

Alberta Conservation Association
2021/22 Project Summary Report

Project Name: Owl River Fish Habitat Protection

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Partnerships

Alberta Environment and Parks

County of Lac La Biche

Syncrude Canada Ltd.

Key Findings

- Drought conditions in 2021 likely impacted water quality in the Owl River, which was comparable to baseline levels in 2011.
- Dissolved oxygen levels remained optimal for the fish community, but temperature approached lethal limits in July.
- Water quality was marginal in 2021, with high levels of total phosphorous, nitrogen, and coliforms although macroinvertebrate diversity was comparable to past assessments.

Abstract

In partnership with Syncrude, ACA is monitoring instream habitat on the Owl River from 2020 to 2045 related to riparian habitat restoration. In general, 2021 was considered a drought year, and water quality was likely impacted by low water levels but remained similar to 2011 baseline conditions. Dissolved oxygen levels were within optimal ranges for walleye and the fish community, but temperatures approached tolerance limits in July. Total phosphorus, total nitrogen, and total coliform counts were high across all sites. There was no clear pattern of macroinvertebrate distribution, and the total number of macroinvertebrate families in 2021 was

similar to those in previous years. Overall water quality in the Owl River was classified as marginal in 2021. Due to low water levels in 2021, the fish community and aquatic habitat assessment were deferred to 2022.

Introduction

Syncrude is monitoring riparian and instream habitat for 25 years on the Owl River to satisfy a Fisheries and Oceans Canada (DFO) authorization, starting in 2020, with instream portions focusing on water quality and macroinvertebrates. Monitoring is meant to complement riparian habitat restoration along a Class A watercourse designated for walleye spawning (Syncrude 2019).

Our study area includes 40 km of the Owl River from Lac La Biche and sections of the Piche River and Square Creek (Figure 1). This includes walleye spawning habitat in the upper 10 km, and the downstream 30 km section, which runs through grazing leases and private land that support livestock grazing.

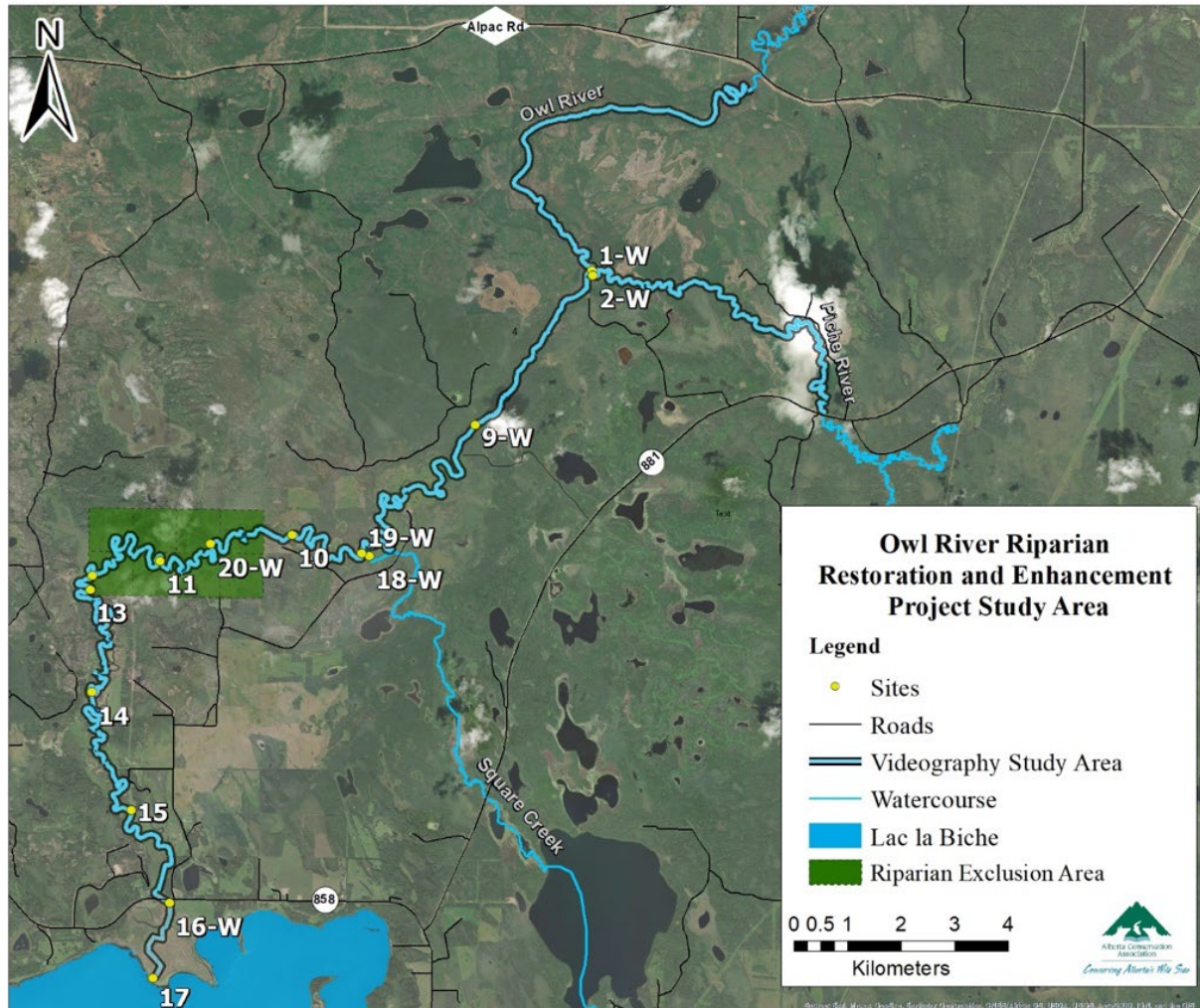


Figure 1. Owl River system study area showing 2021 water quality monitoring locations marked “W.”

Methods

From May to October, we monitored water quality monthly at seven sites using a handheld meter, collected water samples, and installed data loggers to record hourly temperatures as per Alberta Environment (2006) protocols. Lab analysis of samples reported on ions, nutrients, metals, and biological variables. We compared water quality data from all sites to federal and provincial guidelines (CCME 2007, GoA 2018) and used the Canadian Council of Ministers of the Environment (CCME 2017) water quality index (WQI) to determine overall condition on the Owl River. The index was based on eight parameters suggested by provincial jurisdictions. Where parameters did not have accepted guidelines, they were derived using historical data

(CCME 2016) (Table 1). A beaver dam on Square Creek affected flow at site 18-W, and it was not included in our analysis.

Table 1. Parameters and associated guidelines used in calculation of CCME Water Quality Index for the Owl River in 2021.

Parameter	Specification	Guideline	Source
Dissolved oxygen	15 May to 30 June	8.3 mg/L	GoA 2018
	1 Jul to 15 May	6.5 mg/L	GoA 2018
pH	-	6.5 - 9.0	GoA 2018
TSS	Background < 25 mg/L	+ 5 mg/L	GoA 2018
	Background > 25 mg/L	+ 25 mg/L	GoA 2018
Coliforms (<i>E. coli</i>)	-	100 #/100 mL ¹	GoA 2018
Total phosphorous (TP)	-	110 µg/L	Derived
Total nitrogen (TN)	-	0.93 mg/L	Derived
Chloride - dissolved	-	180 mg/L	CCME 2011
Sulphate - dissolved	Hardness 76 – 180	309 mg/L	GoA 2018
	Hardness 181 – 250	429 mg/L	GoA 2018

We conducted macroinvertebrate sampling at six sites and used a Petite Ponar Grab Sampler at depositional sites and a dip net at erosional sites. Five replicates were taken at each site and samples were identified to the family level (Barbour et al. 1999). For each replicate, indices of richness, diversity, equitability, %EPT (Ephemeroptera, Plecoptera, and Trichoptera), and Hilsenhoff's Biotic Index (HBI) were calculated.

Results

Water temperature, conductivity, pH, and dissolved oxygen (DO) had no clear trend between sites except turbidity, which was lower in the Piche (Table 1). In general, DO was high and temperature was within tolerable limits for fish except in July where maximum temperature reached 29.2°C. Average daily temperatures at site 9-W were lower in August compared to other sites (Figure 2).

Table 2. Mean (\pm SD) key water quality variables from May to October 2021 in the Owl River system.

Site	Temperature (°C)	Conductivity (μ S/cm)	pH	Turbidity (FNU)	Dissolved Oxygen (mg/L)	Sample Size (n)
1-W	13.0 \pm 7.6	287 \pm 83	8.07 \pm 0.07	7.76 \pm 2.36	9.11 \pm 1.99	6
9-W	13.5 \pm 8	299 \pm 71	8.27 \pm 0.08	7.15 \pm 3.66	10.07 \pm 1.69	6
20-W	12.4 \pm 8.6	325 \pm 72	8.19 \pm 0.17	7.76 \pm 2.22	9.83 \pm 1.89	4 ²
19-W	12.9 \pm 7.4	300 \pm 71	8.14 \pm 0.13	7.6 \pm 3.37	8.99 \pm 2.12	6
16-W	14.4 \pm 7.4	295 \pm 67	8.03 \pm 0.17	7.98 \pm 4.35	8.58 \pm 2.03	6
2-W ³	13.0 \pm 8.1	327 \pm 19	8.24 \pm 0.07	5.83 \pm 5.79	9.63 \pm 1.88	6

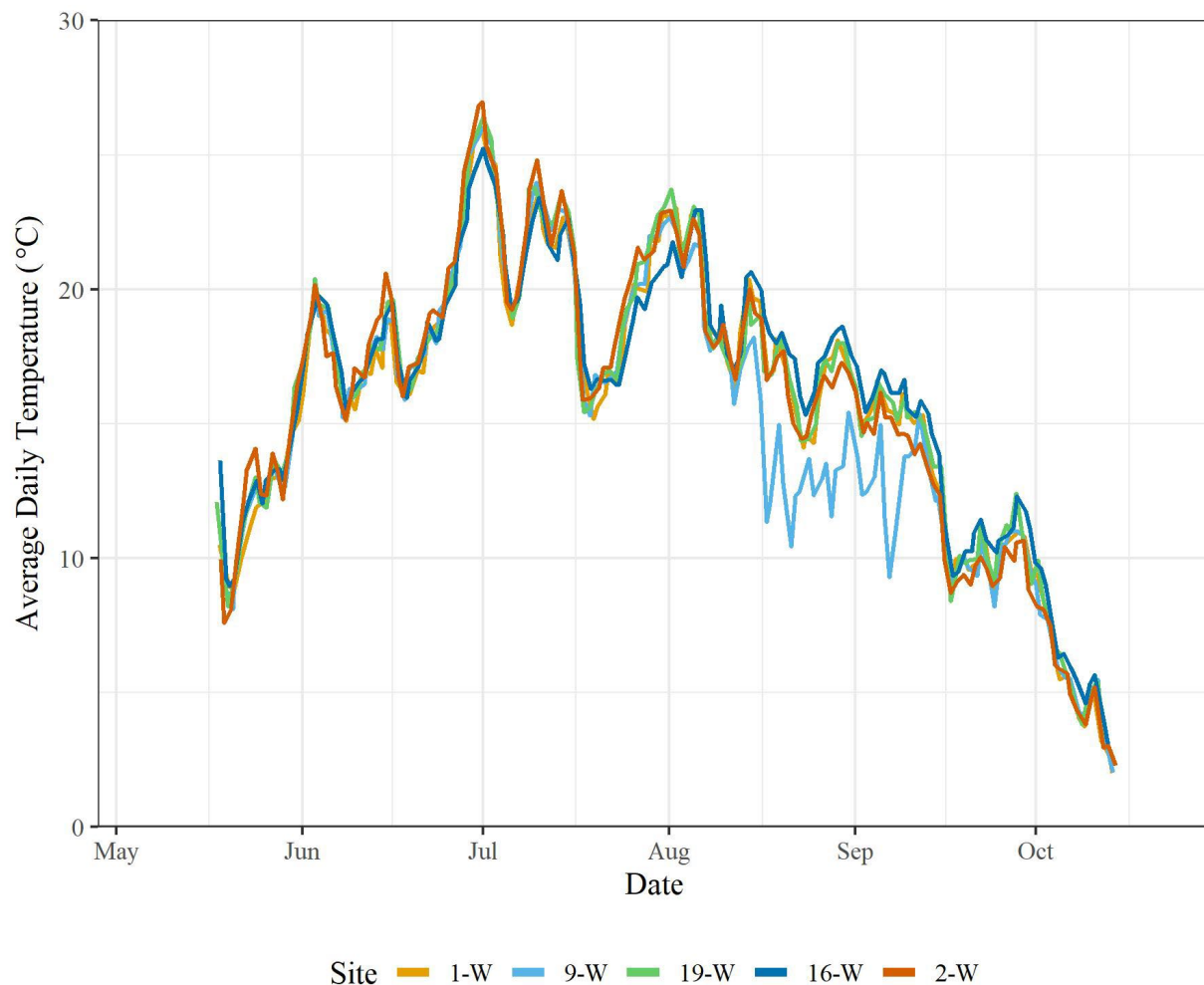


Figure 2. Daily average temperature from instream loggers at five sites from May 18 to October 14, 2021.

In general, TP and TN concentrations were high where TN approached the limit upstream sites in the spring. In general, chlorophyll a (Chla) showed no clear trend but was generally higher at site 1-W. Total coliforms exceeded the limit at all sites, and *E. coli* was detected at all sites (Table 4). Metal concentrations mostly met guidelines, with three instances where silver was above guidelines. The CCME WQI rated the Owl River as marginal with no trend along the course of the river at individual sites (Table 4).

Table 3. Mean (\pm SD) key nutrient and biological variables from May to October 2021 in the Owl River system (sample size same as Table 2).

Site	TP ($\mu\text{g/L}$)	TN (mg/L)	Chlorophyll a ($\mu\text{g/L}$)	<i>E. coli</i> (mpn/100mL)	Total Coliforms (mpn/100mL)
1-W	93 \pm 34	0.80 \pm 0.17	13.7 \pm 6.3	45 \pm 42	1733 \pm 809
9-W	91 \pm 31	0.84 \pm 0.19	11.2 \pm 5.6	40 \pm 38	1593 \pm 904
20-W	92 \pm 34	0.75 \pm 0.13	8.9 \pm 5.8	37 \pm 16	1072 \pm 920
19-W	91 \pm 30	0.82 \pm 0.12	10.4 \pm 6.6	47 \pm 18	1742 \pm 759
16-W	103 \pm 34	0.82 \pm 0.11	10.5 \pm 8.2	30 \pm 15	1530 \pm 957
2-W	45 \pm 22	0.94 \pm 0.15	4.9 \pm 4.4	70 \pm 41	1715 \pm 855

Table 4. CCME Water Quality Index results for the Owl River, 2021.

Site	CCME WQI	Classification
All	63	Marginal
1-W	75	Fair
9-W	69	Fair
16-W	77	Fair
20-W	85	Good
19-W	77	Fair

A total of 13,238 macroinvertebrates from 63 families were identified, the most common being Chironomidae (Table 5). Site 16-W was low in all indices except for the biotic index, and site 2-W had the highest abundance overall.

Table 5. Characteristics of the macroinvertebrate community collected at six sites on the Owl and Piche Rivers, September 8 – 9, 2021; values are \pm SD; $n=5$ replicates per site.

Site	Richness (S) ¹	Diversity (H) ²	Equitability (J) ³	% EPT ⁴	Biotic Index ⁵	Total Abundance
1-W	23.6 \pm 13.9	2.7 \pm 0.2	0.8 \pm 0.1	42.4 \pm 19.9	5.5 \pm 0.4	704
9-W	28.2 \pm 7.1	2.8 \pm 0.3	0.8 \pm 0	23.5 \pm 19.9	6.1 \pm 0.2	2689
20-W	28.8 \pm 4.8	2.9 \pm 0.2	0.8 \pm 0.1	45.0 \pm 19.6	5.3 \pm 0.5	1045
19-W	25.0 \pm 10.4	2.9 \pm 0.4	0.9 \pm 0.1	36.1 \pm 15.2	5.1 \pm 0.6	2035
16-W	18.0 \pm 6.0	1.4 \pm 0.4	0.5 \pm 0.1	2.2 \pm 2.0	8.0 \pm 0.3	2218
2-W ⁶	28 \pm 11.6	2.6 \pm 0.3	0.8 \pm 0.1	16.8 \pm 16.5	5.7 \pm 0.7	4547

¹ Taxonomic Richness (S)

² Shannon-Wiener Diversity index (H) range typically from 1.5 – 3.5

³ Equitability (Pielou's evenness) index (J') range from 0 – 1

⁴ Percentage of individuals belonging to the order EPT

⁵ Hilsenhoff's Biotic Index (HBI range from 0 – 10

⁶ Site located on Piche River, approximately 200 m upstream of confluence with Owl River

Conclusion

Substantial improvements in water quality have not yet been observed; however, atypically low flows likely negatively impacted water quality in the Owl River system this year. DO was within optimal ranges for the fish community, but temperatures approached upper limits for some species in July. High levels of TP and TN suggest this is a nutrient-rich system, and high levels of total coliforms and presence of *E. coli* indicate fecal contamination likely due to cattle grazing and agricultural runoff in the area. The Owl River was classified as marginal, meaning water quality generally departed from desirable levels. We found no clear trends in the macroinvertebrate community along the length of the river. The total number of families in 2021 was comparable to previous years, but diversity was higher and sensitive species were lower.

Communications

- Summary report provided to Syncrude Canada Ltd.

Literature Cited

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Photos



Photo 1. Macroinvertebrate sampling completed by staff member (Troy Furukawa) on the Owl River September. Photo: Kacey Barrett



Photo 2. Water samples being collected for analysis by ACA staff member (Lindsay Dowbush) on the Piche River. Photo: Kacey Barrett



Photo 3. Water quality monitoring site 20-W on the Owl River facing upstream.

Photo: Lindsay Dowbush



Photo 4. Water quality monitoring site 19-W on the Owl River facing downstream.

Photo: Lindsay Dowbush