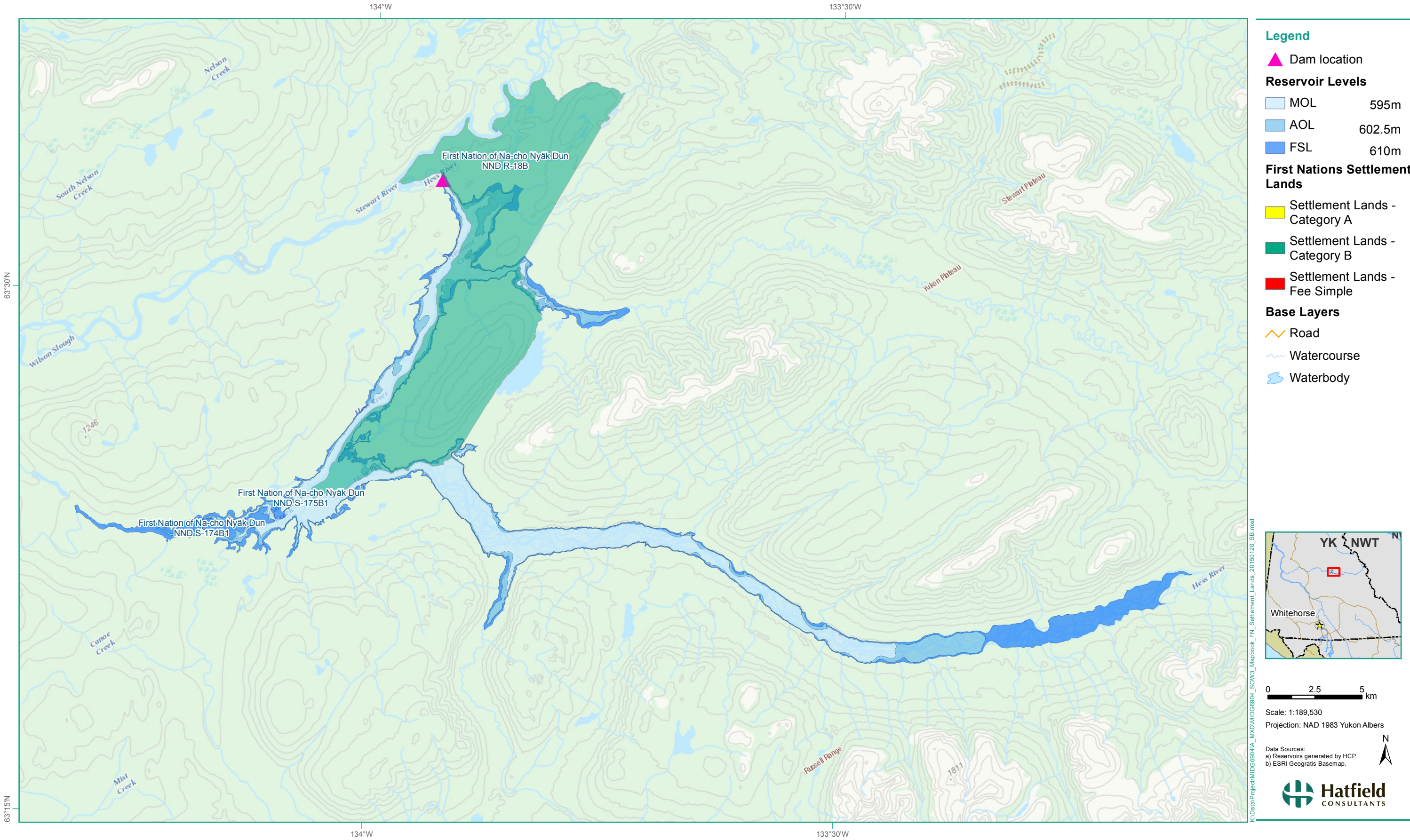
- River deemed as having a high suitability for fish habitat
- Potential Transboundary issues as per Yukon River Salmon Agreement with USA
- Presence of Land Tenure and First Nations Settlement Lands noted
- Constructability risks deemed moderate

Recommendation: Study further, including scalability analysis to re-evaluate project size

AREA OF STUDY	TWO MILE CANYON
Environmental (Fisheries)	H
Environmental (Aquatic SAR)	L
Environmental (Terrestrial SAR)	L
Surface/Subsurface Tenure	H
Constructability	M
Economic (Meeting Gap)	L
Economic (Size vs. Need)	M

H = High effects M = Medium effects L = Low effects

FIRST NATIONS SETTLEMENT LANDS
Map 13 – Two Mile Canyon [Site ID = STEWA-HESS-0552]



UPPER CANYON

LARGE, MEDIUM and SMALL

CAPACITY	DISTANCE TO TRANSMISSION	NEAREST COMMUNITY	WINTER ENERGY ABILITY
25 - 75 MW	10 km to future transmission	Watson Lake	Excellent
	290 km to existing transmission	RIVER	
		Frances River	

PROJECT DESCRIPTION

Upper Canyon (Large) is a potential 75 MW hydroelectric project on the Frances River, located in the Liard River Basin approximately 95 km north of Watson Lake.

Upper Canyon (Medium) is a 58 MW hydroelectric project that is a smaller alternative to the above mentioned "Upper Canyon (Large)" project. The Upper Canyon (Medium) project is located at the same location (approximately 95 km north of Watson Lake).

Upper Canyon (Small) is a 25 MW hydroelectric project alternative that is smaller than both the above mentioned "Upper Canyon (Large)" and "Upper Canyon (Medium)" project. The Upper Canyon (Small) project is located at the same location (approximately 95 km north of Watson Lake) capacity of 100 MW.



DEVELOPMENT CONSTRAINT FINDINGS

PROS:

- Small Version Only: More efficient use of water available (not oversized in medium term outlook), although limitations noted when approaching 50 year outlook
- Medium and Large Versions Only: Good ability to meet long term outlook (50 year) future energy gaps

CONS:

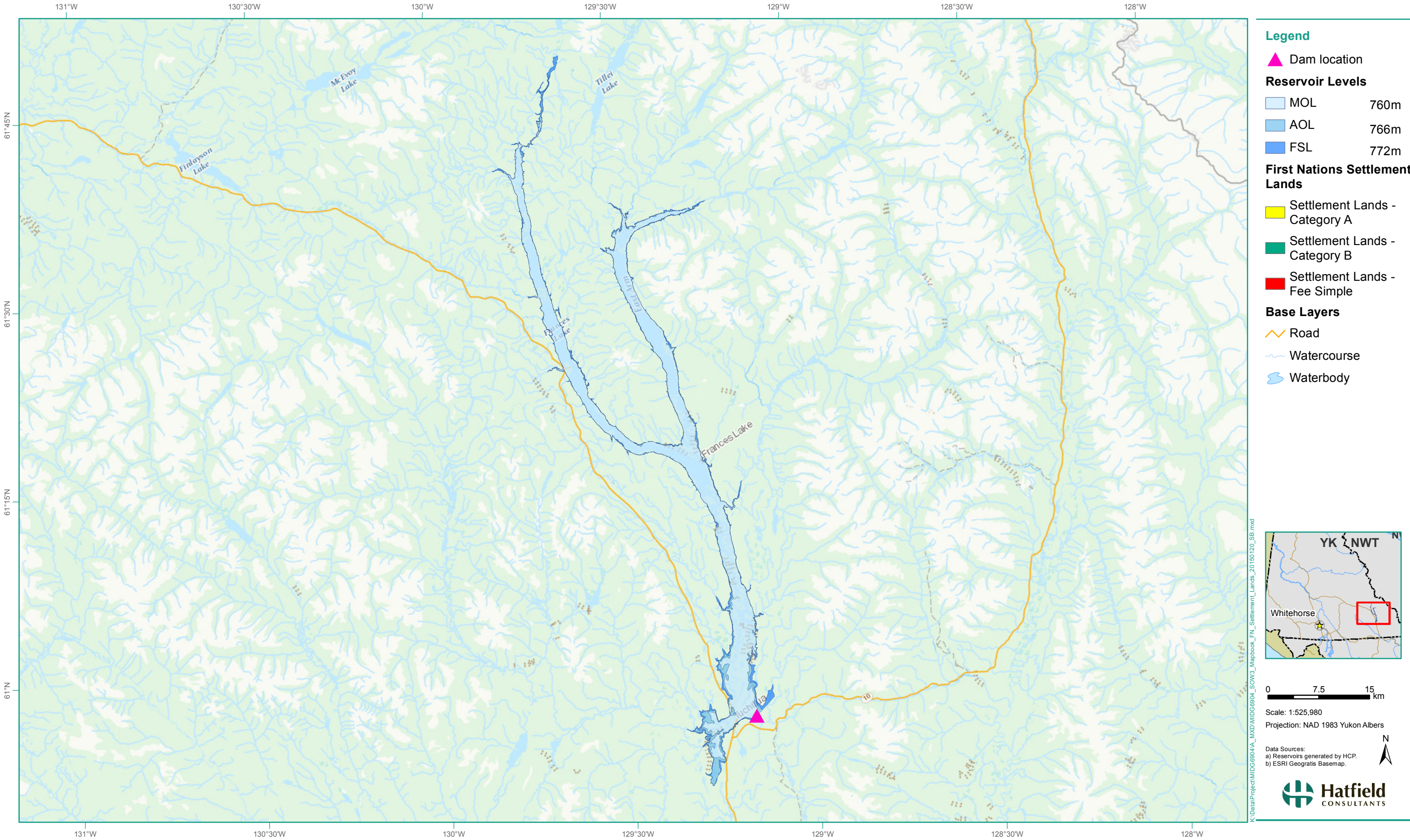
- Frances Lake (which is flooded) is noted as fisheries Conservation Waters and as having depressed fisheries stocks
- Frances River is flagged for potential Trans-boundary issues
- Terrestrial Species-at-Risk flagged as having significant mitigation issues noted
- Presence of Land Tenure and Interim Protected Lands noted
- Constructability risks deemed high (known bedrock faults in dam area)
- Medium and Large Versions Only: May be over-sized relative to long term need

Recommendation: Study further, including scalability analysis to re-evaluate project size (potentially finding a project that has lower impacts to Frances Lake by operating reservoir within (or closer to) the range of natural lake levels)

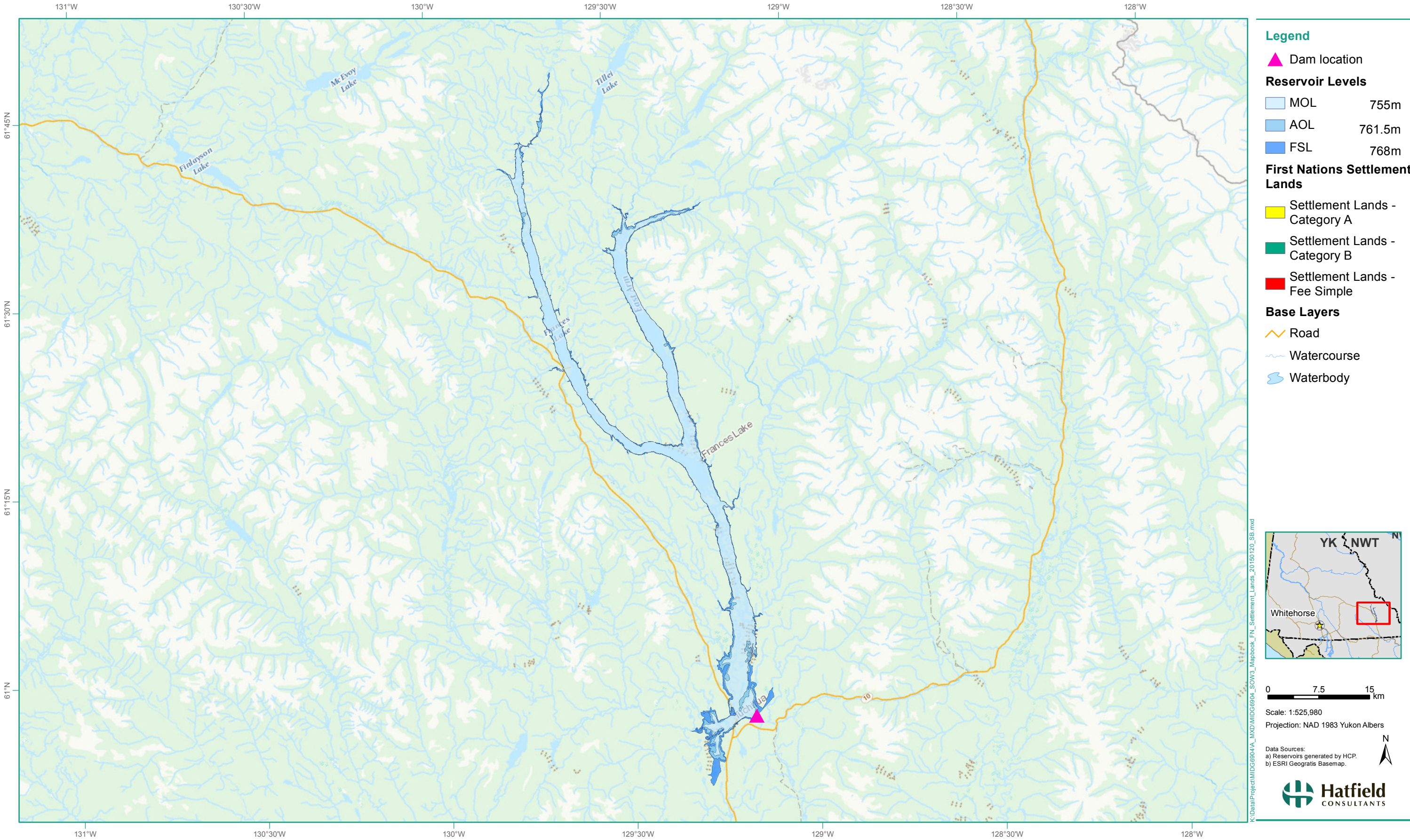
AREA OF STUDY	SMALL	MEDIUM	LARGE
Environmental (Fisheries)	H	H	H
Environmental (Aquatic SAR)	H	H	H
Environmental (Terrestrial SAR)	H	H	H
Surface/Subsurface Tenure	H	H	H
Constructability	H	H	H
Economic (Meeting Gap)	M	L	L
Economic (Size vs. Need)	L	M	M

H = High effects M = Medium effects L = Low effects

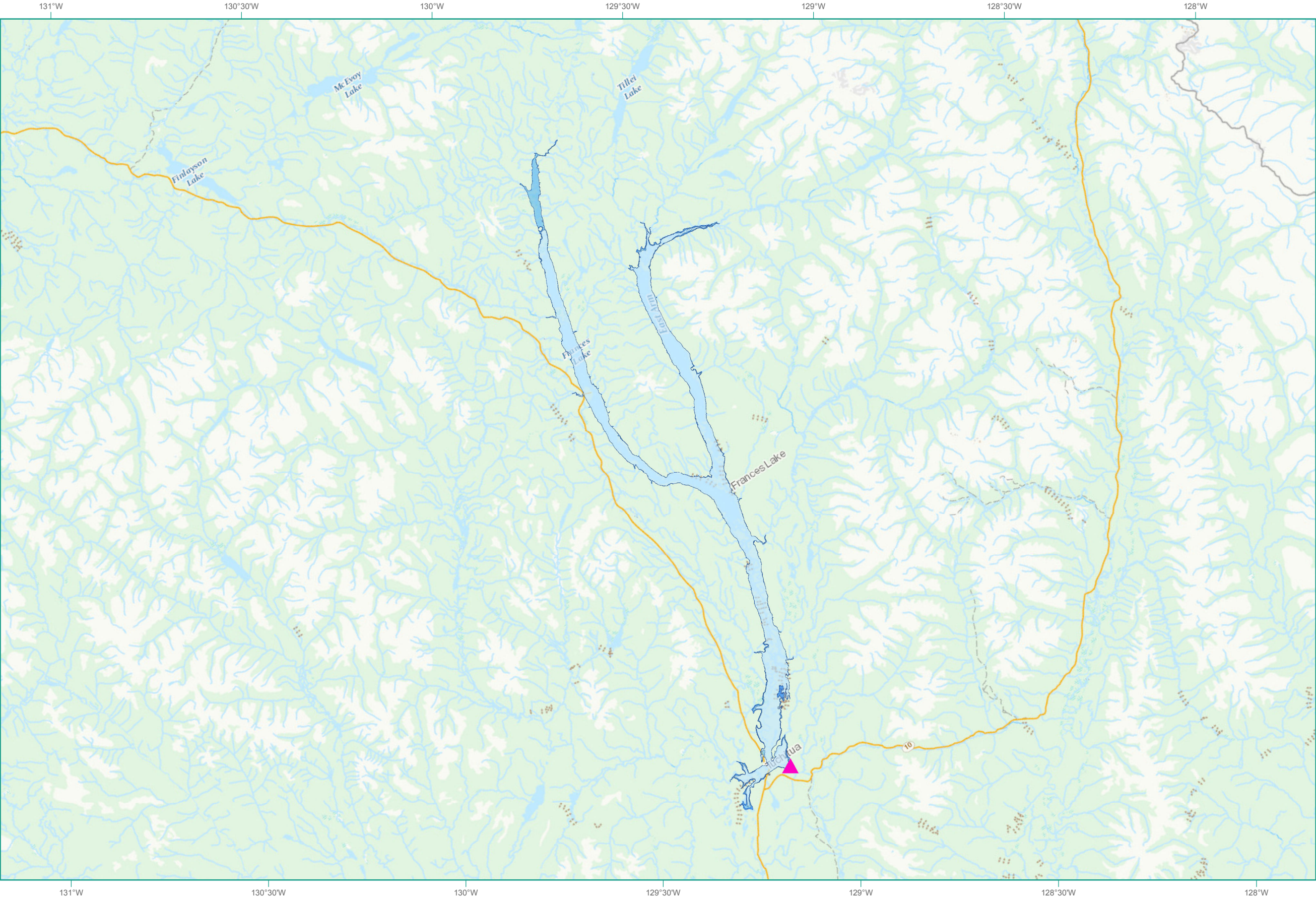
FIRST NATIONS SETTLEMENT LANDS
Map 14 – Upper Canyon (Large) [Site ID = LIARD-FRANC-0730-C]



FIRST NATIONS SETTLEMENT LANDS
Map 15 – Upper Canyon (Medium) [Site ID = LIARD-FRANC-0730-B]

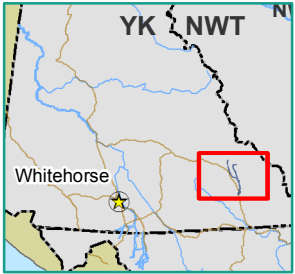


FIRST NATIONS SETTLEMENT LANDS
Map 16 – Upper Canyon (Small) [Site ID = LIARD-FRANC-0730-A]



Legend

- Dam location
- Reservoir Levels**
 - MOL 752m
 - AOL 754.5m
 - FSL 757m
- First Nations Settlement Lands**
 - Settlement Lands - Category A
 - Settlement Lands - Category B
 - Settlement Lands - Fee Simple
- Base Layers**
 - Road
 - Watercourse
 - Waterbody



0 7.5 15 km

Scale: 1:525,980

Projection: NAD 1983 Yukon Albers

Data Sources:
a) Reservoirs generated by HCP.
b) ESRI Geogratis Basemap.

N

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