Appendix U - Trout Creek

Associated Environmental

APPENDIX U

Okanagan Basin Water Board
Okanagan Nation Alliance
B.C. Ministry of Forests, Lands and Natural Resource Operations

Trout Creek

May 2016

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APPENDIX U

Table of Contents

1 Introduction

The purpose of this appendix is to provide information to support the application of recommended environmental flow needs (EFN)-setting methods for Trout Creek following the methods outlined in the accompanying report[1]. This document contains information obtained and collated by Associated Environmental Consultants Inc. (Associated) and will be revised following additional input from Okanagan Nation Alliance. A summary of current available information for Trout Creek is provided in Table 6-1 in the accompanying report and Table U-1 at the end of this appendix.

Section 5 in the accompanying report provides an overview of two recommended EFN-setting methods for tributaries within the Okanagan Basin, while Section 6 lists the key steps to implement each of the two methods, in both flowchart and text form.

Environmental flows have been previously recommended for Trout Creek by Koshinsky (1972), nhc (2001; 2004; 2005), Epp (2003-2005), and ESSA and Solander (2009) (Table 6-1 in the accompanying report).

In addition, a Water Use Plan Operating Agreement for the Trout Creek watershed was developed collaboratively by the District of Summerland, the B.C. Ministry of Environment, and Fisheries and Oceans Canada in 2005. This plan established minimum flows in the lower main stem of Trout Creek (Water Management Consultants 2005).

2 Relevant Information for Setting Environmental Flow Needs

This section summarizes the information available to support EFN-setting in Trout Creek. Available information sources for Trout Creek are included within Table U-1 at the end of this appendix.

2.1 OVERVIEW OF THE WATERSHED

Trout Creek has a watershed area of approximately 746 km^2. Flowing from forested plateau headwaters, Trout Creek drops through a deeply incised canyon before and flowing through a section of wider floodplain. The main tributaries to Trout Creek include North Trout, Camp, Bull, Isintok, and Darke Creeks (Summit 2009). Land use activities in the watershed include agriculture and urban development in the lower portions of the watershed and range, grazing, and forestry throughout the rest of the watershed.

The Trout Creek watershed is shown in Figure 1-1 in the main report.

[1] Associated Environmental Consultants Inc. (Associated). 2016. Collaborative Development of Methods to Set Environmental Flow Needs in Okanagan Streams. Working Document, Current Version. Prepared for the Okanagan Basin Water Board, Okanagan Nation Alliance, and B.C. Ministry of Forests, Lands and Natural Resource Operations. May 2016

2.2 STREAMFLOWS

2.2.1 Hydrometric Data

There is currently one active Water Survey of Canada (WSC) hydrometric station within the Trout Creek watershed:

- **Camp Creek at Mouth near Thirsk** (WSC 08NM134; Drainage area: 34.6 km^2; Natural; Period of record: 1965-2010)

In addition, historic records are available for the following hydrometric stations within the watershed:

- **Thirsk Lake near the Outlet** (WSC 08NM238; Regulated; Period of record: 1979-1987)
- **Trout Creek Below Thirsk** (WSC 08NM238; Regulated; Period of record: 1979-1986)
- **Bull Creek near Crump** (WSC 08NM133; Drainage area: 46.9 km^2; Natural; Period of record: 1965-1986)
- **Darke Creek Northwest Fork** (WSC 08NM023; Drainage area: 13.2 km^2; Natural; Period of record: 1921-1922)
- **Darke Creek at Meadow Valley** (WSC 08NM025; Drainage area: 54.9 km^2; Regulated; Period of record: 1921-1922)
- **Trout Creek Summerland Diversion** (WSC 08NM055; Natural; Period of record: 1922-1931)
- **Trout Creek near Faulder** (WSC 08NM054; Drainage area: 704 km^2; Regulated; Period of record: 1922-1954)
- **Trout Creek near Summerland** (WSC 08NM042; Drainage area: 756 km^2; Regulated; Period of record: 1920-1922)
- **Trout Creek at the Mouth** (WSC 08NM158; Drainage area: 764 km^2; Regulated; Period of record: 1969-1982)

In addition, the B.C. Ministry of Environment operated a seasonal hydrometric station on Trout Creek between 2004 and 2007:

- **Trout Creek at Canyon Mouth** (Regulated; Period of record: 2004-2007).

2.2.2 Naturalized Streamflows

Figure 6-1 in the accompanying report highlights the necessity of producing hydrographs under natural conditions and under actual, licensed, and future proposed water use conditions. nhc (2001; 2004; 2005) and Summit (2009) provide naturalized streamflow estimates for Trout Creek at the mouth. In addition, as part of the Okanagan Water Supply and Demand Project, net and naturalized flows were modelled for the majority of Okanagan tributaries, including Trout Creek (Summit 2010). Figure 2-1 provides a summary of the modelled mean weekly net and naturalized streamflows for Trout Creek at the mouth for 1996-2006 (i.e., the model calibration period).

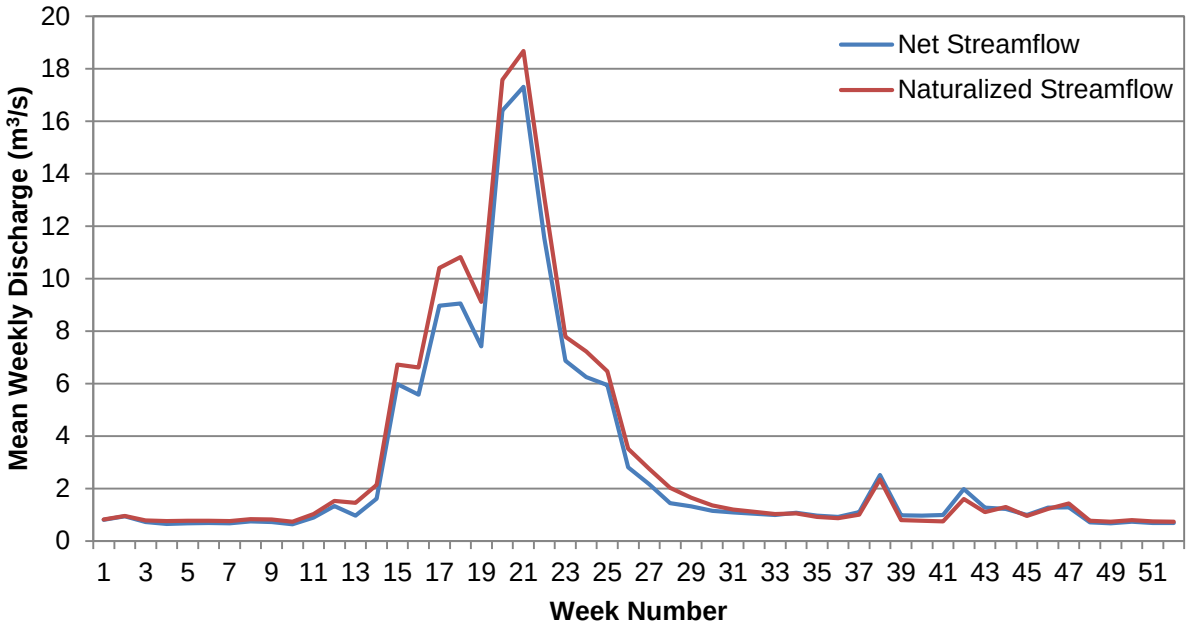

Figure 2-1
Mean weekly net and naturalized flows for Trout Creek at the mouth, 1996-2006 (Summit 2010).

Phases 2 and 3 of the Okanagan Water Supply and Demand Project included modeling of multiple future scenarios for the Okanagan Basin, which considered projected climate change, population growth, changes to irrigation efficiencies, and other factors. Net and naturalized streamflow outputs for Mill Creek at the mouth are available for each future scenario.

2.3 FISH AND AQUATIC HABITAT

Fish habitat values are considered to be higher in the upper reaches of Trout Creek, with potentially better spawning, incubation, and rearing conditions for fish, including rainbow trout (nhc 2005). However, several chutes and small falls limit fish migration to those upper reaches for many species. Seven barriers to fish migration were identified on the lower 8.8 km of Trout Creek by nhc (2003). In addition, nhc (2005) provide the most recent summary of fish and aquatic habitat in Trout Creek, including physical habitat, water quality, and potential future impacts to existing aquatic habitat.

No sensitive habitat inventory and mapping (SHIM) has been completed for Trout Creek (Table 6-1 in the accompanying main report).

2.3.1 Current and Historical Fish Species Presence

Fish species found in Trout Creek include rainbow trout, kokanee, eastern brook trout, mountain whitefish, largescale sucker, longnose dace, prickly sculpin, sculpin (general), redside shiner, and peamouth chub

(ESSA and Solander 2009). Chinook and Coho are not currently present in Trout Creek but could be supported if species recovery to Okanagan Lake occurs in the future (ESSA and Solander 2009).

Since current (and potentially historic) fish presence information is important for developing an EFN flow regime, it is recommended that up-to-date fish presence information be obtained from publically available databases at the time of investigation.[2]

2.3.2 Fish Periodicity and Habitat Suitability

nhc (2005) provides a fish periodicity chart for Trout Creek, which defines critical timing periods for adult migration, spawning, incubation, fry rearing, and par rearing for rainbow trout and kokanee, including adult (Figure 2 in nhc [2005]) (Table 6-1 in the accompanying main report). In addition, Epp (2003-2005) provides Weighted Useable Width results for Trout Creek and provide essential building blocks for developing Habitat Suitability Index (HSI) curves for Trout Creek.

In addition, Appendix E in the accompanying report provides information on salmonid species-specific life stage periodicities for the Okanagan Basin, as well as HSI curves for select species. The information within nhc (2005) and Appendix E should be used at a minimum to support EFN-setting for Trout Creek.

2.4 WATER USE AND STORAGE

The District of Summerland (DoS) is the major water supplier in the Trout Creek watershed.

Recent information on water demands for the DoS can be found in Section 3 of a water availability assessment completed by Agua Consulting (2014). Water demand information for DoS and other users within the watershed was also summarized by Dobson (2008 [included in Summit 2010]).

Summit (2010) provides an estimate of actual surface water use within the Trout Creek watershed for 1996-2006 in Appendix C of the Okanagan Water Supply and Demand Project – Phase 2. The actual mean annual surface water use over 1996-2006 was estimated to be 7,961 ML. These water use estimates were subsequently included within the Okanagan Hydrologic Connectivity Model that was used to investigate ‘first-in-time, first-in-right’ water license legislation within the Okanagan Basin (Summit 2013)

2.4.1 Storage Reservoirs

The main storage reservoir within the Trout Creek watershed is Thirsk Reservoir. This reservoir is located directly on Trout Creek and therefore regulates streamflows directly downstream. There are an additional eight reservoirs in the upper watershed, as follows:

- 4 Headwaters Reservoirs
- Crescent Reservoir
- Whitehead Reservoir

[2] Fish presence information can be obtained from the Government of B.C. Fish Inventory Summary System Database Query: http://www.env.gov.bc.ca/fish/fiss/.

- Tsuh Reservoir
- Isintok Reservoir

Runoff from the upper catchment area is collected in the four Headwaters reservoirs. Additional headwater storage is provided in Whitehead reservoir and the combined outflow provides the supply to the mainstem Thirsk reservoir. The reservoirs are managed to collect water during freshet and to release water in the summer and fall to meet downstream demands and fish flow requirements. Streamflows downstream of the Thirsk Reservoir are supplemented by streamflow from Camp, Lost Chain, Bearpaw, Bull ,and Isintok Creeks. Water in the Tsuh Reservoir has not been used for many years.

2.4.2 Water Licences and Major Points of Diversion

There are 105 current water extraction licences and three active applications within the Trout Creek watershed. Since knowledge of current water licences is critical in developing EFN flow regimes, it is recommended that up-to-date water licence information be obtained at the time of investigation.[3]

The DoS has an intake on lower Trout Creek approximately 12 km upstream from the mouth and holds 25 water licenses in the watershed for storage, waterworks, and irrigation purposes. Section 4.1 in Agua Consulting (2014) provides a summary of the DoS's water licences.

2.4.3 Interbasin Transfers

There are no direct diversions of water to or from the Trout Creek watershed.

2.5 GROUNDWATER AND SURFACE WATER INTERACTION

Summit (2009) identified that Trout Creek likely loses water to groundwater and estimated that streamflow is lost to groundwater at a rate of 0.04 m^3/s across its alluvial fan (Section 3.6 of Summit 2009). Groundwater loss estimates reported by Summit (2009) are similar to those estimated for Trout Creek by the Trout Creek Water Use Plan Consultative Committee (2005).

2.6 TRADITIONAL KNOWLEDGE

The current version of this document does not include presentation of any Okanagan Nation Traditional Knowledge. However it is anticipated that a future revision will include such information, as well as potentially other technical information held by the Okanagan Nation Alliance Fisheries Department.

[3] Water Licence Information can be obtained from the Government of B.C. Water Licences Query: http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input.

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Table U-1 Summary of relevant information for setting environmental flow needs within Trout Creek watershed

Information Source	Fish and Aquatic Management											Streamflow				Water Management																
	Current Fish Species Presence	Historic Fish Species Presence	Fish Periodicity Tables	Aquatic Habitat	Channel Characteristics	Channel Cross-Sections	Channel Velocity/Depth Measurements	Habitat Suitability Index	Fish Barriers (Natural/Man-made)	EFN Investigations / Recommended Fish Flows	Other Relevant Information	Streamflow Measurements	Water Quality / Temperature	Streamflow Estimates	Other Relevant Information	History of Water Management	Water License Points-of-Diversion Mapping	Water License Information	Water License – Conservation Storage/Flows	Water Purveyor Intakes	Groundwater Wells Mapping	Groundwater Information	Water Use Information (Actual/Estimated)	Return Flow Information	Land Use and Associated Water Supply Source	Interbasin/Intrabasin Transfers	Flow Regulation	Reservoir Flow Release Patterns	Reservoir Minimum Flow Releases	Other Relevant Information
Online Resources																																
B.C. Habitat Wizard (http://www.env.gov.bc.ca/habwiz/)	✓								✓																							
B.C. Ministry of Forests, Lands, and Natural Resource Operations – Dam Safety Program (http://www.env.gov.bc.ca/wsd/public_safety/dam_safety/). Contact: Mike Noseworthy, Dam Safety Officer (Penticton).																											✓				
B.C. Orchard Museum (https://kelownamuseums.ca/museums/the-bc-orchard-industry-museum/)																✓																
B.C. Water Licences Query (http://a100.gov.bc.ca/pub/wtrwhse/water_licences.input)																		✓														
B.C. Water Resources Atlas (http://www.env.gov.bc.ca/wsd/data_searches/wrbc/)												✓	✓				✓			✓	✓	✓					✓					
B.C. Water Use Reporting Center (http://www.obwb.ca/tools/bc-water-use-reporting-centre/)												✓											✓									
B.C. Water Well Application (https://a100.gov.bc.ca/pub/wells/public/)																					✓											
DataBC (http://www.data.gov.bc.ca/)												✓	✓				✓	✓		✓	✓	✓					✓					
District of Summerland (http://www.summerland.ca/). Contact: Watershed Manager																✓				✓			✓				✓	✓	✓	✓		
Fisheries Inventory Summary System (http://www.env.gov.bc.ca/fish/fiss/)	✓			✓																												
Okanagan Historical Society Reports (https://open.library.ubc.ca/#/collections/ohs)																✓																
Water Survey of Canada (https://www.ec.gc.ca/rhc-wsc/)												✓																				
Literature Resources																																
Western Water Associates Ltd., Polar Geoscience Ltd., and ESSA Technologies Ltd. 2014. Okanagan Water Allocation Tool Plan. Prepared for the Okanagan Basin Water Board, May 2014.										✓																						
Polar Geoscience Ltd. 2012. Projected Water Supply and Use in the Okanagan Basin (2011-2040) – Okanagan Basin Water Accounting Model Results. Prepared for the Okanagan Basin Water Board. March 2012. *Note: Several Excel spreadsheets (not attached to the report) are available from the author describing monthly water extraction, water use, and net and natural streamflow for all major tributaries in the Okanagan Basin.*														✓	✓																	

Information Source	Fish and Aquatic Management											Streamflow				Water Management															
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Epp, P. 2012. HSI tables in Microsoft Excel Files: Glide Habitat Template and Riffle Habitat Template.								✓																							
Epp, P. 2010. 2009 Flow & Habitat Monitoring: Trout Creek. B.C. Ministry of Environment, Penticton. March 2010. Annual Trout Creek Flow & Habitat Monitoring reports also prepared by P. Epp for 2005, 2006, 2007 & 2008.										✓		✓																			
Rayne, S., and K. Forest. 2010. Historical trends in annual water yields for the Okanagan Basin, British Columbia, Canada. Nature Proceedings: doi: 10.1038/npre.2010.4946.1															✓																
Summit Environmental Consultants Inc. 2010. Okanagan Water Management and Use (Appendix C). In: Okanagan Water Supply and Demand Project, Phase 2 Summary Report. Prepared for Okanagan Basin Water Board, July 2010.																✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			✓
DHI Water and Environment. 2010. Okanagan Basin Water Accounting Model. Prepared for the Okanagan Basin Water Board, November 2010.														✓												✓				
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Summit Environmental Consultants Ltd. 2009. Surface Water Hydrology and Hydrologic Modeling Study – "State of the Basin" Report. Prepared for the Okanagan Basin Water Board, September 2009. *Note: detailed spreadsheets supporting the findings of the report are available from the author.*											✓	✓	✓		✓	✓															
Agua Consulting Inc. 2008 District of Summerland 2008 Water Master Plan. August 2008.										✓			✓			✓		✓					✓					✓			
Dobson Engineering Ltd. 2008. Water Management and Use Study. Prepared for Okanagan Basin Water Board, December 2008.																✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
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Information Source	Fish and Aquatic Management											Streamflow				Water Management																
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2007.																																
Cohen, S., and T. Neale. 2006. Participatory Integrated Assessment of Water Management and Climate Change in the Okanagan Basin, British Columbia. Environment Canada and University of British Columbia, Vancouver.														✓	✓								✓								✓
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Information Source	Fish and Aquatic Management											Streamflow				Water Management															
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kokanee spawning data review. Prepared for District of Summerland.																															
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