BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: October 1 to 31, 2021

Prepared by BC Hydro

December 21, 2021

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 will be operated at the outlet of the generating station to provide fish passage during the operation phase of the Project.

In 2021 water surface elevations at the temporary facility have been high and above the operating range (i.e., engineering design criteria) of the temporary facility, which led to a number of adjustments to infrastructure and operations to allow the temporary facility to operate above design criteria. High water surface elevations also have the potential to reduce the biological effectiveness of the temporary facility. As a result, BC Hydro implemented the contingent measures listed in Section 4.8 of the Fish Passage Management Plan[2].

Contingent measures consisted of weekly boat electroshocking surveys (hereafter contingent fish capture and transport) to capture target species downstream of the diversion tunnel outlet and transport and release them upstream of the Project. Only those species trying to fulfill life history requirements upstream of the Project (Arctic Grayling, Rainbow Trout and Mountain Whitefish) were transported and released upstream of the Project during the reporting period (EIS, Volume 2, Appendix O[3]; BC Hydro 2015[4]). All other species were released at their capture location downstream of the Project.

Operation of the temporary facility and implementation of contingent fish capture collectively provided for upstream fish passage for target species during the reporting period.

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 October 2021. Note that the facility was shutdown following the last day of operation on October 31.

This report has the following sections:

- Biological operation;
- Environmental conditions;
- Mechanical operation;
- Adjustments; and
- Contingent fish capture and transport.

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

[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
[3] Available at: https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_O.pdf
[4] Available at: http://sitecproject.com/sites/default/files/Fisheries-and-Aquatic-Habitat-Monitoring-and-Follow-up-Program.pdf

4.1 of the Fish Passage Management Plan[5].

Summary

In general the operation of the temporary facility was effective at providing for the upstream passage of fish during the reporting period. Ninety-two fish were sorted and sampled at the temporary facility (Table 1). Specifically, the facility operator sorted 76 Mountain Whitefish, 8 Largescale Sucker, 7 Longnose Sucker, and 1 White Sucker. In addition to operating the temporary facility, BC Hydro conducted two sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 260 Mountain Whitefish, 2 Rainbow Trout and 1 Arctic Grayling upstream of the Project (Table 6). Twenty-nine fish from other species were encountered during contingent fish capture and were released downstream of the Project (Table 6).

Fish were observed in the pools adjacent to the entrance pool during the reporting period. Flows from the horizontal pumps pass through these pools and through vertical diffusers to the entrance pool to provide the attraction flows at the facility. Fish should not be able to access these pools; thus the fish observed in these areas could not readily access the fishway or return to the Peace River. As such, the facility operator and BC Hydro conducted a salvage of these pools while the facility was being winterized from October 31 to November 16 using traps and angling. In total 10 Mountain Whitefish, 10 Longnose Sucker, 6 Sculpin species, and 1 Largescale Sucker were salvaged and returned to the Peace River. Two mortalities – 1 Longnose Sucker and 1 Mountain Whitefish – were observed during salvage efforts (Table 1).

Several adjustments to the top of the fishway in August and September were continued in October to improve the biological and mechanical operation of the temporary facility. Where appropriate, the adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2022.

Appendix I provides a high-level summary of operation of the temporary facility and implementation of contingent fish capture and transport during the reporting period.

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

[5] Available at: http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf

Biological operation

In total, 92 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Two mortalities – 1 Longnose Sucker and 1 Mountain Whitefish – were observed in the AWS Receiving Pools during the reporting period (described above; 0.6% of all fish sorted in 2021), which is in-line with the anticipated levels of mortality during operations[6].

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

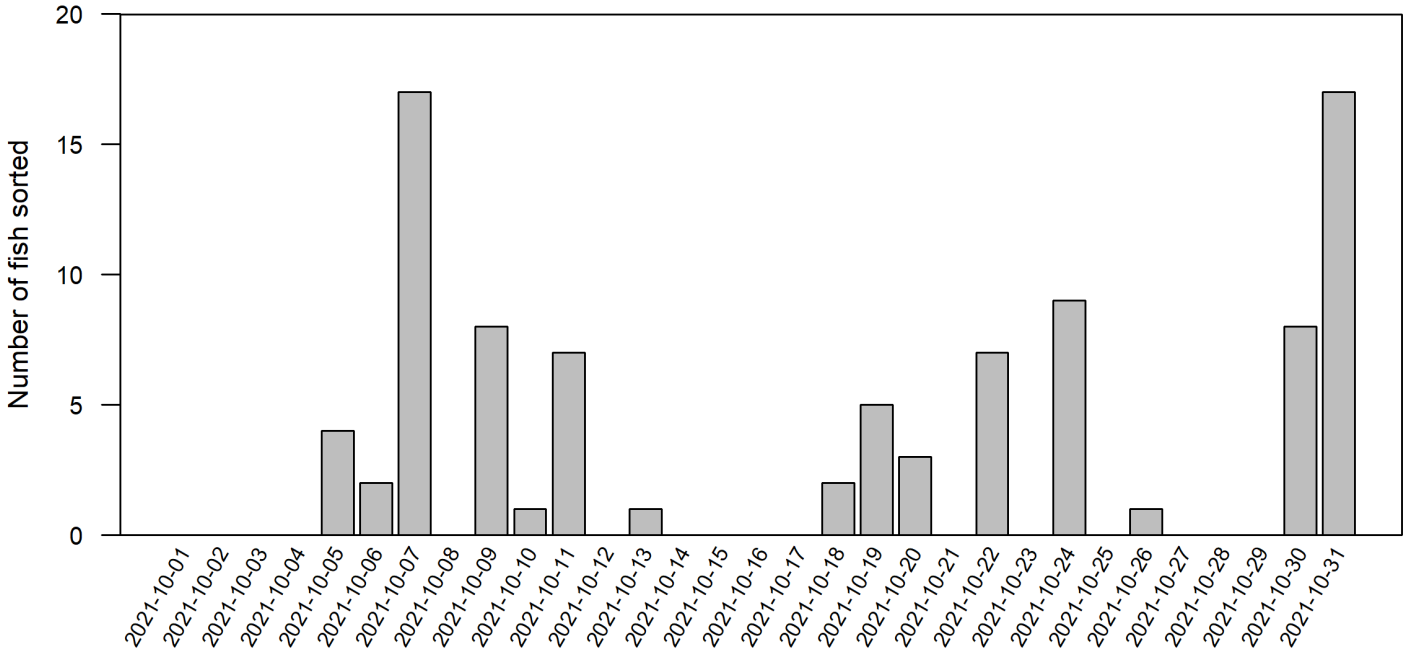
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	8	8	7	0	N/A	N/A
Longnose Dace						
Longnose Sucker	7	7	6	1	N/A	N/A
Mountain Whitefish	76	76	70	1	N/A	N/A
Northern Pike						
Northern Pikeminnow						
Northern Redbelly Dace						
Peamouth						
Pearl Dace						
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout						
Redside Shiner						
Slimy Sculpin						
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker	1	1	1	0	N/A	N/A
Yellow Perch						
Grand total	92	92	84	2	N/A	N/A

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

[6] 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 17 fish were sorted daily during the reporting period (Figure 1).

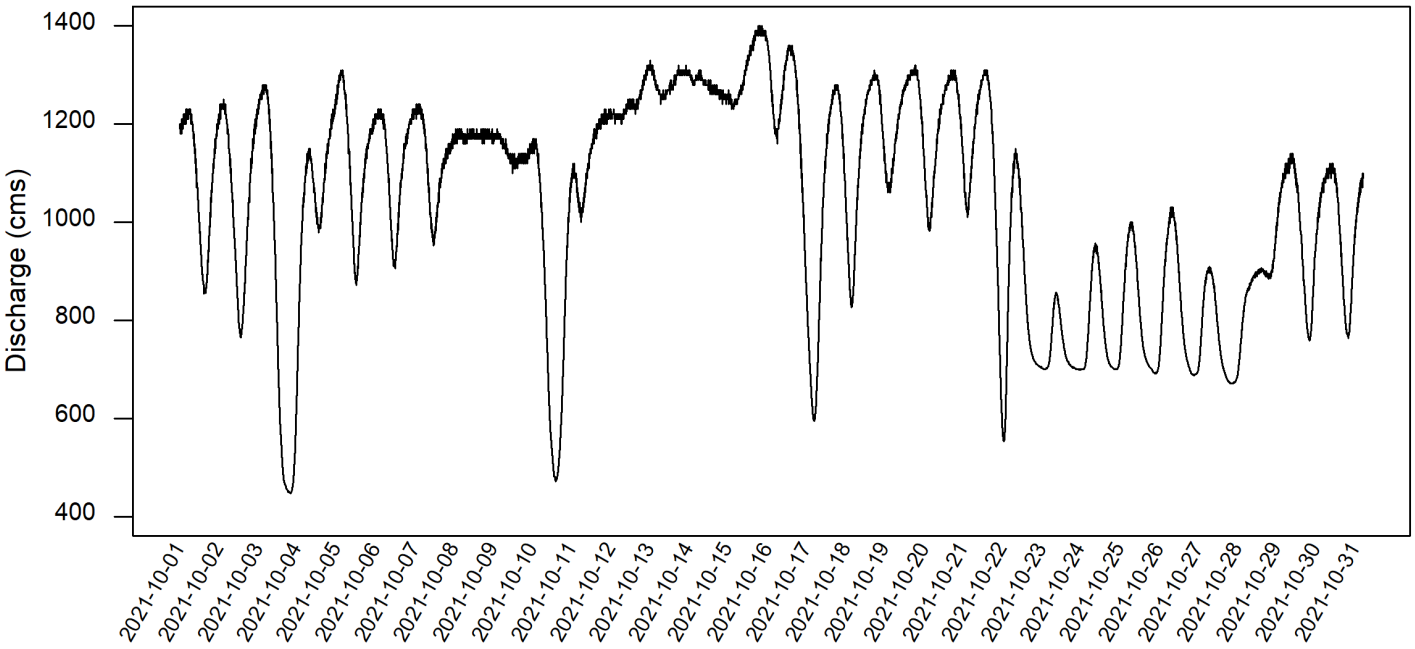
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

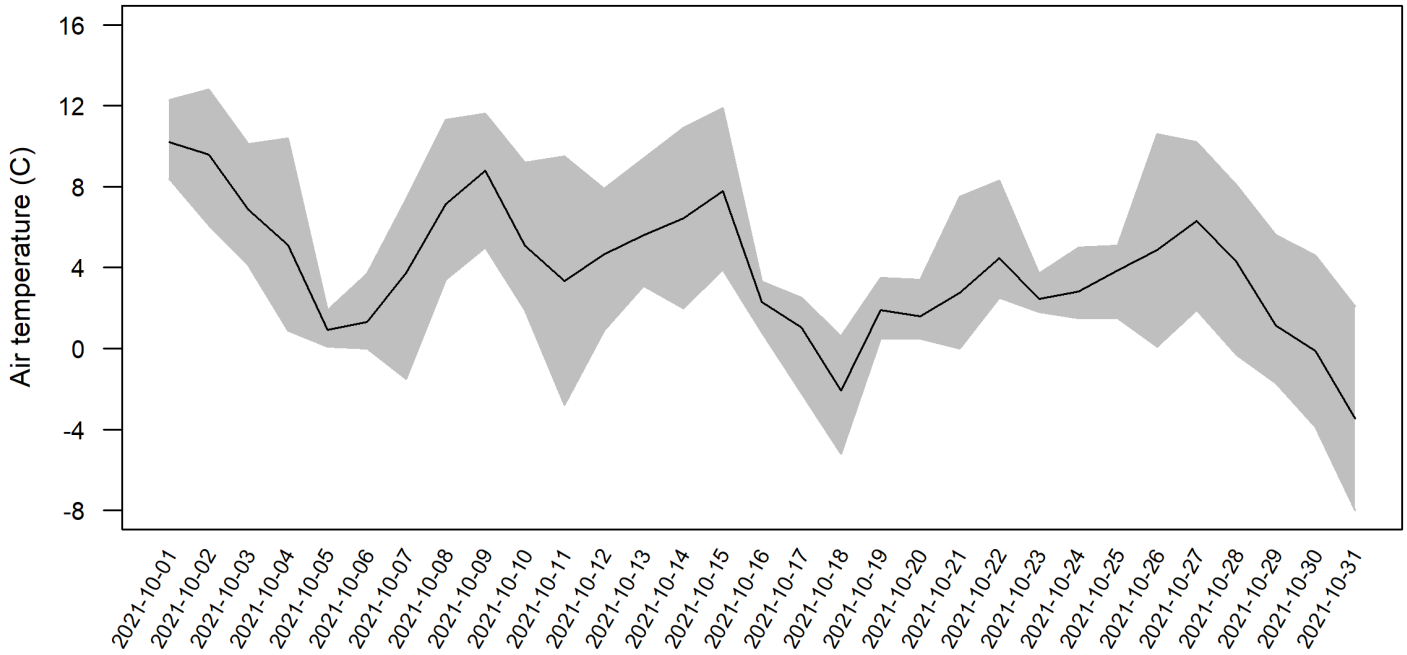
Discharge in the Peace River fluctuated during the reporting period from a low of 448 cms on October 3 to a high of 1400 cms on October 16 (Figure 2).

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 November 16; 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 high of 12.8°C on October 2 to a low of -8.0°C on October 31 (Figure 3).

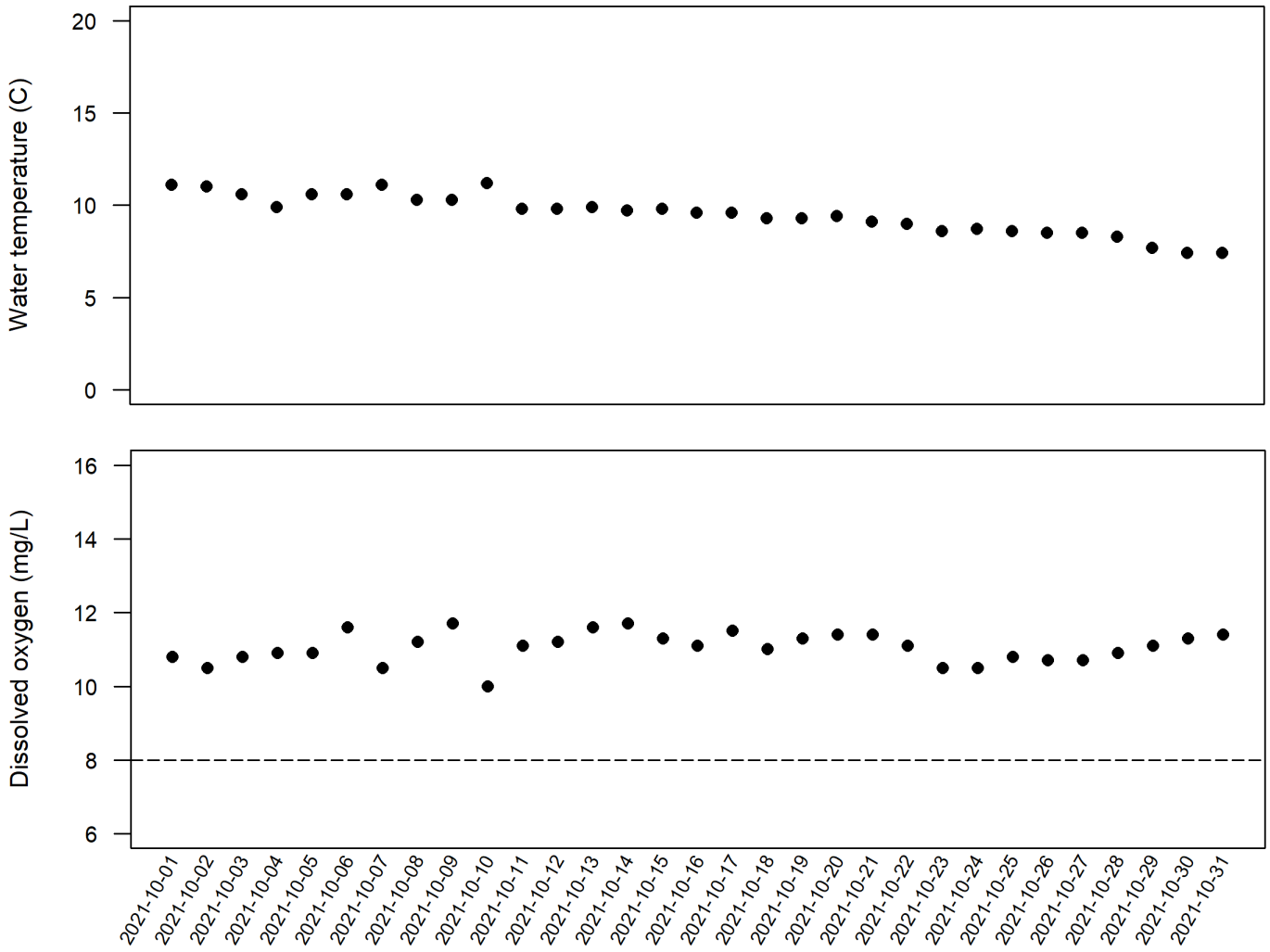
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[7] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature steadily decreased during the reporting period from a high of 11.2°C on October 10 to a low of 7.4°C on October 31 (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.

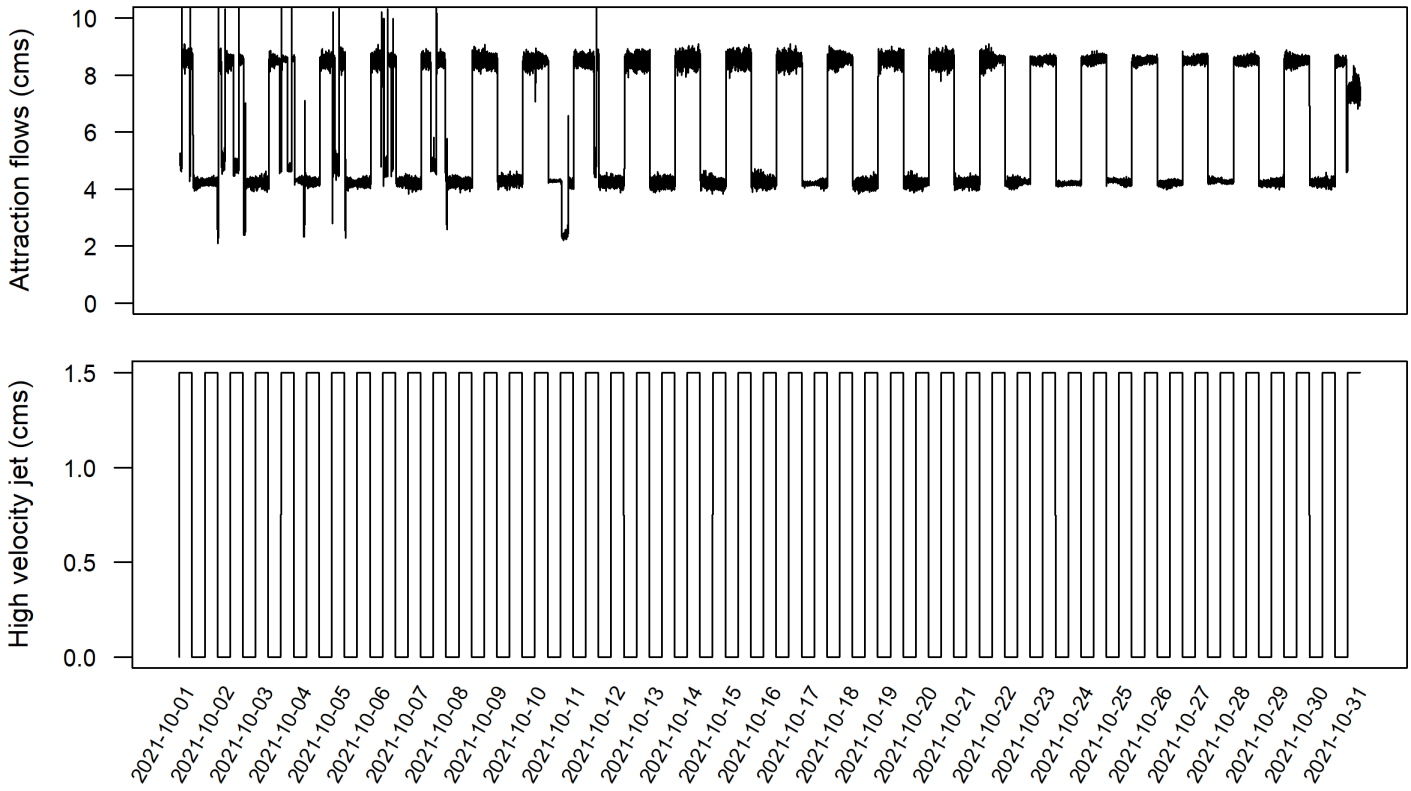


Mechanical operation

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). Attraction flow pumps continued to fault during the first half of October, which consisted of short periods of higher or lower attraction flow (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”. 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
2021-10-01	3	08:30, 11:00, 13:00
2021-10-02	3	08:30, 11:00, 13:00
2021-10-03	3	08:30, 11:00, 13:00
2021-10-04	3	08:30, 11:00, 13:00
2021-10-05	3	08:30, 11:00, 13:00
2021-10-06	3	08:30, 11:00, 13:00
2021-10-07	3	08:30, 11:00, 13:00
2021-10-08	3	08:30, 11:00, 13:00
2021-10-09	3	08:30, 11:00, 13:00
2021-10-10	3	08:30, 11:00, 13:00
2021-10-11	3	08:30, 11:00, 13:00
2021-10-12	3	08:30, 11:00, 13:00
2021-10-13	3	08:30, 11:00, 13:00
2021-10-14	3	08:30, 11:00, 13:00
2021-10-15	3	08:30, 11:00, 13:00
2021-10-16	3	08:30, 11:00, 13:00
2021-10-17	3	08:30, 11:00, 13:00
2021-10-18	3	08:30, 11:00, 13:00
2021-10-19	3	08:30, 11:00, 13:00
2021-10-20	3	08:30, 11:00, 13:00
2021-10-21	3	08:30, 11:00, 13:00
2021-10-22	3	08:30, 11:00, 13:00
2021-10-23	3	08:30, 11:00, 13:00
2021-10-24	3	08:30, 11:00, 13:00
2021-10-25	3	08:30, 11:00, 13:00
2021-10-26	3	08:30, 11:00, 13:00
2021-10-27	3	08:30, 11:00, 13:00
2021-10-28	3	08:30, 11:00, 13:00
2021-10-29	3	08:30, 11:00, 13:00
2021-10-30	3	08:30, 11:00, 13:00
2021-10-31	3	08:30, 11:00, 13:00

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

Date	Standby or shutdown	Rationale
2021-10-07 13:56 to 2021-10-07 17:37	Shutdown	Fishway flows were turned off to clean out sand from the fish lock and flush out the sprayers in the pre-sort holding pool (Panel C in Appendix II). Attraction flows and sorting cycles were unaffected by this routine maintenance.

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	Attraction flows dropping and spiking on occasion.	Variable frequency drive faulting due to debris accumulation on the pump station screens, which creates a large differential in hydraulic head between the diversion tunnel outlet and the wet well.	Variable frequency drive manually reset following each fault and the programming changed to self-clean on a more regular basis.

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 2022.

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

Component	Adjustment
Mechanical operation	Several adjustments to the top of the fishway in August and September were continued in October to improve the biological and mechanical operation of the temporary facility (References: Temporary Upstream Fish Passage Facility, Operations Reports, August 1 to 31, 2021 and September 1 to 30, 2021).

Contingent fish capture and transport

In total, 263 fish were transported upstream through contingent fish capture during the reporting period (Table 2). Specifically, 260 Mountain Whitefish, 2 Rainbow Trout and 1 Arctic Grayling were transported upstream of the Project.

Table 6. Number of fish captured by boat electroshocking and transported and released upstream (U) and downstream (D) of the Project.

Species	Session 17		Session 18		Total
	October 13		October 21		
	U	D	U	D	
Arctic Grayling			1		1
Brook Stickleback					
Brook Trout					
Bull Trout		3		1	4
Burbot					
Finescale Dace					
Flathead Chub					
Goldeye					
Kokanee		2		2	4
Lake Chub					
Lake Trout		1			1
Lake Whitefish					
Largescale Sucker		4		2	6
Longnose Dace					
Longnose Sucker		1		2	3
Mountain Whitefish	125		135		260
Northern Pike		2		1	3
Northern Pikeminnow		1		1	2
Northern Redbelly Dace					
Peamouth					
Pearl Dace					
Prickly Sculpin					
Pygmy Whitefish					
Rainbow Trout	2	1			3
Redside Shiner					
Slimy Sculpin					
Spoonhead Sculpin					
Spottail Shiner					
Trout-perch					
Walleye		2		2	4
White Sucker				1	1
Yellow Perch					
Total	127	17	136	12	292
Grand total	144		148		

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 and implementation of contingent fish capture during the reporting period.

From:	Brent Mossop and Nich Burnett, Fish and Aquatic – Site C Clean Energy Project
Reporting Period:	October 1 to 31, 2021
Subject:	Monthly Update on Upstream Fish Passage

92 fish sorted at facility

Operated facility for 31 days

263 fish transported through contingent fish capture

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Fish approached, entered and passed the fishway
Sorting & Transport		• Sorted 92 fish from four species
Fish Mortality		• Two mortalities during reporting period • Survival rate >99% for all fish sorted in 2021
Operation Within Criteria		• Operated within and outside of design criteria
External Communication		• Provided updates to CWR, IE and IEM
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Adjustments to flow distribution at top of fishway to improve passage and increase 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

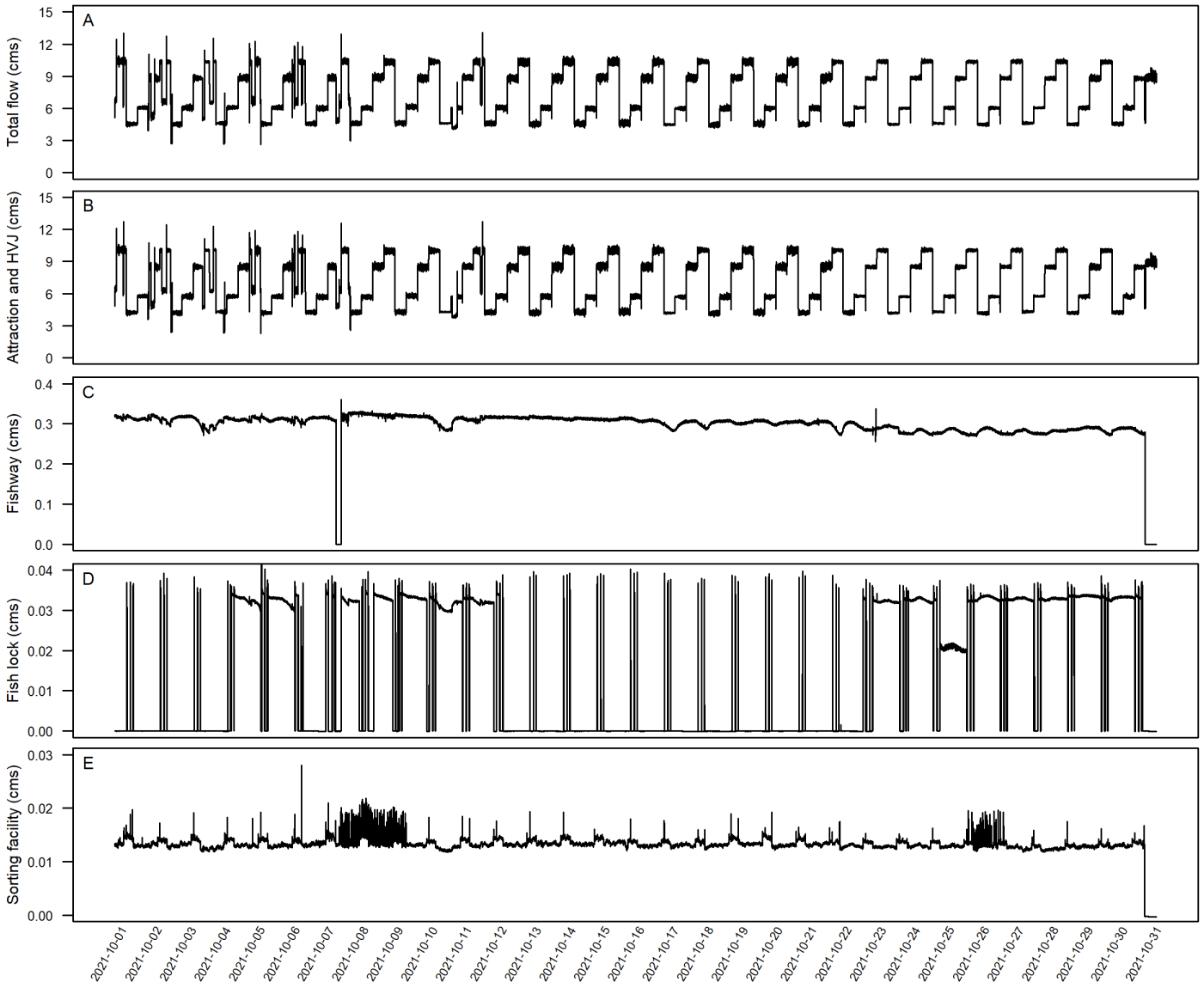
Target Species

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[8], 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).



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