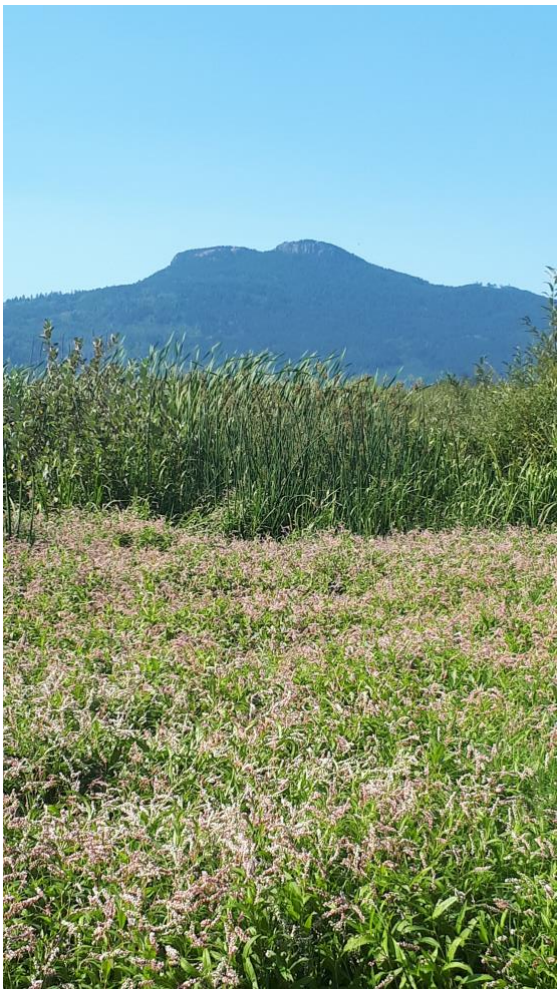

MUNICIPALITY OF NORTH COWICHAN SERVICE AGREEMENT WITH THE SOMENOS MARSH WILDLIFE SOCIETY PARROT'S FEATHER CONTROL REPORT

Prepared for: Municipality of North Cowichan

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2 EXECUTIVE SUMMARY

Parrot's feather (Myriophyllum aquaticum) is an invasive aquatic weed which originates from the Amazon basin (Washington State Department of Ecology, 2001) and has colonized most of Somenos Creek since its introduction in 2014 (Preikshot 2019). As part of a two year pilot project to mitigate the numerous negative impacts of Parrot's Feather on the creek, the Somenos Marsh Wildlife Society (the Society) manually removed parrot's feather from Somenos Creek, with work occurring from May 29th to October 16th, 2024. Highlights of the scope and acievements of year two work include;

- Expanding project work to a 1.44km section of Somenos Creek, upstream of the Lakes Road Bridge.
- Seven cutting events and
- 23 collection events.
- 185 Volunteer hours.
- Removal of 58.45m^3 (~573 102-litre totes) of parrot's feather
- Maintenance of a 2-to-4-meter clear channel clear over a 1.44 km section from Lakes Road upstream towards the lake.
- Decomposition of all removed Parrots Feather in designated disposal areas.
- Monitoring of water quality parameters like turbidity and dissolved oxygen during project activities.
- Full benefit of controlling Parrots Feather will require the project to be extended to cover the entire creek.

3 INTRODUCTION

The Somenos Marsh Wildlife Society (the Society) proposed the two-phase Parrots Feather control program as part of management recommendations in Preikshot (2019), which were subsequently adopted by North Cowichan Council. The project was done in partnership with the Municipality of North Cowichan (MNC) and with the support of Cowichan Tribes to determine the effectiveness and benefits of cutting parrot's feather to maintain a channel clear of the aquatic weed in Somenos Creek.

Parrot's feather is an invasive aquatic weed that was first recorded in Somenos Creek in 2014 (Preikshot, 2019). It is native to the Amazon River basin and is commonly found in relatively shallow, warm, slow-moving water and is well adapted to nutrient-rich environments (Washington State Department of Ecology, 2001). In Somenos Creek these conditions allow parrot's feather to grow vigorously during the summer, though significant die back events can occur in the winter when temperatures drop below freezing. Parrot's feather has spread through the majority of Somenos Creek because nutrient-rich runoff from cleared land over the entirety of the Somenos Watershed is concentrated in in the creek.

Parrot's feather is known to have negative impacts on water quality in Somenos Creek, it impairs recreational use, and potentially acts as a barrier to adult (upstream) and juvenile (downstream) salmon migration. Somenos Creek drains the Somenos watershed at its mouth on the Cowichan River. Populations of Coho salmon (Oncorhynchus kisutch) use Richards Creek, Averill Creek, and Bings Creek to

spawn (Burns 2002). Chum Salmon (O. mykiss) and coastal cutthroat trout (O. clarkii clarkii) are known to occur in the watershed (Habitat Wizard, 2024). Somenos Creek therefore serves as the gateway to the watershed for return migrating adult Pacific Salmon and the exit path for seaward migrating juveniles. Mats of parrot's feather in the creek thus present physical and water quality barriers to fish migration until high water events or Parrot's Feather die off during frosts.

Drier and hotter summers associated with anthropogenic climate change, will likely extend the growth season of parrot's feather, thus leading to greater coverage, thicker mats, and more permanent changes to the ecology of the creek system, threatening fish habitat, recreational use and water quality. In order to mitigate such outcomes, MNC, in partnership with the Society, embarked on a long-term strategy in 2019 to restore trees and riparian habitat to resotre shading to the creek. Parrot's Feather is known to thrive in the parts of Somenos Creek that have been cleared of trees and have little or no shade. Therefore, a major component of the service agreement that MNC has with the Society is devoted to restoration of treed riparian habitat along Somenos Creek. Such shading, however is a long-term, decadal project and interim, short-medium term approaches have become necessary to bridge the time gap to protect and restore Somenos Creek water quality, drainage, and habitat.

In the summer of 2023, the society completed phase 1 of the Parrot's Feather Control Project (the project). In the summer of 2024, the society began phase 2, which expanded the project length and frequency of removal events. This report will outline the methodologies and results from phase 2 of the control project.

4 METHODS

4.1 PROJECT LOCATION

The project took place in Somenos Creek, extending from a point ~300m from the head of the creek where parrot's feather is established, to Lakes Road bridge, ~1.4 km downstream (Figure 1) The area covered was 844m longer than work in 2023. Surveys by the Society from 2021 to 2023 show that other aquatic plants, including great yellow pond-lily (Nuphar polysepala) and smartweed (Polygonum spp.) are present through most of the creek.The project stream reach is generally ~4-5m wide, with a few sections narrowing to ≤3 meters during the dry season. The stream bank is generally steep, and the wetted channel is approximately 1.5 to 2 meters deep. The creek has very limited observable flow, if any, during dry summer months (Preikshot, 2019), and riparian and aquatic vegetation cover most of the creek in some sections.

4.2 PROCEDURES

In collaboration with the Municipality of North Cowichan, and with letters of support from Sonia Furstenau MLA, and Cowichan Tribes, The Society submitted applications to Federal and Provincial regulators in 2023 and 2024 to permit Parrots Feather Cutting. Approval was provided by all regulators for cutting activities in 2023 and 2024. Residents neighbouring the affected stream reach were informed of the cutting work through a letter and a staff canvas in 2023. Signs informing passersby of the project were placed at the boat launch and next to the parrot's feather disposal sites.

Figure 1: Parrot's feather control project area and other important locations on Somenos Creek.

The project had three main aspects: cutting, collecting, and water quality monitoring. The growing edge of the parrot's feather was cut with an underwater electric aquatic weed mower; the cut sections were then collected with a boat into 102 liter totes (see Figure 2, 3 and Appendix B) and removed from the Creek to dry and compost on the bank above the high-water mark. Water quality was monitored with two Onset Hobo U26 Dissolved Oxygen Data Loggers that tracked temperature and dissolved oxygen variation at a control location and in the project area. Turbidity (NTU) was also monitored to ensure instream work stayed within provincial water quality guidelines to prevent impacts on fish. Two boats equipped with electric motors (Minn Kota Endura Trolling Motor) were used for all work in the creek (see Appendix B). To prevent downstream movement of parrot's feather fragments, a containment boom was installed across the creek under the Lakes Road bridge, Figure 4.The dissolved oxygen loggers were left in the creek until December to capture data on the fall flush.

Society staff and volunteers worked in the creek 1-2 times a week from May 29th to October 16th, totaling 26 events, averaging 3.5 hours per event. 8 different volunteers and 2 board members contributed 185 hours to the project. Three society staff contributed 688 hours to the projects instream work, communications, planning and reporting.

4.3 CUTTING

Parrot's feather cutting took place on 8 dates, shown in Table 1. In addition to the gear described above, life jackets, waterproof shoes and paddles were used during cutting (see Appendix B). Cutting personnel were; a boat driver, mower operator, and one to two support workers for boatwork and sampling. The aquatic mower was mounted on a reinforced gunwhale on the starboard side of the boat (see Figure 2).

Consequently, the NE side of the creek was cut while moving upstream and the SW side while moving downstream. Most of the cutting was completed using the aquatic mower; however, in some sections where growth was encroaching on the cleared channel, hand-cutting tools were used during collection events to remove sections of the parrot's feather.

Figure 2: The aquatic weed mower attached to the gunwale of the boat.

4.4 Collecting

Parrot's feather collection took place on 23 dates, shown in table 1 . Tools used during collection events included one to two boats, electric motors, 5-8 plastic totes for parrot's feather collection, a hand saw to cut any parrot's feather that was still partially attached, and pitchforks and rock rakes for collection. Life jackets, waterproof gloves, and waterproof shoes were also needed (see Appendix B). Personnel for each boat included a driver and two to four other personnel to collect the parrot's feather and maintain balance in the boat. Previously cut parrot's feather was collected from the creek using rakes and pitchforks, drained of as much water as possible, and then placed in the totes (Figure 3). Totes were brought to drop off points on the bank, see Figure 1. The parrot's feather from each tote was inspected for any fish, invertebrates, or other aquatic life before being spread out to dry.

Table 1: Cutting and Collecting Dates Summer of 2024.

Month	May	June	July	August	September	October
Date and Action	29th cut + collect	5th cut	4th collect	1st collect	4th cut	9th collect
		12th cut + collect	10th collect	8th collect	11th collect	16th collect
		19th collect	11th collect	14th collect	12th collect	
		20th cut	17th collect	21st collect	18th collect	
		27th cut + collect	18th cut	28th collect	26th collect	
			24th collect	29th collect		
			25th collect			
			31st cut + collect			

Figure 3: Parrot's feather collection in Somenos Creek.

4.5 Water Quality Testing

Water quality was monitored with U26 probes to record temperature and dissolved oxygen every 10 minutes throughout the project's duration. The first data logger was installed at Lakes Road bridge, 0.5 m under the surface, mid-channel, to monitor potential downstream effects of the project work. The second data logger was installed at the Tzouhalem Road bridge, 0.5m below the surface, mid-channel, and served as a control site for water quality in the Creek (Appendix A, Figure 1). Data was collected from both loggers weekly. The data loggers were left until December 2024 to monitor water quality during and after the fall flush.Turbidity was tested before, during and after work was completed to monitor changes in turbidity levels and ensure the activities in the Creek did not produce turbidity levels that exceeded water quality guidelines outlined by the British Columbia Approved Water Quality Guidelines (Singleton, 2021). Water samples were collected and tested using a YSI 9300. Regular testing began on July 10th and continued until the end of the project.

5 Results

5.1 Mitigations

To meet requirements laid out in the 2024 permits for work in the creek, a boom was intalled to catch parrot's feather fragments floating downstream between work events. Accumulation of the parrot's feather at the boom was only observed during the early stages of the project in June and when the Creek began noticeably flowing in October. Staff did note an accumulation of common duckweed (Lemna minor) at the boom which suggests that when the Creek was flowing the boom was effective at stopping material from being carried downstream from the project area.

Figure 4: Boom placement under the lakes Road bridge with a mat of cut parrot's feather.

Precautions were taken to ensure that the parrot's feather was not accidentally carried offsite to potentially contaminate other waterbodies when the equipment was removed from the project area. This involved visually inspecting, washing, and disinfecting any equipment that had to be taken off-site during the project. At the end of the project, all equipment was thoroughly washed and inspected before being removed from the site. Additional precautions included draining and drying both boats before their use in other waterbodies, signage on the site of the project, and staff and volunteer education on limiting potential contamination.

5.2 Cutting, Collecting and Drying

Cutting in 2024 was successful at creating a 2-to-4-meter-wide channel free of parrot's feather in the creek. For each cutting event completed in the creek, on average, three removal events were needed to remove all cut material. In some reaches of the creek, cutting by hand was needed during collecting events to maintain a clear channel. By mid-August, the most upstream 150 meters of the project area had grown over completely, leading to the boats being unable to enter that portion of the creek, see Figure 1. In total, the society removed 58.45m^3 of parrot's feather from Somenos Creek, measured by 573 102-litre plastic totes. All collected parrot's feather was discarded at the drop sites, shown in Figure 1. Green frog (Lothobates clamitans) and American bullfrog (Lithobates catesbeianus) tadpoles, aquatic snails, and a few species of benthic invertebrates such as unidentified dragonfly nymphs were found in parrot's feather cuttings but fish were never seen. Animals caught in the cut parrot's feather were removed carefully and placed back in the creek. After being discarded, the parrot's feather was left to decompose. All discarded parrot's feather from the first year of the project in 2023 appears to have decomposed completely, therefore the Society is assuming that the parrot's feather cut in 2024 will decompose with similar results and will not be viable for regrowth in the spring of 2025.

The kayak based parrot's feather surveys of 2023 were replaced by an aerial drone survey of the creek on the 12th of September 2024. The drone survey imagery suggests that the 2024 cutting noticeably reduced parrots feather coverage in the middle of the creek compared to the uncut reach, below the project area. See Appendix A, Figure 2, for the full parrot's feather survey results.

Figure 5:Images of parrot's feathercoverage in the project area (left) and bellow the project area (right). The cleared channel can be seen clearly in the project area photo.

5.3 Water Quality

5.3.1 Turbidity

Turbidity was monitored before, during, and after cutting and removal activities, see Table 3. However, monitoring began on July 10th due to shipping delays for the equipment. It is assumed that low flow in the period between May and September yields variable and highly localized conditions for water quality including turbidity This localization of conditions may be due to groundwater influences, aquatic plant growth, and animal activity in the creek. Samples were taken based on work locations. Both cutting events and removal events were seen to cause organic material disturbance which increased turbidity in the creek. This was chiefly decomposed material and/or algae that was attached to the root masses of the parrot's feather being removed. However, increases of turbidity associated with cutting and collection, tended to be gone after 24 hours, see Table 2. Sediment from the creek's bottom or banks was rarely disturbed.

The BC turbidity guidelines for aquatic life require no change over 5 NTU at any time when background turbidity is between 8 – 50 NTU (Singleton, 2021). The majority of after samples were taken within 1 – 2 hours of the 'during' sample and show a return to the starting turbidity levels or are within the recommended ranges. There were, however, two outliers, 'during' removal events on September 11th and 18th, where turbidity guidelines were exceeded, turbidity did return to below the 'before' levels two hours after work in the affected areas was completed.

Table 2: Results of all turbidity sampling completed fot the parrot's feather control program.

Date	Action	Before NTU	During NTU	After NTU (taken within 24 hrs)
10-Jul-24	Removal	6	6	4
17-Jul-24	Removal	0	-	2
18-Jul-24	Cutting	2	-	0
24-Jul-24	Removal	4	8	4
25-Jul-24	Removal	6	12	6
31-Jul-24	Cutting	6	10	8
8-Aug-24	Removal	2	3	1
14-Aug-24	Removal	6	6	6
28-Aug-24	Removal	4	6	6
29-Aug-24	Removal	8	6	10
4-Sep-24	Cutting	0	12	6
11-Sep-24	Removal	10	16	6
12-Sep-24	Removal	4	10	6
18-Sep-24	Removal	10	98	8
26-Sep-24	Removal	12	16	11
9-Oct-24	Removal	2	10	0

5.3.2 Temperature and Dissolved Oxygen

Two dissolved oxygen/temperature data loggers were installed in Somenos Creek, which recorded measurements every ten minutes. The first data logger was placed at the Lakes Road bridge to capture water quality directly below the project area. The second data logger was placed at the Tzouhalem Road bridge (Appendix A, Figure 1), around 660m downstream from the Lakes Road bridge, to act as a control site. Data loggers were cleaned weekly as algal growth was noted to impact the data quality. The graphs in Figures 6 and 7 show the average daily temperatures and dissolved oxygen levels.

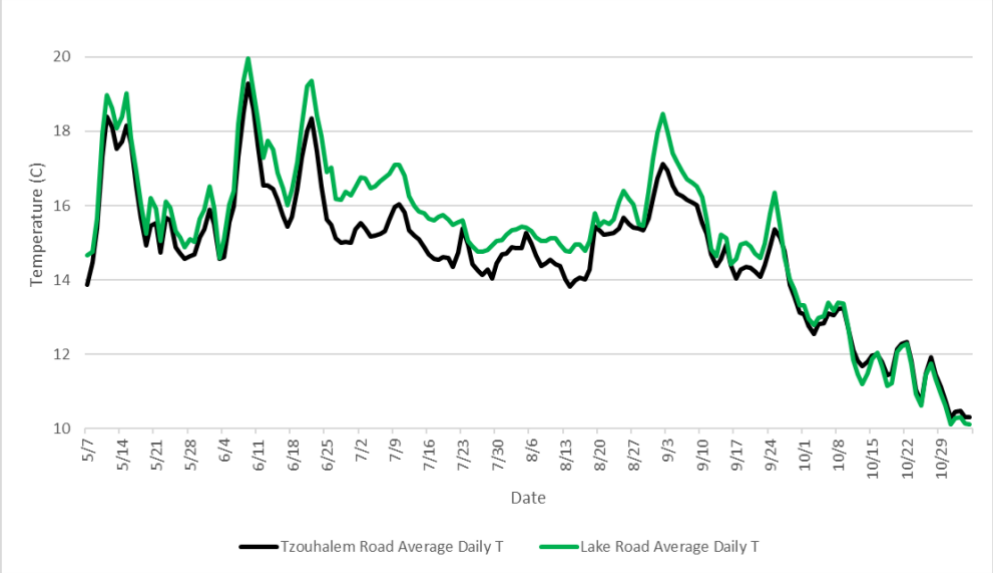

Figure 6: Average daily temperatures of Somenos Creek at the control (Tzouhalem Road) and protect site (Lakes Road).

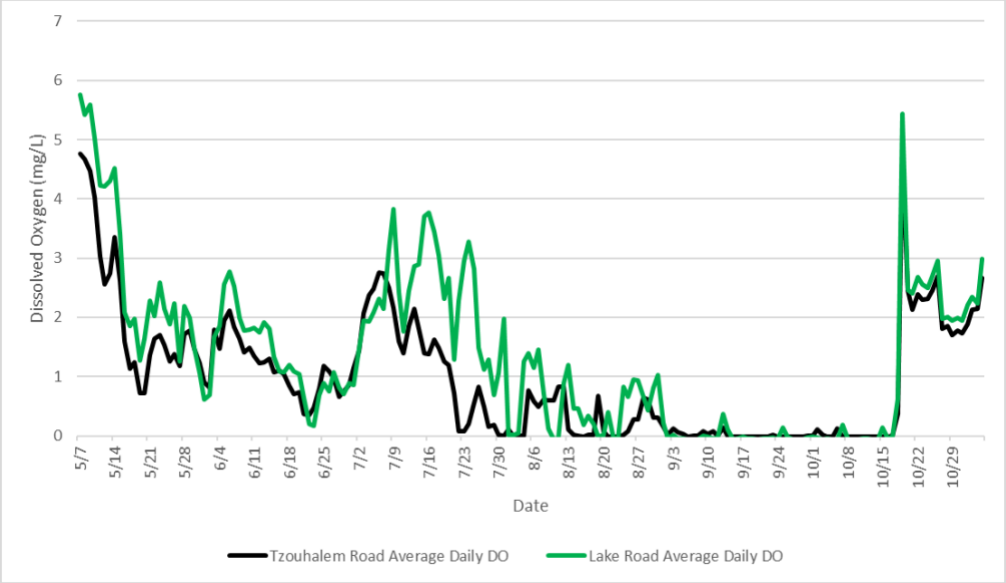

Figure 7: Average daily dissolved oxygen of Somenos Creek at the control (Tzouhalem Road) and project site (Lakes Road)

Data shows that both dissolved oxygen and temperature were greater at Lakes Road than at Tzouhalem Road, see Figures 6 and 7. T-tests on the observed difference between temperature and DO at the two sites suggested that they were significantly different, with $P<0.05$. Further investigation is required to determine the cause of the difference. Detailed water quality data is available from the authors upon request.

6 Conclusions

Cutting and removal of parrot's feather in Somenos Creek created a 2-to-4-meter-wide clear channel, and resulted in the removal of 58.45m^3 of parrot's feather to decompose on the bank overwinter. The drone survey completed by the Municipality on September 12th, clearly shows the cleared channel in the project area. Society staff and volunteers worked in the creek on 27 different days through the summer, an increase from 19 days in 2023, and volunteer hours more than tripled from 2023 at 185 hours in 2024. Work in the creek was not observed to increase turbidity levels for more than two hours or disrupt fish populations. While water quality did show a statistically significant difference between the project and control sites, it is not clear whether this is due to the project impact or natural processes.

Expansion of such work to the entire creek length would require an increase in funding, equipment, and staff. The support of Cowichan Tribes will be essential to allow work on the lower section of the creek from Tzouhalem Road to the confluence with the Cowichan River.

7 APPENDIX A – ADDITIONAL IMAGES

Figure1: Satalite image showing water quality logger locations in Somenos Creek.

Figure 2: Full image of the parrot's feather survey completed by the Municipality of North Cowichan on September 12th, 2024.

8 Appendix B – Equipment

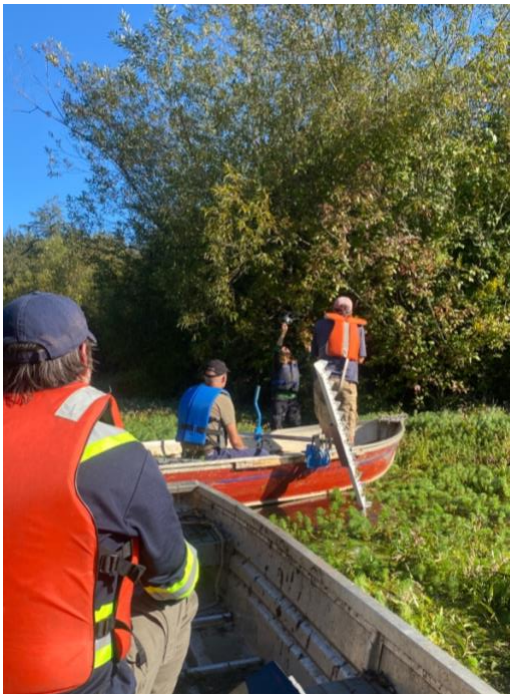

Figure 1: One of the boats with the aquatic mower attached to the gunwale.

Figure 2: One of the boats with collection totes full of parrot's feather.

Figure 3: Parrot's feather collection from one of the boats with the collection tools and motor.

Figure 4: Totes full of parrot's feather in one of the boats.

9 APPENDIX C – REFERENCES

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