BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: June 1 to 30, 2021

Prepared by BC Hydro

Submitted September 23, 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 undergoing spawning migrations during the reporting period (EIS, Volume 2, Appendix O[3]; BC Hydro 2015[4]) were transported and released upstream of the Project, which included Arctic Grayling, Bull Trout, Rainbow Trout, and the Sucker species. 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 2021.

This report has the following sections:

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

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

[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

mechanical equipment to ensure the temporary facility achieves the biological objectives described in Section 4.1 of the Fish Passage Management Plan[5].

Summary

Five hundred and seventy-one fish were sorted and sampled at the temporary facility, and transported and released into the Peace River upstream of the Project (Table 1). Specifically, the facility operator sorted 268 Mountain Whitefish, 165 Largescale Sucker, 123 Longnose Sucker, 8 White Sucker, 4 Northern Pikeminnow, 2 Rainbow Trout, and 1 Arctic Grayling (Photos 1, 2 and 3). In addition to operating the temporary facility, BC Hydro conducted two sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 195 Longnose Sucker, 152 Largescale Sucker, 24 White Sucker, 18 Bull Trout, and 3 Rainbow Trout upstream of the Project (Table 6). Three hundred and five fish from other species were encountered during contingent fish capture and were released downstream of the Project (Table 6).

On June 11 and 29 the facility operator observed a sheen on the surface of the water in the West Auxillary Water Supply (AWS) Receiving Pool and immediately shut down the facility. Given that the sheen may have been oil, and to mitigate the risk of oil being released into the Peace River, the operator deployed an absorbent boom in the pool and closed the entrance gates (Photo 4). On both occasions, laboratory analysis of collected water samples confirmed that the sheen was not hydrocarbon-based and was instead of natural origin. Operations began shortly after receiving results from the laboratory.

Several adjustments were made to improve the biological and mechanical operation of the temporary facility. Adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2022.

BC Hydro shared information related to the operation of the temporary facility through a number of venues:

- Updates to DFO and FLNRORD on June 4; and
- Updates to CWR, IE and IEM on June 25.

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, 571 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Four mortalities – 2 Longnose Sucker and 1 Largescale Sucker in the pre-sort holding pool, and 1 Mountain Whitefish during processing – were observed during the reporting period (0.5% of all fish sorted in 2021), which is in-line with the anticipated levels of mortality during operations[6]. Sucker mortalities observed in the pre-sort holding pool informed the adjustments described in Table 5.

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

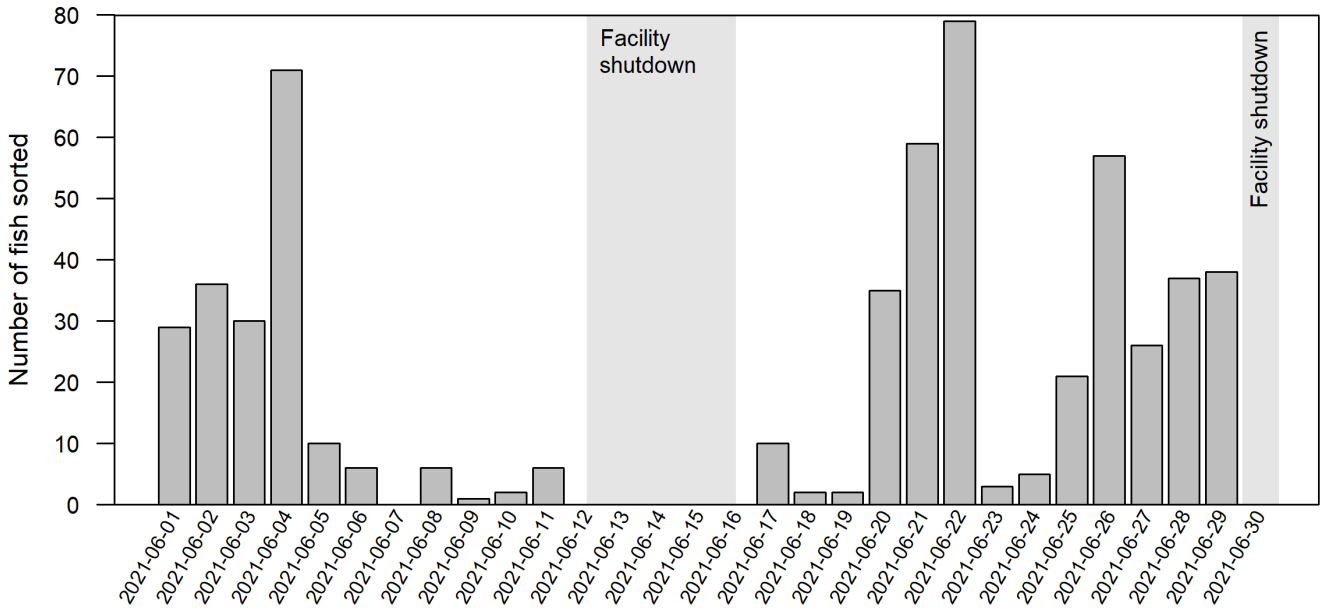
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling	1	1	1	0	1	1
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	165	165	160	1	N/A	N/A
Longnose Dace						
Longnose Sucker	123	123	114	2	N/A	N/A
Mountain Whitefish	268	268	251	1	N/A	1
Northern Pike						
Northern Pikeminnow	4	4	N/A	0	N/A	N/A
Northern Redbelly Dace						
Peamouth						
Pearl Dace						
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout	2	2	2	0	1	2
Redside Shiner						
Slimy Sculpin						
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker	8	8	8	0	N/A	N/A
Yellow Perch						
Grand total	571	571	536	4	2	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 79 fish were sorted daily during the reporting period (Figure 1).

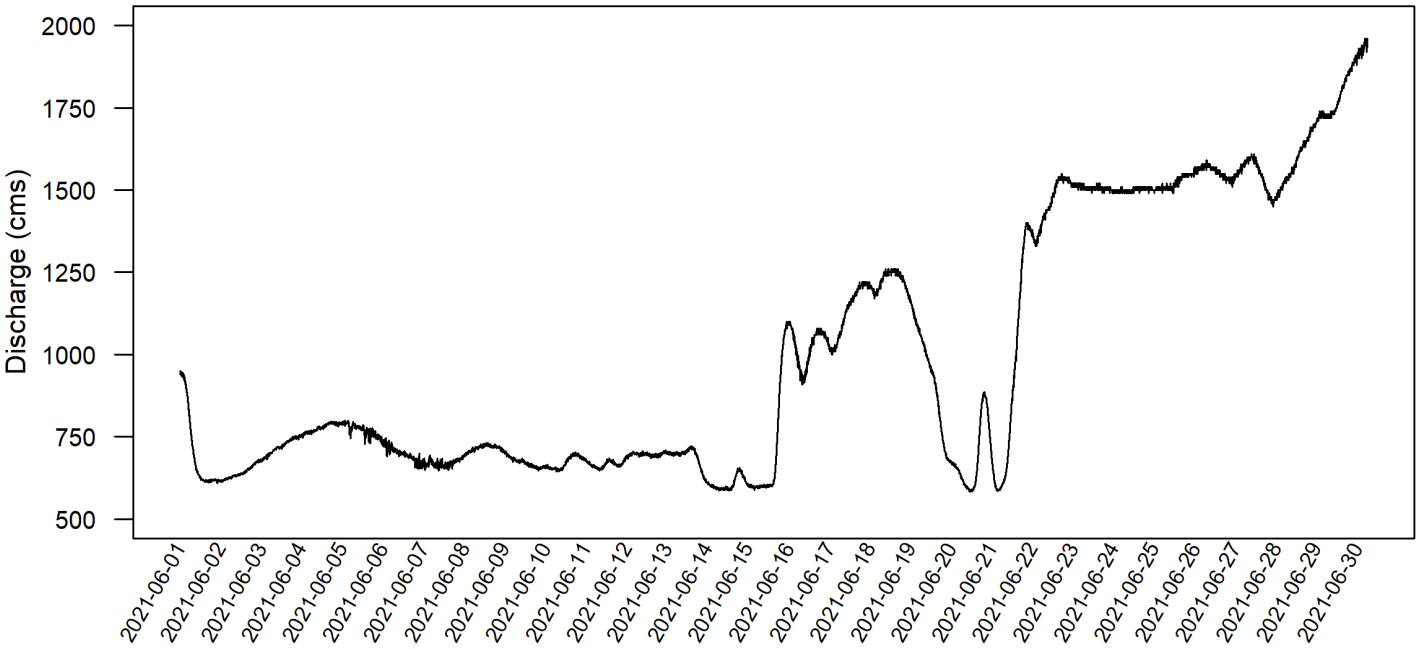
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

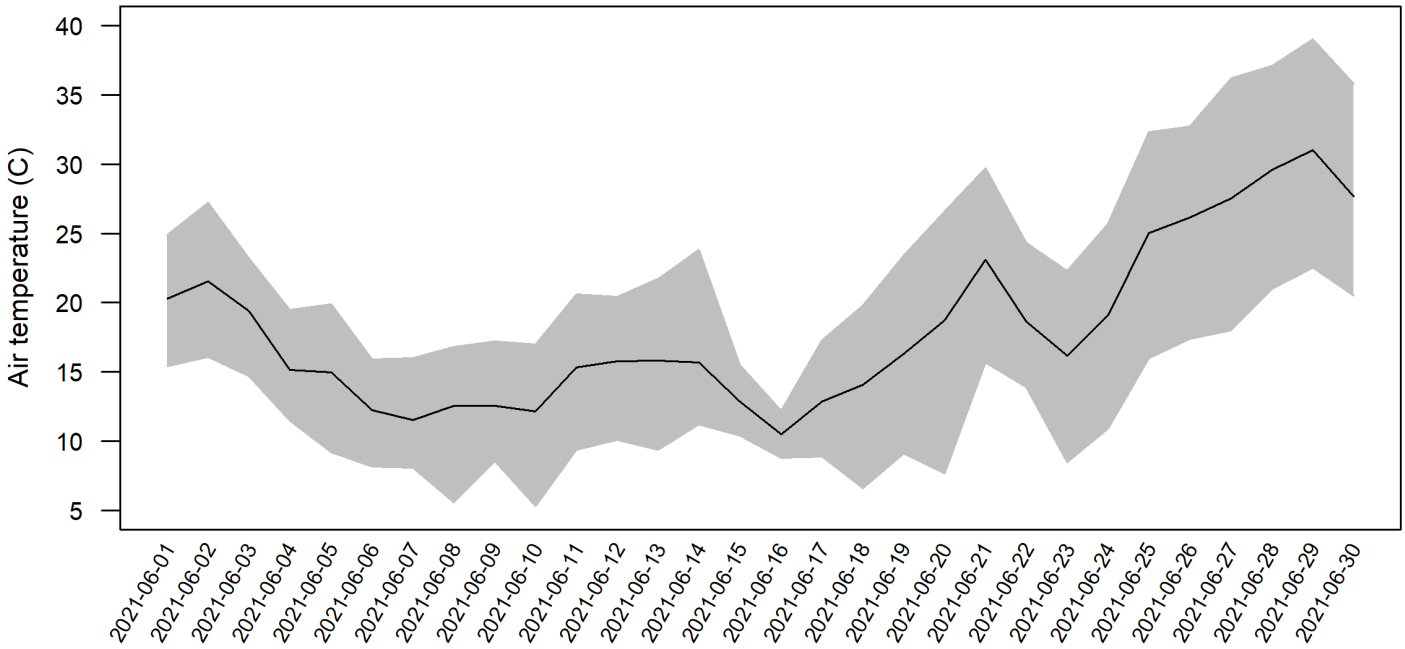
Discharge in the Peace River fluctuated during the reporting period from a low of 582 cms on June 20 to a high of 1960 cms on June 30 (Figure 2).

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 16 at 5-minute intervals and were listed as provisional by the WSC.



Air temperature fluctuated during the reporting period from a low of 5.3°C on June 10 to a high of 39°C on June 29 (Figure 3).

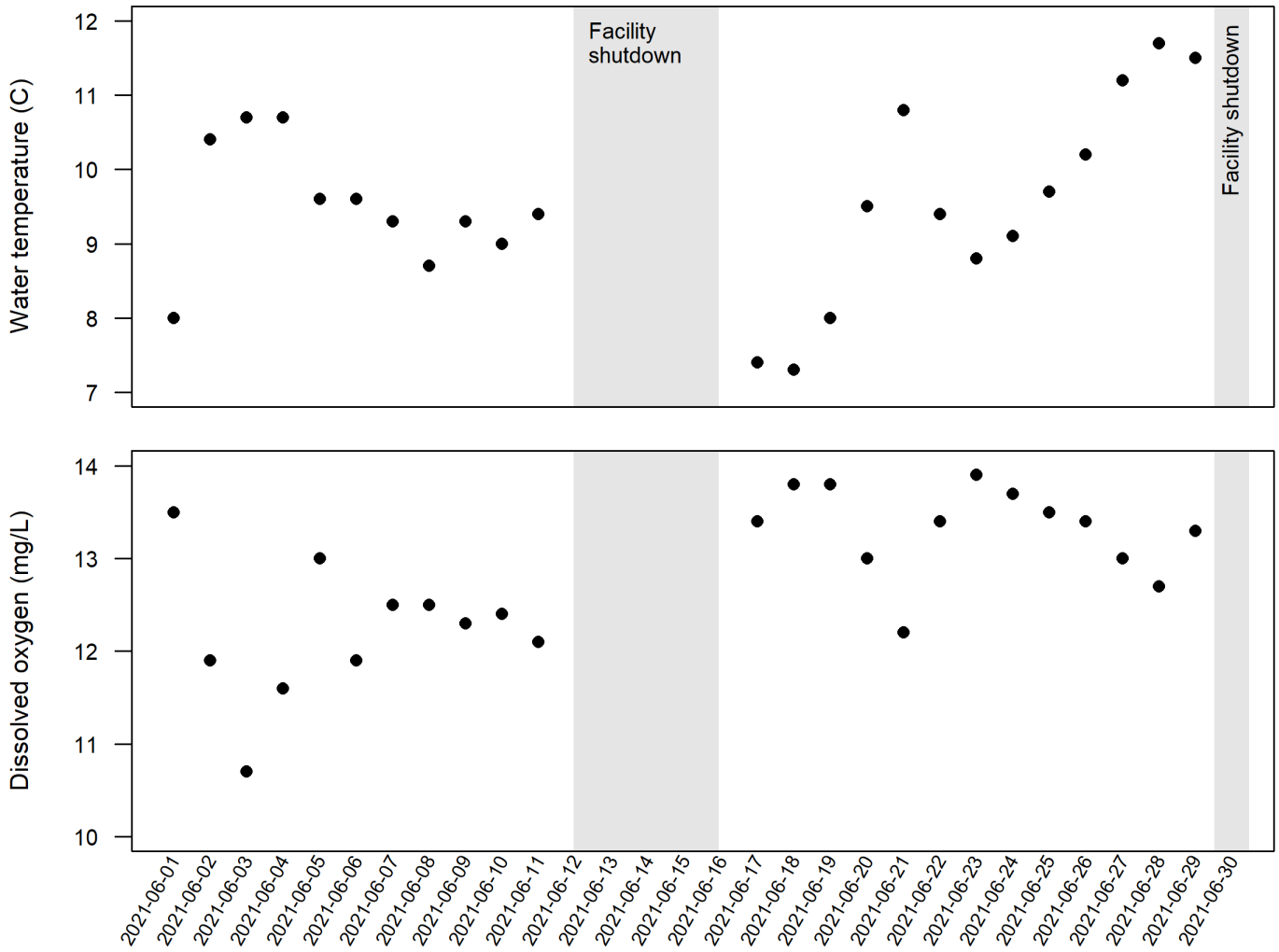
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[7] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature fluctuated during the reporting period from a low of 7.3°C on June 18 to a high of 11.7°C on June 28 (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.

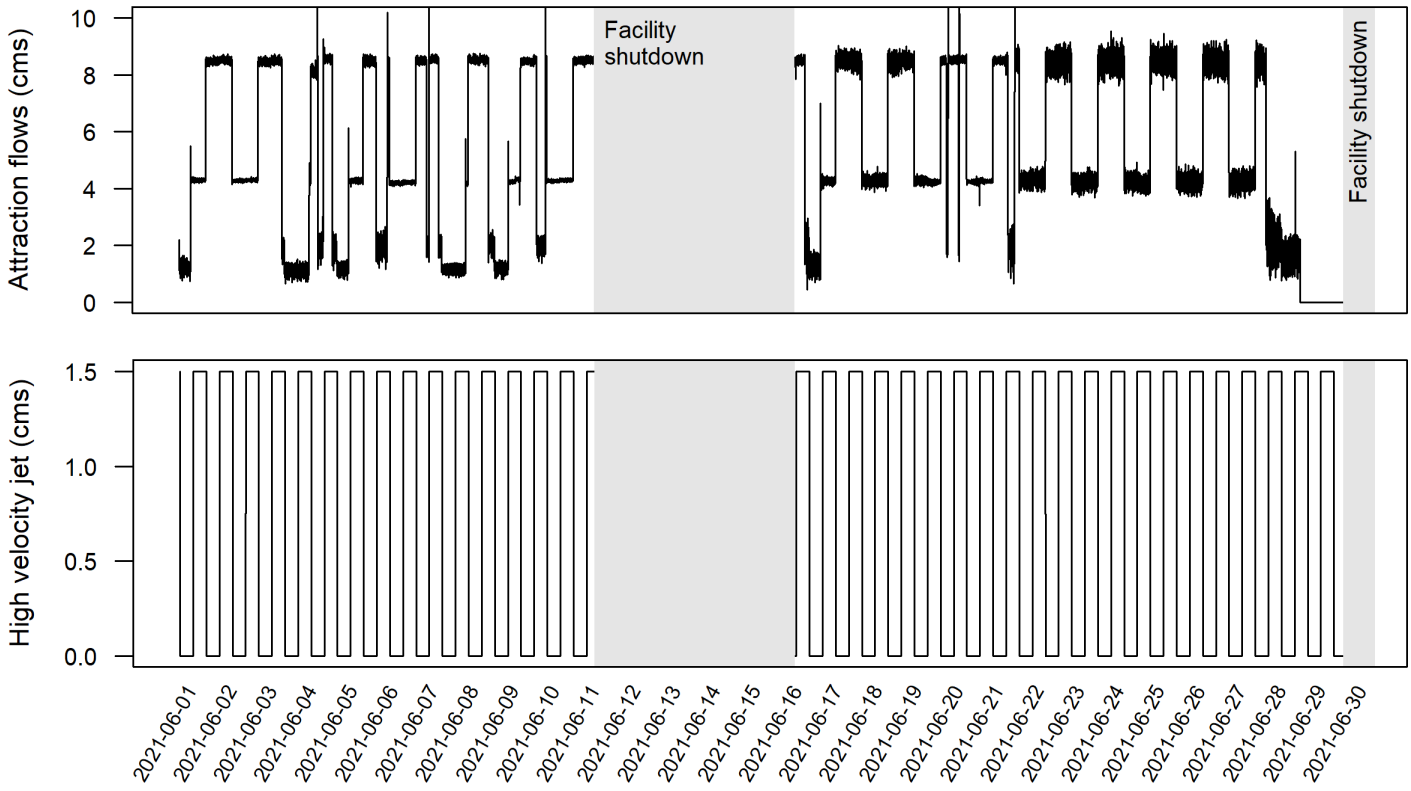


Mechanical operation

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 throughout June (Table 4), and the facility was shutdown between June 11 and 16 and June 29 and 30 (Table 3).

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 June 4, 7 and 17, and June 11 to 16 and June 29 to 30 due to the facility being shutdown (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2021-06-01	3	08:30, 11:00, 13:00
2021-06-02	3	08:30, 11:00, 13:00
2021-06-03	3	08:30, 11:00, 13:00
2021-06-04	2	08:30, 13:00
2021-06-05	3	08:30, 11:00, 13:00
2021-06-06	3	08:30, 11:00, 13:00
2021-06-07	2	08:30, 12:00
2021-06-08	3	08:30, 11:00, 13:00
2021-06-09	3	08:30, 11:00, 13:00
2021-06-10	3	08:30, 11:00, 13:00
2021-06-11	3	08:30, 11:00, 13:00
2021-06-12	-	Facility shutdown
2021-06-13	-	Facility shutdown
2021-06-14	-	Facility shutdown
2021-06-15	-	Facility shutdown
2021-06-16	-	Facility shutdown
2021-06-17	2	08:30, 13:00
2021-06-18	3	08:30, 11:00, 13:00
2021-06-19	3	08:30, 11:00, 13:00
2021-06-20	3	08:30, 12:00, 13:00
2021-06-21	3	08:30, 11:00, 13:00
2021-06-22	3	08:30, 11:00, 13:00
2021-06-23	3	08:30, 11:00, 13:00
2021-06-24	3	08:30, 11:00, 13:00
2021-06-25	3	08:30, 11:00, 13:00
2021-06-26	3	08:30, 11:00, 13:00
2021-06-27	3	08:30, 11:00, 13:00
2021-06-28	3	08:30, 11:30, 13:00
2021-06-29	3	08:30, 10:30, 10:45
2021-06-30	-	Facility shutdown

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

Date	Standby or shutdown	Rationale
2021-06-11 18:05 to 2021-06-16 12:51	Shutdown	On June 11 and 29 the facility operator observed a sheen on the surface of the water in the West AWS Receiving Pool and immediately shut down the facility. Given that the sheen may have been oil, and to mitigate the risk of oil being released into the Peace River, the operator deployed an absorbent boom in the pool and closed the entrance gates (Photo 4). On both occasions, laboratory analysis of collected water samples confirmed that the sheen was not hydrocarbon-based and was instead of natural origin. Operations began shortly after receiving results from the laboratory.
2021-06-29 11:23 to 2021-06-30 23:59		

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 occassion.	Variable frequency drive faulting due to debris accumulation on the outside of the wet well creating a large differential in hydraulic head.	Variable frequency drive manually reset following each fault.

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. 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	Facility operator observed two Longnose Sucker and one Largescale Sucker mortalities in the pre-sort holding pool during the first week of June. Root cause of mortality was unknown, however the injuries may have suggested contact with mechanical components in and around the pre-sort holding pool. As such, the facility operator started to perform the following prior to each sorting cycle in an effort to minimize mortality: (1) use a long-handled dipnet to encourage and scare fish away from the vee-trap gates and the crowder screen; (2) observe the raising of the crowder screen after each crowd to ensure no fish were stranded on the crowder screen horizontal platform at the bottom; and (3) observe the fish lock brail floor as it is raised to ensure no fish are being impinged in the gap between the brail floor and the concrete wall of the fish lock.

Contingent fish capture and transport

In total, 392 fish were transported upstream through contingent fish capture during the reporting period (Table 2). Specifically, 195 Longnose Sucker, 152 Largescale Sucker, 24 White Sucker, 18 Bull Trout, and 3 Rainbow Trout were transported upstream of the Project. One mortality – a Longnose Sucker – was observed during the reporting period.

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

Species	Session 10		Session 11		Total
	June 17 and 19		June 25 and 26		
	U	D	U	D	
Arctic Grayling					
Brook Stickleback					
Brook Trout					
Bull Trout	10		8		18
Burbot		1		1	2
Finescale Dace					
Flathead Chub					
Goldeye					
Kokanee					
Lake Chub					
Lake Trout		1			1
Lake Whitefish					
Largescale Sucker	62		90		152
Longnose Dace					
Longnose Sucker	105		90		195
Mountain Whitefish		204		61	265
Northern Pike		1		2	3
Northern Pikeminnow		12		7	19
Northern Redbelly Dace					
Peamouth					
Pearl Dace					
Prickly Sculpin					
Pygmy Whitefish					
Rainbow Trout	1		2		3
Redside Shiner		2		5	7
Slimy Sculpin					
Spoonhead Sculpin					
Spottail Shiner					
Trout-perch					
Walleye		3		5	8
White Sucker	18		6		24
Yellow Perch					
Total	196	224	196	81	697
Grand total	420		277		

Photos

Photo 1. Processing Longnose Sucker (top: June 4, 2021) and Largescale Sucker (bottom: June 11, 2021) in the sorting facility. Spawning colouration can be seen on the Longnose Sucker.

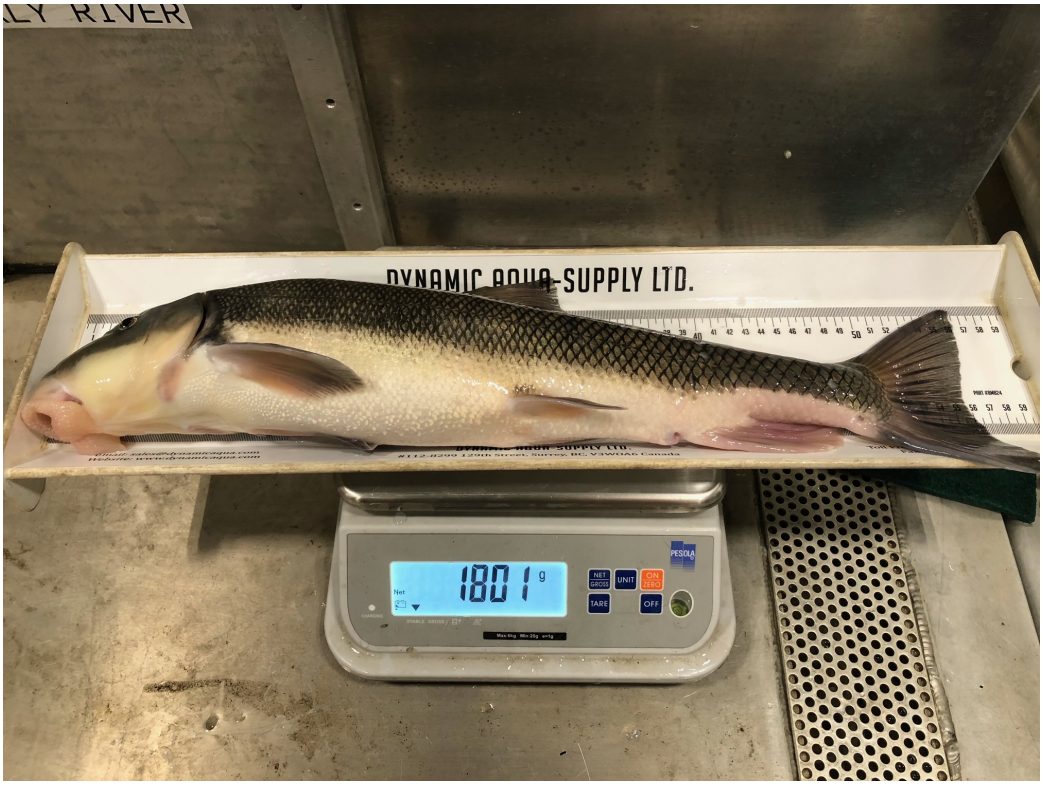


Photo 2. Fish exit a lock into an anaesthetic tank prior to sampling and tagging in the sorting facility (June 21, 2021).

Photo 3. Facility operator samples and tags a Mountain Whitefish in the sorting facility (June 21, 2021).

Photo 4. An absorbent boom was deployed in the West AWS Receiving Pool and the entrance gates were closed to mitigate the risk of oil being released into the Peace River (June 11, 2021). Laboratory analysis of the water sample confirmed that the sheen was not hydrocarbon-based and was instead of natural origin.

Prepared by

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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, 2021
Subject:	Monthly Update on Upstream Fish Passage

571 fish sorted at facility

Operated facility for 24 days

392 fish transported through contingent fish capture

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Observed higher passage in June compared to May • Some target species are in the fishway but are not passing
Sorting & Transport		• Sorted 571 fish from seven species • Transported additional 392 fish through contingent fish capture
Fish Mortality		• Four mortalities representing 0.5% mortality out of all fish processed in 2021
Operation Within Criteria		• Operated within and outside of design criteria
External Communication		• Provided updates to DFO, FLNRORD, CWR, IE and IEM
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Minor, process-based adjustments made to operations

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

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

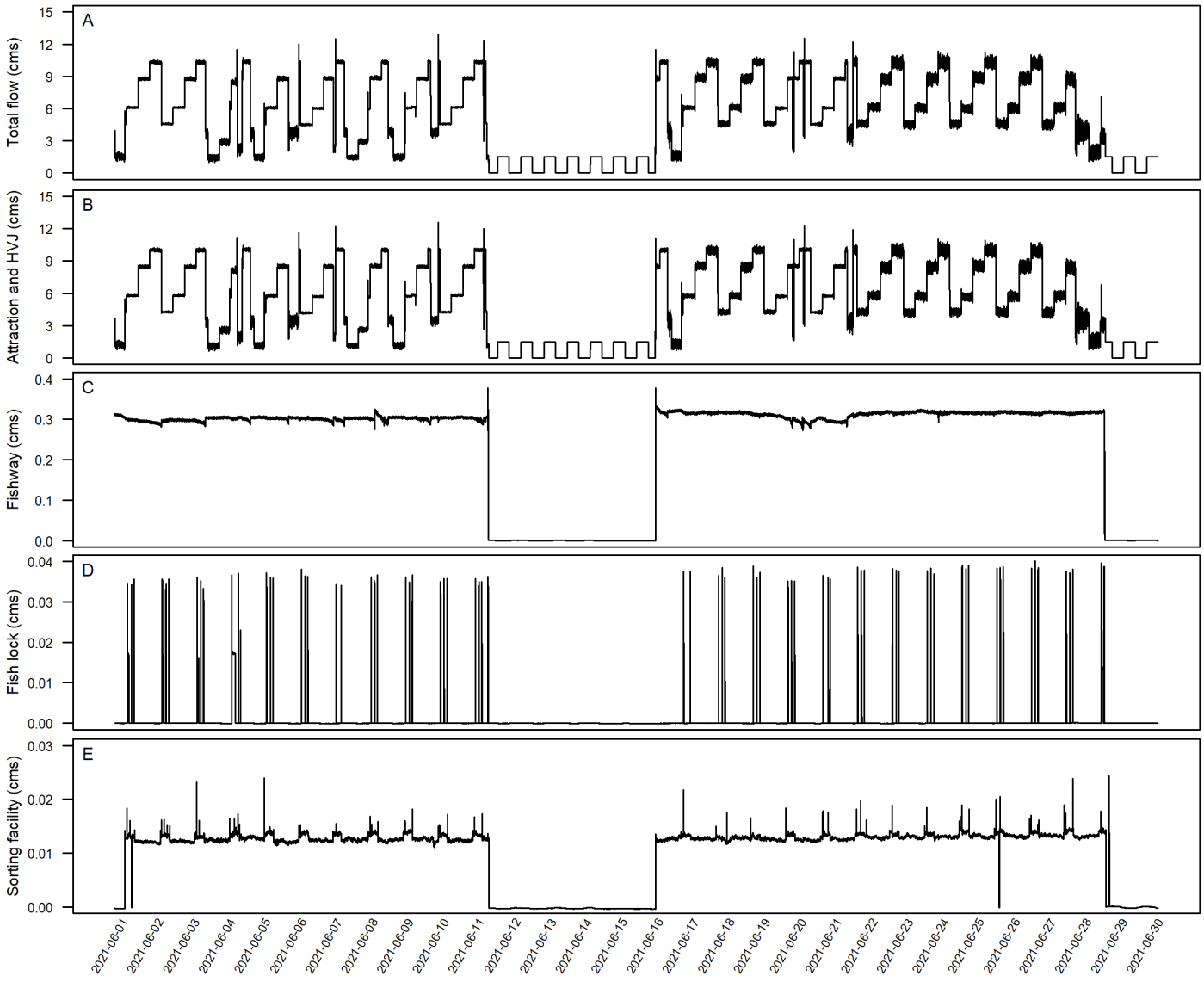
Target Species

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