Peace Project Water Use Plan

WILLISTON TARGETED DEBRIS MANAGEMENT

Implementation Year 10

Reference: GMSWORKS-22

Study Period: 2018

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GMSWORKS#22 – Final Report

2018

PREPARED FOR: BC HYDRO

PREPARED BY: CHU CHO ENVIRONMENTAL LLP AND CHU CHO INDUSTRIES LP

IMPLEMENTATION PERIOD: SPRING – FALL 2018

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SIGNATURE PAGE:

Chu Cho Environmental 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 2018 season.

Michael Tilson – General Manager, Chu Cho Environmental

1.0 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 with environmental services being provided by Chu Cho Environmental LLP.

1.1 Overview of Activities

In general, debris management activities included:

- Accessing numerous beaches via truck, crew boat and barge,
- Removing debris from the shores of these beaches using a rock truck, excavator and bull dozer,
- Piling the debris at the high-water mark for removal or burning,
- Communication with local stakeholders 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 provides a summary of parameters that describe the program in 2018:

Table 1: Key Parameters Describing 2018 Program

Number of Beaches	Total Volume Piled	Total Number of Piles	Avg. Cost per Pile	Avg. Cost per Cubic Meter
10	75,304 m^3	454	$1,649.85	$12.14

1.3 Before and After Debris Management Pictures

The following series of images show several beaches before and after debris management.

Figure 1: Collins Beach South prior to debris management.

Figure 2: Collins Beach South after debris management.

Figure 3: Ole Creek beach before debris management.

Figure 4: Ole Creek beach after debris management.

Figure 5: Stromquist before debris management.

Figure 6: Stromquist after debris management.

Figure 7: Corless A before debris management.

Figure 8: Corless A after debris management.

2.0 Work Locations and Volume of Debris Managed

In 2018, all work was completed in the Finlay Arm of the Williston Reservoir. Debris removal occurred along 10 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 10 locations where CCI conducted debris management activities in 2018. The beach names provided in Table 2 are the most commonly used colloquial names.

Table 2: GMSWORKS#22 Work Locations 2018

Location	Equipment Used	Days on Site	Notes:
Chunamon	2 Excavator (Cat 330 and Linkbelt), 2 Rock Trucks (Volvo A20), 2 Cat DH6 Dozers, Crew Boat and Barge.	8 days	Low water in 2018 allowed the crew to manage a number of zones on this large beach. Likely more work required in 2019.
Moody	2 Excavator (Cat 330 and Linkbelt), 2 Rock Trucks (Volvo A20), 2 Cat DH6 Dozers, Crew Boat and Barge.	14 days	Moody required cleanup after 2017 work. A number of embayments were accessible in 2018 that weren't in 2017.
Tsay Keh Beach	2 Excavator (Cat 330 and Linkbelt), 2 Rock Trucks (Volvo A20), 2 Cat DH6 Dozers.	9 days	Debris accumulates rapidly on TK Beach. Efforts focused on thoroughly cleaning the beach to make it much safer. Likely more but limited work required in 2019.
Stromquist/Ole	2 Excavator (Cat 330 and Linkbelt), 2 Rock Trucks (Volvo A20), 2 Cat DH6 Dozers, Crew Boat and Barge.	10 days	No previous management at Ole Creek or Stromquist. Debris Piled above highwater line at shore. More work required in 2019.
Corless A,B,C	2 Excavator (Cat 330 and Linkbelt), 2 Rock Trucks (Volvo A20), 2	6 Days	These beaches were not previously accessible. Low water in 2018 allowed the crew to begin

	Cat DH6 Dozers, Crew Boat and Barge.		management in these zones. More work required in 2019.
Collins Beach	2 Excavators, Rock Truck, 2 Cat DH6, Pickup Trucks	5 days	Collins Beach required re-piling and piling of new debris.
Bruin Beach	2 Excavators, Rock Truck, 2 Cat DH6.	5 Days	Debris piled at shoreline above high water, no environmental issues. Numerous arch sites and no work zones on this beach.

The following series of images shows an overview of work locations for typical beaches within the Finlay Arm of the reservoir. Figure 9 shows an excavator piling debris on Corless A. Figure 10 shows the barge heading into Ole Creek to pick up equipment.

Figure 9: Excavator working on Corless A.

Figure 10: Barge travelling towards Ole Creek.

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 grabber or a bucket and a thumb. The rotating grabber 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. Once the excavators create a sufficiently large pile, a D6 Cat fitted with a rake blade pushes 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 approximately 300km of shoreline in 2018.

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 30%, 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). A technician would measure the Length, width and height dimensions of 5 piles on a given beach. The total volume would be calculated (V = L•W•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 70% or (100% - 30%). $V_{AVG} * 0.7 = V_{FINAL}$.

In 2018, CCI created 454 piles of debris on the beaches of the Finlay Arm of the Williston Reservoir. Piles ranged in size from 100m^3 to 600m^3, the average being approximately 165m^3. 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 2018:

Table 3: Volume of Debris Managed in 2018

Location	Number of Piles	Volume of Debris (m^3)	Notes:
Chunamon	72	14,310	High debris density. Large piles.
Moody	103	22,590	High debris density in specific locations.
Tsay Keh Beach	41	7,240	Low debris density but critical location.
Stromquist/Ole	65	8,476	Moderate debris density. Access is difficult in high water years.
Corless A,B,C	39	10,998	High debris density in specific locations. Very large piles. More work to be completed.
Collins Beach	69	3,410	Low debris density. Beach was thoroughly cleaned in 2018.
Bruin Beach	65	8,280	Moderate debris density. Beach was thoroughly cleaned in 2018.
TOTALS	**454**	**75,304**	**-**

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 $1,649.85 and the average cost per cubic meter was $12.14. Compare these values to 2017 where the average cost per pile was $1,643.63 and the average cost per cubic meter was $8.02. These values do not include the cost of pile burning; costs of pile burning are presented in Section 5.0.

Table 4: Debris management cost estimate per beach

Location	Total Cost/Beach	Cost/Debris Pile	Cost/Cubic Meter
Chunamon	90,974.64	1,263.54	6.36
Moody	156,310	1,517.57	6.92
Tsay Keh Beach	91,026	2,220.15	12.57
Stromquist/Ole	133,897.71	2,059.96	15.8
Corless A,B,C	83,202.89	2,133.41	7.57
Collins Beach	96,358.98	1,396.51	28.27
Bruin Beach	62,257.42	957.81	7.52
Total/Average	**$714,027.64**	**$1,649.85**	**$12.14**

3.0 Environmental Management

3.1 Environmental Issues

Chu Cho Environmental 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. There were amphibians found on all beaches in 2018 but due to the dry conditions their prevalence was reduced relative to 2017. Where they are found, a 30m no work zone is flagged in order to protect the amphibians and or reptiles. In addition to amphibians, other reptiles and wildlife are observed regularly. These include, garder snakes, grizzly bears, black bears, moose, elk, wolves and other small carnivores. Figure 11 shows an example of a zone flagged for no-work where an amphibian was discovered.

Figure 11: Pink flagging indicates discovery of an amphibian and marks a no-work zone.

3.2 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 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 vehicle inspections are completed using a standard form, which is stored in the field office for the program. Regular maintenance occurs before during and after each crew shift. The following sequence of images shows some examples of good spill prevention management. During the 2018 season there were no major fluid spills and 8 small non-reportable spills to ground that were cleaned up by CCI. There were no spills to watercourses or the reservoir. Figure 12 shows the fuel bowser located along the shore away from the reservoir an outfitted with a large spill kit for use while refueling as well as repairs. Figures 13 and 14 show the spill kits being used during field based repairs of the equipment.

Figure 12: Fuel bowser with large spill kit.

Figure 13: Repair of hydraulic line with attention to spill potential.

Figure 14: Grapple implement in resting position during repair with spill pads below.

4.0 Archaeological Management and Chance Finds

4.1 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. Figure 15 below shows a previously recorded but not collected artifact on Middle Creek North Beach. This artifact was discovered using the GPS and was flagged so that crews would not work in this area.

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 archaeological site alteration permit SAP 2016-0363 that was approved on October 31st, 2016 and is valid until 2019.

Figure 15: Previously marked but uncollected artifact on Middle Creek South.

5.0 Debris Pile Burning

Debris pile burning is not yet complete as of writing this report. An amended report will be provided in early 2019 as the data become available.

Table 5: Debris pile burned per beach during 2018 burning season.

Location	Days on Site	Piles Burned
TOTAL		

6.0 Conclusions

The GMSWORKS#22 Debris Management Program piled 75,304 m^3 of debris in 454 piles at an average cost of $12.14 per cubic meter. Generally the 2018 season was successful and CCI is well prepared to initiate the 2019 program in June 2019.

During the reconnaissance flight in May 2018 it was identified that there are still numerous areas where debris accumulations exist in both the Parsnip and Finlay arms of the reservoir. Figures 16 and 17 show two specific locations where there are dense debris accumulations. Figure 18 shows an additional issue that was noted during the reconnaissance flight; that is that piles which were ignited during the winter of 2018 were still smoldering in May 2018. CCI sent crews over to respond to this issue immediately using water pumps to extinguish the smoldering fires.

Figure 16: Significant debris accumulation in Corless B area.

Figure 17: Longshore debris accumulations in the Chowika-Middle Creek North area.

Figure 18: Large pile near Ospika burned in winter 2018 still smoldering in May 2018.