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December 11, 2014

Our File: 5600-15-WAT-LIC-AWS
DFO File: 14-HPAC-00430

Mr. Brad Fanos
Regional Manager, Fisheries Protection Program
Fisheries and Oceans Canada
200 – 401 Burrard Street
Vancouver, BC V6C 3S4

Subject: Request for Review
DFO File No: 14-HPAC-00430
Englishman River Water Withdrawal Project, Parksville

Dear Mr. Fanos,

The enclosed Request for Review is further to the Arrowsmith Water Service (AWS) original submission dated April 30, 2014, which was reviewed and responded to via letter dated August 20, 2014 and a follow up meeting on September 3, 2014.

As indicated in discussions at the September 3, 2014 meeting, since the construction of the Arrowsmith Dam, the resulting summer flow augmentation has made significant fisheries improvements to the Englishman River and will continue to do so after full water extraction over and above the existing (pre-dam construction) condition. The construction of the Arrowsmith Dam was the start of our plans for a regional water supply system and we are merely following our original plan as a phased approach, that being:

- First Phase: construction of the Arrowsmith Dam (1999) and provide interconnection to each region as required
- Second Phase: construct a new intake
- Final Phase: provide enhanced water treatment

As part of our Conditional Water Licence issued in March 1997, half of the 9,000,000 m^3 of storage at Arrowsmith Lake reservoir is reserved for fisheries enhancements. The Conditional Water Licence and corresponding Provisional Operating Rule (specifying a flow of 1.60 m^3/s at the Hwy 19A Bridge) were issued based on the premise of utilizing the existing City of Parksville intake in the interim until such time the future proposed AWS water intake was constructed upstream of the Englishman River Water Survey Canada (WSC) hydrometric gauge (08HB002). Our original licence application proposed to locate the intake immediately downstream of the confluence of the Englishman and South Englishman rivers. Our Change of Works Water Licence Amendment was approved on January 22, 2013 that defines the diversion of surface water from the Englishman River at a point upstream of Highway 19 (downstream of the original proposed location).

Following our discussions with DFO representatives at the September 3, 2014 meeting, we have made significant changes in the design and proposed operation of the water intake structure. Even though the Ministry of Forest, Lands and Natural Resource Operations (MFLNO) has approved a proposed water withdrawal of up to 48 ML/d from the Englishman River through the conditional water license (C129170) issued on January 17, 2013, we believe actual future water demands are uncertain and, if successful, Aquifer Storage and Recovery (ASR) could potentially supplement future water demand. Therefore, the ERWS has decided to install pumping capacity at the intake to withdraw up to 28.8 ML/d (0.33 m^3/s) at the current time. This maximum rate is based on nominal maximum daily average demand of 24 ML/d (0.28 m^3/s) with an allowance for +/-20% instantaneous peak flow variation to account for fluctuations in flow rate for the water treatment plant process. It is understood that this Request for Review application for the intake is based on a maximum withdrawal rate of 28.8 ML/d with the understanding that any future increase in withdrawal capacity will require further consultation.

Further design changes and responses to your comments and concerns, as stated in your letter dated August 20, 2014, are summarized below:

Minimum Instream Flow Releases:

Historically, minimum conservation flows in the Englishman River have been based on recommendations made by DFO and MoE in response to the original water licence application for Arrowsmith Dam and a proposed new intake on the Englishman River in 1992. Both DFO and MoE recommended a preferred minimum flow of 1.13 m^3/s be maintained through the summer from July to October with DFO recommending an absolute minimum of 0.71 m^3/s. MoE refined the preferred minimum flow stating that 1.13 m^3/s should be maintained at or above a 20-year return period drought condition. These minimum conservation flows have provided the basis for the current operating order for Arrowsmith Lake dam which requires specific minimum flows to be maintained at the Englishman River near Parksville Water Survey of Canada Gauge (WSC 08HB002).

A revised series of conservation flows were determined from hydrologic modelling by KWL and habitat-flow modelling by LGL. KWL determined feasible flow rates downstream of the raw water intake by forecasting withdrawal rates at various average and drought year flow scenarios and optimizing storage management and dam release operations at Arrowsmith Lake. LGL used a river habitat simulation model to assess the effects of the revised minimum downstream conservation flows on target fish species rearing habitats. LGL concluded that maintaining conservation flows at or above these four targets will mitigate potential impacts as a result of water withdrawals and ensure that all important spawning and rearing sections of the river downstream of the intake remain productive and viable for salmon and trout. The recommended conservation flows downstream of the proposed intake are outlined in Table 1.

TABLE 1. RECOMMENDED DOWNSTREAM CONSERVATION FLOWS BELOW PROPOSED RAW WATER INTAKE

Scenario	Downstream Conservation Flow
Above Average Year	1.6 m^3/s
Below Average Year (2-year Return Period to 5-year Return Period Drought)	1.4 m^3/s
Dry Year (5-year Return Period to 20-year Return Period Drought)	1.2 m^3/s
Very Dry Year (greater than 20-year return period drought)	0.9 m^3/s
Current conservation flow downstream of existing intake is 1.13 m^3/s for 20-year return period drought with absolute minimum of 0.71 m^3/s. Arrowsmith Dam was designed to maintain minimum preferred flow of 1.13 m^3/s up to 15-year return period drought condition with minimum flow of 0.9 m^3/s supported using syphon during periods of low lake levels.	

As part of phased water supply development by AWS, construction of water storage at Arrowsmith Lake has increased summer baseflows significantly throughout the anadromous section of the river when compared to pre-dam conditions. Management of Arrowsmith Lake releases using the current provisional rule curve will mitigate potential fish habitat impacts in the lower two reaches (Reaches 1 and 2) caused by water extraction at the proposed intake structure. At anticipated withdrawal rates based on average monthly water demand, the Arrowsmith Dam is capable of supporting flows of 1.6 m^3/s, 1.2 m^3/s and 0.9 m^3/s downstream of the intake for median flows, low summer flows (up to 5-year drought) and extreme low summer flows (up to 20-year drought), respectively, provided the operating rules for Arrowsmith Lake maximize conservation of storage in the early part of the summer season. Also, upstream migration by juvenile and adult salmon and trout will not be impeded at low, moderate or high river discharges as a result of water intake operation.

Further detailed analysis and technical information on Minimum Instream Flow Releases can be found in the following as part of the Request for Review application attached.

- Aquatic Effects Assessment, October 2014
- Hydrological background to the instream flow assessment (including background to the downstream impacts assessment) provided in TM 2A

Maximum Instantaneous Withdrawal Rate:

The maximum "instantaneous" withdrawal rate will be 28.8 ML/d (24 ML/d + 20% for fluctuations). The withdrawal rate will not spike during periods of high demand during the day because the Water Treatment Plant (WTP) does not directly feed the distribution system (i.e., WTP "turns on" based on reservoir levels). The river intake will provide continuous feed through the WTP and into a clearwell for storage. From the clearwell, pumps are called based on system demands and above ground reservoir levels. The above ground reservoirs are designed to buffer peak flows and provide storage during high summer demand. Therefore, providing additional storage in the clearwell and above ground reservoirs negates the need for instantaneous withdrawal directly from the river.

Further detailed analysis and technical information on the Maximum Instantaneous Withdrawal Rate can be found in the following technical memos as part of the application for review attached:

- Hydrological background to the instream flow assessment (including background to the downstream impacts assessment) provided in TM 2A
- Information on withdrawal rates provided in TM 2C

Measures to Mitigate Fish Impingement:

Although the maximum instantaneous withdrawal rate will be 28.8 ML/d, the intake screen was designed based on maintaining a maximum approach velocity of 0.11 m/s for 48 ML/d flow with a screen opening size of 2.54 mm, which satisfies DFO criteria. The screen calculation also includes provision for 10% additional screen area and since it is sized for the ultimate flow (48 ML/d), it will be oversized. Screen cleaning will consist of an automated backwash system of air blowing from the inside of the intake and will occur at regular intervals or as required. The screen cleaning system will be sized to clear irregular debris loading with a maximum water surface differential across the screen (i.e., during high river levels). The air bursts will start from the upstream screen panel and continue downstream so material caught in one panel does not get trapped in an adjacent panel.

Further detailed analysis and technical information on measures to mitigate fish impingement can be found in the following as part of the application for review attached:

- Intake screen design sizing methodology and automated screen cleaning design are described in TM 2C.

Alternative water withdrawal techniques:

The existing in-river buried tee screen infiltration gallery does not involve direct/screened water withdrawals. However, it does not function well and therefore a similar style intake was not considered for the new intake. A Coanda-type screen was considered, but the Coanda intake structure would be a permanent structure that spans the entire low flow channel along the right side of the river. Alternatively, a Coanda intake could be constructed as a parallel in-stream structure but this type of structure lacks some of the advantages of the inclined side river screen. It was determined that the proposed inclined side river screen design has less impact on fish habitat during construction and permanent operation. The following matrix evaluation was considered in the pre-design for screen alternatives:

Inclined Side River Screen	Coanda In-River Screen
No need to enter river	Self-cleaning, no anticipated need to enter river
Minimal impact on fish passage and recreational river use	Potential impact on fish passage and recreational river use
Low risk of harming fish	Mitigate fish impact with ladder
Proven system	Proven system
Mechanically simple	Mechanically simple
Cleaned by air	Self-cleaning
Smaller footprint	Small footprint
Easier incorporation of river flow measurement	More difficult to incorporate river flow measurement
Lower capital cost	Lower capital cost
Low O&M cost	Low O&M cost

Further detailed commentaries on alternative water withdrawal techniques are included in TM 2C.

Incorporation of a Fishway:

The weir has been deleted from the design which removes physical obstructions in the river; therefore, a fishway is no longer required. Please see the attached updated drawings provided in the preliminary design report.

Flow Ramping Procedures:

A maximum ramping rate of 2.5 cm/hour will be established to prevent impacts during fry emergence and summer and winter rearing. A maximum river water level change of 2.5 cm/hour for representative riffles would equate to withdrawal rate changes at the intake that would vary with river flows and range between maxima of 0.25-0.37 m^3/s/hour.

Further detail on maximum rate of change of flow allowed for the water intake, and potential impacts to downstream habitat are provided in the attached Aquatic Effects Assessment.

Relocating the intake:

The water extraction from the Englishman River is intended to supplement existing groundwater supply to the AWS service areas in order to address uncertainty regarding the sustainability of groundwater supplies for present and future needs. The AWS original water licence application referenced the surface water intake location below the confluence of the Englishman and South Englishman rivers. The volume of storage of water at the Arrowsmith Lake reservoir for release during critical summer months for both future domestic water withdrawals and enhanced fisheries rearing flows was based on the intake at this location. Further advancement of the AWS capital plan for the next phase (intake) took into account environmental and financial factors which determined that the best location would be downstream of the originally proposed intake site. Although this option does not provide a gravity feed and control, it was determined that it represented the most attractive option as it presents cost savings and also provides substantial fisheries benefits for the Englishman River by extending the zone of enhanced low flows, from summer releases at the Arrowsmith Dam, further downstream. This benefit will become more significant as climate change could adversely affect the low flow regime of the river as time progresses. This option received conditional support from the AWS Management Committee in July of 2005 and the report was finalized in March 2008. In 2009 AWS engaged the services of Associated Engineering (BC) Ltd. to review the downstream option and determine the best location for the intake and future water treatment plant. On April 2011 Associated Engineering (BC) Ltd. finalized the report and concluded (based on a triple line bottom approach of analyzing risk, social and environmental factors) that the best location for the downstream intake location is just above the Highway 19 Bridge. The report also concluded that both future domestic water supply and fisheries flow requirements can be achieved by the release of additional flows from the Arrowsmith Dam during critical summer months.

The original scoping study (prepared by Associated Engineering) provides rationale for the intake siting. The full report is included in the attached CD for reference.

Long Term Monitoring:

A monitoring program will be implemented to confirm effectiveness of mitigation measures and operational strategies (e.g., maintenance flows, flow ramping, Arrowsmith Dam flow release management, screening of water withdrawals) in avoiding serious harm to fish. Monitoring will include field measurements and reporting on the following parameters:

- temperature, turbidity and discharge,
- wetted widths and depths at riffle and glide habitats,
- distribution and relative abundance of fish species and life stages, and
- incidence of fish being impinged on the intake screen.

Further detailed long term monitoring plans can be seen in Section 5.5 of the attached Aquatic Effects Assessment.

We look forward to continuing to work cooperatively together on common interest projects. Should you have any questions, please feel free to contact me.

Regards,

Mike Squire, AScT
Program Manager – Arrowsmith Water Service / Englishman River Water Service

cc: Herb Klassen, DFO (e-mail)
Mike McCulloch, MFLNO - Fish and Wildlife (e-mail)
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Attachments (on enclosed CD):

Aquatic Effects Assessment
TM 2A – Intake Hydrology and Hydraulics
TM 2B – Arrowsmith Lake Reservoir Water Supply
TM 2C - Intake, Raw Water Pump Station, and Transmission Mains
TM 4A: Distribution System Upgrades – Water Demands
TM 4B: Distribution System Upgrades- Water Modelling
Discussion Paper 8-1 – Comparison of Intake Locations