3.13 Powers Creek

Powers Creek flows from the west side of the Okanagan Basin into Okanagan Lake at West Kelowna, B.C. The Powers Creek watershed has an area of approximately 145 km^2 (Associated 2016) and the total stream length is 29.5 km (Lukey & Louie 2015). Powers Creek drains a gently sloping plateau in the upper reaches before flowing through a deeply incised canyon and through a terrace of thick glacial sediments, before flowing across a large alluvial fan. A summary of creek characteristics is found in Table 3-39 and additional stream-specific data is provided in Appendix B13.

The lowest 1 km reach of Powers Creek is impaired by heavy urban encroachment and corresponding loss of riparian vegetation. Intermediate reaches have moderate riparian cover and impacts (Lukey & Louie 2015). The stream is known to support populations of Kokanee (spawning) and Rainbow (Associated 2016). Powers Creek has been recognized previously for its significant current and potential future Kokanee and Rainbow producing capabilities (Anonymous 1969; Wightman & Taylor 1978; Tredger 1988). The maximum reported Kokanee escapement was 35,000 in 1985 (Tredger 1988). A small (passable) chute is located approximately 0.7 km from the mouth (Tredger 1988) and a potential barrier to fish migration is located at Highway 97 (~ 2.7 km from the mouth) where there is a series of cascades and a culvert. A permanent barrier is located upstream at the water treatment facility of the Westbank Irrigation District (~ 7.5 km from the mouth; Lukey & Louie 2015). Tredger (1988) notes the high quality of trout rearing habitat between the chute and the potential barrier at 2.7 km. During 2017 flooding the creek deposited significant amounts of mobile bed material in the lowest reach. This material was removed by dredging and the flood conveyance capacity readjusted. Given the fact that the fan of Powers Creek where it flows into Okanagan Lake has been constrained by development, these deposits will continue to cause issues for flood capacity and Kokanee access into the creek.

At present there are 85 points of diversion and 4 pending water licence applications within the watershed (Associated 2019); however, the actual volume extracted annually is unknown. The City of West Kelowna is the main water user in the watershed and has developed headwater storage including Horseshoe Lake, Dobbin Lake, Paynter Lake, Jackpine Lake, Lambly Lake, and Tadpole Lake reservoirs (Associated 2016). Inter-basin water transfers into Powers Creek occur from Lambly (Bear) Creek and from Alocin Creek in the Nicola River watershed to supplement streamflows to the West Kelowna water intake on Powers Creek (Associated 2016; Lejbak pers. comm.). Powers Creek is considered fully recorded after June 30 unless storage is provided (Shepherd & Ptolemy 1999).

Since 1987, the B.C. MOE has held a water licence on Powers Creek for instream (conservation) use for the maintenance of 0.085 m^3/s within the creek throughout the year (Shepherd & Ptolemy 1999). Further, MOE placed a Water Act Reserve on Powers Creek (and all its tributaries) on June 15, 1989 (Dobson 2010), requiring that 0.13 m^3/s be maintained within the creek to meet current and projected angling demands for recreational fisheries (Lejbak pers. comm. 2019). Powers Creek is 'flow sensitive' during the winter but not the summer season as flows are above 20% LTMAD (Table 3-40). Water losses or gains across the alluvial fan near the mouth are unknown.

Naturalized flow data were provided by Associated (2019) with an estimated data quality rating of C (data error between 25% and 50%); residual and maximum licensed flows were not available at the time of reporting. Okanagan Tennant EFNs for Powers Creek were developed in accordance with the methods outlined in Section 2.2. No WUW data was collected in Powers Creek. Fish periodicity and flow standards described in Table 2-2 to Table 2-6 were used. Weekly Okanagan Tennant EFNs were set to the lower of the naturalized flow or flow standard. The exception was Kokanee spawning, for which the EFN was set

to the median naturalized flows during the spawning period. A summary of EFNs for Powers Creek is provided in Table 3-41 including the median EFN and the range of weekly EFNs, with weekly details in Figure 3-28, Figure 3-29 and Appendix B13, and flow sensitivities in Table 3-40. Further information on EFN setting in Powers Creek is provided at the end of this section.

Table 3-39: Powers Creek description

Drainage Area	145 km^2
Median Elevation	1242 m
WSC station	No active stations 08NM136 (historic) Lambly Lake Diversion to Powers Creek (1965-1972) 08NM033 (historic) Powers Creek above Westbank Diversion (1920-1974) 08NM034 (historic) Powers Creek Westbank Diversion (1920-1931) 08NM059 (historic) Powers Creek below Westbank Diversion (1924-1987) 08NM157 (historic) Powers Creek at the Mouth (1969- 1982)
MOE station (Epp 2008b)	08NM570 (historic) Powers Creek at Gellatly Road (2004-2009)
LTMAD	0.643 m^3/s (Associated 2019)
Fish species expected	Rainbow, Kokanee, Eastern Brook Trout, Sculpin (general) (ESSA & Solander 2009)
Land use	Forestry in upper watershed, and agriculture and urban development in the lower watershed (Associated 2016)

Table 3-40: Flow sensitivities in Powers Creek

Species & life stage	**1-in-2 yr 30-day summer low flow**		**1-in-2 yr 30-day winter low flow**	
	Flow (m^3/s)	% LTMAD	Flow (m^3/s)	% LTMAD
Rainbow rearing	0.137	21%		
Insect production				
Kokanee spawning				
Rainbow overwintering			0.113	18%
Kokanee egg incubation				

Source: Associated (2019)

Table 3-41: EFN summary table for Powers Creek

Species & life stage	**Time period**	**Okanagan Tennant Recommended EFN**				**Critical flow**	
		Median (m^3/s)	% LTMAD	Min (m^3/s)	Max (m^3/s)	Flow (m^3/s)	% LTMAD
Rainbow rearing & insect production [a]	April 1 – Oct 31	0.141	22%	0.129	0.486	0.032	5%
Rainbow spawning	May 20 – Jul 10	1.12	174%	0.574	3.80	0.321	50%
Kokanee spawning	Sep 4 – Oct 3	0.141	22%	0.141	0.141	0.064	10%
Rainbow overwintering	Nov 1 - March 31	0.143	22%	0.120	0.160	0.032	5%

a while EFNs apply to the entire period, median values are presented for the summer low flow period from Jul 15-Sept 30.

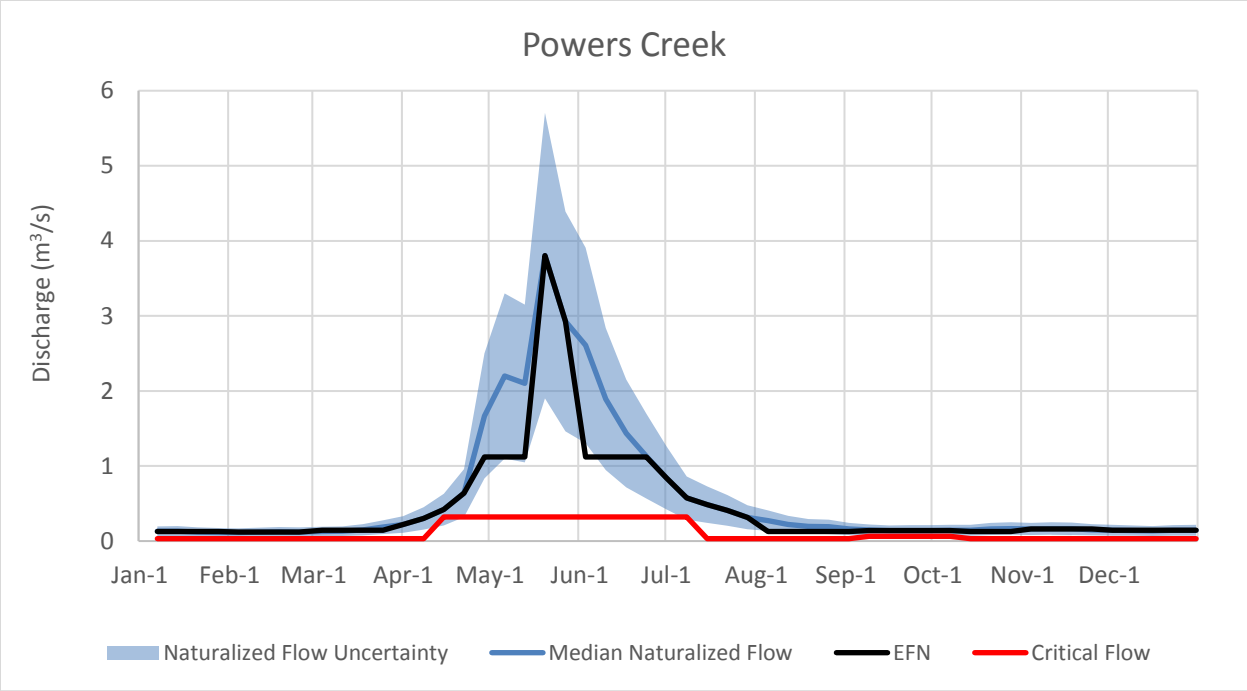

Figure 3-28: Weekly EFNs, critical flow and streamflows in Powers Creek

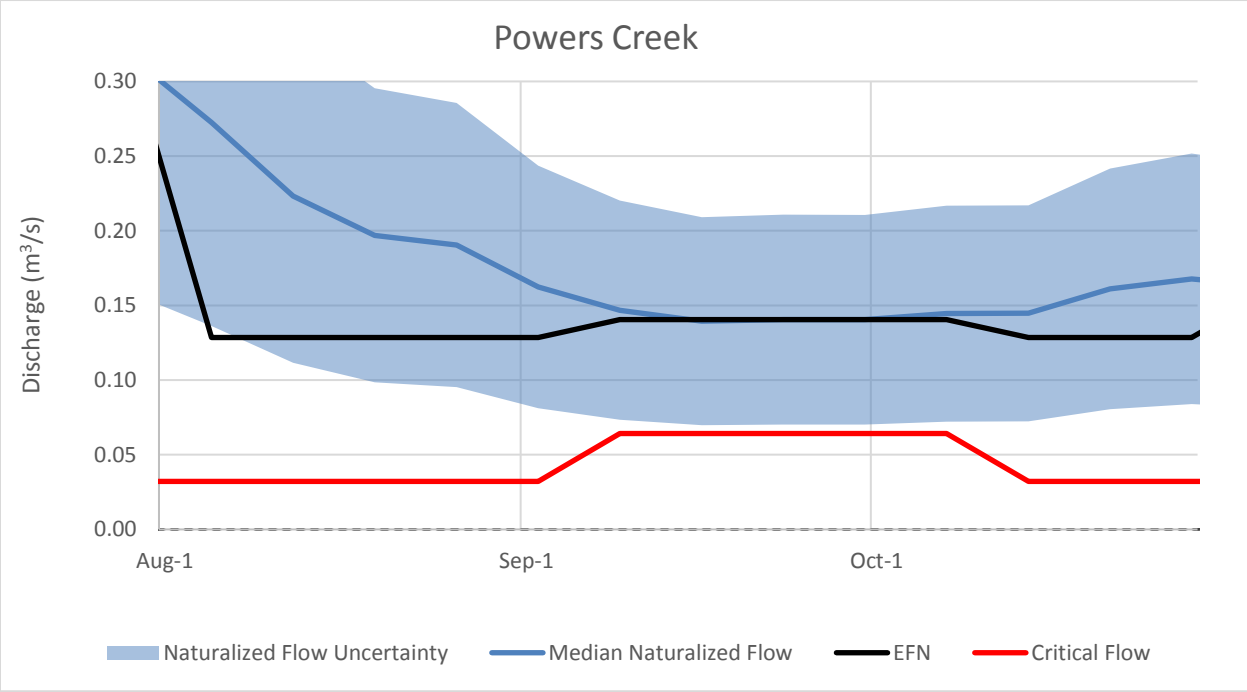

Figure 3-29: Weekly EFNs, critical flow and streamflows during the summer and fall period in Powers Creek

Rainbow parr rearing

The recommended EFN for Rainbow rearing is 0.129 m^3/s which is equal to the flow standard of 20% LTMAD. No WUW data was collected in Powers Creek for this project. Historical EFN recommendations made for Rainbow parr rearing were 0.11 m^3/s (Koshinsky 1972b) and 0.4-0.6 m^3/s (ESSA & Solander 2009). The recommended critical flow for Rainbow rearing is 0.0.32 m^3/s (5% LTMAD) based on the LTMAD criterion (Table 2-7).

Naturalized weekly flows during the mid-July to late September period are slightly higher than the recommended EFN (median 0.141 m^3/s, Table 3-41). Historical residual flows recorded at the WSC hydrometric station 08NM157 (Powers Creek at the Mouth, Figure B13-1 Appendix B13) from 1969 - 1982 during the same period were 0.218 m^3/s which suggests flow supplementation from storage. Historical WUW information (Tredger & Wightman 1988) shows modest gains in Rainbow parr rearing capacity between the recommended EFN and the residual flows. The authors recommend a flow of 0.14 m^3/s for Rainbow rearing based on field observations. More recent flow data collected by Epp (2008b) from 2004 - 2008 (Figure B13-1, Appendix B13) show residual rearing flows near the recommended EFN, with large annual differences and some years well below the recommended EFN.

Rainbow spawning

The recommended Okanagan Tennant EFN for Rainbow spawning is 1.12 m^3/s (Table 3-41), which is equal to the flow standard of 174% LTMAD. The recommended critical flow for Rainbow spawning is 0.321 m^3/s (50% LTMAD) based on the LTMAD criterion (Table 2-7). Estimated naturalized flows and residual flows recorded at the WSC hydrometric station 08NM157 (Powers Creek at the Mouth, Figure B13-1, Appendix B13) from 1969 - 1982 are above the recommended EFN for most of the spawning period, therefore EFNs for Rainbow spawning are considered achievable. A previous EFN recommendation by ESSA & Solander (2009) was approximately 1.75 m^3/s.

Kokanee spawning

The recommended Okanagan Tennant EFN for Kokanee spawning is 0.141 m^3/s (22% LTMAD, Table 3-41) which is equal to median naturalized flows during the spawning period. No WUW data was collected in Powers Creek for this project but historical information is available. According to Tredger (1988), there were no large gains in Kokanee spawning capacity at flows greater than 0.12 m^3/s; however, large decreases were observed below that. They suggest that 0.13 m^3/s is a suitable flow for Kokanee spawning. Data from Epp (2008b) indicate that WUW at the recommended EFN is approximately 60% of the maximum WUW, which is equal to or greater than the WUW available at the recommended EFN flows in other study streams. Historical minimum discharge recommendations for Kokanee spawning are generally in the range from 0.12-0.14 m^3/s (Koshinsky 1972b; Tredger 1988). The recommended critical flow for Kokanee spawning is 0.064 m^3/s (10% LTMAD) based on the LTMAD criterion (Table 2-7).

Median flows at the WSC hydrometric station 08NM157 (Powers Creek at the Mouth, Figure B13-1, Appendix B13) from 1969 - 1982 were 0.241 m^3/s, which is substantially greater than the Okanagan Tennant EFN presented above. However, more recent flow data collected by Epp (2008b) from 2004 - 2008 documented spawning flows at or well below the Okanagan Tennant EFN (Figure B13-1, Appendix B13). Meeting EFNs for Kokanee spawning is considered achievable in conjunction with improved flow management.