Please note that I am not qualified academically or professionally to comment on the RDN's plans, though I do have a science background. I live on Gabriola and these are just my islander's opinions based on observations made over a decade of regular visits in all seasons and weathers to the marsh.

These notes are intended to bring members of the Gabriola Island Streamkeepers up-to-speed on the issues but entirely only to the degree to which they have the time and interest to be involved.

The notes reflect only my own opinions and acquired knowledge. They must not to be taken as reflecting the collective views of the Gabriola Streamkeepers membership or the views of any other Gabriola Streamkeepers member.

The notes were written in some haste and the writing may sometimes deserve editing to correct mistakes and dispel the glibness that normally there would be time to do.

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Version 1 (Jan. 15, 2024): distributed to all GSK members and a selected few others.
Version 2 (Jan. 19, 2024): some typos, layout, and consequent page number changes to Version 1. The only content changes of significance are:
— the addition of the single sentence beginning "Comment: The local residents…" on p.9
— the inclusion of Reference 11 received January 15, 2024, and comments
— the inclusion of Reference 12 without comment
— the inclusion of Reference 13 without comment
— comment on confusing NHC/EDI map orientations, Reference 10 for example.
This version, although current, has not been distributed as the changes to Version 1 are not substantial.

Version 3 (May 7, 2024): Notes added after the decision made by RDN to delay decommissioning until 2025.
Version 4 (November 26, 2024): Notes added after receipt by RDN of EDI Report Reference 14.

November 26, 2024

Gabriola Streamkeepers (GSK) Briefing Notes on Coats Marsh Weir

Nick Doe

…in response to the RDN's proposal not to repair or replace the concrete weir at Coats Marsh Regional Park, but instead to demolish it, thereby permanently draining the weirpool.

Doing this would leave only the beaver dam preventing the whole of the marsh from also being drained with complete loss of irreplaceable Gabriola Island wetland habitat.

The RDN is doing this to avoid having to upgrade the weir to the modern provincial government standards for dams that pose a risk to human safety, and to avoid potential liability for damage or loss of downstream private-property "infrastructure" should the weir be left either as it is, or only modestly renovated, and should the beaver dam, which is retaining water to the great benefit of the marsh's ecosystem, subsequently fail catastrophically.

Please check RDN project reference: https://www.getinvolved.rdn.ca/coats-marsh-weir

References

These are the official references in case they are needed, but I'm not expecting anyone to read them. Some are out-of-date and contain information and mis-information that GSK members living on Gabriola Island don't need, but I may cite them in this note for completeness.

All are from my own website where they were posted because RDN have on occasion refused to make some of them public, and others are difficult to locate on the RDN website or otherwise obtain.

The meaning of any generally-used acronyms relating to wetlands and watercourses can be found in the GSK glossary https://nickdoe.ca/pdfs/Webp676.pdf.

RDN consultants' flushed-out acronyms can be found in the reference list that follows.

1. RDN: Coats Marsh Regional Park, 2011-2021 Management Plan, August 29, 2011 (File:6101).
2. RDN: Coats Marsh Regional Park, 2011-2021 Management Plan Appendices, August 29, 2011 (File:6102)
3. Madone Environmental Services: Gabriola Island Riparian Area Regulation Stream Identification, February 24, 2012 (File:6103)
4. RDN: Request for Proposals 22-064, Coats Marsh Weir Elevation Study, Addendum 1, July 8, 2012 containing:
   Madrone Environmental Services: Post-Construction Report, Coats Marsh Flood Protection Berm, September 12, 2023 (File: 6104)
5. Sustainable Resource Mechanical Engineering and Project Management (SRM Projects): Coats Marsh Weir Assessment, June 1, 2020 (File:699)
6. Madrone Environmental Services: A Proposed Strategy for Water Level Management – Coats Marsh Gabriola Island, BC, September 14, 2021 (File:6105)
7. RDN: Recording of the meeting of the Regional Parks and Trails Select Committee, May 2, 2023. Begins at 40:58.
   https://rdn-pub.escribemeetings.com/Players/ISIStandAlonePlayer.aspx?Id=46a9d0fa-0d87-4023-9bad-8be577f88d5b
8. RDN: Staff Report To Regional Parks and Trails Select Committee, May 2, 2023 containing:
   Nature Trust of BC: Letter of Support regarding Coats Marsh Weir Replacement (File:6106)
9. Northwest Hydraulic Consultants (NHC): Coats Marsh Weir Elevation Study, April 12, 2023 containing:
   Environmental Dynamics Inc. (EDI): Wetland Assessment, April 2023 (File:6107)
10. Northwest Hydraulic Consultants (NHC): Coats Marsh Dam Preliminary Decommissioning Plan, December 18, 2023 containing:
    Environmental Dynamics Inc. (EDI): Environmental Components, December 2023 (File:6110).
11. Northwest Hydraulic Consultants (NHC): Coats Marsh Dam Preliminary Decommissioning Plan, Beaver Dam Risk Assessment, January 10, 2024 (File:6113)
12. RDN: Recording of the meeting of the Regional Parks and Trails Select Committee, February 6, 2024. Begins at 29:30. Also File: 6114 .
    https://rdn-pub.escribemeetings.com/Players/ISIStandAlonePlayer.aspx?Id=b1cc876f-3071-4cef-a5e9-3a43ed5b689d
13. RDN: letters of support from Nature Trust BC (NTBC) and Environment Canada for RDN's Coats Marsh weir decommissioning plan (File:6115) .
14. Environmental Dynamics Inc. (EDI): Environmental Impacts Weirpool Area, October 2024 (File:6116).

For completeness again I'll list some of the pertinent references on my website (nickdoe.ca), but again I'm not expecting anyone to read them. These references are also itemized on the web page found here.

I have no special expertise, or frankly any interest in, government regulations and legalities, and am not qualified professionally or academically to speak about constructing concrete dams, although I do have an unrelated scientific background which in my retirement years I've used to learn about the ecology and geology of the marsh.

The notes are written in diary form, always within a day or two of my having visited the marsh. They contain observations, calculations, and lots of photographs and include

- a glossary of wetland terms (676)
- historical notes (697)
- water-level observations (673b, most other 673 files)
- water budget observations (how much goes in, out, and is stored in the wetland) including measurements of creek flow rates (litres/sec, and how to measure flow rates) and calculation of catchment areas that unlike academic papers take account of their unusual nature due to the anisotropic nature of the sandstone fractures on Gabriola (673u, 673t, and not listed 573 and 551 if you're really interested)
- measurement of rainfall measurements at the marsh and statistical analysis of precipitation records for Gabriola (most 673 files, 698)
- mapping of creeks and wetlands (661, 668)
- lists of the species of plants and animals seen, photographed, and occasionally inexpertly identified (679, most other 673 files)
- thoughts on replacing the weir with a sluice gate discounting the possibility of catastrophic failure of the beaver dam (673y, 673z, 673zb)
- thoughts on a simple re-design of the concrete weir to increase its ability to carry flood water again discounting the possibility of catastrophic failure of the beaver dam (673zc)
- letters on managing the wetland as a nature reserve (680, 690); and
- even a hopelessly-beginner's attempt at a poem reflecting the pleasure that regularly visiting the park brings to me (673zc, pp. ZC 564/5).

Nick Doe and Gabriola Streamkeepers (GSK) Files

661. Atlas of Wetlands and Watercourses on Gabriola (File:661)
668. Hydrogeology of Coats Marsh, Gabriola Island, 2015-2021 (File:668)
673. Observations at Coats Marsh (File:673) see Binder673 below for supplementary files
673b. Summary of water level measurements (File:673b)
673t. Notes on evaporation and evapotranspiration (File:673t)
673u. Water balance and catchment area calculations (File:673u)
673ze. Observations Jun-Dec 2024 (File 673ze).
676. Wetland and Watercourse Glossary (File:676)
678. Freshwater Fish on Gabriola Island (File:678)
679. Coats Marsh Species Checklists (File:679)
680. Letters and Responses to RDN, POSAC, LTC, GaLTT, GSK, and NTBC on the management of parks on Gabriola Island, BC, Canada (File:680)
682. Observing ducks and geese at Coats Marsh, Gabriola Island, July 2017 (File:682)
690. Coats Marsh and Surrounding Public Lands Management 2009-2019 (File:690)

691. Geology of Coats Marsh area, Gabriola Island, BC—a summary, 2019 (File:691)
692. Flora of Coats Marsh area, Gabriola Island, BC—a summary, 2019 (File:692)
693. Fauna of Coats Marsh area, Gabriola Island, BC—a summary, 2019 (File:693)
697. Brief History of the Weir (File:697)
698. Rainfall on Gabriola, 1944-2023 (File:698)
6111. Beaver dam stability. Prof. Brazier and Dr. Puttock, University of Exeter (File:6111)

Binder673 Field Observations Binder 2015-2024 (File:Binder673)
This is a very large file (>120 MB) made up of the following supplementary files. The recent files in this list may be more up-to-date than in the binder. Page numbers are numerically continuous in the binder, but the page numbers of 673 files have alphabetic prefixes that identify which individual file they are from. For example p. D123 means page 123 in the 673d file.

673d. 2015 (File:673d)
673e. 2016 Jan.-March (File:673e)
673f. 2016 Apr.-Jun. (File:673f)
673g. 2016 Jul.-Sept. (File:673g)
673h. 2016 Oct.-Dec. (File:673h)
673j. 2017 Jan.-March (File:673j)
673k. 2017 Apr.-Sept. (File:673k)
673m. 2017 Oct.-Dec. (File:673m)
673n. 2018 Jan.-Dec. (File:673n)
673q. 2019 Jan.-Jun. (File:673q)
673r. 2019 Jul.-Dec (File:673r)
673s. 2020 Jan.-Jun. (File:673s)
673v. 2020 Jul,-Dec. (File:673v)
673w. 2021 Jan.-Jul. (File:673w)
673x. 2021 Jul.-Sept. (File:673x)
673y. 2021 Oct.-Dec. (File:673y)
673z. 2022 (File:673z)
673za. 2023 Jan.-Apr. (File:673za)
673zb. 2023 May-Aug. (File:673zb)
673zc. 2023 Sept.-Dec. (File:673zc)
673zd. 2024 Jan.-May (File:673zd)
673ze 2024 Jun-Dec. (File:673ze).

Excellent newspaper coverage by Rachelle Stein-Wotten in the *Gabriola* SOUNDER If you have difficulty locating these send me an e-mail and I'll send you a copy.

53. May 10, 2023, 33(19), *Regional parks committee in favour of decommissioning Coats Marsh weir*,p.12
https://simplecirc.com/view_issue/34699

54. Oct.11, 2023, 33(41, printed 40), *RDN has Coats Marsh weir decommission design underway following federal approval*, p.7;
https://simplecirc.com/view_issue/38847

55. Jan.10, 2024, 34(2), Draft plans released for decommissioning, restoration of Coats Marsh Weir, pp. 4-5
https://simplecirc.com/view_issue/41383

56. Feb.14, 2024, 34(7), Committee wants report on ecological impacts of Coats Marsh project, p. 3 https://simplecirc.com/view_issue/42398

Introductory comments

As far as I know, despite now several studies by consultants, the RDN have not considered that it is reckoned by an expert in beaver dams that the beaver dam, in its Coats Marsh lake-like setting, will never fail catastrophically. (Reference 6111; 673b p.B3). Despite this, catastrophic failure continues to be a major concern in their planning. It will of course be breached harmlessly from time-to-time, as it is now, in periods of high rainfall or rapid snow melts, but breaching is not catastrophic failure. Its decay mode, should it be abandoned by the beaver and allowed to rot out, will be the development of a series of breaches over time, each progressively reducing the maximum water level retained. Beaver dams are not like dams that humans build.

In any case, the beaver dam must allow water to flow through it or over it—it is actually a weir rather than a dam. If it didn't allow such a flow, there would be no way for the inflow to the lake, principally from the two creeks at the east end of the marsh (East Path Creek and NE Arm Creek), to exit via the weir into Coats Marsh Creek, and from there flow down to Hoggan Lake and into the sea.

No effort that I am aware of has been made by the RDN to investigate the option of reducing the potential liability for damage or loss of downstream "infrastructure" (mainly a log cabin built before riparian regulations were introduced, not a residential structure). The consequences of failure of the weir are currently assessed by off-island consultants as being HIGH. (Reference 10), which requires among other stipulations that the weir undergo regular inspection. The less onerous options for the RDN yet to consider are SIGNIFICANT and LOW.

No creative ways have been looked at for meeting the intent of the new provincial dam regulations without resorting to building a heavy-duty, high-cost, new dam, and demolishing the beaver dams and presumably heavy-handedly re-locating the beaver to prevent him re-building his dams. The original builders and park donor would have despaired.

There is a video recording of the RDN Regional Parks and Trails Select Committee meeting on May 2, 2023, (Reference 7) in the list below at which the recommendation to demolish the weir was made.

One aspect of the difficulties in dealing with this issue is that the RDN and Gabriola Islands Trust LTC are not traditionally organized to recognize the sometimes-sharp distinction between a "park", managed primarily for human recreational purposes, and a "nature reserve", managed with the needs of wildlife having, as near as is practical, absolute priority. See for example letters to the LTC from IT Trustee Susan Yates (Reference 680, pp.29/30, November 27, 2023), *former* IT Trustee Deborah Ferens (Reference 680, p.30, November 28, 2023), and myself (Reference 680, pp.28-29, July 9, 2019) on the LTC's long-standing failed attempts to put ecological protection zoning into their toolbox. In the same thread, GaLTT (Reference 680, pp.30/1, November 27, 2019), which has an unusual mixed mandate to develop trails and to foster conservation, declined to support giving ecological protection zoning to Coats Marsh RP. Currently, Gabriola does not have any ecological areas protected by IT zoning.

Reserving selected natural areas with limited, if any, opportunities for human recreation is not always favoured by everyone (we the taxpayers pay for it and are thus entitled to go there)

despite generally held opinions to the effect that considering the environment is an important aspect of land use planning. The notion that compromises are always possible is not true; human disturbance and anthropocentric management of an area almost always has some impact, usually negative, on the wildlife that would have thrived there had it and its habitat remained without human influence.

Most of what has been written about the weir, starts with the assumption that what is being dealt with are concerns about "regulations" and "liability", not what is the best we can do for this small portion of the natural world. Badly needed in discussion about the future of the marsh is its status as a nature-reserve, not as if it were similar to an industrial-grade impoundment, and a feeling for the beauty of its "tranquility", a word donor Clyde Coats used several times in remarks made at the opening ceremony of the park one sunny day in the May of 2009.

Technical and terminology details

I use "lake" in these notes, some people use "pond", it is technically a "shallow-water wetland". The latest NHC report (Reference 10) calls it a "reservoir", a term I have never heard used on Gabriola, but which is perhaps in keeping with their general approach to managing it.

Despite references to beavers (plural) and beaver family, there is, and has only ever been, one beaver active in the lake, a male judging by the absence of kits, and he is not always present being accustomed to take occasional breaks for a few weeks, likely down to Hoggan Lake. He probably was introduced into the Coats Marsh lake around the turn of the century by Clyde Coats, though this is not certain. It is however, I gather, not unusual for a beaver to lead a solitary life in this way.

Fish. There are no fish in the lake, but Jethro has seen trout in the deep pools up to a hundred metres or so on the upstream side of the South Road culvert in Coats Marsh Creek. The official Riparian Area Regulations (RAR), which are incomplete, are wrong on this. (Reference 3); however it is true that the way from there upstream is not passable by fish. One of the consequences of the absence of fish is that the wetland supports a large variety of species of dragonflies, whose nymphs would otherwise have to compete with the fish.

By "beaver dam" most people are referring to the dam spanning the 30-metre width of the lake, about 60 metres upstream of the weir. No part of this dam has ever been removed. There is however a smaller earlier dam immediately adjacent to the weir. At times in past years it has looked like an unorganized collection of debris, but more recently the beaver has been developing it. (Reference 673zc, pp. ZC561/3) It is this smaller dam that older comments like "removal of the dam" are referencing. Despite the beaver's attention I sometimes continue to call it "debris" knowing full-well the beaver would disapprove.

The major dam splits the lake into two unequal parts.
The larger part of the lake east and upstream of the major beaver dam is known by locals as the "outer" part of the lake, less often as the "east end". I'm in the habit of calling it the "outer" part too, but sometimes have taken to just calling it the "lake" in field notes when the context is clear that it is only the outer part of the lake that I'm referring to.

The smaller portion on the downstream side of the larger dam, the embayment, has been called by several names; I'm currently using "weirpool". It is the weirpool that the RDN are proposing

to drain by removing the weir and the beaver's subsidiary dam (the debris) that is butting-up against the baffle of the weir.

Water level measurements are made by consultants relative to mean sea level (AMSL) while my own have been relative to the top of the concrete columns comprising the weir (CWB=concrete-weir baseline). CWB is 97.0 metres AMSL. (Reference 26) RDN's water-level observations have never been published and may only apply to the weirpool. Records do exist of water levels prior to 2015 but they have not been normalized to CWB and are not in the possession of the RDN. The RDN appears not to have any records of levels before 2015 from any source. If they do, they have not made them available to the public.

Although called a "marsh" there is a technical distinction between a marsh and a swamp. Marshland is generally considered to be land that would be populated with grasses and forbs (small shrubs) if dry, swamps by trees. Some species of ducks prefer one to the other.

Coats Marsh shows aspects of both, but the species of duck and other waterbirds most commonly there seem to regard it as more of a swamp than say Dicks Swamp on the Boultons' Somerset Farm, which paradoxically is more of a marsh. Wood ducks (*Aix sponsa*) for example are fairly common at Coats Marsh, while northern pintails (*Anas acuta*), occasionally seen at Dicks Swamp, have never been seen at the marsh. However, because of the unusual geology of the lake, it is unlikely trees of any size could grow there, even if it were dry. It would be a sandstone plain with only a relatively thin layer of soil populated with mosses, grasses, forbs, reeds, and shrubs like roses and stunted willows, or perhaps to be pessimistic (or perhaps realistic), almost monotypic habitat dominated by reed canary grass as is the NE Arm and Canary Grass Meadow.

Old history

Several accounts of the history of the marsh exist on the websites of the RDN and GaLTT, most of which is not relevant here, but I have to include mine (Reference 697) because some people refer to "restoring the marsh to its historical state" as an objective, when the "historical state" has been cherry-picked to suit the writer's perspective. For example, the lake was once drained and used as a pasture evidenced by the barbed-wire fence completely surrounding it, remains of which still exist, and by a concrete cistern for watering livestock at the east end. A valid "historical state" if you're a farmer.

July 20, 1872. The earliest maps we have of the marsh are in the two pre-emption claims of land by the Hoggan brothers. David Hoggan's claim shows a lake (Hoggan Lake), and William Hoggan's claim shows a swamp (Coats Marsh).

1874/5. A survey map shows the NW¼ and NE¼ of Section 10 owned at the time by William Hoggan. Coats Marsh is outlined and shown as unforested swamp in the centre, straddling the two quarter-sections as it does today. Early maps were careful to include swamps because land unsuitable for agriculture did not count toward the area being pre-empted. East Path Creek is traceable on the map all the way back to McGuffies Swamp, but no similar outlet (Coats Marsh Creek) from the marsh down to Hoggan Lake is apparent. (Reference 661)

ca. 1940. Draining the swamp for agricultural purposes was accomplished by blasting and trenching a deep narrow gulley, a fissure, through the sandstone ridge at the west end of the lake. This was probably done by Bill Coats who acquired the land in the early 1940s after a massive wildfire in the summer of 1938. Bill also owned the millstone quarry in the 1930s so he would have had access to gunpowder.

ca. 1968. According to Gordon McDonald, the fissure was blocked by a 20-foot-wide weir. This weir had two concrete columns bonded to the sandstone and spanning the fissure except for a 2-foot-wide gap mid-way between them. This gap was closed by a baffle, a simple sluice gate, which consisted of 2 X 12-inch wooden planks stacked one on top of the other and held in matching vertical grooves in the columns and sealed by the pressure of the water. The height of the baffle could thus be adjusted, a foot at a time, by adding and removing a plank to either hold back water or allow water to drain through the gap into the creek. Because the fissure is over three metres deep (10 ft.), removing all the boards allowed the marsh to be drained completely, but in his day, Bill was often frustrated by the island's duck hunters who for their own reasons preferred to keep the baffle stacked with planks and the marsh flooded. There was talk at one time of the area being used as a cranberry farm but that remained just an idea.

1968-ca.2002-5.

For a period when it was a meadow and pasture, there were radio antennas there, and you still come across junk if you auger down through the bed of the lake. The weir remains today much as when it was first constructed. Clyde Coats, Bill's son, used it or planned to use it to drain stored water down into Hoggan Lake to augment his hydro-electric power generation plant. The idea for making it a park was formulated in 2005 by the now-defunct Gabriola Land Conservancy.

2008. The now re-flooded marsh was acquired from the Coats family through a donation of half its value by owner Clyde Coats and a partnership between the Nature Trust of BC, the RDN, and the BC Trust for Public Lands (Environment Canada Ecological Gift program).

May 22, 2009. Official opening of the park [Joe Stanhope RDN; Gisele Rudischer, Regional Director; Doug Walker NTBC; Leigh Ann Millman; Clyde Coats]. "That park (the 707 CP) should satisfy a great deal of recreational needs, leaving Coats Marsh with its sensitive wetlands to thrive as wildlife habitat". Gisele's comment.
THE FLYING SHINGLE, Vol. 37 (11), p.2, June 5, 2009 and *Gabriola* SOUNDER Vol. 19 (21), p.1, May 25, 2009
Clyde Coats comments indicate that there was already a beaver present in the park.

October 2009. A beaver-proof Clemson 8-inch pond leveller was installed after the then topmost baffle plank was removed. The debris/dam accumulated just a few metres upstream of the baffle was removed. This was to eliminate flooding of private property (Lot 5).

2012. GSK founded. Initially not involved in wetlands on Gabriola. I did not start reporting on Coats Marsh until 2015, which I visited often, when I realized that the RDN had not been doing any monitoring or data gathering.

GSK members continue to monitor the water quality of Mallett Creek and GSK is listed as a stakeholder in the Coats Marsh weir project. (Reference 10).

February 2012. Riparian Area Study of Gabriola by Madrone Environmental Services. Omitted to talk to locals and so made several mistakes including speculating that there are no fish in the lowest reaches of upper Coats Marsh Creek. (Reference 3)

2013. When the pond-leveller proved inadequate to control the flow of flood water, a berm was built over the low-lying land to the south of the weir, raising the surface there 0.3 metres above the top of the weir. The tops of the columns were at that time connected with a wooden walkway known now as the "deck", or less often "bridge" founded on beaver debris dredged from the

weirpool. Although the deck has several times been flooded, the berm has never been breached. (Reference 4)

2014. In March, there was the largest flood ever experienced in historical times. The downstream cabin had water flowing beneath it but no damage was done because it is built on stilts. No flooding issues were reported by any of the downstream landowners. (Guy/Cheryl, Donna, and Mark)

Newer history

June 1, 2020. Qualified engineering study of the integrity of the weir (Reference 5).

[Comment: The local residents have not observed any increase in the deterioration in the concrete weir for the last ten years or more.]

Comments:

> Quote: "Because the weir is located on a stream, the government of BC will likely require it to be licensed under the BC Water Sustainability Act and, if so, will require it to be registered under the BC Dam Safety Regulation (DSR). Further, if registered under the BC DSR, the weir will require operation, maintenance and surveillance activities according to its dam failure consequences classification, which we view as "significant".
>
> [Comment: The weir does not have a water licence, but is currently regulated as a dam under the Water Sustainability Act and the BC Dam Safety Regulation (B.C. Reg. 40/2016) Reference 9].
>
> "The weir was inspected on May 1, 2020 and found to have notable deterioration. Inspection of the conditions upstream and downstream of the weir carried out on the same date identified a number of risk management issues that need to be considered by the RDN.
>
> "Priority recommendations for action include:
> – immediately investigate lowering the level to the "design" weir spill level through installation of an appropriately sized Clemson pond leveller through the beaver dam and, if feasible, install the pond leveller before the fall 2020 rains
> [Comment: A siphon system was installed in lieu of the suggested pond leveller. Reference 6]
>
> – immediately remove the beaver debris piled in front of the Coats Marsh Weir and footbridge, as well as the vegetation buildup
> [Comment: Removing the debris is not as simple as it sounds. It is not unconsolidated sandy material that constitute the "sediment" piled up against the upstream side of the baffle. It is a mix of compacted fines and organic material (mud, wood, and vegetation). Removing just the surface material would enable the beaver to quickly repair the damage.
>
> Build-up of the water level in the weirpool as a result of this small dam has not been a problem because as soon as it is breached and the level exceeds CWB, the effective width of the sill is increased tenfold (from 2 to 20 ft., 0.6 to 6 m). This slows down the

rise in water level to the extent that it has never yet gone on to breach the berm. (Reference 673zc, pp. ZC561/2)]

– investigate raising the park pathway footbridge adjacent to Coats Marsh Weir and, if feasible, complete this work before the fall 2020 rains
[Comment: Not judged to be worth the effort. There is no access by pedestrians to the south side of the lake because allowing that would seriously disturb the habitat of species of duck that use tree cavities for nesting besides alarming ducks when they are moulting, flushing transients who are resting there in the migration seasons. Buttertubs Marsh in Nanaimo, which is completely surrounded by a well-used trail, is not how we want the lake to become. Not completing an around-the-lake trail as proposed in the Coats Marsh Management Plan (Reference 1, p.18) needed some persuasion by GSK greatly assisted by the GaLTT.

The deck does indeed impede the flow of floodwater, but the degree that it does is hard to estimate with confidence.]

– engage with the government of BC to determine if they require the Coats Marsh Weir to be licensed under the Water Sustainability Act and if so proceed with registering the weir under the Dam Safety Regulation.
[Comment: so far as I know, done.]

Sept. 14, 2021. Proposed strategy for water level management (Reference 6)

Recommendation to install a siphon system across the beaver dam as an alternative to pushing a Clemson Pond Leveller through the dam. This proposal was implemented.

[Comment: the RDN regards the siphoning system as a success. I most assuredly don't. The need for periodic maintenance disturbs the wildlife, which together with the severe yo-yoing of the water level of the lake may account for the significant drop in the number of ducks and other waterbirds, including breeding pairs, using the marsh since it was installed. It is important to not draw down the water level to a point where there is insufficient water in droughty summers to make up for evapotranspiration, which may amount to 5mm/day. The lake was inadvertently drained by the siphons in the summer of 2023 and the negative consequences readily observed. (Reference 673zb; 673zc). I suppose if I were legally-minded, I might suggest that asking staff to go out on the dam to make regular inspections of the siphons could be conjectured as putting them in danger given that the RDN is of the opinion that the dam might fail catastrophically.]

April 12, 2023. NHC report (Reference 9)

All of the five scenarios enunciated in this report include completely removing both of the beaver's dams. It was rapidly dismissed as being unacceptable for a nature reserve.

Given the need to address the weir structure's deteriorating condition, quote:

the objective of this study was to determine the engineering and environmental implications of modifications considering the following five elevation scenarios:

Scenario 1. A replacement dam at an elevation that precludes the need to build a new embankment structure [berm] along the west side of the weir pool (elevation 96.1 m)
[Comment: 96.1 m = -0.90 m CWB. The berm is at +0.30 m CWB. Essentially just re-building the concrete weir with a wider spillway and lowering the water level in the lake. Bern retained. Capital cost $390 k.]

Scenario 2. A replacement dam at the same elevation as the existing weir overflow flashboard (elevation 96.4 m)
[Comment: 96.4 m = -0.60 m CWB. Wider spillway. Replacement berm. This elevation is arbitrary and was lowered when the pond-leveller was installed. It does not define the summer water level in the weirpool because evapotranspiration causes the level to drop below that, nor does it define the winter water level on account of the beaver's debris. The berm would need to be replaced. Capital cost $590 k.]

Scenario 3. A replacement dam at an intermediate elevation between the existing weir overflow and the top of the site's beaver dam. This has been set as the top elevation of the existing weir concrete (elevation 97.0 m)
[Comment: Comment: 97.0 m = 0.0 m CWB. Wider spillway. Replacement berm. Capital cost $740 k.]

Scenario 4. A replacement dam at the same elevation as the beaver dam (elevation 97.7 m)
[Comment: 97.7 m = +0.70 m CWB. Wider spillway. Replacement berm. Capital cost $1.08 M.]

Scenario 5. Removal of the existing weir and decommissioning of the dam structure
[Comment: Resulting in complete drainage of the marsh and probable loss of beaver habitat. Capital cost 435 k.]

"NHC provided a dam consequence classification review in accordance with provincial guidelines, including an inventory of downstream assets and a qualitative assessment of potential consequences in the event of a dam breach. We recommend a preliminary classification of **High Consequence** for the existing weir due to potential for loss of life at a cabin located on private property at 1040 Coats Drive. [Comment: a recommendation apparently accepted by the RDN without as far as I know any public comment.]

"The beaver dam upstream of the weir appeared to be actively maintained by beavers, with no overflow channels or breaches identified. [Comment: Mis-information. In high water situations there are always several spillways on the dam with a capacity far greater than that of the siphons, and the beaver uses these in normal situations to move back and forth across his dam.]

"However, the beaver dam impounds water above the existing weir and berm. This arrangement is contrary to current dam safety practices for a regulated structure, regardless of the real or presumed stability of the beaver dam. NHC recommends beaver dam removal under all scenarios. [Comment: .. and beaver or any successor(s) removal to avoid them being rebuilt. Completely inappropriate for a nature reserve.]

"The most technically straightforward approach is for RDN to form an agreement with the land owner to carry out one of the following actions: 1) removing or relocating the cabin to another area of the property, or 2) removing the unlicensed stacked rock weir adjacent to the cabin, thereby greatly increasing the channel capacity and reducing flood levels at the cabin. [Comment: RDN has, as far as I know, have never discussed this as recommended. The flow of Coats Marsh Creek to Hoggan Lake is mostly though undeveloped woodland and a small wetland and absorbs floodwater harmlessly.]

From the perspective of the non-human population of the park, the most favourable scenario is missing. Scenario 6: Just go away and leave it alone.

April 12, 2023. EDI report (contained in Reference 9 and updated in Reference 10)

While a reasonable assessment of the environment of the marsh, it contains some information that is not correct or incomplete, but to be fair, could not reasonably be obtained from observations made solely on one or two ferry-in/ferry-out visits at one particular time of the year. By "area" I am sometimes including the riparian area of upper Coats Marsh Creek that extends from the park through private property. Comments:

> The concrete weir structure was constructed more precisely *circa* 1968, not sometime between the late 1960s and 1980s.
>
> The site classification Western Red Cedar–Indian Plum is incorrect. It is based on an interpretation by a forester of aerial photographs, made years ago. This Sensitive Ecosystems Mapping (SEM) system lacks any reference to the disproportionately important small riparian areas. It has become of very limited value as a planning tool. The dominant site species in the uplands area are Douglas-fir (*Pseudotsuga menziesii*), oceanspray (*Holodiscus discolor*), and salal (*Gaultheria shallon*); within the riparian area the species are red cedar (*Thuja plicata*), ninebark (*Physocarpus capitatus*), and sword-fern (*Polystichum munitum*).
>
> The dominant aquatic plant species in the marsh is not water smartweed (*Persicaria amphibia*). Though patches of water smartweed do exist, the dominant species is watershield (*Brasenia schreberi*). This is of some relevance because these plants are rooted in the bed of the lake and both have limited but differing tolerance to deep water. Having some of the lake's surface remaining open in summer because of its depth affects the ecology because some duck species (lake ducks) require open water in order to gain flight.
>
> It is close to certain that there are no fish in the lake. Various reasons, including the facts that species of waterbirds that rely on fish for food are all either absent (no resident kingfishers, herons, common mergansers, etc.) or only very rare visitors for no more than one or two days per year. No fish or fish fry have ever been caught by Gabriola Streamkeepers in traps, no rises after hatching flies have even been observed, and no dead carcasses have ever reported. Complete drainage was the norm in historical times.
>
> East Path Creek is not the largest source of inflow at all times in the wet season. Later in the season, outflow from the North East wetland into the lake sometimes exceeds the flow in the creek.
>
> I do not see any discussion on the ecological value of the weirpool itself as distinct from the wetland as a whole. One difference for example is that in winter when the lake is frozen over, the weirpool tends to remain as a refuge for the waterfowl by virtue of staying ice-free on account of the movement of water through to the weir. There are occasions when the population of swans and ducks in the weirpool is greater than that in the lake . I have in the past observed breeding pairs of ducks in the weirpool, which is perhaps more sheltered from owl, eagle, and hawk predators, but not at all recently.
>
> The negative effects of the yo-yoing of the level in the lake is not addressed. The siphoning system installed by RDN that causes this does not perform any useful function. Despite severe drawdown of the water level a few days of heavy rain in the wet season very quickly restores the water levels.

The 16 species of wading birds, swans, geese and waterfowl listed as occurring within the Coats Marsh area taken from (Reference 690) omits information on how often these species are observed. Some species are so rarely seen they don't warrant inclusion in this list. A more complete source, regularly updated, is (Reference 679) which ranks them as being abundant (A); common (C); frequent (F); occasional (O); rare (R); exceptionally rare and unlikely once more common (X); local, absent elsewhere (L); not in any Gabriola species checklists (*); not in either the Coats Marsh RP nor 707 CP Management Plans (†); exotic species (+); and not seen for five years or more but possibly once more common e).
I would remove: gadwalls (possibly a mistaken ID), ruddy ducks (very rare brief transients), snowy owl (an exceptionally rare observation), belted kingfishers (very occasionally seen for brief visits when they feed on frogs. Leaving them in the list suggests to the reader there might be fish in the lake, which there aren't).

Nesting concerns should include the cavity breeders, wood dusks, hooded mergansers, and until recently, observations that occasionally a pair of buffleheads linger into late spring.

It has to be stressed that nearly all species of waterfowl that use the lake are extremely sensitive to disturbance because of the smallness of the lake and thus high visibility of human intruders.

Although there is no cause-and-effect linkage, it is striking that the number of species breeding there has declined in recent years, and that winter populations are just a fraction of what they used to be. Claims by the RDN that their staff have circumnavigated the marsh to monitor possible damage to the environment make no sense when you appreciate how easily the waterfowl residents are put to flight. I can only get good photographs of the ducks by sometimes literally crawling through the bush. Equally, insensitivity to the effect of disturbance has been demonstrated by co-owners NTBC who have flown a drone over the lake, something which ought not need to be banned but evidently does need to be.

Reference to WHA re-frogs is an error. WHA only applies to provincially-managed Crown land, not parks. Northern red-legged frogs are common both everywhere in the wetland and in the riparian areas of Coats Marsh Creek.

May 2, 2023. Staff Report to Regional Parks and Trails Select Committee (Reference 8)

Quote: Table 1: Pros and Cons – Weir decommissioning while retaining beaver dam

PROS	CONS
— This is the preferred project scenario from the Nature Trust BC. — Removes built infrastructure from the park. — Reduces operational costs associated with maintaining a regulated dam structure. — Comparatively low capital cost. — Retains the aquatic ecosystem in its present state upstream of the beaver dam. — Comparatively low site impacts from construction activities.	— Regulatory uncertainty. The province expressed willingness to accept and review this project but has not committed to approval. — Liability uncertainty. The RDN would most likely retain liability associated with keeping the beaver dam in place. — Beaver dam uncertainty. Removing the concrete weir will drain the lower pool area of the marsh, exposing the bottom slope of the beaver dam and potentially weakening it. The beaver may die or leave the marsh, resulting the beaver dam no longer being repaired or maintained. — A failure of the beaver dam may cause damage downstream to private property and infrastructure. This risk could be minimized by relocating the cabin that's located on private property within the floodplain or removing the unlicensed stack rock weir adjacent to the cabin to increase channel capacity. — A failure of the beaver dam would also drain Coats Marsh and may result in the requirement for environmental restoration work.

The last CON is a *dandy*. Surely an error. We're talking about complete destruction of the ecosystem as we know it.

Further quotes not needing comment:

"Regulatory Considerations

"The recommended weir decommissioning project will require support or approval from a number of agencies.

"The Nature Trust of British Columbia (NTBC). NTBC are co-owners of the property and have expressed support for the project.
"BC Ministry of Forests. The existing Coats Marsh weir is a provincially regulated structure and is regulated by the Water Sustainability Act and the BC Dam Safety Regulation. Operation of

the existing structure, as well as any future repair, replacement, or decommissioning work will require approval from the province.
"Environment and Climate Change Canada (ECCC). The federal Ecological Gifts Program is administered by ECCC. The park property was received in part through this program, and any changes to the environment in the park require approval from ECCC."

May 2, 2023. RDN Parks and Trails Committee Meeting, May 2, 2023 (Reference 7)

Regulatory approval having been obtained, the presented Staff Plan was adopted after some interesting discussion of the issues.

December 18, 2023. NHC report (Reference 10)

> Map orientations are confusing, north at the top OK, but east on the left? Should be on the right.
>
> Currently, the preliminary scope of dam decommissioning includes the following elements:
>
> – leaving the existing upstream beaver dam in place to maintain habitat value
> [Comment: excellent.]
>
> – removal of the existing weir and appurtenant structures, including the existing berm
> [Comment: no more weirpool and only the beaver dam remaining to prevent the marsh from being completely drained. For anyone uncertain of the extent of the drainage in the weirpool they should note that the proposed level of what would be the new sill is -2.00 m CWB. The lowest ever observed is -1.18 m on September 19, 2023, photographs of the consequence are in Reference 673zc, p.ZC573.
>
> Removing the berm appears only to be a regulatory requirement, there only to prevent it being used, or regarded, as a final resource for flood control. If the weir is rebuilt to "code" why is this cautionary measure needed. It just adds to the cost.]
>
> – construction of a grade control structure at the marsh outlet to mitigate complete drainage of the marsh, which would otherwise occur due to historical lowering of the marsh outlet channel
> [Comment: not exactly clear to me. The drainage channel running the whole east-west extent of the lake presumably down to bedrock was dredged by Bill Coats in order to reduce flooding in his pastures/hay fields. Allowing the marsh to flood by blocking Bill's ditch is no substitute for retaining the wetland as it has become. Far too shallow.]
>
> – construction of an overflow channel adjacent to the main outlet channel to better manage water levels near private property boundaries, and
> [Comment: Without apparently releasing the RDN from liability due to flooding.]
>
> – revegetation planting with native species.
> [Comment: What's to prevent the spread of reed canary grass? Reed canary grass thrives in areas that alternate between wet and dry.]

Any quantitative assessment of risk usually involves two factors, the probability of an event happening multiplied by the consequences should it happen.

I can only repeat regarding the first factor my conversation with Professor Richard Brazier of Exeter University who has been researching beaver dams in the UK since 2013 that:
"Considering the system that you refer to - which is a low energy lake system, in my opinion,

especially given the maturity of the dam, the chance of any catastrophic failure is non-existent". (Reference 6111)

The second factor is the business of the three downstream landowners on liability and its magnitude but I gather no in-depth discussions with the RDN have occurred.

A risk assessment has thus yet to be made.

January 10, 2024. NHC report (Reference 11)

Further to risk assessment, when either the probability of an event happening is low but the consequences should it happen are high, or, the probability of an event happening is high but the consequences should it happen are low, the numerical value of the overall risk (a big number multiplied by a small number) usually becomes somewhat subjective and only useful for comparative purposes.

You also need to distinguish between risk to an individual from risk to a responsible agency. (The risk of me being injured in a car accident driving from Vancouver to Whistler is very small because I hardly ever go there any more, but the risk of somebody (anybody) suffering the same misfortune is high enough for MOTI to give it a great deal of attention).

> [Comment: I don't have the qualifications to critique the NHC Risk Assessment but it does seem to focus unduly on the low-probability : high-consequence end of the spectrum. At least two of the selected references deal with catastrophic failure in steep-alpine environments (Case et al. 2003; Hillman 1998), while a third (Alan Puttock 2019) (Reference 6111) records that in the UK between 2014 and 2019 there were no catastrophic failures of beaver dams in low stream-power sites (order 1-4, like Coats Marsh).
>
> For a breach (meaning loss of a section of the dam 5 to 10 metres wide down to bedrock), the report estimates a 200-year storm peak marsh inflow of 4.54 m^3/s (4540 L/s) for 5 hours, and a flow at South Road of 21.5 m^3/s (21,500 L/s) due to dam failure.
>
> Just for reference, I've never observed more than around 600 L/s leaving the marsh when the weir was flooded. And flooding is sometimes due to rapid snow-melt rather than concentrated high rainfall.]

Final comments for 2023

I am finding it very difficult to comment in more detail on the latest proposed plan. The objectives are essentially meeting stringent provincial government standards for dam construction with limited or unexplored flexibility, and limiting RDN liability in the event of a catastrophic beaver dam failure without considering that a more realistic assessment of beaver dam stability would lessen the need for such extreme flood control measures. Little has been done to explore keeping the cost below what the liability actually is or could become.

The whole planning process that has led to this point has been done by the RDN without, as far as I know, involvement of Gabriola Island stakeholders. It's difficult for me to concentrate comment on this latest plan without implying acceptance of all prior recommendations and decisions which I had no part in making. In my view, insufficient attention has been paid to establishing an environment involving the beaver(s), but without depending on them alone to ensure the long-term survival of the marsh to at least as it was before it was drained in the mid-20^{th} century, and without having to constantly undo their dam building and re-building efforts.

And above all, I have the strong feeling that appreciation of the non-monetary and spiritual values of the marsh have not been given priority over more tangible concerns either by the RDN or its consultants. The consultants have done their commendable professional best to follow the in-my-view flawed mandate they were given and within undoubtedly time and fiscal constraints. However, "preserve and protect" is the island's governance mandate.

My obvious and unconstructive preference is Scenario 6: Just go away and leave it alone.

Nick Doe

Update for 2024

Responses received by the RDN to the public engagement or the Coats Marsh Weir Decommissioning project beginning on December 18, 2023 and ending on January 26, 2024. (References 12 and 13).

A motion that a biologist conduct a report on the ecological impacts of the decommissioning of the weir was passed at the RDN Regional Parks and Trails Committee meeting February 6, 2024 (Reference 56).

As a result of the two items it was decided to postpone implementation of the proposed plan until 2025. There would be no work on the ground at the site in 2024.

A very cogent and pertinent letter to the RDN and NTBC dated July 11, 2024 sent by Rob Brockley former President of GaLTT (Reference 680, pp. 70-71). Well worth reading.

November 26, 2024 EDI biologist report on the ecological impacts of draining the weirpool (Reference 14).

Received by the RDN Board at their November 26 meeting. This was for information only. The discussion did mention on-going land management matters, presumably involving flooding avoidance of Lot 5, the private property at the far west end of the marsh area.

The mandate of the authors did not include consideration of the proposal to drain (dewatering as the RDN puts it) the weirpool leaving draining of the whole marsh area depending on the beaver dam remaining and being maintained intact. The report states:

> EDI is not qualified to speak to the beaver dam's stability, functionality or likelihood of failure, and defers to information provided in the Beaver Dam Risk Assessment (NHC 2024) [Reference 11] for consideration and discussion.

The report adds very little new compared to the earlier report [Reference 9 and updated in Reference 10], reviewed in the April 12, 2023 section of this paper (pp.12-13).

Errors in that earlier report have not been corrected, and no comment has been made in this new report on the benefit the weirpool has in providing an open-water shelter for waterbirds when most of the remainder of the waterbody is iced over as it usually is at least once every winter.

Much of the information on fish in upper Coats Marsh Creek and the lack of fish in Coats Marsh is already well-known to GSK members. Fish were again this year observed in Coats Marsh Creek above the South Road culvert. GSK also has its own water quality (WQ) testing equipment and the WQ of the waterbody has been tested from time-to-time with no concerns.

No long-term plan is detailed in the report on how to turn the drained weirpool into a native-plant "garden" requiring virtually constant attention, as gardens do, to limit the spread of reed canary grass, which is already well established there.

All three wetlands (NE Arm, SE Arm, Canary Grass Meadow) in the catchment area of Coats Marsh Creek are almost monotypic habitat dominated by reed canary grass with infestations of thistles, tansy ragwort, and non-native agricultural grasses. Given the failure of the RDN to find the resources to control these in open upland areas in the parks, it is difficult to accept that management of the drained weirpool will fare any better.

There are some pictures of the current infestation of reed canary grass in the weirpool in Reference 673ze (Nov.27, 2024).

The report suggests adding side channels to the drainage ditch dug down to bedrock by Coats to provide more habitat for frogs. One acknowledged problem with this is that there is a danger that thinning the bedrock clay overburden will increase infiltration into the sandstone and enhance leakage through fractures beneath the berm. Another consideration is that the dominant aquatic plant in the marsh, which is watershield (*Brasenia schreberi*) not the smartweed ((*Persicaria amphibia*) in the report, is only kept in check by water of sufficient depth and this will no longer be there after drainage.

◊