

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: June 1 to 30, 2022

Prepared by BC Hydro

July 21, 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 Q¹). 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.

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 Plan².

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 O³; BC Hydro 2015⁴). 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 June 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>

Summary

Five hundred and thirty eight fish – 241 Longnose Sucker, 205 Largescale Sucker, 33 Northern Pikeminnow, 32 Mountain Whitefish, 25 White Sucker, 1 Bull Trout, 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, Photo 1). In addition to operating the temporary facility, BC Hydro conducted three sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 484 Longnose Sucker, 321 Largescale Sucker, 49 White Sucker, 13 Bull Trout, 5 Rainbow Trout and 3 Arctic Grayling upstream of the Project (Table 6). Two hundred and fifty 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 June 2022 to improve the biological and mechanical operation of the temporary facility.

- On June 8 BC Hydro installed a finger weir and orifice panel in the vee-trap throat to improve trapping efficiency (Photo 3). Fish can now either swim over the finger weir or through the orifice and cod fingers to enter the pre-sort holding pool. BC Hydro set the finger weir at 23 cm below the water surface to match the existing hydraulic drop between fishway pools. Capture rates will be monitored to determine the effectiveness of the adjusted trapping mechanism.

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, 538 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Five mortalities – 3 Longnose Sucker and 2 Largescale Sucker in the fish lock and AWS Receiving Pool – were observed during the reporting period (1.1% of all fish sorted in 2022), which is in-line with the anticipated levels of mortality during operations⁶.

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

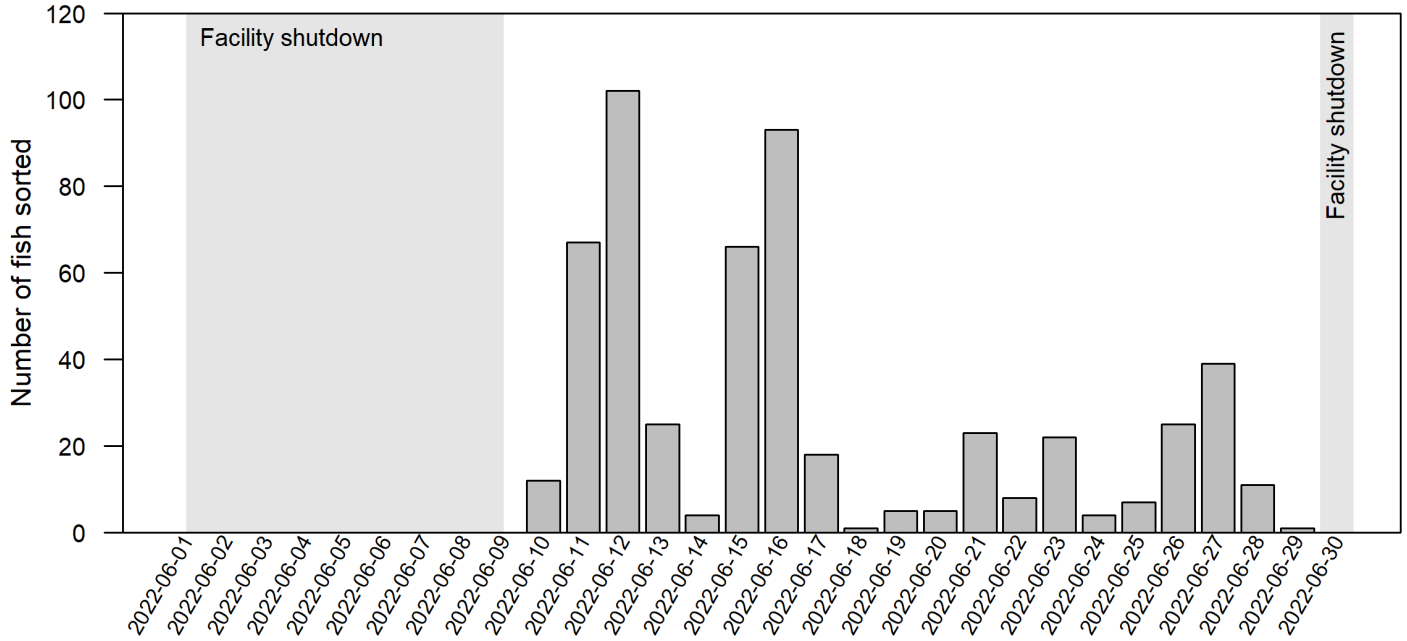
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout	1	1	0	0	0	0
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	205	205	168	2	N/A	N/A
Longnose Dace						
Longnose Sucker	241	241	217	3	N/A	N/A
Mountain Whitefish	32	32	30	0	N/A	0
Northern Pike						
Northern Pikeminnow	33	33	N/A	0	N/A	N/A
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	25	25	24	0	N/A	N/A
Yellow Perch						
Grand total	538	538	440	5	1	1

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 102 fish were sorted daily during the reporting period (Figure 1). Similar rates of passage were observed in [June 2021](#), where 571 fish passed the facility and 392 fish were passed via contingent fish capture.

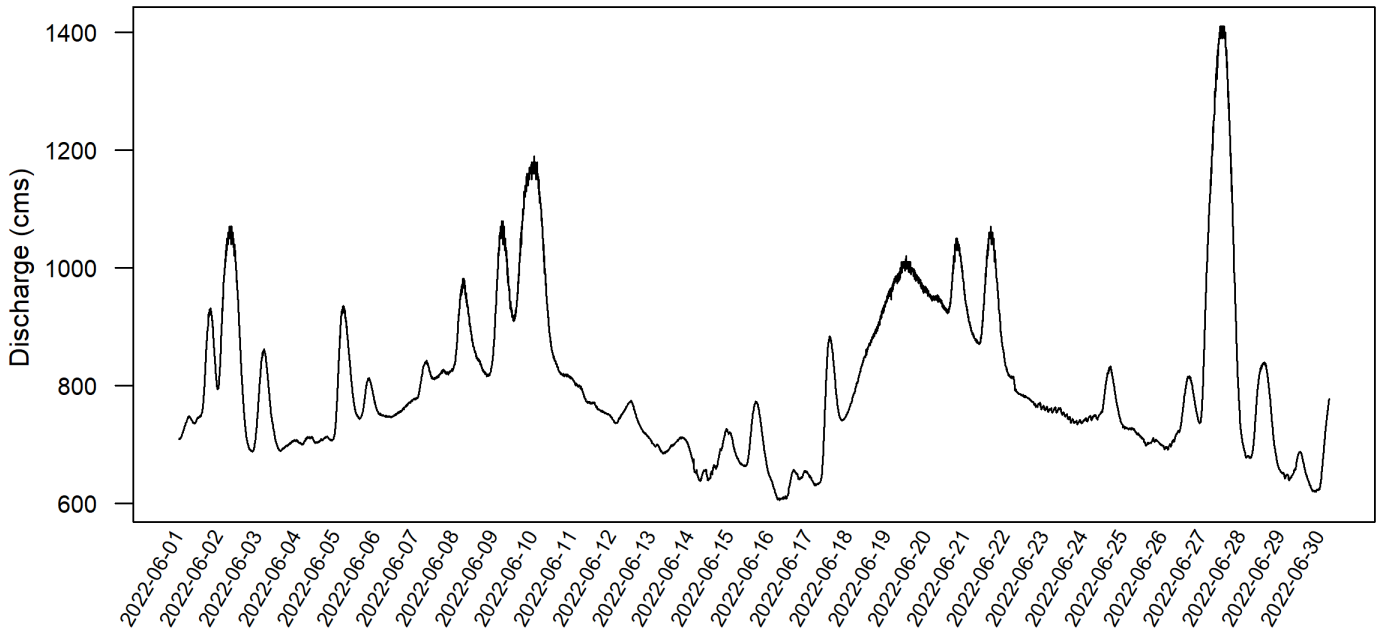
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

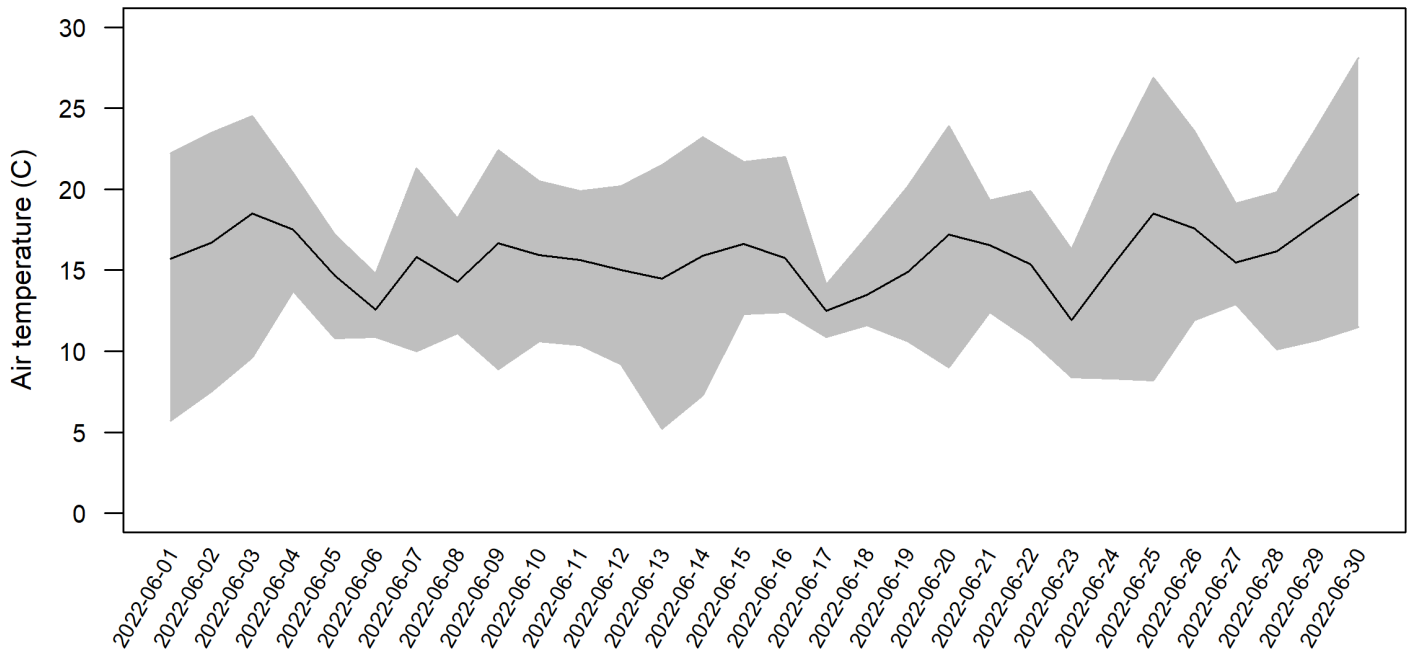
Discharge in the Peace River fluctuated during the reporting period from a low of 605 cms on June 16 to a high of 1410 cms on June 28 (Figure 2).

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 July 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 5.2°C on June 13 to a high of 28.1°C on June 30 (Figure 3).

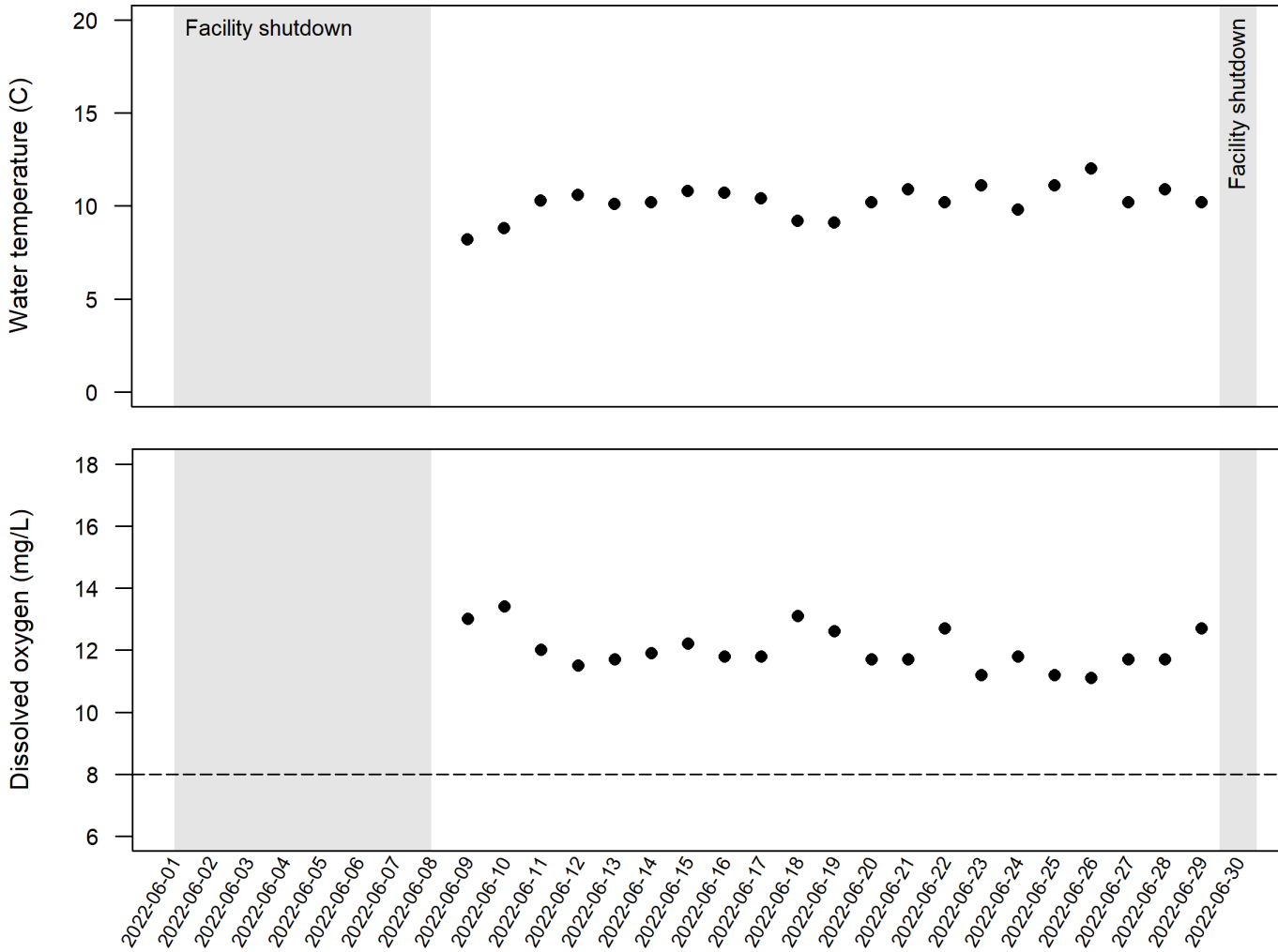
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accommodation⁷ (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature steadily increased during the reporting period from a low of 8.2°C on June 9 to a high of 12.0°C on June 26 (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.

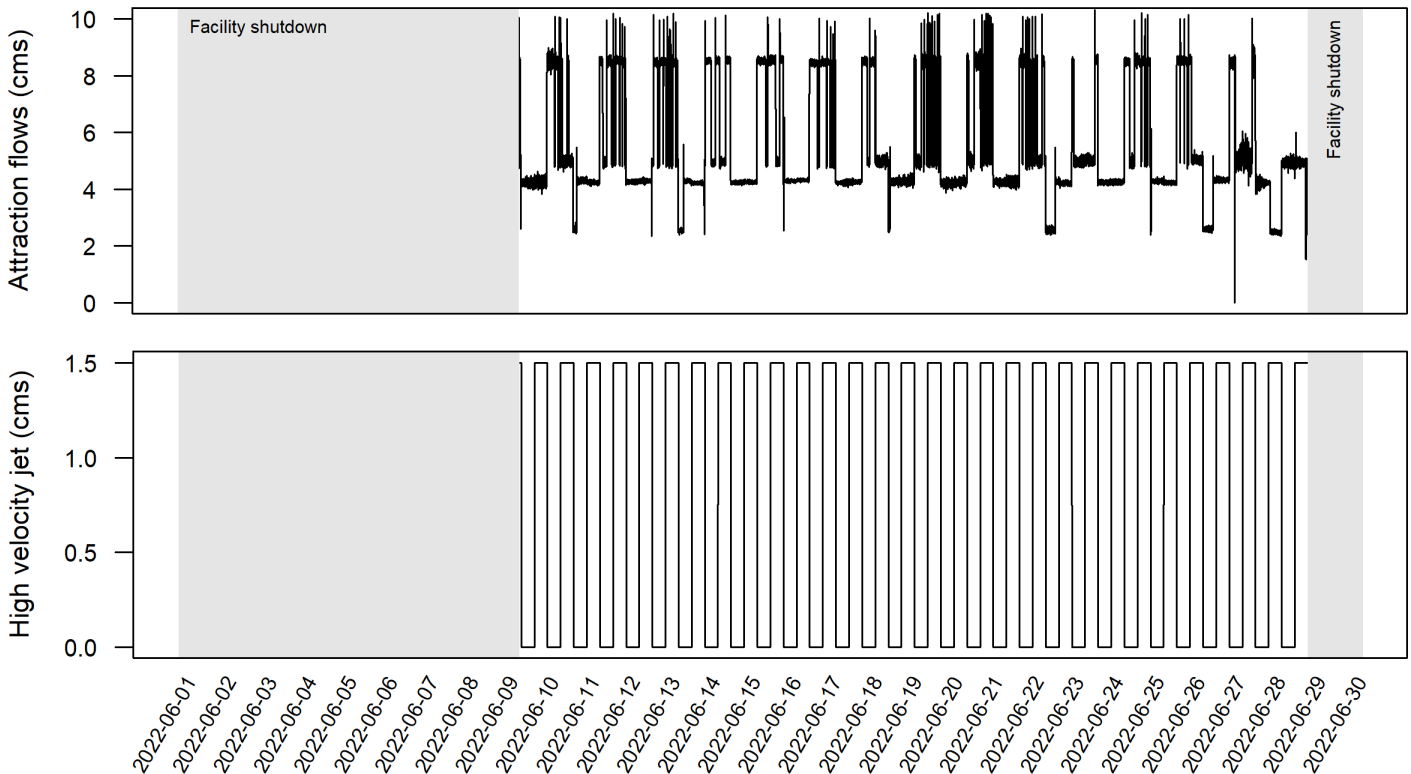


Mechanical operation

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 June 1 to 9 and June 29 to 30 (Tables 3 and 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 one and three sorting cycles were conducted each day during the reporting period, with the exception of June 1 to 8 and June 30 when the facility was shutdown (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2022-06-01	-	Facility shutdown
2022-06-02	-	Facility shutdown
2022-06-03	-	Facility shutdown
2022-06-04	-	Facility shutdown
2022-06-05	-	Facility shutdown
2022-06-06	-	Facility shutdown
2022-06-07	-	Facility shutdown
2022-06-08	-	Facility shutdown
2022-06-09	2	11:00, 13:00
2022-06-10	3	08:30, 11:00, 13:00
2022-06-11	3	08:30, 13:00, 14:46
2022-06-12	2	08:30, 14:18
2022-06-13	2	08:30, 11:00
2022-06-14	3	08:30, 11:00, 13:00
2022-06-15	3	08:30, 11:00, 13:00
2022-06-16	2	08:30, 11:00
2022-06-17	3	08:30, 11:00, 13:00
2022-06-18	3	08:30, 11:00, 13:00
2022-06-19	3	08:30, 11:00, 13:00
2022-06-20	2	08:30, 11:00
2022-06-21	3	08:30, 11:00, 13:00
2022-06-22	3	08:30, 11:00, 13:00
2022-06-23	3	08:30, 11:00, 13:00
2022-06-24	3	08:30, 11:00, 13:00
2022-06-25	3	08:30, 11:00, 13:00
2022-06-26	3	08:30, 11:00, 13:00
2022-06-27	3	08:30, 11:00, 13:00
2022-06-28	3	08:30, 11:00, 13:00
2022-06-29	1	08:30
2022-06-30	-	Facility shutdown

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

Date	Standby or shutdown	Rationale
2022-06-01 00:00 to 2022-06-09 08:30	Shutdown	<p>High rainfall on May 28 resulted in a significant increase in local inflows (Moberly and Halfway rivers) and debris and suspended sediment in the Peace River (Reference: Temporary Upstream Fish Passage Facility. Operations Report, May 1 to 31, 2022). Debris and suspended 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. BC Hydro kept the facility down to protect mechanical equipment (e.g., pumps) from damage and ensure fish health.</p> <p>BC Hydro conducted the following maintenance and adjustments during this shutdown: (1) clean out the sediment from the fish lock, pre-sort holding pool and sensor stilling tubes, and (2) install a finger weir and orifice panel in the vee-trap throat to improve trapping efficiency (Table 5).</p>
2022-06-29 09:57 to 2022-06-30 15:41	Shutdown	<p>Sediment continued to build up in the pre-sort holding pool (Photo 2), and the operator observed a significant differential between the diversion tunnel outlet and wetwell. BC Hydro kept the facility down to protect mechanical equipment (e.g., pumps) from damage and ensure fish health.</p> <p>BC Hydro conducted the following maintenance and adjustments during this shutdown: (1) clean out the sediment from the pre-sort holding pool, and (2) modify the finger weir and orifice panel and side panels of the vee-trap to strike a balance between increasing trapping efficiency and not causing sediment to build up in the pre-sort holding pool (Table 5).</p>

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.

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 Plan². 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 June 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).
	On June 8 BC Hydro installed a finger weir and orifice panel in the vee-trap throat to improve trapping efficiency (Photo 3). Fish can now either swim over the finger weir or through the orifice and cod fingers to enter the pre-sort holding pool. BC Hydro set the finger weir at 23 cm below the water surface to match the existing hydraulic drop between fishway pools. Capture rates will be monitored to determine the effectiveness of the adjusted trapping mechanism.

Contingent fish capture and transport

In total, 875 fish were transported upstream through contingent fish capture during the reporting period (Table 6). Specifically, 484 Longnose Sucker, 321 Largescale Sucker, 49 White Sucker, 13 Bull Trout, 5 Rainbow Trout and 3 Arctic Grayling were transported upstream of the Project (Photos 2 and 3).

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

Species	Session 9		Session 10		Session 11		Total
	June 1 and 2		June 7 and 8		June 14 and 15		
	U	D	U	D	U	D	
Arctic Grayling	1		1		1		3
Brook Stickleback							
Brook Trout							
Bull Trout	6		4		3		13
Burbot		8		4		1	13
Finescale Dace							
Flathead Chub							
Goldeye							
Kokanee		1					1
Lake Chub							
Lake Trout							
Lake Whitefish							
Largescale Sucker	92	4	104	1	125		326
Longnose Dace						1	1
Longnose Sucker	149	6	140	5	195	7	502
Mountain Whitefish		50		41		54	145
Northern Pike		1		4		1	6
Northern Pikeminnow		17		11		22	50
Northern Redbelly Dace							
Peamouth							
Pearl Dace							
Prickly Sculpin							
Pygmy Whitefish							
Rainbow Trout	1		2		2		5
Redside Shiner		1		3		2	6
Slimy Sculpin							
Spoonhead Sculpin							
Spottail Shiner							
Trout-perch							
Walleye						3	3
White Sucker	14	2	17		18	2	53
Yellow Perch							
Total	263	90	268	69	344	93	1127
Grand total	353		337		437		

Photos

Photo 1. Biologists sample a Northern Pike in the sorting facility, where a distended belly showed signs of spawning (June 25, 2022).



Photo 2. Build up of sediment in the pre-sort holding pool, which required clean out with a hydrovac at the beginning and end of the reporting period (June 29, 2022).



Photo 3. BC Hydro installed a finger weir and orifice panel in the vee-trap throat to improve trapping efficiency (left panel; June 9, 2022). Fish can now either swim over the finger weir or through the orifice and cod fingers to enter the pre-sort holding pool. BC Hydro set the finger weir at 23 cm below the water surface to match the existing hydraulic drop between fishway pools (right panel; June 13, 2022).



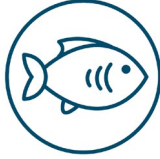
Prepared by

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



538 fish sorted at facility



Operated facility for 21 days



875 fish transported through contingent fish capture

Category	Performance	Commentary
Safety	Meets or Exceeds Expectations	<ul style="list-style-type: none"> Effective interfaces among contractors
Fish Passage ¹	Nearing Expectations	<ul style="list-style-type: none"> Passage rates consistent with those observed in June 2021
Sorting & Transport	Meets or Exceeds Expectations	<ul style="list-style-type: none"> 538 fish from 7 species
Fish Mortality	Nearing Expectations	<ul style="list-style-type: none"> Five mortalities during reporting period Survival rate 99% for all fish sorted in 2022
Operation Within Criteria	Nearing Expectations	<ul style="list-style-type: none"> Operated within and outside of design criteria Shutdown due to debris and sediment clogging intake screens
External Communication	Meets or Exceeds Expectations	<ul style="list-style-type: none"> Provided updates to DFO, MOF and MOE
Effectiveness Monitoring	Meets or Exceeds Expectations	<ul style="list-style-type: none"> Monitoring equipment performing well
Learning & Adjustment	Meets or Exceeds Expectations	<ul style="list-style-type: none"> Installed finger weir and orifice panel to increase trapping efficiency at the top of the fishway

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations
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¹ Infographic available here: <https://www.sitecproject.com/sites/default/files/fish-passage-facility.pdf>

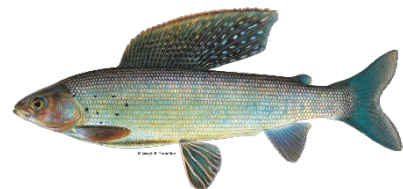
Target Species



Bull Trout

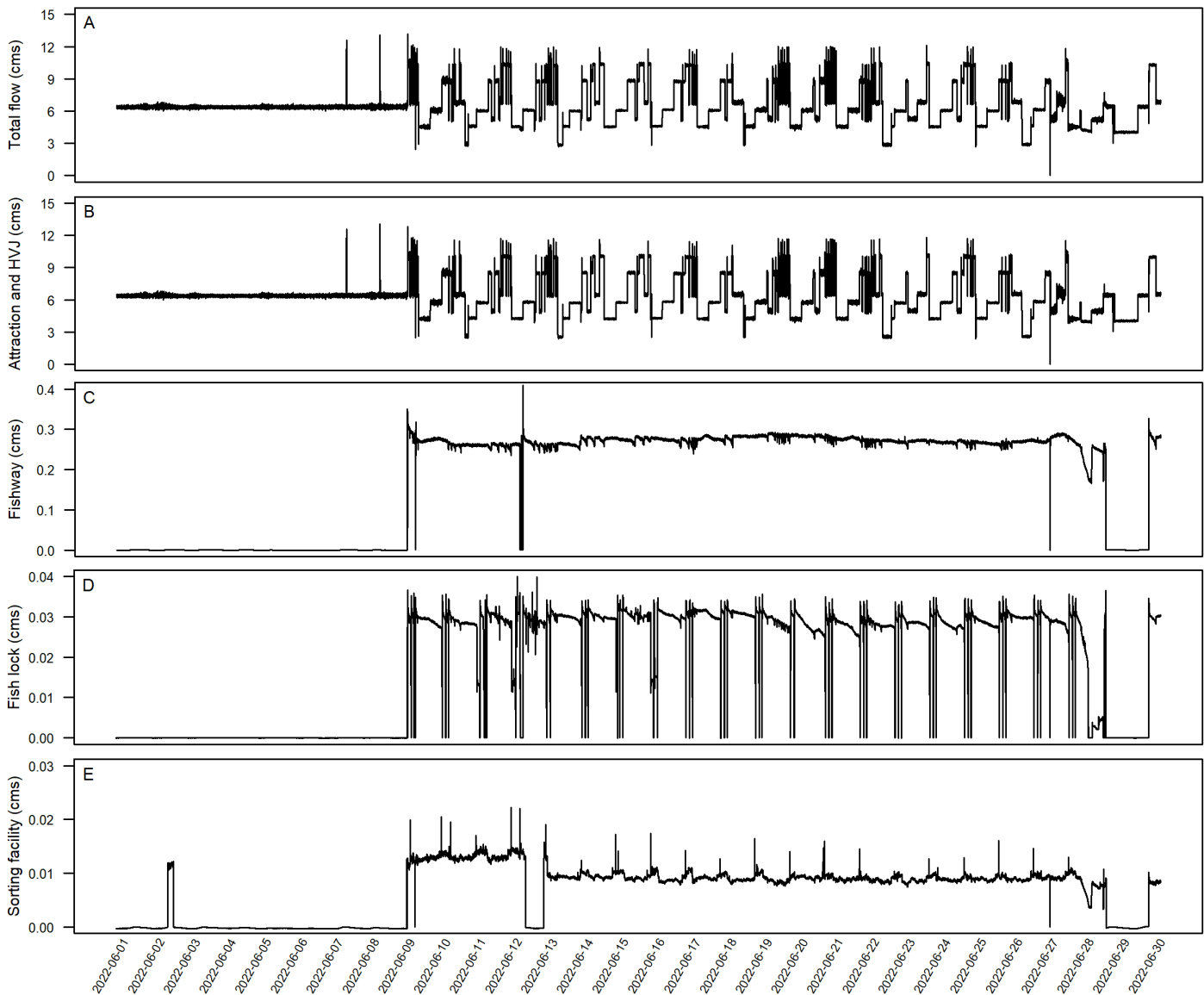


Rainbow Trout



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 133987⁸, 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://siteproject.com/sites/default/files/fish-passage-facility-water-licences-133986-133987.pdf>