BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: October 1 to 31, 2020

Prepared by BC Hydro

Submitted January 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 (Map 1). 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.

The following sequence of construction activities related to upstream fish passage milestones occurred in 2020:

- Diversion outlet cofferdam was breached on September 11 (Photo 1), providing a connection between the Peace River and the diversion tunnel outlet (Photo 2);
- Commissioning of the temporary facility from September 23 to 30 (Photo 3). Facility operator opened the trap at the top of the fishway (referred to as a 'vee-trap'), which allowed fish to swim into the pre-sort holding pool and be available for crowding into the sorting facility;
- Diversion tunnel gates were opened on September 30 (Photo 4), which started to divert the Peace River through the diversion tunnels;
- River closure occurred on October 3 (Photo 5) with the final rip rap placement of the rockfill berm across the Peace River; and
- Operation of the temporary facility from October 1 to 31.

Fish were able to continue to naturally swim past the dam site in the Peace River until October 3.

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 2020. Operations in 2020 were limited to the month of October, as pre-commisioning and commissioning occurred in September and 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
- Photos.

Biological operation is defined as the sorting, sampling, tagging, transport and release of fish (Photos 6 to 10). Mechanical operation is defined as the operation of the pumps, gates, crowder, lock, sensors, loggers, and other mechanical equipment (Photos 11 to 13) to ensure the temporary facility achieves the biological

[1] Available at: https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_Q.pdf

objectives described in Section 4.1 of the Fish Passage Management Plan[2].

Summary

In general the operation of the temporary facility during the first month of operations was effective at providing for the upstream passage of fish. Seventy-one fish were sorted and sampled at the temporary facility – 70 of the 71 fish were transported and released due to a single mortality identified at release (Table 1). Specifically, the facility operator sorted 63 Mountain Whitefish, 6 Longnose Sucker, 1 Arctic Grayling, and 1 Slimy Sculpin. Following the sampling and tagging procedures of the OPP, sixty-three fish were PIT tagged and 23 fish were sampled for genetics, microchemistry and/or ageing (Table 1).

No fish were sorted during commissioning despite the vee-trap being open and the operation of the temporary facility mimicking normal operations. Fish may not have been attracted to the temporary facility and the diversion tunnel outlet until the river was closed and the Peace River flowed solely through the diversion tunnels.

Several adjustments were made to improve the biological and mechanical operation of the temporary facility. Adjustments will be reflected in an updated revision of the OPP for operations in 2021.

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

- Presentation to the Peace Williston Advisory Committee on September 18;
- Tour representatives from Fisheries and Oceans Canada and the Ministry of Forests, Lands and Natural Resource Operations and Rural Development on September 25 and November 3;
- Presentation to Indigenous groups at Environmental Forum #13 on October 14; and
- Tour representatives from the Halfway River First Nation, Blueberry River First Nation, Saulteau First Nation, Doig River First Nation, Prophet River First Nation, McLeod Lake Indian Band, and Métis Nation British Columbia on September 23 and November 4 (Photo 14).

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.

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

Biological operation

In total, 71 fish were sorted in the temporary facility during the reporting period (Table 1). Two mortalities – both Mountain Whitefish – were observed during the reporting period (3% of all fish sorted in 2020), which is in-line with the anticipated levels of mortality during operations[3]. One mortality was identified at release while the other occurred in the sorting facility during sampling.

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

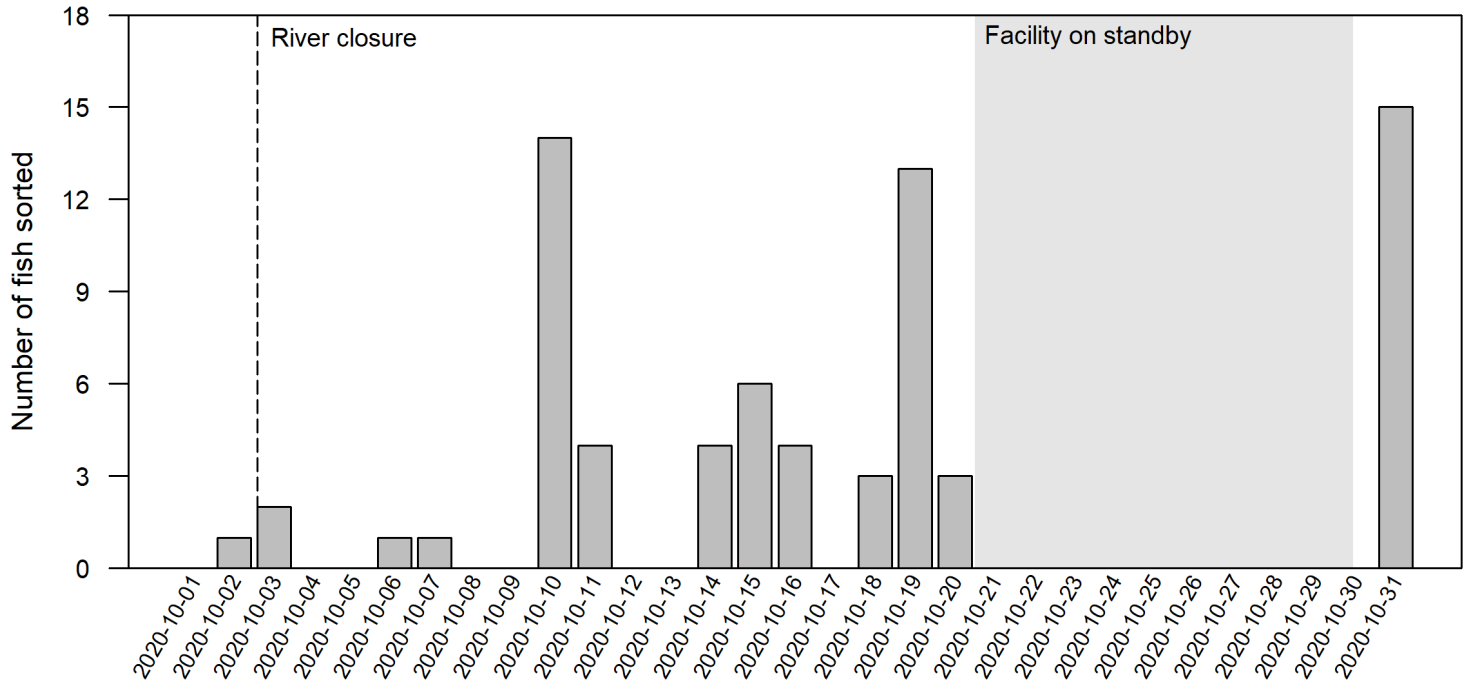
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling	1	1	1		1	1
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker						
Longnose Dace						
Longnose Sucker	6	6	6		N/A	N/A
Mountain Whitefish	63	62	58	2	N/A	20
Northern Pike						
Northern Pikeminnow						
Northern Redbelly Dace						
Peamouth						
Pearl Dace						
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout						
Redside Shiner						
Slimy Sculpin	1	1	N/A		1	N/A
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker						
Yellow Perch						
Grand total	71	70	65	2	2	21

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.

The facility operator sorted the first fish – a Longnose Sucker – in the temporary facility on October 2 (Photo 7). Between zero and 15 fish were sorted daily during the reporting period (Figure 1). Note that the facility was on standby from October 20 to 30 due to cold weather conditions[4], as shown in Figure 3 and described in Table 3.

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

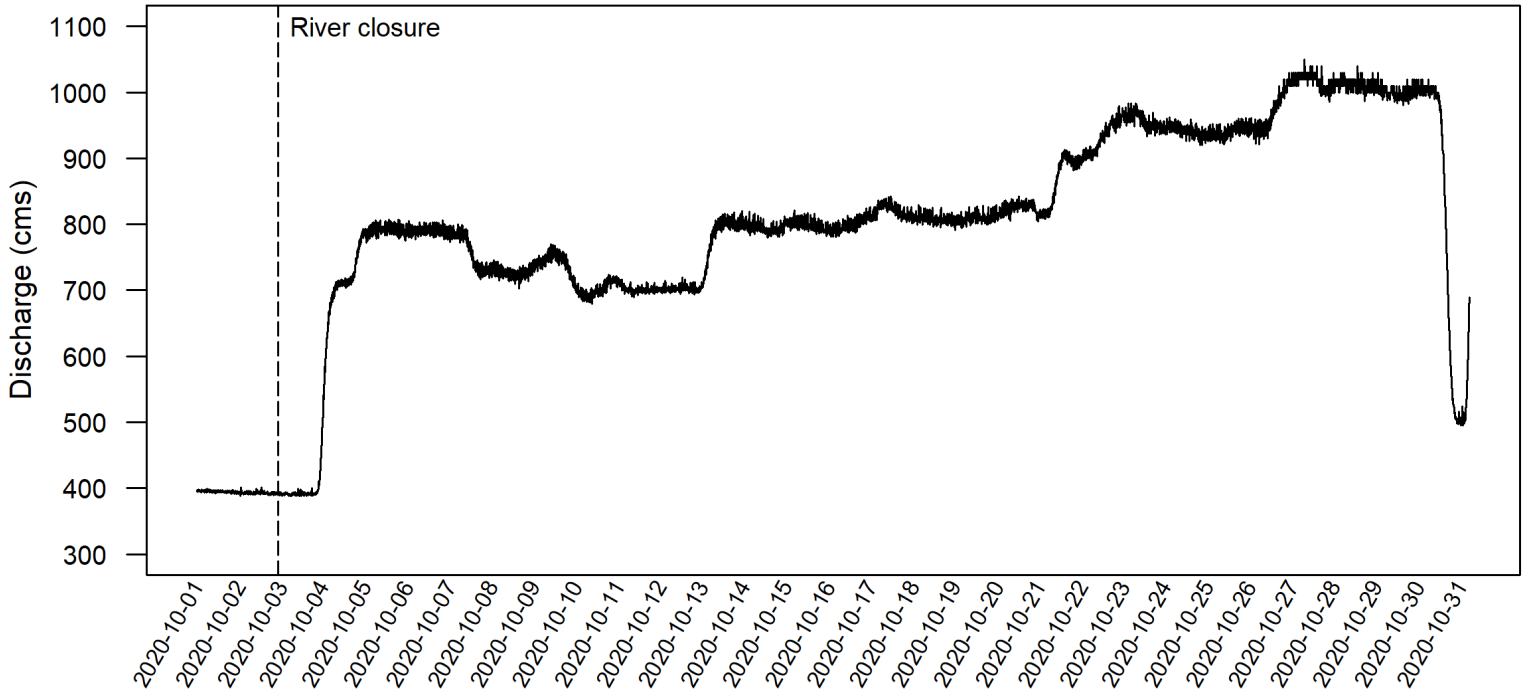


[4] Cold weather conditions were described in Section 3.1.3.3 of the OPP.

Environmental conditions

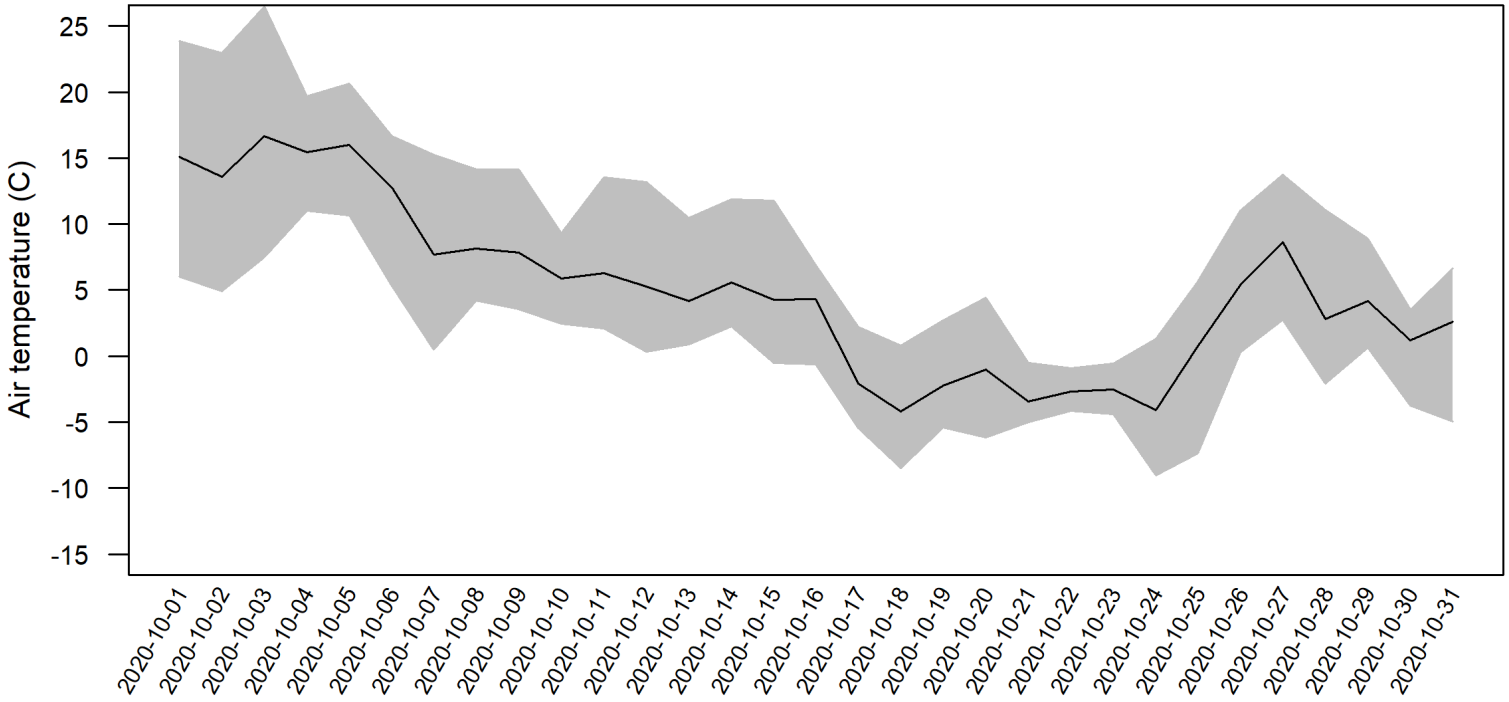
Discharge in the Peace River was held low (approximately 400 cms) from September 29 to October 3 to support placement of the final rip rap at the rockfill berm (Photo 5). Following river closure on October 3, flows increased to approximately 800 cms and remained above this level until a planned ramp down event at Peace Canyon Dam on October 31 to support Highway 29 construction activities at the Halfway River (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 9 at 5-minute intervals and were listed as provisional by the WSC.



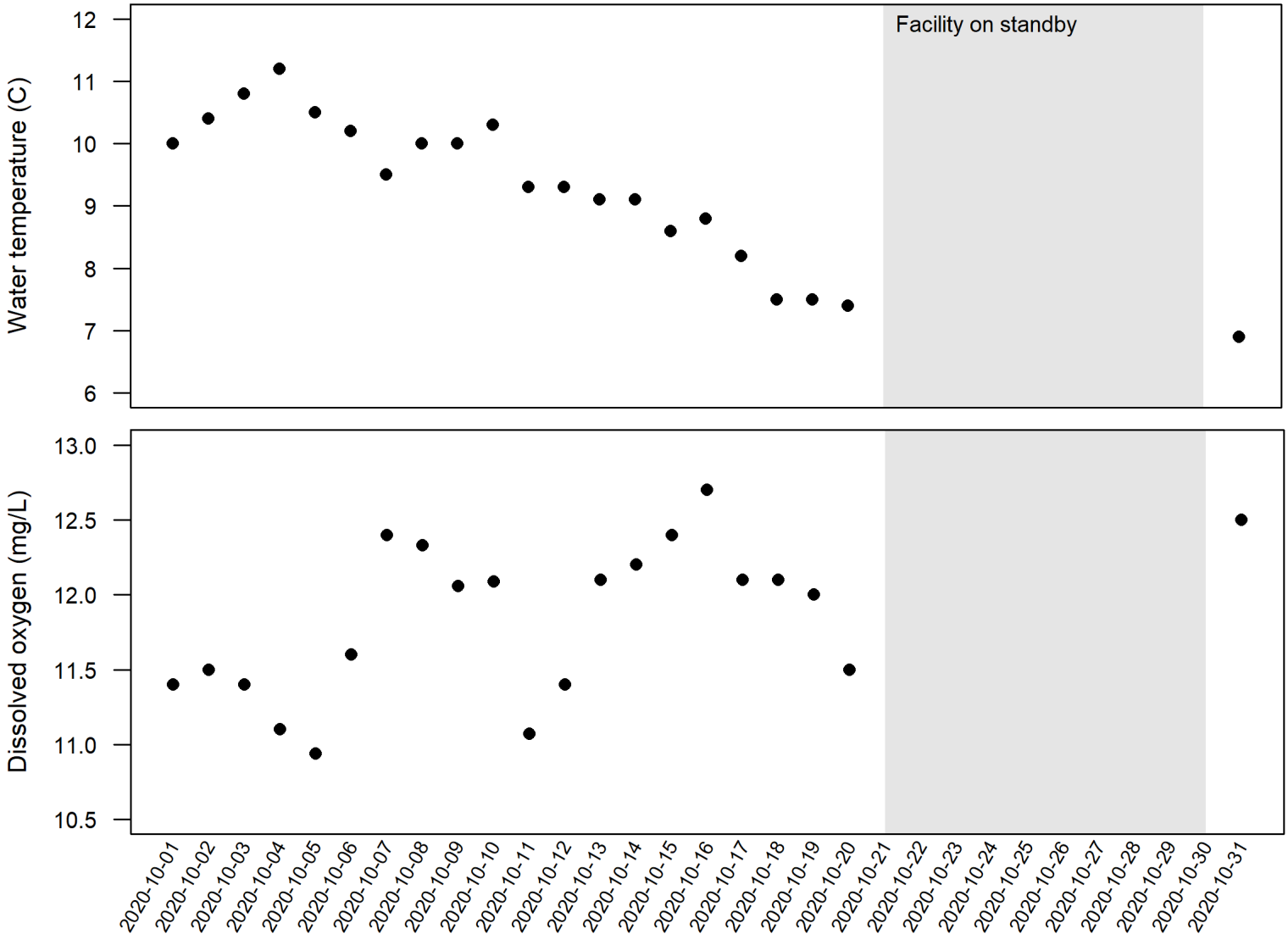
Air temperatures steadily decreased during the reporting period, reaching a low of -9°C on October 24 (Figure 3). As a result, the facility operator put the temporary facility on standby from October 20 to 30 due to the potential risk to fish health and damaging mechanical equipment (Table 3).

Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured at the temporary facility (Sensor No. TT-602). Shaded area represents the minimum and maximum daily air temperatures.



Water temperatures steadily decreased during the reporting period from a high of 11.2°C on October 4 to a low of 6.9°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.

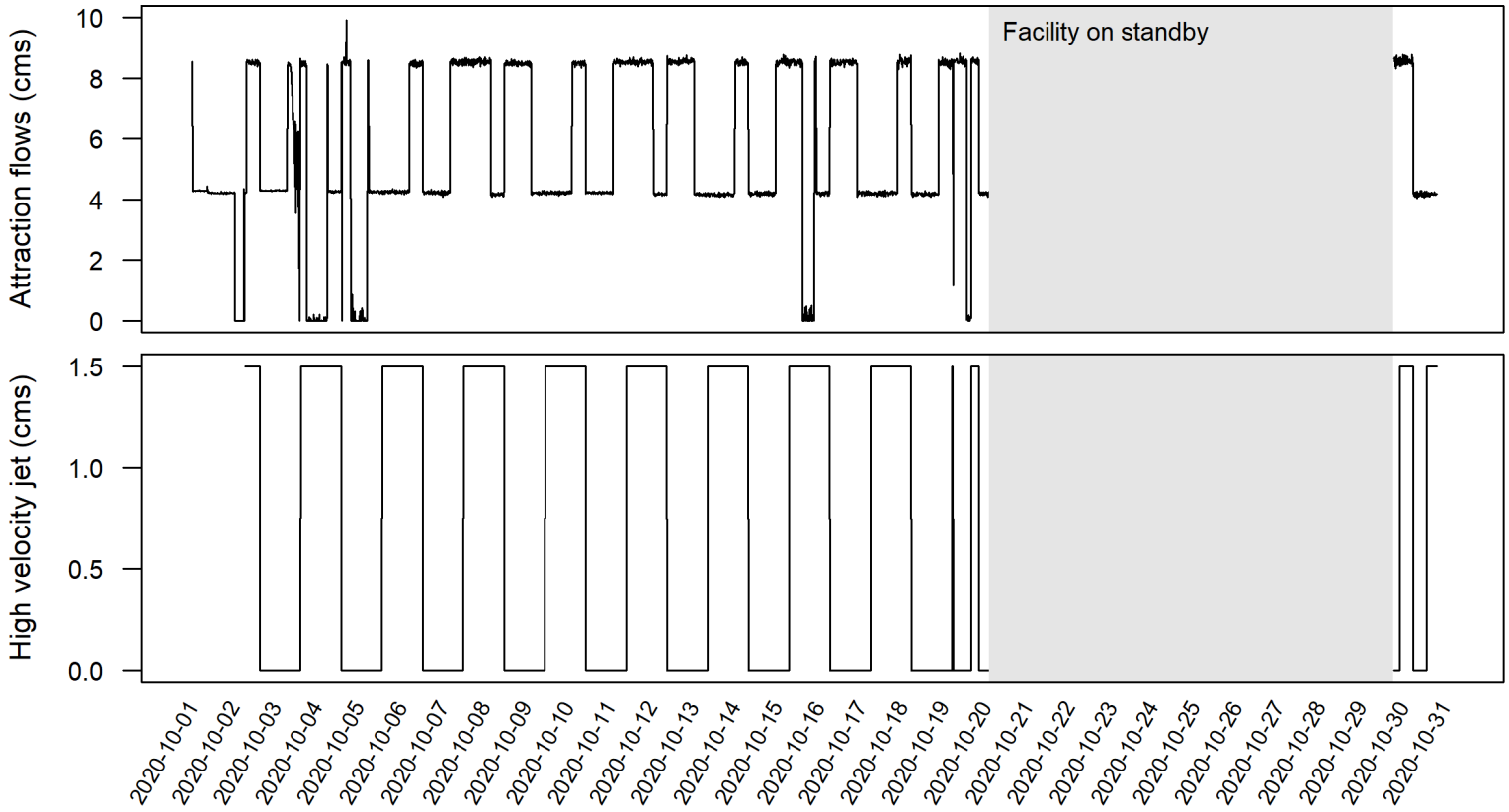


Mechanical operation

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 intended to operate the attraction flows and high velocity jet as described in Section 3.3.1 of the OPP, whereby conditions were changed every 8 hours during the reporting period. In general the attraction flows and high velocity jet were operated in a manner consistent with the OPP (Figure 5). Exceptions include early and mid October when Pumps 1 and 2, which provide the attraction flows, briefly shutdown due to high water elevations in the diversion tunnel outlet triggering alarms in the programming of the temporary facility (Figure 5).

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”.

Operators initially set the number of sorting cycles to two per day to allow enough time to transport any sorted Bull Trout to the Halfway River after the second sorting cycle in the early afternoon (Table 2). Three sorting cycles were eventually selected as being the optimal number because Bull Trout were not present during the reporting period[5]. Operators conducted a fourth sorting cycle on October 31 to sort remaining fish in the pre-sort holding pool prior to shutting the temporary facility down for the year.

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2020-10-01	2	09:00, 13:30
2020-10-02	2	09:00, 13:30
2020-10-03	2	09:00, 13:30
2020-10-04	2	09:00, 13:30
2020-10-05	2	09:00, 14:30
2020-10-06	2	09:00, 13:00
2020-10-07	2	09:00, 13:00
2020-10-08	2	09:00, 13:00
2020-10-09	2	09:00, 13:00
2020-10-10	5	08:30, 11:00, 11:40, 13:00, 14:20
2020-10-11	3	08:30, 11:00, 13:00
2020-10-12	3	08:30, 11:00, 13:00
2020-10-13	3	08:30, 11:00, 13:00
2020-10-14	3	08:30, 11:00, 13:00
2020-10-15	3	08:30, 11:00, 13:00
2020-10-16	3	08:30, 11:00, 13:00
2020-10-17	3	08:30, 11:00, 13:00
2020-10-18	3	08:30, 11:00, 13:00
2020-10-19	3	08:30, 11:00, 13:00
2020-10-20	3	08:30, 11:00, 13:00
2020-10-21	-	Facility on standby
2020-10-22	-	Facility on standby
2020-10-23	-	Facility on standby
2020-10-24	-	Facility on standby
2020-10-25	-	Facility on standby
2020-10-26	-	Facility on standby
2020-10-27	-	Facility on standby
2020-10-28	-	Facility on standby
2020-10-29	-	Facility on standby
2020-10-30	-	Facility on standby
2020-10-31	4	08:30, 11:00, 13:00, 13:30

[5] BC Hydro did not expect to sort Bull Trout during the reporting period as this species does not undergo upstream movements past the dam site in October.

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

Date	Standby or shutdown	Rationale
2020-10-20 14:00 to 2020-10-30 12:30	Standby	Crews started to encounter problems on October 17 when overnight air temperatures dropped below -6°C (Figure 3). Pumps started to freeze and required regular manual spinning to avoid ice build up and damage (described in Table 4). Crews kept the facility running until October 20, when the decision was made to put the facility on standby due to the potential risk to fish health and damaging mechanical equipment, as described in Section 3.1.3.3 of the OPP. The facility operator re-started the facility on October 30 after air temperatures had increased and mechanical equipment had been inspected and considered fit to operate.

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
2020-10-04	Malfunction	Pumps 1 and 2, which provide the attraction flows, shut down automatically overnight for approximately 4 hours. Both pumps were operational for the first crowd at 09:00 on October 4.	Flow increase in the Peace River the night of October 3 (Figure 2) caused shutdown alarms to be triggered due to water elevations exceeding the 5% exceedance design criteria of 410.5 m at the fishway entrance.	Shutdown alarms re-programmed with a higher water elevation (410.8 m).
2020-10-16	Breakdown	Pumps 4 and 8 (water supply to the sorting facility), and Pump 9 (water supply to fish lock) were inoperative due to freezing temperatures on October 16 (Pump 9 only) and October 17 (Pump 4, 8, and 9).	Cold air temperatures caused water to freeze in Pumps 4, 8 and 9.	All pump shafts were manually spinned to allow operation and crowding events proceeded as normal. Flow to the fishway was maintained at all times and there were no fish stranding concerns.
2020-10-19	Breakdown	Pump 9 froze overnight and there were mechanical issues with manipulating the brail gate (i.e., did not respond correctly to raising controls).	Cold air temperatures caused water to freeze in Pump 9.	Pump 9 was left on overnight, with a small volume of water flowing, in an attempt to prevent the pump from freezing.
2020-10-30	Breakdown	Ice accumulated on the fishway water supply pump valves after the temporary facility was on standby.	Cold air temperatures caused water to freeze in the fishway water supply pump valves.	Manual opening and closing of the fishway water supply pump valves.

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 2021.

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

Component	Adjustment
Mechanical operation	Operator increased the height differential between the fish lock brail gate and the water level from 0.2 to 0.4 m to allow for sufficient water volume to maintain fish health while in fish lock.
	Pump 4, which supplies water to the sorting facility, was manually shut off prior to leaving the temporary facility at the end of each shift to avoid heating up facility water used for fish processing.
	Additional sorting cycles were conducted on October 10 (5 crowds) and October 11 (3 crowds) in an attempt to crowd fish that passed through the vee-trap into the pre-sort holding pool and were not crowded, either because they escaped back through the vee-trap or remained downstream of the crowder. When fish catches were low (i.e., less than 20), three daily sorting cycles at approximately 08:30, 11:00, and 13:00 were conducted.
	Following the observation of two suckers in the vee-trap wings during two crowding cycles, the facility operator adjusted the pre-crowd procedure. The previously-used method of striking the outside of the vee-trap with a long-handled dip net was discontinued. The new method involved clearing the vee-trap wings by lowering a long-handled net into the wings from above to herd fish out before lowering the wing gates. This required partially advancing the crowding platform with the crowding screen raised to allow access to the vee-trap wings from above. Following herding and gate closure, the crowding platform was returned to the starting position and a crowding cycle initiated as usual.
	Three crowds (08:30; 11:00; and 13:00) were conducted daily beginning October 11.
	Beginning on October 17, Pumps 4 and 8, both of which supply water to the sorting facility, were left on overnight to provide a small volume of water to the fish pods in an effort to prevent pumps from freezing.
	Beginning October 17, the Pump 9 valve was manually spinned during the night shift in an effort to prevent the pump from freezing.
	Attempts to encourage fish to move out of the vee-trap wing areas using a dipnet were discontinued, because it was not effective at displacing fish.
	Pump 9, which supplies water to the fish lock, was left on overnight, with a small volume of water flowing, in an attempt to prevent the pump from freezing.
	On October 31, a fourth sorting cycle was conducted to crowd all remaining fish in the pre-sort holding pool prior to shutting the temporary facility down for the year.
Biological operation	On October 11, the primary release site at the right bank boat launch upstream of the debris boom was not accessible due to slippery road surface conditions. Fish were instead released at an alternate site in the Peace River upstream of the Project. The facility operator decided that releasing fish at an alternate site was required to ensure fish health and minimize further holding time. Fish were released at the newly-created emergency response boat launch on the right bank downstream of the debris boom, approximately 550 m downstream of the primary release site.
	On October 31, the single Arctic Grayling was released in the Peace River instead of the Moberly River, as discussed with representatives from Fisheries and Oceans Canada, Ministry of Environment, and Ministry of Forests, Lands and Natural Resource Operations and Rural Development on September 23, 2020. Arctic Grayling do not undergo movements related to spawning in October, so this adjustment was not considered to have affected their ability to fulfill portions of their lifecycle upstream of the Project.

Photos

Photo 1. Excavators breach the Stage 1 Downstream Cofferdam to connect the diversion tunnel outlet with the Peace River (September 11, 2020).

Photo 2. Overview of the temporary facility located at the outlet of the diversion tunnels (October 2, 2020).

Photo 3. Worker opens the vee-trap on the first day of commissioning (September 23, 2020).

Photo 4. Diversion began on September 30, 2020, when the diversion tunnel gates were opened.

Photo 5. Final rip rap is placed on the rockfill berm (center) to close the Peace River on October 3, 2020 (looking downstream).

Photo 6. Workers conduct a crowding cycle during the first day of commissioning the temporary facility (September 23, 2020).

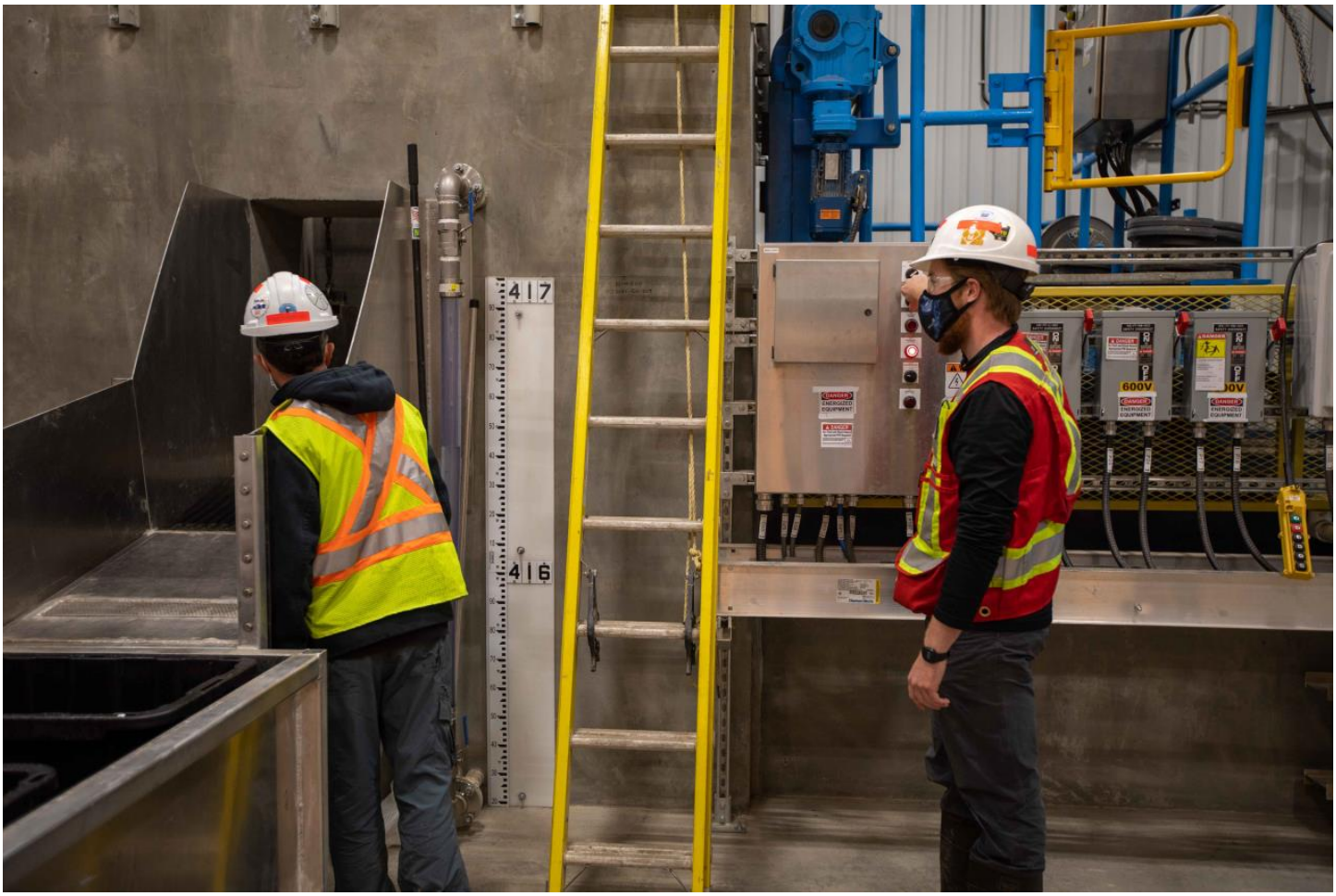


Photo 7. Weighing the first fish – a Longnose Sucker – on the second day of operations (October 2, 2020).

Photo 8. Workers load a transport pod onto the transport truck using the monorail crain hoist inside the sorting facility (October 2, 2020).

Photo 9. Transport truck is backed up to the release site 2 kilometers upstream of the dam site in the Peace River (October 2, 2020).

Photo 10. Workers sample a mortality (Mountain Whitefish) to confirm sex and collect otoliths for microchemistry and ageing analysis (October 10, 2020).

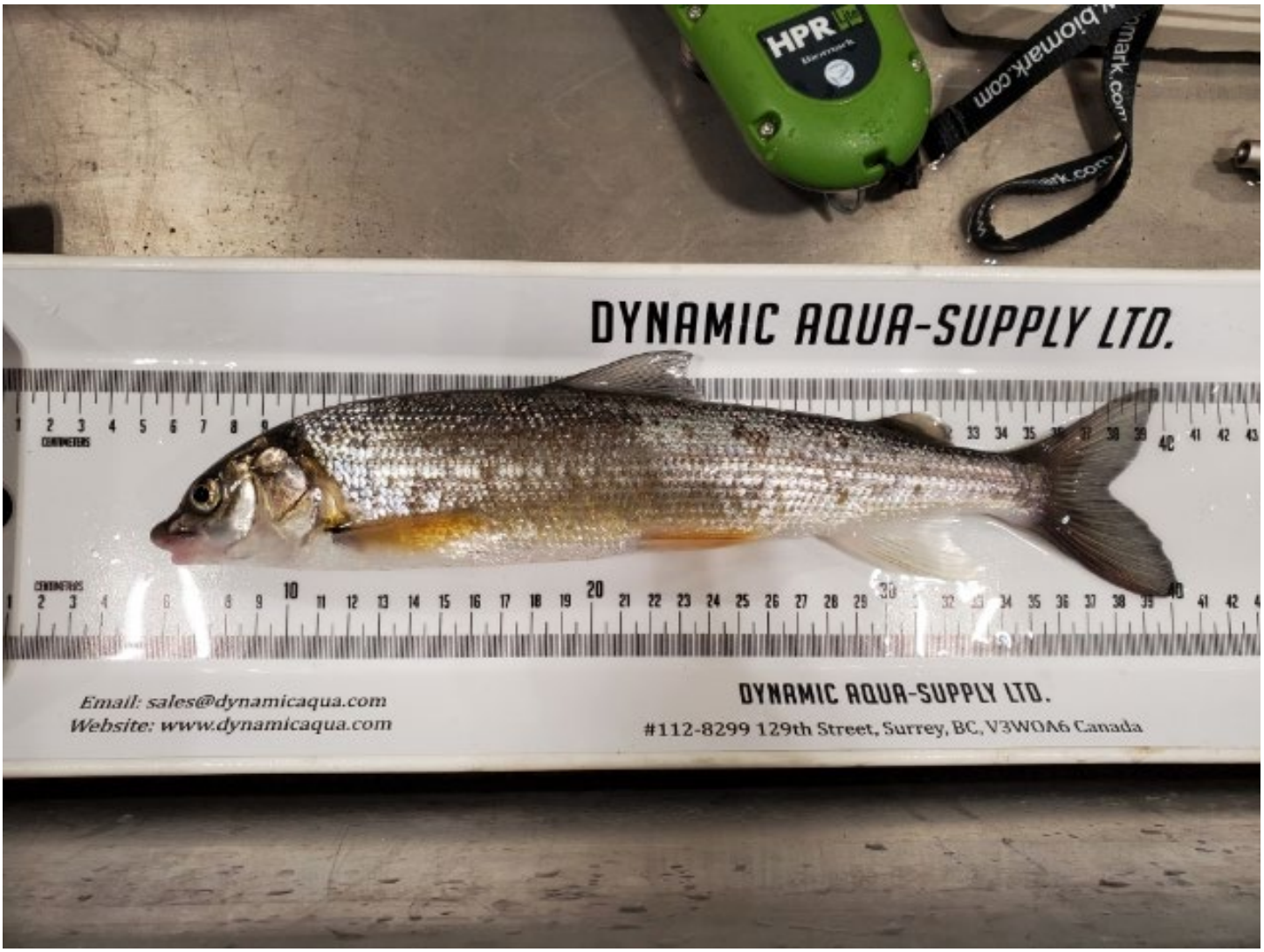


Photo 11. Ten pumps are located on site to provide flows to the fishway and the sorting facility (September 14, 2020).

Photo 12. Two entrance gates provide the attraction flows at the fishway entrance. Gates are programmed to automatically adjust their position to maintain the same head differential between the entrance pool and the diversion tunnel outlet (September 14, 2020).

Photo 13. Fish enter the pre-sort holding pool (center) where they are crowded and raised to the elevation of the sorting facility through the use of the lock (left) (September 14, 2020).

Photo 14. BC Hydro toured representatives from the Halfway River First Nation, Blueberry River First Nation, Saulteau First Nation, Doig River First Nation, Prophet River First Nation, McLeod Lake Indian Band, and Métis Nation British Columbia around the temporary facility as part of broader site tours (September 23 and November 4, 2020).

Prepared by

This report was prepared by the following individuals:

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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:	October 1 to 31, 2020
Subject:	Monthly Update on the Temporary Upstream Fish Passage Facility

71 fish sorted

Operated for 21 days

350+ tagged fish detected in and around the facility

Category	Performance	Commentary
Safety		• Verification: two minor hazards, two good safety practices • Lots of interfaces among contractors
Fish Passage[1]		• Fish approached, entered and passed the fishway • Observed an increase in fish activity after river closure
Sorting & Transport		• Sorted 71 fish from four species • Transport pod and transport truck system deemed effective
Fish Mortality		• Two mortalities – both Mountain Whitefish – representing 3% mortality out of all fish processed in 2020
Operation Within Criteria		• Operated within most engineering and design criteria • Put on standby for 10 days due to cold snap
External Communication		• Produced an informational video to share on social media • Presented to the Peace Williston Advisory Committee
Indigenous Relations		• Presented at Environmental Forum and toured representatives from the HRFN, BRFN, SFN, DRFN, PRFN, MCIB, and MNBC
Regulatory		• Received approvals on time to commission and operate • Toured DFO, FLNRORD, IE and IEM around the facility
Effectiveness Monitoring		• Monitoring data, including detection of 350+ tagged fish in and around the facility, informed operations and adjustments
Learning & Adjustment		• Minor, process-based adjustments made to operations and others identified for operations starting in spring 2021

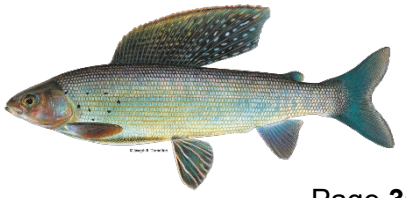
Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

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

Target Species

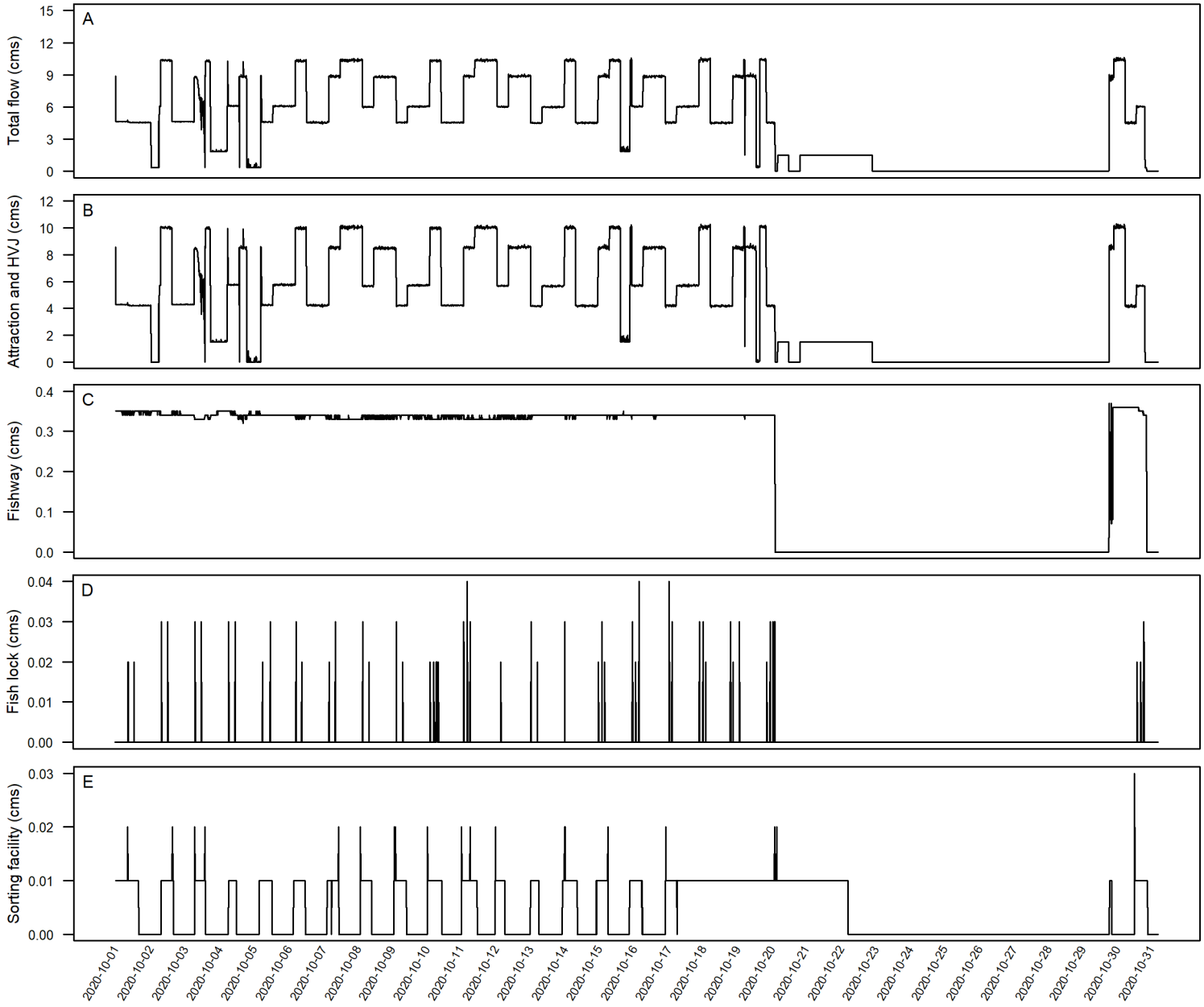
Bull Trout

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[6], 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).



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