BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: September 1 to 30, 2022

Prepared by BC Hydro

October 7, 2022

Introduction

BC Hydro diverted the Peace River through two diversion tunnels on the left bank of the dam site during the fall of 2020. River diversion represented the first activity in the construction of the Site C Clean Energy Project (the Project) to affect upstream fish movement in the Peace River (EIS, Volume 2, Appendix Q[1]). As such, the temporary upstream fish passage facility (hereafter temporary facility) was operated to pass fish upstream and allow them to fulfill portions of their lifecycles upstream of the Project.

Note that the temporary facility will operate during the river diversion phase of construction (2020 to 2023) on the left bank of the Peace River at the outlet of the diversion tunnels. BC Hydro intends to operate the temporary facility from April 1 to October 31 each year based on the timing of fish movements in the Peace River and to avoid damaging mechanical equipment during cold weather conditions from November to March. Following the closure of the diversion tunnels and reservoir filling in the fall of 2023, the permanent upstream fish passage facility (hereafter permanent facility) will be operated at the outlet of the generating station to provide fish passage during the operation phase of the Project.

Structure of the report

This report summarizes the data and information presented in weekly reports prepared by the facility operator, as described in the Manual of Operational Parameters and Procedures (OPP), and covers the full extent of operations in September 2022.

This report has the following sections:

- Biological operation;
- Environmental conditions;
- Mechanical operation; and
- Adjustments.

Biological operation is defined as the sorting, sampling, tagging, transport and release of fish. Mechanical operation is defined as the operation of the pumps, gates, crowder, lock, sensors, loggers, and other mechanical equipment to ensure the temporary facility achieves the biological objectives described in Section 4.1 of the Fish Passage Management Plan[2].

Summary

Three hundred and sixty five fish – 299 Redside Shiner, 55 Mountain Whitefish, 4 Largescale Sucker, 2 Longnose Sucker, 2 White Sucker, 1 Bull Trout, 1 Slimy Sculpin, and 1 Pearl Dace – were sorted and sampled at the temporary facility, and transported and released into the Peace River upstream of the Project (Table 1, Photo 1).

Several adjustments to the top of the fishway in August, September and October 2021 were continued in September 2022 to improve the biological and mechanical operation of the temporary facility.

- Sediment was flushed out of the fish lock and pre-sort holding pool on a weekly basis by slowly releasing flow through Pump 9.
- On September 17, the operator raised the finger weir to 5 cm below the water surface to improve trapping efficiency.
- Several adjustments were made to improve the efficiency of fish processing. Changes were made to the physical setup of the sorting area to reduce the risk of injury to fish, improve ergonomics and the ability of the operators to communicate with each other, and allow for both individuals to be involved in

[1] Available at: https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_Q.pdf
[2] Available at: http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf

the tagging and sampling of fish. Changes were also made to the order in which measurements and samples were collected from fish to streamline the process.

Appendix I provides a high-level summary of operation of the temporary facility during the reporting period.

Appendix II summarizes the total flow diverted from the Peace River to operate the temporary facility during the reporting period.

Biological operation

In total, 365 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Three mortalities – 2 Redside Shiner and 1 Mountain Whitefish – were observed during the reporting period (0.7% of all fish sorted in 2022), which is in-line with the anticipated levels of mortality during operations[3].

Table 1. Total number of fish sorted, sampled, transported and released during the reporting period.

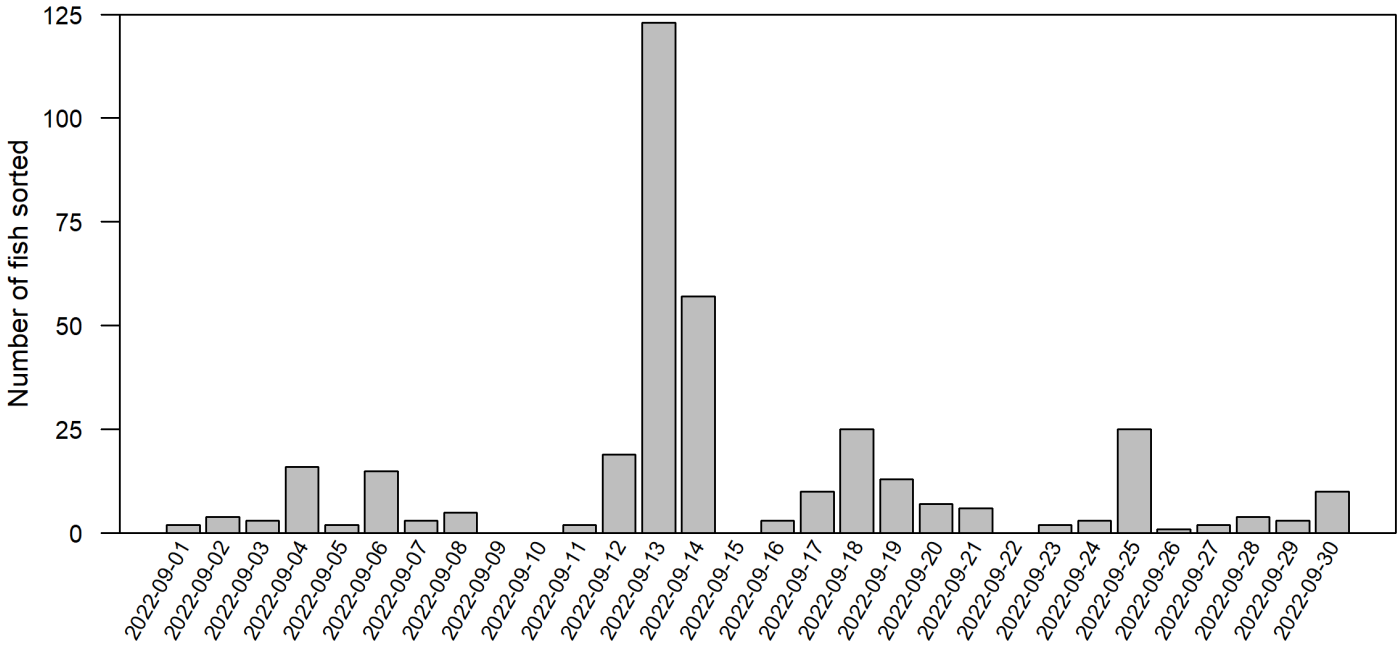
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout	1	1	1	0	1	1
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	4	4	3	0	N/A	N/A
Longnose Dace						
Longnose Sucker	2	2	1	0	N/A	N/A
Mountain Whitefish	55	55	48	1	N/A	1
Northern Pike						
Northern Pikeminnow						
Northern Redbelly Dace						
Peamouth						
Pearl Dace	1	1	N/A	0	1	N/A
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout						
Redside Shiner	299	299	N/A	2	299	N/A
Slimy Sculpin	1	1	N/A	0	1	N/A
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker	2	2	2	0	N/A	N/A
Yellow Perch						
Grand total	365	365	55	3	302	2

Not all fish species were PIT tagged or sampled for genetics, microchemistry, or ageing, as described in the OPP.

[3] The FAA for Main Civil Works and Facility Operations (15-HPAC-01160) describes an acceptable level of incidental mortality to be no more than 5% of the total number of fish sorted in the temporary facility on an annual basis.

Between zero and 123 fish were sorted daily during the reporting period (Figure 1).

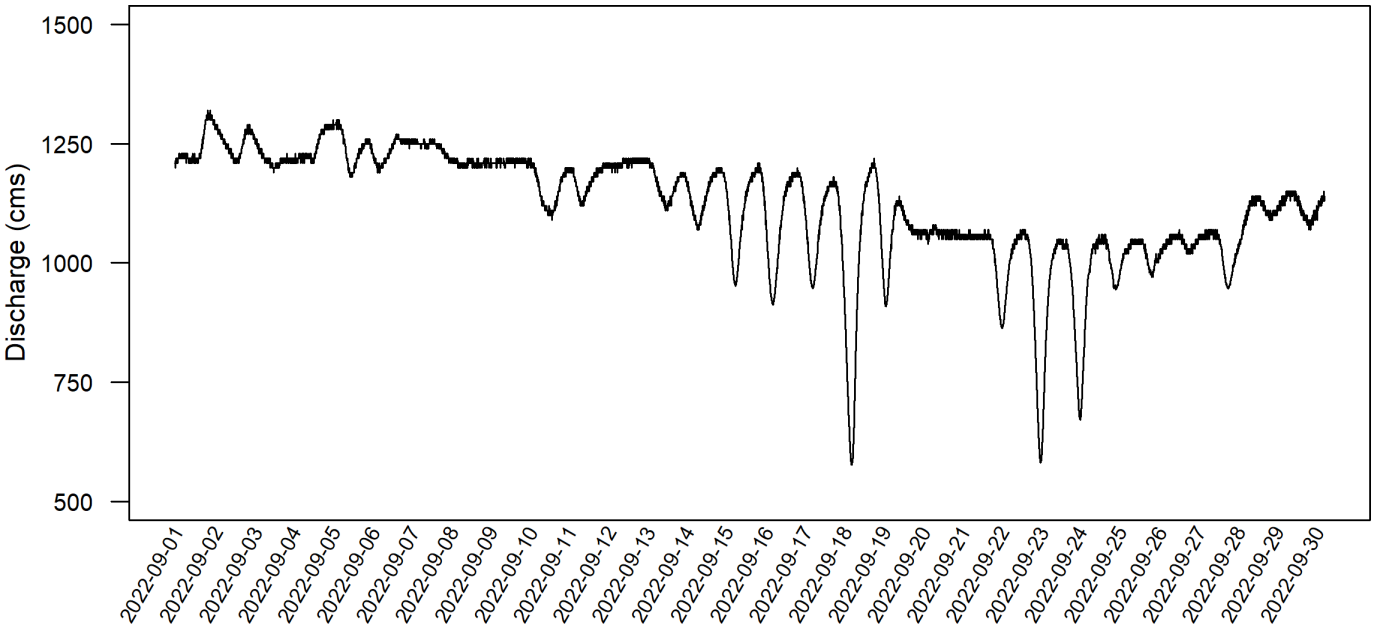
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

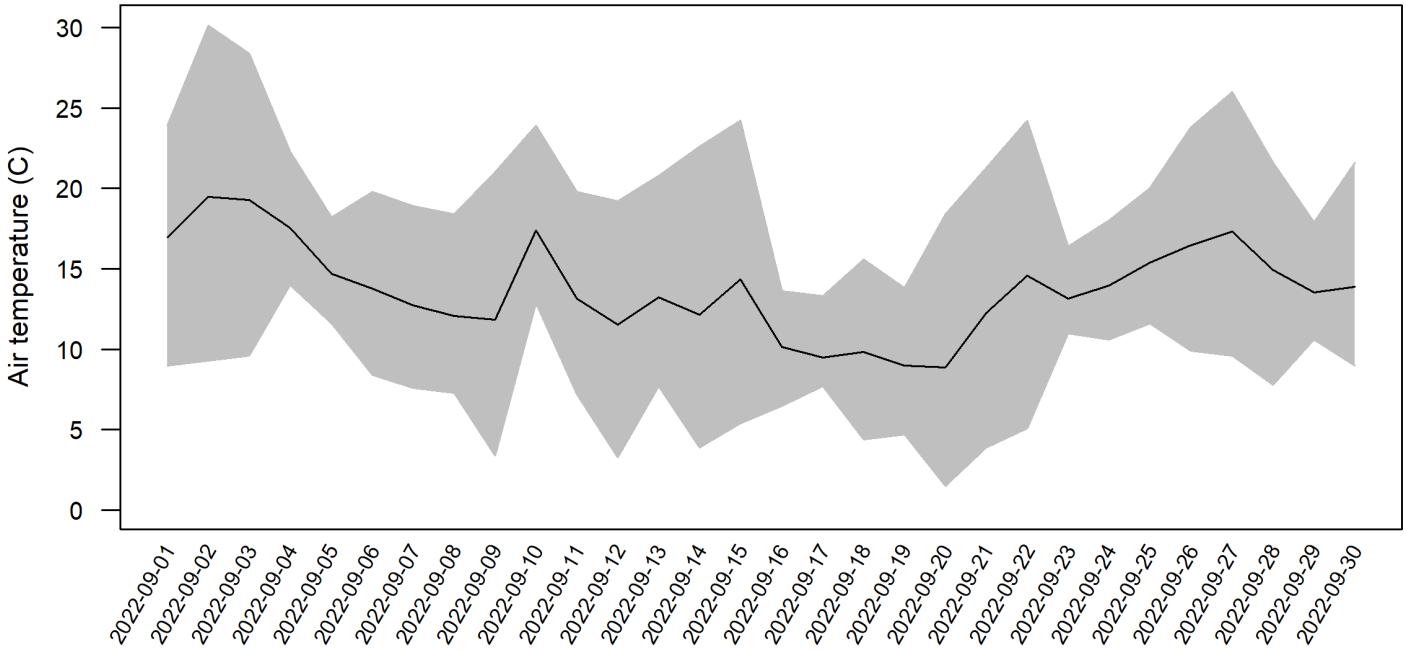
Discharge in the Peace River fluctuated during the reporting period from a low of 576 cms on September 18 to a high of 1320 cms on September 1 (Figure 2).

Figure 2. Discharge in the Peace River during the reporting period as measured at the Peace River above Pine River (07FA004) Water Survey of Canada (WSC) hydrometric station. Data were downloaded from the WSC on October 5; the downloaded data were provided at 5-minute intervals and were listed as provisional by the WSC.



Air temperature fluctuated during the reporting period from a low of 1.5°C on September 20 to a high of 30.1°C on September 2 (Figure 3).

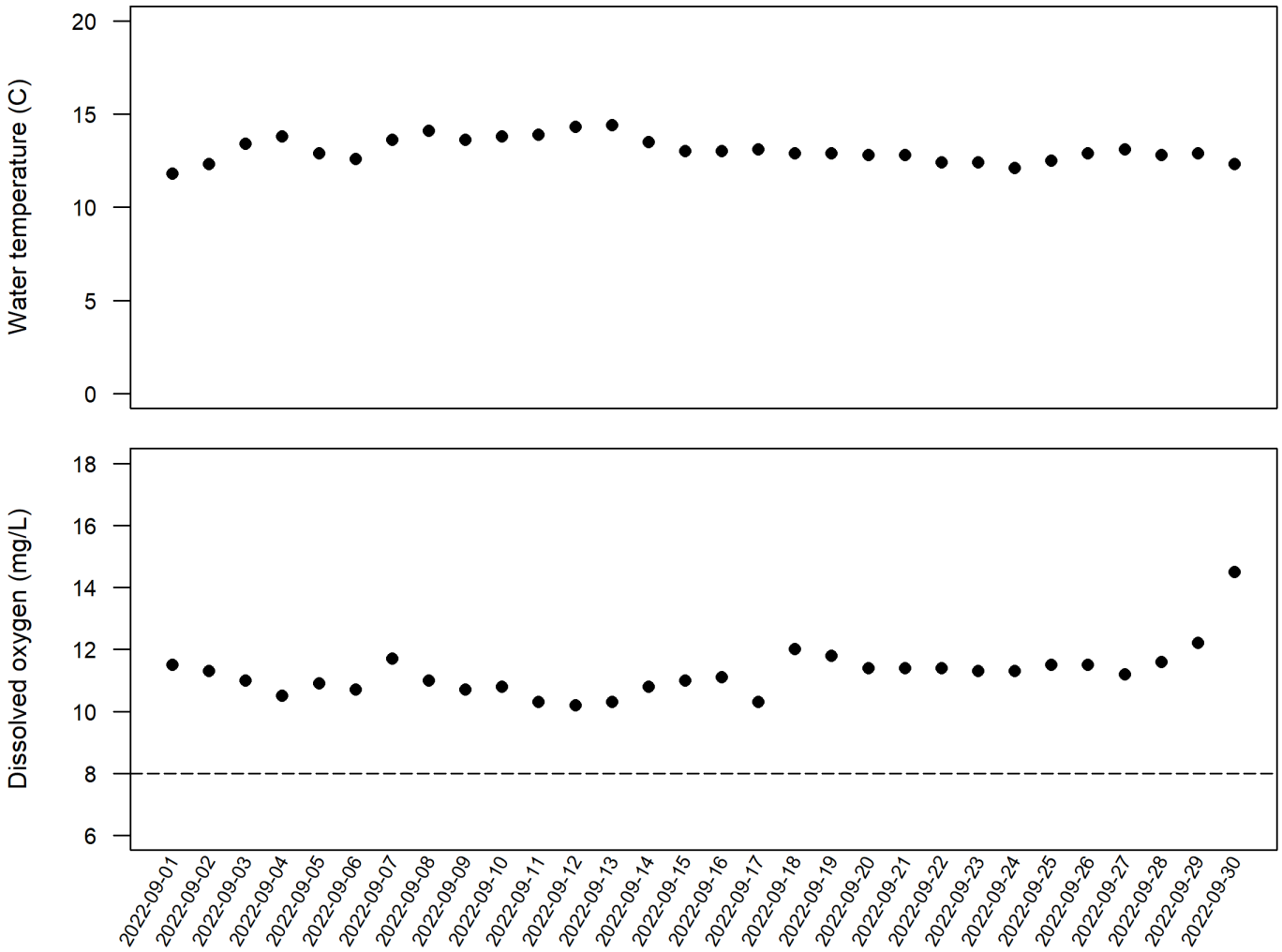
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[4] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



[4] Available at: https://www.env.gov.bc.ca/epd/bcairquality/data/station.html?id=E309527

Water temperature remained stable during the reporting period (Figure 4). Dissolved oxygen remained above the minimum dissolved oxygen level (8.0 mg/L) described in the design report of the temporary facility.

Figure 4. Daily water temperature (°C) and dissolved oxygen (mg/L) during the reporting period as measured in the pre-sort holding pool of the temporary facility.

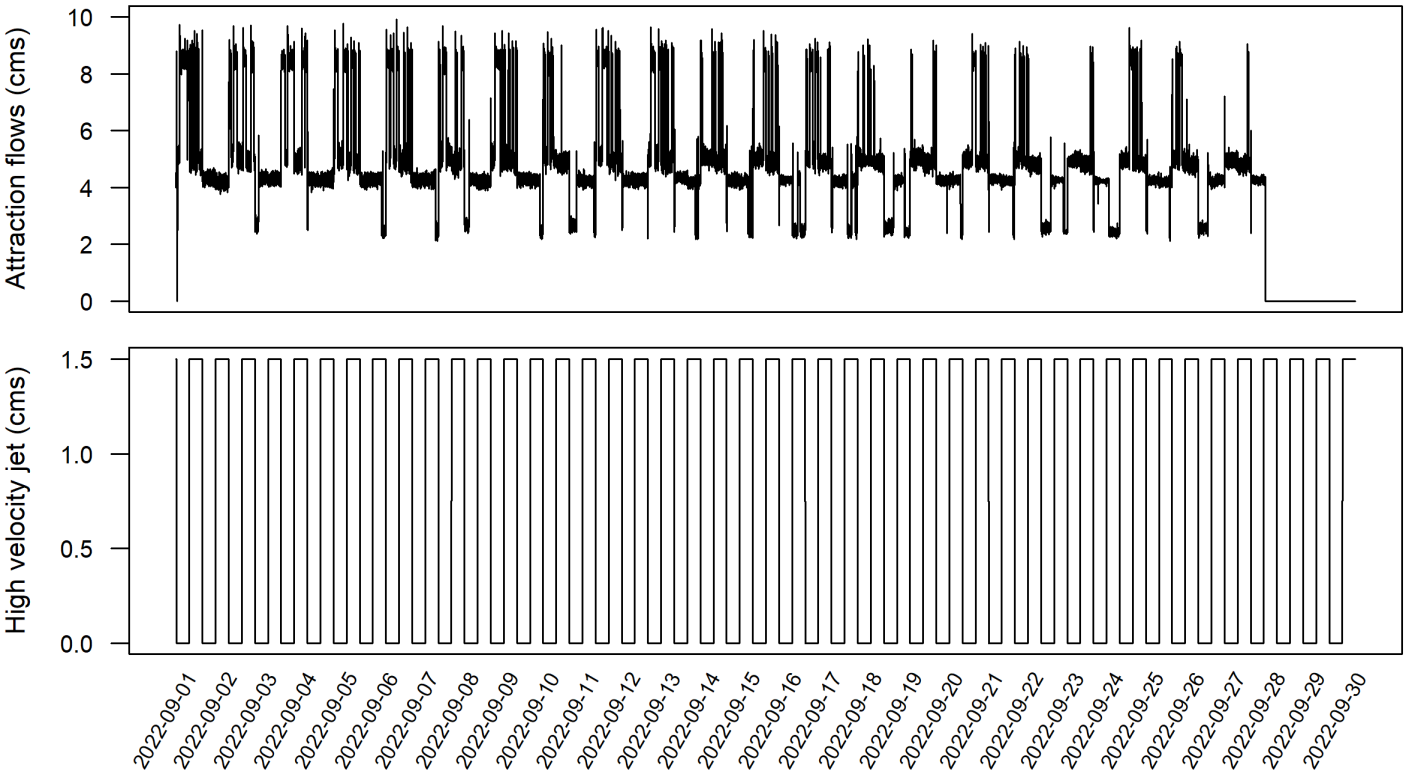


Mechanical operation

Operation of the attraction flows and high velocity jet intends to attract fish towards the fishway entrance. Once fish have entered the temporary facility, flows within the fishway intend to provide a flow signal for fish to detect and swim up each pool to the sorting facility.

BC Hydro operated the attraction flows and high velocity jet as described in Section 3.2.1.3 of the OPP, whereby conditions were changed every 8 hours during the reporting period (Figure 5), with the exception of September 28 to 30 (Table 4).

Figure 5. Operation of the attraction flows and high velocity jet during the reporting period.



Fish were crowded daily from the pre-sort holding pool into the fish lock. Operators then proceeded to raise crowded fish to the elevation of the sorting facility. Note that this process is referred to as a “sorting cycle”. Between two and three sorting cycles were conducted each day during the reporting period (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2022-09-01	3	08:30, 11:00, 13:00
2022-09-02	3	08:30, 11:00, 13:00
2022-09-03	3	08:30, 11:00, 13:00
2022-09-04	3	08:30, 11:00, 13:00
2022-09-05	3	08:30, 11:00, 13:00
2022-09-06	3	08:30, 11:00, 13:00
2022-09-07	3	08:30, 11:00, 13:00
2022-09-08	3	08:30, 11:00, 13:00
2022-09-09	3	08:30, 11:00, 13:00
2022-09-10	3	08:30, 11:00, 13:00
2022-09-11	3	08:30, 11:00, 13:00
2022-09-12	2	08:30, 11:00
2022-09-13	3	08:30, 11:00, 13:00
2022-09-14	3	08:30, 11:00, 13:00
2022-09-15	3	08:30, 11:00, 13:00
2022-09-16	3	08:30, 11:00, 13:00
2022-09-17	3	08:30, 11:00, 13:00
2022-09-18	3	08:30, 11:00, 13:00
2022-09-19	3	08:30, 11:00, 13:00
2022-09-20	3	08:30, 11:00, 13:00
2022-09-21	3	08:30, 11:00, 13:00
2022-09-22	3	08:30, 11:00, 13:00
2022-09-23	3	08:30, 11:00, 13:00
2022-09-24	3	08:30, 11:00, 13:00
2022-09-25	3	08:30, 11:00, 13:00
2022-09-26	3	08:30, 11:00, 13:00
2022-09-27	3	08:30, 11:00, 13:00
2022-09-28	3	08:30, 11:00, 13:00
2022-09-29	3	08:30, 11:00, 13:00
2022-09-30	3	08:30, 11:00, 13:00

Table 3. Summary of standby or shutdown periods during the reporting period.

Date	Standby or shutdown	Rationale
N/A	N/A	No standby or shutdown periods occurred during the reporting period.

Table 4. Root causes and corrective actions as a result of equipment malfunctions, breakdowns, or damage during the reporting period.

Date	Malfunction, breakdown or damage	Description	Root cause	Corrective action
Several	Malfunction	Pump 1 did not provide the complete attraction flows (4.25 or 8.5 cms) outlined in Section 3.2.1.3 of the OPP.	Sediment clogged the water intake screens such that water could not pass through the wetwell to feed the pumps; this caused the differential between the diversion tunnel outlet and wetwell to exceed criteria and the facility to auto shutdown.	Programmed attraction flow pumps (Pumps 1 and 2) to self-clean hourly and repaired the spray valves used to clean the water intake screens.
Several	Malfunction	Brail elevator repeatedly halted and slowed.	Suspected causes of sediment build-up in the fish lock and system malfunction.	Sediment was proactively flushed out of the fish lock on a weekly basis, and the system was reset to restore basic functionality.
Several	Malfunction	Pump 3, which provides flows to the fishway, was experiencing significant vibration.	To be determined on inspection from the manufacturer. Suspected to be either serious wear of the stuffing box or a failed spider bearing	Operator switched to Pump 7 which can also provide flows to the fishway.
2022-09-28	Breakdown	Variable frequency drives of Pumps 1 and 2, which provide attraction flows, continue to fault.	Dust intrusion and power cycling due to intake differential interlock.	Pumps shut down to prevent further damage. Variable frequency drives to be sent in for repair.

Adjustments

Several adjustments were made during the reporting period to improve the biological and mechanical operation of the temporary facility (Table 5). BC Hydro described the potential for adjustments to the day-to-day biological and mechanical operation of the temporary facility in Section 7 of the Fish Passage Management Plan[2]. In general the temporary facility was operated as planned and described in the OPP. Where appropriate, the adjustments outlined below will be reflected in an updated revision of the OPP for operations in 2023.

Table 5. Summary of adjustments made to the biological and mechanical operation of the temporary facility during the reporting period.

Component	Adjustment
Mechanical operation	Sediment was flushed out of the fish lock and pre-sort holding pool on a weekly basis by slowly releasing flow through Pump 9.
	On September 17, the operator raised the finger weir to 5 cm below the water surface to improve trapping efficiency.
Biological operation	Several adjustments were made to improve the efficiency of fish processing. Changes were made to the physical setup of the sorting area to reduce the risk of injury to fish, improve ergonomics and the ability of the operators to communicate with each other, and allow for both individuals to be involved in the tagging and sampling of fish. Changes were also made to the order in which measurements and samples were collected from fish to streamline the process.

Photos

Photo 1. Biologists sample a Bull Trout in the sorting facility (September 19, 2022).

Prepared by

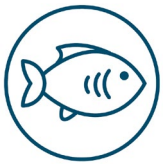
This report was prepared by the following individuals:

Qualified Individual	Expertise
Brent Mossop, MRM, RPBio	Fisheries
Nich Burnett, MSc, RPBio	Fisheries

Appendix I. High-level summary of operation of the temporary facility during the reporting period.

From:	Brent Mossop and Nich Burnett, Fish and Aquatic – Site C Clean Energy Project
Reporting Period:	September 1 to 30, 2022
Subject:	Monthly Update on Upstream Fish Passage

365 fish passed



8 species sorted at facility

Operated facility for 30 days

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Passed 365 fish
Sorting & Transport		• Sorted 8 species
Fish Mortality		• Three mortalities during reporting period • Survival rate >99% for all fish sorted in 2022
Operation Within Criteria		• Operated within and outside of design criteria
External Communication		• Provided updates to Indigenous nations
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Raised finger weir to improve trapping efficiency

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

[1] Infographic available here: https://www.sitecproject.com/sites/default/files/fish-passage-facility.pdf

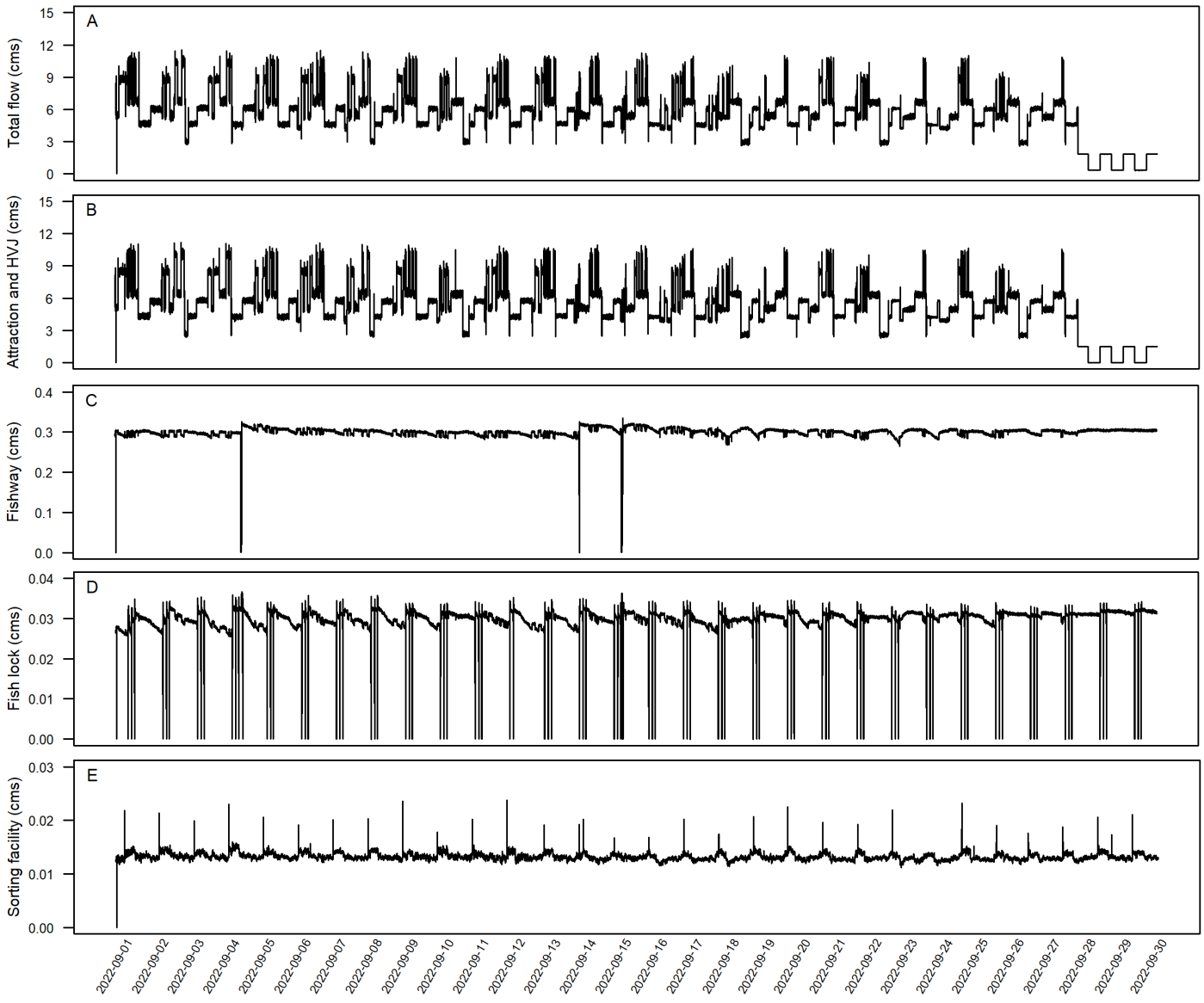
Target Species

Bull Trout

Rainbow Trout

Arctic Grayling

Appendix II. (A) Total flow (cms) diverted from the Peace River to operate the temporary facility during the reporting period. Total flow is a combination of flows used for the attraction flows and high velocity jet (B), fishway (C), fish lock (D), and sorting facility (E), as described in T023 Plan for Measurement of Flow. Under Conditional Water Licence 133987[5], BC Hydro is authorized to divert up to 15 cms of flow from the Peace River to operate the temporary facility; this authorized quantity was not exceeded during the reporting period (A).



[5] Available at: http://sitecproject.com/sites/default/files/fish-passage-facility-water-licences-133986-133987.pdf