



**Peace Project Water Use Plan**

**WILLISTON TARGETED DEBRIS MANAGEMENT**

**Implementation Year 13**

**Reference: GMSWORKS-22**

**Study Period: 2021**

**CHU CHO ENVIRONMENTAL  
1940 3RD AVENUE  
PRINCE GEORGE, BRITISH COLUMBIA  
V2M 1G7**

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# GMSWORKS#22 – Final Report

2021



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## GMSWORKS#22 – Final Report: 2021

### Prepared For

BC Hydro  
6911 Southpoint Drive | Burnaby, BC | V2N 4X8

### Prepared By

Cornelia Thomi, RPF and Travis Mclsaac  
Chu Cho Industries LP  
1940 3rd Avenue | Prince George, BC | V2M 1G7

Jon Kostyshyn, Program Manager  
Chu Cho Industries LP  
#201 – 1940 3rd Avenue | Prince George, BC | V2M 1G7

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# Signature Page

Chu Cho Industries has prepared this report using sound technical and professional judgment based on our extensive expertise and experience in developing and conducting works of this nature. We have identified and developed this report in order to provide clear and concise information regarding the debris management works completed during the 2021 season.

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Cornelia Thomi, RPF – Operations Coordinator, Chu Cho Industries LP

Travis McIsaac –Site Supervisor, Chu Cho Industries LP

Jonathan Kostyshyn- Program Manager, Chu Cho Industries LP

# 1 Introduction

This report documents the annual operations of the GMSWORKS#22 debris management program. This report provides detail on the scope of work completed during the spring, summer and fall months including the methodologies, timing and cost of the work. Specifically, this report identifies the equipment used, work locations, the total volume of debris managed and the cost per cubic meter to complete the management. This report will also provide descriptions of the archaeological and environmental work that was completed during each stage of operations. GMSWORKS#22 is managed and implemented by Chu Cho Industries LP.

## 1.1 Overview of Activities

In general, debris management activities included:

- Pre- debris reconnaissance flight (in spring) to determine which beaches have highest debris content and could be targeted for that year’s debris cleanup.
- Accessing numerous beaches via truck, crew boat and barge,
- Removing debris from the shores of these beaches using a rock truck, two excavator, butt top and bulldozer,
- Piling the debris at the high-water mark for removal or burning,
- Communication with local stakeholders (Finley River Outfitters) regarding the extent to which they require/desire debris management in their high use areas,
- Managing amphibians that would be potentially disturbed by moving the debris,
- Managing other environmental issues,
- Managing archaeological and other heritage concerns, and;
- Conducting spill prevention and response measures.

## 1.2 Summary of Measurements

The following Table 1 provides a summary of parameters that describe the program in 2021

Table 1: Key Parameters Describing 2020 Program

Number of Beaches	Total Volume Piled	Total Number of Piles	Avg. Cost per Pile	Avg. Cost per Cubic Meter
8	130,169.4 m <sup>3</sup>	189	\$5,662.73	\$7.64

### 1.3 Before and After Debris Management Pictures

The following series of images show several beaches before and after debris management. Note the beaches are not in order as no before pictures were completed for Collins Bay Beach, Tsay Keh Dene Beach, Van Sommers, and North Bevel.



Figure 1: Collins Bay after debris management picture taken on August 16, 2021



Figure 2: Tsay Keh Dene after debris management



Figure 3: Van Sommers after debris management picture taken Oct 27, 2021



Figure 4: North Bevel before debris management



Figure 5: North Bevel after debris management



Figure 6 : Peace Point before debris management.



Figure 7 : Peace Point after debris management.



Figure 8 : Peace Arm before debris management.



Figure 9 : Peace Arm after debris management.





Figure 10 : Ospika South before debris management



Figure 11 : Ospika South after debris management.



Figure 12 : Lafferty before debris management.



Figure 13 : Lafferty after debris management

## 2 Work Locations and Volume of Debris Managed

In 2021, all work was completed in the Finlay Arm and Peace Arm of the Williston Reservoir. Debris removal occurred along 8 beaches in this zone, with work focused on piling the debris above the high-water mark. Chu Cho Industries LP (CCI) developed an Operational Work Plan (OWP) that was revised throughout the season in response to changing water levels and beach accessibility. The OWP describes the order in which beaches are to be managed and the equipment that will be used. The OWP also outlines the environmental and archaeological issues that must be managed at each location.

### 2.1 Work Locations

The following table details the 8 locations where CCI conducted debris management activities in 2021. The beach names provided in Table 2 are the most commonly used colloquial names.

Table 2: GMSWORKS#22 Work Locations 2021

Location	Equipment Used	Days on Site	Notes:
Collins Beach	2 Excavators, butt n top, 1 Cat DH6 Dozer, ATV, Pickup	4 Days	Accessed by Collins Camp road. Debris cleaned up to edge of swamp.
Tsay Keh Dene	1 Excavators, 1 butt n top, ATV, Pickup.	6.5 Days	Tsay Keh Beach to Hydro Creek. Access by road.
Van Sommers	2 Excavators, 1 butt n top, 1 rock truck with fuel tank, Crew boat, pickup, and Barge / Tugboat.	3.5 Days	Barge access used on this beach.
North Bevel	2 Excavators, 1 butt n top, 1 Rock Truck (A20), pickup, Crew Boat, and Barge / Tugboat.	6 Days	Only accessible by boat. This is the same beach but different location from last year.
Peace Point	2 Excavators, 1 butt n top, 1 Rock Truck, pickup, Crew Boat, and Barge / Tugboat.	9 Days	Moved smaller piles into larger pile higher on the beach. Only accessible by boat. Never cleaned debris here before.

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Peace Arm	2 Excavators, 1 butt n top, 1 Rock Truck, Crew Boat, and Barge / Tugboat.	9.5 Days	Debris never removed from this beach. Only accessible by boat. 2-3 more beaches to be done in this area another year- preferably at the start due to high fall winds.
Ospika South	2 Excavators, 1 butt n top, 1 Rock Truck, pickup, Crew Boat, and Barge / Tugboat.	3.5 Days	Only accessible by boat. Did not finish as water level was too high to keep going safely. Debris never removed from this beach.
Lafferty	2 Excavators, 1 butt n top, 1 Rock Truck, Crew Boat, pickup and Barge / Tugboat.	10 Days	Re-pile old burns. Clean up whatever was washed up on shore. Access boat and pickup. Equipment barged to site and demobed using lowbeds.

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The following series of images shows an overview of work locations for typical beaches within the Finlay/Peace Arm of the reservoir. Figure 14 shows a button top and rock truck piling debris on Peace Point Beach.



Figure 14 : Debris piling by Link Belt on Peace Point beach

## 2.2 Volume of Debris Managed

The debris tends to accumulate along the shoreline of the reservoir. Debris is piled using excavators fitted with a rotating grapple (Linkbelt- button top) or a bucket and a thumb. The rotating grapple can circle through 360 degrees and can open and shut to grab and move debris, the bucket and thumb are similar but cannot rotate through 360 degrees. The button top loads the rock truck with debris especially in tight areas with a lot of debris but no room for piles. The rock truck moves the debris and unloads it in areas better suited for piling and burning away from the high-water mark of the reservoir. The excavators are used to pile debris after the rock truck is completed or in areas where the rock truck is not needed. This year only Collins Bay Beach used the D6 Cat that was fitted with a rake blade to push the stray debris towards the center of the

pile to pack it tight in order that it burns with greater intensity. This process is simple, proven efficient and was replicated along the shoreline.

After the management of each beach was complete, two technicians visited the beach in order to count and measure the debris piles. The technicians independently counted and measured the piles in order to minimize bias and ensure that the numbers are accurate.

Debris piles are inherently misshapen, porous, and dissimilar. Our team consulted a number of industry professionals as well as primary research sources in search for the best methodology for measuring debris piles and calculating an accurate assessment of the volume of debris contained within. Typically, the technician measuring the debris would envision the pile as a geometric shape to calculate the volume and then use a porosity factor to estimate the actual volume. The shape of the debris varies greatly, depending on the size and homogeneity of the debris. Porosity is a disputed factor amongst professionals who regularly measure debris pile volumes. Porosity factors that practitioners commonly used in debris pile volume estimation ranged from 20% to 39%.

For this project, we have reasoned that estimating the debris piles as rectangular prisms is sufficiently accurate. In order to estimate porosity, we have chosen 25%, which is a rough average of the most commonly used numbers. This is consistent with the recommendations provided by the independent contractor that BC Hydro hired for the project in 2016 (P.Comm J. Kostyshyn, 2017). In 2021 the methodology used was for a technician to measure the Length, width and height dimensions of 5 piles on a given beach. The total volume would be calculated ( $V = L \cdot W \cdot H$ ). Then the average of the five volumes would be calculated  $(V_1 + V_2 + V_3 + V_4 + V_5 / 5) = V_{AVG}$ . Then  $V_{AVG}$  would be multiplied by 75% or (100% - 25%).  $V_{AVG} * 0.75 = V_{FINAL}$ . Approximately 10% of all the piles for each beach were measured to calculate the volume.

In 2021, CCI created 189 piles of debris on the beaches of the Finlay/ Peace Arm of the Williston Reservoir. Piles ranged in size from 200 m<sup>3</sup> to 28661 m<sup>3</sup>, the average being approximately 450 m<sup>3</sup>. Larger piles were created on flatter wider beaches where conditions allowed the equipment operators to efficiently pile the debris. Smaller piles were created in areas where there was little beach to work with and where the high-water mark was a concern. In general, larger piles are burned more efficiently.

The following table provides the number of piles and volume of debris collected on each beach in 2021:

Table 3: Volume of Debris Managed in 2021

Location	Number of Piles	Volume of Debris (m <sup>3</sup> )	Notes:
Collins Beach	37	8355	
Tsay Keh Dene	28	17,425	TKD to Hydro Creek
Van Sommer	26	7408	
North Bevel	42	11,835	
Peace Point	17	14,398	
Peace Arm	19	9800	
Ospika South	15	2475	
Lafferty	5	58473	
<b>TOTALS</b>	<b>189</b>	<b>130,169.4</b>	<b>-</b>

## 2.3 Estimated Costs

Table 4 provides an estimate of the average cost per beach to manage the debris. The costs are highly variable across beaches and depend on the size of the beach, the density of the debris, the access and the precariousness of the operations (i.e. how close to water, how steep the beach gradient, etc.). The costs presented in the following table were derived using the value on each invoice and the debris pile counts conducted by CCI. The average cost per pile was \$5,640.68 and the average cost per cubic meter was \$7.64. Compare these values to 2020 where the average cost per pile was \$2,674.28 and the average cost per cubic meter was \$9.01. \* Note- Lafferty beach only had 5 piles of which 2 were very large, this is the reason why the costs per pile are so much higher than the other beaches. The debris was scattered throughout the beach, so Travis made the call to use the rock truck to make 3 large piles and 2 medium piles. The bigger piles are easier to burn. There was no size restriction or steep gradients on this beach. The cost per cubic meter is significantly lower than the average cost/cubic meter.

Table 4: Debris management cost estimate per beach in 2021.

Location	Total Cost/Beach	Cost/Debris Pile	Cost/Cubic Meter
Collins Beach	\$ 42,221.57	\$ 1,141.12	\$ 5.05
Tsay Keh Dene	\$ 59,088.86	\$ 2,110.32	\$ 3.39
Van Sommer	\$ 44,999.67	\$ 1,730.76	\$ 6.07
North Bevel	\$ 68,682.24	\$ 1,635.29	\$ 5.80
Peace Point	\$ 107,232.27	\$ 6,307.78	\$ 7.45
Peace Arm	\$ 113,924.96	\$ 5,996.05	\$ 11.62

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Ospika South	\$ 48,934.81	\$ 3,262.32	\$ 19.77
Lafferty *	\$ 115,590.92	\$23,118.18	\$ 1.98

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### 3 Detailed Beach Activities

#### Collins Bay:

Archaeology was completed by Brian Tomah on July 7<sup>th</sup>. No artifacts were found. Air is smoky from fires burning in the Mackenzie TSA.

Equipment was washed at Collins Bay Camp prior to being placed on the beaches. The first few days of debris cleanup were done at Collins Bay Beach.



Figure 15 : Debris piling on Collins Bay Beach

#### Tsay Keh Dene Beach:

Archaeology was completed by Brian Tomah and Shawn Tomah on July 13<sup>th</sup>. No artifacts were found.

There were a couple of days where the air was very smoky from near by fires in the Isola.



Figure 16 : Tsay Keh Dene Debris piling

Van Sommer:

Archaeology was completed by Brian Tomah and Shawn Tomah on July 17<sup>th</sup> and 19<sup>th</sup>. No artifacts were found.

North Bevel:

Archaeology was completed by Brian and Shawn Tomah, Ethan Pierre on July 20<sup>th</sup> and 21<sup>st</sup>. No artifacts were found.

A typical day is the crew would leave Collins Bay Camp at 6AM, drive to Ospika, safety meeting, boat to Bevel beach, and then start work. End of the day- they would do maintenance on their machines, boat back, and drive back to Collins Bay Camp.

A hydraulic line burst on the linkbelt spilling 3L of hydraulic oil- nothing spilled into the water. It was cleaned up immediately using the spill kits, the hose was replaced, and the contaminated soils brought back to Collins Bay Camp. From camp the contaminated soils were brought to Mackenzie for proper disposal.

A garter snake was found the day after an area was cleared on North Bevel of debris.



Figure 17 : Snake found on North Bevel



Figure 18 : Debris piling by excavator on North Bevel Beach.



Figure 19 : Debris piling North Bevel Beach.

Peace Point:

Archaeology was completed by Shawn Tomah on July 30<sup>th</sup> and August 4<sup>th</sup> . No artifacts were found.

This beach was only accessible by boat or barge. Safety meetings were either held in the boat at Ospika or onsite with all the crew prior to morning start-up.

Debris cleanup occurred on rainy to hot temperatures days with little to very thick smoke. On August 1<sup>st</sup>, the job site was inspected by Cornelia Thomi for safety and environmental quality. No major issues were noted.



Figure 20: Debris piling by Rock truck on Peace Point Beach.

A deer was seen walking on the beach- see figure 21 below.



Figure 21 : Deer seen on Peace Point Beach

The crew found a cave/ den located at 56.03.2250 N 123.57.7819 W. They marked this area with pink flags to keep equipment away from these areas.

Peace Arm:

Archaeology was completed by Shawn Tomah and Ethan Pierre on August 14th. No artifacts were found. No streams found. On August 18<sup>th</sup>, the site was inspected by Cornelia for safety and environmental quality- no major concerns noted.

There were a couple of days when the crew was unable to access the site due to high winds. The crew found alternative work either at Collins Bay Camp or scouting for debris in sheltered bays.

On this beach, 30 plus tiny brown frogs were found right at the shoreline. Red flags were added around the frogs as a buffer to prevent the frogs and their habitat from being destroyed. See figure 22 and 23 of the little frogs and the buffered area.



Figure 22 : Little Western Toads were found along Peace Arm Shoreline



Figure 23: Peace Arm Shoreline with red flags

An eagle's nest was noted in the timber along the beach- no bird seen using the nest. Noted Grizzly bear tracks on this beach.

Date & Time: Wed, Aug 18, 2021, 09:49:29 PDT  
Position: 10 N 446790 6210806 (Error)  
Altitude: 671m (Error)  
Datum: WGS-84  
Azimuth/Bearing: 036° N36E 0640mils True (+16°)  
Elevation Angle: +09.0°  
Horizon Angle: +00.3°  
Zoom: 1.0X  
peace arm debris



Figure 24 : Peace Arm Debris Pile





Figure 25: Debris on Peace Arm Beach that was too narrow to pile due to high reservoir levels

Ospika South:

Archaeology was completed by Brian Tomah on Aug 26 and 27th. No artifacts were found.

The crew moved from the Peace Arm area at the end of August due to continuous high winds coming from the south that prevented access to the Peace Arm.

Lafferty:

Archaeology was completed by Brian Tomah on Sept 8, 2021. No artifacts were found.

This beach was added to the original plan in early September due to high winds from the south that prevented access to the boat/ barge only beaches. It was found that Lafferty had a high content of debris of which most of that was log bundles that escaped from the tows to Mackenzie from logging and refloated debris from elsewhere on the reservoir. Previously burned piles were re-piled as well. In addition, there were bundles of log tows that were lost as a result of barging logs to the mills in Mackenzie. There would be no need to use boats to access this beach as there was pickup access. See additional pictures below from the debris cleanup of this beach.



Figure 26: Lafferty before debris cleanup



Figure 27: Lafferty after debris cleanup

## 4 Environmental Management

### 4.1 Environmental Issues

Chu Cho Industries (CCI) provided environmental monitoring services for GMSWORKS#22. The Environmental Management Plan specifies procedures for ensuring that potential environmental issues that might arise due to debris program operations are minimized. This includes standard items such as spill prevention and management and a detailed procedure for amphibian management.

The amphibian management plan is based on avoidance through surveying and flagging no work zones. The avoidance-based plan is meant to reduce the potential harm to amphibians and to avoid all handling. Prior to conducting debris removal, each beach is surveyed for amphibians and reptiles. On a typical beach there may be 5 – 10 zones where amphibians are either found or where there is good amphibian habitat. Where they are found, a no work zone was flagged around them in order to protect the amphibians and or reptiles. In addition to amphibians, other reptiles and wildlife are observed regularly or just their tracks. These include, garter snakes, grizzly bears, black bears, moose, elk, whitetail deer, wolves and other small carnivores. Figure 28 shows an example of a zone flagged for no-work where an amphibian was discovered in the 2019 debris season.



Figure 28 : Pink flagging indicates discovery of an amphibian and marks a no-work zone.

## 4.2 Spill Prevention and Management

Spill prevention and management is an ongoing process that CCI takes seriously and goes to great lengths to ensure that there are zero spills to the ground. Good spill prevention management is rooted in good equipment management through maintenance and regular checks. All equipment is inspected before, during and after each shift to ensure that hydraulic lines and other potential leak points are all secure. The equipment inspections are completed using a standard form, which is in each machine. The completed forms are stored in Mackenzie shop/ office for each piece of equipment separately. Regular maintenance occurs before and after each crew shift- daily.

In spring of 2021, a spill response training course was put on for CCI employees living in Tsay Keh Dene who would be working on Debris in 2021. The course featured creating an inverted culvert. The participants installed an inverted weir using PVC pipe and an earthen berm. As the creeks were still frozen during the time of the training, the students used a water pump to pump water up a hill and let it flow down the ditch simulating a spill in moving water, the berm was then constructed to contain the water, the purpose of the PVC pipe is to allow subsurface water to flow through while containing the floating surface oil. The students used canola oil during the exercise to simulate an oil spill. Below are some pictures taken during the course.

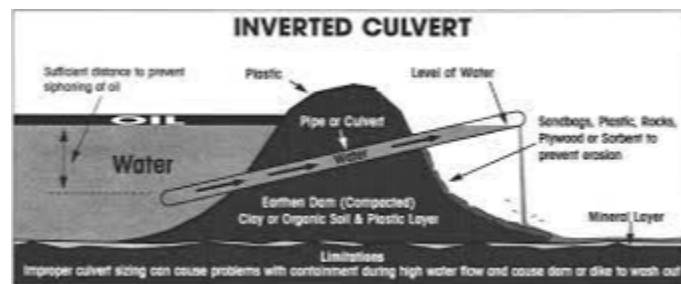


Figure 29 : Example of an Inverted Culvert that was replicated in course



Figure 30 : Creating the berm for the Inverted Culvert



Figure 31 : Completed Inverted Culvert for the course

The following sequence of images shows some examples of good spill prevention management. During the 2021 season, there were no major fluid spills and 1 small non-reportable spill to ground that was cleaned up by CCI. There were no spills to watercourses or the reservoir. Figure 32 show the fuel tank on the Peace Point beach with proper drip containment. Figure 33 shows the spill kits being used during field-based repairs of the equipment.



Figure 32: Fuel tank with drip containment at Peace Point



Figure 33 : Managing and replacing leaking hoses with spill kit and tray.

## 5 Archaeological Management and Chance Finds

### 5.1 Archaeological Procedures

The archaeological monitor uses a GPS loaded with archaeological site data that were supplied by Millennia Archaeology. The GPS helps the monitor identify areas that are marked as no work zones as well as areas where artifact collection has occurred or where artifacts have been identified but not collected.

Prior to commencing work on any beach, the archaeological monitor has a quick debrief with the management crews to help identify no work zones or areas of potential concern. The archaeological monitoring works ahead of the debris crews to conduct searching and investigation activities to clear the area for work. The debris management work is conducted under the *Heritage Conservation Act* Section 12 Site Alteration Permit number is 2016-0363 was approved on October 31<sup>st</sup>, 2016 and is valid until December 31, 2021.

In the fall of 2021, Millennia applied for a 12.2 Heritage Inspection Permit held by Millennia and a 12.4 Alteration permit that will be held jointly by CCI and Millennia. The new permit applications combine all the potential beaches of the Finlay, Parsnip, and Peace reach for both the debris program and the Williston Dust Mitigation program into one application.



## 6 Debris Pile Burning

Debris pile burning was completed during the winter of 2020/2021 for most of the piles that have been piled in recent years. Debris burning occurred only on sites where there are gravel or sand surfaces. Burning occurred on the following beaches: Tsay Keh Dene, Parsnip, Omineca, North Ospika, various sites along the Chunnamon, Davis and Bruin. Sites with organics were communicated to the crew as No Burn Sites prior to the 2020/2021 burn season.



Figure 34 : Winter 2021 Pile Burning

## 7 Recommendations

It would be ideal to start this Debris Management Program sooner when more beach surface is exposed. An additional, site supervisor may be required in spring 2022 so both the Dust and Debris projects can be run at the same time.

It is recommended that Millennia work on getting archaeology data loaded on gps units for beaches further south along the Peace and Parsnip Arm. Chu Cho Industries will speak to Millennia to see if there is additional archaeology data along the Peace and Parsnip Arm that can be loaded onto gps units for the 2022 debris season.

## 8 Conclusions

The GMSWORKS#22 Debris Management Program piled 130,169 m<sup>3</sup> of debris in 189 piles at an average cost of \$7.64 per cubic meter. Generally, the 2021 season was successful and CCI is well prepared to initiate the 2022 program in May 2022.

During the reconnaissance flight on May 27, 2021, it was identified that there is lots of debris accumulations all over the reservoir - north of Ospika, south of Ospika to Peace, Pete Toy and Teare Creek, Ingenika South to Factor Ross, and Ivor Creek North to Van Sommer.