BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: April 1 to 30, 2022

Prepared by BC Hydro

May 9, 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 will be operated at the outlet of the generating station to provide fish passage during the operation phase of the Project.

In 2022 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, Bull Trout, Rainbow Trout, and the Sucker species) 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 April 2022.

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

Despite high water surface elevations, BC Hydro continuously operated the temporary facility during the reporting period. Four fish – 3 Mountain Whitefish and 1 Rainbow Trout – were sorted and sampled at the temporary facility, and transported and released into the Peace River upstream of the Project (Table 1). In addition to operating the temporary facility, BC Hydro conducted four sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 36 Largescale Sucker, 20 Bull Trout, 5 Longnose Sucker, 3 Rainbow Trout, 3 Arctic Grayling and 2 White Sucker upstream of the Project (Table 6). Five hundred and ninety two fish from other species were encountered during contingent fish capture and were released downstream of the Project (Table 6).

Several adjustments to the top of the fishway in August, September and October 2021 were continued in April 2022 to improve the biological and mechanical operation of the temporary facility. BC Hydro also made some physical modifications to the trapping mechanism (vee-trap) in March 2022 to improve passage into the pre-sort holding pool. Channels were bolted onto the side arms of the vee-trap and panels were lowered into place to concentrate the flow cue through the upstream half of the vee-trap (Photo 1). Where appropriate, the adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2023.

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, 4 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). One mortality (Mountain Whitefish) was observed in the fish lock during the reporting period (25% of all fish sorted in 2022)[6]; this individual had sustained significant scale loss from the operculum to the dorsal fin (Photo 2). Cause of mortality is unknown.

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

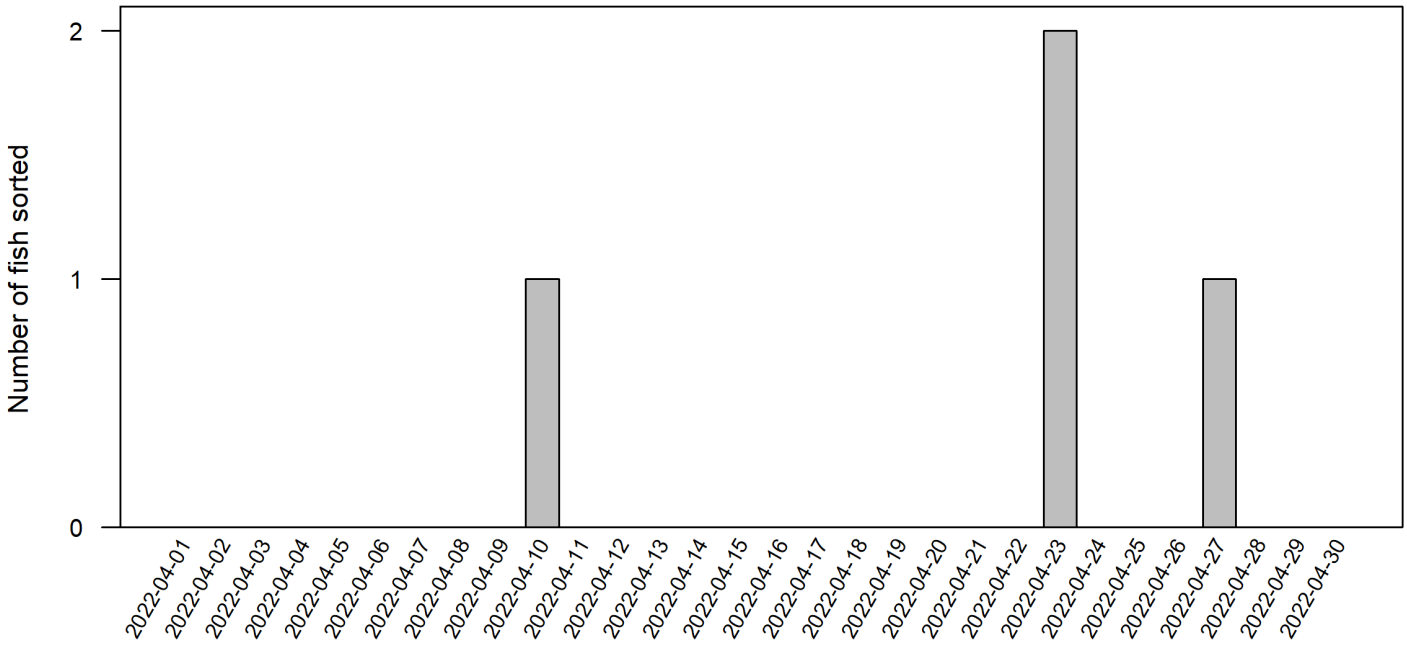
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish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

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 two fish were sorted daily during the reporting period (Figure 1). Similar rates of passage were observed in April 2021, where 7 fish passed the facility and 42 fish were passed via contingent fish capture. Low rates of passage may have been due to below normal air (Figure 3) and water temperatures (Figure 4) during the reporting period.

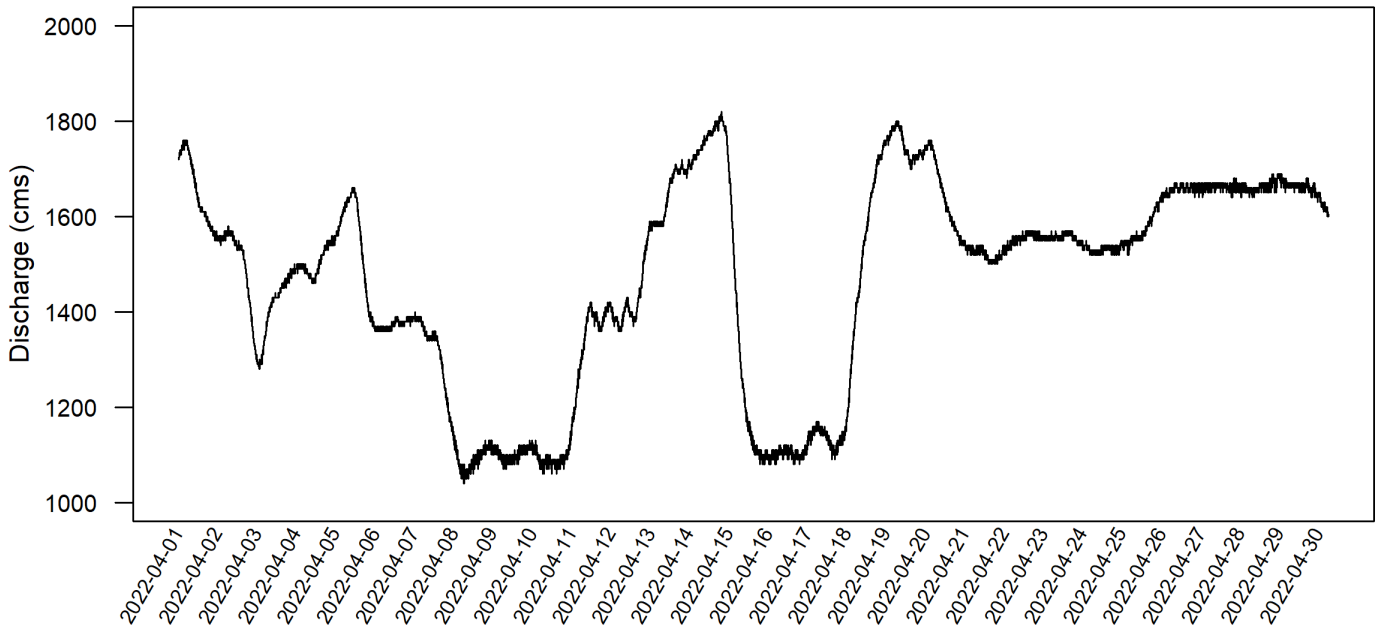
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

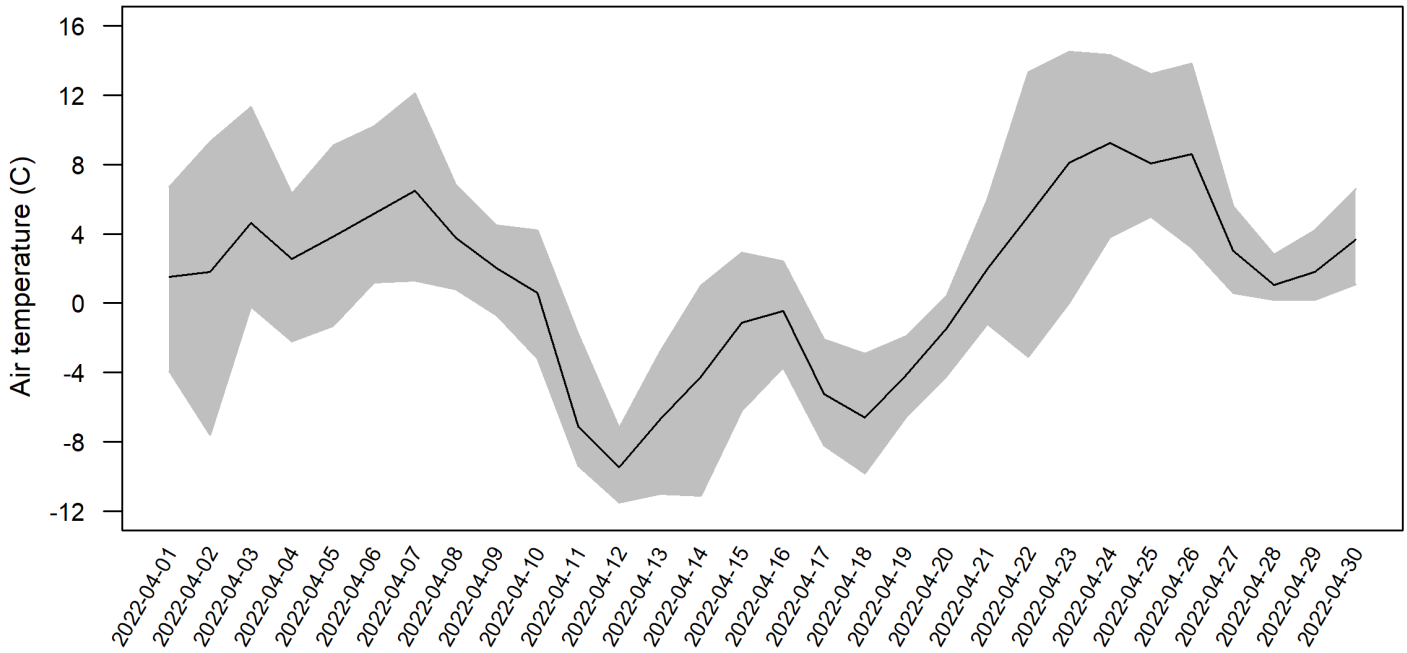
Discharge in the Peace River fluctuated during the reporting period from a low of 1040 cms on April 8 to a high of 1820 cms on April 15 (Figure 2).

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 May 3; 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 14.5°C on April 23 to a low of -11.5°C on April 12 (Figure 3).

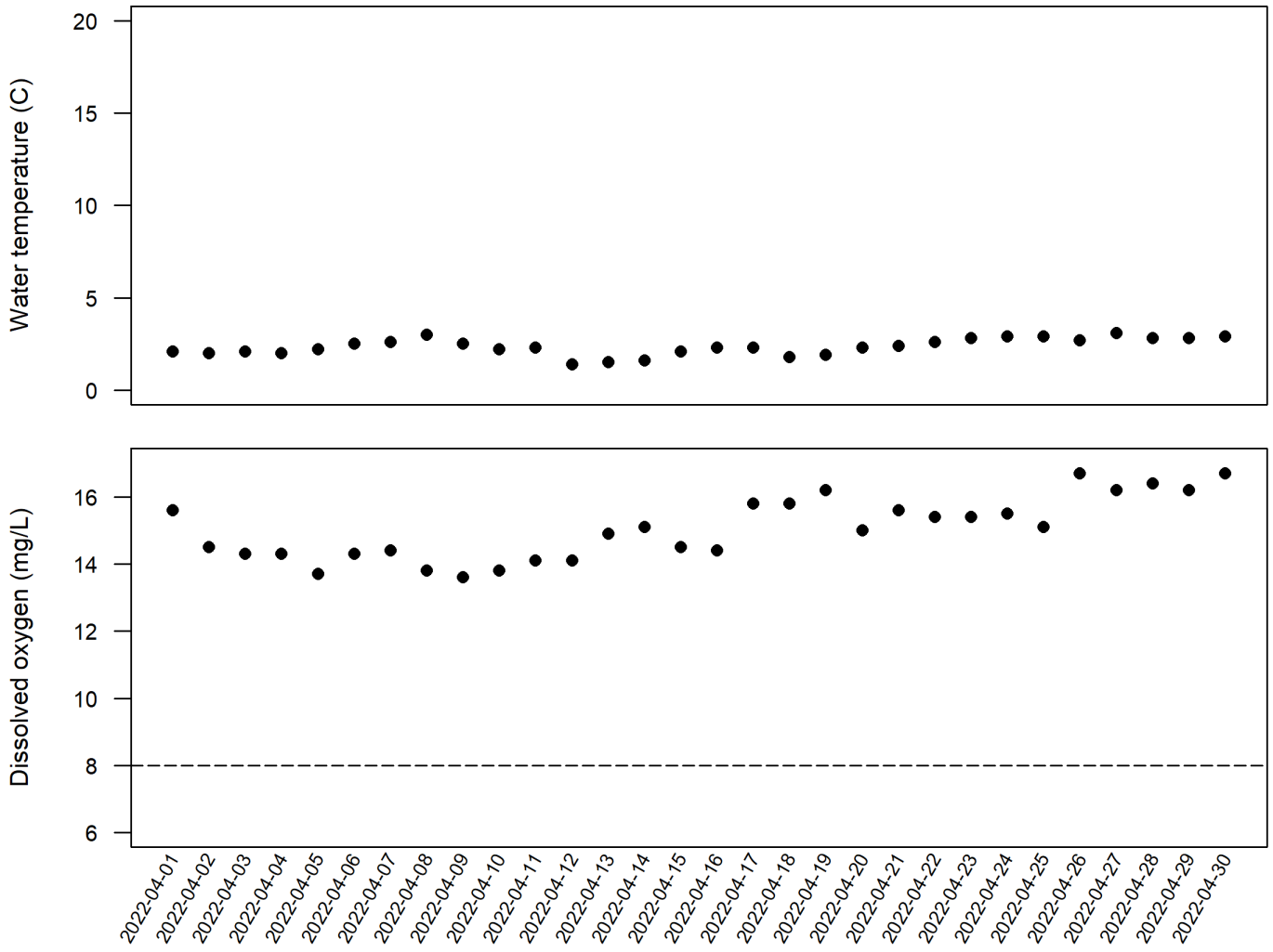
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[7] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature remained stable throughout the month of April (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.

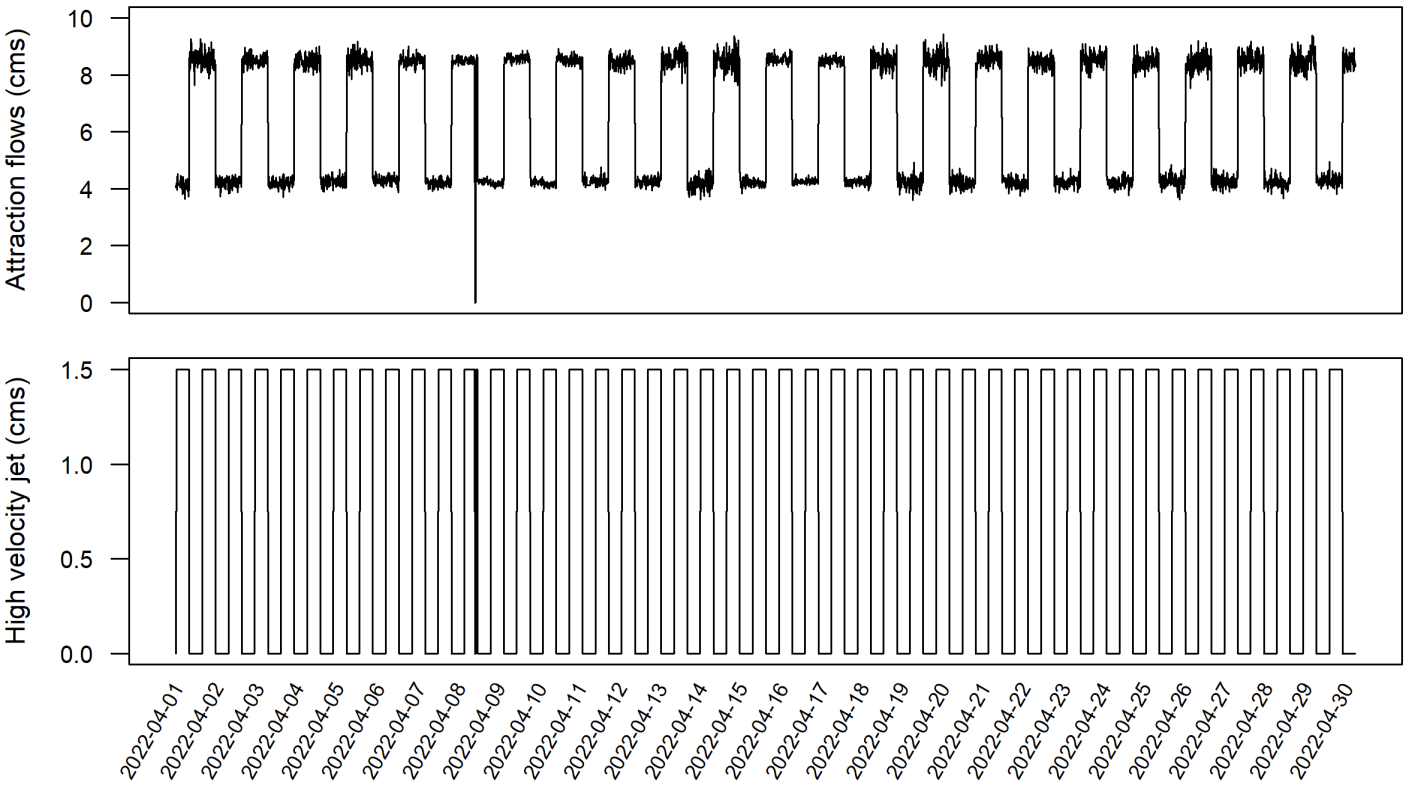


Mechanical operation

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). Pump discharge data were not logged between 14:30 and 15:00 on April 8 due to a system update – the attraction flows and high velocity jet ran continuously despite data not being logged.

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, with the exception of April 18 (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2022-04-01	3	08:30, 11:00, 13:00
2022-04-02	3	08:30, 11:00, 13:00
2022-04-03	3	08:30, 11:00, 13:00
2022-04-04	3	08:30, 11:00, 13:00
2022-04-05	3	08:30, 11:00, 13:00
2022-04-06	3	08:30, 11:00, 13:00
2022-04-07	3	08:30, 11:00, 13:00
2022-04-08	3	08:30, 11:00, 13:00
2022-04-09	3	08:30, 11:00, 13:00
2022-04-10	3	08:30, 11:00, 13:00
2022-04-11	3	08:30, 11:00, 13:00
2022-04-12	3	08:30, 11:00, 13:00
2022-04-13	3	08:30, 11:00, 13:00
2022-04-14	3	08:30, 11:00, 12:30
2022-04-15	3	08:30, 11:00, 13:00
2022-04-16	3	08:30, 11:00, 13:00
2022-04-17	3	08:30, 11:00, 13:00
2022-04-18	2	08:30, 11:00
2022-04-19	3	08:30, 11:00, 13:00
2022-04-20	3	08:30, 11:00, 13:00
2022-04-21	3	08:30, 11:00, 12:30
2022-04-22	3	08:30, 11:00, 13:00
2022-04-23	3	08:30, 11:00, 13:00
2022-04-24	3	08:30, 11:00, 13:00
2022-04-25	3	08:30, 11:00, 13:00
2022-04-26	3	08:30, 11:00, 13:00
2022-04-27	3	08:30, 11:00, 13:00
2022-04-28	3	08:30, 11:00, 12:30
2022-04-29	3	08:30, 11:00, 13:00
2022-04-30	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
2022-04-19	Malfunction	Pump 7 – which feeds water into the fishway – shut off at 04:57 despite sending a 'good status' to the PLC.	Pump 7 failed as a result of the variable frequency drive locking up. Pump 3 – which acts as a backup to Pump 7 – did not turn on because the PLC received a 'good status' from Pump 7.	Flows in the fishway were manually turned back on by onsite staff at 05:55. Logic in the PLC was reviewed and revised to correct the programming.

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	Several adjustments to the top of the fishway in August, September and October 2021 were continued in April 2022 to improve the biological and mechanical operation of the temporary facility (References: Temporary Upstream Fish Passage Facility, Operations Reports, August 1 to 31, 2021, September 1 to 30, 2021, and October 1 to 31, 2021).
	In addition to the operational adjustments implemented in August, September and October 2021, BC Hydro made some physical modifications to the trapping mechanism (vee-trap) in March 2022 to improve passage into the pre-sort holding pool. Channels were bolted onto the side arms of the vee-trap and panels were lowered into place to concentrate the flow cue through the upstream half of the vee-trap (Photo 1).
Biological operation	BC Hydro installed a higher efficiency antenna on the vee-trap to detect passive integrated transponder (PIT) tags at this critical location (Photo 3). Such an adjustment will improve the ability to monitor the biological effectiveness of the facility.

Contingent fish capture and transport

In total, 69 fish were transported upstream through contingent fish capture during the reporting period (Table 2). Specifically, 36 Largescale Sucker, 20 Bull Trout, 5 Longnose Sucker, 3 Rainbow Trout, 3 Arctic Grayling and 2 White Sucker were transported upstream of the Project (Photo 4).

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

Species	Session 1		Session 2		Session 3		Session 4		Total
	April 9		April 14		April 23		April 28 and 29		
	U	D	U	D	U	D	U	D	
Arctic Grayling	1				1		1		3
Brook Stickleback									
Brook Trout									
Bull Trout	8	1	3		6		3		21
Burbot									
Finescale Dace									
Flathead Chub									
Goldeye									
Kokanee		1		1		2		8	12
Lake Chub									
Lake Trout									
Lake Whitefish									
Largescale Sucker	15		1		12		8		36
Longnose Dace									
Longnose Sucker	1				1		3		5
Mountain Whitefish		216		81		90		188	575
Northern Pike									
Northern Pikeminnow									
Northern Redbelly Dace									
Peamouth									
Pearl Dace									
Prickly Sculpin									
Pygmy Whitefish									
Rainbow Trout	1				1		1		3
Redside Shiner									
Slimy Sculpin									
Spoonhead Sculpin									
Spottail Shiner									
Trout-perch									
Walleye									
White Sucker					1	4	1		6
Yellow Perch									
Total	26	218	4	82	22	96	17	196	661
Grand total	244		86		118		213		

Photos

Photo 1. (A) Channels were bolted onto the side arms of the vee-trap and panels were lowered into place to concentrate the flow cue (light blue arrow) through the upstream half of the vee-trap (March 18, 2022). (B) Screenshot of IFC Construction Drawing 1020-M13-00419 showing the vee-trap and spatial context of (A).

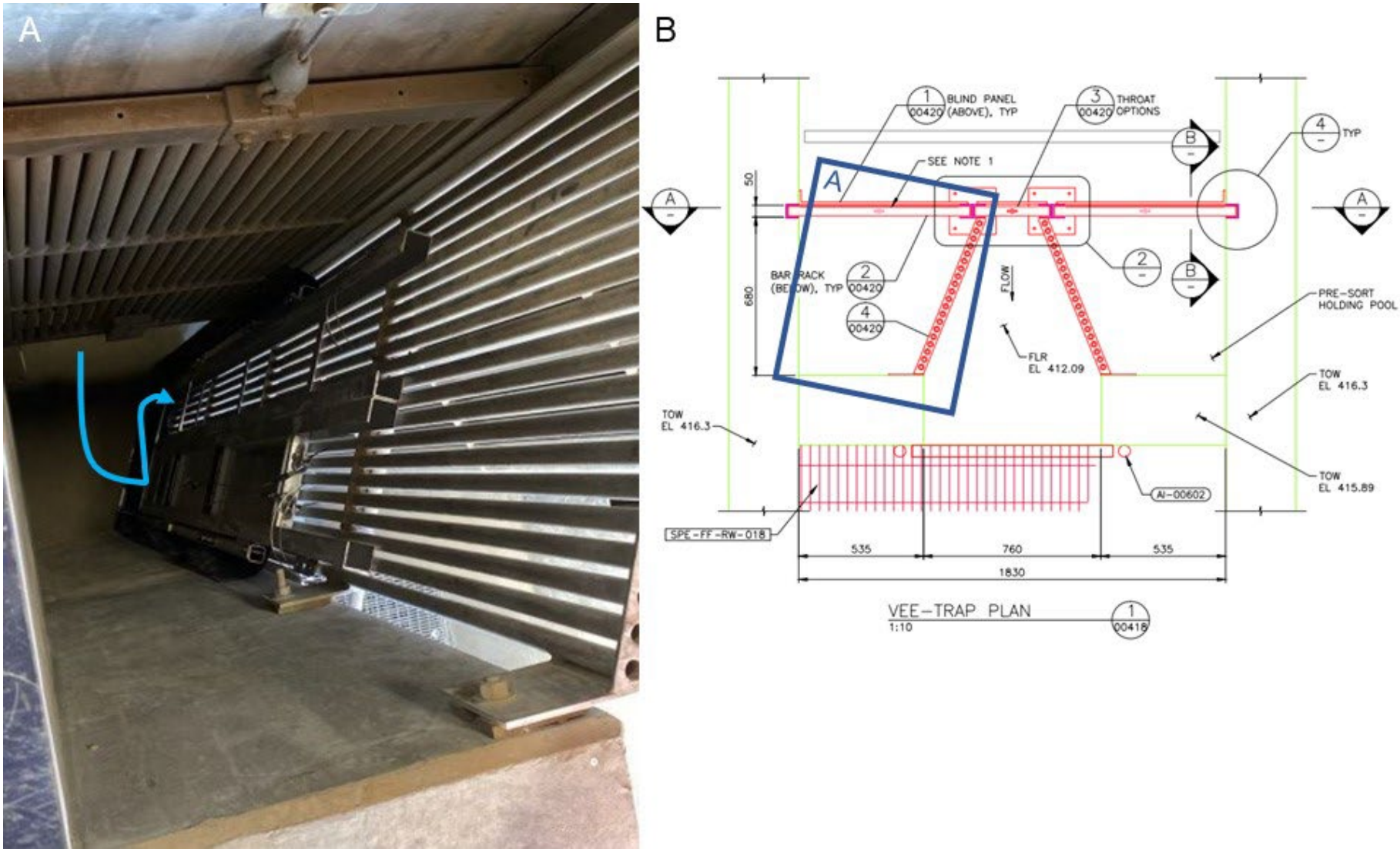


Photo 2. Biologists sample a mortality (Mountain Whitefish) to confirm sex and collect otoliths for microchemistry and ageing analysis (April 22, 2022).

Photo 3. Crews install a passive integrated transponder (PIT) antenna onto the side of the vee-trap to detect tagged fish entering the pre-sort holding pool (March 18, 2022).

Photo 4. Crews releasing a contingent-caught Arctic Grayling into the Moberly River following capture downstream of the diversion tunnel outlet (April 28, 2022).

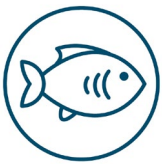
Prepared by

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 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:	April 1 to 30, 2022
Subject:	Monthly Update on Upstream Fish Passage



4 fish sorted at facility

Operated facility for 30 days

69 fish transported through contingent fish capture

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Passage rates consistent with those observed in April 2021
Sorting & Transport		• Released contingent-caught Arctic Grayling into Moberly River
Fish Mortality		• One mortality at the fishway (Mountain Whitefish) • No mortalities during contingent fish capture
Operation Within Criteria		• Operated within and outside of design criteria • Operated continuously despite below criteria air temperatures
External Communication		• Presented to Indigenous nations at Environmental Forum • Provided updates to DFO, MOE and FLNRORD
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Physical modifications to the trapping mechanism (vee-trap) to improve passage into the pre-sort holding pool

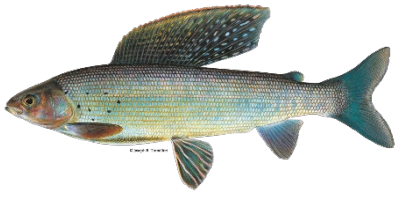
Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

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

Target Species

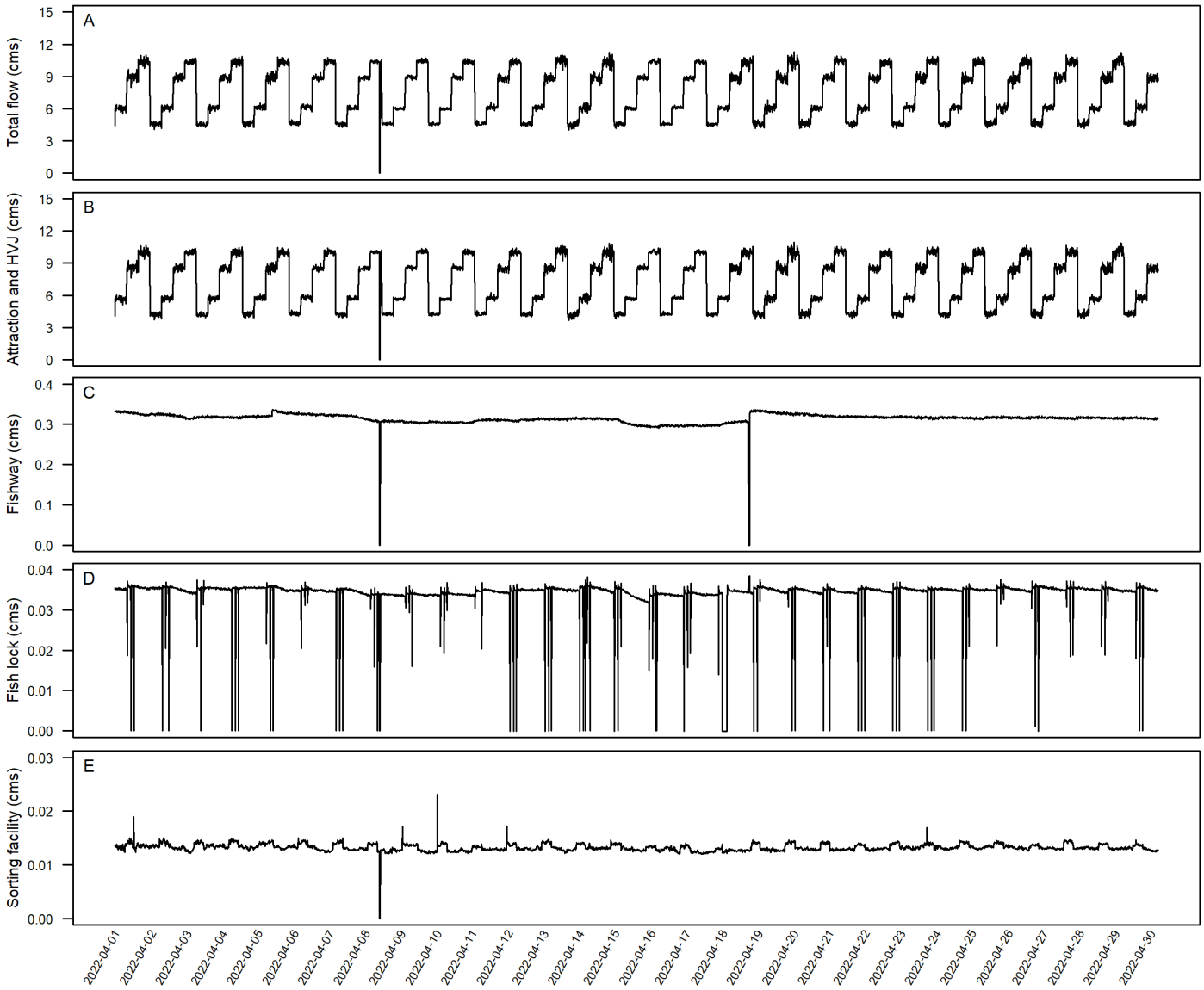
Bull Trout

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