

Waterpower Project Scope

For The Shannon Creek Waterpower Project

Submitted in support of applications filed under the Water Act and The
Land Act



Prepared by:

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Amended: December 19, 2011

Executive Summary

The Shannon Water Power Project is located on Shannon Creek, located east of the town of Avola, in the North Thompson Valley. Avola is located ~190km north of Kamloops, B.C. on Hwy #5. Figure 1 illustrates the General Location of the Shannon Creek Hydro Project and Figure 2 shows the Shannon Water Power Project Concept.

The Shannon Water Power Project is a renewable green-energy, small scale run-of-river hydroelectric power project, that includes a reservoir on Shannon Lake, an intake on Shannon Creek at a lower elevation than the lake, an intake on Carole Creek, a diversion from the Carole Creek Intake to the Shannon Creek Intake, a Penstock from Shannon Intake to a Power House located near the bottom of the valley, and a transmission line that will connect to a BC Hydro Substation located in Avola. Shannon Lake will be used for water storage by installing a dam that will be between 4 and 6m. high. A Coanda type intake will be located on Shannon Creek at ~1365m. elevation and a typical diversion intake will be located on Carole Creek at ~1515m. elevation. A small headpond of ~0.3 ha will form above these intake sites. 3,500m. of penstock will transport water down to a Powerhouse located at ~600m. elevation. A 25kV transmission will be constructed from the Powerhouse to a B.C. Hydro Substation located ~1.2km away in the town of Avola.

The preliminary design for the project is indicating a 2.5 MW hydro plant capacity that will be run at a projected 35+% capacity with this application. This results in average annual energy output of 7.6+ GWh/y that will be delivered to B.C. Hydro under an Energy Purchase Agreement.

This project is located on stable terrain and there are no adverse affects expected to these known values:

- Fish and fish habitat – a Fish and fish habitat study completed in 1999 and published in 2000 by ARC Environmental Ltd. indicated that the only reach of Shannon Creek that had presence of fish and fish habitat was the lowest reach. This reach is located below this project footprint. This inventory found a similar situation in Carole Creek; fish only in the lowest reach.
- Wildlife habitat – there is a designated Ungulate Winter Range (U-3-004) located in the upper portion of the Shannon Creek Watershed. This winter range is for Mountain Caribou and the scope of this project will be consistent with resource guidelines included in this Order.

Once the penstock is installed, the proponent intends to minimize the impact to the forest industry by ensuring that the disturbed areas are reforested. The proponent is working with Interfor – Adams Lake Division, who manages the Forest License tenure in this area, to coordinate road and harvest plans to benefit both parties.

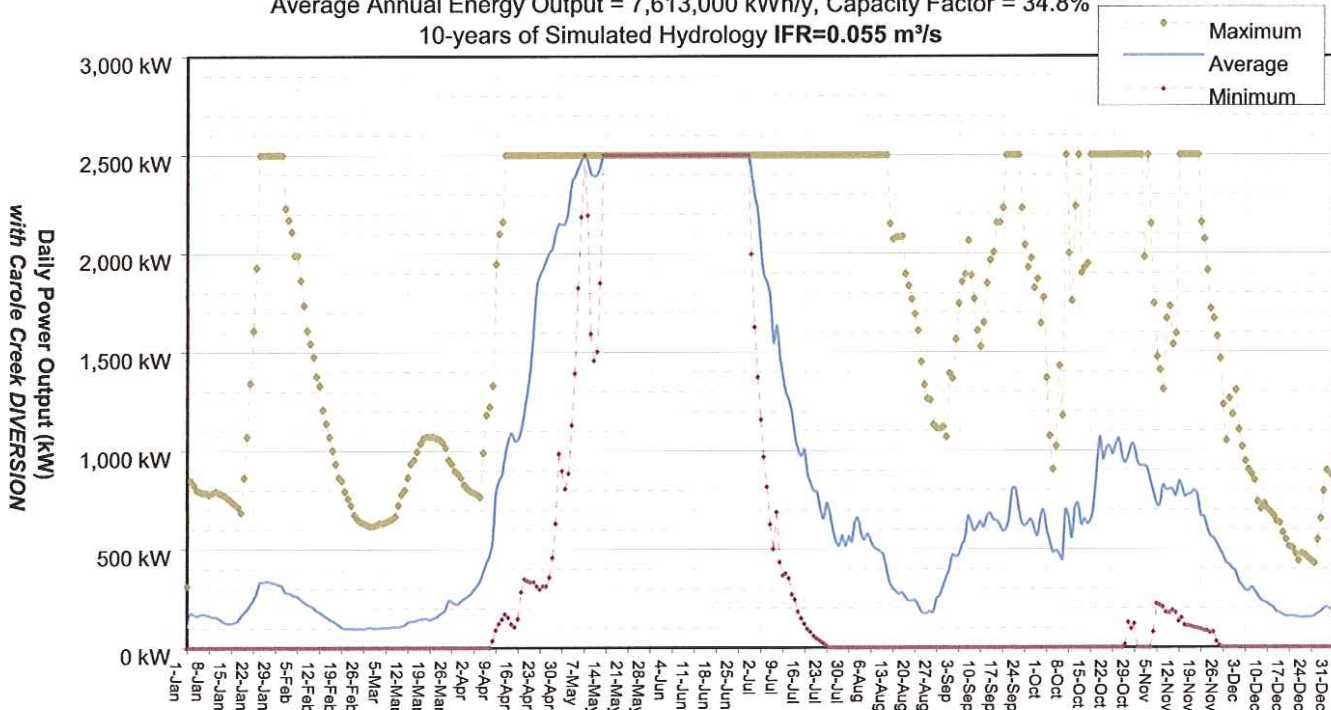
Simpcw First Nation, headquartered in Chu Chua, B.C., is the primary First Nation that has claimed this area in their territory. Preliminary discussions have taken place with the Simpcw First Nation Sustainable Resource Management Department to ensure that they are knowledgeable of who is proposing this project as well as the project scope.

SHANNON WATER POWER PROJECT SUMMARY

	SHANNON CREEK Hydro Project with CAROLE CREEK DIVERSION
Project Layout	FIGURE 2
Carole Cr. Diversion	Up to 0.15 m ³ /s
Carole Cr. Diversion pipeline	≈2788 m of 12 inchØ HDPE pipe
Shannon Cr. Drainage Basin Area	13.8 km ²
Shannon Cr. Mean Annual Discharge (MAD)	0.32 m ³ /s (0.023 m ³ /s/km ²)
Shannon Cr. IFR Minimum Releases	0.055 m ³ /s (1.9 cfs) (≈17.2%MAD)
Updated Power Intake Elevation	1372 m (4501 ft)
Powerhouse (turbine) Elevation	600 m (1968 ft)
Updated Gross Head	772 m (2533 ft) (1097 psi)
Updated North-side Penstock-pipeline	≈3520 m of 24, 18 & 14 inchØ pipe
Turbine Design Flow	0.44 m ³ /s (15.5 cfs)
Hydro Plant Capacity	2,500 kW (2.5 MW)
Average Annual Energy Output	7,613,000 kWh/y (7.6 GWh/y)
Capacity Factor	34.8%
Mean Annual Utilized Flow	0.15 m ³ /s (47%MAD)
Mean Annual Remaining Flow	0.21 m ³ /s (66%MAD)
Daily Power Output CHART	FIGURE B-4-2, B-4-3

SHANNON CREEK Hydro Project DAILY POWER OUTPUT (kW)

Design Flow = 0.44 m³/s, Gross Head = 772 m, Plant Capacity = 2,500 kW
Average Annual Energy Output = 7,613,000 kWh/y, Capacity Factor = 34.8%
10-years of Simulated Hydrology IFR=0.055 m³/s



1.0 Proponent Information

Soler Logging Ltd. is a privately owned incorporation that is based in Clearwater, B.C. Owners Dale and Kim Miller have acquired the services of the following consultants to assist in the preparation of this project:

Pentti O. Sjöman, PEng, POSjöman Hydrotech Consulting, 9035 Altair Place, Burnaby, British Columbia, Canada, V3J 1A8, mobile phone 604-219-1732, E-mail: penttis@telus.net

Pentti has completed Hydrology and Power Studies for the Shannon Creek Power Project and will be providing preliminary and final engineering, assistance with procurement of equipment, and supervision of construction activities.

Wes Bieber, R.P.F., Longfellows Natural Resource Management Solutions Inc., 234 Murtle Rd., Clearwater, B.C. V0E 1N1, Telephone 250-674-3882, E-mail: wes.bieber@longfellows.ca

Wes has assisted in managing this project from its inception. He has significant experience in this landscape from his years working for Weyerhaeuser Company Ltd. and was knowledgeable of the planning resources that were available. He has been involved in the establishment of water monitoring equipment and has assisted with stream flow measurement. He will continue to manage this project as it now proceeds through application, agreement, and construction phases.

Michael J. Milne, ABCFP Limited License (hydrology), M. J. Milne & Associates Ltd., 2603 23rd St., Vernon, B.C., V1T 4J7, Telephone 250-558-5770, E-mail: mjmilne@telus.net

Michael has been instrumental in planning and implementing the stream monitoring program. He has also provided field services during the establishment of water monitoring equipment and has assisted with stream flow measurement. He has also provided strategic guidance in the early phases of this project. Michael will continue to provide professional services, both strategically as well as operationally.

Project Contacts include:

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Wes Bieber	250-674-3882	wes.bieber@longfellows.ca

2.0 Project Concept and Description

The Shannon Creek Hydro Power Project is located ~190km north of Kamloops B.C. across from the town of Avola, B.C. This is illustrated in Figure 1. The Shannon Creek Watershed is tributary to the North Thompson River. Figure 2 illustrates the details of the Shannon Water Power Project.

2.1 Capacity of the Project

The preliminary design for the project is indicating a 2.5 MW hydro plant capacity that will be run at a projected 35+% capacity with this application. This results in average annual energy output of 7.6 GWh/y that will be delivered to B.C. Hydro under an Energy Purchase Agreement. Table 1 on the next page illustrates the key Hydro Project attributes of this project.

2.2 Watershed Characteristics and Availability of Water

There is no Water Survey of Canada gauging station on Shannon Creek. To develop simulated hydrology, short term gauging data is correlated with nearby Water Survey of Canada daily discharge data.

Flow gauging stations were installed in Shannon Creek and Carole Creek on May 6, 2010 by Soler Logging Ltd., M.J. Milne & Associates Ltd. and Longfellows Inc. The last download of this data was completed on November 2, 2011. A Hydrology and Power Study was completed by POSjoman HYDROTECH CONSULTING using data downloaded on June 23, 2011. M.J. Milne & Associates Ltd. developed a stage-discharge rating curve for Shannon Creek using 12 spot flow measurements ranging from 0.05 m³/s to 3.7 m³/s. This information was then compared to the matching period of WSC Blue River and WSC Harper Creek average daily unit discharge. The 2011 WSC data is preliminary raw data that take up to a year to be finalized. The comparison illustrated that WSC Harper Creek has reasonably good correlation to Shannon Creek gauging. This hydrology analysis will be refined and updated during the winter of 2011/12 with the additional data that has now been made available. M.J. Milne & Associates Ltd. developed a stage-discharge rating curve for Carole Creek using 11 spot flow measurements ranging from 0.005 m³/s to 1.17 m³/s. This data was similarly compared to the WSC Harper Creek and a reasonably good correlation was also revealed.

Figure 2 shows the Shannon and Carole Creek drainage basins along with a general layout of the potential small scale hydro project. Currently, this project is proposed with the following features:

- Power intake on Shannon Creek at elevation 1365m.
- The drainage area above this intake location is 13.8 km².
- A proposed Reservoir located on Shannon Lake.
- A Diversion Intake on Carole Creek at elevation 1515m.
- Diversion Pipeline – estimated at 2,788m length and located along a planned Road Permit road from the Diversion Intake on Carole Creek to the Power Intake on Shannon Creek.
- Penstock – pipeline from the water intake to the powerhouse is estimated at 3,500m.

Soler Logging Ltd.
SHANNON CREEK Hydro Project
HYDROLOGY and POWER Study

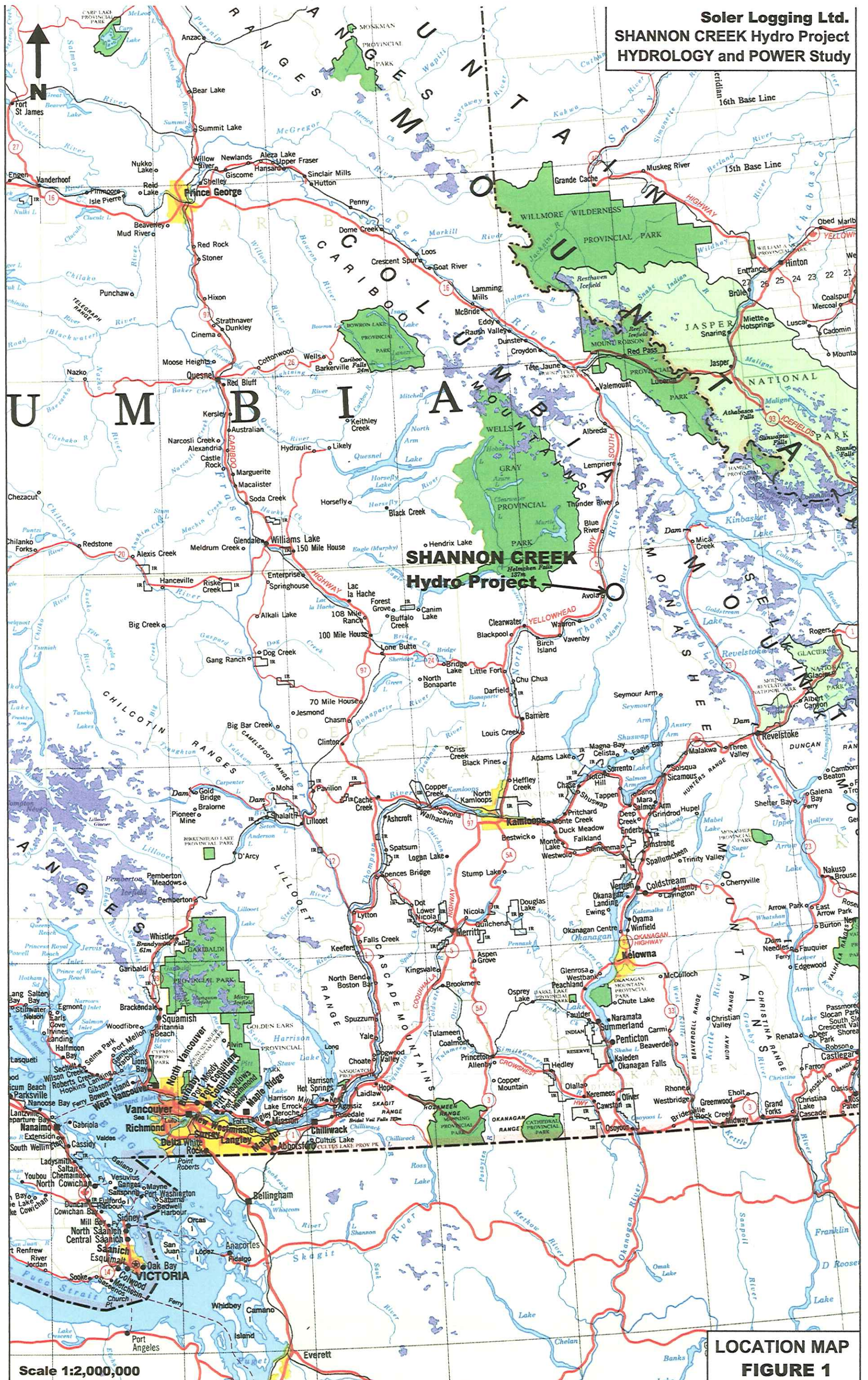
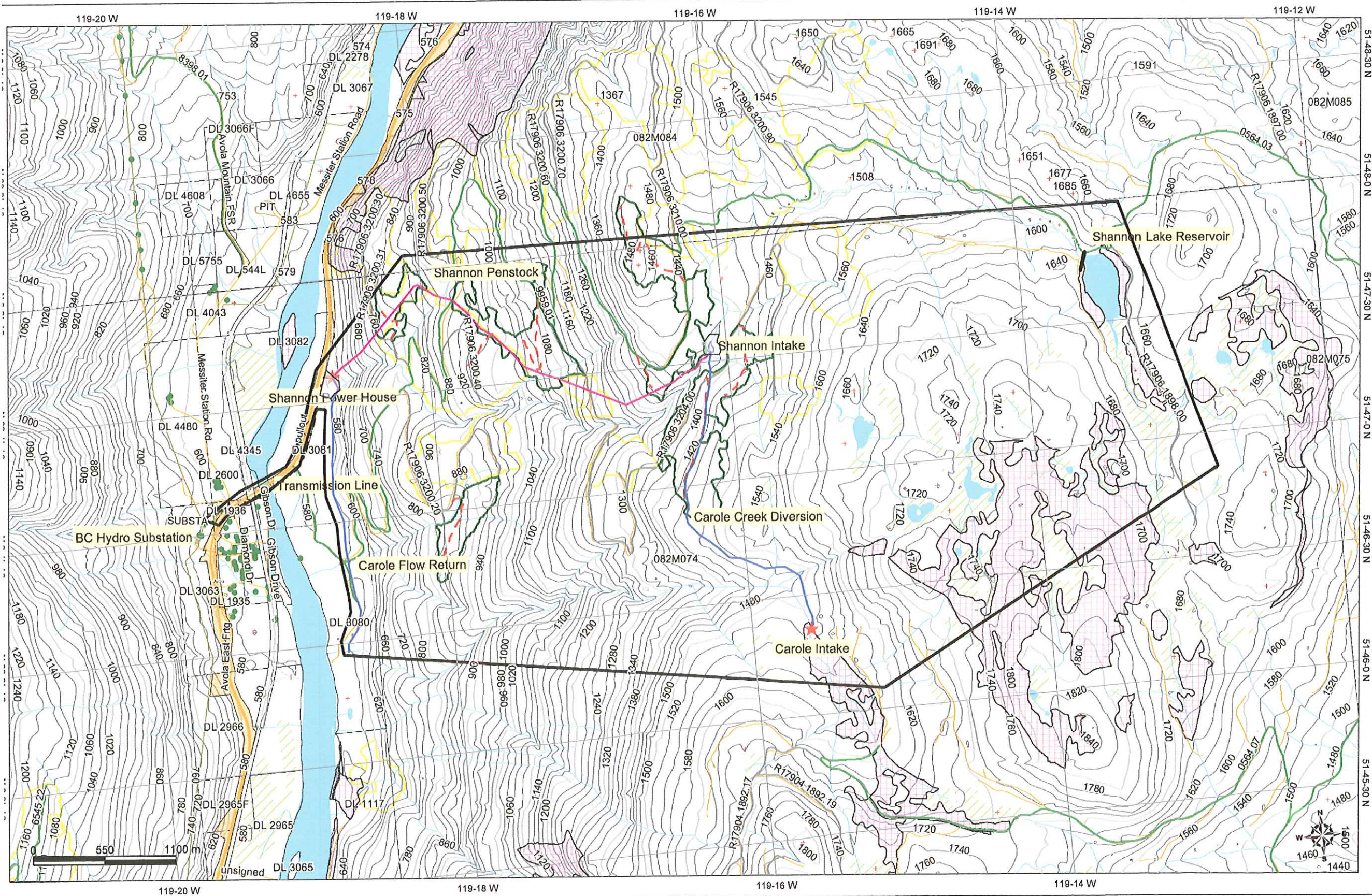


Figure 2: Shannon Water Power Project



Legend

- Intake
- Future Roads
- Penstock Location
- Future Harvest
- BCGS Grid (1:20K)
- Major Cities
- Road and Non Status Trim Road
- Transportation - Points (TRIM)
- Holpad
- Active Tenure Roads
- Forest Service Road
- Road Permit
- EUP Road
- Cultural Points (1:20K)
- Cultural Lines (1:20K)
- OGMA Non Legal Current
- Survey Parcel Primary
- Active Harvesting Authority
- Parks
- National Parks
- Provincial Parks
- FWA Wetlands
- FWA Manmade Waterbodies
- FWA Rivers
- FWA Lakes
- FWA Stream Networks

Scale: 1: 30,000

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Key Map of British Columbia



- Powerhouse is located at elevation 600m.

Based on Fish and Fish Habitat Inventories completed in 1999 (published 2000) by Arc Environmental, the only fish presence in Shannon Creek was in the very lowest reach below 600m. By applying the BC Instream Flow Methodology for a fishless stream, the following monthly threshold flows were determined:

	Shannon Creek	Carole Creek
Mean Annual Discharge (MAD)	0.32m ³ /s	0.11m ³ /s
Median daily flow for the lowest flow month	0.055 m ³ /s	
Instream Flow Releases (IFR) or Minimum Releases	0.055 m ³ /s, ~17.2% of MAD	August thru April = 0.020m ³ /s, ~20% of MAD May thru July = 0.034m ³ /s, ~30% of MAD

Figure 3 and 4 illustrate the 2010-2011 Shannon Creek daily gauged discharge along with the spot flow measurements used for the Stage-Discharge Curve. Figures 5 and 6 illustrate 2010-2011 Carole Creek daily gauged discharge along with the spot flow measurements used for the Stage-Discharge Curve.

Figure 7 illustrates the simulated combined daily inflow for Shannon Creek (with Carole Creek Diversion) at the proposed intake site. This chart shows the average daily inflow for each day over the 10 years of simulated daily discharge as well as the maximum and minimum daily inflow for each day over the 10 years of simulated daily discharge.

Figure 8 illustrates the simulated daily inflow for Carole Creek at the proposed diversion intake site. This chart shows the average daily inflow for each day over the 10 years of simulated daily discharge as well as the maximum and minimum daily inflow for each day over the 10 years of simulated daily discharge.

2.3 Parameters for the Operation of Works

2.3.1 Shannon Lake Reservoir

A reservoir is proposed ~4.2 km. upstream of the Shannon Creek Intake site at Shannon Lake (~1630m. elevation). This site is currently being studied to understand water storage capability.

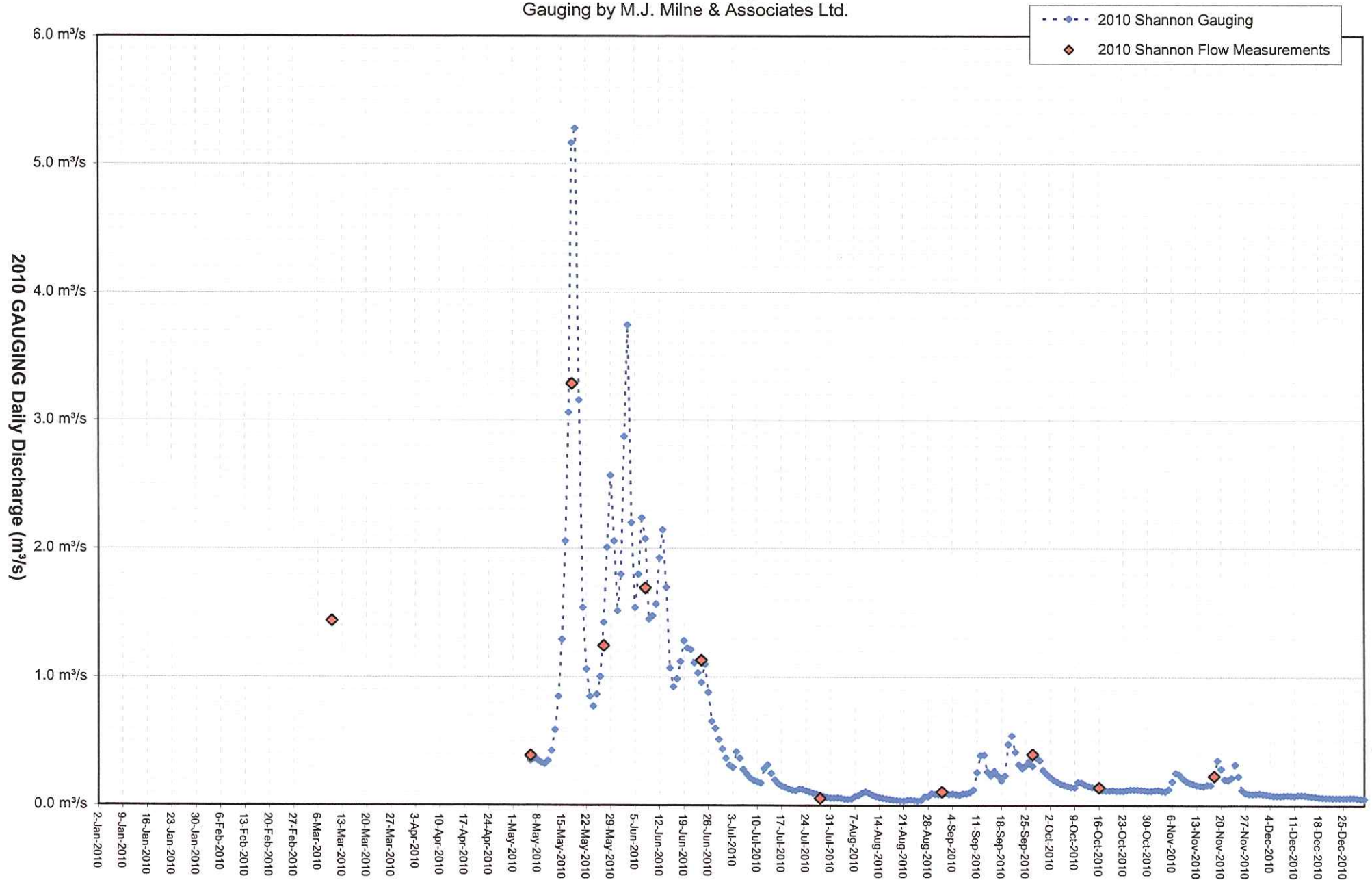
2.3.2 Water Intakes

The water intake is on Shannon Cr. at an elevation of 1365m. ASL. and will be a Croanda type intake. The intake infrastructure and associated access will require approximately 1.6 ha of crown land to be permitted to the proponent in a Crown Land Occupancy Permit.

SHANNON CREEK Hydro Project 2010 GAUGING Daily Discharge (m³/s)

13.8 km² drainage area above gauging station

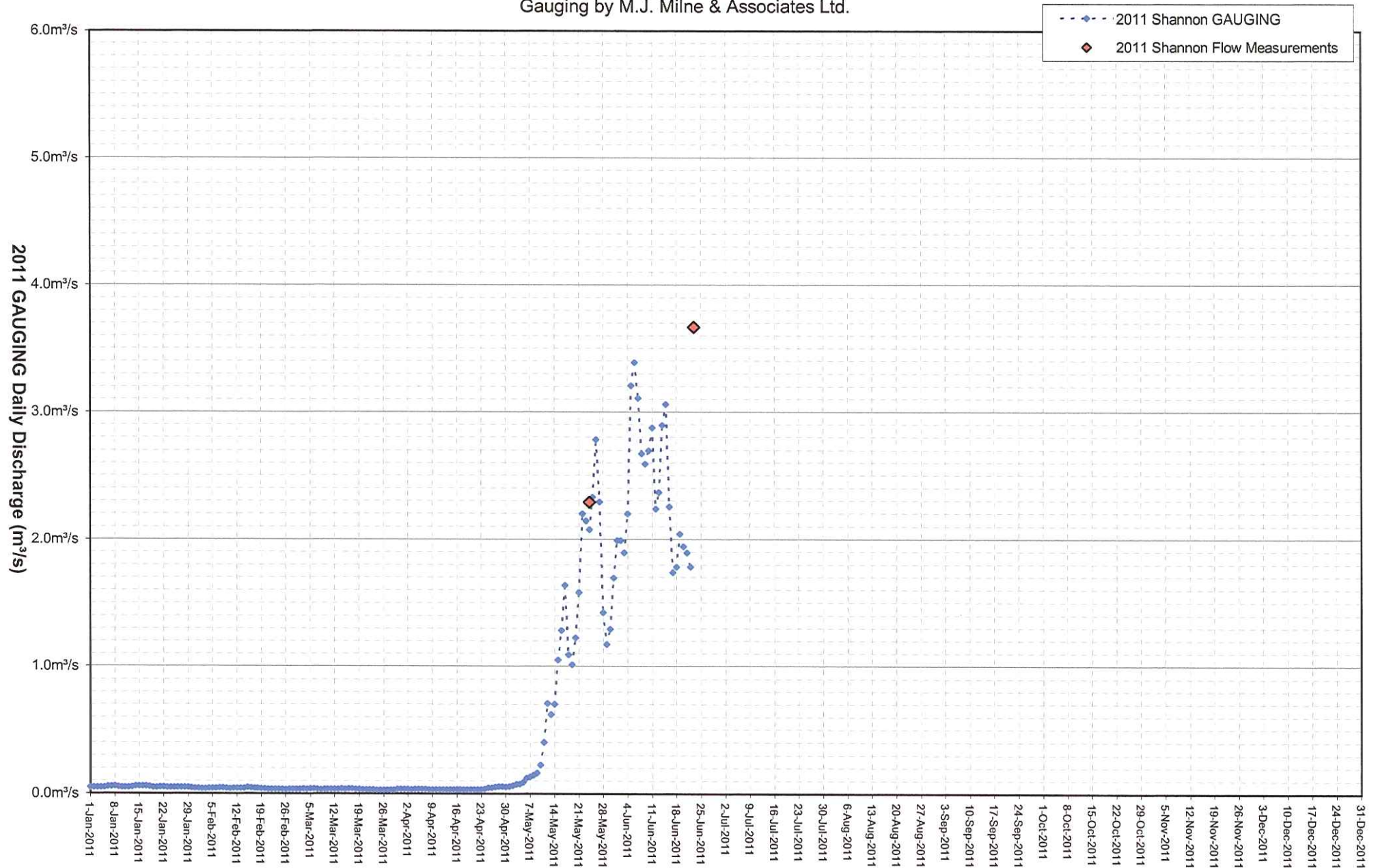
Gauging by M.J. Milne & Associates Ltd.



SHANNON CREEK Hydro Project 2011 GAUGING Daily Discharge (m³/s)

13.8 km² drainage area above gauging station

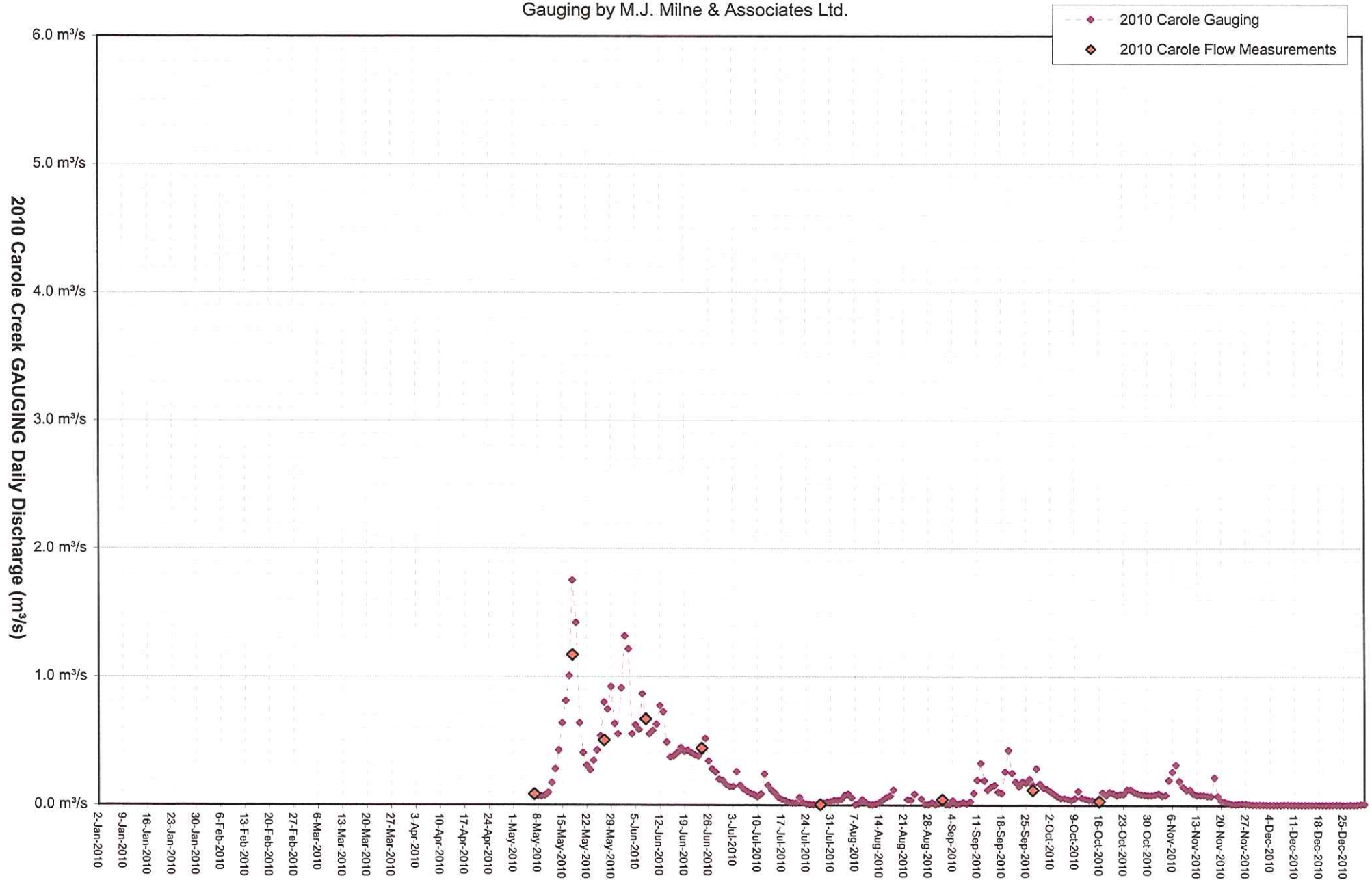
Gauging by M.J. Milne & Associates Ltd.



SHANNON CREEK Hydro Project

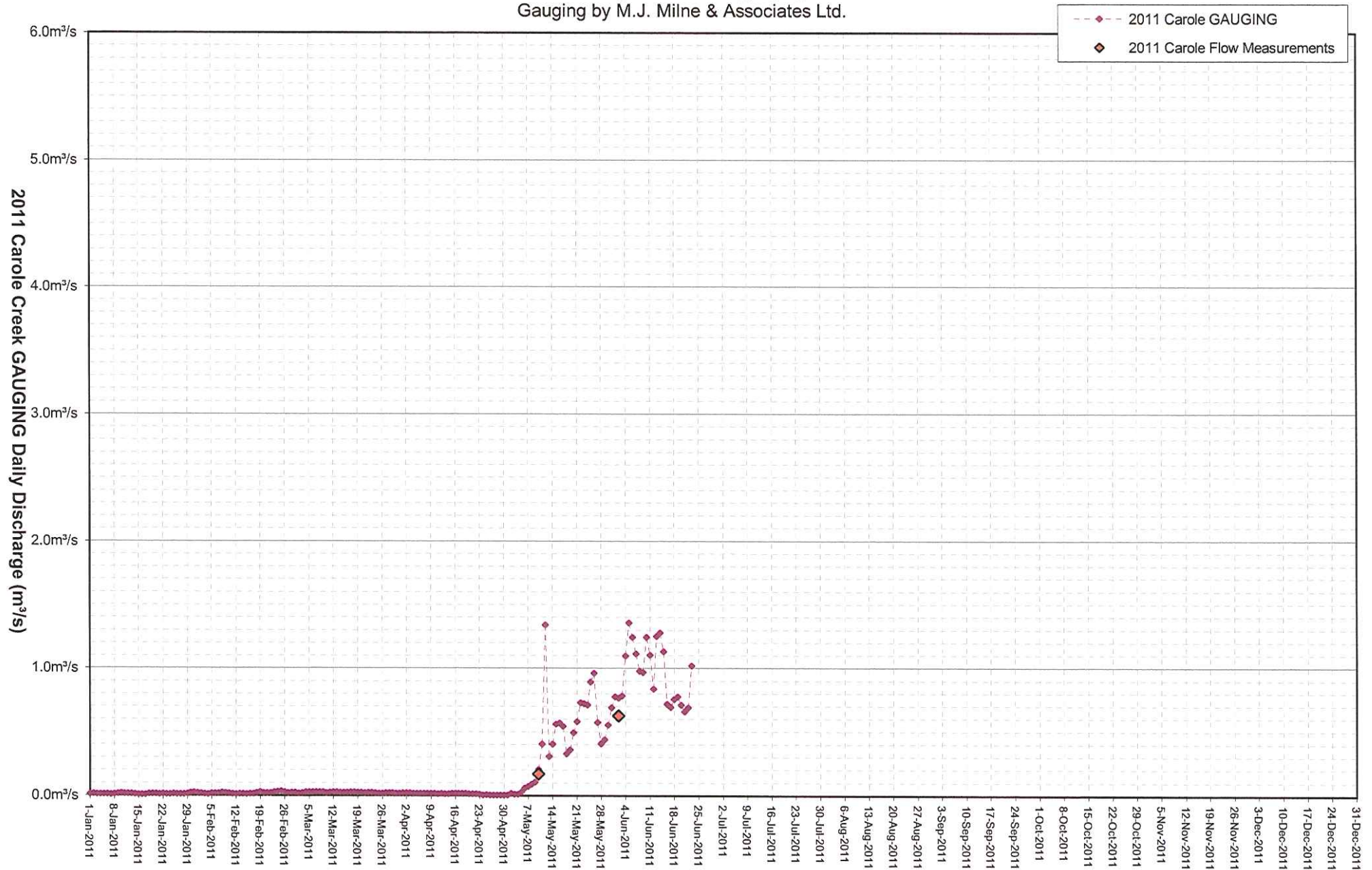
2010 Carole Creek GAUGING Daily Discharge (m³/s)

5.4 km² drainage area above gauging station
Gauging by M.J. Milne & Associates Ltd.



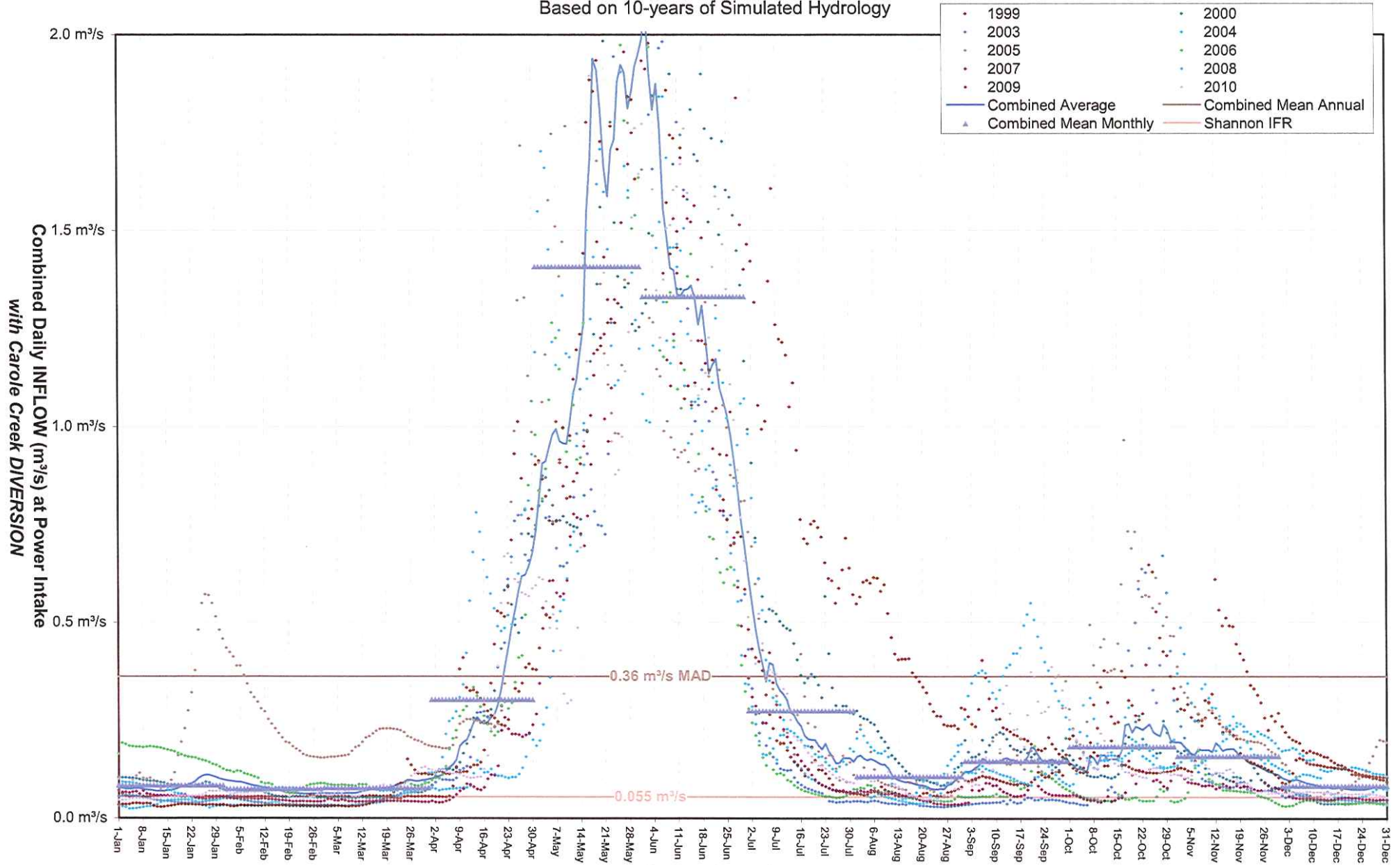
SHANNON CREEK Hydro Project 2011 Carole Creek GAUGING Daily Discharge (m³/s)

5.4 km² drainage area above gauging station
Gauging by M.J. Milne & Associates Ltd.



SHANNON CREEK Hydro Project Combined DAILY INFLOW (m³/s) at Power Intake with Carole Creek DIVERSION

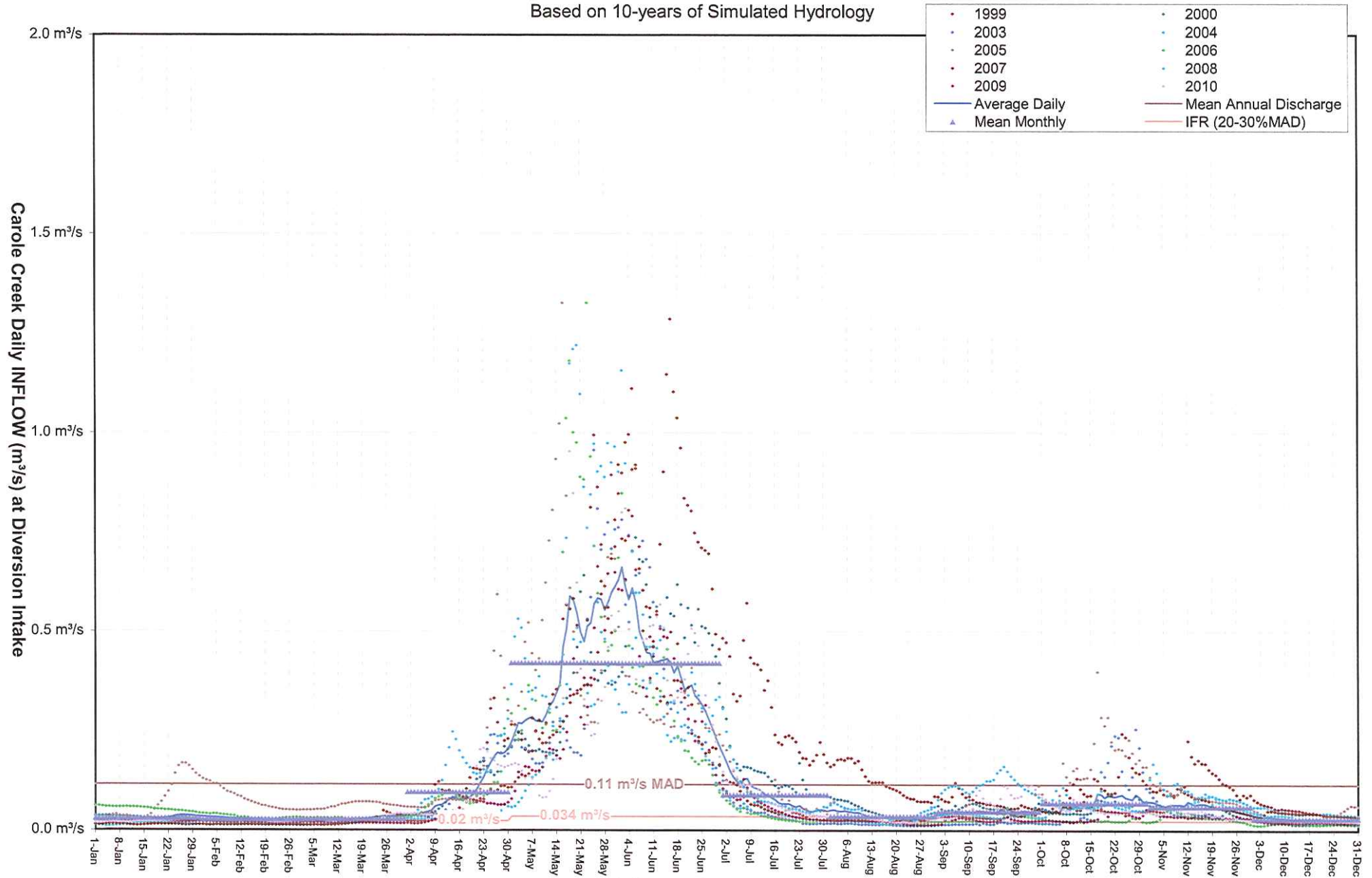
Shannon Cr. 13.8 km² Drainage Basin Area plus up to 0.15 m³/s diverted from Carole Cr.
Based on 10-years of Simulated Hydrology



SHANNON CREEK Hydro Project Carole Creek DAILY INFLOW (m³/s) at Diversion Intake

5.4 km² Drainage Basin Area above Diversion Intake El. 1450 m

Based on 10-years of Simulated Hydrology



A water diversion intake is planned on Carole Creek for the purposes of diverting water to the Shannon Cr. Intake. This typical diversion intake would consist of:

- A bypass for Instream Flow Releases (minimum releases).
- A screened diversion pipeline entrance capable of diverting up to the maximum diversion of $0.15\text{m}^3/\text{s}$.
- An overflow for passing surplus and flood flows.

2.3.3 Diversion Pipeline

An ~2,788m. long diversion pipeline is planned to be constructed along a future forest road that will be constructed by International Forest Products Ltd. to access future harvest areas under their Forest License A18693.

2.3.4 Penstock

This water power project is proposing to construct ~3,500m. of penstock from the intake located on Shannon to the Power House located at the valley bottom. The elevation difference is estimated at ~765m. The penstock will follow a combination of existing roads and downslope locations between road systems. The penstock will require a Crown Land Occupancy Permit for the infrastructure as well as R/W for temporary access during construction activities. Soler Logging Ltd. is working with Interfor – Adams Lake Division to coordinate the planning of this water power project with forest road building and harvest activities.

2.3.5 Powerhouse

The Powerhouse, tailrace and associated access is located on a portion of DL3081 (KDYD) that is currently designated Crown Provincial. The appropriate tenure (lease or Crown Land Occupancy) will be required. Access to the Power House will be on a R/W constructed on a Crown Land Occupancy Permit. The Power House/Tailrace is expected to occupy approximately 1/3 ha. located within a 2 ha. permitted area.

2.3.6 Power Lines

A 25kV Power Line will be built from the Powerhouse following the Hwy#5 Right of Way until it joins with the B.C. Hydro Sub-Station located in Avola B.C.

3.0 Linkages with other Projects and Roads

This proponent is not aware of any other water power projects that are located in the Shannon Creek area. This proponent is however working in adjacent areas as described below:

3.1 Sundt Creek – Sundt Cr. is located to the north of Shannon Creek. It is also a non-fish, lakeheaded watershed that we have completed flow measurement studies on. Refer to Figure 9 for a conceptual project plan for Sundt Water Power. An Hydrology and Power Study will be completed in the winter of 2011/12. Based on the results of this and a feasibility study, applications for Water License and Crown Land would proceed in 2012.

3.2 Gamble Creek – Stream flow monitoring is complete on Gamble Creek in preparation for a Gamble Creek Hydrology and Power Study that will be completed in the winter of 2011/12. Gamble Creek (aka Foam Creek) is also a non-fish, lakeheaded stream that is located north of Finn Creek. Refer to Figure 10 for a conceptual plan for the Gamble Creek Water Power Project.

3.3 Froth Creek – Stream flow monitoring is complete on Froth Creek in preparation for a Froth Creek Hydrology and Power Study to be completed in the winter of 2011/12. Default fish inventory indicates Froth Creek as a fish stream, however we will complete studies to verify this. Project parameters have not been verified to date for this project.

The Shannon Water Power Project is located in an operating area of Interfor's Forest License A18693. The proponent has been working with Interfor to coordinate harvest and road plans with the requirements of accessing and clearing the water intake and penstock location associated with this water power project. The Shannon FSR will be upgraded for both initiatives; removing several steep grade sections and widening out switchbacks that were originally designed for 5 axle trucks.

4.0 Market for Electricity

The preliminary design for the project is indicating a 2.5 MW hydro plant capacity that will be run at a projected 35+% capacity with this application. This results in average annual energy output of 7.6 GWh/y that will be delivered to B.C. Hydro under an Energy Purchase Agreement. Currently, B.C. Hydro is carrying out an interconnection study for this project.

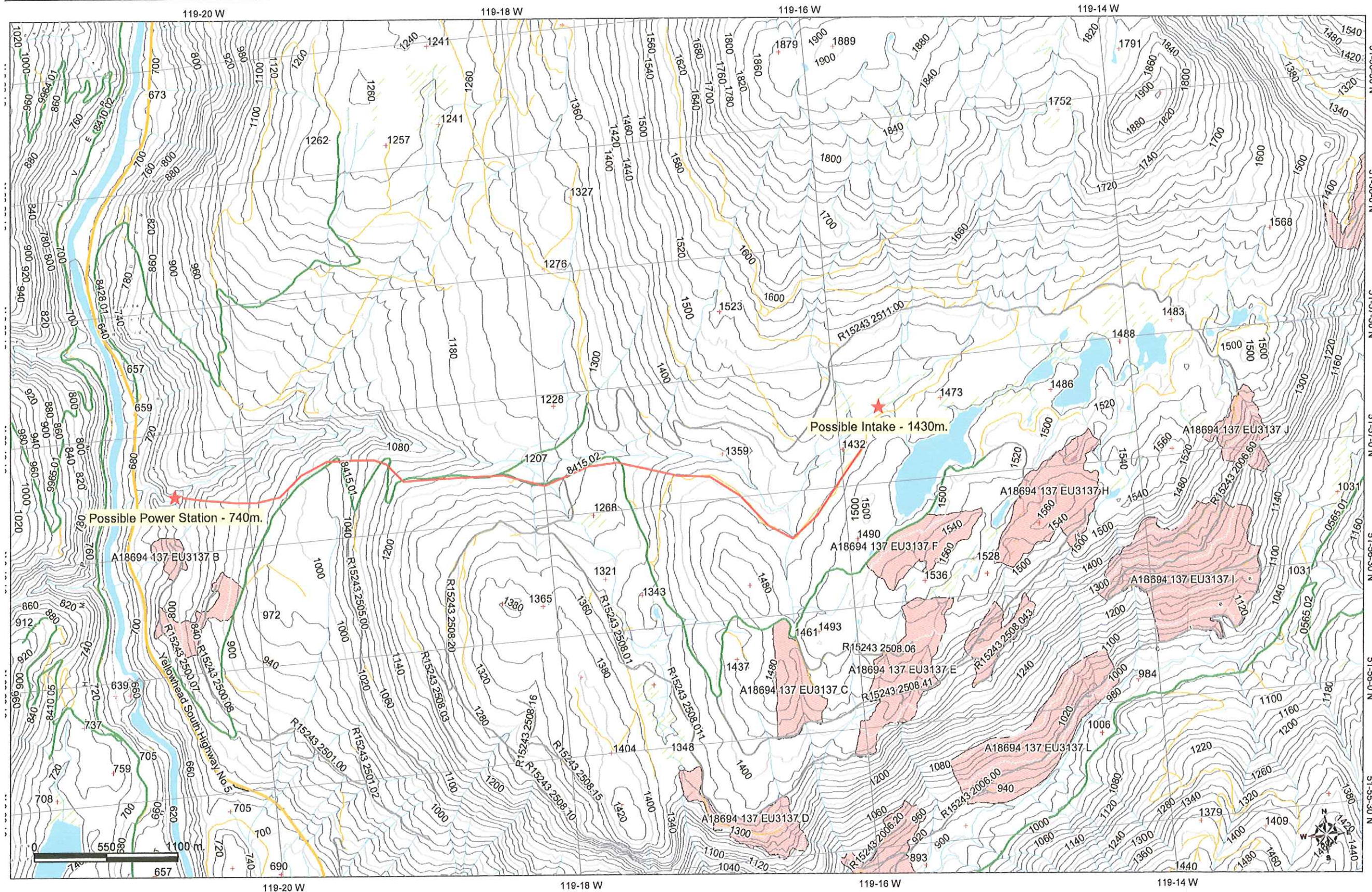
5.0 Schedule for Completion of Project

The proponent intends on making all applications for the necessary authorities required. These include but are not limited to the Water License, Crown Land Occupancy, B.C. Hydro Standing Offer Program. Final engineering and design of the water power project would be completed in the spring/summer of 2012. Materials will be acquired throughout the engineering and design phase with expectation of commencing with water intake and penstock construction, at the earliest, in the fall of 2012. This will depend on acquiring the necessary authorisations. Powerhouse construction would be carried out through the later fall and early winter. Connection to the Avola Substation could be accomplished for early April, prior to the 2013 freshet. If the necessary permits are not received until after the construction window in 2012 then these dates would be shifted to 2013 and 2014 respectively.

6.0 First Nations Involvement

There are four native bands that require notification of this project. Information has been sent to the Adams Lake Band, Lower Shuswap Indian Band, Neskonlith Indian Band, and Simpcw First Nation. One meeting has taken place with the Sustainable Resource Manager of Simpcw First Nation with further communication expected.

Figure 10: Gamble Cr. Water Power Project



Legend

- Major Cities
- Transportation - Points (TRIM)
- Holpad
- Active Tenure Roads
- Forest Service Road
- Road Permit
- SUP Road
- Active Cut Blocks
- Parks
- National Parks
- Provincial Parks
- CWB Wetlands
- CWB Manmade Waterbodies
- CWB Rivers
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Key Map of British Columbia



7.0 Fish and Wildlife Information

As previously discussed, fish and fish habitat studies were done on Shannon Creek in 1999 and published in 2000 by ARC Environmental Ltd. The result of this study indicated that the only reach of Shannon Creek that had presence of fish and fish habitat was the lowest reach. This reach is located below this project footprint. Further, the only reach in Carole Creek that had presence of fish and fish habitat was the lowest reach located below 600m. elevation.

There is a designated Ungulate Winter Range (U-3-004) located in the upper portion of the Shannon Creek Watershed. This winter range is for Mountain Caribou and the scope of this project will be consistent with resource guidelines included in this Order.