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September 29, 2022

VIA EMAIL: laura.friend@nrcb.ca

Natural Resources Conservation Board
#901, 620 – 7 Avenue SW
Calgary, AB T2P 0Y8

Attention: Laura Friend

Dear Madam:

Re:	**Pigeon Lake Watershed Association – G&S Cattle Ltd.** **Response to Request for Board Review**
Application No.	**RA21045**
Location:	**NW 3-47-2 W5M**
File No:	**0156518-00001**

We represent Gloria Booth, Randy Booth and David Labutis, directly affected parties, in the above noted matter.

Pursuant to the Board's letter of September 23, 2022 and section 13(4) of the *Agricultural Operations Practices Act Administration Procedures Regulation*, please find enclosed our clients' response to the applications for review.

Sincerely,

MLT AIKINS LLP

Per: for Meaghan M. Conroy

MMC:seb
Enclosure

IN THE MATTER OF Natural Resources Conservation Board Application No. RA21045, G&S Cattle Ltd., NW 3-47-2 W5M

Response from Gloria Booth, Randy Booth, and David Labutis to the applications for review of Decision Summary RA21045

Submitted by:

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I. INTRODUCTION

Pursuant to section 13(4) of the *Agricultural Operation Practices Act Administrative Procedures Regulation*,[1] Randy Booth, Gloria Booth (the "**Booths**") and Dave Labutis ("**Labutis**") (collectively, the "**Neighbours**") submit this response to the Request for Review ("**RFR**") filed by G&S Cattle Ltd. ("**G&S**" or "**Applicant**") regarding Decision Summary RA21045 (the "**Decision**") issued by the Approval Officer on August 31, 2022, which denied Application No. RA21045 (the "**Application**").

The Application sought approval for a 4000 head confined feeding operation (the "**CFO**") located at NW ¼ 3-47-2 W5M (the "**CFO Lands**") within the County of Wetaskiwin (the "**County**"). The Neighbours are landowners within the notification radius set out in the *Agricultural Operations, Part 2 Matters Regulation*.[2] Both submitted Statements of Concern in response to the Application by the deadline of April 7, 2022.[3] As confirmed by the Decision, the Neighbours are considered directly affected parties for the purposes of the *Agricultural Operation Practices Act*[4] ("***AOPA***", or the "**Act**").[5]

The Neighbours agree with the Decision to deny the Application and submit that G&S's RFR must be denied.

The Approval Officer carefully and thoroughly considered the issues in the RFR and other issues raised by directly affected parties. He weighed the unrefuted submissions and technical information relied on by directly affected parties and methodically examined the land use planning documents and information from the County. In the end, he concluded that "the proposed CFO would pose materially negative and long-lasting effects on the community" and that it would not be an appropriate use of the land.[6] The Decision noted that this might not be case for every CFO proposed near a lake community. However, the unique context and location, the sensitivity of this particular lake, and the community investment to maintain the health of the watershed, led to the conclusion that the effects of *this* particular proposed CFO on *this* community would be unacceptable.[7] The Neighbours, one of whom is an agricultural operator, fully agree with this assessment.

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[1] *Agricultural Operation Practices Act Administrative Procedures Regulation*, Alta Reg 106/2017, s 13(4).

[2] *Agricultural Operations, Part 2 Matters Regulation*, Alta Reg 257/2001, s 5.

[3] NRCB Decision Summary RA21045 at 11; Booth Statement of Concern (April 5, 2022) **[TAB 1];** Labutis Statement of Concern. **[TAB 2]**

[4] *Agricultural Operation Practices Act*, RSA 2000, c A-7 ["*AOPA*"].

[5] NRCB Decision Summary RA21045 at 10-11.

[6] NRCB Decision Summary RA21045 at 1

[7] NRCB Decision Summary RA21045 at 38-39.

In addition, the Decision found the Application did not meet AOPA requirements, the most serious shortcoming being that the catch basin that would "pose a high risk to groundwater".[8] The RFR does not challenge this conclusion. Accordingly, the Application could not be approved even if a review were granted, so there would be no utility in granting a review.

II. Grounds to Deny G&S RFR

The Neighbours respectfully submit that there is no basis to grant the RFR because:

(a) The Approval Officer more than adequately considered all the issues raised in the RFR;

(b) The evidence supports the Approval Officer's conclusions;

(c) The arguments raised in the RFR have little merit; and

(d) There would be no utility in granting a review because the catch basin does not comply with *AOPA* standards. The Application could not be approved even if a review were granted.

III. THE NEIGHBOURS

Randy and Gloria Booth

Randy and Gloria Booth were both raised on family farms and have spent their lives in the country. In their initial Statement of Concern, dated April 5, 2022, they explained that they are not against responsible farming, but had significant concerns about having a CFO so close to their home and to Pigeon Lake. The Booths are in their mid-sixties and purchased a residential acreage on Pt-SE-3-47-2-W5M in the Pigeon Lake watershed in July 2008 "to live in a tranquil, peaceful environment"[9] as part of their long-term plans for retirement. The Booths were deliberate in choosing a property in the Pigeon Lake watershed. They explain that "[a]t Pigeon Lake, agricultural land offers the unique benefit of vistas within a close proximity to the lake. Recreational opportunities and amenities are available in close proximity and many multigeneration farmers reside on the land with predominately small to medium sized operations."[10]

The Booth's proximity to the proposed CFO is as follows:

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[8] NRCB Decision Summary RA21045 at 5-6.

[9] Booth Statement of Concern (April 5, 2022). **[TAB 1]**

[10] Booth Statement of Concern (April 5, 2022). **[TAB 1]**

Feedlot Component	Distance				
	Property Line	House	Auxiliary Building	Garden	Well
Quarter Section Pens & Catchment Basin	1020 m	1150 m	1100 m	1110 m	1149 m
Designated Area for Manure Spreading	753 m	842 m	779 m	807 m	841 m

The Booths raised a number of issues in their Statements of Concern, including but not limited to concerns regarding:

- Odors and air quality;
- Domestic water quality and safety (they rely on well-water);
- Unacceptable impacts on the sensitive Pigeon Lake watershed;
- Noncompliance of the manure storage facility to the 30m set back from a stream on the CFO property; and
- Economy – They explained that the economic health of the community is closely linked to the health of Pigeon Lake. Small businesses rely on the high recreational value of the lake.

The Booths explained:

> When the water quality (not only at our home) but at Pigeon Lake declines, including harmful algal blooms and fish kills, there will be no water activities at the Lake. We will not be able to go swimming, float boating or any other sports without the possibility of being sick.
>
> Runoff is very likely to occur from feedlot operations surfaces when rainfall or snowmelt. In proper [sic] disposal of manure also may cause runoff. Runoff from a feedlot will transport large quantities of organic matter, nutrients and pathogens and will pollute our drinking water sources and public waters and will pose a risk to fish and ducks as well as to livestock and humans.
>
> We have followed the process of the Pigeon Lake watershed's efforts to clean Pigeon Lake and applaud all of their efforts and the time they have spent trying to save this valuable resource – not only for the lake dwellers but the farmers and all of the generations to follow.
>
> We are also very worried about the health of the environmentally sensitive creeks that drain from the proposed location of the feedlot into Pigeon Lake.

In support of their concerns, the Booths' asked the Approval Officer to consider the studies and information included with the Pigeon Lake Watershed Association's ("**PLWA**") Statement of Concern, including the Pigeon Lake Watershed Management Plan ("**PLWMP**").[11]

Dave Labutis

As an agricultural operator himself, Labutis isn't opposed to all CFOs. He opposes this particular Application because of its size, location in a sensitive watershed, and the siting of the catch basin upslope from an intermittent stream which feeds into Sunset Harbour Creek, which his cattle rely on and which flows into Pigeon Lake. Labutis has a registered angus herd pasturing, which will include pasturing directly adjacent to the proposed CFO quarter section in the future.

The Labutis family was one of the first to settle and farm in the Pigeon Lake watershed. They began farming the land adjacent to the proposed CFO almost 100 years ago. For generations, the Labutis family has balanced harvesting the land with protecting it. Currently, the Labutis land consists of cultivated farmland, cattle pasture land, and forests with standing timber.

The CFO Lands are kitty-corner to one of Labutis' quarter sections (SE 3-47-2 W5M). The proximity to the proposed CFO to this parcel is as follows:

Feedlot Component	Distance		
	Property Line	House	Garden
Quarter Section Pens & Catchment Basin	387 m	1280 m	1340 m
Designated Area for Manure Spreading	0 m	935 m	785 m

Labutis' existing agricultural business will be negatively affected if the Decision is reversed. Labutis is especially concerned about the risk of contamination to surface water that his cattle rely on. He knows the health of his herd depends on them having access to clean uncontaminated water. As noted in Labutis' Statement of Concern,[12] Sunset Harbour Creek located on NE ¼ Sec 3-47-2-W5M (his father Ozzie Labutis' owns this land, that Labutis manages it) already contains high levels of phosphorus as a result of seasonal cow-calf operation established by G&S a few years ago. Labutis sampled the water on the portion of Sunset Harbour Creek that traverses his father's land in March, 2022 and found phosphorous levels were 10 to 25 times higher than the readings taken in 2013 (before the cow-calf facility was operating). This creek runs into Pigeon Lake.

[11] PLWA Statement of Concern **[TAB 16]**; PLWMP **[TAB 6]**.

[12] Labutis Statement of Concern. **[TAB 2]**

Labutis supports efforts to protect fresh water sources as essential to sustaining traditional farming operations and the health of Pigeon Lake. The Labutis Statement of Concern referenced his support for the PLWMP and watershed management efforts.

IV. Summary of Decision

On August 31, 2022, the Approval Officer issued his Decision denying G&S's Application for a CFO within the Pigeon Lake watershed. The denial was based on the proposed CFO's material, negative and long-lasting effects on the community and that "it would not be an appropriate use of the land."[13] In addition, the Application did not comply with the groundwater protection requirements set out in the *Standards and Administration Regulation* and other AOPA requirements.[14]

The Approval Officer carried out a robust assessment of over 20 issues raised in the Statements of Concern filed by directly affected parties, including:

- Odours and nuisances;
- Increased traffic;
- Groundwater usage and licensing;
- Groundwater quality;
- Surface water;
- Manure application;
- Existing cattle herd;
- Cumulative effects of area on the watershed and Pigeon Lake;
- Location in the sensitive Pigeon Lake watershed;
- Environmental Impact Assessment;
- Property values;
- Disposal of dead cattle and increase in predators;
- Notification radius;
- Health;
- Antibiotic use in cattle and impacts on the surrounding environment;
- Wildlife and fisheries;
- Effects on the community, economy, and environment;
- Climate change and greenhouse gases;
- Catch basin capacity; and
- Adverse impacts on Indigenous or traditional use.

[13] NRCB Decision Summary RA21045 at 1.

[14] NRCB Decision Summary RA21045 at 5-6.

The Approval Officer determined that the Application met the land use provisions of the County's municipal development plan ("**MDP**") making the CFO presumptively an appropriate use of land, and presumed to have acceptable effects on the community. However, the Decision found these presumptions were rebutted based on a number of factors.

G&S incorrectly characterizes the lynchpin of the Decision as being "a yes-or-no decision based on a single factor: community approval, as expressed in the PLWMP." [15] This entirely misrepresents the nature of the Decision and concerns expressed by directly affected parties. As described by the Approval Officer, "the significance, variety, and substance of the concerns expressed by the directly affected parties" rebutted the presumptions of the CFO's acceptable effects on the economy and community.[16]

Some of the factors relied on by the Approval Officer to deny the application on the basis of section 20(1)(i)(ix) include the following:

- Location of CFO lands in the Pigeon Lake watershed which is the primary source of water entering the lake;[17]
- Pigeon Lake's susceptibility to nutrient accumulation and possible overloading;[18]
- The considerable time and resources invested by "many people, groups and government" to rehabilitate the overall health of the lake;[19]
- The intention and willingness of the County to work to work with various interest groups involved in the land use planning around Pigeon Lake;[20]
- A 2018 resolution passed by Council for the County to work collaboratively to implement the PLWMP;[21]
- The County's recommendation that the Approval Officer consider the PLWMP and Pigeon Lake Area Concept Plan ("**PLACP**");[22]
- Pigeon Lake's popularity and high use of the greater area by recreational users;[23]
- The direct and adverse effect of odors and nuisances greater than what might be normally expected because of this high use.[24]

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[15] Request for Review by G&S Cattle, submitted September 22, 2022, at 4 ["G&S RFR"].
[16] NRCB Decision Summary RA21045 at 6.
[17] NRCB Decision Summary RA21045 at 28.
[18] NRCB Decision Summary RA21045 at 34-35.
[19] NRCB Decision Summary RA21045 at 35.
[20] NRCB Decision Summary RA21045 at 35.
[21] NRCB Decision Summary RA21045 at 32.
[22] NRCB Decision Summary RA21045 at 37.
[23] NRCB Decision Summary RA21045 at 6 and 30.
[24] NRCB Decision Summary RA21045 at 25.

Non-compliance with AOPA Requirements

The Application did not meet AOPA's groundwater protection requeirements and set-back requirements from existing water wells. The Decision explains that the after the Application was deemed complete and following the public comment period, the location and design of the catch basin was updated twice: on July 21, 2022 and again on August 22, 2022.[25] The August 22, 2022 redesign moved the location of the catch basin and increased its depth below ground.[26] The Approval Officer reviewed the updated drawings and determined that, if allowed, the proposed change would pose a high risk to groundwater.[27] Specifically, the Approval Officer assessed the borehole information provided in G&S's geotechnical report to determine that the sandstone layer nearest to the revised catch basin location is "very shallow" and the minimum 1 m separation from the uppermost groundwater resource would not be met.[28] The Decision concluded that due to the updated catch basin location and increased depth below ground, acceptable impacts to the environment could not be presumed.[29]

V. There is No Basis to Grant the RFR

Section 25(1) of *AOPA* governs the Natural Resources Conservation Board's ("**NRCB**" or the "**Board**") authority with respect to RFRs. The provision directs the Board to dismiss a review if the issues raised in the RFR were adequately dealt with by the Approval Officer, or if the issues in the RFR are of little merit:

> **25(1)** The Board **must**, within 10 working days of receiving an application under section 20(5), 22(4) or 23(3) and within 10 working days of the Board's determination under section 20(8) that a person or organization is a directly affected party,
>
> (a) dismiss the application for review, if in the opinion of the Board, the issues raised in the application for review were adequately dealt with by the approval officer or the issues raised are of little merit, or
>
> (b) schedule a review. [emphasis added]

The above provision is mandatory. There is no discretion to grant a review where the issues in the RFR were adequately considered by the Approval Officer or where the issues raised in the RFR are of little merit.

The onus lies on G&S cattle to demonstrate that **both** that,

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[25] NRCB Decision Summary RA21045 at 1.
[26] NRCB Decision Summary RA21045 at 5.
[27] NRCB Decision Summary RA21045 at 5.
[28] NRCB Decision Summary RA21045 at 5-6.
[29] NRCB Decision Summary RA21045 at 6.

a. the Approval Officer's Decision failed to adequately consider the issues as identified in the RFR; **and**
b. that these issues have merit.[30]

G&S does not meet either part of the legal test.

1. Approval Officer adequately considered the issues set out in the RFR

G&S does not argue that the issues raised in its RFR were inadequately considered by the Approval Officer. Rather, G&S disagrees with the outcome of the Decision. The Board does not have the authority to overturn the Decision simply because an applicant disagrees with the outcome.

Previous Board decisions indicate that often a mere mention of the specific concerns raised by directly affected parties is sufficient for an issue to be "adequately considered".[31] In this Decision, the Approval Officer more than "adequately considered" the issues and assessed them with an eye to the unique qualities of this community and this particular location.

The RFR asks this Board to grant a review on issues related to "appropriate use of land" and "community". The Approval Officer explored these issues extensively. We would point the Board to the following sections of the Decision:

- the main body of the Decision Summary (pages 1-7)
- Appendix A, Consistency with municipal development plan (pages 8-9)
- Appendix D, Concerns raised by directly affected parties, (pages 28 and 30)
- Appendix E, Responses from referral agencies (page 32)
- Appendix F, Use of land and effects on the community (pages 33-39)

2. Evidence to support the Decision

There was significant evidence before the Approval Officer to support his conclusions.

The directly affected parties provided the Approval Officer with substantial data and information from multiple sources, including scientific information, to support his conclusion that the CFO would have unacceptable effects on the community and was an inappropriate use of land. We note that the information filed by directly affected responders, including the Neighbours, went

[30] Double T Cattle Co. Ltd., Board Decision RFR 2022-08 / RA21043 (June 24, 2022), at 1.

[31] See e.g., Beumer Cattle Ltd., Board Decision RFR 2022-08 / LA10035 (December 1, 2011) at 5; Bos Dairy, Board Decision RFR 2009-01 / RA07046 (January 13, 2009) at 4.

unchallenged by the Applicant. As canvassed further below, despite having an opportunity to do so, G&S did not provide a response to any of the statements of concern in advance of the Decision being issued.[32]

A number statements of concern filed by directly affected parties relied on, and in many cases, enclosed excerpts from a variety of publicly available resources for the Approval Officer's consideration. Some of resources relied on:

1. Pigeon Lake State of the Watershed Report;[33]
2. Pigeon Lake Phosphorous Budget;[34]
3. 2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota;[35]
4. PLMWP– 2018;[36] and
5. PLACP.[37]

Many of the Approval Officer's specific conclusions regarding land use and the community are detailed in the above resources. For instance:

1. The Approval Officer's conclusion that "Pigeon Lake is a high use area of recreational value" is supported by findings in the Pigeon Lake State of the Watershed Report,[38] the 2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota[39] and the PLACP[40] confirming the popularity of and use of Pigeon Lake for recreational activities;

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[32] NRCB Decision Summary RA21045 at 25.

[33] Aquality Environmental Consulting Ltd., "Pigeon Lake State of the Watershed Report" (2008), online: https://alms.ca/wp-content/uploads/2017/11/Pigeon_SoW.pdf. ["Pigeon Lake State of the Watershed Report"] (See e.g., Statements of Concern of Deanna Klatt, Martin Klatt, Madison Klatt **[TABS 3-5]**)

[34] Alberta, "Pigeon Lake Phosphorous Budget" (2014), online: https://open.alberta.ca/dataset/3dde9aa9-a1e7-4a77-9be9-5224987ea888/resource/c5e58ede-ad4b-4f24-be27-6cf127b20eef/download/pigeonlakephosphorousbudget-mar2014a.pdf. ["Pigeon Lake Phosphorous Budget"] (See e.g., Statements of Concern of Deanna Klatt, Martin Klatt, Madison Klatt **[TABS 3-5]**)

[35] Alberta, "2013 Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota, online: https://open.alberta.ca/dataset/7b427b5d-4a64-4153-8f26-17bcf24428be/resource/1c3f3686-e932-4659-a58b-c01ab35501f0/download/2013pigeonlakewatersedimentquality-2014.pdf. ["2013 Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota"] (See e.g., Statements of Concern of Deanna Klatt, Martin Klatt, Madison Klatt **[TABS 3-5]**)

[36] Pigeon Lake Watershed Management Plan, online: https://static1.squarespace.com/static/5f08c5ea4b94b90797a861d0/t/5f23597281ffe86e03c12e1d/1596152224153/PLWMP_2018_Main_Report_20180504_MC4N.pdf ["PLWMP"] **[TAB 6]** (See e.g., Statements of Concern of Dave Labutis, Stephanie Labutis, Randy and Gloria Booth **[TABS 1, 2, 7]**)

[37] County of Wetaskiwin, Pigeon Lake Area Concept Plan, online: https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/2394/Pigeon-Lake-Watershed-Area-Concept-Plan. ["PLACP"] **[TAB 8]** (See e.g., Statements of Concern of Nicole Klatt, Terence and Barbara Wildman, Tom and Roxanne Rose **[TABS 9-11]**)

[38] Pigeon Lake State of the Watershed Report at 31-33, 40.

[39] 2013 Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota at 2.

[40] PLACP at 8-9. **[TAB 8]**

2. The Approval Officer's decision to consider the PLACP as a non-statutory plan is supported by the following statement within the PLACP: "[i]n the MDP Council identified the Pigeon Lake area as one that needs careful study and guidance so that development can continue in a sustainable manner; the PLACP addresses this need"[41]; and

3. The Approval Officer's conclusion that the proposed CFO would be "incompatible" with the way Pigeon Lake has been used due to "the small size of the watershed, the history of lake rehabilitation efforts, and the long residence time of water in the lake"[42] is supported by the Pigeon Lake Phosphorous Budget, which states "nutrients entering the lake tend to remain available within the lake for extended periods of time"[43] and "[d]espite the relatively small watershed to lake surface area ratio, total phosphorus loadings from the watershed represent a significant fraction of the overall nutrient budget indicating a need for reducing external loads to the lake"[44].

4. The history of Pigeon Lake rehabilitation efforts is documented in the PLWMP.[45]

In addition, many of the directly affected parties, including the Neighbours, referenced and adopted the PLWA Statement of Concern and/or its enclosed CFO Adverse Effects Background Report (the "**Background Report**").[46]

As outlined in the PLWA Statement of Concern, it was contacted by agricultural landowners and cottage owners to file a statement of concern including technical information to help them demonstrate the adverse effects of a CFO in the watershed as well as the community's commitment to protecting the lake and its watershed.

The Background Report summarizes the major areas that would be impacted by the proposed CFO the cause-and-effect relationship between the proposed CFO and detrimental effects on the Pigeon Lake watershed.[47] The Background Report relies on a range of data and detailed studies collected over a span of many years to support its conclusions. The studies and sources include:

- Pigeon Lake Watershed Management Plan – 2018 Appendices ("**Technical Report**");
- Water monitoring data for Sunset Harbour Creek in 2013 and 2022 demonstrating high levels of phosphorus and nitrogen;
- Satellite imagery capturing the location and intensity of Harmful Algal Blooms in Pigeon Lake;

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41 PLACP at 4. **[TAB 8]**

42 NRCB Decision Summary RA21045 at 38.

43 Pigeon Lake Phosphorous Budget at 1.

44 Pigeon Lake Phosphorous Budget at 25.

45 PLWMP at 2-5. **[TAB 6]**

46 See Statement of Concerns filed by Montana First Nation, Métis Nation of Alberta, Makenna and Jaxon Klatt, Karin and Cole Brodersen, and Randy and Gloria Booth (April 5, 2022). **[TABS 1, 12-15]**

47 PLWA Statement of Concern at 2; PLWA, CFO Adverse Effects Background Report. **[TAB 16]**

- Annual testing by Alberta Health Services identifying blue green algae and fecal bacteria as public health risks; and
- Alberta Fisheries monitoring data from 2020 showing increased risk to walleye in Pigeon Lake.

The Technical Report referred to above, summarizes, *inter alia*, riparian health assessments from 2002 and 2008,[48] runoff modelling,[49] invasive species monitoring,[50] historical climate and lake level fluctuations from 1945 to 2016,[51] lake water quality,[52] and a paleolimnological study from 2013.[53] Taken together with the additional information provided in the Background Report, these resources demonstrate that the effects of the CFO are reasonably expected to have unacceptable effects on the Pigeon Lake watershed and community.

In addition to referencing the Background Report in its Statement of Concern, the Métis Nation of Alberta ("**MNA**") provided the following resources:

- Land elevation heatmap of Pigeon Lake area overlaid with proposed CFO and manure spreading areas;[54] and
- Map of MNA Harvesting Areas.[55]

The MNA also described its specific concerns about impacts to MNA citizens who use the lake to practice their constitutionally protected Aboriginal rights to harvest. The MNA detailed how increased nutrient levels in Pigeon Lake could pose have adverse effects on their harvesting rights and health.[56] The MNA also described how its annual cultural youth camps and family camps, which create opportunities for MNA citizens to "engage in cultural practices, intergenerational knowledge transfer, and community bonding", would be adversely affected by the introduction of additional nutrients into the watershed.[57] The MNA concluded that the overall effects of the CFO would cause "significant and adverse effects on Metis rights, claims, interests, culture, physical and mental health, and economy."[58] The RFR ignores the concerns raised by the MNA and the three First Nations responders.

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[48] Pigeon Lake Watershed Management Plan 2018 - Appendices at 30-31, online: https://static1.squarespace.com/static/5f08c5ea4b94b90797a861d0/t/5f23580231b108563e69c094/1596151843960/PLWMP_2018_Appendix_2018.08.24.pdf ["Technical Report"]. **[TAB 6]**

[49] Technical Report at 26-27. **[TAB 6]**

[50] Technical Report at 32-37. **[TAB 6]**

[51] Technical Report at 38-46. **[TAB 6]**

[52] Technical Report at 46-51. **[TAB 6]**

[53] Technical Report at 52-55. **[TAB 6]**

[54] Statement of Concern of the Métis Nation of Alberta at 5. **[TAB 13]**

[55] Statement of Concern of the Métis Nation of Alberta at 17. **[TAB 13]**

[56] Statement of Concern of the Métis Nation of Alberta at 6-7. **[TAB 13]**

[57] Statement of Concern of the Métis Nation of Alberta at 8. **[TAB 13]**

[58] Statement of Concern of the Métis Nation of Alberta at 9. **[TAB 13]**

The above information provided to the Approval Officer is further supported by the attached report titled "Estimation of Pollutant Loads in Surface Water Runoff Stemming from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed", prepared by Margaret Allan, M.Eng, P.Eng., P.Geo., FGC, FEC (the "**Allan Report**")[59], and referenced in the attached correspondence from Theo Charette, biologist, and co-author of the PLWMP ("**Charette Correspondence**").[60]

On August 22, 2022, the Neighbours and the PLWA provided the Allan Report and the Charatte Correspondence to the Approval Officer. This material provides further scientific project-specific information related to their summary of issues in the Neighbours' April, 2022 Statements of Concern. The Neighbours learned through the Decision, dated August 31, 2022, that the material was not considered by the Approval Officer (NRCB Decision Summary RA21045 at 11)"

The Charette Correspondence explains:

> Pigeon Lake is a very fragile ecosystem. The area that drains into Pigeon Lake (its watershed), is only about 2 times larger than the lake itself. As a result, the average amount of time that water stays in the lake (i.e., water residence time) is over 100 years. This means that once a pollutant enters the lake, it stays there for a very long time. Any pollutants that enter the lake (e.g., herbicides, fertilizers, sediment, sewage) are not readily flushed out of the system and remain in the lake for a long time. This highlights the tremendous importance of nutrient management.[61]

He goes on: "reducing nutrient inputs from the watershed are critical to the long-term health of Pigeon Lake." Because of the long water residence time of Pigeon Lake, even small increases in nutrient inputs into the lake will compound over time and affect lake health in the long term. "[T]hrough the concerted efforts of many individuals, restoring a lake takes a long time. The goal of restoring Pigeon Lake to natural nutrient levels requires incremental efforts. Adding such a significant source of nutrients to Pigeon Lake [through the CFO] would directly counter these efforts."[62]

The Allan Report focuses in part on how the CFO's introduction would negate the efforts undertaken by the community to work collaboratively to limit nutrients within the Pigeon Lake watershed, and concludes:

> It is my expert opinion that introducing the proposed CFO will jeopardize the health and utility of Pigeon Lake because of its particular susceptibility to water quality issues such as harmful algal blooms. The

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[59] Margaret Allan, M.Eng, P.Eng., P.Geo., FGC, FEC, "Estimation of Pollutant Loads in Surface Water Runoff Stemming from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed" (September 28, 2022) ["Allan Report"]. [**Tab 17]**

[60] Correspondence from Théo Charette, M.Sc., P.Biol. to NRCB dated August 22, 2022 ["Charette Correspondence"]. **[Tab 18]**

[61] Charette Correspondence. **[Tab 18]**

[62] Charette Correspondence. **[Tab 18]**

> addition of the CFO in the watershed would essentially negate nutrient load reductions achieved by the implementation of wastewater systems and other watershed beneficial management practices promoted by the PLWA.

Using a model developed for the United States Environmental Protection Agency (US EPA) to calculate nutrient and sediment loads in runoff for feedlots and manure spreading operations, the Allan Report assesses potential nutrient loading associated with the proposed CFO. The model estimates that the Application if approved, would result in "*just through surface runoff* an additional 262 kg/yr of phosphorus, 3,033 kg/yr of nitrogen, and 4,357 kg/yr of biochemical oxygen demand (BOD). Resulting increases in surface water concentrations within Sunset Harbour Creek (which drains to Pigeon Lake) are estimated at 1.0 mg/L of phosphorus, 18.6 mg/L of nitrogen, and 25.5 mg/L of BOD; concentrations in Tide Creek (which also drains to Pigeon Lake) are estimated to increase by 0.23 mg/L of phosphorus, 0.79 mg/L of nitrogen, and 1.5 mg/L of BOD. For Sunset Harbour Creek, these additions would represent more than an order of magnitude increase over its typical nutrient concentrations."[63] It explains that "Pigeon Lake is already exhibiting limits in its ability to assimilate external nutrient loads and thus even small increases in runoff-sourced nutrients will have a significant impact."[64]

The Allan Report explains that the natural setting for the proposed CFO "has significant implications for CFO risk management"[65] as does the proximity of surface water receptors to the CFO including the tributary of Sunset Harbour Creek which she says runs "less than 30m from the proposed catch basin and 130 m from the proposed manure collection facility (not 400 m, as stated in the Application)."[66] Sunset Harbour Creek runs into Pigeon Lake.

Widespread community interest

The level of community participation in the NRCB process for this Application was notable, as was the broad consensus amongst those who filed responses. The NRCB received submissions from 388 respondents by the response deadline, representing a cross-section of the community, comprised of individuals (including farmers), summer villages, Indigenous communities, corporations and other organizations.[67] Of the close to 400 responses, only three were non-objections.[68] The 41 respondents found to be directly affected included those residing on agricultural land within the notification radius and four Indigenous communities. Of these directly affected parties, all but one asked that the Application be denied.

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63 Allan Report, at ii (emphasis original). [**Tab 17]**

64 Allan Report, at ii. [**Tab 17]**

65 Allan Report, at section 2, at 2-5. [**Tab 17]**

66 Allan Report, section 3.3, at 7. [**Tab 17]**

67 NRCB Decision Summary RA21045 at 4-5 and Appendix C.

68 NRCB Decision Summary RA21045 at 12, 21.

3. Issues raised in the RFR are of little merit

a) The Approval Officer properly complied with the applicable processes and principles

G&S argues that the Approval Officer disregarded established processes and principles. This assertion has no merit: the Approval Officer carefully followed the legislation, applicable regulations and NRCB Operational Policy 2016-7: Approvals[69] ("**Approvals Policy**").

The Act mandates the consideration of the CFO's effects on the environment, the economy and the community and the appropriate use of land.[70] The Approvals Policy explains that an officer has discretionary authority when considering effects on the environment, community and economy. Section 8.7.3 of the Policy states that presumptions for considering effects on the environment, community and economy are not intended to be definitive and may be overcome by contrary evidence provided by the municipality or directly affected parties. Specifically:

> AOPA section 20(1)(ix) requires approval officers to assess the effects of the proposed development on the environment, community and economy, and whether the development is an "appropriate use of land." These are all broadly worded, open-ended factors whose consideration could require long investigations and subjective judgement calls.
> …
> The presumptions are decision-making guides and are not meant to be definitive or unchangeable. The presumptions can be overcome by contrary evidence obtained by an approval officer, or provided by a municipality, other directly affected parties, or by referral agencies.[71]

The Approval Officer followed the Approvals Policy. He also accounted for the Board's decision in *Folsom Dairy Ltd.*, which stated that community impacts include broader considerations that take into account the "totality of the impacts, both positive and negative, on the citizens living and working in proximity of the CFO".[72]

In examining these broader considerations, the Approval Officer considered, and was entitled to consider, the submissions from directly affected parties, including technical studies they relied on in their Statements of Concern, as well as the municipal instruments referred to by the County, other municipalities and directly affected parties.[73] These submissions from directly affected parties, including the Neighbours, spoke to unacceptable impacts on the broader community, not just to impacts on themselves.

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[69] Natural Resources Conservation Board Operational Policy 2016-7: Approvals, online (pdf): https://www.nrcb.ca/public/download/files/97525 ["Approvals Policy"].
[70] *AOPA*, 20(1)(b)(ix).
[71] Approvals Policy, s 8.7.3. [emphasis added]
[72] NRCB Decision Summary RA21045 at 38.
[73] NRCB Decision Summary RA21045 at 38.

G&S's post-Decision demand for the Approval Officer to carry out more studies and hold open-houses lacks credibility. It is notable that G&S did not bother to respond to *any* of the Statements of Concern until it filed its RFR, despite having four months to do so.[74] The appropriate time to request further investigations, studies and reports, or to request the Approval Officer facilitate meetings was prior to the release of the Decision. Many of the Statements of Concern in fact called for further studies. To the best of our knowledge, G&S did not make similar requests of the Approval Officer.

The RFR complains that the Approval Officer did not weigh "the detailed technical evidence provided by G&S, against the PLWMP."[75] First, as is evident from the requests for more information on the catch basin design, it is apparent that the Approval Officer carefully reviewed G&S's technical information and found it wanting. He found G&S's technical information deficient to demonstrate that the CFO would meet AOPA's requirements. He then gave G&S two opportunities to fix the deficiencies. Second, as noted above, G&S did not respond to any submissions from the public and, to the best of our knowledge, provided no "detailed technical information" against the PLWMP. Interestingly, the G&S RFR likewise includes no technical information to counter the Decision's conclusions, the Background Report the PLWMP or the many other studies relied on by directly affected parties and listed above. The time to provide information to counter the PLWMP or the other reports was before the Approval Officer rendered the Decision. As explained by this Board, to ensure a fair and timely process, parties cannot wait for an Approval Officer's decision and then ask for a review based on issues that were not first brought before the Approval Officer for consideration.[76]

b) There was no unfairness to directly affected agricultural operators

The G&S RFR set out as one of its proposed issues that by "adopting the conclusions of the PLWMP, the Decision unfairly focuses on the concerns of unaffected parties to the exclusion of agricultural operators". This issue has no merit.

First, many of the directly affected responders who opposed the CFO are themselves agricultural operators.[77] Labutis is one of them. Notably, directly affected parties surrounding the proposed CFO were near unanimous in their opposition. Thirty-six out of thirty-seven (97%) landowners within the notification radius of the CFO Lands were opposed to the CFO.[78]

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[74] NRCB Decision Summary RA21045 at 25.

[75] G&S RFR, at 4.

[76] Double T Cattle Co. Ltd., Board Decision RFR 2022-08 / RA21043 (June 24, 2022), at 3, citing *Wyntjes*, RFR 2007-10, at 10.

[77] Eight directly affected parties who opposed the Application identified themselves as farmers or ranchers in their Statements of Concern (See Statements of Concern of Johannes and Jolanda Appelman, Deanna Klatt, Makenna and Jaxon Klatt, Nicole Klatt, Dave Labutis, Ozzie and Jennie Labutis, Lancelot and Haimie Mitchell, and Terence and Barbara Wildman). **[TABS 2, 3, 9, 10, 14, 19-21]**

[78] NRCB Decision Summary RA21045 at 11-12.

Many responders within the notification radius, including agricultural operators, referred to the PLWMP[79] and adopted the PLWA Statement of Concern and studies contained therein.[80] They expressed concern about the proposed CFO location within a sensitive watershed, the high use of the greater area for recreation, and the efforts by the community to improve the health of Pigeon Lake. The Approval Officer ultimately determined the presumptions arising from compliance with the MDP were rebutted "in large part due to the proposed location being situated within the Pigeon Lake watershed"[81] – an issue emphasized by many responders including agricultural operators. The Approval Officer noted that "the high use of the greater area by recreational users, the traditional use of the area, and the efforts put in place by the community to improve lake health, all create significant considerations related to this proposed CFO in this location, within this unique community context."[82] Agricultural operators are part of this unique community context, not separate from it.

To the extent that the RFR attempts to characterize this as a polarized battle between recreational cottage owners and farmers within the Pigeon Lake watershed, it is grossly incorrect. As evidenced by the close to 400 responses to the Application (of which only three supported the CFO) there Is widespread consensus in the community, including amongst agricultural operators both inside and outside the notice radius for the proposed CFO. There is no merit to G&S's claim that opposition was limited to non-agricultural operators, or that the Approval Officer did not consider the submissions of agricultural operators. The fact is, the majority of agricultural operators who responded to the Application sought the outcome delivered in the Decision.[83]

c) The PLWMP was one of many factors in the Approval Officer's Decision

As set out under the "Summary of Decision" section above, the PLWMP was one of many considerations that led the Approval Officer to deny the Application.

The Approval Officer reviewed the following municipal instruments:

- PLACP;[84]

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[79] See Statements of Concern filed by Randy and Gloria Booth, Deanna Klatt, Martin Klatt, Madison Klatt, Makenna and Jaxon Klatt, Nicole Klatt, Dave Labutis, Ozzie and Jennie Labutis, Stephanie Labutis, and the County of Wetaskiwin. **[TABS 1- 5, 7, 14, 20, 22]**

[80] See Statement of Concerns filed by Montana First Nation, Métis Nation of Alberta, Makenna and Jaxon Klatt, Karin and Cole Brodersen, and Randy and Gloria Booth (April 5, 2022). **[TABS 1, 12-15]**

[81] NRCB Decision Summary RA21045 at 28.

[82] NRCB Decision Summary RA21045 at 30 [emphasis added].

[83] See Statements of Concern filed by Johannes and Jolanda Appelman, Deanna Klatt, Makenna and Jaxon Klatt, Nicole Klatt, Dave Labutis, Ozzie and Jennie Labutis, Lancelot and Haimie Mitchell, and Terence and Barbara Wildman. **[TABS 2, 3, 9, 10, 14, 19-21]**

[84] NRCB Decision Summary RA21045 at 36-37.

- County of Wetaskiwin MDP;[85]
- County of Wetaskiwin Land Use Bylaw;[86] and
- North Pigeon Lake Area Structure Plan.[87]

As addressed in the Decision, an Approval Officer is not limited to looking exclusively at statutory plans when considering whether a proposed CFO would be an appropriate use of land.[88] In the Approval Officer's view, "the PLACP – like the PLWMP – demonstrates that the County is well aware of, and supports, the objectives and land use principles in the PLACP. In that sense, the PLACP is highly relevant in considering whether the proposed CFO would be an appropriate use of land."[89] Yet, the Approval Officer did not rely solely on the PLACP or the PLWMP to make a determination to deny the Application: he Approval Officer also considered the responses received from directly affected parties, Leduc County's ASP documents and the County's mandate to "protect specific lakes", including Pigeon Lake.[90]

The Approval Officer adequately considered these land use planning documents and used his discretionary authority to determine that the proposed CFO is not an appropriate use of land, as follows:

> In my view, however, this presumption of the proposed CFO being an appropriate use of land is rebutted by several planning documents provided by both Wetaskiwin County and included with some of the responses received. The principles and guidelines in various land use planning documents discourage CFOs in the lake watershed, and how these principles and guidelines were developed with the ongoing collaboration of numerous government, environmental, and municipal bodies.[91]

It is also worth noting that on July 19, 2022, Council for the County resolved to update the draft Pigeon Lake South Intermunicipal Development Plan to prohibit new and expanded CFOs within the Pigeon Lake watershed and to identify areas within the County, outside of watershed where CFOs will be given priority.[92]

The Approval Officer's conclusions were supported by the following evidence on his record:

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[85] NRCB Decision Summary RA21045 at 3, 9, 30, 33-34, 38.
[86] NRCB Decision Summary RA21045 at 7, 32.
[87] NRCB Decision Summary RA21045 at 37.
[88] NRCB Decision Summary RA21045 at 37.
[89] NRCB Decision Summary RA21045 at 37.
[90] NRCB Decision Summary RA21045 at 38.
[91] NRCB Decision Summary RA21045 at 7.
[92] County of Wetaskiwin, Council General Meeting Minutes (July 19, 2022) at 7, online: https://pub-wetaskiwincounty.escribemeetings.com/FileStream.ashx?DocumentId=27982.

- The CFO "goes against the spirit of many of the municipal statutory plans and non-statutory planning documents which were created to protect the watershed and lake from such rich laden projects as CFO's";[93]
- "All relevant statutory plans identify environmental protections as a priority and recognize the vulnerability of Pigeon Lake and its watershed";[94]
- The Application "does not comply with environmental protection goals in the County of Wetaskiwin's municipal development plan";[95] and
- "Millions of dollars have been invested by the Province of Alberta, in concert with the local municipalities and individual ratepayers, to clean up Pigeon Lake."[96]

Attempts to mischaracterize the lynchpin of the Decision as being "a yes-or-no decision based on a single factor: community approval, as expressed in the PLWMP" [97] have no merit. As are attempts characterize recommendations in the PLWMP as "generalized and unsubstantiated". The PLWMP includes detailed and specific objectives[98] and is grounded in scientific studies and data on the watershed collected over many years.[99]

d) The PLWMP represents the community interest

G&S incorrectly states the Approval Officer misrepresents the authority of the PLWMP. The Decision carefully and correctly set out the legal authority of the various municipal instruments considered, including the PLMWP.[100]

The Approval Officer's recognition of the importance of the PLWMP to the community was reasonable and supported by the evidence of widespread support of the PLWMP.

The PLWMP represents a level of collaboration and buy-in between communities that is unique to the Pigeon Lake watershed. The Application received close to 400 responses from Indigenous governments, businesses, organizations, and individuals (including many farmers), who oppose the Application. Many of these Statements of Concern cited the PLWMP[101] including the County's response.

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[93] PLWA Statement of Concern at 4. **[TAB 16]**

[94] PLWA, "CFO Adverse Effects Background Report" (April 2022) at 17. **[TAB 16]**

[95] PLWA Statement of Concern at 4. **[TAB 16]**

[96] PLWA, "CFO Adverse Effects Background Report" (April 2022) at 16. **[TAB 16]**

[97] Request for Review by G&S Cattle, submitted September 22, 2022, at 4.

[98] See PLWMP, Appendix A, Implementation Priorities. **[TAB 6]**

[99] See PLWMP at 4 and Appendix C, Technical Summary. **[TAB 6]**

[100] NRCB Decision Summary RA21045 at 37-38.

[101] Ten of the directly affected parties reference the PLWMP in their Statements of Concern (See Statements of Concern of Randy and Gloria Booth, Deanna Klatt, Martin Klatt, Madison Klatt, Makenna and Jaxon Klatt, Nicole

As explained in the material relied on by directly affected parties, including the Booths, the PLWMP is a planning instrument framed under Alberta's "Water for Life" strategy.[102] The Strategy identifies provincial water quality objectives, scales of planning, and delivery organizations. The PLWA is a Watershed Stewardship Group recognized in the Water For Life Strategy. A multi-stakeholder Steering Committee was created to develop and implement a watershed management plan for the Pigeon Lake watershed following Alberta's Guide to Watershed Management Planning.[103] The Steering Committee continues to be active, meeting nine times a year, and includes representatives from the County, the Province, and community groups[104] amongst others. The PLWMP was carefully developed over several years. Its development included significant technical studies, public consultation and direct consultation with the 12 municipalities and four First Nations that surround Pigeon Lake. It represents a regional agreement to work collaboratively on a common set of goals focused on the Pigeon Lake watershed, shorelands, lake for the benefit of the community and the regional economy that is so tied to the quality of the lake.

The County signed the PLWMP as a regional agreement alongside the eleven other municipalities in the watershed. The Council for the County and every other municipal council passed a common resolution endorsing the PLWMP and committing to integrate the plan in future planning and municipal operations. The common resolution reads:

> Council, having read and considered the Pigeon Lake Management Plan – 2018, resolves as follows:
>
> 1. To work collaboratively with other Pigeon Lake watershed municipalities, the Pigeon Lake Watershed Association and the Pigeon Lake Watershed Steering Committee to implement the Pigeon Lake Management Plan – 2018.
>
> 2. To reference and consider the recommendations of the Pigeon Lake Management Plan – 2018 in the development of new or updated Statutory Plans required under the Municipal Government Act and in the ordinary business of the municipality.[105]

In the PLWMP, the Counties of Wetaskiwin and Leduc take the lead role in initiating community action for land use and phosphorus management through agricultural operations.[106]

Klatt, Dave Labutis, Ozzie and Jennie Labutis, Stephanie Labutis, and the County of Wetaskiwin). **[TABS 1-5, 7, 9, 14, 20, 22]**

[102] Alberta, *Water for Life: Alberta's Strategy for Sustainability* (2003), online: https://open.alberta.ca/dataset/77189444-7456-47f7-944c-085272b1a79c/resource/17c41dc3-1692-4cf9-b931-2892c57a62b1/download/2003-water-life-albertas-strategy-sustainability-november-2003.pdf; Alberta, *Water for Life: A Renewal* (2008), online: https://open.alberta.ca/dataset/16e373f7-35c6-438c-8028-b9ab7e3e2fee/resource/bd7930bf-da3b-449a-8630-ef0b11dde99e/download/waterforlife-renewal-nov2008.pdf.

[103] PLWMP at 2. **[TAB 6]**

[104] PLWMP at vi. **[TAB 6]**

[105] PLWMP at iii. **[TAB 6]**

[106] PLWMP at 17. **[TAB 6]**

It is remarkable to see a consensus amongst such a broad and varied a group of stakeholders in relation to a planning document with the technical depth and implementation detail in the PLWMP. The Approval Officer recognized this and was reasonable to do so.

4. There is No Utility in Holding a Review Hearing

Regardless of the outcome of the Board's analysis pursuant to section 25(1) of *AOPA*, there would be no utility in holding a review hearing. A permit cannot be issued to the Applicant because the applied for facilities do not comply with the applicable *AOPA* requirements.

The Decision found that the Application failed to meet *AOPA* requirements, the most critical of which was due to the catch basin design's failure to meet groundwater protection requirements. G&S had two opportunities to revise the catch basin design to comply with the *Standards and Administration Regulation*.[107] As explained by the Approval Officer:

> …the proposed catch basin's new location likely does not meet the 1 m separation between the facility's naturally occurring protective layer and the uppermost groundwater resource as required in section 9 of the Standards and Administration Regulation. As such, it appears that the proposed naturally occurring protective layer now will not meet the AOPA groundwater protection requirements. This is based on the information currently available in the application… Because the 1 m separation from UGR [uppermost groundwater resource] will likely not be met, the catch basin would be considered to pose a potentially high risk to groundwater.[108]

G&S's RFR does not ask for the Approval Officer's conclusions on the catch basin to be overturned. Accordingly, pursuant to the plain wording in section 25(2) of AOPA and NRCB practice, the catch basin issue cannot be included in any review. As explained in the *Manna Farms* decision, the NRCB's is not at liberty to expand on the issues listed in an RFR:

> To allow the incursion of and adjudication of issues that were not raised in the properly filed requests for review would risk creating a situation where either the parties are not informed of the issues to which they must respond at a hearing or where the Board would be raising issues based on its own interpretation of the approval officer's decision. Neither of these results is fair, efficient, or transparent.[109]

In *Manna Farms*, as in this case, the Approval Officer concluded the CFO application fell short of the *AOPA* regulations. The application for review focused on land use considerations, but did not challenge the conclusion that the application failed to meet AOPA regulations. Because the Board cannot adjudicate issues not challenged in the RFR, it concluded that there was no utility in holding a hearing. The relief sought by the proponent – an approval of the application – was not possible in the face of an Application that does not meet the applicable regulations. As explained by the Board in *Manna Farms*:

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[107] *Standards and Administration Regulation*, Alta Reg 267/2001.

[108] NRCB Decision Summary RA21045 at 5-6.

[109] Manna Farms Ltd., December 17, 2020, Board Decision RFR 2020-11/RA20041 at 4.

> While on its own, the MDP issue may warrant consideration, even if Manna Farms were to prevail in a Board review on the MDP issue, the relief it has requested would not be available as the approval officer's decision to deny the application for failure to meet MDS was unchallenged…there is no utility in holding such a hearing as the result is irrelevant to the outcome for this applicant. Therefore, the Board declines to schedule a review hearing in this matter.[110]

In order for the NRCB to overturn the denial of the Application, the Board would need to overturn many conclusions in the Decision that are not challenged in the RFR, including, critically, that the catch basin design does not meet *AOPA* standards and would pose a high risk to groundwater.

The Neighbours are deeply concerned about the high risk of contamination of their groundwater. As discussed above, the Booths rely on well water in the quarter section next to the proposed catch basin.

The original drawings[111] included with the Application when it was posted for public comment in April, 2022 were illegible and could not be reviewed in any detail. The Applicant subsequently submitted updated and legible drawings of the CFO facility in late July, 2022[112] with a further revision and redesign of the catch basin in late August, 2022.[113] In the limited time since the Neighbours first became aware of the most recent redesign they have undertaken a preliminary review of the material.

With respect to risks to groundwater, the Neighbours concur with the conclusions of the Approval Officer: the catch basin design does not comply with the section 9 of the *Standards and Administration Regulation*,[114] with respect to a 1-meter separation between the bottom of the catch basin and the groundwater surface at the time of construction. The Neighbours are concerned about the potential for the catch basin to leak contaminants into the groundwater and affect their nearby wells.

Moving the catch basin northward puts the north side of the catch basin (with its 2.8-meter excavation depth), very close to the pens. Subsurface conditions including water table depth are detailed in the Union Street Geotechnical report[115]. Subsurface conditions under the pens are described in boreholes BH101, BH102 and BH103[116].Subsurface conditions related to the catch basin are described in boreholes BH105, BH106 and BH107[117]. The pens are located on relatively flat ground at the top of a slope which descends into a depression containing an intermittent drainage channel. The original catch basin location was positioned part way down the slope. Under

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110 Manna Farms Ltd., December 17, 2020, Board Decision RFR 2020-11/RA20041 at 5.

111 Technical Document RA21045 at 29-41.

112 Technical Document RA21045 at 42-54.

113 NRCB Decision Summary RA21045 at 5-6.

114 *Standards and Administration Regulation*, Alta Reg 267/2001.

115 Technical Document RA21045 at 60-100.

116 Technical Document RA21045 at 83-85.

117 Technical Document RA21045 at 83-85.

the pens, the three borehole logs are consistent with a less deep surficial deposit and ground water surface compared to the mid-slope catch basin boreholes. The water table surface elevation under the pens can be reasonably assessed by transposing the borehole log positions[118] onto a combination of finished surface elevations of Drawing C02 Rev4[119]; fill depth of Drawing C04 Rev4[120] in conjunction with the depth to water table from Table 3.3[121]. A preliminary engineering analysis undertaken for the Neighbours calculates that the water table elevation under the pens, as represented at BH102, exceeds by 1 meter the proposed elevation of the revised catch basin bottom elevation (903.75).[122] Due to the proximity of the catch basin to the pens in the revised design, the preliminary analysis concludes that the north side of the catch basin, with its deep excavation, will be under the influence of subsurface conditions under the pens, including a higher water table. The preliminary analysis concludes that the current revised design configuration and location of the catch basin is unlikely to be sufficiently mitigated to meet the regulatory standard. and therefore should not be approved by the NRCB.

The Neighbours also have concerns about the risk of overflow of the catch basin and its potential impacts on surface water in this ecologically unique area. These concerns are substantiated by the attached Technical Memorandum by a water resource engineer ("**McElhanney Report**") and the Allan Report.

As explained in the Reports and the information relied on by directly affected parties, the CFO Lands are in a region which sees high rain falls[123] and located over a groundwater formation with the highest potential to host aquifer systems.[124] This ecological region combined with the catch basin's location: (1) in a sensitive watershed; (2) close to an intermittent stream which drains into the watershed; and (3) upslope from this intermittent stream,[125] increases both *risk* of catch basin overflow and the *severity* of the impacts in the event of an overflow.

An analysis of the public safety hazard presented by the weather patterns in this location is set out in the McElhanney Report. The McElhanney Report calculated the runoff storage demand for the CFO and catch basin based on a recent rainfall event that occurred between June 13 and July 12,

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118 Technical Document RA21045 at 79.

119 Technical Document RA21045 at 57.

120 Technical Document RA21045 at 59.

121 Technical Document RA21045 at 64.

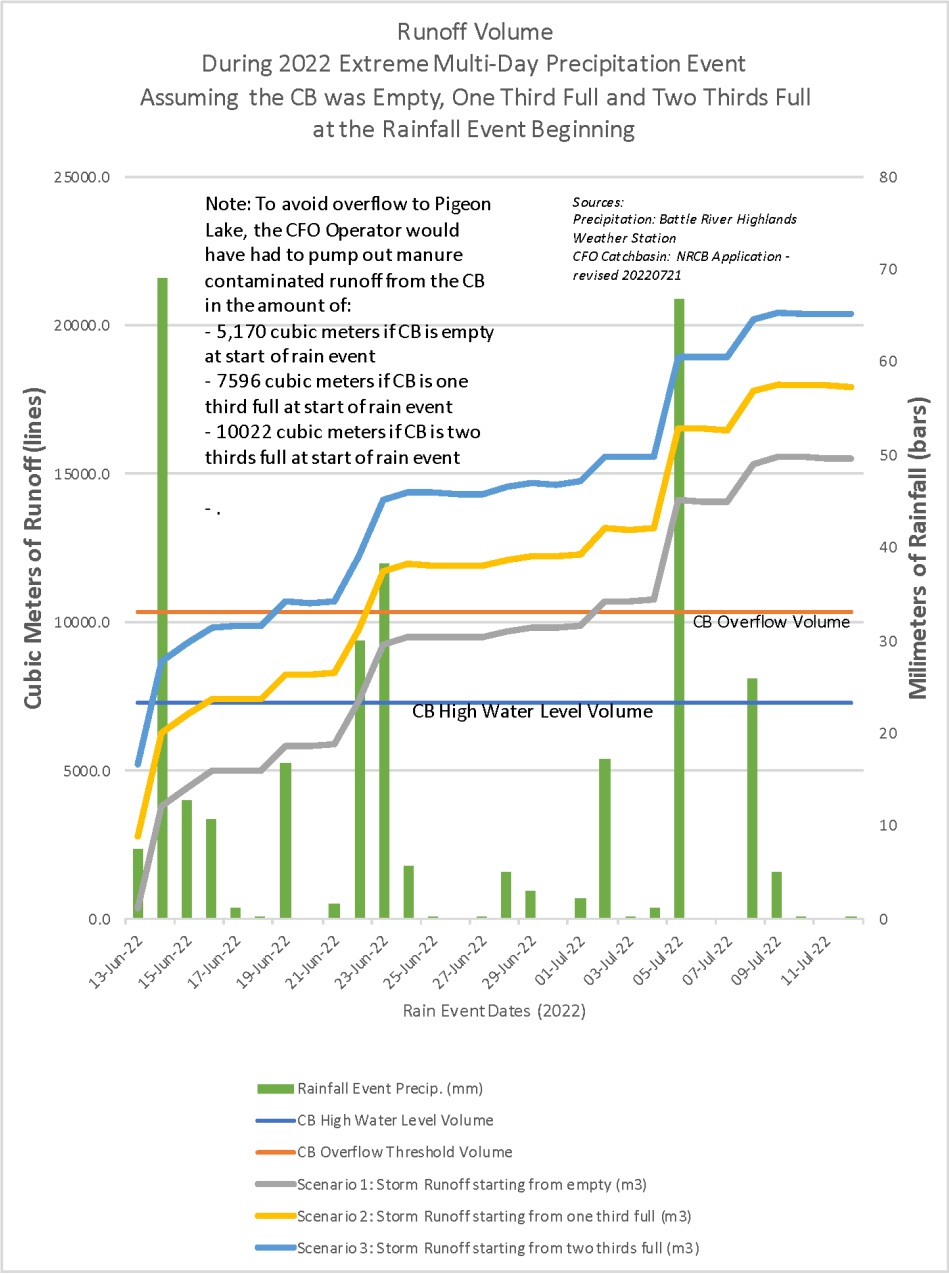
122 Drawing C03 Rev4, Technical Document RA21045 at 58.

123 Allan Report, s 2.2, at 2 **[TAB 17]**; McElhanney Technical Memorandum prepared for MLT Aikins (September 28, 2022) at 5 ["McElhanney Report"] **[TAB 23]**; Pigeon Lake State of the Watershed Report at 12; 2013 Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota at 2, 7, 48.

124 Allan Report s 2.3, at 3. **[TAB 17]**

125 Allan Report, s 4.3.3, at 13:
"The proposed CFO cattle pens and catch basin are upslope of a tributary of Sunset Harbour Creek. This watercourse is about 30 m from the catch basin and 130 m from the manure collection facility (not 400 m, as stated in the Application)." **[TAB 17]**

2022 and produced the following diagram that relates actual rainfall to runoff demand and catch basin capacity.[126]



Based on these calculations, the Neighbours learned that the catch basin capacity would quickly be overwhelmed by a multiple day rain event which, as noted above, is more typical for this site

[126] McElhanney Report, Figure 5, at 6. **[TAB 23]**

that lies in the Northern Boreal Forest EcoRegion. While the CFO operator is likely to have adequate pumping capacity, no information is provided about how the catch basin contents will be transported or safely released. The Neighbours are concerned that operator will be challenged to safely disperse such a large catch basin volume on fields during wet weather, particularly a multi-day rain event. In addition to the demands of running other aspects of the feedlot operation, the field conditions (muddy clay soil) would make it difficult to get equipment to the catch basin to truck out the effluent and then transport the liquid to fields that are being saturated by repeated rainfalls.

The risk of the catch basin overflow is significant for this location and the consequences more dire given the proximity of a watercourse downslope from the catch basin that would transport the catch basin effluent through the Neighbours' property, including the stream that Labutis' cattle rely on, and then to Pigeon Lake. The effects of effluent flowing into the watershed and lake are detailed in the Allan Report, the Charette Correspondence and the material included in the PLWA Statement of Concern, which was relied on by directly affected parties.

Furthermore, the most recent design of the embankment on the southeast corner of the catch basin[127] is vulnerable to an overtopping event. The catch basin is contained with an earthen embankment that comes to a narrow top with no means of safely releasing water without erosional forces cutting into the bank and potentially releasing even more of the catch basin effluent.[128]

It would be contrary to the public interest to issue an approval with these significant unresolved deficiencies.

5. G&S cannot submit another revised catch basin design

The Neighbours would vigorously oppose any attempt by G&S to submit yet another redesign at this stage of the application process. Accepting a material redesign of the CFO facilities at this point would circumvent the public participation process in the Act[129] and amount to a breach procedural fairness. The close to 400 people and entities who filed responses did so based on the content of the original catch basin design.

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[127] Drawing C03 Rev4, Technical Document RA21045 at 58.

[128] McElhanney Report at 3, 7. **[TAB 23]**

[129] *AOPA*, s 19, 20(1)(iii).

VI. Conclusion

The Booths and Labutis are directly affected parties who support the decision of the Approval Officer to deny the Application. The Approval Officer executed a process consistent with *AOPA*, its regulations, and NRCB policy.

The Board must reject G&S's RFR on the basis that 1) the Approval Officer adequately addressed the issues raised in the RFR, 2) the issue set out therein have little merit, and 3) the relief requested by G&S is unavailable, because G&S failed to challenge the Approval Officer's finding that the catch basin design does not clearly meet the *AOPA* groundwater protection requirements.

In the event that the NRCB decides to grant a review, the Neighbours support the RFRs and requests for directly affected party status filed by the Summer Villages of Grandview, Poplar Bay, Crystal Springs, Norris Beach, and Ma-Me-O Beach.

The Neighbours thank the Board for the opportunity to make submissions. Further, they wish to express appreciation to other directly affected families, the PLWA and community members, including the First Nations and Metis Nation of Alberta, whose contributions to these submissions facilitate the preservation of the land and watershed as a community.

All of which is respectfully submitted.

DATED at Edmonton, Alberta, this 29th day of September, 2022

MLT Aikins LLP
Per:

Meaghan M. Conroy / Teresa D. Holmes
Legal Counsel for Randy Booth, Gloria Booth and Dave Labutis

APPENDICES TO WRITTEN SUBMISSIONS

TAB	MATERIALS
1.	Randy and Gloria Booth - Statements of Concern
2.	Dave Labutis – Statements of Concern
3.	Deanna Klatt – Statements of Concern
4.	Martin Klatt – Statements of Concern
5.	Madison Klatt – Statements of Concern
6.	Pigeon Lake Watershed Management Plan – 2018 and Appendices
7.	Stephanie Labutis – Statements of Concern
8.	Pigeon Lake Area Concept Plan
9.	Nicole Klatt – Statements of Concern
10.	Terence and Barbara Wildman – Statement of Concern
11.	Tom and Roxanne Rose – Statement of Concern
12.	Montana First Nation – Statement of Concern
13.	Métis Nation of Alberta – Statement of Concern
14.	Makenna and Jaxon Klatt – Statement of Concern
15.	Karin and Cole Brodersen – Statement of Concern
16.	Pigeon Lake Watershed Association – Statement of Concern and CFO Adverse Effects Background Report
17.	Margaret Allan, M.Eng, P.Eng., P.Geo., FGC, FEC, "Estimation of Pollutant Loads in Surface Water Runoff Stemming from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed" (September 28, 2022)

18.	**Correspondence from Théo Charette, M.Sc., P.Biol. to NRCB dated August 22, 2022**
19.	**Johannes and Jolanda Appelman– Statement of Concern**
20.	**Ozzie and Jennie Labutis – Statements of Concern**
21.	**Lancelot and Haimie Mitchell – Statement of Concern**
22.	**County of Wetaskiwin Correspondence**
23.	**Technical Memo Drainage Review Report (September 29, 2022)**

TAB 1

STATEMENT OF CONCERN

For directly affected property owners near Pigeon Lake

Re: Natural Resources Conservation Board Application RA21045 – Confined Feeding Operation, Greg Thalen and G&S Cattle Ltd.

CFO Location: NW 3-47-2 W5M, Wetaskiwin County

Filer Information

Name (s): Randy and Gloria Booth

Municipal or Rural Address:
Legal Land Description: [redacted]

Mailing Address: [redacted]

Phone: [redacted]

Email: [redacted] or [redacted]

STATEMENT OF CONCERN

The Confined Feeding Operation, Application RA21045, **should be declined**

Response from a Directly Affected Party

Our Background:

We were both raised on family farms, have owned a farm and have chosen to spend our lives in the country. We are not against farming in a responsible manner: however, we do not agree with having a feedlot so close to our home and a lake. We have never been approached by the landowner in question, about our concerns or to even have a discussion on the proposal.

Our family purchased land in the pigeon lake watershed in July 2008, to live in a tranquil, peaceful environment. We enjoy listening to the birds, having fires, weiner roasts and BBQ'ing with friends and family. Also, this was an investment for our retirement.

When we purchased this property, we had lived at Wizard Lake for over 10 years but this was our dream property to retire and enjoy our twilight years.

With our property being in the Watershed area we never dreamed we would be facing this crisis in our retirement years.

For 14 years, since we purchased this property, we have worked (myself, my husband and our son) in the City of Edmonton. We have driven at least an hour one way to go to work, extensive mileage on vehicles, driven through snow and sleet with the end game always being to retire on the property we love.

We live on our acreage full time and have invested hundreds of thousands of dollars to improve our house, barn and our property. This does not include the labour of love hours to complete all of these renovations and upgrades.

When we purchased this acreage the cows in our neighbour's field would roam almost to our house. With co-operation from our neighbour, we fenced our property to solve these problems. This is what neighbours do.

At the current time, we are having issues being in our yard due to the smell of the cows that are already at the operation in question. When the prevailing north westerly winds are blowing, we cannot be outside due to the smell.

We are also questioning whether the operation at the current time is following the rules and regulations they should be.

We are **directly affected** due to the close proximity of this operation. Please look at the location of our property (the white dot on RR22 just north of RG RD 470) as we are **DIRECTLY AFFECTED**.

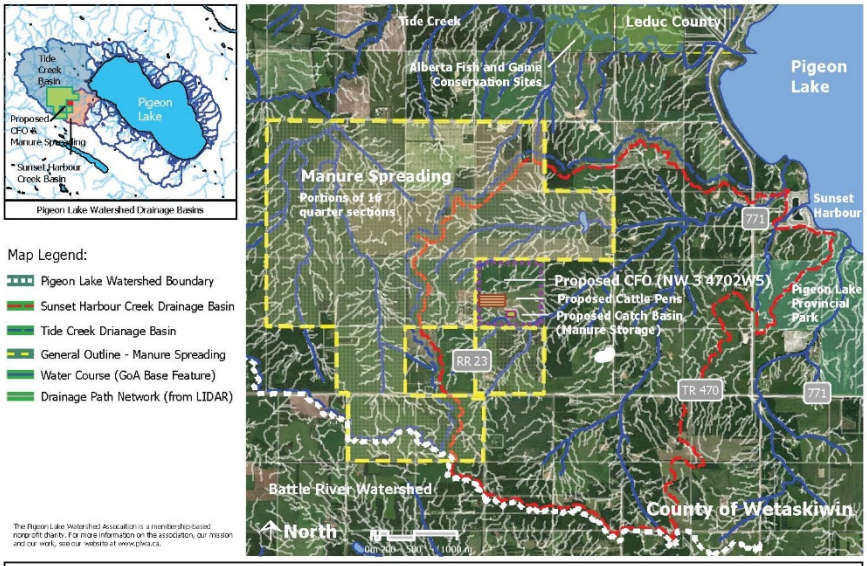

Figure 1
Pigeon Lake Watershed Sub Basin Context
Proposed Confined Feeding Operation

CONCERNS:

1. Health and Safety – Water quality (E-Coli, salmonella, also viruses and parasites in the water). We have 2 wells on our property that if these are affected, we would have to haul water to live and at a considerable expense.

2. Air quality – 2 members of our family have asthma, with very little problems for the past 14 years. However, the approval of this feedlot, will impact the health of our family severely.

3. Property Value – If this feedlot is approved our property value will be decreased immensely, and all the years of sacrifice to create our retirement lifestyle is for naught.

4. Coyotes – The number of coyotes has increased since the landowner in question purchased the property in our area. This is a threat to our pets, and also ourselves when we are out walking or working in the yard.

5. Traffic – We have already noticed an increase in traffic on RG RD 470 past our property. This will lead to road destruction also, and currently the roads around Pigeon Lake do not need any further destruction as they are almost impassable at the current time.

    a. All road bans are in effect between March 1st and June 1st. Who is monitoring the vehicle traffic that may be an overweight at the current time, with their current operation? This will only be an increased problem in the future with more truck traffic. As they will hauling feed, livestock and waste in greater quantities.

6. We also support the local businesses at Pigeon Lake. However, if this is approved many businesses will close and move elsewhere if the recreational value of the lake is destroyed. Tourism will suffer greatly.

7. When the water quality (not only at our home) but at Pigeon Lake declines, including harmful algal blooms and fish kills, there will be no water activities at the Lake. We will not be able to go swimming, float boating or any other sports without the possibility of being sick.

8. Runoff is very likely to occur from feedlot operations surfaces when rainfall or snowmelt. In proper disposal of manure also may cause runoff. Runoff from a feedlot will transport large quantities of organic matter, nutrients and pathogens and will pollute our drinking water sources and public waters and will pose a risk to fish and ducks as well as to livestock and humans.

9. We have followed the process of the Pigeon Lake Watershed's efforts to clean Pigeon Lake and applaud all of their efforts and the time they have spent trying to save this valuable resource – not only for the lake dwellers but the farmers and all of the generations to follow.

10. We are also very worried about the health of the environmentally sensitive creeks that drain from the proposed location of the feedlot into Pigeon Lake.

11. This proposal also contravenes the following development policies:

    a. **The Pigeon Lake Watershed Management Plan** – recognizes that CFO's have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, **Objective 2e** from the Plan states there should be **NO** CFO's within the watershed.
    b. **County of Wetaskiwin Plans** – recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. In **Section 5.5** policies are presented to guide the County when evaluating a proposal to develop land in the watershed. The pertinent policy under the heading Agriculture, in the area structure plan, is clear in recognizing that CFOs should **not** be in the watershed. **Section 5.5.2 Agriculture** – Large-scale confined operations are not appropriate in the Pigeon Lake Watershed.
        i. The County's Land Use Bylaw – **Section 9.6.10** – "An existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."
        ii. The County's Municipal Development Plan also provides direction over the concern of the environment. **Section 3** – Protecting the environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.
    c. Natural Resources Conservation Plan – The **NRCB** has an obligation which is well defined to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to consider factors which will degrade Pigeon Lake and the community surrounding Pigeon Lake will place responsibility both legally and morally on the NRCB and they will be held accountable.

12. The process this application has been through is a very real concern to the landowners surrounding this feedlot. We feel we have **not** had adequate time to review and research this application. No public meetings have been scheduled to discuss any of our concerns or questions. We feel that this is being pushed down our throats and that we have no say in our lives. Because the letter was only sent to landowners within 1.5 miles of this proposal and we were given less than one month notice – brings up the valid concerns of:
    1. What is going on behind the scenes that you do not want us to be aware of?
        a. This is a very valid transparency issue
    2. Why would this not be sent to everyone around Pigeon Lake who this may affect in years to come.
13. This application does not meet the requirements that states a minimum setback of 30M from a stream from a manure storage facility.
14. Legislation requires the approval process must consider the environmental impacts this CFO will have on Pigeon Lake and the surrounding areas affected. Stream analysis evidence already shows there is a significantly high nutrient runoff occurring from this area.

15. The County of Wetaskiwin's Municipal Development Plan specifies manure spreading may not be done within 2.4 km of a named lake (Pigeon Lake). The measured distance from SE10-47-2 W5M a quarter which is designed for manure spreading is 1.66 Km. This application does not comply with these requirements and should be **denied.**
16. We are also concerned about the Wildlife Refuge that is directly north of our property on RG RD 22. The impact of this feedlot will also push our native wildlife away their habitant that they rely on to live.
17. This application has turned neighbours against neighbours and family members against family members.
18. I would also like to know if the 4000 head are in addition to the cattle that are already on the property in question.

Cumulative effect

The application does not reference the current operation and condition of the land, which is relevant for an impact assessment. A large number of cattle and feed transport trucks, manure haulers, and other large vehicles move on and off the property suggesting a large-scale operation is already run on the property. The decision should account for the current condition of the property such as the streams, fields, increased number of predatory animals, water use, and use of public roads to accurately determine the impact of intensifying operations in this location.

Sunset Harbour Creek: This creek is located next to the proposed manure catchment basin. It is not effectively represented in the application. Set back information that is provided should be reviewed carefully. The creek is an environmentally sensitive area. An accurate representation and assessment of the set back is required. The state of the water quality, as a result of the current operation must be assessed. Considering the cumulative effects, the impact of heavy rain and diversion rights should be addressed in the risk assessment.

Inaccurate representation of the drainage basin: The application indicates the land is in the South Saskatchewan Watershed. Pigeon Lake is a sub watershed of the Battle River Watershed and joins with the North Saskatchewan River in Saskatchewan. While this may have been an administrative error on the application, drainage considerations in Pigeon Lake watershed are significant in this application.

Water well Information**:** The proposed CFO application does not address water diversion based on the requirements of the Water Act. The water need is not defined. Is the water use for a 4000 head operation or the cumulative demand?
Under the water act, testing must be completed to identify the draw from an operation of the proposed size. Without accurate information on the water access, calculated against accurate information about the intensity of the operation, me and my neighbours do not have documentation as a legally binding assurance that water access (quality and quantity) will not be compromised.

Coyotes, ravines and flies: As a neighbour, we have observed an increase in the number of coyotes and ravines that are in the area. The coyotes and the ravine's movements suggest they are attracted to the property. We already must be vigilant with our animals because they are at

greater risk of attack from the coyotes. Flies are becoming a more significant issue as well. Intensification on the land and a confined feeding operation in particular will only compound the current problem.

Odour and airborne disease: With the current operation, there are days when our windows have to remain closed because the smell is so strong. Manure from a new CFO, spread over 16-acre, will compound the frequency and intensity of the existing odour problem. In light of the pandemic, airborne pathogens also raise concerns for my family and the neighbours.

Agricultural land in a small watershed: At Pigeon Lake, agricultural land offers the unique benefit of vistas within a close proximity to the lake. Recreational opportunities and amenities are available in close proximity and many multigeneration farmers reside on the land with predominately small to medium sized operations. Spreading manure from a confined feeding operation around Tide Creek and Sunset Harbour creek introduces a new risk that pollutants such as growth promoters, antibiotics, nitrogen and phosphorus that will adversely impact our personal health and will also contribute nutrient runoff in the lake that will lead to harmful algal blooms in Pigeon Lake.

Property Value If this operation is allowed to proceed, the odour, and increased risk from predatory is enough to dimmish the value of our family's property. In addition, the economic health of the community is closely linked to the health of Pigeon Lake. If the lake is not healthy, our property values will drop.

The County of Wetaskiwin's, Municipal Development Plan states "The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment." P 3. In doing so this land use plan reinforces that it supports a high quality of life for residents. It supports economic growth and development but only if it is appropriate to the location and so long as there is no negative impact on air, natural resources, water or soil quality.

Pigeon Lake Watershed Management Plan was adopted as a guide to help reduce the number of algal blooms in Pigeon Lake. The Plan calls for a net reduction in nutrient runoff into Pigeon Lake and states that statutory land use restriction on new or expanded intensive livestock operations (including CFOs), are supported.

Please consider in your decision the CFO Adverse Effects Background Report and Statement of Concern from the Pigeon Lake Watershed Association.

Also please consider the Statement of Concern from the Summer Village of Grandview.

As a family, we have taken care of the resources provided by the land and the water to run effective operations and to enjoy what we have.

Also, if this application is approved, we will be seeking damages in excess of $600,000, for the destruction of our investment in our retirement and our quality of life. We will also be encouraging our neighbours to seek damages. We will be naming all parties that have requested and/or approved this application including the County of Wetaskiwin.

Please do not approve application RA21045.

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From: Gloria Booth [redacted]
Sent: Thursday, April 7, 2022 10:42 AM
To: Nathan Shirley
Subject: DIRECTLY AFFECTED RE: ra21045 (2nd submission)

Filer information:

Name: Gloria Booth
Legal land description: [redacted]
Mailing Address: [redacted]

Phone: [redacted]
Email: [redacted]

Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you Nathan, the NRCB board and Albert Environment Water Officers,

I am writing today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr. Shirley. The soil nutrient load is over capacity.

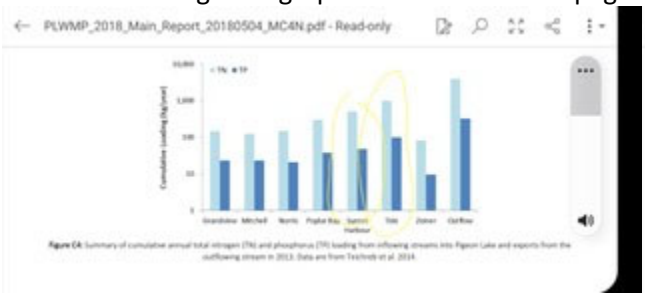
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

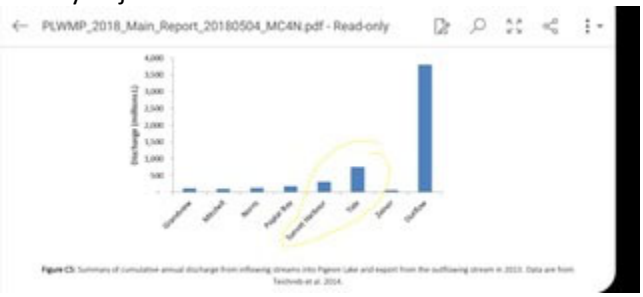
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.





The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents April 6, 2022 brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. Also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning. Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment suspend and cancel the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Respectfully,

Gloria Booth

The various management plans, concepts, and bylaws in effect for the County of Wetaskiwin from 2010 -2021, consistently support desires, intentions and guidelines for land use within the Pigeon Lake.

From the first planning document in *2010 The Municipal Development Plan, or MDP*, is an important planning and decision-making tool that outlines direction and strategies that inform how the County will, look, feel, and grow in the future. Throughout this document, it is stated a main focus to 1) protect the environment 2) reduce conflict with CFOs and other residents 3) preserve agriculture land.

The existing and application of expanding CFO conflicts with all 3 of these focuses and guiding principles. Currently, the significant current contamination from the existing CFO is polluting agriculture land, the environment and major conflicts with a huge number of residents.

An arbitrary buffer around the Lake watershed preventing CFOs from close proximity supports that the county knew and didn't intend to have CFOs near the waterbody. At the time, more study and assessments on the appropriate buffer size needed to be done to ensure it was effective. The *2010* ***Municipal Development Plan sections 4.2.1 and 4.2.2*** **give power and supreme relevance to decisions made around the lake to specified Lake Management plans.** This means all the Watershed Management Plans supersede the *Municipal Development Plans* or any technical conflicts with its supporting Land Use Bylaw. The MDP triggered an Environmental assessment.

In 2014 the county completed a several years environmental assessment and formed a guiding planning document specific to Pigeon Lake. The *2014 Pigeon Lake Watershed Area Concept Plan* concluded the buffer around the lake preventing CFOs needed to extend to the entirety of the watershed. This is in section 5. 5.2. A map specifically showing the current CFOs location is not suitable for a CFO and included it in the buffer.

Throughout the entire document the importance of protecting the lake, its tributaries and the surrounding riparian zones are used as priority 1 in decision-making. This document shows clearly the counties intent to not have a CFO here.

The *2018 Pigeon Lake Watershed Management Plan* surpasses all other guiding plans as it is the most scientific, undisputable and a consorted effort of 12 municipalities that share the watershed. This planning document makes clear intentions of all counties and should weigh the heaviest with NRCB decision-making. It has won an Emerald Award. The top 5 objectives of this plan are all violated by the CFO. The CFO is also the major contributor to pollution in the lake and is undermining all efforts of all 12 counties to help the lake recover. Nobody has turned off the taps on the pollution. This proposal implies we would only open the taps further. What is so damming in this guiding document is that it clearly graphs the agreed intention and first priority all counties, which is topping the contamination. The report also documents the the contamination values from the CFO.

Most recently is the *2021 North Pigeon Lake IDP,* a bylaw that again indicates its desire to not have a CFO in the watershed.

The current *Land use bylaws* states it doesn't have jurisdiction. That is not an approval or intent. They bylaw does still weigh heavy on environmental protection. The smaller scale operations the county does have control over are included in a buffer zone from the lake and homes which does reflect an intent or desire to reduce conflicts with other residents and the environment. This document, which is an enforcement not a guiding decision document, doesn't have much of a statement on CFOs and should

be weighted least in the NRCBs decision. Section 9.6.10 has An unscientific setback of 2.4km for manure handling and storage was proposed in 2017 and didn't make it until 2019. It is outdated with the current guiding documents and particularly to this CFO is nil as section 9.6.7 over rides it regarding approval or decision making. The existing CFO is polluting the lake.

The uprising of stressed and frustrated residents the volume of complaints lodged to 100s of political representatives, online and in person forums talk of civil action and healthrisks causing human death is a massive indicator this is not what the county of Wetaskiwin wanted.

Below, I have included a various dump of sections from the various guiding management documents stated above that support the immediate denial of this application and cancelation of the existing CFO.

2010 Development Plan

Statement of Purpose

"The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment."

The statement above was developed by the Strategic Planning Committee based on public input and issues raised by County staff.

Development and land use decisions will be guided by the Statement of Purpose. Land use planning requires a balancing between the rights of an individual landowner and the long term greater public interest. The County will try to avoid negative impact to environment and inefficient use of natural resources when making decisions.

The Plan's Statement of Purpose reflects on the County's overall Vision:

- Strong Proactive Leadership
- Safe Progressive Communities

In addition, the County encourages all development initiatives, including new area structure plans, in all areas of the County to take into account regional and Intermunicipal plans, including regional plan for North Saskatchewan Plan Region, as identified in the Province of Alberta's Land-use Framework.

The County believes its planning direction, as summarized in the previous Municipal Development Plan's goals below, is still supported by the residents.

1. To maintain a clean environment - to support development so long as there is no negative impact on air, natural resources, water or soil quality;
2. To support and encourage economic growth and development- to support growth and development in appropriate locations while avoiding inefficient use of natural resources such as coal, oil, natural gas and gravel; and
3. To support a high quality life - to weigh the needs of individuals in relation to the greater public interest.

3 Environmental Protection

Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

Although there are concerns over the negative impact of resource industries, the oil and gas activities are regulated by the Province and outside of the County's jurisdiction.

Objective 3.1 Protect environmentally sensitive areas of the County

Maintaining proper distance from environmentally sensitive areas will protect the County residents from potential damage as well as ecological integrity of the area. A professionally prepared report determines the environmental value or the geotechnical integrity of the land and identifies appropriate impact mitigation measures. While it would initially add to the cost of development, this is an important component that would ultimately benefit the County and future residents of the development.

3.1.1 Prior to the approval of a rezoning, subdivision and/or development application, the developer may be required to prepare environmental reports such as biophysical report, slope stability report, or environmental site assessment, prepared by a qualified professional:

a) near environmentally sensitive areas such as lakes, water courses, steep slopes, flood plains, or protected species habitat; or

b) on land with potential contamination from the previous or adjacent uses.

3.1.2 The environmental report for the purpose of the above policies should address:

a) the suitability of the site for proposed development;

b) the impact on wildlife and plant species habitats; and

c) conservation or mitigation measure recommendations.

3.1.3 Natural areas, including creeks, natural drainage channels, ponds, ravines, springs, and wetlands should be dedicated as environmental reserves, in accordance with the Act, Provincial Guidelines, or as recommended by a professional report.

3.1.4 The owner of the land adjacent to an environmental reserve must act responsibly to ensure these reserves remain natural.

3.1.5 When a significant area of environmental reserve is dedicated, Council will consider reducing the municipal reserve contribution.

3.1.6 Council may consider proposals from ratepayers or public groups for the maintenance and protection of reserve land.

3.1.7 The County may use other conservation tools such as environmental reserve easements, conservation easements and restricted covenants to achieve the purpose stated in 3.1.3.

Municipal Development Plan
County of Wetaskiwin No. 10

3.1.8 Where County jurisdiction applies, the restoration of environmentally sensitive areas shall occur by natural means or be restored by a third party where a third party has caused an unauthorised change.

Objective 3.2 Prevent water contamination of lakes in the County

Water quality of lakes in the County is a concern for the residents, as well as for visitors who use the lakes for recreation. Of particular concern is the development around Pigeon Lake and Buck Lake where residential development pressure is high. Domestic waste water can be a significant risk to water contamination, especially when the private sewage systems are not properly operated. Sewage near major lakes should be collected in a piped system or held in cisterns and transported and treated at Municipally and Provincially approved facilities.

3.2.1 Development near lakes must comply with the Requirement for Sewer Service Policy #6611 to prevent the contamination of lake water from domestic waste water.

3.2.2 New development is required to prepare and construct sewer collection systems compatible with a regional sewer treatment system (existing or planned) and in

Objective 3.2 Prevent water contamination of lakes in the County

Water quality of lakes in the County is a concern for the residents, as well as for visitors who use the lakes for recreation. Of particular concern is the development around Pigeon Lake and Buck Lake where residential development pressure is high. Domestic waste water can be a significant risk to water contamination, especially when the private sewage systems are not properly operated. Sewage near major lakes should be collected in a piped system or held in cisterns and transported and treated at Municipally and Provincially approved lagoons.

3.2.1 Development near lakes must comply with the Requirement for Sewer Service Policy #6611 to prevent the contamination of lake water from domestic waste water.

3.2.2 New development is required to prepare and construct sewer collection systems compatible with a regional sewer treatment system (existing or planned) and in accordance with Sewer Policy #6611.

3.2.3 Existing development may also be required to have sewer collection systems compatible with a regional sewer treatment system if access to a transmission line exists or is planned to be near the existing development.

Objective 3.3 Protect ground water supplies for current and future residents

The County requires proof of sufficient potable water supply prior to approving new development. Recently completed Regional Groundwater Assessment recommends a well water level monitoring program in order to properly assess the perceived water level decline[6].

3.3.1 For a new multi-lot residential development without Municipal water service, a ground water analysis and pump test is required at the developer's expense to prove the sufficient water supply is available, in accordance with Policy #6606.

3.3.2 Each new multi-lot residential development without municipal water service must provide its own water supply on-site. Trucking water into the site is not a viable option and development applications with such concept may not be accepted.

3.3.3 Both surface and ground water supplies must not be over-committed to accommodate one proposed development over another. The approval of individual development must carefully consider the cumulative effect.

3.3.4 A well water monitoring program may be initiated in consultation with Alberta Environment.

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6 Regional Groundwater Assessment; Parts of Tp044 to 048, R22 to 28, W4M & Tp045 to 047, R01 to 07, W5M; Groundwater Consulting Environmental Sciences, Hydrogeological Consultants Ltd; 2008

3.3.5 Where there is potential for a municipal water service, new development must plan for future water pipelines (i.e. reserving the pipeline right of way)

Objective 3.4 Storm water is maintained to protect natural drainage pattern

Where possible, and subject to Provincial and Federal policies and regulations, the County will require all new development which may affect or to be affected by existing surface and storm water resources to enhance and protect the quality of water courses.

3.4.1 All watercourses must be protected from negative impact of development and should the damage occur, they must be restored.

3.4.2 Appropriate storm water management design is required to prevent flooding and contamination of the nearby water bodies by conserving and/or regulating the run-off and snow melt.

3.4.3 Where appropriate, development shall incorporate natural drainage course or natural water features, such as bio swales or ditches, for storm water management as opposed to installing piped systems.

3.4.4 Both surface and ground water supplies should not be over-committed to one proposed development over another.

Objective 3.5 Retain existing tree-cover

Tree-covered land near the major lakes, rivers and streams has an important role to protect and filter the water. The County has been encouraging land owners near water courses and water bodies to maintain the existing tree cover through several conservation districts.

3.5.5 Environmental Reserves must remain their natural state.

4 Lakes

Lakes in the County are recognized as a great asset by residents and attract many visitors. Activities around the lakes and development of the lakeshore land have increased.

There are Provincial and Municipal regulations to prevent water contamination from sewage discharge entering the lake while Provincial and Federal regulations control the recreational

use of the lakes. The County will continue to work with Provincial and Federal governments to bring regional solutions for sewage collection and treatment systems.

Buck Lake Management Plan (2002), Pigeon Lake Watershed Management Plan (2000) and Wizard Lake Management Plan (2000) were prepared for the County. These plans provide general guidelines for development around the lakes.

Objective 4.1 Lakes in the County are categorized according to their respective primary roles

The lakes in the County are categorized according to the intensity of the intended use of each lake.

4.1.1 The types of lakes are established as follows:

Type 1: Development – These lakes accommodate various lake shore recreational and residential development.

Type 2: Low-impact Development – These lakes accommodate low impact and small scale development on the lakeshore. These lakes are suitable for wildlife habitat and wilderness conservation.

Type 3: Protection – Lakeshore development is not allowed due to various constraints such as access, size, depth, surrounding land uses.

4.1.2 County's named lakes are categorized as follows:

Type 1: Development – Buck Lake, and Pigeon Lake

Type 2: Low-impact Development – Battle Lake, Bearhills Lake, Town Lake, and Wizard Lake

Type 3: Protection – Bittern Lake, Bloomfield Lake, Coal Lake, Eyot Lake, Labyrinth Lake, Long Lake, Red Deer Lake, Samson Lake, Twin Lakes, and Watelet Lakes

Objective 4.2 Lakes in the County are well managed according to their respective primary roles as established

While activities on the lake are controlled through Provincial regulations, land use regulations could still effectively control the activities on the lake. For example, prohibiting the development of a boat-launch can limit the excessive motor boat use.

For the purpose of this objective, lake shore land is defined as 0.8 km (1/2 mile) from the bed and shore of the lake.

4.2.1 The County may consider updating existing lake management plans for Pigeon Lake and Wizard Lake, in consultation with Leduc County and the Summer Villages.

4.2.2 Maintain communication and cooperation with surrounding municipalities for any statutory or non-statutory plan preparation concerning the lakes in the County that borders on other municipalities.

4.2.3 Development around all lakes including Buck Lake and Pigeon Lake should follow Policy #6611 for sewer systems.

to support the relaxation of the setback and such relaxation is supported by the Province.

5 Industrial

Oil and gas and other industrial activities are also present in the County. While agriculture is the primary industry of the County, there are areas where rural-oriented industrial uses that benefit from the exposure to highway traffic may be developed in the County.

Protecting the County residents from environmental pollution or contamination, or any other negative effects from industrial activities is a fundamental role of the municipality.

Objective 5.1 Follow the existing County policy direction for industrial development

The County is a partner of the Joint Economic Development Initiative (JEDI) with the Town of Millet and the City of Wetaskiwin.

5.1.1 The industrial and commercial development in the County should compliment the JEDI agreement with partner municipalities.

5.1.2 Industrial and highway commercial development may be developed in accordance with Commercial and Industrial Development in the Highway 2 Corridor Policy #6612. The area is shown in Figure 2.

Objective 5.2 The negative impact from industrial development and resource extraction activity is minimized

Appropriate locations for industrial use vary by the type of the industry, surrounding land use, and the impact from the proposed development. The County will review each development application to avoid adverse effects from the proposed industrial use.

5.2.1 The County will continue to rely on the referral process with respect to sour gas facilities.

5.2.2 Industrial development is encouraged to locate in or adjacent to hamlets where such land use is compatible with an urban area.

5.2.3 Some industrial development may be allowed away from hamlets when it is essential to locate in a rural area.

5.2.4 Industrial development and resource extraction facilities should be located on poor agricultural lands.

5.2.5 Industrial and resource extraction development are discouraged to locate within 1.6 km (1 mile) from water bodies or environmentally sensitive areas.

5.2.6 Where sour gas facilities exist, development must comply with the setback recommendations set out by Energy and Resources Conservation Board or its successor body.

5.2.7 Development of a resource extraction operation is reviewed for its impact on infrastructure and resident quality of life in accordance with Requirements for Resource Extraction Operations Policy #6614.

5.2.8 Pipelines are encouraged to be constructed along property lines or within existing right-of-ways.

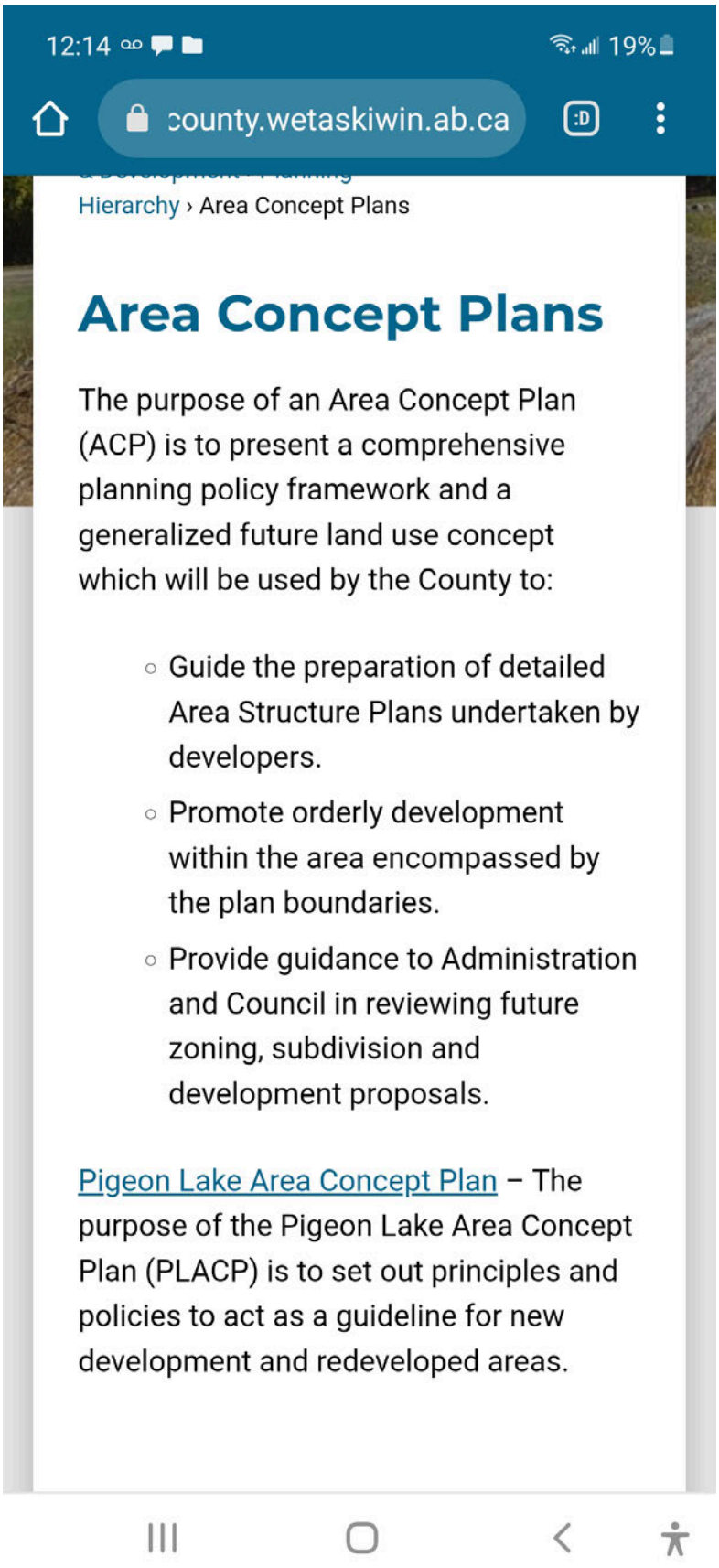
5.2.9 Abandoned resource extraction facilities should be reclaimed by the licensee.

5.2.10 The County will continue to constructively engage the oil and gas industry to minimize the impact on lands within the districts for watershed protection.

Objective 5.3 Support the agro-industrial activities

Agro-industrial activities such as the processing or shipment of agricultural products will benefit the agricultural industry and create additional employment in other industrial sectors. Locating such uses close to the material source and transportation corridors is important for a successful operation.

2014 PL Area Concept Plan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Hierarchy › Area Concept Plans
Area Concept Plans
The purpose of an Area Concept Plan (ACP) is to present a comprehensive planning policy framework and a generalized future land use concept which will be used by the County to:
Guide the preparation of detailed Area Structure Plans undertaken by developers.
Promote orderly development within the area encompassed by the plan boundaries.
Provide guidance to Administration and Council in reviewing future zoning, subdivision and development proposals.
Pigeon Lake Area Concept Plan – The purpose of the Pigeon Lake Area Concept Plan (PLACP) is to set out principles and policies to act as a guideline for new development and redeveloped areas.

5.5 Planning principles

In order to achieve the goals set out above, the County will be guided by the following policies when evaluating a proposal to develop land in the watershed.

5.5.1 Presumption of development approval

Pigeon Lake is seen as primarily a recreational lake, however, standard residential and agriculture remain as predominant land uses in the surrounding watershed. Development is expected, and will be welcome as long as it does not conflict with the planning policies set out here.

5.5.2 Agriculture

Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.

Recreational and residential development must not diminish the right of neighbouring farmers to manage their land using generally acceptable agricultural practices. This is guaranteed by provincial law (Agricultural Operations Practices Act, section 2).

Farm land will be reserved for agriculture, or released for other uses, depending in part on its assessment rating.

The County's normal policy is to reserve better farm land for agriculture. Section 1.2.1 of the MDP defines this as land with a farmland assessment rating of 30% or more, but because of the recreational value of land near Pigeon Lake, the County may allow residential subdivision on land with a farmland assessment rating up to 50%. Figure 7 shows the location of such land.

Note that this applies only in the Pigeon Lake watershed. The cut-off remains 30% in other parts of the County.

Soil quality does not change at property boundaries. Most quarters have a mixture of good and poor soil. On these mixed quarters, development must normally be clustered on the poorer soil, leaving better soil for agriculture, although small or odd-shaped areas of good soil may be included in the developed area.

5.5.3 Protection of environmentally sensitive areas

Area structure plans for land within the Pigeon Lake watershed must include an environmental impact assessment (EIA) prepared by a professional biologist.

This assessment must identify areas of environmental significance or value such as a Wetland Assessment. It must also address the changes that will be caused by the proposed development, especially loss of habitat and the effect on ground and surface water, and must propose ways of offsetting any losses. The requirement for an EIA may be waived by the County if the land to be developed contains no native habitat or wetlands.

Wetlands, including sloughs, must be left in a natural state, and must not be drained or filled unless there is no alternative. In that case, the developer will be required to construct substitute wetlands as close as possible to the one that has been destroyed. The County may protect the substitute wetland through a conservation easement or other registration on title.

Through referral input by Alberta Sustainable Resource Development and the reserve dedication options under the County's subdivision authority, lake shoreline tributaries and wetlands may be protected by a buffer strip wide enough

later in the document.

Plant growth is limited by the supply of nutrients, light and temperature in lake water. Although many nutrients are required for plant growth, phosphorus is the limiting factor in most Alberta lakes. Phosphorus may enter the water from various sources: atmospheric deposition, release from bottom sediments, or runoff from the land through streams or groundwater. The first two are outside our control, but surface runoff is, in part, controllable.

The amount of phosphorus entering a lake from the land depends mainly on the use of that land. Forested land contributes about 10 kg/km2/year. Farm land contributes 20 to 50 kg/km2/yr (less from hay land, and more from crops). Urban areas contribute about 100 kg/km2/yr from surface runoff, plus 0.1 to 0.9 kg per person depending on how sewage is treated. (Figures are taken from the 1998 *Pigeon Lake Water Quality Study* by Lilley Environmental Consulting and Dr. Chris Earle of Concordia University College.)

The County's municipal development plan (MDP) gives a very high priority to agriculture. "As a rural municipality with an agricultural base, the County will take responsibility to maintain the farmland for viable agricultural production" (MDP, page 7), however, the Statement of Purpose at the beginning of the MDP says that its first goal is to "maintain a clean environment (with) no negative impact on air, natural resources, water, or soil quality" (page 3). In this regard, the County supports farmers using "best agriculture practices."

The figures quoted above show that properly designed recreational and residential development can have less of an impact on the environment, and especially water quality, than traditional types of agriculture. For this reason, plus the gains in taxation noted above, the concept plan welcomes properly designed recreational and residential development, ***even on soils which, elsewhere in the municipality, would be protected for agriculture.***

To assist with the restoration of lands back to natural conditions, thereby assisting water quality, the County at its discretion will use its right during the subdivision process to secure Environmental and Municipal Reserves within those lands that most benefit the watershed.

Having said that, we must be clear that no farmer will be forced to sell his land, or to convert it to non-agricultural uses, and he will not be forced to curtail legitimate farm operations because of objections by his neighbours. He must be able to carry on farming responsibly for as long as he wants, and, when the time comes, to pass it on to the next generation or to sell it to another farmer. Any conversion from agricultural to other uses must be voluntary.

5.5 Planning principles

In order to achieve the goals set out above, the County will be guided by the following policies when evaluating a proposal to develop land in the watershed.

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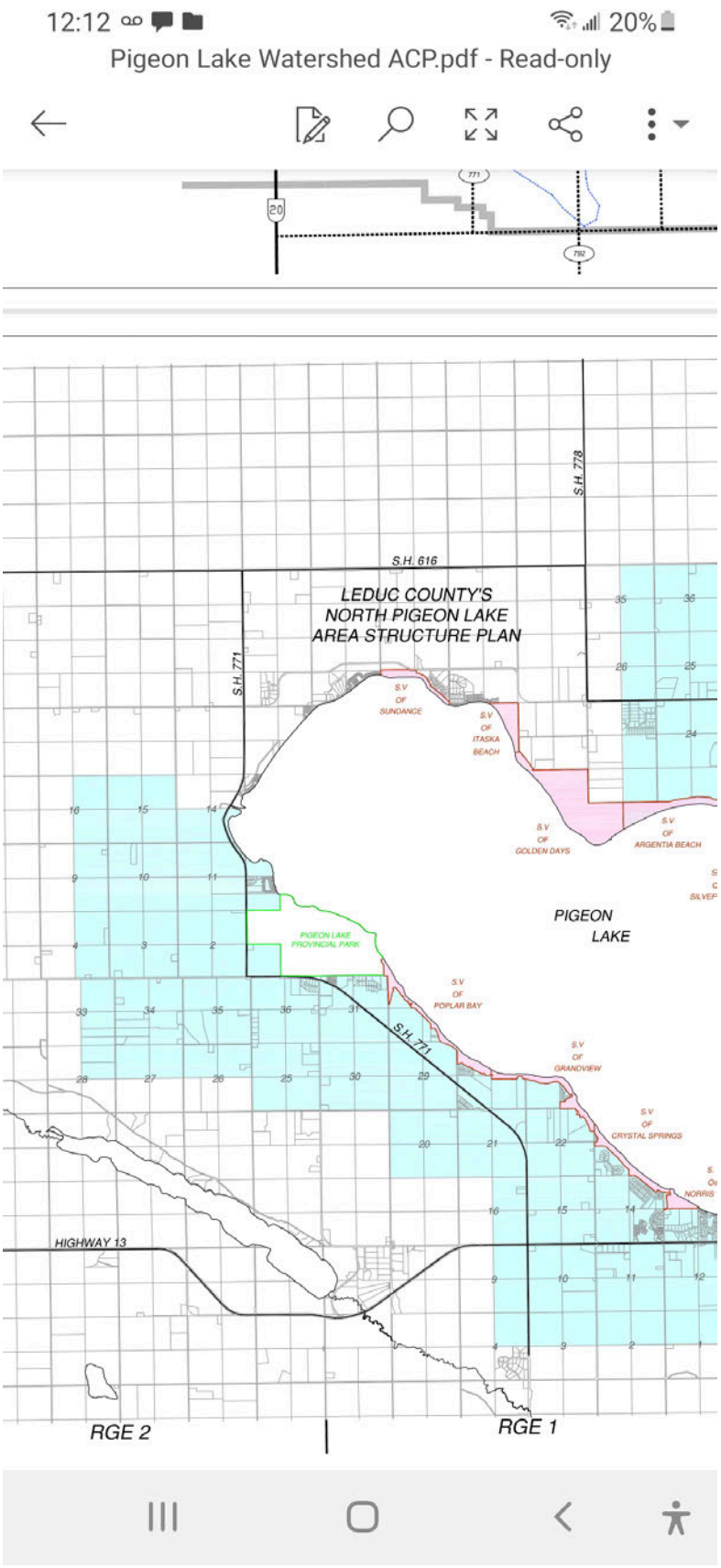
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S.V. OF GOLDEN DAYS
S.V. OF ARGENTIA BEACH
PIGEON LAKE
PIGEON LAKE PROVINCIAL PARK
S.V. OF POPLAR BAY
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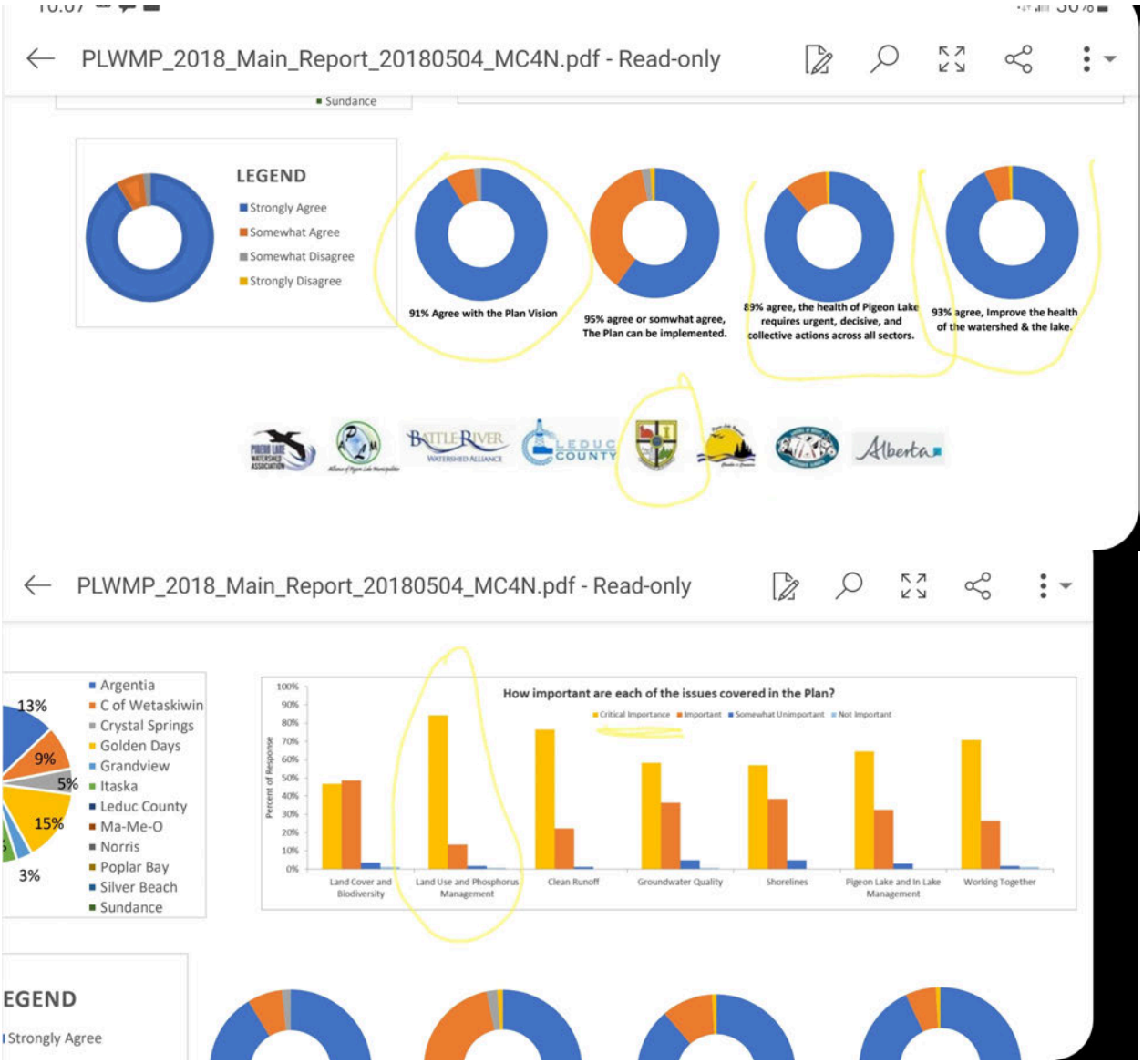
2018 PL Watershed Plan



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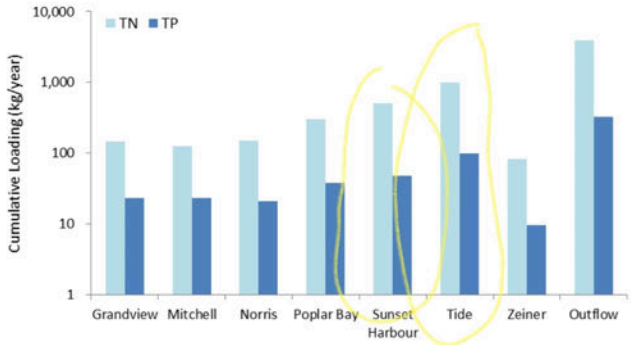

Figure C4: Summary of cumulative annual total nitrogen (TN) and phosphorus (TP) loading from inflowing streams into Pigeon Lake and exports from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

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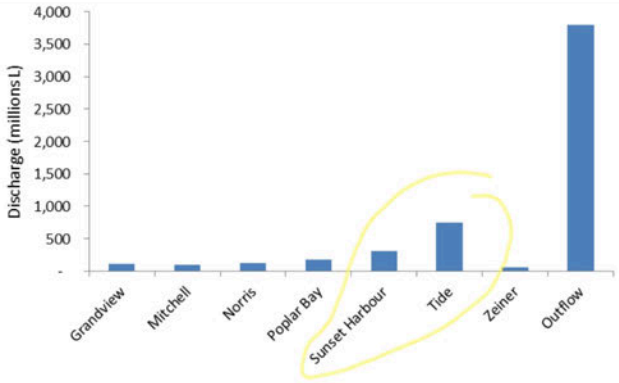

Figure C5: Summary of cumulative annual discharge from inflowing streams into Pigeon Lake and export from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

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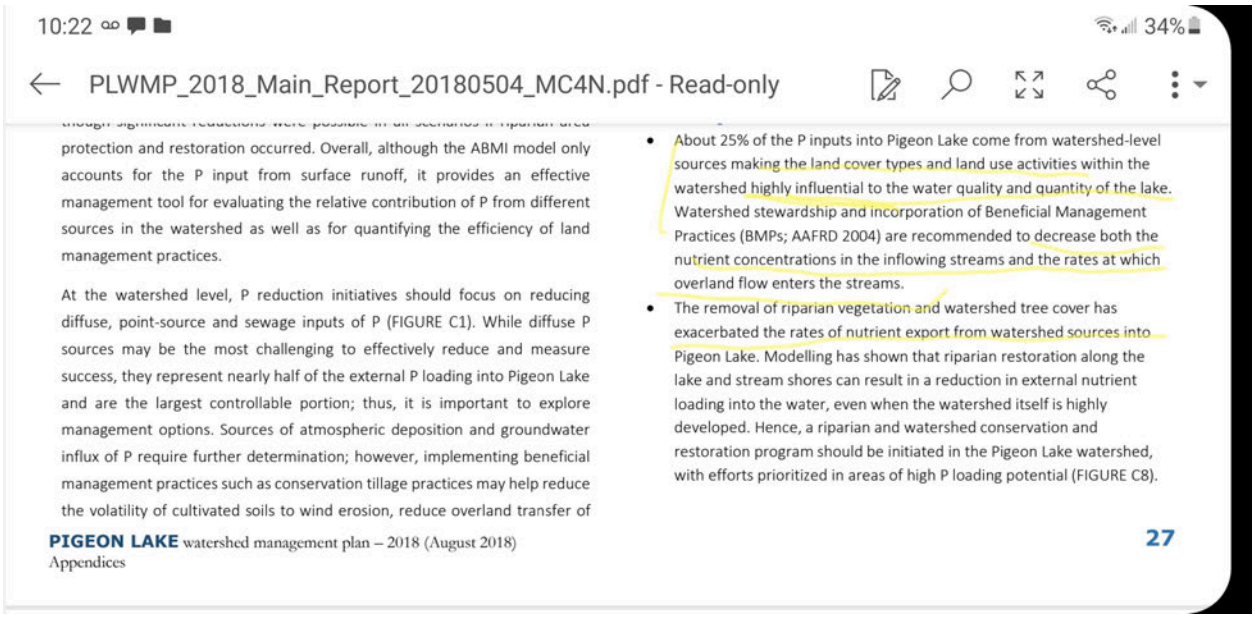
		within 800 metres of the legal bank of Pigeon Lake.				
OB-2 Land Use & Phosphorous	2b	Lawn Fertilizers and Pesticides: Continue to provide education and support for watershed residents to eliminate lawn fertilizers and pesticides on residential properties and to promote alternative practices.	Community Action	Lead: PLWA Support: Mun	05 Largely Completed	Annual Programs,
OB-2Land Use &Phosphorous	2d	Existing Agricultural Operations: Encourage agricultural operators to participate in whole farm reductions in phosphorus runoff using the Alberta Agriculture and Forestry Phosphorus Management Tool and the Environmental Farm Plan Program, and to adopt beneficial management practices that reduce nutrient runoff. Promote agricultural erosion and sediment control practices (e.g. low tillage).	Community Action	Lead: CountiesSupport: PLWA, PLWMP, APLM, GoA	00 Ongoing	Sector Participation
OB-2 Land Use & Phosphorous	2e	New or Expanded Intensive Livestock Operations: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan	Policy	Lead: Mun Support: APLM, GoA, PLWA	00 Ongoing	No Intensive Livestock Operations



protection and restoration occurred. Overall, although the ABMI model only accounts for the P input from surface runoff, it provides an effective management tool for evaluating the relative contribution of P from different sources in the watershed as well as for quantifying the efficiency of land management practices.

At the watershed level, P reduction initiatives should focus on reducing diffuse, point-source and sewage inputs of P (FIGURE C1). While diffuse P sources may be the most challenging to effectively reduce and measure success, they represent nearly half of the external P loading into Pigeon Lake and are the largest controllable portion; thus, it is important to explore management options. Sources of atmospheric deposition and groundwater influx of P require further determination; however, implementing beneficial management practices such as conservation tillage practices may help reduce the volatility of cultivated soils to wind erosion, reduce overland transfer of

- About 25% of the P inputs into Pigeon Lake come from watershed-level sources making the land cover types and land use activities within the watershed highly influential to the water quality and quantity of the lake. Watershed stewardship and incorporation of Beneficial Management Practices (BMPs; AAFRD 2004) are recommended to decrease both the nutrient concentrations in the inflowing streams and the rates at which overland flow enters the streams.
- The removal of riparian vegetation and watershed tree cover has exacerbated the rates of nutrient export from watershed sources into Pigeon Lake. Modelling has shown that riparian restoration along the lake and stream shores can result in a reduction in external nutrient loading into the water, even when the watershed itself is highly developed. Hence, a riparian and watershed conservation and restoration program should be initiated in the Pigeon Lake watershed, with efforts prioritized in areas of high P loading potential (FIGURE C8).

OBJECTIVE 2 Improve phosphorus management for all land uses to achieve a net reduction in nutrient runoff and promote biodiversity.

- Work has begun on introducing beneficial management practices (BMPs) for residential land to achieve nutrient control. The initiatives include:
  - Lawn Fertilizer Ban
  - Model Land Use Bylaw
- Consultation with the agricultural community has been initiated to encourage and implement BMPs to reduce nutrient runoff and improve biodiversity.
- Voluntary adoption of these BMPs needs to be actively supported by the province, municipalities, and stewardship groups.
- Other sectors such as golf courses and the oil and gas industry have beneficial practices that need to be better promoted for local operators.

LAND USE & PHOSPHORUS MANAGEMENT
OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
2a	**Statutory Plans & Land Use Bylaws:** Lakeshore Environmental Area: Adopt an 800 metre "Lakeside Environmental Area" as per the Model Land Use Bylaw, that gives priority to land uses, policies, and environmental provisions designed to protect the lake from nutrient runoff. Policy provisions to include: • Requiring construction management plans with new development permit applications. • Restricting land uses within riparian areas that may increase runoff, increase the potential for contamination of groundwater, and/or impede the effectiveness of important recharge areas • Restricting land uses within 800 metres of the lake where phosphorus and other nutrients, chemicals, or nutrient-rich sediment may pollute the waters of Pigeon Lake. • Requiring a development permit and providing guidelines for the stripping and grading of lands within 800 metres of the bank of Pigeon Lake. Where possible this activity should be discouraged and or sediment controls be implemented during and post construction to eliminate sediment loading of the lake during construction. • Requiring the application of local topsoil and native plants to be included in landscaping plans for new development and redevelopment areas.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	100% municipal participation

LAND USE & PHOSPHORUS MANAGEMENT
OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

	• Prescribing a maximum site coverage percentage for non-permeable surfaces on new development and re-development sites within 800 metres of Pigeon Lake. • Prescribing site coverage guidelines for natural vegetation cover that is compatible with FireSmart development principals • Discouraging the compaction of soils during stripping and grading activities that may interfere with natural groundwater recharge and increase surface water runoff. • Prohibiting the excavation or filling in or clearing of all wetlands and stream courses and their associated riparian lands within 800 metres of the legal bank of Pigeon Lake.				
2b	**Lawn Fertilizers and Pesticides:** Continue to provide education and support for watershed residents to eliminate lawn fertilizers and pesticides on residential properties and to promote alternative practices.	Community Action	Lead: PLWA Support: Mun	Largely Completed	Annual Programs,
2c	**Watershed Stewardship Advocacy & Education:** Encourage landowners (residential, business, recreational and agricultural) to adopt proactive lake-friendly environmental management practices, landscaping and activities. Support land use policies and regulatory measures with public awareness and education.	Community Action	Lead: PLWA Support: Mun, NGO, GoA	Ongoing	Increased Participation
2d	**Existing Agricultural Operations:** Encourage agricultural operators to participate in whole farm reductions in phosphorus runoff using the Alberta Agriculture and Forestry Phosphorus Management Tool and the Environmental Farm Plan Program, and to adopt beneficial management practices that reduce nutrient runoff. Promote agricultural erosion and sediment control practices (e.g. low tillage).	Community Action	Lead: Counties Support: PLWA, PLWMP, APLM, GoA	Ongoing	Sector Participation
2e	**New or Expanded Intensive Livestock Operations**: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan	Policy	Lead: Mun. Support: APLM, GoA, PLWA	Ongoing	No Intensive Livestock Operations
2f	**Recreational Operations:** Encourage recreational land uses (e.g. golf courses, campgrounds) to adopt beneficial management practices (e.g. Audubon Certification) that reduce nutrient run off and promote biodiversity.	Community Action	Lead: PLWA Support: PLWMP, Mun, NGO, GOA	Ongoing	Sector Participation
2g	**Oil and Gas Operations:** Encourage all oil and gas operations to adopt a best management practices on all well sites, batteries, and processing operations to reduce contaminants and phosphorous rich runoff. Encourage future operations to minimize land disturbances.	Community Action	Lead: PLWA, Support: PLWMP, NGO, GOA	Medium to Long Term	Sector Participation

CLEAN RUNOFF

OBJECTIVE 3 Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake.

The movement of water across the watershed carries nutrients to the lake.

- Suspended sediment with attached phosphorus is also entering waterbodies within the watershed and Pigeon Lake itself.
- Suspended sediment negatively impacts the health of waterbodies by: transporting nutrients to the lake, burying important spawning grounds

and nutrients from lawns and gardens, land clearing and disruption of the riparian area).

The Pigeon Lake watershed contains considerable rural development and seasonal activity, with extensive cottage and municipal development along the lakeshore and over 100,000 seasonal visitors. While the direct impact of this population on lake water quality is challenging to quantify, a considerable proportion of the external nutrient loading into Pigeon Lake can be attributed to human presence. Human-generated land cover changes and use increase nutrient loading in two main ways:

1. Increasing the nutrient availability in the watershed:

directly through seven inflowing streams and many drainage ditches. Nutrient loading rates (annual export quantity; FIGURE C4) varied among streams and with the stream's discharge rate (FIGURE C5). Peaks for P- and N-loading in streams typically occurred in April, decreased through May-June, increased again in July-August (due to storm events) and continued to decline into September-October. 2013 data showed that the streams contributed a relatively small proportion of total external nutrient inputs into Pigeon Lake (collectively, approximately 377 kg/year, or about 11% of total external loadings). However, this information should be used with caution since the 2013 sampling missed a portion of spring runoff as sampling began on April 25th of that year. Generally, comprehensive annual water quality data for the inflowing streams are largely lacking relative to data records for the lake itself.

Phosphorus Forms, Cycle and Sources

In most temperate lakes the nutrient that is in shortest supply, and is therefore limiting to biological productivity, is P. Once P exists in sufficient quantities, growth of phytoplankton can proceed until limited by another factor (e.g., light, nitrogen (N) or wind). Excessive quantities of P can promote problematic overgrowth of cyanobacteria, also known as blue-green algae blooms. Cyanobacteria blooms can sometimes produce dangerous toxins, negatively impacting water quality and causing problems for human and ecological health. While many central Alberta lakes, including Pigeon Lake, are naturally productive, increased human development and land cover changes within watersheds over the past century appear to have increased the rates of P input into waterbodies and accelerated eutrophication rates. Thus, quantifying P inputs into waterbodies is an important first step towards controlling eutrophication to help prevent future water quality issues.

mineral particles to dissolved P.

FIGURE C6 shows a simplified P cycle in lakes. Phytoplankton and bacteria assimilate dissolved inorganic P and transform P into particulate organic P as it becomes part of their tissues. As plants and animals excrete waste or die, the organic P sinks to the bottom, where bacterial decomposition turns it back to inorganic P. This inorganic P ultimately returns to the water column and becomes again available for uptake. In the sediment, inorganic P will not pass freely into the water column if the sediment-water interface is well oxygenated. In this situation, P is bound to clays and different compounds, such as iron (Fe), calcium (Ca) or aluminium (Al). In some circumstances, increased P release in well oxygenated sediment has been observed at high pH values following resuspension events in the summer when pH increases due to the high photosynthetic activity. However, anoxic (non-oxygenated) sediments release phosphate to the overlying waters at a much faster rate.

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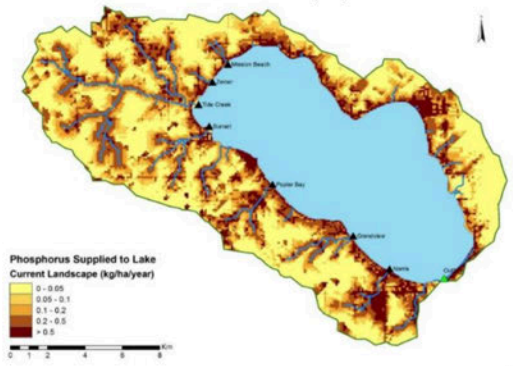
- Municipalities should adopt riparian setback policies to establish appropriate setbacks from all waterbodies in the watershed to maintain water quality, flood water conveyance and storage, bank stability, and habitat. Tools such as the Riparian Matrix Setback Model (Aquality Environmental Consulting 2010) can be used to manage riparian areas in a local municipality (broad brush approach).
- A significant function of wetlands is their ability to trap and retain nutrients. To increase this function in Pigeon Lake's watershed, wetlands should be conserved and restored. Thus, a list of candidate wetlands for restoration within the watershed should be developed and will streamline watershed improvement efforts under the Alberta Wetland Policy. Also, riparian buffers around wetlands are required to protect function.
- The coverage and ecological condition of natural land cover (e.g., forests and wetlands) should be maintained or improved. Conversion of remaining ecological lands to agricultural, residential, or recreational areas should be limited.
- Diffuse runoff over altered (agricultural, developed, etc.) lands comprises a significant portion of external P loadings into Pigeon Lake. Current

AAFRD 2004). Conservation tillage programs can reduce the erodibility of soils and the subsequent potential for export via runoff. Similarly, precision agriculture approaches can be taken to avoid the export of excess nutrients off the land and into waterways by care



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and wetlands) should be maintained or improved. Conversion of remaining ecological lands to agricultural, residential, or recreational areas should be limited.

- Diffuse runoff over altered (agricultural, developed, etc.) lands comprises a significant portion of external P loadings into Pigeon Lake. Current practice does not allow for enforcement or rejection of activity based on cumulative impacts decision making. In the context of Pigeon Lake, development decisions should be thoroughly assessed to ensure that there is either a decrease or, at a minimum, no increase in nutrient export relative to current conditions. Municipal governments must ensure their review of impacts is neither too narrow nor too broad. Approvals for any work should also consider the increases to nutrient and sediment loading as a result of alterations in pre-development hydrology and watershed-level land use changes.
- Adoption of clean runoff BMPs by individual land owners and municipalities into their developments and operations will contribute to water quality improvement and increase water use efficiency.
- In agricultural lands, existing BMPs that promote soil health and responsible resource use should be continued and encouraged (e.g.,

fully controlling the application rate, timing, and placement of inorganic fertilizers or manure. BMPs specific to ranching include reducing the intensity of grazing and trampling near riparian areas and providing water alternatives away from streams.

- In residential areas (i.e. Lakeshore developments, county residential) BMPs and implementation of Low Impact Development (LID) practices in existing and new developments will be very important to reduce P export. Principles and practices for implementing LID practices at Pigeon Lake are detailed in in the Alberta Clean Runoff Action Guide (PLWA and ALIDP 2016). Incorporating low-phosphorus development standards in Land Use Bylaws and statutory plans will be very important to achieve compliance on the part of individual land owners and developers.
- Removal of septic fields, in addition to upgrades to wastewater infrastructure of cottages and public use areas (where antiquated or

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2 SUMMARY OF THE SCIENCE: THE SHORELINE

Riparian Health

Riparian areas are biologically rich and productive areas at the edges of lakes, wetlands and streams. Riparian areas are important habitat and provide essential ecosystem functions to protect the lake's health.

In 2002 and 2008, low-altitude videography was used to conduct a riparian health assessment of Pigeon Lake (SRD 2008). The riparian area surveyed included the collective near-shore area consisting of the lake's shallow water zone (littoral) and the strip of public lakeshore, and the immediately adjacent private land that surrounds the lake. Criteria evaluated to assess riparian "health" included proportion of area covered by natural vegetation, presence of cattails (*Typha latifolia*) and bulrushes (*Scirpus* spp. and *Schoenoplectus* spp.), abundance of trees and shrubs, and the amount of human-caused vegetation removal or physical alteration. The shoreline was divided into consecutive sections and these criteria were used to classify each section into one of three impairment categories: healthy, moderately impaired, or highly impaired. The total length of shoreline in each impairment category was (e.g., maintenance of beaches, erosion control structures, installations of docks, boat lifts and marinas, and the construction of cottages adjacent to the shoreline). Notably, sections of highly impaired shoreline were very long and continuous, with healthier sections being largely restricted to areas of minimal cottage development on the northwest and east shores at the Provincial Park and First Nations Reserve (FIGURE C8)

The Government of Alberta has recommended that a similar shoreline assessment should be performed every five years on Pigeon Lake to monitor the extent and integrity of remaining riparian areas (SRD 2008). In addition, assessments of both the health of the lake and tributary riparian areas would highlight priority areas for protection and restoration.

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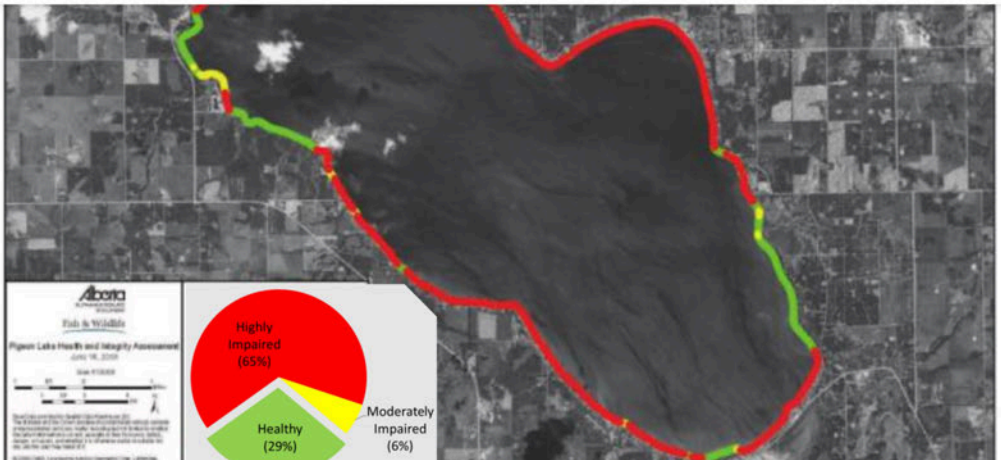

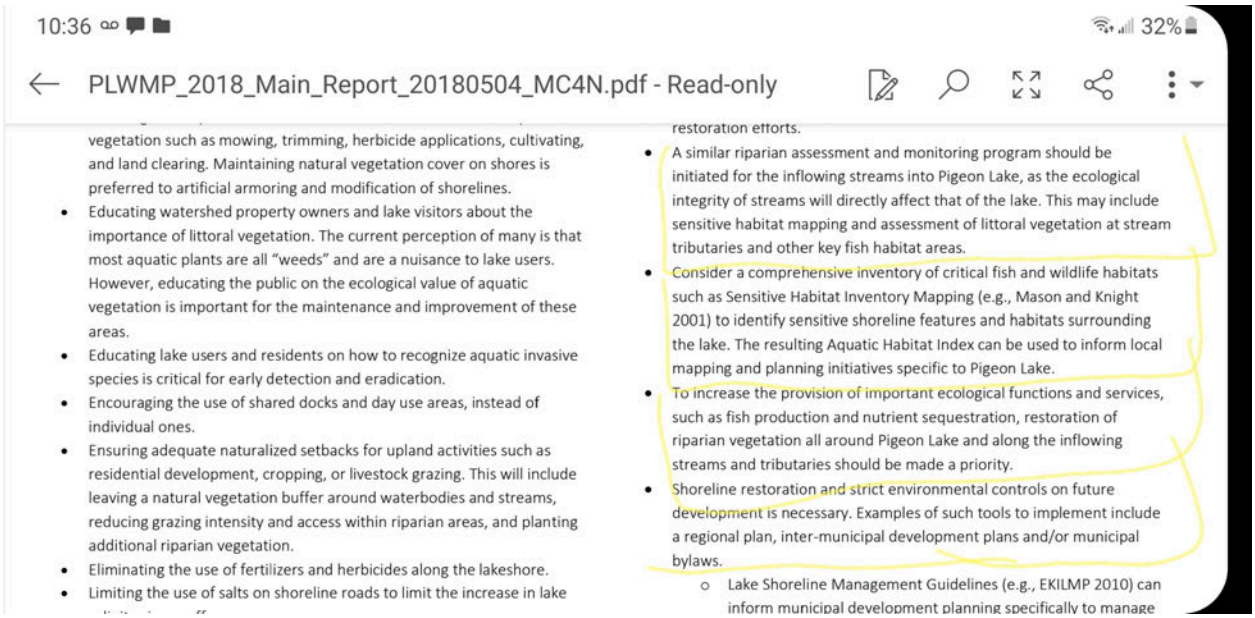
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vegetation such as mowing, trimming, herbicide applications, cultivating, and land clearing. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.
Educating watershed property owners and lake visitors about the importance of littoral vegetation. The current perception of many is that most aquatic plants are all "weeds" and are a nuisance to lake users. However, educating the public on the ecological value of aquatic vegetation is important for the maintenance and improvement of these areas.
Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
Encouraging the use of shared docks and day use areas, instead of individual ones.
Ensuring adequate naturalized setbacks for upland activities such as residential development, cropping, or livestock grazing. This will include leaving a natural vegetation buffer around waterbodies and streams, reducing grazing intensity and access within riparian areas, and planting additional riparian vegetation.
Eliminating the use of fertilizers and herbicides along the lakeshore.
Limiting the use of salts on shoreline roads to limit the increase in lake
restoration efforts.
A similar riparian assessment and monitoring program should be initiated for the inflowing streams into Pigeon Lake, as the ecological integrity of streams will directly affect that of the lake. This may include sensitive habitat mapping and assessment of littoral vegetation at stream tributaries and other key fish habitat areas.
Consider a comprehensive inventory of critical fish and wildlife habitats such as Sensitive Habitat Inventory Mapping (e.g., Mason and Knight 2001) to identify sensitive shoreline features and habitats surrounding the lake. The resulting Aquatic Habitat Index can be used to inform local mapping and planning initiatives specific to Pigeon Lake.
To increase the provision of important ecological functions and services, such as fish production and nutrient sequestration, restoration of riparian vegetation all around Pigeon Lake and along the inflowing streams and tributaries should be made a priority.
Shoreline restoration and strict environmental controls on future development is necessary. Examples of such tools to implement include a regional plan, inter-municipal development plans and/or municipal bylaws.
Lake Shoreline Management Guidelines (e.g., EKILMP 2010) can inform municipal development planning specifically to manage

GROUNDWATER QUALITY

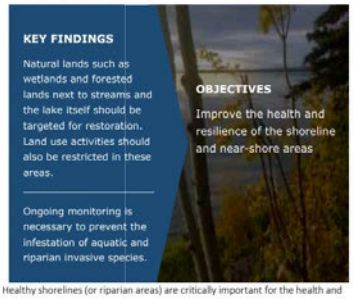
OBJECTIVE 4 Protect Groundwater that feeds into Pigeon Lake.

- Phosphorus from wastewater is identified in the phosphorus budget as contributing 0.9% of the total phosphorus budget and as a potential source to be managed. Phosphorus from wastewater may be accompanied with fecal coliforms.
- Local municipalities have policies to regulate and minimize potential contamination from private waste water disposal systems. Where private systems still exist near the lake, most are provincially approved pump-out tanks and a small percentage are septic fields.
- Septic fields are a source of nutrient release into groundwater and the nearby lake.
- The Northeast portion of the lake is served with a communal wastewater sewer system (gravity collection system and lagoon). Currently under development is a trunk collection line for the south shore.

GROUNDWATER QUALITY
OBJECTIVE 4: Protect groundwater that feeds into Pigeon Lake.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
4a	**Statutory Plans & Land Use Bylaws: Groundwater Conservation:** Incorporate water conservation guidance tools into municipal statutory plans and development requirements.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Medium Term	Task Completion
4b	**Statutory Plans & Land Use Bylaws:** Groundwater Impact Assessments: Require new major developments in the watershed to demonstrate no negative impacts on existing groundwater users or the lake water supply.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Medium Term	Task Completion
4c	**Wastewater Collection:** Support the extension of a regional waste water system to lakeside communities including the two Pigeon Lake Provincial Park campsites.	Policy	Lead: Mun. Support: APLM, PLWA, Local Auth., GOA	Medium Term	Completion of system
4d	**Septic Fields:** Eliminate septic fields for residential lots within the Lakeside Environmental Area	Policy	Lead: Mun. Support: APLM, PLWA, Local Auth., GOA	Medium Term	Elimination of remaining fields
4e	**Wastewater System Inspections:** Promote regular inspections of both private and communal wastewater systems for integrity and leakage. Systems that fail are to be reported and repaired.	Policy	Lead: Mun, Local Auth. Support: APLM, PLWA,	Ongoing	100% Participation
4f	**Water Wells:** Encourage home owners to adopt water conservation and well maintenance practices (e.g. GoA Working Well program). Encourage organizations and municipalities provide information and to host workshops etc.	Community Action	Lead: PLWA Support: Mun, NGO, GOA	Ongoing	Consistent Program
4g	**Industrial Groundwater Extraction:** Monitor permit applications and Intervene where warranted on behalf of the watershed to maintain groundwater flows to the lake.	Community Action	Lead: PLWA Support: Mun, NGO,	Ongoing	Effective Monitoring

THE SHORELINE



Healthy shorelines (or riparian areas) are critically important for the health and protection of aquatic ecosystems. Thus, these areas should be targeted for protection and restoration efforts.

Riparian Beneficial Management Practices (BMPs) involve actions that can be taken by land owners and users within the Pigeon Lake watershed to improve the water quality of the lake and streams. These may include:

- Avoiding the removal of riparian vegetation such as mowing, trimming, or land clearing, if possible. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.
- Educating watershed property owners and lake visitors about the importance of near-shore vegetation. The current perception of many is that most aquatic plants are all "weeds" and, as such, are a nuisance to lake users. However, educating the public of the ecological value of aquatic vegetation is hugely important to maintenance and improvement of these areas.
- Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
- Developing and encouraging the use of community-based lake access and beaches instead of individual ones. Concentrating the traffic in a few spots around the lake will help to reduce shoreline degradation and destruction.
- Ensuring adequate naturalized setbacks for upland activities such as residential development, cropping, or livestock grazing. This may include leaving a natural vegetation buffer around waterbodies, reducing grazing intensity and access within riparian areas, and planting additional riparian vegetation.
- Eliminating the use of fertilizers and herbicides along the lakeshore.
- Limiting the use of lakeside road salts to reduce lake salinity.

SHORELINES

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WORKING TOGETHER

OBJECTIVE 8: Improve regional collaboration, partnerships and organizational effectiveness to promote collective action for a healthy watershed, healthy lake and healthy community.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
8a	**Statutory Regional Plans:** Work toward a watershed-wide Intermunicipal Development Plan (IDP), Regional Collaboration Framework and a sub-regional plan under the North Saskatchewan Regional Plan that all align with the Pigeon Lake Watershed Management Plan. Measures of the Pigeon Lake Watershed Plan 2000 not addressed in the 2018 version will remain in effect until addressed in statutory Plan updates.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA, GoA	Short Term	Task Completion
8b	**Municipal Development Plans:** Work toward consistent municipal development plans for all Summer Villages, that incorporate the environmental protection policies of the Watershed Management Plan and the Model Land Use Bylaw	Policy	Lead: SV. Support: APLM, PLWMP, PLWA, GoA, TS	Short Term	Task Completion
8c	**First Nations:** Engage the First Nations of IR 138A Pigeon Lake Reserve in the Watershed Management Plan.	Policy	Lead: PLWMP/ First Nations Support: APLM, PLWA, GoA	Short Term, Ongoing	Ongoing
8d	**Watershed Management Plan Updates:** Revisit and update the Watershed Management Plan every five years and rewrite the Plan every ten years to accommodate the changing condition of the lake, success of current recommendations, new scientific knowledge, new legislation, and new stakeholder and organizational assets and interests.	Policy	Lead: PLWMP Support: APLM, PLWA, GoA	Medium to Long Term	Task Completion
8e	**Assess Organizational Assets:** Investigate organizational options to increase effectiveness, staff resources, financing, risk management, and accountability in undertaking watershed and lake management tasks, including coordination of scientific inquiry, action by municipalities, and community action.	Policy	Lead: PLWMP Support: APLM. PLWA, GoA	Short to Medium Term	Task Completion
8f	**Incentives to Promote Voluntary Action:** Develop non-monetary and monetary incentive programs to promote voluntary action for individuals, municipalities and organizations	Community Action	Lead: PLWA Support: PLWMP, APLM, GoA, NGO	Ongoing	Program of Incentives
8g	**Communication and Engagement Plan:** Establish a communications and engagement plans for disseminating and reporting Plan progress to and amongst stakeholders.	Community Action	Lead: PLWA Support: PLWMP, APLM, PLWA, GoA	Short Term, Ongoing	Consistent Program
8h	**Monitoring Plan:** Develop an monitoring plan for environmental trends including lake and tributary water quality and for plan performance including fulfillment of success measures.	Technical & Scientific	Lead: PLWMP Support: PLWA APLM GoA	Medium Term, Ongoing	Effective Monitoring Program
8i	**Phosphorous Budget:** Continue to update and refine the phosphorus budget.	Technical & Scientific	Lead: GoA Support: PLWA APLM	Medium Term	Task Completion

PUTTING THE PLAN INTO MOTION

The following provides a summary of the Plan is to be put into action.

POLICY

Policy and statutory plans are how governments can collaborate to improve the health of the lake and watershed. Recently enacted changes in the Municipal Government Act (MGA) provide a significant opportunity to harmonize regional plans and land use policies. The MGA now requires that all Summer Villages prepare a Municipal Development Plan. Watershed Management Plan objectives and policy recommendations have an opportunity to become common to all Summer Villages. Similarly, all adjacent municipalities will be required to have an Intermunicipal Development Plan (IDP) and an Intermunicipal Collaboration Framework (ICF). Common provisions and policies that reference the Plan in new MDP's, IDP's or ICF's for all municipalities bordering Pigeon Lake should provide common senior land use policy for the watershed including a Lakeshore Environmental Area Planning Zone. Land Use Bylaws are being updated by each municipality and this Plan and Model Land Use Bylaw provide guidance to improve their environmental provisions.

The Province may recognize this Plan under the North Saskatchewan Regional Plan. This status will promote coordination between provincial departments on key objectives and promote municipal policy adoption as statutory plans are being updated

Addressing the resources and effective organizational structures monitoring progress, updating the plan and developing detailed guidelines is an ongoing role of the Plan Steering Committee, which is a joint initiative of the Pigeon Lake Watershed Association and the Alliance of Pigeon Lake Municipalities.

COMMUNITY ACTION

The volunteer actions of individual property owners, business, recreation, farm and oil & gas operators are very important. Organizations such the Pigeon Lake Watershed Association, Municipalities and agriculture extension and industry associations play a key role in promoting beneficial practices and providing information, education and support. The Plan asks all individuals and organizations to:

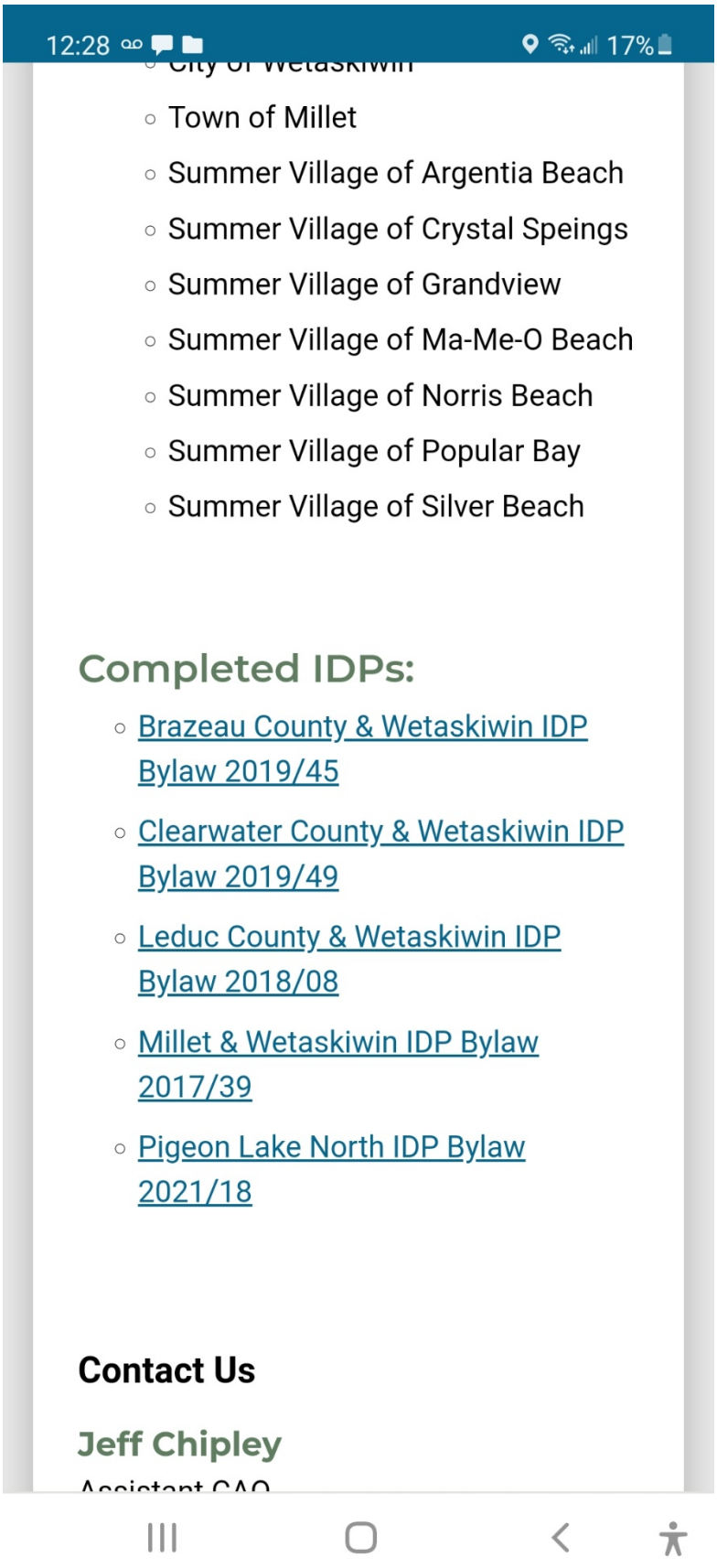
- Seek out information and beneficial practices relevant to their situation.
- Assess their own properties and operations
- Make beneficial changes incrementally.
- Encourage others and councils to make appropriate changes.
- Support volunteer watershed groups such as the PLWA

TECHNICAL / SCIENCE

Moving forward will require the engagement of experts to provide guidance in a variety of areas including:

- **Planning and Land Use Controls** including statutory planning, drainage/water quality guidelines.
- **Research** Ongoing basic and applied lake water quality research and monitoring to address information gaps to help make better management decisions
- **In-lake management options** feasibility and actions
- **Mapping and Plan Monitoring**

rth PL IDP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City of Wetaskiwin
Town of Millet
Summer Village of Argentia Beach
Summer Village of Crystal Speings
Summer Village of Grandview
Summer Village of Ma-Me-O Beach
Summer Village of Norris Beach
Summer Village of Popular Bay
Summer Village of Silver Beach
Completed IDPs:
Brazeau County & Wetaskiwin IDP Bylaw 2019/45
Clearwater County & Wetaskiwin IDP Bylaw 2019/49
Leduc County & Wetaskiwin IDP Bylaw 2018/08
Millet & Wetaskiwin IDP Bylaw 2017/39
Pigeon Lake North IDP Bylaw 2021/18
Contact Us
Jeff Chipley
Assistant CAO

1. Refer major development within their jurisdiction to other participating municipalities;
2. Consider the effect of the lake as a whole, and on other municipalities around the lake before approving any development in the Pigeon Lake Watershed; and
3. Use the policies set out in the 2000 PLWMP as a guide when making any decision affecting the Pigeon Lake Watershed.

2018 PIGEON LAKE WATERSHED MANAGEMENT PLAN

The 2018 PLWMP was approved by the County of Wetaskiwin, Leduc County and the Summer Villages of Argentia Beach, Crystal Springs, Grandview, Golden Days, Itaska Beach, Ma-Me-O Beach, Norris Beach, Poplar Bay, Silver Beach and Sundance Beach in 2018. The purpose of the 2018 PLWMP is to develop a comprehensive, science-based strategy to coordination action for the protection and improvement of Pigeon Lake and the watershed. The goals of the 2018 PLWMP include:

- Reduce the frequency and intensity of algal blooms;
- Improve the health of the watershed and the lake; and
- Improve the recreational value of the lake and economic health of the region.

The 2018 PLWMP was adopted by resolution by the County of Wetaskiwin, Leduc County and the 10 Summer Villages. The figure below shows the boundary of the Pigeon Lake Watershed.

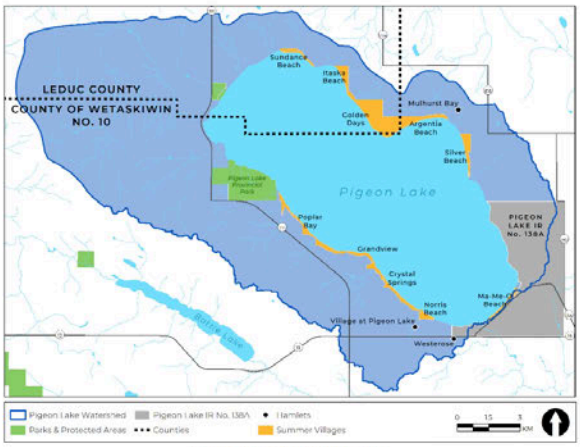
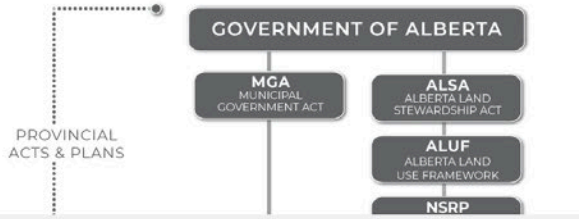


Figure 1. Pigeon Lake Watershed

1.6 PLANNING HIERARCHY

The chart below identifies how an IDP relates to other provincial acts and regulations, intermunicipal collaboration efforts, statutory plans, and planning processes.



RIPARIAN AREAS, WETLANDS, RESERVE DEDICATION AND SETBACKS

5.2.7	Subdivision of lands adjacent to Pigeon Lake, water bodies, watercourses, and wetlands shall be required to provide environmental and/or municipal reserve between the subdivided lots and the legal bank[1]. The width and size of the reserve shall be in accordance with the policies of the municipality's MDP and shall take into consideration the recommendations of the 2018 PLWMP. Other information that may be considered includes: a. Recommendations from qualified professionals; b. Government of Alberta's *Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region;* and c. ESRD Recommended Guidelines for Setbacks chart (see **Appendix C**).	WACP
5.2.8	Development setbacks from Pigeon Lake, water bodies, water courses, and wetlands, and other environmentally significant areas affecting NEW development shall generally be in accordance with the policies of the municipality's MDP and LUB and shall take into consideration the recommendations of the 2018 PLWMP. Other information that may be considered includes: a. Recommendations from qualified professionals; b. Government of Alberta's *Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region*; and c. ESRD Recommended Guidelines for Setbacks chart (see **Appendix C**).	WACP
5.2.9	Within the shoreline riparian area of Pigeon Lake, the use of lands dedicated as environmental and municipal reserves shall be as per the *MGA* and the applicable municipality's bylaws and MDP. Small areas of municipal reserve may be developed for public recreational uses to limit uncontrolled access to the lake.	WACP
5.2.10	The Environmental Reserve, Environmental Reserve Easements, and/or Conservation Reserves shall be established in accordance with Section 664 of the *MGA*. The boundaries of these areas shall normally be defined using the recommendations from a Biophysical Assessment and/or wetland assessment, provided by the development proponent.	
5.2.11	The dedication of Environmental or Municipal Reserve within the IDP area should be coordinated to promote maintenance of these contiguous wildlife corridors.	
5.2.12	Municipal and environmental reserves taken at the time of subdivision may be utilized to facilitate the creation of a regional trail system.	
5.2.13	The retention of wetlands in the IDP area shall be encouraged by the participating municipalities.	MDP

[1] As defined in Section 17 of the *Surveys Act*, the bed and shore of a waterbody ends at the legal bank, also known as the ordinary high water mark. The legal bank is a natural boundary formed by the presence of water that typically results in vegetation distinct from the upland vegetation. The legal bank may fluctuate over time.

5.2.14	The participating municipalities shall explore opportunities for interconnected trails and open space networks when developing new trails, parks, and preserving open space areas.	

WILDFIRE PROTECTION

5.2.15	All new developments in the IDP area shall be designed to reduce risk from wildfires. Where appropriate, the participating municipalities will consider the inclusion of FireSmart Canada recommendations in their respective LUBs.	MDP

HISTORIC RESOURCES

5.2.16	All applications for subdivision and new development on parcels identified as containing or potentially containing historic resources must provide a Historic Resources Impact Assessment (HRIA) and letter of clearance from Alberta Culture, Multiculturalism and Status of Women. Where a HRIA has been waived by the department, a letter of clearance indicating that the HRIA is not required must be provided.	MDP

5.3 NATURAL RESOURCES

Development	services.
Development	Development means: a. an excavation or stockpile and the creation of either of them; b. a building or an addition to or replacement or repair of a building and the construction or placing of any of them in, on, over or under land; c. a change of use of land or a building or an act done in relation to land or a building that results in or is likely to result in a change in the use of the land or building; or d. a change in the intensity of use of land or a building or act done in relation to land or a building that results in or is likely to result in a change in the intensity of use of the land or building.
Discretionary Use	Means a use of land or of a building provided for in a LUB for which a development permit may be issued with or without conditions as provided for in the LUB.

Ecological Feature	Means habitat areas which, either by themselves or in a network, contribute to an ecosystem's productivity, biodiversity, and resilience.
Environmentally Sensitive Area	Means lands that exhibit one or more of the following: a. hazardous lands and areas that are unsuitable for development in their natural state (i.e. floodplains, steep slopes (greater than 15%), unstable slopes); b. areas that perform a vital environmental, ecological or hydrological function (i.e. aquifer, groundwater recharge areas, or peatlands); c. areas that contain unique geological or physiological features; d. ecological features or habitat areas that contain significant rare or endangered animal or plan species and/or provide an important link for the natural migration of wildlife; or e. Protective notations.
Environmentally Significant Area	ESAs are generally defined as areas that are important to the long-term maintenance of biological diversity, physical landscape features and/or other natural processes, both locally and within a larger spatial context. ESAs are determined as per the criteria and evaluation matrix outlined in *Environmentally Significant Areas in Alberta: 2014 Update*.
Habitat Area	Means any vegetated area (forested, shrub, or herbaceous) that might provide habitat for species using both wetland and upland ecosystems.
Multi-Lot Residential Subdivision	A subdivision of land that creates more than three (3) lots out of a quarter section.
Municipality - Initiating	Means the participating municipality which has initiated a referral, review, or dispute resolution process.
Municipality - Participating	Means a municipality party to this IDP (i.e., County of Wetaskiwin and the Summer Villages of Argentia Beach, Golden Days, and Silver Beach).
Municipality - Responding	Means the participating municipality or municipalities which are not the initiating municipality.
Parcel	Means the aggregate of one or more areas of land described in a certificate of title or described in a certificate of title by reference to a plan filed or registered in a Land Titles office.
Peatland	Means a permanent wetland or a wetland complex characterized by the accumulation of peat derived from plant material.
Permitted Use	Means a use of land or of a building allowed under a LUB for which a development permit must be issued with or without conditions, provided that the proposed development complies in every way with the LUB.
Protective Notations	Means a protective notation places a land use restrict on land, usually owing to specific natural features, under the *Public Lands Act*.

Concept.

AGRICULTURAL DEVELOPMENT AND ACTIVITIES

4.2.1	The conservation of existing agricultural lands shall be encouraged to support the existing agricultural community.	MDP, WACP
4.2.2	Agricultural uses allowed within the Agricultural and Rural Development Area shall be those uses identified in the Agricultural District in the County LUB.	
4.2.3	Agricultural operations shall be buffered to reduce negative impacts or encroachment from conflicting land uses and developments on adjacent lands.	
4.2.4	Intensive livestock operations and confined feeding operations shall be regulated in accordance with NRCB requirements and policies and regulations in the County's MDP and LUB in order to minimize negative impacts on the Hamlet of Mulhurst Bay, settled rural residential areas within the County, the Summer Villages, and the water quality of Pigeon Lake.	WACP

SUBDIVISION AND CONVERSION OF AGRICULTURAL LAND FOR OTHER USES

4.2.5	Subdivision and development for uses other than agricultural uses shall be designed to minimize the fragmentation of agricultural lands.	MDP
4.2.6	Multi-lot residential subdivisions may be allowed on agricultural land with a farmland assessment rating less than 40 percent. **Map A9 – Farmland Assessment** identifies the farmland assessment rating of lands within the Plan Area.	MDP, WACP
4.2.7	The development of agricultural hobby farms and small agricultural holdings shall be allowed on poorer agricultural lands within the Agricultural and Rural Development Area, as provided for in the County's LUB.	
4.2.8	Subdivision of agricultural land shall comply with the County's MDP policies and the applicable provisions in County's LUB.	
4.2.9	New multi-lot subdivision and/or multi-unit developments shall not be allowed unless an ASP has been approved by the County. The ASP referral process shall be consistent with the referral policies in **Section 7.4**.	MDP

4.2.10	Multi-lot residential subdivision and/or multi-unit development will be allowed only after the approval of an amendment to the County's LUB, placing the lands affected by the proposed subdivision or development into an appropriate district.	
4.2.11	New multi-lot subdivision and/or multi-unit developments for commercial or industrial uses will not be allowed on lands within the Agriculture and Rural Development Area that are also subject to the policies of the Pigeon Lake Shoreline Area Overlay without an amendment to this IDP.	
4.2.12	Parcels with an area of 10 acres or greater and minimum 60 percent tree cover may be considered for redesignating to the Rural Conservation and Watershed Protection Area.	WACP

4.3 RESIDENTIAL AREA

Goal: Residential multi-lot developments are encouraged in appropriate locations. Residential multi-lot developments are designed to minimize impacts on ecological and water resources and to efficiently utilize available local infrastructure and accommodate the needs of existing and future residents.

Policies in this section apply to lands identified as Residential on **Map 2 – Future Land Use Concept.**

STATUTORY PLAN REQUIREMENTS

4.3.1	Residential multi-lot subdivision and development shall comply with the policies in the County's MDP and LUB.	MDP
4.3.2	New residential multi-lot subdivisions shall not be allowed unless an ASP has been approved by the County. The ASP referral process shall be consistent with the referral policies in **Section 7.4**.	MDP, Policy 61.1.6

DENSITY PROVISIONS

4.3.3	New residential multi-lot development outside of the Pigeon Lake Shoreline Area Overlay shall have a maximum density of 48 lots per quarter section and shall meet the minimum lot area requirements in the applicable district in the County's LUB.	WACP

Land use bylaw

Commercial Unit means a separate or self-contained area or area of one building which contains one commercial unit.

Common Lot means a bareland condominium lot collectively owned by the owners of the condominium subdivision. The lot is reserved for the exclusive use of the residents of the subdivision for purposes such as providing private open space, temporary recreation facilities or storage or access to public parks or reserve land.

Communal Dwelling see Dwelling, Communal.

Communication Tower see Telecommunication Tower

Community Hall means a building, which is available to the public for the purposes of assembly for community, cultural, political or social events.

Community Lot means a bareland condominium lot collectively owned by the owners of a subdivision plan. The lot is reserved for the exclusive use of the residents of the

subdivision for purposes such as providing private open space, temporary recreation facilities or storage or access to public parks or reserve land.

Condominium Unit means a condominium unit as defined by the *Condominium Property Act*, RSA 2000, (C-22).

Confined Feeding Operation (CFO) as defined by the AOPA means an activity on land that is fenced or enclosed or within buildings where livestock are confined for the purpose of growing, sustaining, finishing or breeding by means other than grazing, but does not include seasonal feeding and bedding sites. The County has no jurisdiction over confined feeding operations.

Convenience Store means a building where retail goods and food products are sold as required by area residents on a day-to-day basis and may include fuel pumps. Retail Liquor Store is not included within this definition.

Convention Facility means a development that provides accommodation for meetings, seminars, conventions, product and trade fairs and other exhibitions, with or without eating and drinking facilities.

Conventional Construction or Conventional Stick Built means a building frame or constructed on-site of conventional building materials in accordance with the Alberta Building Code.

Corner Lot or Site means a lot or site located at the intersection of two public roads, other than lanes.

Council means the Council of the County of Wetaskiwin No. 10.

County means the County of Wetaskiwin No. 10.

CSA means the Canadian Standards Association.

Day Care means any child care program provided to seven (7) or more children (under the age of seven (7) who are not attending school on a full time basis) for four (4) or more consecutive hours in each day the program is provided and operates in accordance with Schedule 1 of the Child Care Licencing Regulation.

Day Home means a child care program providing child care to no more than six (6) children zero (0) to twelve (12) years old in the private residence of the child care provider.

Deck means a structure with the top of the floor 0.6 meters (2 feet) or greater in height above finished grade without a roof or walls, except for railings, which is designed and intended for use as an outdoor amenity area.

Deemed Complete means an application for a development permit is in order such that it may be processed.

Deemed Incomplete means a decision to refuse a development or subdivision application because the applicant has provided insufficient information to process the

Land Use Bylaw...336588358.pdf - Read-only

Municipal Improvements mean improvements including, but not limited to, roads and accesses which are or will become owned by the municipality and shall mean the same as Local Improvements.

Municipal Planning Services (MPS): Subdivisions are processed in cooperation with Municipal Planning Services (MPS), who are contracted by the County to initiate all subdivision applications

Municipal Service means a municipally owned and operated system of works for the provision of water, sewer or other services.

Multi-Tenant Commercial Building means a building designed and constructed in accordance with appropriate safety codes to accommodate multiple commercial tenants and/or uses within the same building. Approval for the classification does not include approval for the specific uses.

Must is an operative word that means the action is obligatory.

Natural Severed Split means a parcel of land where a water course such as a river or stream, developed road, railroad, crown claimed water body or ravine physically separates the parcel into separate portions for farming, or where an intervening ownership will not allow his land to be used for crossing for farming purposes. There must be a suitable building site on both portions of the parcel, and physical and legal access to a maintained road.

New Yardsite means land on which there is a working well or on which proof of a water supply has been demonstrated pursuant to the standards of this Bylaw; and where the land must be improved for residential use and be more than ten years old before it can be registered as a separate title.

Notwithstanding means in spite of; without prevention by; nevertheless; all the same; although.

Nuisance Effect means an interference with the common right of the general public or an indefinite number of persons, or an interference with the health, safety, peace or comfort of the community. Specific conditions which may be characterized as nuisances may include, but shall not be limited to, noise, smoke, steam, odour, dust, fumes, exhaust, vibration, heat, glare, refuse matter and storage of hazard or combustible materials or goods or any other elements deemed relevant by the Development Authority.

Obstruction to visibility means an object or thing near a highway or road which affects the safety of vehicular and/or pedestrian traffic.

Oilfield Service Business means a company which provides services to the petroleum exploration and production industry but which does not typically produce petroleum themselves. This may include the provision of infrastructure, equipment, intellectual property and other services.

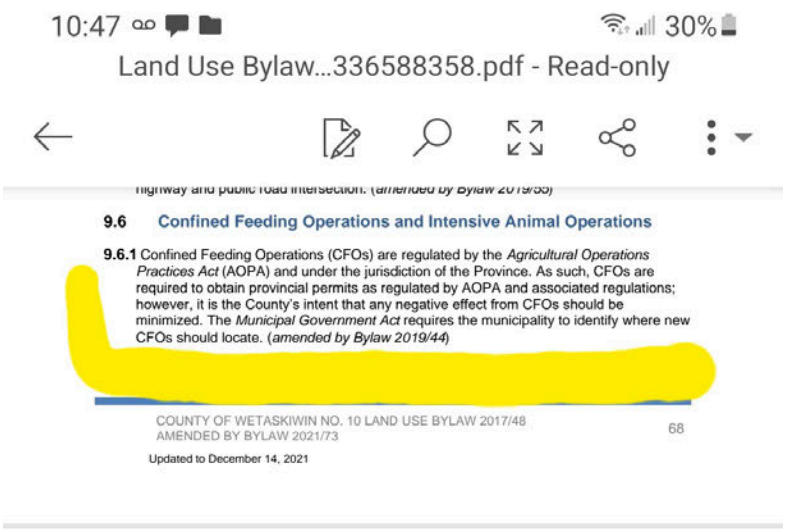
Offsite Home Occupation (Type 1) means business or commercial activities that operate within the following requirements:

- Allowed in all districts (excepting Commercial and Industrial districts which have respective regulations);
- No employees coming to the site, only resident/landowner ;
- No clients coming to the site (not including multiple deliveries per day);
- 500 sq. ft of outdoor storage (pertaining to the Home Occupation); and
- Company vehicles limited to one (1) and such vehicle to be restricted to a one (1) ton truck and max of 30' trailer(No trailer allowed in the following districts Recreational Resort Holding-Dorchester Ranch Resort, Mobile Home, High Density Rural Residential, Lakeshore Residential).

If a proposed use is already listed within a District or another more specific definition may be more suitable, the above definition does not apply. (*amended by Bylaw 2019/55*)

Offsite Home Occupation (Type 2) means business or commercial activities that operate within the following requirements:

- Allowed in all Agricultural, Residential, and Watershed Protection, excluding the Recreational Resort Holding-Dorchester Ranch Resort, Mobile Home, High Density Rural Residential, Districts Lakeshore Residential, and Urban Residential districts;



highway and public road intersection. (*amended by Bylaw 2019/55*)

9.6 Confined Feeding Operations and Intensive Animal Operations

9.6.1 Confined Feeding Operations (CFOs) are regulated by the *Agricultural Operations Practices Act* (AOPA) and under the jurisdiction of the Province. As such, CFOs are required to obtain provincial permits as regulated by AOPA and associated regulations; however, it is the County's intent that any negative effect from CFOs should be minimized. The *Municipal Government Act* requires the municipality to identify where new CFOs should locate. (*amended by Bylaw 2019/44*)

9.6.2 An Intensive Livestock Operation is a Confined Feeding Operation that is smaller than the threshold size that falls under Provincial jurisdiction, as determined by the Provincial guideline.

9.6.3 For Intensive Livestock Operations, the Minimum Distance Separation (MDS) set out in the regulations under AOPA should be maintained.

9.6.4 For Intensive Livestock Operations, the Minimum Distance Separation is determined by using the threshold level of the animal or the combined effects of the different kind of animals that are kept on one premise.

9.6.5 New Intensive Livestock Operations shall obtain development permits from the County.

9.6.6 Existing Intensive Livestock Operations shall obtain a new permit when:

a) changing the category or the number of animals; or

b) increasing the amount of manure produced beyond the existing approval.

9.6.7 A development permit for an existing, expanding or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake. In determining such proposals, the applicant may include an environmental inspection report from a qualified intensive livestock engineer representing Alberta Agriculture or Forestry (or successor).

9.6.8 The Development Officer may request an environmental assessment before issuing a development permit for any expanded or proposed Intensive Livestock Operation.

9.6.9 In accordance with Objective 1.4 of the County's Municipal Development Plan, a development permit for an existing, expanding or proposed intensive livestock operation may be refused if the proposed development is within:

a) 2.4 kilometers (1.5 miles) from the boundary of a City, Town, Village, Hamlet, Summer Village or a school or hospital;

b) Under no circumstances can a new CFO be located within 1.6 km (1 mile) of the following named lakes: Battle Lake, Buck Lake, Coal Lake, Pigeon Lake, Red Deer Lake, Wizard Lake and Twin Lakes; or

c) All other unspecified environmental features, including but not limited to lakes not specified in (b), wetlands, and watercourses shall have setbacks in accordance with *Alberta Operation Practices Act* and Regulations (AOPA) as amended.

9.6.10 Land within identified drainage basins 2.4 kilometres (1.5 miles) around named lakes (as referred to in the Municipal Development Plan) may not be used for manure disposal unless sufficient protection measures are proposed by the operator to prevent manure runoff negatively affecting such lakes. In accordance with the County's jurisdiction regarding Intensive Livestock Operations (ILO). (*amended by Bylaw 2019/44*)

l) is closer to a confined feeding operation or manure storage facility than the minimum separation distance set out in the regulations under AOPA, for the smallest size of that type of operation.

(Example: 300 head is the smallest beef finisher operation recognized as a CFO. The MDS for that size of operation to a single residence is 245.0 meters. (804 feet) Therefore, 245 meters is the MDS for any beef finisher operation that qualified as an intensive livestock operation under the Bylaw definition above).

m) would materially interfere in the natural and economic expansion of an existing agricultural operation or its proposed expansion;

n) would prevent or interfere with the natural and economic extension of a nearby developed area, a coal mine, an oil or gas field, a sewage treatment plant, a waste disposal or transfer site, a gravel pit, a pipeline, or a road system; or

o) is subject to any easement, caveat, restrictive covenant, or other registered encumbrance which makes it impossible to build on the site.

9.12.3 The Subdivision Authority or Development Authority may approve a subdivision or development permit if the Authority is satisfied that there is no risk to persons or property, or that these concerns will be met by appropriate measures.

9.13 Water Supply Standards

9.13.1 The County may require developers to prove out an adequate water supply before approving an application for subdivision or a development permit application. The Province of Alberta *Water Act* (2000) requires that 1,250 m3/year be available per household in a rural subdivision in order to avoid interference between existing household and/or traditional agricultural users in the area.

9.13.2 For the proposed subdivision of single lots in rural areas for residential use, groundwater must provide the water supply unless otherwise provided by a municipally and provincially approved water system.

9.13.3 Cisterns may be allowed only in a previously subdivided lot:

a) as an addition to a well with a low production rate; or

b) as the sole source of supply in areas of the County where a well would be prohibitively expensive, as determined by the County.

9.13.4 Dugouts may not be permitted for residential uses.

9.13.5 For the proposed subdivision of a lot for an existing farm site and related improvements, an existing water well(s) may be accepted as proof of an adequate water supply. If the well(s) does not provide an adequate water supply, the developer may be required to have the well tested by a licensed water well driller.

9.13.6 For the proposed subdivision of two to five lots (including the accumulation or result of subdivision) from a quarter section or its development equivalency, an existing well may be tested or a new well may be drilled by a licensed water well driller and/or report by a hydrological engineer to prove adequate water supply exists, as determined in this section.

9.13.7 For medium to high density residential uses and all other uses, supply standards may be decided through consultation with a hydrological engineer and relevant agencies, including Alberta Environmental Protection, Alberta Agriculture and Rural Development, and the Fire Adviser - Alberta Labour.

9.13.8 For the purpose of Section 9.13.5, Section 9.13.6 and Section 9.13.7 above, the well driller's or hydrological engineer's report must be submitted to the County and must show a minimum two-hour pump test, a minimum production level of 0.5 imperial gallons per minute (igpm), impact on adjacent well drawdown and a minimum recovery rate of 90%.

9.13.9 Development permit or subdivision applications for uses which require large quantities

Surface Water Guidelines

1,2,3,4-Tetrachlorobenzene	
1,2,3,5-Tetrachlorobenzene	
1,2,4,5-Tetrachlorobenzene	
Pentachlorobenzene	
Hexachlorobenzene	
2,4-Dichlorophenol	
2,4,6-Trichlorophenol	
2,3,4,6-Tetrachlorophenol	
Pentachlorophenol	
Dioxins and Furans	
[redacted]	

Table C-11. Surface Water Quality Guidelines

	Drinking Water (mg/L)	Aquatic Life (mg/L)	Irrigation (mg/L)	Livestock Water (mg/L)	Wildlife Water (mg/L)	DFED[1] (mg/kg-bw/d)
Dieldrin	0.0007					
Dimethoate	0.02	0.0062		0.003		
Dinoseb	0.01	0.00005	0.021	0.15		
Diquat	0.07					
Diuron	0.15					
Endosulfan	0.057	0.000003				
Endrin	0.0028					
Glyphosate	0.28	0.065		0.28		
Heptachlor epoxide	0.0000518					
Lindane	0.0028	0.00001		0.004		
Linuron	0.019	0.007	0.00011			
Malathion	0.19	0.0001				
MCPA	0.1	0.0026	0.00004	0.025		
Methoxychlor	0.9	0.00003				
Metolachlor	0.05	0.0078	0.028	0.05		
Metribuzin	0.08	0.001	0.0005	0.08		
Paraquat (as dichloride)	0.01					
Parathion	0.05	0.000013				
Phorate	0.002					
Picloram	0.19	0.029		0.19		
Simazine	0.01	0.01	0.0005	0.01		
Tebuthiuron	0.66	0.0016	0.00043	0.13		
Terbufos	0.001					
Toxaphene	0.00043					
Triallate	0.123	0.00024		0.23		
Trifluralin	0.045	0.0002		0.045		
Other Organics						
Aniline	0.066	0.0022				
Dibutyl phthalate	0.59	0.019				

C>8-C10	0.3
C>10-C12	
C>12-C16	
Sum of all subfractions	

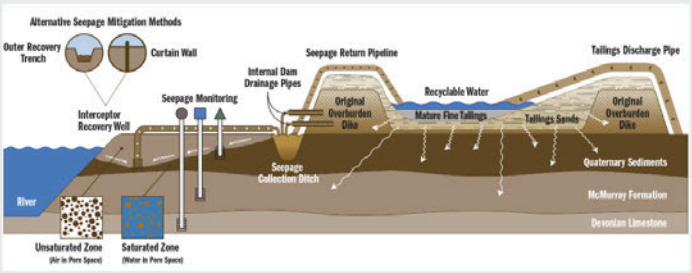
Notes:
Source: CCME (2008a)
Subfraction distribution in groundwat
These values were calculated from th
based on equilibrium partitioning ass

Table C-11. Surface Water Quality Guidelines

	Drinking Water (mg/L)	Aquatic Life (mg/L)	Irrigation (mg/L)	Livestock Water (mg/L)	Wildlife Water (mg/L)	DTEDI[1] (mg/kg-bw/d)
General and Inorganic Parameters						
Aluminum		see note 2	5	5		
Ammonia		see note 2				
Bromate	0.01					
Chloride	250	120	100			
Cyanide (free)	0.2	0.0052				
Electrical Conductivity (dS/m)			1			
Fluoride	1.5		1	1		
Nitrate (as nitrogen)	10	3				
Nitrate + Nitrite (as nitrogen)				100		
Nitrite (as nitrogen)	1.0	see note 2		10		
Sodium	200					
Sodium Adsorption Ratio (SAR)			5			
Sulphate	500	see note 2		1000		
Sulphide - Total (as S)[1]	0.05	0.002				
Total Dissolved Solids (TDS)	500		500	3000		
Metals						
Antimony	0.006					
Arsenic (inorganic)	0.01	0.005	0.16	0.025		
Barium	1					
Boron	5	1.5	1.0	5		
Cadmium	0.005	see note 2	0.0082	0.08		
Chromium (trivalent)		0.0089	0.0049	0.05		
Chromium (hexavalent)		0.001	0.008	0.05		
Chromium (total)	0.05					
Copper	1	0.007	0.2	0.5		
Iron	0.3	0.3	5			
Lead	0.01	see note 2	0.2	0.1		
Manganese	0.05		0.2			

eliminates duplicative efforts and accelerates the development of technologies and processes. This will speed up the reclamation of tailings ponds, as well as environmental performance across all four EPAs.

Tailings Seepage Recapturing and Monitoring Systems



Source: Ministry of Environment and Sustainable Resource Development, Government of Alberta

1 Canadian Association of Petroleum Producers, Responsible Canadian Energy: 2013 Progress Report

previously unsubdivided quarter section in agricultural land unless rezoning or an area structure plan is approved.

1.1.4 In addition to Section 1.1.3, another subdivision is allowed subject to redistricting when:

a) creating a parcel to separate one additional existing residential farmsite, as defined in the current land use bylaw, and in accordance with Policy 6607 Second Yard Subdivisions, as amended; which requires improvements to be more than ten years old; or

b) there are natural or man-made barriers creating a natural severed split such as a river or stream, lake, road, or railway and pose difficulties to farm as one parcel.

1.1.5 The parcel size and the configuration of a new subdivision on an unsubdivided quarter section should be such that the least amount of land is taken out from agricultural production. The recommended parcel size is 2.0 ha (5 ac.).

1.1.6 In order to minimize the impact on the adjacent farming operation, a new parcel on a quarter section is encouraged to locate:

a) where the land is not suitable for agricultural production; and

b) where there is/are existing farmsite(s) on a corner of the adjacent quarter sections; or

c) near where existing improved roads (paved or gravel) intersect.

Objective 1.2 Protect agricultural land to remain in production

Traditional extensive crop farming is the strong backbone of the County's farming industry, which relies on high capability agricultural soil. Once the land is converted to non-agricultural use, it is very difficult to convert it back to productive farmland due to the change in soil characteristics, fragmentation, and possible contamination. At the same time, lower rated land in the western part of the County has traditionally been used for grazing. A typical ranching operation requires a large tract of land to be viable.

Non-agricultural land uses and the more intensive agricultural practices, such as greenhouses, or intensive livestock operations, do not require a large tract of land or highly productive soil but still can be profitable. These land uses have a lesser reliance on the soil capability, and may be directed away from high capability, unsubdivided agricultural land.

At the same time Farmland value should be established for fair evaluation of the ranching or non-traditional agricultural operations.

1.2.1 Productive agricultural land includes:

a) land in production with a farmland assessment value of 30 % or more;

b) grey-wooded soil producing hay, forage or other crops; and

c) land currently used for grazing.

1.2.2 Area structure plan or rezoning will not be considered if the land is classified as productive agricultural land as defined above except as allowed elsewhere in the Municipal Development Plan.

1.2.3 Agricultural uses that do not depend on good soil quality or a large tract of land are encouraged to locate:

a) where the Canada Land Inventory (CLI) soil class for agricultural capability or farmland assessment rate (FAR) value is low (CLI class 4 and lower, FAR below 30%); or

b) on a previously subdivided quarter section.

Objective 1.3 Raise public awareness and share the responsibility of protecting farmland in the County

Farmland is not only used for food production but also fosters various public goods such as open landscape; clean air and water; and wildlife habitat and riparian areas. Although it is difficult to quantify these benefits, it is recognized by most Canadian provinces, including the Province of Alberta, through "right to farm" legislation. The County will continue to foster a positive stature of farming with other land uses.

The general public benefits from the environmental value and also enjoy the beautiful landscape of farmland, but the responsibility of maintaining healthy farmland is primarily carried by the farmers and ranchers. Seasonal variation of earnings or its susceptibility to the weather and other external factors make it hard to maintain a steady income for farmers. Subdividing the farmland is one of the few ways to create lump-sum cash when needed, such as for retirement.

c) land currently used for grazing.

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1.3.1 The County may provide regular public notices through various media to inform the public that the farming operation in the County may cause slow moving traffic, noise, dust, odour, aerial spraying, extended working hours, and manure production and application.

1.3.2 The County may require a caveat to be registered on title for a new lot to advise of the impacts of farming operations such as slow moving traffic, noise, dust, odour, etc. in the County.

1.3.3 The County may consider introducing programs to protect farmland from subdivision or conversion to non-agricultural uses. Such programs may include the transfer of development credit, tax rate freezes for agricultural land in high-demand areas, conservation easement incentives, and cluster zoning provision.

1.3.4 The County will continue to recognize the importance of agriculture in its planning documents.

Objective 1.4 Minimize the land use conflict with Confined Feeding Operations and surrounding land uses

While the Confined Feeding Operations are under Provincial jurisdiction[4], it is the County's intent that any negative effect from the Confined Feeding Operation should be minimized. The Municipal Government Act requires the municipality to identify where new Confined Feeding Operations should locate.

An Intensive Livestock Operation is a Confined Feeding Operation that is smaller than the threshold size that falls under Provincial jurisdiction, as determined by the Provincial guideline.

1.4.1 The minimum distance setback of Alberta Agriculture Code of Practice, as amended, should be maintained.

1.4.2 For an Intensive Livestock Operation, the Minimum Distance Separation is determined by using the threshold level of the animal or the combined effects of the different kind of animals that are kept on one premise.

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1.4.1 The minimum distance setback of Alberta Agriculture Code of Practice, as amended, should be maintained.

1.4.2 For an Intensive Livestock Operation, the Minimum Distance Separation is determined by using the threshold level of the animal or the combined effects of the different kind of animals that are kept on one premise.

1.4.3 Any size of new Confined Feeding Operation (including Intensive Livestock Operation) must not locate within the following setback distances as illustrated in Figure 3.

a) 2.4km (1.5 miles) from the boundary of any city, town, village, hamlet, and school and hospital.

b) Under no circumstances can a new CFO be located within 1.6km (1 mile) of the following named lakes: Battle Lake, Buck Lake, Coal Lake, Pigeon Lake, Red Deer Lake, Wizard Lake and Twin Lakes.

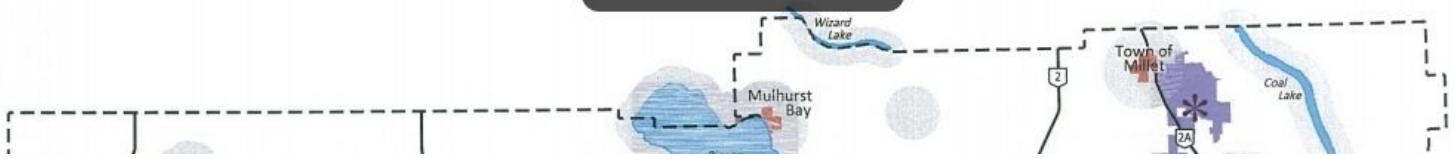
c) All other unspecified environmental features, including but not limited to lakes not specified in (b), wetlands, and watercourses shall have setbacks in accordance with Alberta Operation Practices Act and Regulations (AOPA) as amended.

1.4.4 A new residence is not permitted within the Minimum Distance Separation of an existing Confined Feeding Operation/Intensive Livestock Operation, unless the residence is associated with the operation.

1.4.5 Within the Millet-Wetaskiwin Acreage Study Area, the setback distance outlined in 1.4.4 may be relaxed by up to 25% of the minimum distance separation required by Alberta Agricultural Code of Practice.

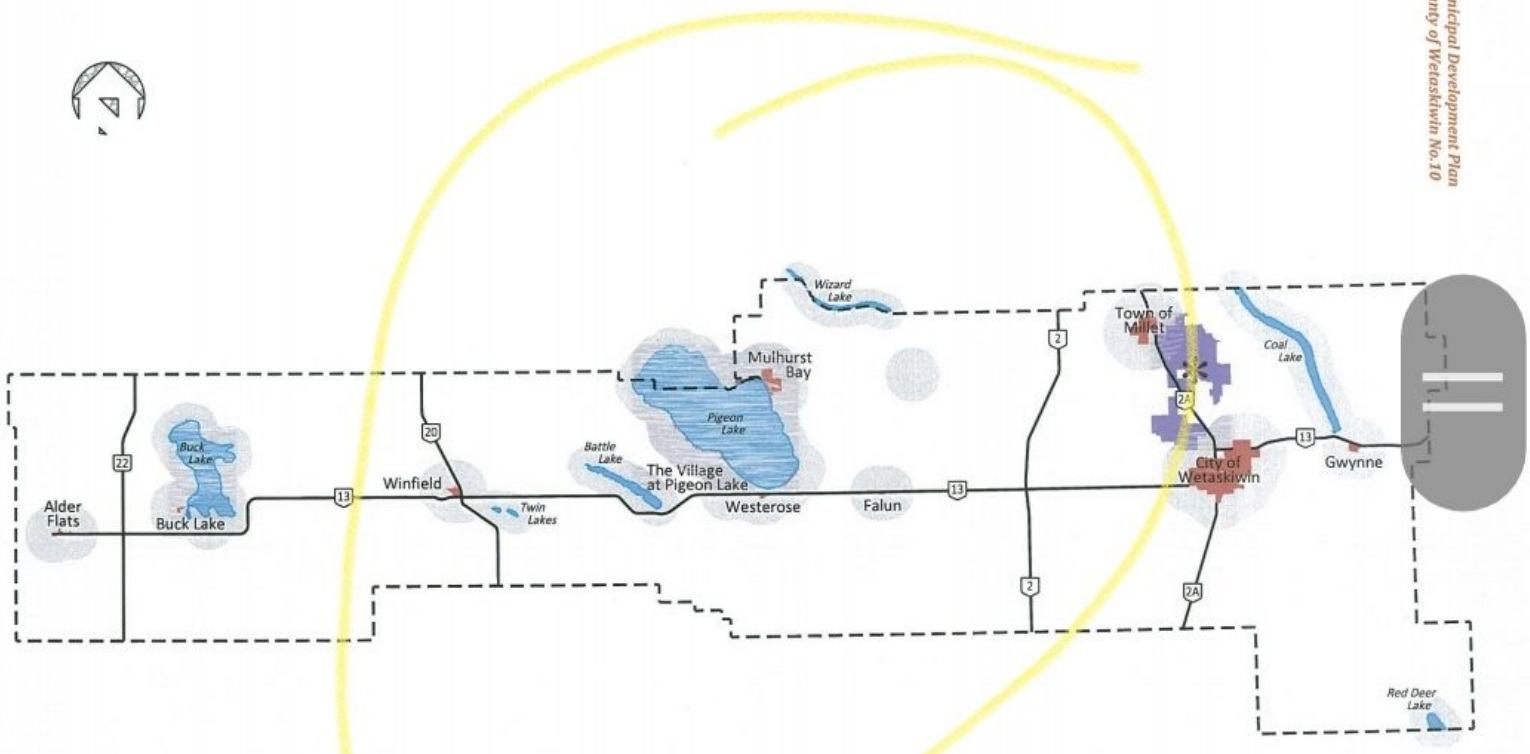
4 Agricultural Operation Practices Act, Agricultural Operations, Part 2, Matters Regulation, Schedule 2 Threshold Levels

13 of 37



required by Alberta Agricultural Code of Practice.

4 Agricultural Operation Practices Act, Agricultural Operations, Part 2. Matters Regulation, Schedule 2 Threshold Levels



County of Wetaskiwin No. 10
Municipal Develpoment Plan

Figure 3: Confined Feeding and Intensive Livestock Operation Setback

Appendix A - Bylaw 2016/55 Scale 1: 500 000

2 Residential

The County is experiencing a growing demand for residential development in non-urban areas. When carefully located, residential development within agricultural land can be a positive addition to the County. At the same time, the cost of providing Municipal and community services in remote locations is much higher than focusing service delivery to one area[5]. Uncontrolled residential subdivisions scattered across the community can become a financial burden to the municipality.

The County is immediately outside of Capital Region, where the Capital Region Plan does not allow typical country residential development within its plan area. Some urban centres with strong growth boundary policies unintentionally triggered leapfrog development outside the growth boundary. The County may see increased pressure for residential subdivision due to its proximity and accessibility to the Capital Region, particularly along Highway 2 and Highway 2A due to the Capital Region Plan's strict approach to country residential development. Nevertheless, it is understood that the land along Highway 2 is difficult to accommodate multi-lot residential development because of the lack of water supply and access limitation requirements by Alberta Transportation.

It is the County's intention that future residential development be clustered and located where services already exist or can be logically and economically extended.

Objective 2.1 Cluster residential development to hamlets and close to services

Hamlets in the County are: Alder Flats, Buck Lake, Falun, Gwynne, Mulhurst Bay,

TAB 2

STATEMENT OF CONCERN

For directly affected property owners near Pigeon Lake

Re: Natural Resources Conservation Board Application RA21045-

Confined Feeding Operation, Greg Thalen and G and S Cattle Ltd.

Filer Information

Name: Dave Labutis

Rural Address: [redacted]

Legal Land Description: [redacted]

Mailing Address: [redacted]

Phone: [redacted]

Email: [redacted]

Statement of Concern

The Confined Feeding Operation, Application RA21045, should be declined

Response from a Directly Affected Party

My Background:

My family was one of the first in the area that settled and farmed this land nearly a hundred years ago and we now have the fifth generation of our family living on this land. They chose this particular location because of Pigeon Lake and the fact it had fish to harvest. In later years as kids we used the lake for swimming and fishing and now the grandkids still do occasionally when there are no advisories. We try to make real efforts to strike a balance between harvesting off the land and preserving the land. We have all been born and raised on this land and currently me and my family(parents Ozzie and Jennie, sisters Deanna Klatt and Stephanie Labutis, brother in law Martin Klatt and niece Nicole Klatt) own 5 1/2 quarters of land in one block in the area. And even though we own equipment capable of removing every last tree off these quarters we have instead chose to leave substantial bush areas and creek areas to leave places for wildlife -we have left enough bush around that we always see moose and deer around and even see the odd lynx cat-unlike intensively farmed areas I have seen in Alberta where they remove every tree right up to the farmhouses making the landscape look like barren wind swept prairie with no refuge left for anything. Said another way its not all about trying to squeeze everything you can for maximum profit-there are things that matter more than money. We enjoy being outside on our land as it serves both purposes of being a source of income as well as recreation-even for my 96 ½ year old dad who still gets out on his quad to check out some of his summer pastured cattle.

CONCERNS

1. Air quality issues-Under their NRCB application I Part 2-Technical Requirements they detail that the manure storage pile will be moved from the current 900 meters to within 400 meters from the nearest water draw-which is straight east of the current operation- a full ½ kilometer closer to our lands west boundary which means the smell of the manure and cattle/equipment noise will be a half kilometer closer to our residences that are downwind of the prevailing northwesterly winds-we currently smell the existing operation on quite a few days and with it being a ½ kilometer closer we will be guaranteed to smell it a whole lot more.

2. Our Creek Water Quality-A creek runs directly from SE corner of the G and S feedlot location on to our land. They say the proposed manure catch basins location is 400 meters from the nearest seasonal creek -that's not correct-it actually looks far closer to 200 meters or far less from the nearest seasonal creek that ultimately flows in to Pigeon Lake via our land and in to Sunset Harbour Creek. The very creek that for roughly the last 3 years has had high amounts of cow manure in it during spring runoff season-so bad in recent years that a couple times we saw lots of manure stained snow and the strong smell of cow manure filled the air if you stood within 10 feet of the creek in the center of the NE ¼ of Sec 3-47-2W5M(my dads quarter immediately straight east of proposed feedlot)-and this in a creek flowing lots of volume of water in to Pigeon Lake at that time of year-plus we have had no pasture cattle or any other cattle on this bush quarter for over 5 years-so for sure the only cattle that could have runoff in to this area would be from G and S . We had a water sample taken using CCME Guidelines and analyzed by an accredited laboratory Element Labs in Edmonton on March 25/2022 for phosphorus and ammonia-it came back high with levels 10 to 25 times higher than any taken in 2013 in Total Phosphorus and was also high in ammonia.

3. Loss of Recreation on Pigeon Lake-Tide Creek and Sunset Harbour Creek are already high in phosphorus coming from the feedlot. We used to enjoy swimming and fishing on Pigeon Lake but with increasing algae blooms and health advisorys its not something we can enjoy as often. The Lake is already high phosphorus level damaged and the current flows out of Tide Creek and Sunset Harbour Creeks are right now adding more phosphorus with the current feedlot operation being identified as the single point source of the current high phosphorus readings in each creek. So in time we will likely not want to use Pigeon Lake at all if it becomes a manure nutrient killed lake.

4. Loss of water wells-With the huge volumes of water needed to feed 4000 cattle there will be huge pressure on water tables. 160,000 liters a day needed. Big concern of how many of our wells could potentially go dry after years of pumping out of many wells at the feedlot.

5. Loss of Property Value and Use-For sure our land values will drop if we ever decide to sell some of our property as lots of its value now is because of its close proximity to Pigeon Lake and its recreation value. Being located right beside a CFO will turn off a lot of buyers especially the

ones attracted to Pigeon Lake because of its recreational value. Nobody would want to pay top dollar for a property bathing in the smell of cow manure. Also had plans to build a new house with a lake view roughly 700 meters from the proposed CFO-but if ever the CFO was approved the house can not be built anywhere near the distance I want it at due to CFO minimum distance requirements in their regs. In addition who would want to build a new house only 700 meters downwind from a CFO if it ever were to get approved so there goes out the window some future plans as well if this thing were ever to be approved.

6. This proposal also seems to contravene the following development policies:

   a. The Pigeon Lake Watershed Management Plan-recognizes that CFO's have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, **Objective 2e** from the Plan states there should be **NO** CFO's within the watershed

   b. **County of Wetaskiwin Plans-** recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. In **Section 5.5** policies are presented to guide the County when evaluating a proposal to develop land in the watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFO's should **not** be in the watershed. **Section 5.5.2 Agriculture -**Large-scale confined operations are not appropriate in the Pigeon Lake Watershed.

      i. The County's Land Use Bylaw-**Section 9.6.10-** "An existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

      ii. The County's Municipal Development Plan also provides direction over the concern of the environment. **Section 3-**Protecting the environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

   c. **Natural Resources Conservation Plan-** The **NRCB** has an obligation which is well defined to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to consider factors which will degrade or damage Pigeon Lake will place the responsibility both legally and morally on the NRCB and they will be held accountable.

7. The County of Wetaskiwin's Muncipal Development Plan states "The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment. P3. IN doing so this land use plan reinforces that it supports a high quality of life for residents. It supports economic growth and development but only if it is appropriate to the location and so long as there is no negative impact on air, natural resources, water or soil quality.

8. Pigeon Lake Watershed Management Plan was adopted as a guide to help reduce the number of algae blooms in Pigeon Lake. The Plan calls for a net reduction in nutrient runoff into Pigeon Lake and states that statutory land use restriction on new or expanded intensive livestock operations (including CFO's), are supported

9. The challenge of spreading 150 TONS of manure equivalent per day over the nearby 16 quarters of land over the summer/fall months and with every last one of them sloping in to gulleys and bowls that all drain exclusively in to the already high phosphorus level fish spawning grounds of Tide Creek or in to Sunset Harbour Creek where the jackfish spawn could very likely cause waste runoff problems over time. Spreading manure and tilling in operations will never neatly match up with favourable weather conditions causing operators of the feedlot feeling pressure to compromise how they would like to do things even if they try to be best intentioned. The way the regs read now they have 48 hours to till in the manure once spread-that's lots of time for thunder storms to roll in and mess up the whole plan badly. Manure will be piling up to the tune of 150tons + per day and with weather like two years ago where it rained almost every day for a couple months straight(May 15-July 15 roughly). How are they supposed to keep up with spreading operations if 2 of your 6 months of potential spreading time are killed by bad weather-might have to start compromising things to get it done.

10. Also Fish and Wildlife bought two quarters of land along Tide creek and others have donated quarter sections along Tide Creek to help preserve its natural state. Taxpayers and lake people have already spent $millions of dollars in septic line installations and to clean up the Waste nutrients they initially had a big part of leaking in to the lake so why would one allow some new operation to have all their rain runoff enter the lake to undo any gains that were made previously. Biologists studying the lake now say the cabin based pollutants are greatly reduced and now it looks like the bulk of it is from surface runoff from the land.

11. Set back distances for manure catch basin should be 1 mile from the nearest creek and not 1 mile back from the lake shore. The creeks in spring on frozen ground become the rapid transit of nutrients to the lake when water flows are high and fast. Very little absorption of nutrients in to soil happens during spring run off times on its way to lake. There are fish upstream on those creeks during spawning that reduce that 1 mile even a lot more especially on Tide Creek where fish can easily be upstream well over a mile and a half.

Cumulative effect

The application does not reference the current operation and condition of the land, which is relevant for an impact assessment. A large number of cattle transport trucks and other large vehicles move on and off the property suggesting a large scale operation is run on the property. The decision should account for the current condition of the property such as streams, fields, increased number of predatory animals, water use, etc. Spreading high volumes of manure over land all sloping towards Tide Creek and Sunset Harbour Creek in volumes that could exceed 150 tons per day introduces a new risk that growth promoters, antibioitics, nitrogen, and phosphorus in the streams will adversely affect our cattle or maybe travel in to our water wells.

The following pages are from a former Pigeon Lake Conservation officer Jannette Hall who has done a lot of work on the Pigeon Lake area and makes the following submissions:

The Pigeon Lake area is in an already stressed ecological area. Cumulative stress from tourists, recreation, farming and development from urban sprawl has already damaged the surrounding habitat. Increased nutrients into the watershed could do a lot of damage to the already fragile fish populations.

This location is in an area that receives the highest and most sudden fluctuations of run off. The massive watershed collects water and concentrates it in this area prior to it being released into the lake. The likelihood of any mitigation techniques failing is high.

Jannette Hall also says"I used to work as a Conservation Officer at Pigeon Lake and am well versed on the fragility of this lake and the unmanaged recreational pressure and industry pollution already stressing and threatening the watershed. Other threats like shallow waters, cause oxygen depletion and algae blooms have brought the lake to an ecological tipping point that conservation efforts have worked hard at reversing the last 20 years. Cumulative impacts MUST be considered and I officially request an Environmental Impact Assessment and the Department of Fisheries be involved to assess critical habitat of the Walleye Spawning grounds". I agree fully with her and likewise request that an Environmental Impact Assessment must be done and that the Department of Fisheries be involved to assess critical habitat of the Walleye Spawning grounds.

Again to quote her expertise she goes on to say "I also lay out the biosecurty impacts on surrounding farms using the battle river and pigeon lake watershed. This high risk operation puts countless farmers and the industry as a whole at risk given the way disease can spread in the lake and the durations of quarantine lock downs. The high risk operations overlap 5 different livestock auctions and ranches in other provinces. These transfers create unnecessary risk to farmers down stream."

And again she says "I also explain the impacts to the environment, specifically the well known and documented Walleye spawning grounds that Alberta Environment has studied for nearly 70 years. The tributary of this spawning ground is so sensitive it has always been closed to fishing and human disturbance and it spurred sewage management policy around the watershed. Given the likelihood that the Public Land Use Act, The Alberta Water Act and the Species at Risk Act will likely all be overlapping, and the NRCBs jurisdiction on manure management it's almost a guarantee the standard practices for manure management for CFOs will fail to mitigate impacts to the Walleye Spawning grounds. The land proposed to handle the manure slurry from the feedlot is already grazed all summer and loaded with manure." And further she says " I insist on a Federal Standards ENVIRONMENTAL IMPACT ASSESSMENT that meets the National standard. I then insist the CFO complies with CCME sampling standards and tier 1 water guidelines for sensitive ecological reserves during spring runoff prior to fish spawning and during every significant rainfall event". I 100% agree with her that an Environmental Impacts Assessment that meets National Standard with Mitigations should be carried out.

I believe the proximity and threats to this fishing spawning ground is justification to request a full ENVIRONMENTAL IMPACT ASSESSMENT as the CFO can have impacts that fall under the Canadian Department of Fisheries and the Navigable Water Act.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up connecting waterbodies of a different class.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

There are clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constant efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm seems to have pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tide creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.

This would also rule out or confirm previous impacts to the lake.

It's also the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

If after this, the process of the application is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this.

● And one more important point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter. The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. Alberta already has one of the highest rates of E-coli infection and these bugs can end up in the lake.

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes as well. As new cows will always be treated pesticides will flush into the water on a consistent base. Feed will also be covered in herbicides and make their way into the lake.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users.

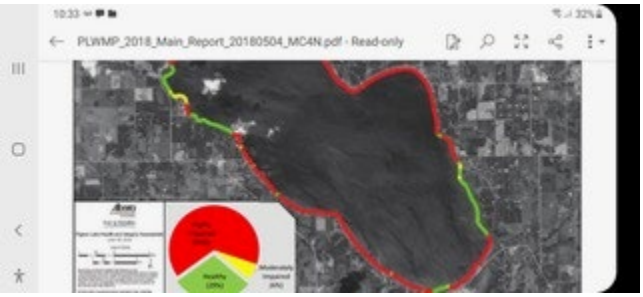
● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a operators polluting the lake. There just isn't the resources to protect Albertan's.

The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.

The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

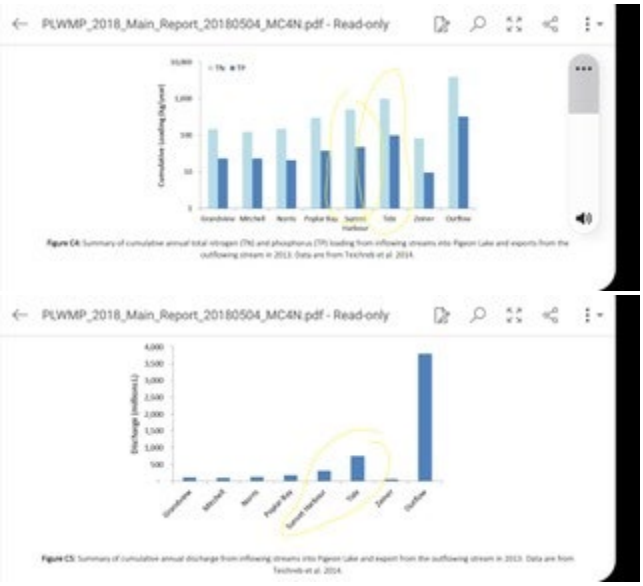
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.



However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



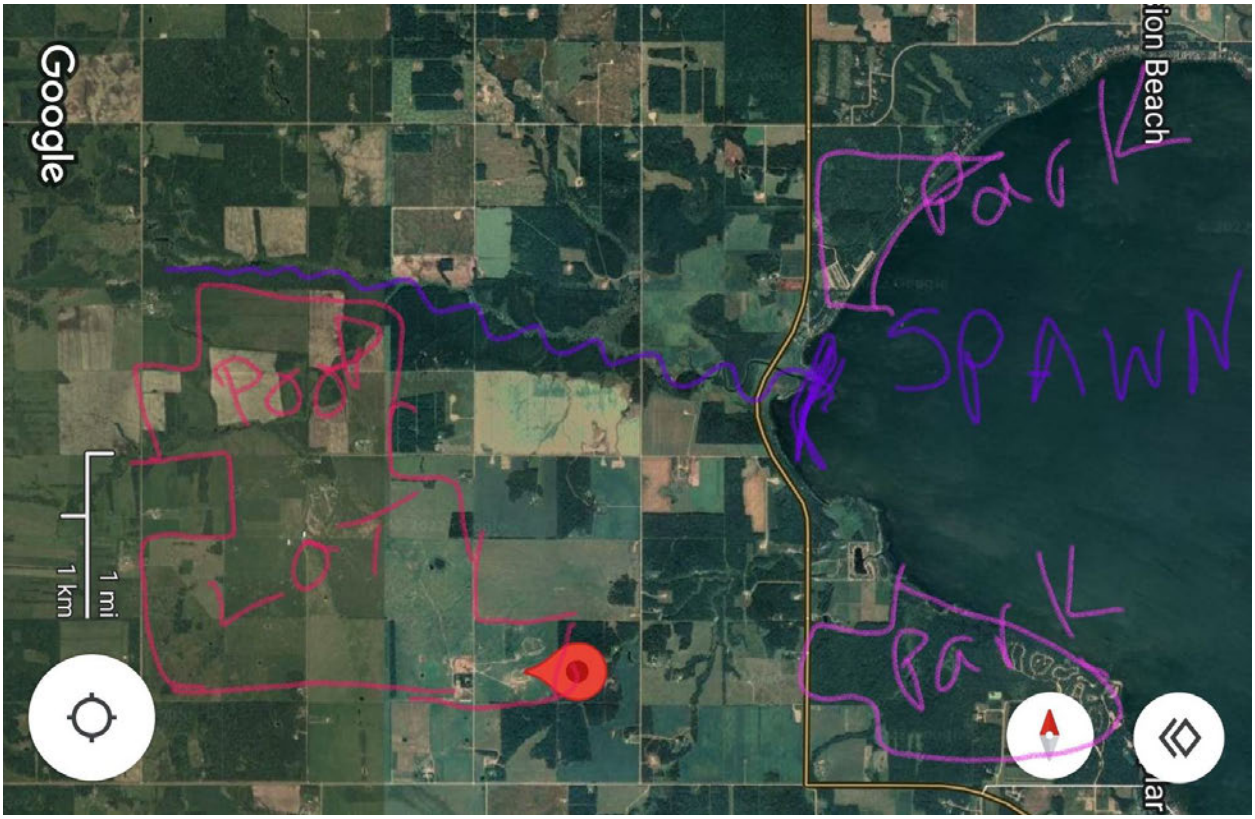
<u>The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.</u>

The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.

Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream in common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation and very low cattle numbers upstream. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams on Pigeon Lake. Zeiner creek is only 1.4km from Tide creek.

There is **very sensitive tributary** closed to fishing along the 771 south of Zeiner where the walleyes spawn. It is **SO CRITICAL** to the lakes health and Ab Parks and Fish and Wildlife have monitored it for 70 years. That was where they first determined raw human sewage (birth control pills) from the lake cabins was impacting the fish navigating back to the spawning grounds and was causing a decline in the fish populations. The feedlot drains in to this creek. You can see it in the aerial. See attached photo, parks pink, walleye spawning purple, feed lot red.



- Very large whitefish die offs have occurred in the last couple years. Whitefish susceptible to summer heat, algae blooms, and depleted oxygen could not survive the increased nitrate and phosphorus from the runoff from the feedlot in even 1 large release. Add to that the unmanaged recreational use, industry and residential pollution cumulative impacts must be considered.

"The University of Calgary says Alberta has one of the highest rates of E-coli infection in the world given its abundance of cattle, sloped terrain, food crops and use of well water". E-coli can live 50 days in manure on a field and 91 in manure Slurry, how often does it rain?

- Cows are standing in their feces for months in crowded pens and from farms and auctions all over the province. Because of the unsanitary conditions, stress and diseases from all over the province heavy antibiotics and corn or grain rations are fed for fast growth. Only 1 in 1000 animals at the meat packers are tested for BSE or e-coli, again the meat packers test is still months away from the animal standing in the feedlot. Its very possible, a positive animal could

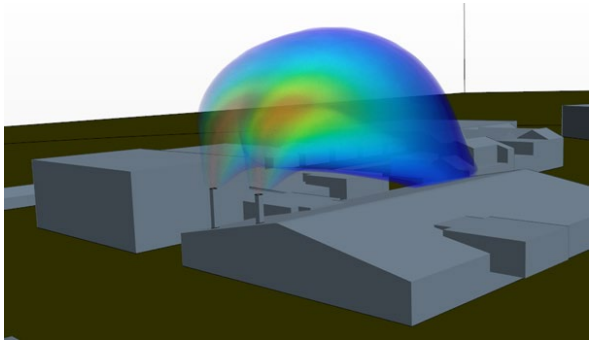


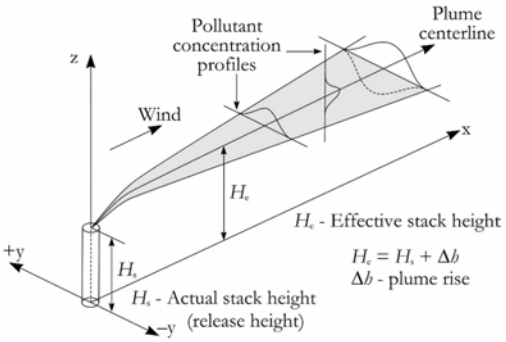
be shedding a prion or bacteria in the environment. This acidic diet and wet muddy, feces covered environment breed super bugs or antibacterial resistant bacteria. The drug resistant e-coil washes off the feedlot and straight into the lake where people like you and I pick it up and either get very sick or die. Look how close the CFO is to the Lake.

- Cows need 40 liters of water a day
- 58,400,000 liters a YEAR out of our groundwater aquifer is needed
- Because of the pesticides fed and the antibiotics used, this manure doesn't breakdown quickly, the microbes needed to are dead. So these catch basin ponds become anaerobic and loaded with toxins and pathogens. They add digesting bacteria and sometimes oxygen to the ponds but that really just aggravates the smell and sends poop particles into the air, called volatile organic compounds (vocs).

- The feedlot is directly upwind of Pigeon lake which causes a drop in property values. The villages on Pigeon Lake fall in what is called an impingement zone from the feedlot. The feed lots "smell" goes up and diffuses and slowly becomes weaker as it disperses. However; when a northern breeze or wind comes in it actually concentrates all the "smells" into one direction, or wind direction. As the wind concentrates and hits the ground, say near the village it bounces back off

the ground creating a super concentrated zone called an impingement zone. This means that the smell might not be bad immediately north of the feedlot but a few kilometers away on a hot and gentle breezing day your home could be blasted with a concentrated release of gas from the feedlot.





- The increased ammonia and bacteria in the air has been proven to directly affect breathing conditions and cancer in neighborhoods next to feed lots.
- With these unknown health risks of constantly breathing the ammonia and manure smell while working outside within 500 meters an expert was saying a Health Impact Study should be carried out.

- If a BSE positive animal is traced back under Canada's Traceability laws, to the feedlot from an auction mart, will a neighbour right beside feedlot fall within the quarantine radius on his property which is touching the feedlot property(other side of fence)? Is he stuck feeding and not being able to sell his livestock for several months because he falls within the quarantine radius of the feedlot? Could he float the financial costs of a quarantine and if the government decides to destroy his animals and partly compensate him could he survive it?

For all the many reasons listed above I would hope that Application RA21045 is definitely <u>not</u> approved. Its absolutely the wrong place to site a 4000 head CFO so close to a lake and so close to our property.

A biologist who has studied the lake a lot said yesterday if you wanted to look for the worst possible lake you could site a CFO near it would be Pigeon Lake. And then look for the worst end of the lake it could be sited on-the inflow- and thats where it is. And then it's sited on land that all slopes and drains to the lake.

The previous owner ran a clean 500 head cow calf operation we never had issues with. But this proposed operation is so much larger and their proposed manure storage is being moved a half kilometer closer to our property from where it is now as per their application. If they had moved it a mile straight west to the middle of their land instead it would have been a bit easier to accept next door to the east regarding smell and noise but then it wouldn't help out Tide creek or any other creeks that the manure spread land would runoff on to. In our creek on NE ¼ Sec 3-47-2-W5 M there is high

phosphorus water running towards the lake as sampled last week-10 to 25 times higher than 11 readings taken in 2013 in Sunset Harbour Creek. In to a lake that was confirmed high phosphorus damaged in 2017 in the ESA Pigeon Lake Runoff Modelling Report and that takes 50-100 years to flush out. A biologist familiar with the report said Alberta Environment can not allow more high phosphorus water to run in to a high phosphorus damaged lake as is happening right now. In the Summer Village of Grandview's Statement of Concern document to the NRCB they detail at length the extent to which they feel Wetaskiwin County did not follow its own intents and words in their own development rules and regulations. Also the same biologist who created the exclusion zone distances that now protect Chain Lakes and Gull Lake in Ponoka County said the minimum distance allowed at Pigeon Lake in the County of Wetaskiwin is based on nothing scientific and is way to short of a distance.

Again for all the many valid reasons listed above Application RA21045 should not be approved.

TAB 3

DEANNA KLATT
[redacted]

APRIL 7, 2022

Natural Resources Conservation Board
Attn: Nathan Shirley, Approval Officer

Via email: Nathan.shirley@nrcb.ca

Re: Application RA21045 - Statement of Concern

a) It will be shown in this submission that there is significant flow from the exact position of the manure storage facility and the manure spreading area through Sunset Harbour Creek to Pigeon Lake. Also, measurements have been presented to show that this flow has already has alarmingly high concentrations of phosphorus from an existing intensive livestock operation. It is well known, particularly to the Natural Resources Conservation Board as the regulator of confined feeding operations, that phosphorus is a nutrient that causes the formation of cyanobacteria blooms. It is also well known by the Government of Alberta, which has provided millions of dollars in funding to reduce the amount of phosphorus entering Pigeon Lake as well as other lakes.

b) *The detrimental effects of phosphorus on water quality are likely to occur*. Pigeon Lake is perhaps one of the most studied lakes in Alberta from a scientific perspective, and without exception, all studies recognize the importance of reducing phosphorus migration into the lake as the primary goal for watershed stewardship. The occurrence of cyanobacteria blooms ("blooms") in 2006 and periodically in subsequent years, spurred on the formation of the Pigeon Lake Watershed Association, the passing of many bylaws and Intermunicipal Development Plans, the implementation of multimillion dollar investments by local communities in wastewater projects, and most importantly, a change in the habits and level of respect of the watershed residents for the watershed. Simply put, if an abundance of phosphorus runs to the lake, the lake will be critically damaged.

c) *The effect will not be trivial*. Anyone who has lived through a significant bloom knows the damaging effects a bloom can have on the quality of life at the lake, the property values and the local economy. Dr. David Schindler, the internationally acclaimed scientist and recipient of the Alberta Order of Excellence in 2008, was largely responsible for identifying the causal relationship between phosphorus and water quality. He gave ample warning of the risks of not controlling phosphorus runoff into streams and lakes. The minimization of nutrients from manure is a foundational conclusion of the *State of the Watershed Report* (Aquality, 2008). The consequential effect of algae blooms is also a major cause of fish kills, the latest

of which occurred during July 2021. Cyanobacteria blooms can be dangerous to human life to the extent that Alberta Health Services monitors beaches and issues an advisory if specified limits are exceeded. A significant bloom occurred during the summer of 2015. This bloom made national headlines as shown below and will happen again unless we take action. Pigeon Lake cannot sustain such an ongoing load of nutrients from this cattle operation.

Pigeon Lake algae warning dashes hopes of scum-free summer

Dave Lazzarino
Aug 05, 2016 • August 5, 2016 • 1 minute read • Join the conversation

Large piles of algae wash up on shore at Pigeon Lake near Mulhurst Bay on September 13, 2015
PHOTO BY GREG SOUTHAM /Edmonton Journal

3. Status of Pigeon Lake

Pigeon Lake has been the victim of many years of improper development practices on both the lakeshore and throughout the watershed. The cumulative effects of a vast number of developments have pushed our lake to the breaking point. This lake has an extremely low flushing rate, estimated to be greater than 100 years, which means the effects of added pollutants are significant. The increase in the number and frequency of harmful algae blooms (HABs) in recent years resulted in the formation of the Pigeon Lake Watershed Association (PLWA) and a flurry of research into what was causing this change.

It soon became apparent that the cause of HABs is directly associated with the external load of nutrients from the adjoining land. Watershed residences became engaged with one common purpose – protecting the lake as a valuable resource for future generations. The PLWA's practices and goals of watershed stewardship are now considered as a gold standard for other watershed groups throughout the province.

The State of the Watershed Report was written in 2008 to establish a starting point and a path forward: where we were then and where we were going (ref: *Pigeon Lake State of the Watershed Report*, Aquality Environmental Consulting Ltd, 2008). This report concluded "External and internal nutrient inputs are a concern to the health of Pigeon Lake. Land use

practices, sewage, and *manure management* around the lake should be managed to *minimize further nutrient loadings to the lake."* (ref: ibid. p.38) (Emphasis added).

The efforts of watershed residents are already having a positive effect on the water quality of Pigeon Lake. Through the implementation of beneficial management practices, nutrient loading into the lake has been decreasing, and the results are starting to show. The intensity of the algae blooms is reducing, and we no longer get the almost yearly health advisories for cyanobacteria. But to sustain the momentum of this improvement, we must not let down our guard. The introduction of a 4000 cattle CFO, with the resulting manure spread over many sections of land in this well-drained area of the watershed, will put a dire strain on the capacity of the lake and set back, perhaps irreversibly, the advances made over the past decades, including the benefit of the regional wastewater system.

4. Topography of Western End of Watershed

The majority of land in the Pigeon Lake watershed lies to the west of the lake. It includes rolling land and many forested areas; however, much of the land has been cleared for agricultural purposes. The area around the proposed CFO is adjacent to an existing intensive livestock operation. This existing operation has approximately 1200 head of cattle that can be readily observed moving around unrestrained in the vicinity of the streams and ponds. This proposed project will more than triple the effects of manure contamination to the environment. The area is drained mainly by Tide Creek and its tributaries but also by other streams and tributaries, including the Sunset Harbour Creek, as it is locally known.

Figure 1 shows the quarter section (NW3-47-2 W5M) in which the proposed CFO is located. This site is drained by the Sunset Harbour Creek and its tributaries, which are ephemeral streams that flow to the northeast approximately 2½ km to Pigeon Lake. There are also other drainage patterns in the area where manure spreading is proposed. During the spring freshet, the rapid runoff of the snow melt has been measured to have a high concentration of dissolved phosphorus. As part of a nutrient loading study, water samples were taken in March 2022 from the two stream crossings on Range Road 22, which are shown in Figure 1. The values for dissolved phosphorus were reported at alarmingly high values of 2.0 and 1.6 mg/L for the north and south tributaries respectively. Dissolved phosphorus is a parameter that gives an indication of the amount of bioavailable phosphorus, which contributes directly to the formation of cyanobacteria blooms.

Sample Description	: RR 22, North, #1	Bureau Veritas Sample Number	: AQL761
Sample Date & Time	: 2022/03/22 16:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	2.0	mg/L	KONE	2010	A535183	0.075	0.0030

Sample Description	: RR 22, S, #1	Bureau Veritas Sample Number	: AQL762
Sample Date & Time	: 2022/03/21 15:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	1.6	mg/L	KONE	2010	A535183	0.15	0.0030

Note: full sample results are available upon request

Previous work by Alberta Environment and Parks on their study of the phosphorus budget for Pigeon Lake (ref: Pigeon Lake Phosphorus Budget, Chris Teichreb, 2014) measured values of Total Phosphorus and Dissolved Phosphorus in Sunset Harbour Creek at values much smaller. The results show that the values of Dissolved Phosphorus have increased by a factor of almost 20 in less than 10 years! (ref: *2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota*, Teichreb, Peter and Dyer, May 2014, page A22). The high values of Dissolved Phosphorus suggest that the land being drained, i.e., Section 3-47-2 W5M, is not being subject to proper stewardship practices. It is recommended that the approval officer visit this land to see what agricultural practices are currently being followed to help determine the starting point of a cumulative effects evaluation.

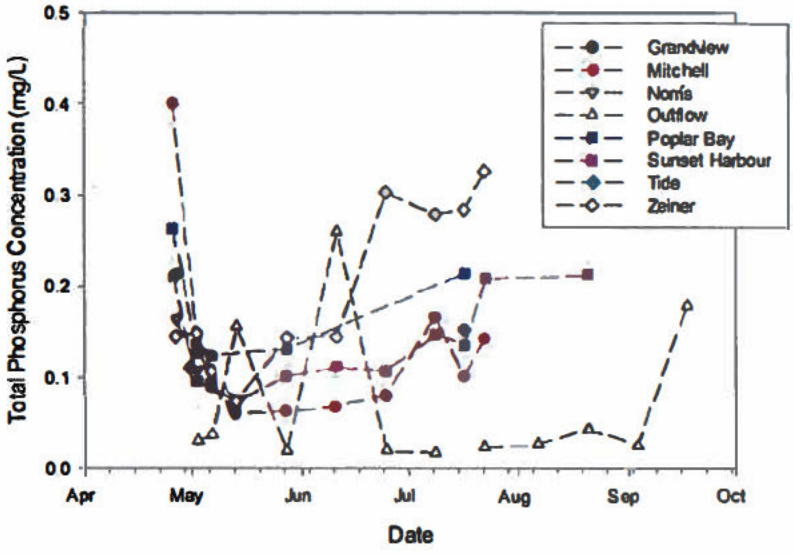


Figure 4-3 Pigeon Lake Streams Total Phosphorus Concentrations, 2013

Ref: *Pigeon Lake Phosphorus Budget*, Teichreb 2014 shows maximum values of Total Phosphorus in Sunset Harbour Creek of 0.2 mg/L compared to 2022 values of greater than 1.6 mg/L of Dissolved Phosphorus in the 2 tributaries

Figure 1. Drainage streams flowing north east to Pigeon Lake. The location of the proposed CFO is highlighted. The white arrows show the locations where the photographs in Figures 3 and 4 were taken.

5. Location of Proposed CFO

The location of the proposed manure lagoon is directly opposite a stream in the drainage pattern for this sub-watershed, which drains to the lake near Sunset Harbour. An enlargement of Section NW3-47-2 W5M is shown in Figure 2. It appears that a current feeding operation is located directly north of the proposed manure lagoon. This structure is also located very close to the stream and should be reviewed, especially in view of the high phosphorus runoff from this area. This stream must have some long-lasting significance as it forms a demarcation between the cleared land and the forested area in the southeast part of this quarter section.

Figure 2. Location of proposed manure lagoon in NW3-47-2-W5M (highlighted) is directly adjacent to a drainage stream.

During periods of heavy rainfall and during the spring freshet, this tributary of Sunset Harbour Creek experiences heavy flows. Photographs taken during the freshet on March 19, 2022, are shown in Figures 3 and 4 of the stream crossing on Range Road 22 and on Hwy 771 respectively. The locations of these steam crossings are indicated on Figure 1 by white arrows.

Figure 3. Steam Crossing on Range Road 22 during spring freshet March 19, 2022.

Figure 4. Stream crossing at Hwy 771 near Sunset Harbour during spring freshet, March 19, 2022.

It is readily apparent from the dark brown colour of the water that the streams are carrying a significant nutrient load from draining the land proposed to be the disposal area for the manure from 4000 cattle. The resulting increase in phosphorus load to Pigeon Lake could well bring Pigeon Lake to the breaking point.

6. Plan for Manure Disposal

If constructed properly, neither the CFO nor the collection area for the produced manure presents any real environmental problems other than perhaps the odour associated with such operations. The true problem arises from the disposal of such a large amount of manure. It appears that this manure will be in liquid form and will be dispersed on a large area of land drained by streams and tributaries that all flow into Pigeon Lake.

The high phosphorus concentrations found in Sunset Harbour Creek, as evidenced by water samples, can only be expected to increase as the load of manure increases. This manure will be applied year after year into the foreseeable future. With the cumulative effects of this proposed operation added to the existing intensive livestock operation on the property and to the effects of development that has already impaired Pigeon Lake, we are basically risking the survival of one of Alberta's premier lakes for a cattle operation that actually contravenes development policies established by the Pigeon Lake Watershed Management Plan, the County of Wetaskiwin, and the Natural Resources Conservation Board. These issues are discussed in the following sections.

7. The Pigeon Lake Watershed Management Plan

The *Pigeon Lake Watershed Management Plan* (the "Plan") was adopted in 2018 by the 12 municipalities of Pigeon Lake and supported by the Chiefs of the Maskwacis Cree Four Nations, the Pigeon Lake Regional Chamber of Commerce, and other key stakeholders. It is a roadmap to guide development in the watershed with the incorporation of beneficial management practices. The Plan recognizes that CFOs have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, Objective 2e from the Plan (p. 17), shown below, states that there should be no CFOs within the watershed:

2e	**New or Expanded Intensive Livestock Operations** Statutory land use restrictions on new or expanded intensive livestock operations (including CFOs) are supported in this Watershed Management Plan	Policy	Lead Mun Support APLM GoA PLWA	Ongoing	No Intensive Livestock Operations

(Note: the Plan can be found at www.PLWA.ca)

8. County of Wetaskiwin Plans

The County of Wetaskiwin (the "County") recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. The County has adopted by resolution the *Pigeon Lake Area Concept Plan* ("ACP") in recognition of the need for long-range plans in areas experiencing growth pressures. *"The County of Wetaskiwin recognizes that increased development and growth pressures need to be addressed on a cooperative basis to ensure the long-term protection and sustainability of Pigeon Lake"* (ref: ACP section 1.1). In Section 5.5, policies are presented to guide the County when evaluating a proposal to develop land in the

watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFOs should not be in the watershed:

> ***5.5.2 Agriculture***
> *Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.*

The County's *Land Use Bylaw* (LUB) also provides some direction on CFOs within the County. In Section 9.6.1 of the LUB, the County recognizes that CFOs are regulated by the Agricultural Operation Practices Act and Regulations (AOPA) and under the jurisdiction of the Province but clearly states *"it is the County's intent that any negative effect from CFOs should be minimized, and that the Municipal Government Act requires the municipality to identify where new CFOs should locate."*

This is a sensible and responsible approach being taken by the County to achieve their goal of protecting Pigeon Lake. The Area Concept Plan, discussed above, clearly states that CFOs should not be located within the watershed. Although CFOs are not under County jurisdiction, the County addresses a high standard for a similar operation – Intensive Livestock Operations. Section 9.6.7 states that "an existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

Their LUB addresses the spreading of manure in Section 9.6.10 as shown below:

> **9.6.10** Land within identified drainage basins 2.4 kilometres (1.5 miles) around named lakes (as referred to in the Municipal Development Plan) may not be used for manure disposal unless sufficient protection measures are proposed by the operator to prevent manure runoff negatively affecting such lakes. In accordance with the County's jurisdiction regarding Intensive Livestock Operations (ILO). (*amended by Bylaw 2019/44*)

The Application specifies land area that will be used for the spreading of manure. It appears that SE10-47-2 W5M is within the specified distance of 2.4 km, as shown in Figure 5.

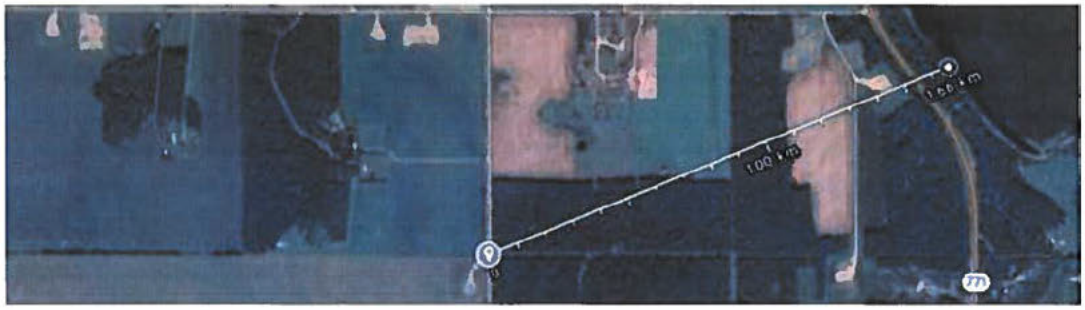


Figure 5. Distance from SE10-47-2W5M to Pigeon Lake is 1.66 km.

The County recognizes that spreading of manure has a negative effect on waterbodies.

The County's *Municipal Development Plan* also provides direction over the concern about the environment. Environmental protection is a focus of this plan as stated in Section 3 shown below:

3 Environmental Protection

Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

9. The Adequacy of the Application

The Regulations are specific as to what is required in the application. Two important items do not appear to be included: water courses and drainage patterns. Drawing C04 appears to show a phantom outline of a water course, but it is not specifically highlighted in the application. Also, the drainage pattern is not shown.

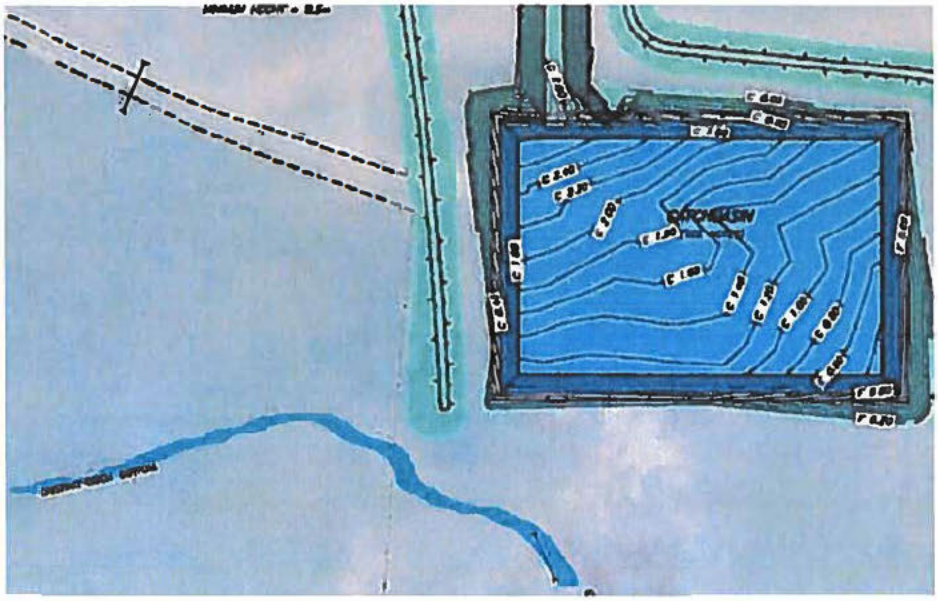


Figure 6. Excerpt from drawing C04 from Application showing adjacent stream highlighted. Notations are illegible on the provided copy.

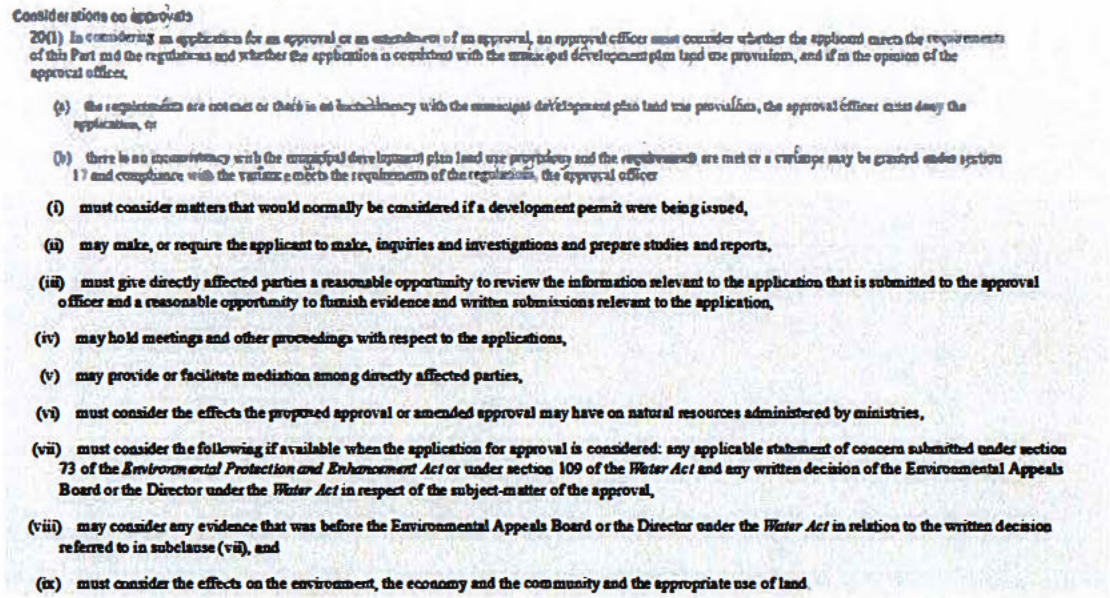
Figure 1 shows this is a water course directly adjacent to a manure lagoon. An excerpt from the referenced drawing is shown as Figure 6 with the water course highlighted for reference purposes. The published application does not show the location of the water wells, nor is the description of the water course legible. However, Figure 6 clearly shows that the manure storage facility fails to meet the minimum setback provisions in AOPA of 30 m.

The drainage pattern is not shown; however, it can be inferred that the area drains towards the stream. This is also implied by the satellite image in Figure 2, which appears to show drainage from a feed lot towards this stream.

10. Regulation by the Natural Resources Conservation Board

CFOs are regulated by the Natural Resources Conservation Board under the requirements of AOPA. While the requirements of AOPA seem to be quite minimal in that the setback distances

seem very small, some important responsibilities are bestowed on the board. Section 20 of AOPA provides these requirements:



Considerations on approvals

20(1) In considering an application for an approval or an amendment of an approval, an approval officer must consider whether the applicant meets the requirements of this Part and the regulations and whether the application is consistent with the municipal development plan and the provision, and if in the opinion of the approval officer,

(a) the requirements are not met or there is an inconsistency with the municipal development plan and the provision, the approval officer must deny the application, or

(b) there is no inconsistency with the municipal development plan land use provisions and the requirements are met or a variance may be granted under section 17 and compliance with the variance meets the requirements of the regulations, the approval officer

(i) must consider matters that would normally be considered if a development permit were being issued,

(ii) may make, or require the applicant to make, inquiries and investigations and prepare studies and reports,

(iii) must give directly affected parties a reasonable opportunity to review the information relevant to the application that is submitted to the approval officer and a reasonable opportunity to furnish evidence and written submissions relevant to the application,

(iv) may hold meetings and other proceedings with respect to the applications,

(v) may provide or facilitate mediation among directly affected parties,

(vi) must consider the effects the proposed approval or amended approval may have on natural resources administered by ministries,

(vii) must consider the following if available when the application for approval is considered: any applicable statement of concern submitted under section 73 of the *Environmental Protection and Enhancement Act* or under section 109 of the *Water Act* and any written decision of the Environmental Appeals Board or the Director under the *Water Act* in respect of the subject-matter of the approval,

(viii) may consider any evidence that was before the Environmental Appeals Board or the Director under the *Water Act* in relation to the written decision referred to in subclause (vii), and

(ix) must consider the effects on the environment, the economy and the community and the appropriate use of land.

Basically, this section of AOPA states the Approval Officer must determine if the application meets with the requirements of the AOPA, the Regulations, and the Municipal Development Plan. If there is an inconsistency, then the Approval Officer must deny the application. If not, then the Approval Officer must consider the following:

- matters normally considered if a development permit were being issued (such as the cumulative environmental impact and location of the CFO),
- the effects on natural resources administered by ministries (such as Pigeon Lake, which is controlled by Alberta Environment and Parks), and
- the effects on the environment.

The NRCB has a clear and well defined obligation to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to properly consider factors which cause the degradation of Pigeon Lake will place the responsibility squarely on the NRCB who will be held accountable.

11. Effect and Process

This project is perhaps the most significant perceived threat to Pigeon Lake in recent history. It has the potential of impacting all watershed residents whether or not they are in the Minimum Setback Distance. It will certainly affect the Ministry of Environment and Parks in that there is a Provincial Park campground just over 2 miles downwind of this facility. Anyone that has driven in the vicinity of Gull Lake or other areas of the province where liquid manure is spread knows all too well the enduring smell of liquid cattle manure. This Park will soon gain a reputation of being a "stinky" campground with a consequential loss of tourism. This ministry will also be faced with the challenges of increased fish kills and a possible loss of a major sports fishing lake. The increased flow of truck traffic hauling cattle, grain, manure, and hay unfortunately, as with odours, also expend past the Minimum Setback Distance.

One other aspect that must not be forgotten is highlighted in the following excerpt from the Alberta Water Council, which needs no further elaboration:

Cultural and Spiritual Values

Since time immemorial, Indigenous peoples have used lakes for all manner of life-supporting and life-affirming purposes, including for travel and as basic sources of food, drinking water and medicinal plants. Lakes are also important areas of cultural, spiritual and aesthetic significance for Indigenous communities. Many Indigenous people believe the Creator gave instructions to respect water, air and the land by keeping it pure, and these original instructions are reflected in many Indigenous beliefs, values and traditions to this day.

Ref: Alberta Water Council *Recommendations to Improve Lake Watershed Management in Alberta,* (2017)

The basic question to be answered is why should such an operation be approved when it will have such detrimental effects on so many watershed residents and visitors. As can be seen from the satellite image in Figure 7, when a bloom appears, it is both transient and ubiquitous, and it affects all lake residents.

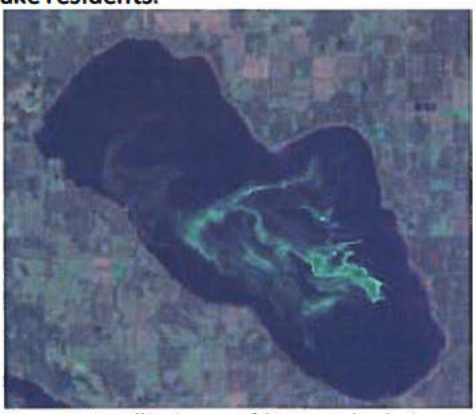


Figure 7. Satellite image of Pigeon Lake during an algae bloom Oct. 17, 2018 (ref: ABMI.ca)

The process for considering this application is also a concern. Section 20(1)(iii) and (iv) state that the officer must give affected parties reasonable opportunity to review the application and also that public meetings may be held. With less than one month notice being given and at a time when many of the affected parties are not at the lake, it does not appear that this condition is satisfied. With the resounding outcry of concern from residents near and far, it is a fair question to ask why a public meeting is not being held.

12. Conclusion

I will be harmfully impacted by my quality of life, property values, additional phosphorus load, disease, medications, etc that will migrate on to my properties as well as the creeks and Pigeon lake.

11.2 This application does not meet the requirements of the Regulations in that the CFO manure storage facility is located within the minimum setback of 30 m of a stream.

11.3 The requirements of the County of Wetaskiwin's Municipal Development Plan are not met in that the County can stipulate where CFOs can be located and clearly declare, through their Area Concept Plan, that the CFO should not be located within the boundaries of the watershed of Pigeon Lake. Also the MDP specifies manure spreading may not be done within 2.4 km of a named lake (including Pigeon Lake). The measured distance from SE10-47-2 W5M, a quarter designated for manure spreading, is 1.66 km as shown in Figure 5. The Application does not comply with the requirements of the County's development plans and therefore must be denied.

11.4 Legislation requires that the approval process must consider the cumulative environmental impacts this CFO will have on Pigeon Lake. Evidence provided from stream analyses shows that there is already a significantly high nutrient runoff occurring from this area of the watershed.

11.5 Approval of this application would impact natural resources under the purview of the Ministry of Environment, which has jurisdiction over Pigeon Lake, and

11.6 This project is not in the public interest.

13. Recommendation

I strongly suggest that this application be denied on the basis of its environmental impact to Pigeon Lake and its failure to meet the legislated requirements.

Deanna Klatt

Nathan: MARCH 28-2022

My name is Deanna Klatt
I own the quarter section at: [redacted]
Mailing Adress: [redacted]
E-Mail Address: [redacted]
Phone Number: [redacted]

I am directly affected by this application

Firstly let me introduce myself. My grandfather homesteaded this quarter and our family has resided here ever since. I am the third generation farmer.
I have always understood and supported farmers and local business.

When my grandfather's generation was living here they drank the water directly out of the creeks and lakes.
Wildlife was an important food source.
All the following generations of my family that have continued to live here have strived to maintain a balance between farming and environment.
Obviously times have changed and it is at a point where farming, industry and population have to be more aware of and regulate their impact on the environment.

The current cow/calf operation asking for a permit for the CFO cannot be closely controlled enough to have its impact on residents and environment (air, creeks and lakes) to be of an acceptable level.
Up until now we have tolerated the current cow/calf operation (smell, noise, traffic and discharge into the creeks). With the application for the large increase in cattle being processed there are now greater concerns.

CFO's concentrate the animal waste and other hazardous substances pollute the air. This is already happening with the cow/calf operation, increasing the amount of cattle will only increase the problem. At times it is intolerable to be outside doing normal activities due to the smell and to the point where house windows cannot be opened as the smell will also be inside the house. The smell from spreading the manure on the land will be grossly unmanageable.

The pollution of our nearby creeks is a very great concern. With the cow/calf that is now operating our creeks smell of manure. Why was animal waste already allowed in our creeks to the point that they can be smelled half a mile away?
We are not aware of any existing permitted CFO.

The polluted creeks that run into Pigeon Lake will and do affect the quality of the water. I grew up here enjoying the lake fishing and swimming and kayaking. My children grew up here enjoying the same things from the lake and now my grandchildren. We now

have limited swimming because of the pollutants. A larger feedlot will only increase these pollutants and the water quality will only decline.

A CFO and the bodily waste being spread on the land is also going to be contaminated with medications, growth enhancers, and disease.
Bacterias and infections spread more rapidly in CFO's, antibiotics are used heavily. Antibiotics are not fully metabolized by cattle and will be present in their bodily waste. This waste can contaminate aquifers, surface water, and water run off.

We have noticed an increase in flies, ravens and predators (coyotes) since the existing cow/calf operation opened, as such there will most certainly be another increase. Where have the dead animals from the existing cow/calf operation been disposed of?
Where will the dead from the CFO be disposed of?

Cattle flatulence as well as bodily waste produce methane, carbon dioxide, nitrous oxide as well as other trace gasses, these adversely effect local air quality as well as they are the largest contributors (world wide) to the negative effects of climate warming.

This feedlot will decrease our property values. Properties that were built up through the many years to co-exist with nature. We now have the smell, noise of the cattle, and deterioration of the surrounding environment.
The increased traffic moving cattle, feed etc. in and out of the CFO.

This application has also brought to light that the cow/calf already in existence needs to be licensed/monitored due to the fact that we already experience pollution problems.
How many cow/calf head were processed last year?
Will the existing cow/calf operation be closed and a permitted 4000 head CFO be in operation?
If cow/calf continues what are the volumes projected and how will that be monitored?

According to the application, allocation of source water for this proposal appears to be designated to existing wells; to my knowledge these wells are for domestic purposes. The water act in Alberta requires a license for all commercial users other than household purposes.

The quality of my environment is valuable to me.
I feel it is unfair that G&S Cattle Ltd. would impose these drastic changes on my community. The owner of the G&S Cattle Ltd. does not live here and will not experience these changes. I am appalled and saddened that this company would choose a site for a massive feedlot this close to a lake and this close to creeks that feed the lake. Our families have been good stewards of the land and have farmed and recreationed with nature considered. We have already been affected by the cow/calf operation. G&S Cattle Ltd. wish to drastically increase their current volumes, which will further destroy the nature of my community.

I would like to request that the NRCB decline this application for approval.

Regards,

Deanna Klatt

From: [redacted]
Sent: Thursday, April 7, 2022 4:37 PM
To: Nathan Shirley
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; premier@gov.ab.ca
Subject: Fwd: CFO application #RA21045

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

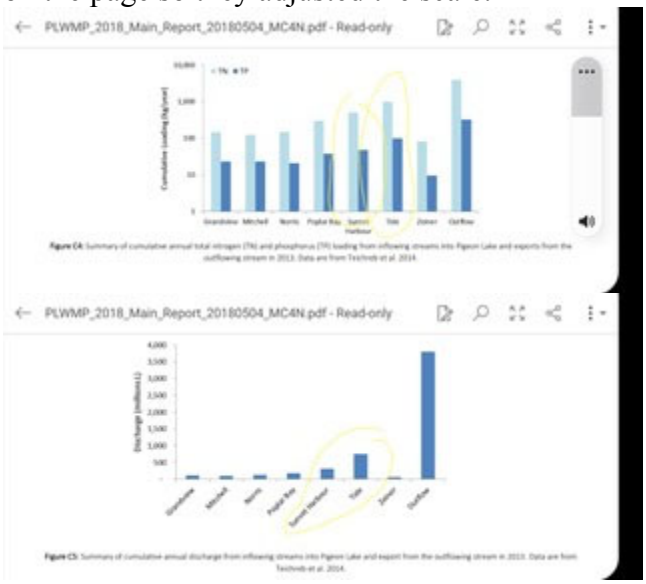
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it’s in critical condition.

The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning. Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Deanna Klatt

From: [redacted]
Sent: Thursday, April 7, 2022 4:32 PM
To: Nathan Shirley
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: RE: CFO APPLICATION # RA21045

Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.
This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and

corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

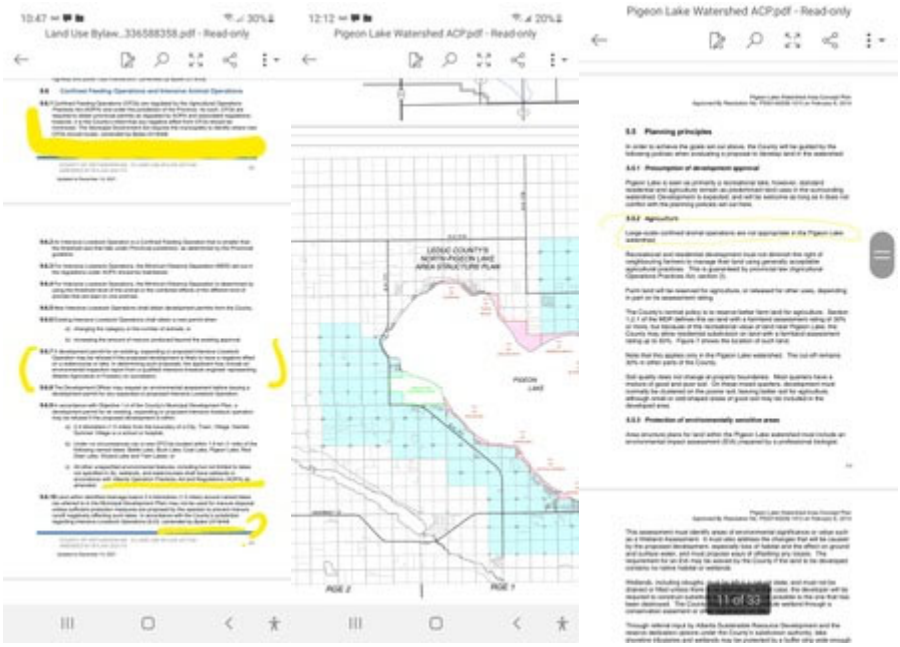
Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a

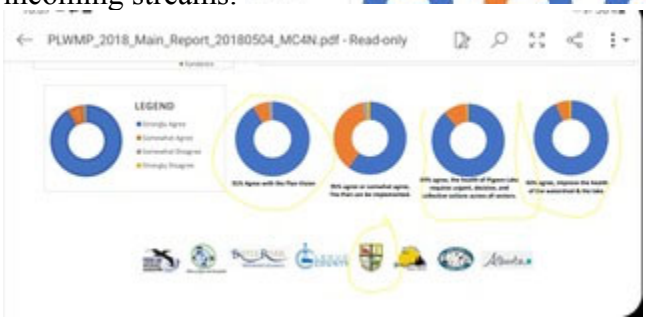
while. https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-contemplate-2017-municipal-election/



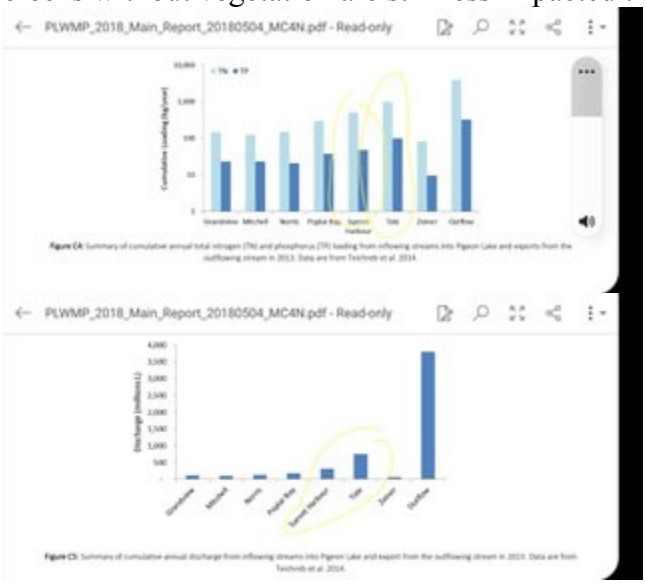
It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.



The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP.
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 

However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.



The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.

TAB 4

From: Martin Klatt [redacted]
Sent: Wednesday, April 6, 2022 10:42 AM
To: Nathan Shirley
Subject: CFO application #RA21045 Apr. 6-22

Nathan

My name is Martin Klatt.
I will be directly effected by the proposed feed lot on NW-3-47-2-W5M.
I own the land location [redacted].
I have encountered 2, of what I perceive as deficiencies in the current application.
They are:

1- on page 3 of the application option 2 is dated and signed by Gregg Thalen as the chosen option.
Item 6 states in bold print,
"AS RELEVANT",
“THE CFO IS LOCATED IN THE SOUTH SASKATCHEWAN RIVER BASIN”
This proposed project is not in that river basin. As such this application is incorrect, irregardless of the rest of the info provided in item 6

2- regulations require the NRCB application is to be posted online and/or able to be viewed in person in your offices.
Due to covid, as noted on your website in person viewing was not an available option at this time.
The online version of this application is not legible on many of the important documents...the print is too small.
If it is expanded the info becomes a blur.

It is my opinion that the NRCB has not fulfilled its obligations as required and must reject or postpone this proposal in its present form.

Martin Klatt

From: Martin Klatt [redacted]>
Sent: Thursday, April 7, 2022 10:38 AM
To: Calgary.Lougheed@assembly.ab.ca
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; Nathan Shirley
Subject: NRCB APPLICATION #RA21045 APR 7-22

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

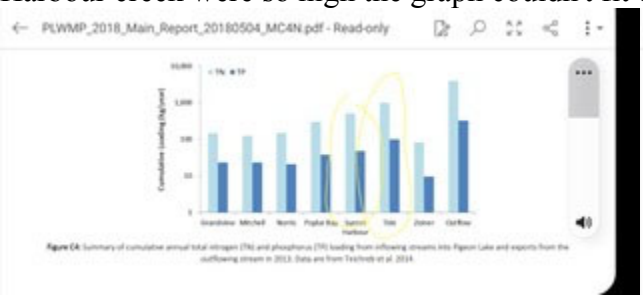
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

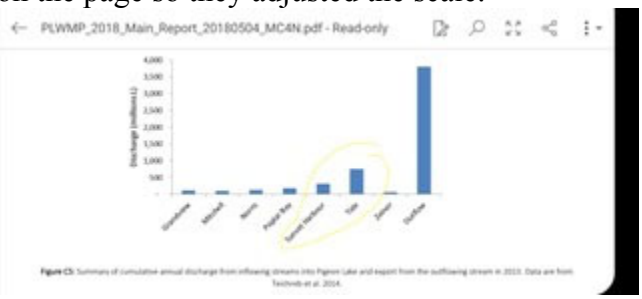
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.





The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning. Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

MARTIN KLATT

From: Martin Klatt [redacted] >
Sent: Thursday, April 7, 2022 12:18 PM
To: Calgary.Lougheed@assembly.ab.ca
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; Nathan Shirley
Subject: POSSIBLE FLAWS IN CFO APPLICATION #RA21045 APR 7-22

Hello

My name is Martin Klatt, I own the [redacted].
I will be directly effected by the proposed feed lot on NW-3-47-2-W5M.
Please consider and respond to, what I interpret as deficiencies serious enough to act on before the application goes to the decision making process.
See attached link to view the entire completed and filled application #RA21045.

My concerns are:

1- on page 3 of the application option 2 is dated and signed by the applicant as their chosen option pertaining to the "water act".
Right above their signature is their acknowledging of the location of the CFO being in the "south Saskatchewan River Basin".
Item 6
"AS RELEVANT",
"I/WE ACKNOWLEDGE THAT THE CFO IS LOCATED IN THE SOUTH SASKATCHEWAN RIVER BASIN", etc.
This proposed project is not in that river basin. As such this application is incorrect.
On page one the legal land description is given, but not many people can relate that to an area on a map.
Interested persons could read the info given under option 2 and assume this application does not effect them.

2- regulations require the NRCB application is to be posted online and/or able to be viewed in person in your offices.
Due to covid, as noted on your website and in the NRCB letter to directly 'affected party", in person viewing was not an available option at this time.
The online version of this application is not legible on many of the important documents...the print is too small.
If it is expanded (zoom in) the info becomes a blur.

It is my option that the NRCB has not fulfilled its obligations as required and must reject this proposal in its present form.

Martin Klatt

https://www.nrcb.ca/public/download/files/201086

Nathan:

My name is Martin Klatt
I own the land at: [redacted]
Mailing Adress: [redacted]
E-Mail Address: [redacted]
Phone Number: [redacted]

Firstly let me introduce myself.
I married my wife and moved onto this land in 1980 and have lived here continuously since.

I have always kept a balance between our farming and commercial operations in balance with this environment.

The current cow/calf operation asking for a permit to open a beef, cow/calf CFO must be rejected.
Up until now we have tolerated the current cow/calf operation (smell, noise, traffic and discharge into the creeks). With the application for the large increase in cattle being processed there are now greater concerns.

CFO's concentrate animal waste smells as well as other hazardous substances polluting the air.
This is already happening with the cow/calf operation, increasing the amount of cattle will only increase the problem. At times it is intolerable to be outside doing normal activities due to the smell and to the point where house windows cannot be opened as the smell will also be inside the house.

The pollution of our nearby creeks is a very great concern. With the cow/calf that is now operating our creeks smell of manure. Why was animal waste already allowed in our creeks to the point that they can be smelled half a mile away?

A CFO and the bodily waste being spread on the land is also going to be contaminated with medications, growth enhancers, disease, etc.
Bacterias and infections spread more rapidly in CFO's, antibiotics are used heavily. Antibiotics and medications are not fully metabolized by cattle and will be present in their bodily waste. This waste can contaminate the land, aquifers, surface water, and the creeks and lake.

We have noticed an increase in flies, and predators (coyotes, ravens, foxes) since the existing cow/calf operation opened, as such there will most certainly be another increase.
Where have the dead animals from the existing cow/calf operation been disposed of?
Were will the dead from the CFO be disposed of?

Cattle flatulence as well bodily waste produce methane, carbon dioxide, nitrous oxide as well as other trace gasses which contribute to climate change. The medications and disease can become air born, these adversely effect local air quality.

This feedlot will decrease our property values.
The smell, the noise of the cattle, the deterioration of the surrounding environment.
The increased traffic moving cattle, feed etc. in and out of the CFO.

This application has also brought to light that the cow/calf already in existence needs to be licensed/monitored due to the fact that we already experience these problems.
How many cow/calf head were processed last year?
Will the existing cow/calf operation be closed and a permitted 4000 head CFO be in operation?
If cow/calf continues what are the volumes projected and how will that be monitored?

According to the application allocation of source water for this proposal appears to be designated to existing wells, to my knowledge these wells are for domestic purposes. The water act in Alberta requires a licence for all commercial users, I am aware that the existing operation water sources (wells) ran dry last year and water was transported in to cover the deficit.

Can these issues be controlled with close monitoring and detailed reports?

The quality of my environment is valuable to me.
I am strongly opposed to the feedlot.
I feel it is unfair that you would impose these drastic changes on my community when as an owner of the proposed CFO you do not live here and will not experience these changes.

I request that the NRCB refuse this application.

Martin Klatt

MARTIN KLATT

[redacted]

Phone: [redacted]

Email: [redacted]

APRIL 7, 2022

Natural Resources Conservation Board
Attn: Nathan Shirley, Approval Officer

Via email: Nathan.shirley@nrcb.ca

Re: Application RA21045 - Statement of Concern

a) It will be shown in this submission that there is significant flow from the exact position of the manure storage facility and the manure spreading area through Sunset Harbour Creek to Pigeon Lake. Also, measurements have been presented to show that this flow has already has alarmingly high concentrations of phosphorus from an existing intensive livestock operation. It is well known, particularly to the Natural Resources Conservation Board as the regulator of confined feeding operations, that phosphorus is a nutrient that causes the formation of cyanobacteria blooms. It is also well known by the Government of Alberta, which has provided millions of dollars in funding to reduce the amount of phosphorus entering Pigeon Lake as well as other lakes.

b) *The detrimental effects of phosphorus on water quality are likely to occur*. Pigeon Lake is perhaps one of the most studied lakes in Alberta from a scientific perspective, and without exception, all studies recognize the importance of reducing phosphorus migration into the lake as the primary goal for watershed stewardship. The occurrence of cyanobacteria blooms ("blooms") in 2006 and periodically in subsequent years, spurred on the formation of the Pigeon Lake Watershed Association, the passing of many bylaws and Intermunicipal Development Plans, the implementation of multimillion dollar investments by local communities in wastewater projects, and most importantly, a change in the habits and level of respect of the watershed residents for the watershed. Simply put, if an abundance of phosphorus runs to the lake, the lake will be critically damaged.

c) *The effect will not be trivial*. Anyone who has lived through a significant bloom knows the damaging effects a bloom can have on the quality of life at the lake, the property values and the local economy. Dr. David Schindler, the internationally acclaimed scientist and recipient of the Alberta Order of Excellence in 2008, was largely responsible for identifying the causal relationship between phosphorus and water quality. He gave ample warning of the risks of not controlling phosphorus runoff into streams and lakes. The minimization of nutrients from manure is a foundational conclusion of the *State of the Watershed Report* (Aquality, 2008). The consequential effect of algae blooms is also a major cause of fish kills, the latest

of which occurred during July 2021. Cyanobacteria blooms can be dangerous to human life to the extent that Alberta Health Services monitors beaches and issues an advisory if specified limits are exceeded. A significant bloom occurred during the summer of 2015. This bloom made national headlines as shown below and will happen again unless we take action. Pigeon Lake cannot sustain such an ongoing load of nutrients from this cattle operation.

Pigeon Lake algae warning dashes hopes of scum-free summer

Dave Lazzarino
Aug 05, 2016 • August 5, 2016 • 1 minute read • Join the conversation

Large piles of algae wash up on shore at Pigeon Lake near Mulhurst Bay on September 13, 2015
PHOTO BY GREG SOUTHAM /Edmonton Journal

3. Status of Pigeon Lake

Pigeon Lake has been the victim of many years of improper development practices on both the lakeshore and throughout the watershed. The cumulative effects of a vast number of developments have pushed our lake to the breaking point. This lake has an extremely low flushing rate, estimated to be greater than 100 years, which means the effects of added pollutants are significant. The increase in the number and frequency of harmful algae blooms (HABs) in recent years resulted in the formation of the Pigeon Lake Watershed Association (PLWA) and a flurry of research into what was causing this change.

It soon became apparent that the cause of HABs is directly associated with the external load of nutrients from the adjoining land. Watershed residences became engaged with one common purpose – protecting the lake as a valuable resource for future generations. The PLWA's practices and goals of watershed stewardship are now considered as a gold standard for other watershed groups throughout the province.

The State of the Watershed Report was written in 2008 to establish a starting point and a path forward: where we were then and where we were going (ref: *Pigeon Lake State of the Watershed Report*, Aquality Environmental Consulting Ltd, 2008). This report concluded "External and internal nutrient inputs are a concern to the health of Pigeon Lake. Land use

practices, sewage, and *manure management* around the lake should be managed to *minimize further nutrient loadings to the lake."* (ref: ibid. p.38) (Emphasis added).

The efforts of watershed residents are already having a positive effect on the water quality of Pigeon Lake. Through the implementation of beneficial management practices, nutrient loading into the lake has been decreasing, and the results are starting to show. The intensity of the algae blooms is reducing, and we no longer get the almost yearly health advisories for cyanobacteria. But to sustain the momentum of this improvement, we must not let down our guard. The introduction of a 4000 cattle CFO, with the resulting manure spread over many sections of land in this well-drained area of the watershed, will put a dire strain on the capacity of the lake and set back, perhaps irreversibly, the advances made over the past decades, including the benefit of the regional wastewater system.

4. Topography of Western End of Watershed

The majority of land in the Pigeon Lake watershed lies to the west of the lake. It includes rolling land and many forested areas; however, much of the land has been cleared for agricultural purposes. The area around the proposed CFO is adjacent to an existing intensive livestock operation. This existing operation has approximately 1200 head of cattle that can be readily observed moving around unrestrained in the vicinity of the streams and ponds. This proposed project will more than triple the effects of manure contamination to the environment. The area is drained mainly by Tide Creek and its tributaries but also by other streams and tributaries, including the Sunset Harbour Creek, as it is locally known.

Figure 1 shows the quarter section (NW3-47-2 W5M) in which the proposed CFO is located. This site is drained by the Sunset Harbour Creek and its tributaries, which are ephemeral streams that flow to the northeast approximately 2½ km to Pigeon Lake. There are also other drainage patterns in the area where manure spreading is proposed. During the spring freshet, the rapid runoff of the snow melt has been measured to have a high concentration of dissolved phosphorus. As part of a nutrient loading study, water samples were taken in March 2022 from the two stream crossings on Range Road 22, which are shown in Figure 1. The values for dissolved phosphorus were reported at alarmingly high values of 2.0 and 1.6 mg/L for the north and south tributaries respectively. Dissolved phosphorus is a parameter that gives an indication of the amount of bioavailable phosphorus, which contributes directly to the formation of cyanobacteria blooms.

Sample Description	: RR 22, North, #1	Bureau Veritas Sample Number	: AQL761
Sample Date & Time	: 2022/03/22 16:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	2.0	mg/L	KONE	2010	A535183	0.075	0.0030

Sample Description	: RR 22, S, #1	Bureau Veritas Sample Number	: AQL762
Sample Date & Time	: 2022/03/21 15:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	1.6	mg/L	KONE	2010	A535183	0.15	0.0030

Note: full sample results are available upon request

Previous work by Alberta Environment and Parks on their study of the phosphorus budget for Pigeon Lake (ref: Pigeon Lake Phosphorus Budget, Chris Teichreb, 2014) measured values of Total Phosphorus and Dissolved Phosphorus in Sunset Harbour Creek at values much smaller. The results show that the values of Dissolved Phosphorus have increased by a factor of almost 20 in less than 10 years! (ref: *2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota*, Teichreb, Peter and Dyer, May 2014, page A22). The high values of Dissolved Phosphorus suggest that the land being drained, i.e., Section 3-47-2 W5M, is not being subject to proper stewardship practices. It is recommended that the approval officer visit this land to see what agricultural practices are currently being followed to help determine the starting point of a cumulative effects evaluation.

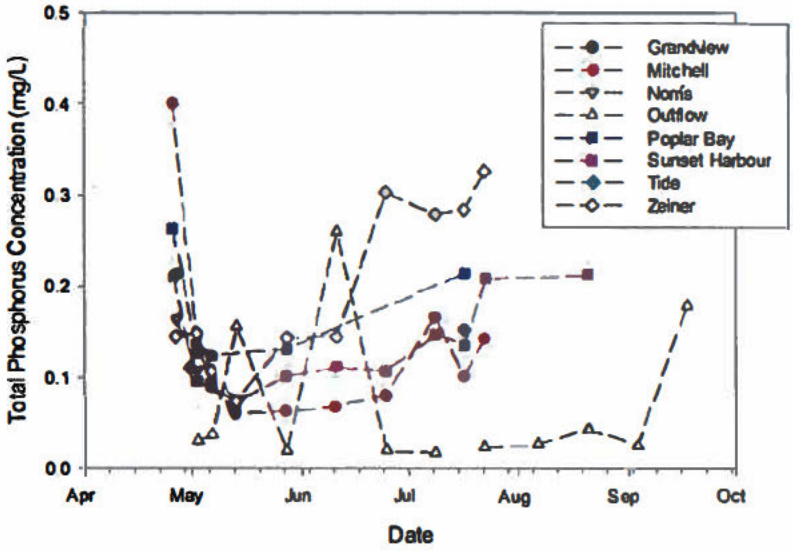


Figure 4-3 Pigeon Lake Streams Total Phosphorus Concentrations, 2013

Ref: *Pigeon Lake Phosphorus Budget*, Teichreb 2014 shows maximum values of Total Phosphorus in Sunset Harbour Creek of 0.2 mg/L compared to 2022 values of greater than 1.6 mg/L of Dissolved Phosphorus in the 2 tributaries

Figure 1. Drainage streams flowing north east to Pigeon Lake. The location of the proposed CFO is highlighted. The white arrows show the locations where the photographs in Figures 3 and 4 were taken.

5. Location of Proposed CFO

The location of the proposed manure lagoon is directly opposite a stream in the drainage pattern for this sub-watershed, which drains to the lake near Sunset Harbour. An enlargement of Section NW3-47-2 W5M is shown in Figure 2. It appears that a current feeding operation is located directly north of the proposed manure lagoon. This structure is also located very close to the stream and should be reviewed, especially in view of the high phosphorus runoff from this area. This stream must have some long-lasting significance as it forms a demarcation between the cleared land and the forested area in the southeast part of this quarter section.

Figure 2. Location of proposed manure lagoon in NW3-47-2-W5M (highlighted) is directly adjacent to a drainage stream.

During periods of heavy rainfall and during the spring freshet, this tributary of Sunset Harbour Creek experiences heavy flows. Photographs taken during the freshet on March 19, 2022, are shown in Figures 3 and 4 of the stream crossing on Range Road 22 and on Hwy 771 respectively. The locations of these steam crossings are indicated on Figure 1 by white arrows.

Figure 3. Steam Crossing on Range Road 22 during spring freshet March 19, 2022.

Figure 4. Stream crossing at Hwy 771 near Sunset Harbour during spring freshet, March 19, 2022.

It is readily apparent from the dark brown colour of the water that the streams are carrying a significant nutrient load from draining the land proposed to be the disposal area for the manure from 4000 cattle. The resulting increase in phosphorus load to Pigeon Lake could well bring Pigeon Lake to the breaking point.

6. Plan for Manure Disposal

If constructed properly, neither the CFO nor the collection area for the produced manure presents any real environmental problems other than perhaps the odour associated with such operations. The true problem arises from the disposal of such a large amount of manure. It appears that this manure will be in liquid form and will be dispersed on a large area of land drained by streams and tributaries that all flow into Pigeon Lake.

The high phosphorus concentrations found in Sunset Harbour Creek, as evidenced by water samples, can only be expected to increase as the load of manure increases. This manure will be applied year after year into the foreseeable future. With the cumulative effects of this proposed operation added to the existing intensive livestock operation on the property and to the effects of development that has already impaired Pigeon Lake, we are basically risking the survival of one of Alberta's premier lakes for a cattle operation that actually contravenes development policies established by the Pigeon Lake Watershed Management Plan, the County of Wetaskiwin, and the Natural Resources Conservation Board. These issues are discussed in the following sections.

7. The Pigeon Lake Watershed Management Plan

The *Pigeon Lake Watershed Management Plan* (the "Plan") was adopted in 2018 by the 12 municipalities of Pigeon Lake and supported by the Chiefs of the Maskwacis Cree Four Nations, the Pigeon Lake Regional Chamber of Commerce, and other key stakeholders. It is a roadmap to guide development in the watershed with the incorporation of beneficial management practices. The Plan recognizes that CFOs have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, Objective 2e from the Plan (p. 17), shown below, states that there should be no CFOs within the watershed:

2e	**New or Expanded Intensive Livestock Operations** Statutory land use restrictions on new or expanded intensive livestock operations (including CFOs) are supported in this Watershed Management Plan	Policy	Lead Mun Support APLM GoA PLWA	Ongoing	No Intensive Livestock Operations

(Note: the Plan can be found at www.PLWA.ca)

8. County of Wetaskiwin Plans

The County of Wetaskiwin (the "County") recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. The County has adopted by resolution the *Pigeon Lake Area Concept Plan* ("ACP") in recognition of the need for long-range plans in areas experiencing growth pressures. *"The County of Wetaskiwin recognizes that increased development and growth pressures need to be addressed on a cooperative basis to ensure the long-term protection and sustainability of Pigeon Lake"* (ref: ACP section 1.1). In Section 5.5, policies are presented to guide the County when evaluating a proposal to develop land in the

watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFOs should not be in the watershed:

> ***5.5.2 Agriculture***
> *Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.*

The County's *Land Use Bylaw* (LUB) also provides some direction on CFOs within the County. In Section 9.6.1 of the LUB, the County recognizes that CFOs are regulated by the Agricultural Operation Practices Act and Regulations (AOPA) and under the jurisdiction of the Province but clearly states *"it is the County's intent that any negative effect from CFOs should be minimized, and that the Municipal Government Act requires the municipality to identify where new CFOs should locate."*

This is a sensible and responsible approach being taken by the County to achieve their goal of protecting Pigeon Lake. The Area Concept Plan, discussed above, clearly states that CFOs should not be located within the watershed. Although CFOs are not under County jurisdiction, the County addresses a high standard for a similar operation – Intensive Livestock Operations. Section 9.6.7 states that "an existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

Their LUB addresses the spreading of manure in Section 9.6.10 as shown below:

> **9.6.10** Land within identified drainage basins 2.4 kilometres (1.5 miles) around named lakes (as referred to in the Municipal Development Plan) may not be used for manure disposal unless sufficient protection measures are proposed by the operator to prevent manure runoff negatively affecting such lakes. In accordance with the County's jurisdiction regarding Intensive Livestock Operations (ILO). (*amended by Bylaw 2019/44*)

The Application specifies land area that will be used for the spreading of manure. It appears that SE10-47-2 W5M is within the specified distance of 2.4 km, as shown in Figure 5.

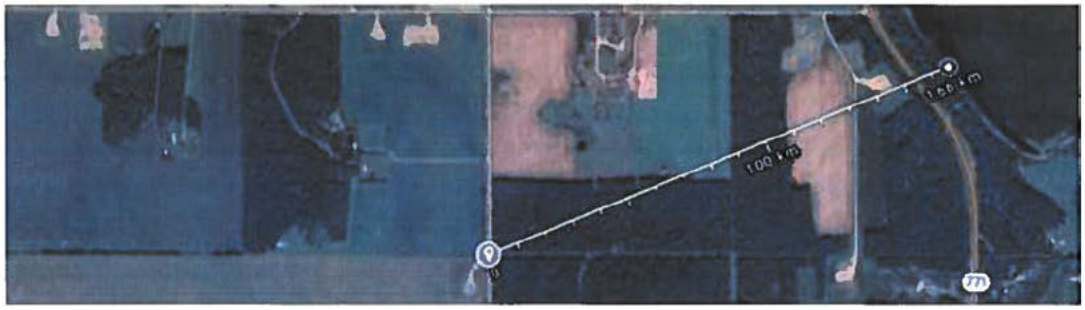


Figure 5. Distance from SE10-47-2W5M to Pigeon Lake is 1.66 km.

The County recognizes that spreading of manure has a negative effect on waterbodies.

The County's *Municipal Development Plan* also provides direction over the concern about the environment. Environmental protection is a focus of this plan as stated in Section 3 shown below:

3 Environmental Protection

Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

9. The Adequacy of the Application

The Regulations are specific as to what is required in the application. Two important items do not appear to be included: water courses and drainage patterns. Drawing C04 appears to show a phantom outline of a water course, but it is not specifically highlighted in the application. Also, the drainage pattern is not shown.

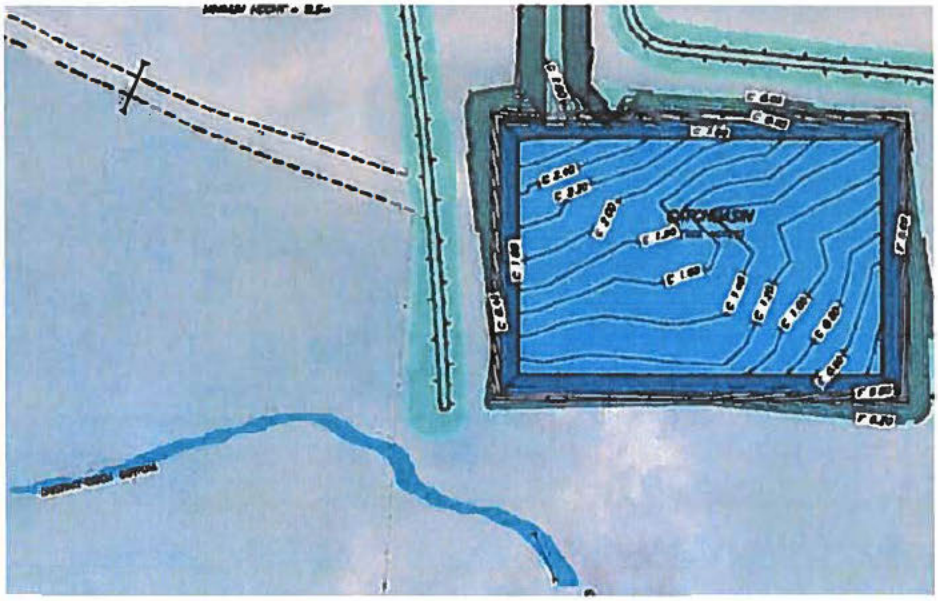


Figure 6. Excerpt from drawing C04 from Application showing adjacent stream highlighted. Notations are illegible on the provided copy.

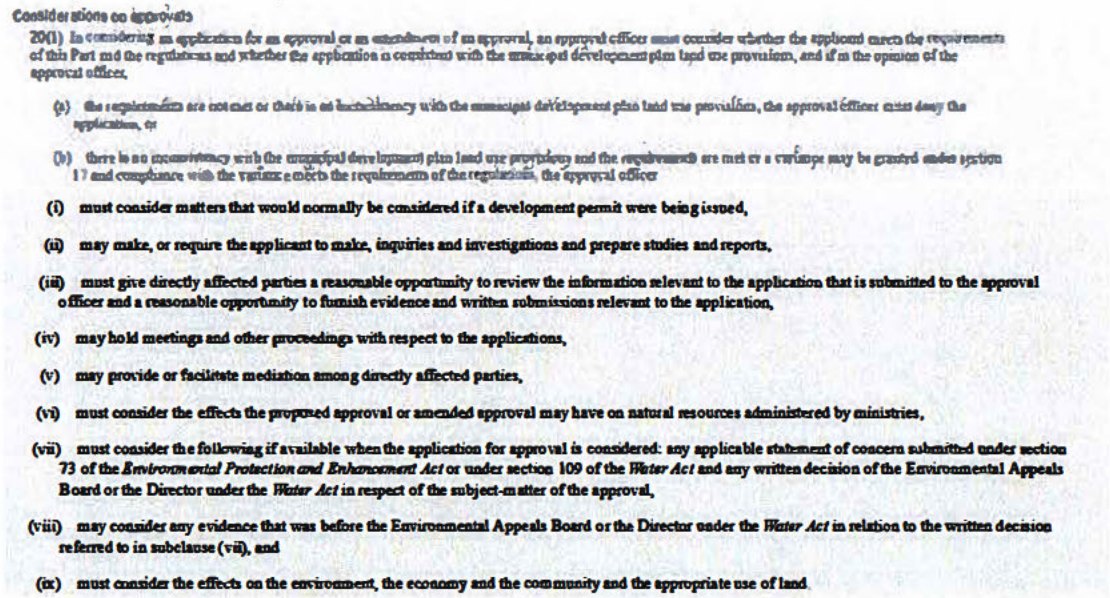
Figure 1 shows this is a water course directly adjacent to a manure lagoon. An excerpt from the referenced drawing is shown as Figure 6 with the water course highlighted for reference purposes. The published application does not show the location of the water wells, nor is the description of the water course legible. However, Figure 6 clearly shows that the manure storage facility fails to meet the minimum setback provisions in AOPA of 30 m.

The drainage pattern is not shown; however, it can be inferred that the area drains towards the stream. This is also implied by the satellite image in Figure 2, which appears to show drainage from a feed lot towards this stream.

10. Regulation by the Natural Resources Conservation Board

CFOs are regulated by the Natural Resources Conservation Board under the requirements of AOPA. While the requirements of AOPA seem to be quite minimal in that the setback distances

seem very small, some important responsibilities are bestowed on the board. Section 20 of AOPA provides these requirements:



Considerations on approvals

20(1) In considering an application for an approval or an amendment of an approval, an approval officer must consider whether the applicant meets the requirements of this Part and the regulations and whether the application is consistent with the municipal development plan and the provision, and if in the opinion of the approval officer,

(a) the requirements are not met or there is an inconsistency with the municipal development plan and the provision, the approval officer must deny the application, or

(b) there is no inconsistency with the municipal development plan land use provisions and the requirements are met or a variance may be granted under section 17 and compliance with the variance meets the requirements of the regulations, the approval officer

(i) must consider matters that would normally be considered if a development permit were being issued,

(ii) may make, or require the applicant to make, inquiries and investigations and prepare studies and reports,

(iii) must give directly affected parties a reasonable opportunity to review the information relevant to the application that is submitted to the approval officer and a reasonable opportunity to furnish evidence and written submissions relevant to the application,

(iv) may hold meetings and other proceedings with respect to the applications,

(v) may provide or facilitate mediation among directly affected parties,

(vi) must consider the effects the proposed approval or amended approval may have on natural resources administered by ministries,

(vii) must consider the following if available when the application for approval is considered: any applicable statement of concern submitted under section 73 of the *Environmental Protection and Enhancement Act* or under section 109 of the *Water Act* and any written decision of the Environmental Appeals Board or the Director under the *Water Act* in respect of the subject-matter of the approval,

(viii) may consider any evidence that was before the Environmental Appeals Board or the Director under the *Water Act* in relation to the written decision referred to in subclause (vii), and

(ix) must consider the effects on the environment, the economy and the community and the appropriate use of land.

Basically, this section of AOPA states the Approval Officer must determine if the application meets with the requirements of the AOPA, the Regulations, and the Municipal Development Plan. If there is an inconsistency, then the Approval Officer must deny the application. If not, then the Approval Officer must consider the following:

- matters normally considered if a development permit were being issued (such as the cumulative environmental impact and location of the CFO),
- the effects on natural resources administered by ministries (such as Pigeon Lake, which is controlled by Alberta Environment and Parks), and
- the effects on the environment.

The NRCB has a clear and well defined obligation to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to properly consider factors which cause the degradation of Pigeon Lake will place the responsibility squarely on the NRCB who will be held accountable.

11. Effect and Process

This project is perhaps the most significant perceived threat to Pigeon Lake in recent history. It has the potential of impacting all watershed residents whether or not they are in the Minimum Setback Distance. It will certainly affect the Ministry of Environment and Parks in that there is a Provincial Park campground just over 2 miles downwind of this facility. Anyone that has driven in the vicinity of Gull Lake or other areas of the province where liquid manure is spread knows all too well the enduring smell of liquid cattle manure. This Park will soon gain a reputation of being a "stinky" campground with a consequential loss of tourism. This ministry will also be faced with the challenges of increased fish kills and a possible loss of a major sports fishing lake. The increased flow of truck traffic hauling cattle, grain, manure, and hay unfortunately, as with odours, also expend past the Minimum Setback Distance.

One other aspect that must not be forgotten is highlighted in the following excerpt from the Alberta Water Council, which needs no further elaboration:

> *Cultural and Spiritual Values*
> Since time immemorial, Indigenous peoples have used lakes for all manner of life-supporting and life-affirming purposes, including for travel and as basic sources of food, drinking water and medicinal plants. Lakes are also important areas of cultural, spiritual and aesthetic significance for Indigenous communities. Many Indigenous people believe the Creator gave instructions to respect water, air and the land by keeping it pure, and these original instructions are reflected in many Indigenous beliefs, values and traditions to this day.

Ref: Alberta Water Council *Recommendations to Improve Lake Watershed Management in Alberta,* (2017)

The basic question to be answered is why should such an operation be approved when it will have such detrimental effects on so many watershed residents and visitors. As can be seen from the satellite image in Figure 7, when a bloom appears, it is both transient and ubiquitous, and it affects all lake residents.

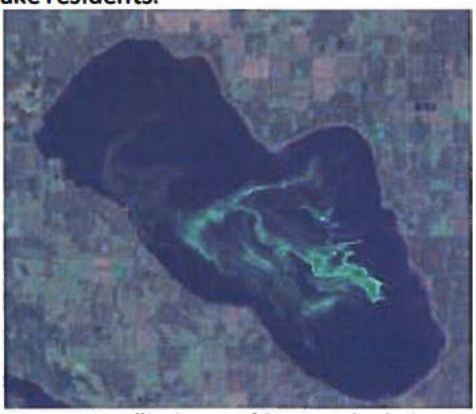


Figure 7. Satellite image of Pigeon Lake during an algae bloom Oct. 17, 2018 (ref: ABMI.ca)

The process for considering this application is also a concern. Section 20(1)(iii) and (iv) state that the officer must give affected parties reasonable opportunity to review the application and also that public meetings may be held. With less than one month notice being given and at a time when many of the affected parties are not at the lake, it does not appear that this condition is satisfied. With the resounding outcry of concern from residents near and far, it is a fair question to ask why a public meeting is not being held.

12. Conclusion

I will be harmfully impacted by my quality of life, property values, additional phosphorus load, disease, medications, etc that will migrate on to my properties as well as the creeks and Pigeon lake.

11.2 This application does not meet the requirements of the Regulations in that the CFO manure storage facility is located within the minimum setback of 30 m of a stream.

11.3 The requirements of the County of Wetaskiwin's Municipal Development Plan are not met in that the County can stipulate where CFOs can be located and clearly declare, through their Area Concept Plan, that the CFO should not be located within the boundaries of the watershed of Pigeon Lake. Also the MDP specifies manure spreading may not be done within 2.4 km of a named lake (including Pigeon Lake). The measured distance from SE10-47-2 W5M, a quarter designated for manure spreading, is 1.66 km as shown in Figure 5. The Application does not comply with the requirements of the County's development plans and therefore must be denied.

11.4 Legislation requires that the approval process must consider the cumulative environmental impacts this CFO will have on Pigeon Lake. Evidence provided from stream analyses shows that there is already a significantly high nutrient runoff occurring from this area of the watershed.

11.5 Approval of this application would impact natural resources under the purview of the Ministry of Environment, which has jurisdiction over Pigeon Lake, and

11.6 This project is not in the public interest.

13. Recommendation

I strongly suggest that this application be denied on the basis of its environmental impact to Pigeon Lake and its failure to meet the legislated requirements.

Martin Klatt

From: [redacted]
To: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; Nathan Shirley
Subject: ADDITION TO LETTER ABOUT FLAWS IN APPLICATION RA21045 APRIL 7-22
Date: April 7, 2022 4:17:04 PM

ALL

In addition to my previous concerns regarding the incorrect information in the original application. If that causes quash on the application I INSIST THAT ALL of the current letters of concern be applied to any NEW application within the next two years to make sure residents are not confused and miss re-submitting their concerns of impacts””

Thank You

Martin Klatt

From:	[redacted]
To:	Nathan Shirley
Cc:	premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject:	CFO application #RA21045
Date:	April 7, 2022 4:34:28 PM
Attachments:	Screenshot_20220405-224752_Word.jpeg Screenshot_20220406-001244_Word.jpg Screenshot_20220406-000711_Word.jpeg Screenshot_20220405-220650_Word.jpeg Screenshot_20220405-220838_Word.jpeg Screenshot_20220405-223328_Word.jpg Screenshot_20220405-221131_Word.jpeg Screenshot_20220405-221217_Word.jpeg

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Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.
This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been

seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First

Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a while.
https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-

contemplate-2017-municipal-election/

It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.

The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP. The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 
However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.

The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land. The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.

TAB 5

Madison Klatt

I live on [redacted].

I am a member of the 5th generation of my family. My family has kept our land a lot like it was when my great, great grandpa homesteaded here. I like to live surrounded by nature. I love enjoying the lake, mostly for fishing and swimming. I am also an Indigenous person and it is an important part of my culture to preserve nature and not abuse it. I already smell the cow manure and hear the cows very often, and I am also unable to enjoy the creek at our home because the water is almost always brown. My mom is also very worried if I touch the water that it could make me sick. I like to open my window for fresh air, and some times I can't because of the smell of cow poop. When I have children, I want them to be able to enjoy my home just like I want to. I do not want a CFO located anywhere near my home or the lake.

Thank you Mr. Shirley.

Sincerely,
Madison Klatt

MADISON KLATT
[redacted]

APRIL 7, 2022

Natural Resources Conservation Board
Attn: Nathan Shirley, Approval Officer

Via email: Nathan.shirley@nrcb.ca

Re: Application RA21045 - Statement of Concern

a) It will be shown in this submission that there is significant flow from the exact position of the manure storage facility and the manure spreading area through Sunset Harbour Creek to Pigeon Lake. Also, measurements have been presented to show that this flow has already has alarmingly high concentrations of phosphorus from an existing intensive livestock operation. It is well known, particularly to the Natural Resources Conservation Board as the regulator of confined feeding operations, that phosphorus is a nutrient that causes the formation of cyanobacteria blooms. It is also well known by the Government of Alberta, which has provided millions of dollars in funding to reduce the amount of phosphorus entering Pigeon Lake as well as other lakes.

b) *The detrimental effects of phosphorus on water quality are likely to occur*. Pigeon Lake is perhaps one of the most studied lakes in Alberta from a scientific perspective, and without exception, all studies recognize the importance of reducing phosphorus migration into the lake as the primary goal for watershed stewardship. The occurrence of cyanobacteria blooms ("blooms") in 2006 and periodically in subsequent years, spurred on the formation of the Pigeon Lake Watershed Association, the passing of many bylaws and Intermunicipal Development Plans, the implementation of multimillion dollar investments by local communities in wastewater projects, and most importantly, a change in the habits and level of respect of the watershed residents for the watershed. Simply put, if an abundance of phosphorus runs to the lake, the lake will be critically damaged.

c) *The effect will not be trivial*. Anyone who has lived through a significant bloom knows the damaging effects a bloom can have on the quality of life at the lake, the property values and the local economy. Dr. David Schindler, the internationally acclaimed scientist and recipient of the Alberta Order of Excellence in 2008, was largely responsible for identifying the causal relationship between phosphorus and water quality. He gave ample warning of the risks of not controlling phosphorus runoff into streams and lakes. The minimization of nutrients from manure is a foundational conclusion of the *State of the Watershed Report* (Aquality, 2008). The consequential effect of algae blooms is also a major cause of fish kills, the latest

of which occurred during July 2021. Cyanobacteria blooms can be dangerous to human life to the extent that Alberta Health Services monitors beaches and issues an advisory if specified limits are exceeded. A significant bloom occurred during the summer of 2015. This bloom made national headlines as shown below and will happen again unless we take action. Pigeon Lake cannot sustain such an ongoing load of nutrients from this cattle operation.

Pigeon Lake algae warning dashes hopes of scum-free summer

Dave Lazzarino
Aug 05, 2016 • August 5, 2016 • 1 minute read • Join the conversation

Large piles of algae wash up on shore at Pigeon Lake near Mulhurst Bay on September 13, 2015
PHOTO BY GREG SOUTHAM /Edmonton Journal

3. Status of Pigeon Lake

Pigeon Lake has been the victim of many years of improper development practices on both the lakeshore and throughout the watershed. The cumulative effects of a vast number of developments have pushed our lake to the breaking point. This lake has an extremely low flushing rate, estimated to be greater than 100 years, which means the effects of added pollutants are significant. The increase in the number and frequency of harmful algae blooms (HABs) in recent years resulted in the formation of the Pigeon Lake Watershed Association (PLWA) and a flurry of research into what was causing this change.

It soon became apparent that the cause of HABs is directly associated with the external load of nutrients from the adjoining land. Watershed residences became engaged with one common purpose – protecting the lake as a valuable resource for future generations. The PLWA's practices and goals of watershed stewardship are now considered as a gold standard for other watershed groups throughout the province.

The State of the Watershed Report was written in 2008 to establish a starting point and a path forward: where we were then and where we were going (ref: *Pigeon Lake State of the Watershed Report*, Aquality Environmental Consulting Ltd, 2008). This report concluded "External and internal nutrient inputs are a concern to the health of Pigeon Lake. Land use

practices, sewage, and *manure management* around the lake should be managed to *minimize further nutrient loadings to the lake."* (ref: ibid. p.38) (Emphasis added).

The efforts of watershed residents are already having a positive effect on the water quality of Pigeon Lake. Through the implementation of beneficial management practices, nutrient loading into the lake has been decreasing, and the results are starting to show. The intensity of the algae blooms is reducing, and we no longer get the almost yearly health advisories for cyanobacteria. But to sustain the momentum of this improvement, we must not let down our guard. The introduction of a 4000 cattle CFO, with the resulting manure spread over many sections of land in this well-drained area of the watershed, will put a dire strain on the capacity of the lake and set back, perhaps irreversibly, the advances made over the past decades, including the benefit of the regional wastewater system.

4. Topography of Western End of Watershed

The majority of land in the Pigeon Lake watershed lies to the west of the lake. It includes rolling land and many forested areas; however, much of the land has been cleared for agricultural purposes. The area around the proposed CFO is adjacent to an existing intensive livestock operation. This existing operation has approximately 1200 head of cattle that can be readily observed moving around unrestrained in the vicinity of the streams and ponds. This proposed project will more than triple the effects of manure contamination to the environment. The area is drained mainly by Tide Creek and its tributaries but also by other streams and tributaries, including the Sunset Harbour Creek, as it is locally known.

Figure 1 shows the quarter section (NW3-47-2 W5M) in which the proposed CFO is located. This site is drained by the Sunset Harbour Creek and its tributaries, which are ephemeral streams that flow to the northeast approximately 2½ km to Pigeon Lake. There are also other drainage patterns in the area where manure spreading is proposed. During the spring freshet, the rapid runoff of the snow melt has been measured to have a high concentration of dissolved phosphorus. As part of a nutrient loading study, water samples were taken in March 2022 from the two stream crossings on Range Road 22, which are shown in Figure 1. The values for dissolved phosphorus were reported at alarmingly high values of 2.0 and 1.6 mg/L for the north and south tributaries respectively. Dissolved phosphorus is a parameter that gives an indication of the amount of bioavailable phosphorus, which contributes directly to the formation of cyanobacteria blooms.

Sample Description	: RR 22, North, #1	Bureau Veritas Sample Number	: AQL761
Sample Date & Time	: 2022/03/22 16:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	2.0	mg/L	KONE	2010	A535183	0.075	0.0030

Sample Description	: RR 22, S, #1	Bureau Veritas Sample Number	: AQL762
Sample Date & Time	: 2022/03/21 15:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	1.6	mg/L	KONE	2010	A535183	0.15	0.0030

Note: full sample results are available upon request

Previous work by Alberta Environment and Parks on their study of the phosphorus budget for Pigeon Lake (ref: Pigeon Lake Phosphorus Budget, Chris Teichreb, 2014) measured values of Total Phosphorus and Dissolved Phosphorus in Sunset Harbour Creek at values much smaller. The results show that the values of Dissolved Phosphorus have increased by a factor of almost 20 in less than 10 years! (ref: *2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota*, Teichreb, Peter and Dyer, May 2014, page A22). The high values of Dissolved Phosphorus suggest that the land being drained, i.e., Section 3-47-2 W5M, is not being subject to proper stewardship practices. It is recommended that the approval officer visit this land to see what agricultural practices are currently being followed to help determine the starting point of a cumulative effects evaluation.

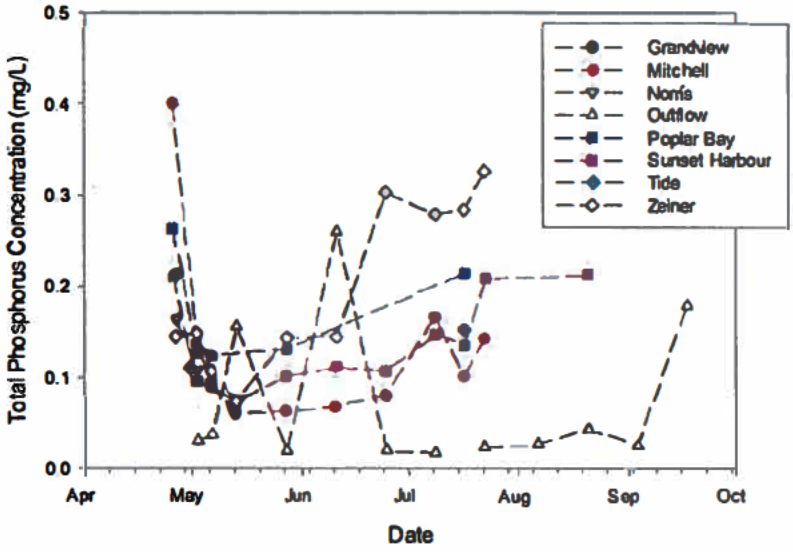


Figure 4-3 Pigeon Lake Streams Total Phosphorus Concentrations, 2013

Ref: *Pigeon Lake Phosphorus Budget*, Teichreb 2014 shows maximum values of Total Phosphorus in Sunset Harbour Creek of 0.2 mg/L compared to 2022 values of greater than 1.6 mg/L of Dissolved Phosphorus in the 2 tributaries

Figure 1. Drainage streams flowing north east to Pigeon Lake. The location of the proposed CFO is highlighted. The white arrows show the locations where the photographs in Figures 3 and 4 were taken.

5. Location of Proposed CFO

The location of the proposed manure lagoon is directly opposite a stream in the drainage pattern for this sub-watershed, which drains to the lake near Sunset Harbour. An enlargement of Section NW3-47-2 W5M is shown in Figure 2. It appears that a current feeding operation is located directly north of the proposed manure lagoon. This structure is also located very close to the stream and should be reviewed, especially in view of the high phosphorus runoff from this area. This stream must have some long-lasting significance as it forms a demarcation between the cleared land and the forested area in the southeast part of this quarter section.

Figure 2. Location of proposed manure lagoon in NW3-47-2-W5M (highlighted) is directly adjacent to a drainage stream.

During periods of heavy rainfall and during the spring freshet, this tributary of Sunset Harbour Creek experiences heavy flows. Photographs taken during the freshet on March 19, 2022, are shown in Figures 3 and 4 of the stream crossing on Range Road 22 and on Hwy 771 respectively. The locations of these steam crossings are indicated on Figure 1 by white arrows.

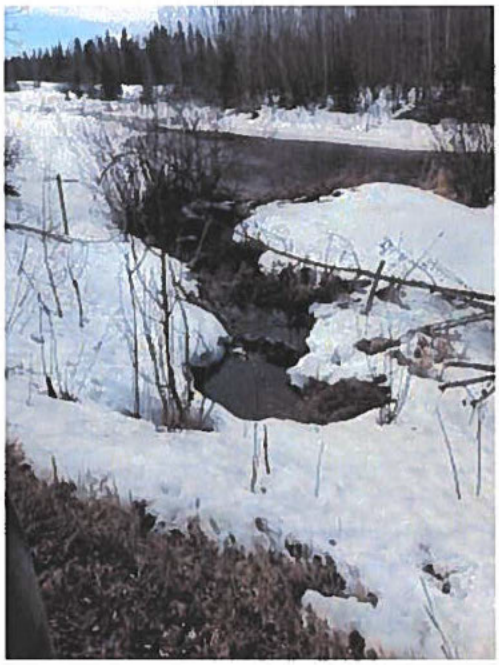


Figure 3. Steam Crossing on Range Road 22 during spring freshet March 19, 2022.

Figure 4. Stream crossing at Hwy 771 near Sunset Harbour during spring freshet, March 19, 2022.

It is readily apparent from the dark brown colour of the water that the streams are carrying a significant nutrient load from draining the land proposed to be the disposal area for the manure from 4000 cattle. The resulting increase in phosphorus load to Pigeon Lake could well bring Pigeon Lake to the breaking point.

6. Plan for Manure Disposal

If constructed properly, neither the CFO nor the collection area for the produced manure presents any real environmental problems other than perhaps the odour associated with such operations. The true problem arises from the disposal of such a large amount of manure. It appears that this manure will be in liquid form and will be dispersed on a large area of land drained by streams and tributaries that all flow into Pigeon Lake.

The high phosphorus concentrations found in Sunset Harbour Creek, as evidenced by water samples, can only be expected to increase as the load of manure increases. This manure will be applied year after year into the foreseeable future. With the cumulative effects of this proposed operation added to the existing intensive livestock operation on the property and to the effects of development that has already impaired Pigeon Lake, we are basically risking the survival of one of Alberta's premier lakes for a cattle operation that actually contravenes development policies established by the Pigeon Lake Watershed Management Plan, the County of Wetaskiwin, and the Natural Resources Conservation Board. These issues are discussed in the following sections.

7. The Pigeon Lake Watershed Management Plan

The *Pigeon Lake Watershed Management Plan* (the "Plan") was adopted in 2018 by the 12 municipalities of Pigeon Lake and supported by the Chiefs of the Maskwacis Cree Four Nations, the Pigeon Lake Regional Chamber of Commerce, and other key stakeholders. It is a roadmap to guide development in the watershed with the incorporation of beneficial management practices. The Plan recognizes that CFOs have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, Objective 2e from the Plan (p. 17), shown below, states that there should be no CFOs within the watershed:

2e	**New or Expanded Intensive Livestock Operations** Statutory land use restrictions on new or expanded intensive livestock operations (including CFOs) are supported in this Watershed Management Plan	Policy	Lead Mun Support APLM GoA PLWA	Ongoing	No Intensive Livestock Operations

(Note: the Plan can be found at www.PLWA.ca)

8. County of Wetaskiwin Plans

The County of Wetaskiwin (the "County") recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. The County has adopted by resolution the *Pigeon Lake Area Concept Plan* ("ACP") in recognition of the need for long-range plans in areas experiencing growth pressures. *"The County of Wetaskiwin recognizes that increased development and growth pressures need to be addressed on a cooperative basis to ensure the long-term protection and sustainability of Pigeon Lake*" (ref: ACP section 1.1). In Section 5.5, policies are presented to guide the County when evaluating a proposal to develop land in the

watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFOs should not be in the watershed:

> ***5.5.2 Agriculture***
> *Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.*

The County's *Land Use Bylaw* (LUB) also provides some direction on CFOs within the County. In Section 9.6.1 of the LUB, the County recognizes that CFOs are regulated by the Agricultural Operation Practices Act and Regulations (AOPA) and under the jurisdiction of the Province but clearly states *"it is the County's intent that any negative effect from CFOs should be minimized, and that the Municipal Government Act requires the municipality to identify where new CFOs should locate."*

This is a sensible and responsible approach being taken by the County to achieve their goal of protecting Pigeon Lake. The Area Concept Plan, discussed above, clearly states that CFOs should not be located within the watershed. Although CFOs are not under County jurisdiction, the County addresses a high standard for a similar operation – Intensive Livestock Operations. Section 9.6.7 states that "an existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

Their LUB addresses the spreading of manure in Section 9.6.10 as shown below:

> **9.6.10** Land within identified drainage basins 2.4 kilometres (1.5 miles) around named lakes (as referred to in the Municipal Development Plan) may not be used for manure disposal unless sufficient protection measures are proposed by the operator to prevent manure runoff negatively affecting such lakes. In accordance with the County's jurisdiction regarding Intensive Livestock Operations (ILO). (*amended by Bylaw 2019/44*)

The Application specifies land area that will be used for the spreading of manure. It appears that SE10-47-2 W5M is within the specified distance of 2.4 km, as shown in Figure 5.

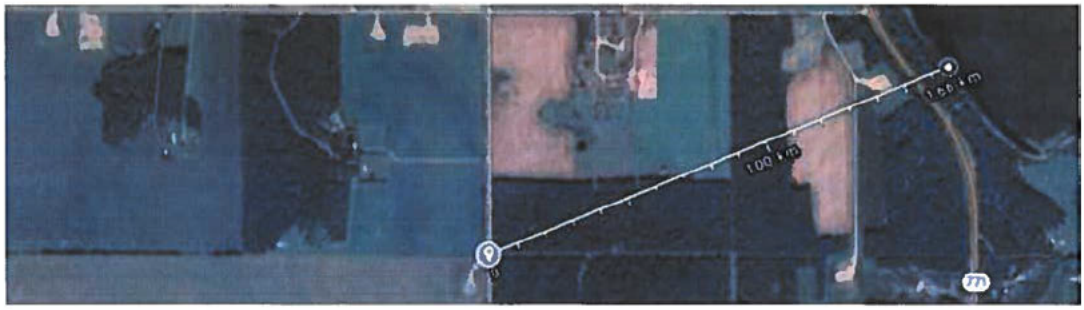


Figure 5. Distance from SE10-47-2W5M to Pigeon Lake is 1.66 km.

The County recognizes that spreading of manure has a negative effect on waterbodies.

The County's *Municipal Development Plan* also provides direction over the concern about the environment. Environmental protection is a focus of this plan as stated in Section 3 shown below:

3 Environmental Protection

Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

9. The Adequacy of the Application

The Regulations are specific as to what is required in the application. Two important items do not appear to be included: water courses and drainage patterns. Drawing C04 appears to show a phantom outline of a water course, but it is not specifically highlighted in the application. Also, the drainage pattern is not shown.

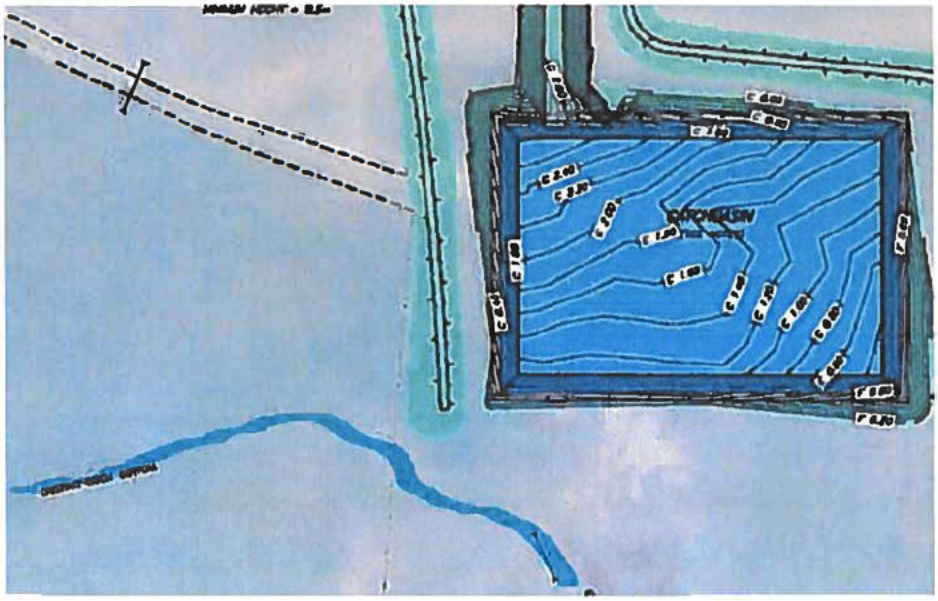


Figure 6. Excerpt from drawing C04 from Application showing adjacent stream highlighted. Notations are illegible on the provided copy.

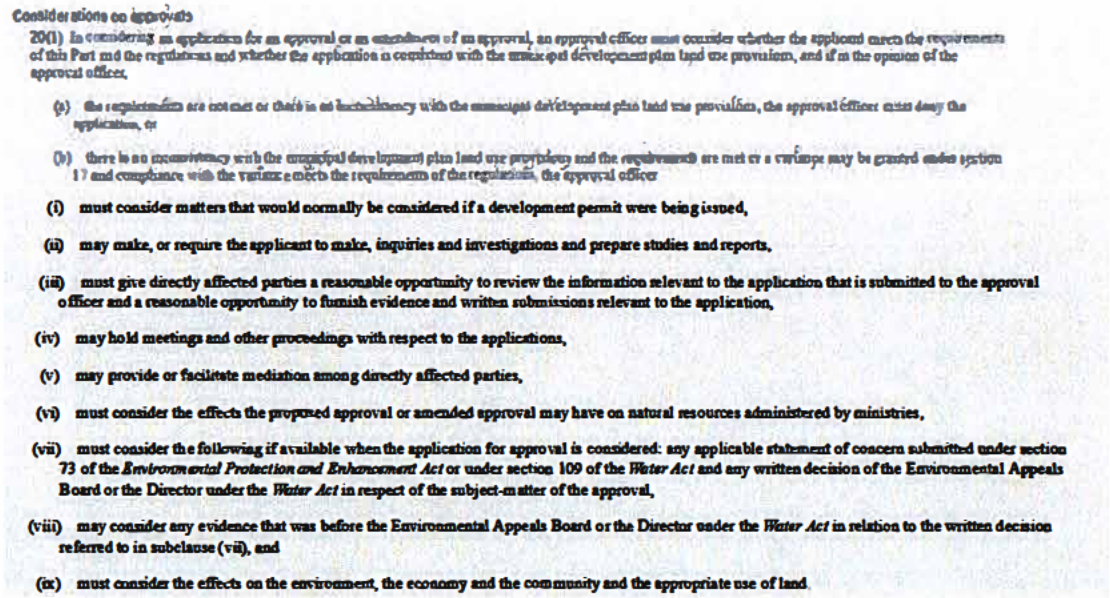
Figure 1 shows this is a water course directly adjacent to a manure lagoon. An excerpt from the referenced drawing is shown as Figure 6 with the water course highlighted for reference purposes. The published application does not show the location of the water wells, nor is the description of the water course legible. However, Figure 6 clearly shows that the manure storage facility fails to meet the minimum setback provisions in AOPA of 30 m.

The drainage pattern is not shown; however, it can be inferred that the area drains towards the stream. This is also implied by the satellite image in Figure 2, which appears to show drainage from a feed lot towards this stream.

10. Regulation by the Natural Resources Conservation Board

CFOs are regulated by the Natural Resources Conservation Board under the requirements of AOPA. While the requirements of AOPA seem to be quite minimal in that the setback distances

seem very small, some important responsibilities are bestowed on the board. Section 20 of AOPA provides these requirements:



Considerations on approvals

20(1) In considering an application for an approval or an amendment of an approval, an approval officer must consider whether the applicant meets the requirements of this Part and the regulations and whether the application is consistent with the municipal development plan and the provincial, and if in the opinion of the approval officer,

(a) the requirements are not met or there is an inconsistency with the municipal development plan and the provincial, the approval officer must deny the application, or

(b) there is no inconsistency with the municipal development plan land use provisions and the requirements are met or a variance may be granted under section 17 and compliance with the variance meets the requirements of the regulations, the approval officer

(i) must consider matters that would normally be considered if a development permit were being issued,

(ii) may make, or require the applicant to make, inquiries and investigations and prepare studies and reports,

(iii) must give directly affected parties a reasonable opportunity to review the information relevant to the application that is submitted to the approval officer and a reasonable opportunity to furnish evidence and written submissions relevant to the application,

(iv) may hold meetings and other proceedings with respect to the applications,

(v) may provide or facilitate mediation among directly affected parties,

(vi) must consider the effects the proposed approval or amended approval may have on natural resources administered by ministries,

(vii) must consider the following if available when the application for approval is considered: any applicable statement of concern submitted under section 73 of the *Environmental Protection and Enhancement Act* or under section 109 of the *Water Act* and any written decision of the Environmental Appeals Board or the Director under the *Water Act* in respect of the subject-matter of the approval,

(viii) may consider any evidence that was before the Environmental Appeals Board or the Director under the *Water Act* in relation to the written decision referred to in subclause (vii), and

(ix) must consider the effects on the environment, the economy and the community and the appropriate use of land.

Basically, this section of AOPA states the Approval Officer must determine if the application meets with the requirements of the AOPA, the Regulations, and the Municipal Development Plan. If there is an inconsistency, then the Approval Officer must deny the application. If not, then the Approval Officer must consider the following:

- matters normally considered if a development permit were being issued (such as the cumulative environmental impact and location of the CFO),
- the effects on natural resources administered by ministries (such as Pigeon Lake, which is controlled by Alberta Environment and Parks), and
- the effects on the environment.

The NRCB has a clear and well defined obligation to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to properly consider factors which cause the degradation of Pigeon Lake will place the responsibility squarely on the NRCB who will be held accountable.

11. Effect and Process

This project is perhaps the most significant perceived threat to Pigeon Lake in recent history. It has the potential of impacting all watershed residents whether or not they are in the Minimum Setback Distance. It will certainly affect the Ministry of Environment and Parks in that there is a Provincial Park campground just over 2 miles downwind of this facility. Anyone that has driven in the vicinity of Gull Lake or other areas of the province where liquid manure is spread knows all too well the enduring smell of liquid cattle manure. This Park will soon gain a reputation of being a "stinky" campground with a consequential loss of tourism. This ministry will also be faced with the challenges of increased fish kills and a possible loss of a major sports fishing lake. The increased flow of truck traffic hauling cattle, grain, manure, and hay unfortunately, as with odours, also expend past the Minimum Setback Distance.

One other aspect that must not be forgotten is highlighted in the following excerpt from the Alberta Water Council, which needs no further elaboration:

Cultural and Spiritual Values

Since time immemorial, Indigenous peoples have used lakes for all manner of life-supporting and life-affirming purposes, including for travel and as basic sources of food, drinking water and medicinal plants. Lakes are also important areas of cultural, spiritual and aesthetic significance for Indigenous communities. Many Indigenous people believe the Creator gave instructions to respect water, air and the land by keeping it pure, and these original instructions are reflected in many Indigenous beliefs, values and traditions to this day.

Ref: Alberta Water Council *Recommendations to Improve Lake Watershed Management in Alberta,* (2017)

The basic question to be answered is why should such an operation be approved when it will have such detrimental effects on so many watershed residents and visitors. As can be seen from the satellite image in Figure 7, when a bloom appears, it is both transient and ubiquitous, and it affects all lake residents.

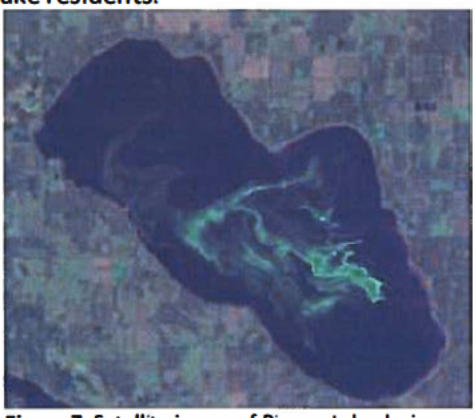


Figure 7. Satellite image of Pigeon Lake during an algae bloom Oct. 17, 2018 (ref: ABMI.ca)

The process for considering this application is also a concern. Section 20(1)(iii) and (iv) state that the officer must give affected parties reasonable opportunity to review the application and also that public meetings may be held. With less than one month notice being given and at a time when many of the affected parties are not at the lake, it does not appear that this condition is satisfied. With the resounding outcry of concern from residents near and far, it is a fair question to ask why a public meeting is not being held.

12. Conclusion

I will be harmfully impacted by my quality of life, property values, additional phosphorus load, disease, medications, etc that will migrate on to my properties as well as the creeks and Pigeon lake.

11.2 This application does not meet the requirements of the Regulations in that the CFO manure storage facility is located within the minimum setback of 30 m of a stream.

11.3 The requirements of the County of Wetaskiwin's Municipal Development Plan are not met in that the County can stipulate where CFOs can be located and clearly declare, through their Area Concept Plan, that the CFO should not be located within the boundaries of the watershed of Pigeon Lake. Also the MDP specifies manure spreading may not be done within 2.4 km of a named lake (including Pigeon Lake). The measured distance from SE10-47-2 W5M, a quarter designated for manure spreading, is 1.66 km as shown in Figure 5. The Application does not comply with the requirements of the County's development plans and therefore must be denied.

11.4 Legislation requires that the approval process must consider the cumulative environmental impacts this CFO will have on Pigeon Lake. Evidence provided from stream analyses shows that there is already a significantly high nutrient runoff occurring from this area of the watershed.

11.5 Approval of this application would impact natural resources under the purview of the Ministry of Environment, which has jurisdiction over Pigeon Lake, and

11.6 This project is not in the public interest.

13. Recommendation

I strongly suggest that this application be denied on the basis of its environmental impact to Pigeon Lake and its failure to meet the legislated requirements.

Madison Klatt

TAB 6

PIGEON LAKE

watershed management plan 2018

Pigeon Lake Watershed Management Plan Steering Committee
May 04, 2018

Working Together for a Healthy Watershed, Healthy Lake, and Healthy Community

TECHNICAL SUPPORT

(RECOMMENDED CITATION)

Pigeon Lake Watershed Management Plan Steering Committee (plwmp.ca). May 2018.
The Pigeon Lake Draft Watershed Management Plan 2018.
Pigeon Lake Watershed Association (plwa.ca) and Alliance of Pigeon Lake Municipalities (aplm.org)

PLAN ADOPTION AND SUPPORT

Pigeon Lake Watershed Management Plan - 2018

Municipal Resolution This Plan has been adopted by municipalities councils having passed the following resolution.

Council, having read and considered the Pigeon Lake Management Plan - 2018, resolves as follows:

1. *To work collaboratively with other Pigeon Lake watershed municipalities, the Pigeon Lake Watershed Association and the Pigeon Lake Watershed Steering Committee to implement the Pigeon Lake Management Plan - 2018.*
2. *To reference and consider the recommendations of the Pigeon Lake Management Plan - 2018 in the development of new or updated Statutory Plans required under the Municipal Government Act and in the ordinary business of the municipality.*

Municipality		Signature	Date
Leduc County,	Mayor		July 3, 2018
County of Wetaskiwin,	Reeve		June 1, 2018
SV of Argentia Beach,	Mayor		June 19, 2018
SV of Crystal Springs,	Mayor		June 13, 2018
SV of Grandview,	Mayor		June 8, 2018
SV of Golden Days,	Mayor		May 29, 2018
SV of Itaska Beach,	Mayor		June 8, 2018
SV of Ma-Me-O Beach,	Mayor		June 8, 2018
SV of Norris Beach,	Mayor		May 30, 2018
SV of Poplar Bay,	Mayor		June 8, 2018
SV of Silver Beach,	Mayor		Aug 20, 2018
SV of Sundance Beach,	Mayor		Aug 20, 2018

Endorsements of the Pigeon Lake Management Plan - 2018 by partner organizations.

Endorsing Organizations	Date
Alliance of Pigeon Lake Municipalities (APLM)	September 20, 2017
Pigeon Lake Watershed Association (PLWA)	December 07, 2017
Alberta Lake Management Society (ALMS)	March 26, 2018
Battle River Watershed Alliance (BRWA)	April 26, 2018
Pigeon Lake Regional Chamber of Commerce	February, 2018

Letter of Support for the Mamawo Mimiw Sakahikan Working Group and the Pigeon Lake Watershed Management PLan

Samson Cree Nation

Ermineskin Cree Nation

Louis Bull Tribe

Montana Band

SAMSON CREE NATION ERMINESKIN CREE NATION LOUIS BULL TRIBE MONTANA BAND

Letter of Support for the Mamawo Mimiw Sakahikan Working Group and the Pigeon Lake Watershed Management Plan

The state of Pigeon Lake and the importance of water for the current residents and future generations is bringing the watershed communities together.

The Maskwacis Cree (Samson Cree Nation, Ermineskin Cree Nation, Louis Bull Tribe and Montana First Nation) support the exploration of partnerships with the Pigeon Lake Watershed Association and the Pigeon Lake Watershed Management Plan (PL Plan) Committee to realize the vision:

Working together for a healthy watershed, healthy lake and healthy community.

The Mamawo Mimiw Sakahikan Working Group is commissioned to investigate opportunities and report recommendations to the Maskwacis Cree.

The Maskwacis Cree recognize that the health of Pigeon Lake and its watershed is complex with multiple governments, municipalities, and stakeholders. We recognize and are concerned that the health of the lake impacts the health of the people who collectively live, work and play at Pigeon Lake. We also recognize that the land, the shore and the lake are important to a healthy natural environment.

The Maskwacis Cree is in support of Mamawo Mimiw Sakahikan Working Group work to:

- Explore how the PL Plan may be important for the Pigeon Lake Reserve.
- Build bridges with the PL Plan Committee and have a voice in the work being done.
- Provide the Maskwacis Cree and the Pigeon Lake Reserve Residents with opportunities to be informed and to participate in the implementation of the PL Plan.
- Identify and share the tools and knowledge from this work, for the benefit of the Maskwacis Cree and Pigeon Lake Reserve.

Given that water is life, and that all living things depend on it, the health of the rivers, lakes, ground water, rain and snow are all of critical importance to the Maskwacis Cree; we, the Maskwacis Cree, as recognized governments for IR 138A Pigeon Lake Reserve endorse and support the formation, work and goals of the Mamawo Mimiw Sakahikan Working Group as stated in this Letter of Support and Terms of Reference.

CONSENTED to by the CHIEFS of the MASKWACIS CREE:

Per: Per: Per: Per:

Chief Vern Saddleback, Samson Cree Nation
Chief Craig Makinaw, Ermineskin Cree Nation
Chief Irvin Bull, Louis Bull Tribe
Chief Leonard SOTR, Montana Band

cc Ermineskin Cree Nation
Louis Bull Tribe
Montana First Nation
Samson Cree Nation
Government of Alberta, Environment and Parks
Battle River Watershed Alliance
Pigeon Lake Watershed Association
Pigeon Lake Watershed Management Plan Steering Committee

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Pigeon Lake Watershed Management Plan Steering Committee

Members *(alphabetical order)*

Tim Belec	President, Lakedell Agricultural Society
Doris Bell**	Former Deputy Mayor, SV of Crystal Springs
Glenn Belozer	Councillor, Leduc County, APLM Rep
Wiebe Buruma	Alberta Agriculture & Rural Development
Don Davidson (Deputy Chair)**	Mayor, SV of Grandview, APLM Rep
Susan Ellis**	Executive Director, PLWA
Robert (Bob) Gibbs, (Chair)**	PLWA Director, WMP Committee Chair
Ruth Harrison	Former PLWA Board, AFGA, NSWA
Tom Karpa	Pigeon Lake Regional Chamber of Commerce
Ron LaJeunesse**	Deputy Mayor, SV of Crystal Springs
Arin MacFarlane Dyer**	Planner, Alberta Environment and Parks
Nicholaus Moffat	Parks Planner, Leduc County
Rex Nielsen	APLM Vice Chair, Itaska Councillor, APLM Rep
Kathy Rooyakkers	Reeve, County of Wetaskiwin
Sarah Skinner**	Watershed Planning Coordinator, BRWA
John Slater	Councillor, SV of MaMeO Beach
Harold Wynn	CAO, SV of Silver Beach and SV of Sundance

** Plan Writing and Engagement Team Member

Plan Advisors

Jane Dauphinee	Senior Planner, Municipal Planning Services Ltd.
Theo Charette	Limnologist, CPP Environmental
Leta van Duin	ED, Alberta Low Impact Development Partnership
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Kim Barkwell	County Sustainable Ag Program Manager
Hugh Read	Editorial Assistance, Westbridge Communication Inc. & Grandview Beach Councillor
Chris Teichreb	Limnologist Albert Energy Regulator, (Former AEP)
Greg Nelson	Watershed Planner, AEP
Claire Klassen	Limnologist, Alberta Environment and Parks
Richard Casey	Limnologist, Alberta Environment and Parks
Terry Chamulak	Hydrologist, Alberta Environment and Parks
Cristina Buendia-Fores	Hydrologist, Alberta Environment and Parks
Tom Habib	Research Coordinator, Alberta Biomonitoring Institute

INTRODUCTION

Pigeon Lake is a popular beautiful prairie lake which has provided both livelihood and enjoyment for many generations of Albertans. Geologically, the lake is over 10,000 years old, left behind after retreating glaciers. The watershed and lake are part of Treaty 6, for the traditional lands of aboriginal peoples, stretching from Alberta's eastern slopes to the Manitoba border. The Maskwacis Cree (Samson Cree Nation, Ermineskin Cree Nation, Louis Bull Tribe and Montana First Nation) were provided home reserves near Maskwacis, Alberta and a satellite reserve on the shores of Pigeon Lake (Reserve 138A) for traditional access to Pigeon Lake and fishing.

Early settlement activities were based on logging, farming and fishing. Today, in addition to farming, the watershed features several hamlets, acreages and cottage communities, IR 138A, campgrounds and business centers – all creating a significant regional economy.

The lake provides for many types of recreation and the simple pleasures of enjoying nature. All those who live, work and play in the watershed influence the health of the lake. This Pigeon Lake Watershed Management Plan ("Plan") provides guidance as to what we can accomplish together to improve the health of the lake and surrounding watershed.

PURPOSE

The purpose of the Pigeon Lake Watershed Management Plan is to develop a comprehensive, science-based strategy to coordinate action for the protection and improvement of Pigeon Lake, its shore lands, and its watershed.

VISION

Working together for a healthy watershed, healthy lake, and healthy community.

The Plan recognizes that a large-scale complex set of systems and processes influence the overall health of the lake. Many of these processes are nature-based and beyond human control. Similarly, the time frame for positive outcomes is difficult to predict. The Plan advocates for multiples management strategies that are within our collective control. The Plan sets out a road map for collective action in key areas to offset the effects of the past and to restore a better balance for the lake environment. To address the challenges facing the lake, action and commitment is needed by all parties.

GOALS

The Plan's goals are to:

- Reduce the frequency and intensity of algal blooms.
- Improve the health of the watershed and the lake.
- Improve the recreational value of the lake and economic health of the region.

COMMON GROUND

The Plan recognizes that a variety of perspectives and interests exist among the various municipalities and stakeholders of the Pigeon Lake watershed. The Plan focuses on topics and actions that are rooted in science, provide benefit, and represent common ground.

PLAN DEVELOPMENT

Technical development of the Watershed Management Plan progressed in stages over a number of years:

2012-14 Establishment of the Pigeon Lake Watershed Management Plan Steering Committee and Terms of Reference

2013-15 Development of Beneficial Management Practice (BMP) Recommendations and Guides for:

1. Cosmetic Fertilizers and Soil Management
2. Model Land Use Bylaw
3. Surface Water Runoff

2016-18 Preparation of the comprehensive Pigeon Lake Watershed Management Plan was undertaken in several stages.

COMMUNITY AND STAKEHOLDER ENGAGEMENT

The Plan incorporates input from the public and stakeholders starting from the development of the Terms of Reference to the most recent Plan initiative. A summary of engagement initiatives that shaped the current plan are detailed in Appendix B of the Appendix volume. An engagement committee has been directing engagement and communication initiatives. Engagement and communication methods include:

- ✓ Joint Newsletters (APLM/PLWA) – spring and fall
- ✓ PLWA Community Engagement (farmers markets, door to door)
- ✓ PLWA AGM Presentations and Open House
- ✓ PLWMP and PLWA websites
- ✓ Annual Pigeon Lake Leaders Session
- ✓ Facebook since 2014 (Pigeonlakewatershedassociation)
- ✓ Pigeon Lake Twitter
- ✓ Workshops and Open Houses
- ✓ On Line Survey using Survey Monkey
- ✓ Engagement of specific stakeholder groups
- ✓ Presentations to Municipal Councils, AIMS and the APLM

All these strategies have been used throughout the development of the Plan in 2016-18. Public and stakeholder support for the plan has been very positive. The online survey was conducted in the summer of 2017. A total of 176 people filled in the survey on behalf of at least 397 people of which 95.5% own property around Pigeon Lake- see more in Appendix B.

Representations have been made to all 12 Municipal Councils to clarify concerns and seek support. Working with local groups such as the Pigeon Lake Regional Chamber of Commerce has been positive and ongoing.

MASKWACIS CREE

Since the PLWA began, engagement with the Maskwacis Cree has been important. In 2017, the draft Plan gave further impetus for working together. A working group of the Maskwacis Cree has been proposed in support of the Plan Vision and to explore opportunities to work together.

BACKGROUND

Pigeon Lake is a popular recreational lake in central Alberta.

Lake and watershed management planning is a means to address concerns and issues affecting Pigeon Lake and its surrounding watershed. The first two versions of watershed management plans for Pigeon Lake were completed in 1975 and 1985 respectively. In 2000, a Watershed Management Plan for the Pigeon Lake area was adopted by resolution by twelve municipalities (two counties and ten summer villages) with municipal boundaries abutting Pigeon Lake. While currently in effect, this plan needs to be updated.

Following significant algae blooms in 2006, the Pigeon Lake Watershed Association (PLWA) was formed to assist the watershed municipalities and stakeholders in addressing concerns and courses of action. Recognizing the need to plan and work collaboratively with community, municipal, traditional, and provincial partners, the PLWA began commissioning new scientific studies to determine the state of the lake, the shoreline area, and the surrounding lands.

In 2012, the PLWA began a renewed Pigeon Lake Watershed Management Plan that focused on education, beneficial practices and bylaws. This program was directed by a multi-stakeholder Steering Committee. By 2016, the PLWA, in partnership with the Alliance of Pigeon Lake Municipalities (APLM) and Alberta Environment and Parks (AEP), committed to prepare a comprehensive Pigeon Lake Watershed Management Plan (2018) that would combine the knowledge gained from research on the Pigeon Lake area with beneficial management practices for improved outcomes.

FIGURE 1: Aerial Photo of the Pigeon Lake Watershed (Outlined in Black)

The Plan promotes implementation by municipal partners through the statutory planning and bylaw adoption processes. The Plan also identifies actions that can be

implemented by individuals, municipal governments, provincial government, First Nations, non-governmental organizations, and technical specialists.

PROGRESS TO DATE

This Plan is informed by a considerable number of studies and prior initiatives already in place. These efforts have been spearheaded and funded by many organizations including the municipalities, the PLWA, the APLM, several non-governmental organizations, the Government of Alberta, The Government of Canada, the PLWMP Steering Committee, the University of Alberta, and the Alberta Biomonitoring Institute.

The following works are either underway (**u/w**) or completed (✓).

Scientific Studies

STATUS	DATE	TITLE
✓	2001+	Annual LakeWatch Reports (Water Quality) (2001, 2010, 2011, 2013, 2014, 2015, 2016, ongoing)
✓	2008	Pigeon Lake State of the Watershed Report
✓	2006/08	Shoreline Assessments
✓	2010	Hydrological Assessment and Water Balance Update
✓	2010+	Cyanobacteria Monitoring (Since 2010)
✓	2011	Water Quality Conditions & Long-Term Trends in Alberta Lakes
✓	2012	Options for the Control of Blue Green Algae.
✓	2012	Blue Green Algae Management: Review of work to date (PLWA)
u/w	2012+	Investigations of water importation, hydraulic dredging, and phosphorus inactivation
✓	2013	Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota
✓	2013	Aquatic Invasive Species PVC monitoring
✓	2014	Pigeon Lake Phosphorus Budget 2014
✓	2015	PLWA Citizen Cyanobacteria Monitoring
✓	2016	Paleolimnology Sediments Study
✓	2016	Tropic Cascade Mesocosm Research
u/w	2016	Algae Harvesting
✓	2016	Sediment Sampling Study
✓	2016/17	Pigeon Lake Watershed Phosphorus Runoff Model
✓	2017	Pigeon Lake Summary of the Science
u/w	2017/18	Pigeon Lake Bloom Causal Factors
u/w	2017/18	Research on economic costs of blue green algae blooms

Social Research Studies

STATUS	DATE	TITLE
✓	2013	PLWMP Engagement Report "Are We on Track?"
✓	2014	Cosmetic Fertilizer Survey
✓	2015	Clean Runoff Survey

Legislation & Beneficial Practices Guidance

STATUS	DATE	TITLE
✓	2008	Law & Policy Framework Phase I Report
✓	2010	Regulatory and Policy Actions for a Healthy Pigeon Lake Watershed Phase II Report
✓	2012/13	PLWMP Terms of Reference
✓	2012/14	PLWMP Topic I – Cosmetic Fertilizers & Soil Management • Cosmetic Fertilizers Terms of Reference (2012) • Research on North AM Bylaws (2013) • Input from Soil Experts (2013) • Cosmetic Fertilizer & Soil Nutrients Guide (2014-15)

STATUS	DATE	TITLE
✓	2012/14	PLWMP Topic II – Model Land Use Bylaw • Model Land Use Bylaw: Lakeshore Environmental Development Provisions
✓	2012/14	PLWMP Topic III – Surface Water Runoff • Alberta Clean Runoff Action Guide

Stewardship Education and Advocacy

STATUS	DATE	TITLE
✓	2006+	Stewardship and Education Initiatives • Websites, Newsletters & Brochures • Information Booths, Speakers, Education Sessions • Himalayan Balsam Eradication Program • Grandview Creek Restoration • Tree Planting Program • Watershed 101 for new Councillors • Newcomers Packages • Love the Lake (Children's Event)

✓	2006+	Advocacy
		• Meetings and representation at APLM, Annual Information Meetings, Council Meetings, with First Nation Elders and committees when invited, and with all levels of Alberta Environment and Parks.
		• Representing Pigeon Lake & learning from others
		  • At Central Alberta Recreational Lake Forum
		  • At North America Lake Management Society

✓	2006-2016	Living by Water Shoreline Property Consultations
✓	2011+	Review of land development applications & municipal plans • Leduc County (2011 and 2016) • Watermere Resort (2012 & 2014) • County of Wetaskiwin (2013)
✓	2013+	Aquatic Invasive Species Prevention Efforts, Education & Monitoring
✓	2014+	Healthy-Lake Lawns Program • Brochure, 'How to create and maintain better lawns' spring and fall emails and native grass seed
✓	2015/16	Clean Runoff Action • Clean Runoff Introduction brochure • Three municipal demonstration sites installed • Two residential demonstration sites installed and another underway. • One shoreline pilot restoration and demonstration site installed • Watershed Rain Barrel Campaign (57 sold) • 25 Bird Houses & 10 Bat Boxes installed • Landscaper Clean Runoff workshops. • Sold 25 bags of PLWA native grass seed mix (225g)
✓	2017	• Clean Runoff workshop and native plant sale for everyone • Kids took 64 Bird Houses and 12 Bat Boxes home to install • 17 Rain Barrels sold • Two Clean Runoff Residential Demonstration Site Open Houses Shoreline Restoration Open House

SNAPSHOT OF THE LAKE AND WATERSHED

The Pigeon Lake Watershed Management Plan has a study area of 284 km^2; this includes an area of 96.7 km^2 for Pigeon Lake itself, and 187 km^2 for the surrounding drainage area (or 'Watershed'). The boundary of the Pigeon Lake Watershed Management Plan study area is illustrated in Figures 1 and 2. A list of physical properties of the lake and watershed are provided in Table A.

TABLE A: Physical Properties of the Lake and Watershed

PIGEON LAKE PHYSICAL FEATURES	PHYSICAL PROPERTIES
Lake Surface Area	96.7 km^2
Lake Water Volume	603,000,000 m^3
Maximum Depth	9.1 m
Mean Depth	6.2 m
Shoreline Length	46 km
Mean Annual Lake Evaporation	664 mm
Mean Annual Precipitation	534 mm
Mean Annual Inflow	17,000,000 m^3
Mean Residence Time	Greater than 100 Years
Lake Weir Sill Elevation	849.935 m (Above Sea Level)
Watershed Land Drainage Area	187 km^2
Watershed to Lake Area Ratio	2:1

Pigeon Lake is a relatively shallow large prairie lake. Relative to other Alberta lakes, studies of lake bed sediments show that the lake is moderately nutrient rich (eutrophic) and has always produced algae, which in turns supports a robust fishery. The mean residence time to replace the total volume of water in the lake is over 100 years.

Located in central Alberta, the entire Plan area is located within the Battle River Watershed, which is part of the even larger North Saskatchewan River Watershed.

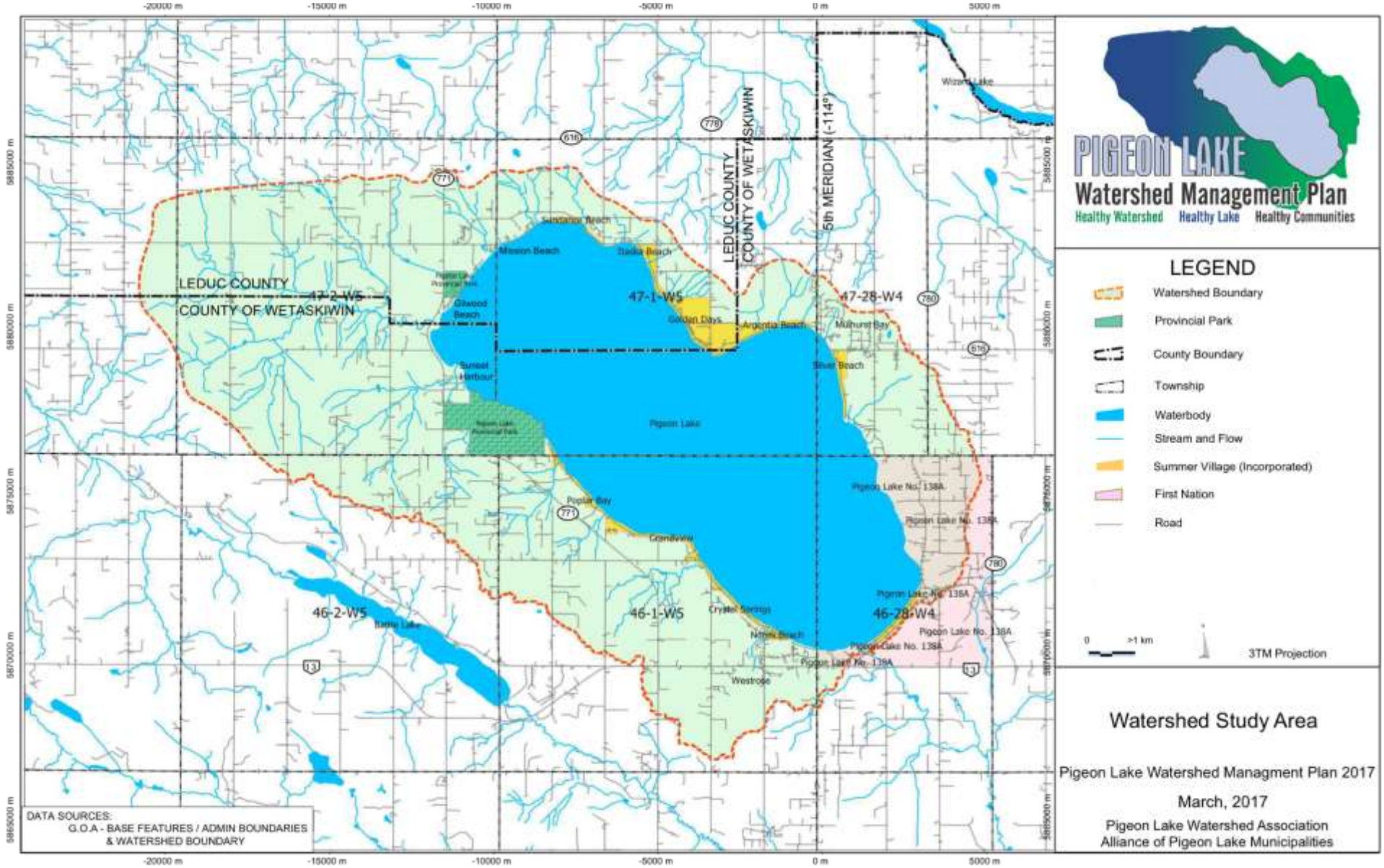
Lands within the Pigeon Lake watershed are administered by ten summer villages, two counties, Maskwacis Cree (IR 138A), and the Government of Alberta (Provincial Parks).

A summary of the science has been prepared by a professional limnologist as a background to the development of the plan. Key factors affecting the overall strategy of the plan are presented below along with key implications.

ALGAE BLOOMS

An important driver of this Plan is that algal blooms have become noticeably more severe and frequent, especially since 2002. Algae are naturally present and are a foundation for the lake's food web and fishery. However, when algae are excessive, they form blooms. Blooms and related health advisories may have caused significant economic and social impacts. The costs of these impacts are being assessed. This Plan promotes a multi-pronged approach to reducing blooms and phosphorus levels.

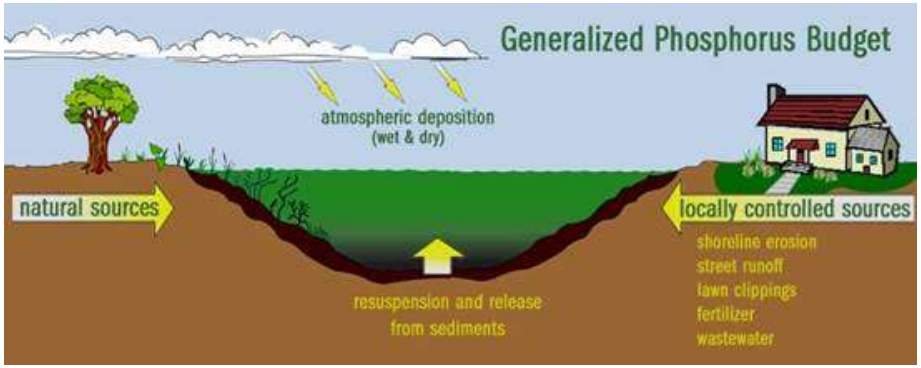
FIGURE 2: Pigeon Lake Watershed Management Plan Study Area



PHOSPHORUS

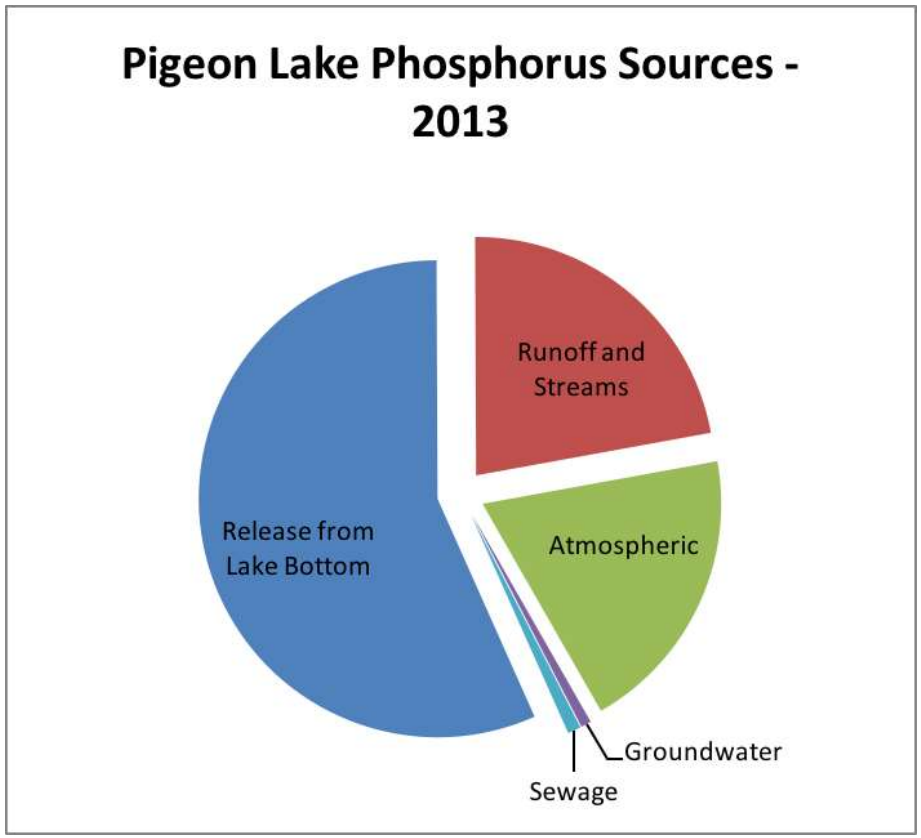
Algae levels are dependent on a variety of factors including climate cycles, sunlight, wind, and nutrient levels in the lake. Specifically, concentrations of phosphorus (a type of nutrient) greatly influence bloom formation. During ice-free conditions, phosphorus enters the lake from the surrounding watershed and the atmosphere (Figure 3) and is taken up by algae. During ice-covered conditions, the suspended sediment and algae (and the associated phosphorus) will settle out into the lakebed sediments, so that phosphorous returns to a low level during ice covered conditions. This cycle is repeated annually.

FIGURE 3: Generalized Phosphorous Budget



The movement of phosphorous into the lake from various sources can be calculated in a "phosphorus budget." During the open-water season of 2013, detailed measurements were taken of phosphorus movement into Pigeon Lake. From these measurements, a summation of annual phosphorus inflows and outflows was prepared in 2014.The phosphorous budget estimates that during the open water season, the lake gains on average 13,250 kg (13.2 metric tonnes) of total phosphorus from sources identified in Figure 4. Each winter, except for small amounts leaving the lake, this amount of phosphorus

FIGURE 4: Phosphorus Sources in 2013



is incorporated into the lakebed sediments, some of which get re-released to the lake in the following years.

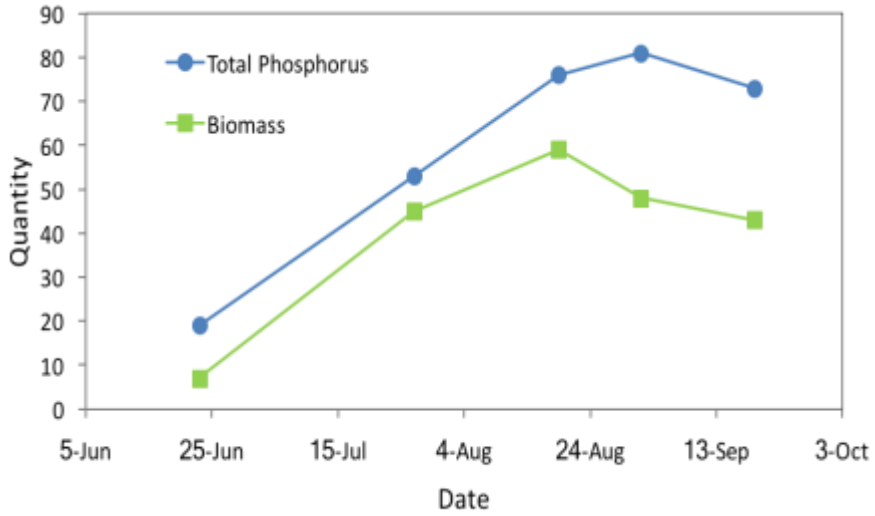
The five colored segments of the pie chart show the relative magnitude of the sources of internal and external loading. The sources of phosphorus that can potentially be managed include runoff, sewage, and release from lake bottom sediments. The Plan will include specific actions to address these sources of phosphorus.

The pie chart (Figure 4) represents only part of a typical year, is generalized and may not be typical of all years. Also, the chart may not fully differentiate

all sources nor all mechanisms and causes of phosphorous entering the lake. More research is needed. Phosphorus from internal sources (the sediments) is phosphorus from external sources deposited in prior years. Managing phosphorus sources from the watershed is a key priority of the Plan.

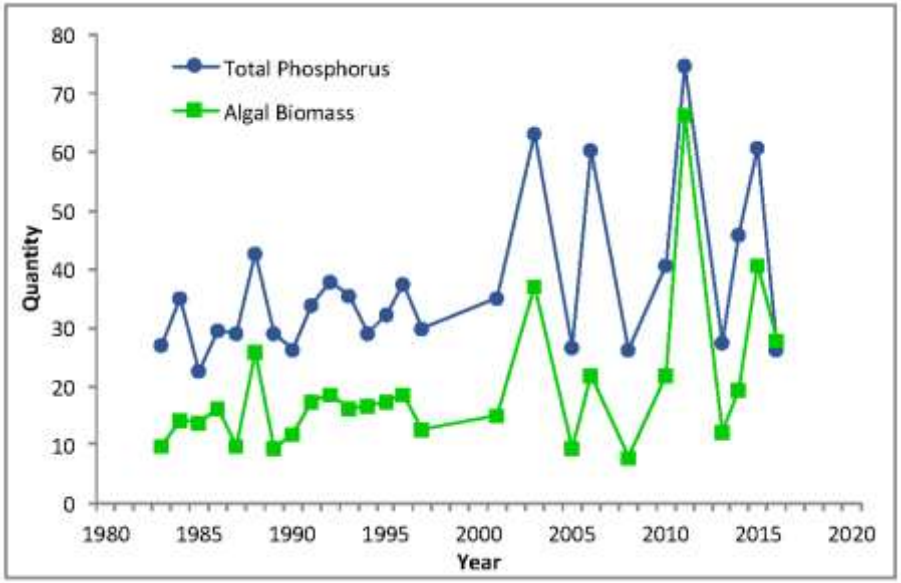
Each year, phosphorus levels in the lake vary from quite low during winter ice cover to higher levels, which in certain years coincide with bloom conditions. Figure 5 shows an example of phosphorus levels in 2015 relative to algal biomass during the open water season.

FIGURE 5: Seasonal Trends in Total Phosphorus and Algal Biomass



Trend lines in phosphorus and algae levels show considerable variations, from one year to the next. Figure 6 shows that since 2002 the pattern of peaks and lows has changed with larger fluctuations and specific years being much higher. There reasons are not fully understood and require more research.

FIGURE 6: Total Phosphorus and Algal Biomass 1983 to 2016



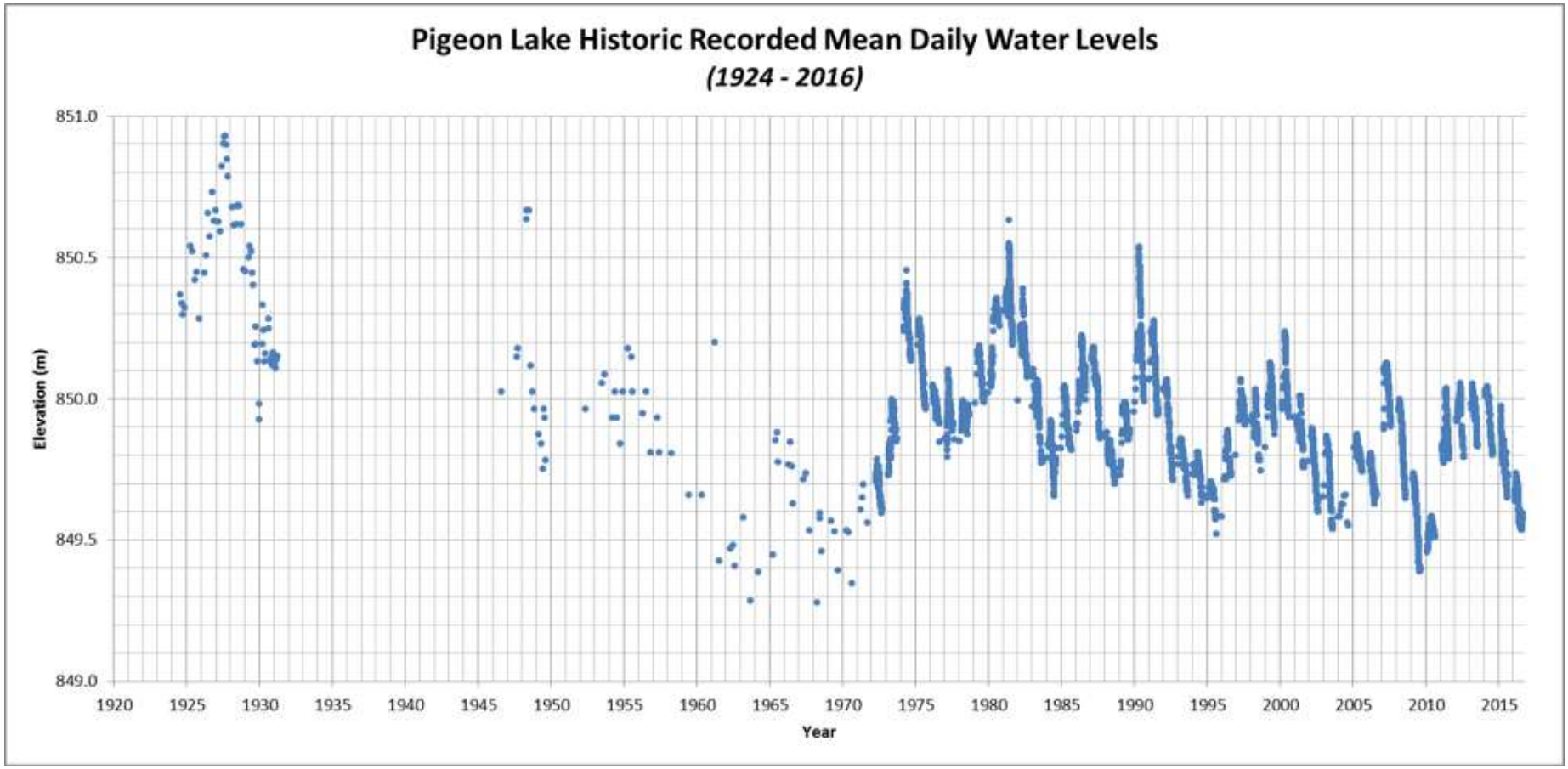
Note: Data points are the annual average value of all samples for each year

LAKE WATER LEVELS

Pigeon Lake is a permanent waterbody. It has a long residence time (the amount of time that water will remain in a basin) of greater than 100 years. The watershed of Pigeon Lake is small relative to the lake itself, with a surface area ratio of approximately 2:1 watershed (187 km^2) to lake (96.7 km^2). Compared to other Alberta lakes, the small drainage area and large evaporative area makes Pigeon Lake particularly sensitive to climatic variability, with changes to precipitation and/or evaporative rates having a considerable impact on lake water levels.

The lake does not have large water withdrawals. The outflow creek that drains Pigeon Lake into the Battle River is fitted with a weir with a crest elevation of 849.935 meters above sea level (masl). When water reaches this elevation, outflow occurs, including a small amount of nutrient release.

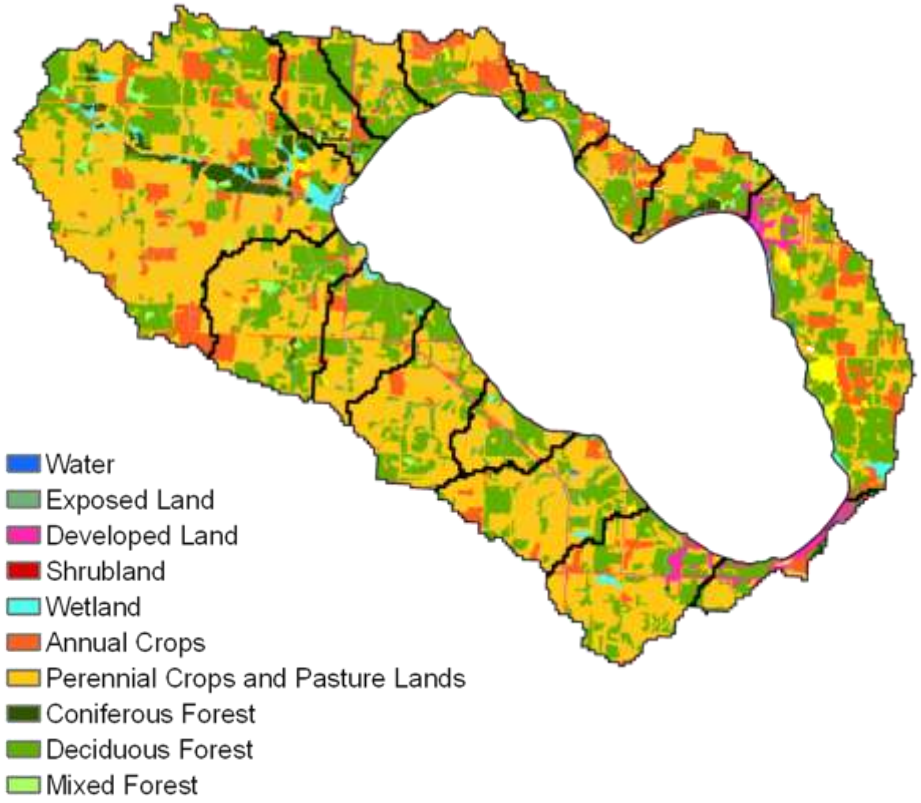
Pigeon Lake has lake level data available since the 1920s. The extensive historical water level data demonstrates that Pigeon Lake experiences ongoing water level cycles of both increasing and decreasing trends when considered over a longer time-period.



LAND COVER AND PHOSPHORUS

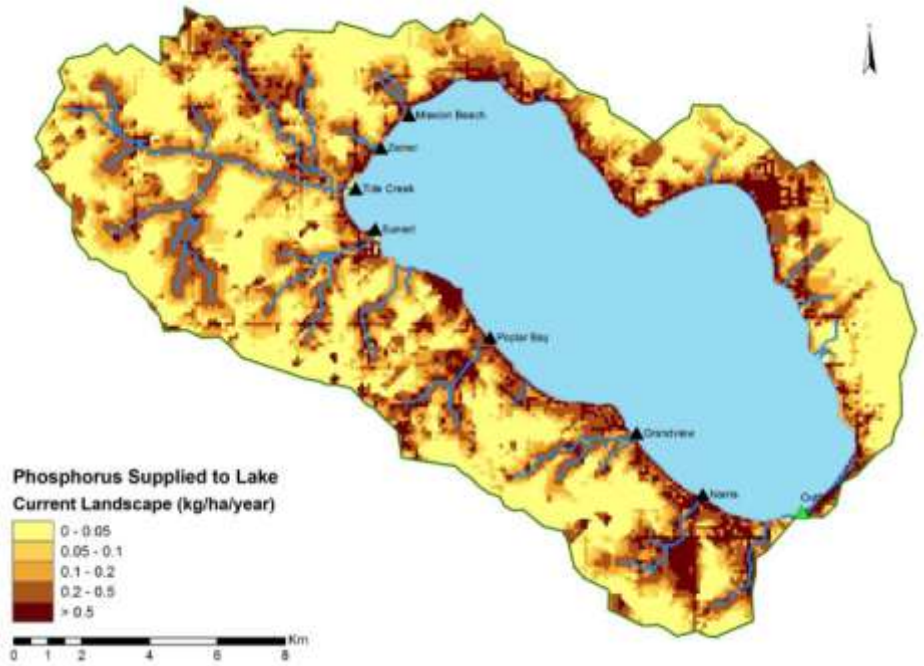
Historically, the watershed was naturally vegetated with forests, grasslands, and wetlands. Currently, the watershed is occupied by a mix of natural vegetation, farming, and developed lands (See Figure 7).

FIGURE 7: Pigeon Lake Watershed Land Cover



The amount of phosphorus runoff from watershed lands is affected to the types of and proportions of land cover. Based on the current land cover types, (for example, forest, pasture, crops, and developed land), a phosphorus loading model was developed. Figure 8 illustrates the pattern of phosphorus intrusion into the lake from the surrounding watershed.

FIGURE 8: Phosphorus Entering Pigeon Lake from the Watershed



Source: Habib. 2017: http://ecosystemservices.abmi.ca/wp-content/uploads/2014/10/ABMI-Pigeon-Lake-Phosphorus-Modelling-final-version-July-2017.pdf

This model shows that areas near streams and the lake shore are the most abundant sources of phosphorus flowing into Pigeon Lake. Based on this information, the Plan will focus on addressing land uses and natural buffers along the streams and lake.

PLAN IMPLICATIONS

From the preceding section and the best available evidence, key considerations affecting the overall strategy and perspective of the plan are:

- Multiple strategies will be required to improve the health of Pigeon Lake. No one strategy (silver bullet) exists that will address the bloom problem.
- The sources of phosphorus that can potentially be managed include runoff, sewage (e.g. septic fields), and release from lakebed sediments.
- The plan identifies three geographic areas where nutrient sources can be managed:
  - The Watershed Lands
  - The Shoreline
  - The Lake
- Managing nutrients, particularly phosphorus, in the watershed is a key priority. Feasible strategies to manage internal loading needs to be further investigated.
- The state of science about Pigeon Lake continues to evolve. Significant knowledge gaps still remain, especially related to nutrient and blue-green algae behavior throughout each season of the year.
- While in-lake treatments have shown promise for smaller water bodies, there are no known examples of successful in-lake treatment interventions for a lake the size of Pigeon Lake. In-lake treatments are short term and require periodic reapplication. Addressing matters such as feasibility, environmental negative effects, regulatory approvals, organizational delivery, and financing means that decisions about in-lake treatment will take further investigation and time.

Photo: Clean Runoff Municipal Demonstration

A ROADMAP

The Plan is organized into four main sections:

- The Watershed Lands: Pigeon Lake watershed up to the height of land surrounding the lake
- The Shoreline: Pigeon Lake's shoreline, including the bank and near shore waters.
- The Lake: Pigeon Lake itself, and
- Working Together: improving our collaboration and organizational capacity

Each of the four key areas of the Plan (Pigeon Lake, Shoreline, Watershed Lands, and Working Together) is structured in the following manner (see diagram):

- ❖ Plan Area (e.g., Watershed, Shoreline, the Lake)
  - Plan Objectives: where we want to go.
    - Recommendations and Actions: How we will get there:
      - Policy: Statutory plans, bylaws, agreements
      - Technical: Science and monitoring
      - Community Action: Advocacy, education, and voluntary action

The recommendations and actions are presented in a tabular form to show how the Plan will be implemented. Alongside of each recommendation are listed:

- responsible parties
- time frame
- measures of success

WATERSHED LANDS

KEY FINDINGS

Reducing the amount of phosphorus pollution entering the water of Pigeon Lake must be a key goal for managing the lake.

The coverage and ecological condition of land cover types with low phosphorous runoff (e.g., forests grasslands and wetlands) should be maintained and/or improved.

Key natural lands such as wetlands and forested lands next to streams and the lake itself should be targeted for restoration. Land use activities should also be restricted in these areas.

OBJECTIVES

Increase land cover types (e.g. forest, wetlands) that have lower nutrient release rates, trap nutrients, and that promote biodiversity.

Improve phosphorous management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake.

Protect groundwater that feeds into Pigeon Lake.

LAND COVER & BIODIVERSITY

OBJECTIVE 1 Increase land cover types (e.g., forest, wetlands) that have lower nutrient release rates, trap nutrients, and promote biodiversity.

- Over 60% of the watershed has already been cultivated or converted for human uses, including urban development, pasture/perennial crops, and annual crops.
- Land cover is directly related to the sources and quantity of phosphorus that is entering the lake.
- Promoting land cover types that have low phosphorus runoff is one important watershed management strategy.
- Providing healthy vegetated buffers along water courses,
- Managing wetlands and natural areas as important nutrient traps.
- Promoting natural forest buffers will add to biodiversity (species diversity) important to the ecosystem health of the watershed.

•

LAND COVER & BIODIVERSITY OBJECTIVE 1: Increase land cover types (e.g. forest, wetlands) that have lower nutrient release rates, trap nutrients, and that promote biodiversity				
RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
1a **Land Conservation:** Conserve watershed priority areas with protective designations, including: the Provincial Park, private land conservation purchases, conservation easements, environmental reserves, and land use districts.	Policy	Lead: PLWMP Support: NGO, GoA, Mun, PLWA	Ongoing	Additional 10% over entire watershed
1b **Statutory Plans & Land Use Bylaws:** Retain Natural Vegetation: Develop guidelines and implement policies and regulations within statutory planning documents and municipal land use bylaws to retain natural areas and wildlife corridor (e.g. 80% tree cover for 20-acre lots) within new subdivisions; and for the requirement for development permits for tree and natural vegetation removal on residential lots.	Policy	Lead: Mun[1] Support: APLM, PLWMP	Short Term	100% municipal participation
1c **Statutory Plans & Land Use Bylaws:** Wetlands: Implement policies and regulations in municipal planning documents to retain all wetlands and peatlands as nutrient traps. Implementation tools may include: • Requiring the delineation and classification of wetlands as a component of statutory plan development, subdivision or development permit applications. • Implementing development setbacks from wetlands and peatlands based on their classification	Policy	Lead: Mun. Support: APLM, PLWMP	Short Term	100% municipal participation
1d **Restoration:** Implement programs to encourage the restoration of natural vegetation on lands throughout the watershed including reforestation and restoration of wetlands using incentives such as the Alternative Land Use Services Program (alus.ca)	Community Action	Lead: PLWA Support: Operators, Mun, GoA, PLWMP, NGO	Ongoing	One project per year
1e **Mapping:** map watershed priority areas such as wetlands, wildlife habitat, environmentally significant areas	Technical & Scientific	Lead: PLWMP Support: Mun, GoA, PLWMP	Medium Term	Task Completed

[1] Mun: authority remains with each Municipality to separately act on any given recommendation. APLM (Alliance of Pigeon Lake Municipalities) provides a forum for municipalities to discuss practices and may recommend consideration by member councils, but final authority remains with the member councils

LAND USE & PHOSPHORUS MANAGEMENT

OBJECTIVE 2 Improve phosphorus management for all land uses to achieve a net reduction in nutrient runoff and promote biodiversity.

- Work has begun on introducing beneficial management practices (BMPs) for residential land to achieve nutrient control. The initiatives include:
  - Lawn Fertilizer Ban
  - Model Land Use Bylaw
- Consultation with the agricultural community has been initiated to encourage and implement BMPs to reduce nutrient runoff and improve biodiversity.
- Voluntary adoption of these BMPs needs to be actively supported by the province, municipalities, and stewardship groups.
- Other sectors such as golf courses and the oil and gas industry have beneficial practices that need to be better promoted for local operators.

LAND USE & PHOSPHORUS MANAGEMENT
OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
2a	**Statutory Plans & Land Use Bylaws:** Lakeshore Environmental Area: Adopt an 800 metre "Lakeside Environmental Area" as per the Model Land Use Bylaw, that gives priority to land uses, policies, and environmental provisions designed to protect the lake from nutrient runoff. Policy provisions to include: • Requiring construction management plans with new development permit applications. • Restricting land uses within riparian areas that may increase runoff, increase the potential for contamination of groundwater, and/or impede the effectiveness of important recharge areas • Restricting land uses within 800 metres of the lake where phosphorus and other nutrients, chemicals, or nutrient-rich sediment may pollute the waters of Pigeon Lake. • Requiring a development permit and providing guidelines for the stripping and grading of lands within 800 metres of the bank of Pigeon Lake. Where possible this activity should be discouraged and or sediment controls be implemented during and post construction to eliminate sediment loading of the lake during construction. • Requiring the application of local topsoil and native plants to be included in landscaping plans for new development and redevelopment areas.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	100% municipal participation

LAND USE & PHOSPHORUS MANAGEMENT OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.				
• Prescribing a maximum site coverage percentage for non-permeable surfaces on new development and re-development sites within 800 metres of Pigeon Lake. • Prescribing site coverage guidelines for natural vegetation cover that is compatible with FireSmart development principals • Discouraging the compaction of soils during stripping and grading activities that may interfere with natural groundwater recharge and increase surface water runoff. • Prohibiting the excavation or filling in or clearing of all wetlands and stream courses and their associated riparian lands within 800 metres of the legal bank of Pigeon Lake.				
2b **Lawn Fertilizers and Pesticides:** Continue to provide education and support for watershed residents to eliminate lawn fertilizers and pesticides on residential properties and to promote alternative practices.	Community Action	Lead: PLWA Support: Mun	Largely Completed	Annual Programs,
2c **Watershed Stewardship Advocacy & Education:** Encourage landowners (residential, business, recreational and agricultural) to adopt proactive lake-friendly environmental management practices, landscaping and activities. Support land use policies and regulatory measures with public awareness and education.	Community Action	Lead: PLWA Support: Mun, NGO, GoA	Ongoing	Increased Participation
2d **Existing Agricultural Operations:** Encourage agricultural operators to participate in whole farm reductions in phosphorus runoff using the Alberta Agriculture and Forestry Phosphorus Management Tool and the Environmental Farm Plan Program, and to adopt beneficial management practices that reduce nutrient runoff. Promote agricultural erosion and sediment control practices (e.g. low tillage).	Community Action	Lead: Counties Support: PLWA, PLWMP, APLM, GoA	Ongoing	Sector Participation
2e **New or Expanded Intensive Livestock Operations**: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan	Policy	Lead: Mun. Support: APLM, GoA, PLWA	Ongoing	No Intensive Livestock Operations
2f **Recreational Operations:** Encourage recreational land uses (e.g. golf courses, campgrounds) to adopt beneficial management practices (e.g. Audubon Certification) that reduce nutrient run off and promote biodiversity.	Community Action	Lead: PLWA Support: PLWMP, Mun, NGO, GOA	Ongoing	Sector Participation
2g **Oil and Gas Operations:** Encourage all oil and gas operations to adopt a best management practices on all well sites, batteries, and processing operations to reduce contaminants and phosphorous rich runoff. Encourage future operations to minimize land disturbances.	Community Action	Lead: PLWA, Support: PLWMP, NGO, GOA	Medium to Long Term	Sector Participation

CLEAN RUNOFF

OBJECTIVE 3 Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake.

The movement of water across the watershed carries nutrients to the lake.

- Suspended sediment with attached phosphorus is also entering waterbodies within the watershed and Pigeon Lake itself.
- Suspended sediment negatively impacts the health of waterbodies by: transporting nutrients to the lake, burying important spawning grounds and impeding the flow of water.
- Low-Impact Development Practices are promoted in the Alberta Clean-Runoff Action Guide for individual lot owners and municipalities.
- Drainage management needs to have phosphorus as the target water quality criteria for the Pigeon Lake basin.

CLEAN RUNOFF OBJECTIVE 3: Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake				
RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
3a **Roads:** Eliminate salt and pesticide applications for all road allowances within 800 metres of the lake.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	100% Participation
3b **Statutory Plans & Land Use Bylaws: New Subdivision Stormwater:** Require all new developments to: • provide a storm water quality management plan that is net neutral or better in phosphorus release rates and incorporates low impact development drainage practices. • Regulating post development storm drainage flow to no net increase in amount or rate of water flow offsite. • When applicable, requiring developers to submit and follow Stormwater Site Implementation Plans (SSIPs) that comply with a Master Drainage Guidelines for the Watershed.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	100% Participation
3c **Statutory Plans & Land Use Bylaws: Sediment and Erosion Control:** all new developments and redevelopment to institute a construction erosion and sediment control plan.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	100% Participation
3d **Beaver Management:** Manage beaver populations and natural structures in tributaries to promote nutrient trapping while adequately protecting infrastructure and property.	Policy	Lead: PLWA Support: PLWMP, Mun, GOA	Ongoing	100% Participation
3e **Clean Runoff:** Promote clean runoff practices on private and public properties as per the Alberta Clean Runoff Action Guide.	Community Action	Lead: PLWA. Support: Mun, NGO, GoA	Ongoing	Increased Participation
3f **Water Quality Guideline:** Develop a drainage water quality guide with quality and release rates guidelines for new major developments and proposed retrofits for existing drainage systems. Phosphorus is to be recognized as the water quality parameter of greatest concern for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Mun	Medium Term	Task Completion

GROUNDWATER QUALITY

OBJECTIVE 4 Protect Groundwater that feeds into Pigeon Lake.

- Phosphorus from wastewater is identified in the phosphorus budget as contributing 0.9% of the total phosphorus budget and as a potential source to be managed. Phosphorus from wastewater may be accompanied with fecal coliforms.
- Local municipalities have policies to regulate and minimize potential contamination from private waste water disposal systems. Where private systems still exist near the lake, most are provincially approved pump-out tanks and a small percentage are septic fields.
- Septic fields are a source of nutrient release into groundwater and the nearby lake.
- The Northeast portion of the lake is served with a communal wastewater sewer system (gravity collection system and lagoon). Currently under development is a trunk collection line for the south shore.

GROUNDWATER QUALITY
OBJECTIVE 4: Protect groundwater that feeds into Pigeon Lake.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
4a	**Statutory Plans & Land Use Bylaws: Groundwater Conservation:** Incorporate water conservation guidance tools into municipal statutory plans and development requirements.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Medium Term	Task Completion
4b	**Statutory Plans & Land Use Bylaws:** Groundwater Impact Assessments: Require new major developments in the watershed to demonstrate no negative impacts on existing groundwater users or the lake water supply.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Medium Term	Task Completion
4c	**Wastewater Collection:** Support the extension of a regional waste water system to lakeside communities including the two Pigeon Lake Provincial Park campsites.	Policy	Lead: Mun. Support: APLM, PLWA, Local Auth., GOA	Medium Term	Completion of system
4d	**Septic Fields:** Eliminate septic fields for residential lots within the Lakeside Environmental Area	Policy	Lead: Mun. Support: APLM, PLWA, Local Auth., GOA	Medium Term	Elimination of remaining fields
4e	**Wastewater System Inspections:** Promote regular inspections of both private and communal wastewater systems for integrity and leakage. Systems that fail are to be reported and repaired.	Policy	Lead: Mun, Local Auth. Support: APLM, PLWA,	Ongoing	100% Participation
4f	**Water Wells:** Encourage home owners to adopt water conservation and well maintenance practices (e.g. GoA Working Well program). Encourage organizations and municipalities provide information and to host workshops etc.	Community Action	Lead: PLWA Support: Mun, NGO, GOA	Ongoing	Consistent Program
4g	**Industrial Groundwater Extraction:** Monitor permit applications and Intervene where warranted on behalf of the watershed to maintain groundwater flows to the lake.	Community Action	Lead: PLWA Support: Mun, NGO,	Ongoing	Effective Monitoring

THE SHORELINE

KEY FINDINGS

Natural lands such as wetlands and forested lands next to streams and the lake itself should be targeted for restoration. Land use activities should also be restricted in these areas.

Ongoing monitoring is necessary to prevent the infestation of aquatic and riparian invasive species.

OBJECTIVES

Improve the health and resilience of the shoreline and near-shore areas

Healthy shorelines (or riparian areas) are critically important for the health and protection of aquatic ecosystems. Thus, these areas should be targeted for protection and restoration efforts.

Riparian Beneficial Management Practices (BMPs) involve actions that can be taken by land owners and users within the Pigeon Lake watershed to improve the water quality of the lake and streams. These may include:

- Avoiding the removal of riparian vegetation such as mowing, trimming, or land clearing, if possible. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.
- Educating watershed property owners and lake visitors about the importance of near-shore vegetation. The current perception of many is that most aquatic plants are all “weeds” and, as such, are a nuisance to lake users. However, educating the public of the ecological value of aquatic vegetation is hugely important to maintenance and improvement of these areas.
- Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
- Developing and encouraging the use of community-based lake access and beaches instead of individual ones. Concentrating the traffic in a few spots around the lake will help to reduce shoreline degradation and destruction.
- Ensuring adequate naturalized setbacks for upland activities such as residential development, cropping, or livestock grazing. This may include leaving a natural vegetation buffer around waterbodies, reducing grazing intensity and access within riparian areas, and planting additional riparian vegetation.
- Eliminating the use of fertilizers and herbicides along the lakeshore.
- Limiting the use of lakeside road salts to reduce lake salinity.

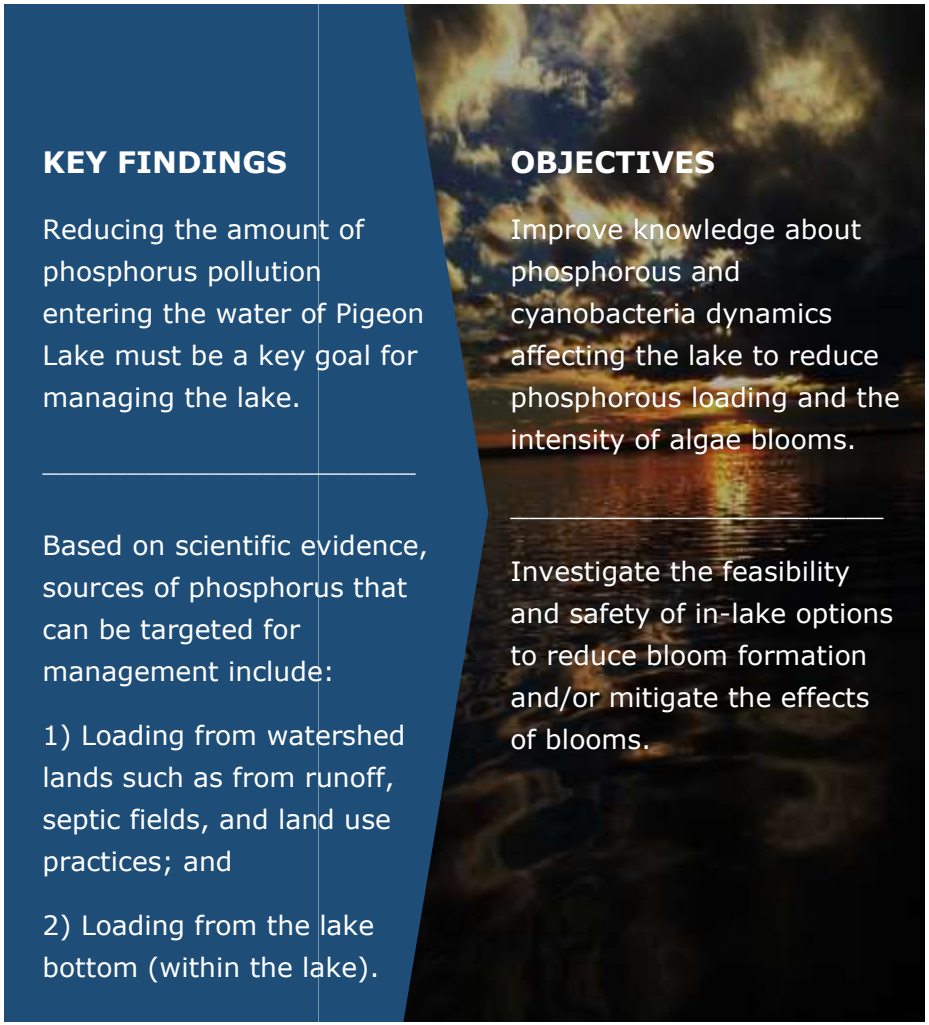
SHORELINES

OBJECTIVE 5: Improve the health and resilience of the shoreline and near-shore areas

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
5a	**Statutory Plans & Land Use Bylaws: Shoreline and Tributary Setbacks:** • For Sensitive shore lands: implement restrictive land use designations that preserve natural buffers. • For new subdivisions: implement development setbacks from the surveyed shoreline of the Lake for new development, based on riparian setback guidelines with a minimum of 30 m, including restrictions for tree and vegetation clearing. At time of subdivision, where existing development would not make the provision of an environmental reserve inappropriate, require the provision of a 30-metre-wide environmental reserve adjacent to the shoreline of the lake. • For existing lot redevelopment: establish minimum building setbacks as per guidelines set out in the Model Land Use Bylaw.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Short Term	Task Completed 100% municipal participation
5b	**Statutory Plans & Land Use Bylaws:** Shoreline Modification: Require bylaw provisions consistently across the watershed that any shoreline modification requires a development permit for lands **above and** abutting the legal bank. Municipal policies need to ensure that above legal bank modification approvals are conditional to a Provincial permit being in place for related modifications to the shore below the legal bank. Except for reasonable access shore lines are to be kept in a natural state. Modifications include regrading, natural vegetation clearing, drainage modifications.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA	Ongoing	No shoreline modifications without approvals
5c	**Restoration of Aquatic Vegetation:** Retain and re-establish cattail and reed beds to support fish habitat, provide erosion protection and filter nutrients.	Policy	Lead: GoA Support: Mun PLWA	Ongoing	Increased compliance
5d	**Lake Shoreline Property Management Guidelines:** Develop a checklist and reference guide to assist development officers and lot owners in addressing the special development requirements for shore line lots. (e.g. On the Living Edge Update).	Community Action	Lead: PLWMP Support: PLWA, APLM, PLWMP, Mun.	Short Term	Task Completion
5e	**Shoreline Practices and Restoration:** Provide guidance documents, incentive programs, technical information, and support to shoreline landowners to implement healthy shoreline practices, shoreline restoration, and lake-friendly landscaping.	Community Action	Lead: PLWA Support: Mun, NGO, GOA	Short Term	50% Participation
5f	**Algal Biomass:** Provide guidance and support for landowners on addressing algal biomass accumulation along shorelines.	Community Action	Lead: Mun / PLWMP, Support: PLWA, GoA	Ongoing	Consistent information
5g	**Noxious Weeds:** Continue invasive species eradication programs, including education, monitoring, and eradiation of prohibited noxious weeds.	Community Action	Lead: MUN, PLWA, Support: NGO	Ongoing	Outbreaks under control
5h	**Shoreline Health Assessment:** update the Pigeon Lake shoreline and tributary shoreline health (riparian) assessment.	Technical & Scientific	Lead: PLWMP Support: PLWA GOA	Short Term	Task Completion
5i	**Mapping:** Undertake a comprehensive inventory of critical fish and wildlife habitat (such as Sensitive Habitat Inventory Mapping).	Technical & Scientific	Lead: PLWMP Support: PLWA	Medium Term	Task Completion

THE LAKE

High nutrient levels contribute to the growth of blue-green algae. Blue-green algae advisories have been applied to the lake since 2010, which is when the Alberta Health Services (AHS) monitoring program was implemented. Recent algae blooms have impacted the use and enjoyment of the lake by residents and visitors and affected recreational property values within the watershed.



Since blue-green algae can be affected by many climatic and other environmental factors, information gaps about the causal factors for blooms and the behavior of blue-green algae need to be filled.

Pigeon Lake Technical Committees have reviewed several methods that have been implemented in other jurisdictions to address excess lake nutrient levels and harmful algal blooms. Treatment options under consideration include:

PIGEON LAKE & IN-LAKE MANAGEMENT

- Removal of algae:
  - Manipulation of the lake food web to control Blue Green Algae
  - Harvesting algae from the water surface and shorelines and exporting the biomass out of the watershed
- Removal of nutrients:
  - Chemical inactivation of P in the water column via addition of aluminum, calcium, iron and/or lanthanum-enriched bentonite clay (e.g., Phoslock®)

These approaches are currently being reviewed to determine their viability to treat the current water quality problems; however, the circumstances supporting their efficacy at one lake may not be true when applied to another. Review of these strategies requires lake-specific research, environmental and socio-economic risk assessments (including evaluation of potential risks to the lake, financial costs, and overall efficacy), formal stakeholder consultation, and

regulatory approval prior to implementation. Before moving forward with any in-lake treatment, professionally prepared feasibility studies with costs, risks, and benefits are needed and should be made available to the public. Any in-lake engineered treatment will require Provincial Government regulatory approval and should not be undertaken without public consultation and the implementation of a program for on-going scientific monitoring.

The following table provides recommendations and actions for achieving the identified Pigeon Lake and In-Lake Management objectives.

PIGEON LAKE & IN-LAKE MANAGEMENT

OBJECTIVE 6: Improve knowledge about phosphorus and cyanobacteria dynamics affecting the lake to reduce phosphorus loading and the intensity of algae blooms.

OBJECTIVE 7: Investigate the feasibility and safety of in-lake options to reduce bloom formation and/or mitigate the effects of blooms and also to build local defences against harmful invasive species.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
6a	**Advancement of Science:** Identify knowledge gaps relating to the formation of cyanobacteria blooms and techniques for meaningful reductions. Prioritize specific investigations and research projects. Source funds and implement ongoing research for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Technical Specialists, PLWA, GoA	Ongoing	Coordinated Published program.
7a	**Invasive Species:** Complement the Government of Alberta's province-wide efforts with local initiatives to improve education and build local defenses to keep out aquatic invasive species. Measures include monitoring, public education, signage, and other initiatives	Community Action	Lead: PLWA Support: APLM, Mun, Technical Specialists, PLWMP, GoA	Ongoing	Effective local program
7b	**In-Lake Management:** Evaluate potential management options including project description, costs and financing; effectiveness in reducing phosphorus and algal blooms; reapplication frequency; environmental, social, and economic risks; and regulatory concerns. Implement where feasible.	Technical & Scientific	Lead: Mun, APLM Support. Technical Specialists	Ongoing	Coordinated published program.

WORKING TOGETHER

OBJECTIVE 8 Improve regional collaboration, partnerships and organizational effectiveness to promote collective action for a healthy watershed, healthy lake and healthy community.

- People and different jurisdictions have different and sometimes conflicting perspectives on the nature and scale of Pigeon Lake's problem, the likely effectiveness of proposed solutions,
- The Plan provides an opportunity to coordinate implementation, and assess the organizational assets to implement the plan and its policies

WORKING TOGETHER

OBJECTIVE 8: Improve regional collaboration, partnerships and organizational effectiveness to promote collective action for a healthy watershed, healthy lake and healthy community.

	RECOMMENDATIONS	Type	Roles	Time Frame	Success Measure
8a	**Statutory Regional Plans:** Work toward a watershed-wide Intermunicipal Development Plan (IDP), Regional Collaboration Framework and a sub-regional plan under the North Saskatchewan Regional Plan that all align with the Pigeon Lake Watershed Management Plan. Measures of the Pigeon Lake Watershed Plan 2000 not addressed in the 2018 version will remain in effect until addressed in statutory Plan updates.	Policy	Lead: Mun. Support: APLM, PLWMP, PLWA, GoA	Short Term	Task Completion
8b	**Municipal Development Plans:** Work toward consistent municipal development plans for all Summer Villages, that incorporate the environmental protection policies of the Watershed Management Plan and the Model Land Use Bylaw	Policy	Lead: SV. Support: APLM, PLWMP, PLWA, GoA, TS	Short Term	Task Completion
8c	**First Nations:** Engage the First Nations of IR 138A Pigeon Lake Reserve in the Watershed Management Plan.	Policy	Lead: PLWMP/ First Nations Support: APLM, PLWA, GoA	Short Term, Ongoing	Ongoing
8d	**Watershed Management Plan Updates:** Revisit and update the Watershed Management Plan every five years and rewrite the Plan every ten years to accommodate the changing condition of the lake, success of current recommendations, new scientific knowledge, new legislation, and new stakeholder and organizational assets and interests.	Policy	Lead: PLWMP Support: APLM, PLWA, GoA	Medium to Long Term	Task Completion
8e	**Assess Organizational Assets:** Investigate organizational options to increase effectiveness, staff resources, financing, risk management, and accountability in undertaking watershed and lake management tasks, including coordination of scientific inquiry, action by municipalities, and community action.	Policy	Lead: PLWMP Support: APLM. PLWA, GoA	Short to Medium Term	Task Completion
8f	**Incentives to Promote Voluntary Action:** Develop non-monetary and monetary incentive programs to promote voluntary action for individuals, municipalities and organizations	Community Action	Lead: PLWA Support: PLWMP, APLM, GoA, NGO	Ongoing	Program of Incentives
8g	**Communication and Engagement Plan:** Establish a communications and engagement plans for disseminating and reporting Plan progress to and amongst stakeholders.	Community Action	Lead: PLWA Support: PLWMP, APLM, PLWA, GoA	Short Term, Ongoing	Consistent Program
8h	**Monitoring Plan:** Develop an monitoring plan for environmental trends including lake and tributary water quality and for plan performance including fulfillment of success measures.	Technical & Scientific	Lead: PLWMP Support: PLWA APLM GoA	Medium Term, Ongoing	Effective Monitoring Program
8i	**Phosphorous Budget:** Continue to update and refine the phosphorus budget.	Technical & Scientific	Lead: GoA Support: PLWA APLM	Medium Term	Task Completion

PUTTING THE PLAN INTO MOTION

The following provides a summary of the Plan is to be put into action.

POLICY

Policy and statutory plans are how governments can collaborate to improve the health of the lake and watershed. Recently enacted changes in the Municipal Government Act (MGA) provide a significant opportunity to harmonize regional plans and land use policies. The MGA now requires that all Summer Villages prepare a Municipal Development Plan. Watershed Management Plan objectives and policy recommendations have an opportunity to become common to all Summer Villages. Similarly, all adjacent municipalities will be required to have an Intermunicipal Development Plan (IDP) and an Intermunicipal Collaboration Framework (ICF). Common provisions and policies that reference the Plan in new MDP's, IDP's or ICF's for all municipalities bordering Pigeon Lake should provide common senior land use policy for the watershed including a Lakeshore Environmental Area Planning Zone. Land Use Bylaws are being updated by each municipality and this Plan and Model Land Use Bylaw provide guidance to improve their environmental provisions.

The Province may recognize this Plan under the North Saskatchewan Regional Plan. This status will promote coordination between provincial departments on key objectives and promote municipal policy adoption as statutory plans are being updated

Addressing the resources and effective organizational structures monitoring progress, updating the plan and developing detailed guidelines is an ongoing role of the Plan Steering Committee, which is a joint initiative of the Pigeon Lake Watershed Association and the Alliance of Pigeon Lake Municipalities.

COMMUNITY ACTION

The volunteer actions of individual property owners, business, recreation, farm and oil & gas operators are very important. Organizations such the Pigeon Lake Watershed Association, Municipalities and agriculture extension and industry associations play a key role in promoting beneficial practices and providing information, education and support. The Plan asks all individuals and organizations to:

- Seek out information and beneficial practices relevant to their situation.
- Assess their own properties and operations
- Make beneficial changes incrementally.
- Encourage others and councils to make appropriate changes.
- Support volunteer watershed groups such as the PLWA

TECHNICAL / SCIENCE

Moving forward will require the engagement of experts to provide guidance in a variety of areas including:

- Planning and Land Use Controls including statutory planning, drainage/water quality guidelines.
- Research Ongoing basic and applied lake water quality research and monitoring to address information gaps to help make better management decisions
- In-lake management options feasibility and actions
- Mapping and Plan Monitoring

CONCLUSION

The Pigeon Lake Watershed Management Plan provides a comprehensive, science-based strategy to coordinate action for the protection and improvement of Pigeon Lake, its shore lands, and its watershed.

The roadmap provided by the Plan will enable improved coordinated action of all parties concerned about the health the Pigeon Lake and its watershed. The Plan enables all of us to be "Working together for a healthy watershed, healthy lake, and healthy community".

NOTES

PIGEON LAKE

watershed management plan 2018

appendices

Pigeon Lake Watershed Management Plan Steering Committee
Issued Aug 24, 2018

Working Together for a Healthy Watershed, Healthy Lake, and Healthy Community

TECHNICAL SUPPORT

(RECOMMENDED CITATION)

Pigeon Lake Watershed Management Plan Steering Committee (plwmp.ca). August 2018.
The Pigeon Lake Watershed Management Plan 2018 – Appendices.
Pigeon Lake Watershed Association (plwa.ca) and Alliance of Pigeon Lake Municipalities (aplm.org)

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Pigeon Lake Watershed Management Plan Steering Committee

Members *(alphabetical order)*

Tim Belec	President, Lakedell Agricultural Society
Doris Bell**	Former Deputy Mayor, SV of Crystal Springs
Glenn Belozer	Councillor, Leduc County, APLM Rep
Wiebe Buruma	Alberta Agriculture & Rural Development
Don Davidson (Deputy Chair)**	Mayor, SV of Grandview, APLM Rep
Susan Ellis**	Executive Director, PLWA
Robert (Bob) Gibbs, (Chair)**	PLWA Director, WMP Committee Chair
Ruth Harrison	Former PLWA Board, AFGA, NSWA
Tom Karpa	Pigeon Lake Regional Chamber of Commerce
Ron LaJeunesse**	Deputy Mayor, SV of Crystal Springs
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Kim Barkwell	County Sustainable Ag Program Manager
Hugh Read	Editorial Assistance, Westbridge Communication Inc. & Grandview Beach Councillor
Chris Teichreb	Limnologist Albert Energy Regulator, (Former AEP)
Greg Nelson	Watershed Planner, AEP
Claire Klassen	Limnologist, Alberta Environment and Parks
Richard Casey	Limnologist, Alberta Environment and Parks
Terry Chamulak	Hydrologist, Alberta Environment and Parks
Cristina Buendia-Fores	Limnologist, Alberta Environment and Parks
Tom Habib	Research Coordinator, Alberta Biomonitoring Institute

APPENDIX A: IMPLEMENTATION PRIORITES

PLWMP 2018 Implementation Priorities

Updated 2018 - 0

Implementation priorities from the Pigeon Lake Watershed Management Plan-2018 found in the attached table. Notes regarding the use and interpretation of the tables are as follows:

1) PRESENTATION ORDER: The forty-six recommendations of the PLWMP 2018 are presented below sorted first by lead agency and second by time frame. This presentation of the recommendations sorted in this order is intended to facilitate the annual review of action priorities by each "Lead Agency" (see Roles column).
2) OBJECTIVE: Coloured Boxes in the first column visually relate to the eight objectives described in the main body of the Plan document and are repeated below.
3) TYPE: Three types of actions or recommendation are identified in the main body of the report and described on page 17. They include Policy, Community Action and Technical/Scientific.
4) ROLES: Roles are allocated into two types: Lead and Support. Being a "Lead" means that this agency or group is best suited to track and organize resources to make progress on the recommendation. Achieving outcomes with Lead organization internal resources is not necessarily expected or required. A Lead agency needs to work with organizations or resources can accomplish the identified outcomes. Descriptors for lead roles are as follows:

Roles:	Roles:	Roles:
Mun= Municipalities	PLWMP= Steering Committee	TS= Technical Specialist/ Researcher
SV= Summer Villages	LA= Local Authorities	FN= First Nation
APLM= Municipal Alliance	GoA= Government of Alberta	O= Operators (farm, golf course, etc.)
PLWA= Watershed Assoc.	NGO= Non-Governmental Organization	LA= Local Authorities

Note: Mun: the authority remains with each Municipality to separately act on a given recommendation. APLM (Alliance of Pigeon Lake Municipalities) provides a forum for municipalities to discuss practices and may recommend consideration by member councils, but final authority remains with the member councils

5) Time Frame: refers to time for substantial completion of recommendation. Lead time is often needed for movement on a given recommendation. Early actions are identified under Annual Priorities
6) Success Measure: Measures have been chosen based on the ability to measure outcomes.
7) Annual Priorities- 2018: An annual review of past progress and annual priorities would be conducted by The PLWMP Steering Committee.
8) LIVING PLAN & ANNUAL REVIEW: Lead agencies are requested to annually review recommendations under their purview, to determine and reassess priorities and report to the PLWMP Steering Committee.
9) PLWMP Steering Committee: this multi-stakeholder committee is the overall steward and coordinator of the PLWMP 2018. The Steering Committee needs to monitor progress and make course corrections as warranted, including reallocation of tasks and redefining time frames and success measures.

PLWMP 2018 OBJECTIVES

LAND COVER & BIODIVERSITY
OBJECTIVE 1: Increase land cover types (e.g. forest, wetlands) that have lower nutrient release rates, trap nutrients, and that promote biodiversity

LAND USE & PHOSPHORUS MANAGEMENT
OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

CLEAN RUNOFF
OBJECTIVE 3: Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake

GROUNDWATER QUALITY
OBJECTIVE 4: Protect groundwater that feeds into Pigeon Lake.

SHORELINES
OBJECTIVE 5: Improve the health and resilience of the shoreline and near-shore areas

PIGEON LAKE & IN-LAKE MANAGEMENT
OBJECTIVE 6: Improve knowledge about phosphorus and cyanobacteria dynamics affecting the lake to reduce phosphorus loading and the intensity of algae blooms.

OBJECTIVE 7: Investigate the feasibility and safety of in-lake options to reduce bloom formation and/or mitigate the effects of blooms and also to build local defences against harmful invasive species.

WORKING TOGETHER
OBJECTIVE 8: Improve regional collaboration, partnerships and organizational effectiveness to promote collective action for a healthy watershed, healthy lake and healthy community.

PLWMP 2018 Implementation Priorities

Arranged by: Recommendation Code

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-1 Land Cover & Biodiversity	1a	Land Conservation: Conserve watershed priority areas with protective designations, including: the Provincial Park, private land conservation purchases, conservation easements, environmental reserves, and land use districts.	Policy	Lead: PLWMP Support: NGO, GoA, Mun, PLWA	00 Ongoing	Additional 10% over entire watershed

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-1 Land Cover & Biodiversity	1b	Statutory Plans & Land Use Bylaws: Retain Natural Vegetation: Develop guidelines and implement policies and regulations within statutory planning documents and municipal land use bylaws to retain natural areas and wildlife corridor (e.g. 80% tree cover for 20-acre lots) within new subdivisions; and for the requirement for development permits for tree and natural vegetation removal on residential lots.	Policy	Lead: Mun Support: APLM, PLWMP	01 Short Term	100% municipal participation
OB-1 Land Cover & Biodiversity	1c	Statutory Plans & Land Use Bylaws: Wetlands: Implement policies and regulations in municipal planning documents to retain all wetlands and peatlands as nutrient traps. Implementation tools may include: · Requiring the delineation and classification of wetlands as a component of statutory plan development, subdivision or development permit applications. · Implementing development setbacks from wetlands and peatlands based on their classification	Policy	Lead: Mun Support: APLM, PLWMP	01 Short Term	100% municipal participation
OB-1 Land Cover & Biodiversity	1d	Restoration: Implement programs to encourage the restoration of natural vegetation on lands throughout the watershed including reforestation and restoration of wetlands using incentives such as the Alternative Land Use Services Program (alus.ca)	Community Action	Lead: PLWMP Support: Operators, Mun, GoA, PLWA, NGO	00 Ongoing	One project per year
OB-1 Land Cover & Biodiversity	1e	Mapping: map watershed priority areas such as wetlands, wildlife habitat, environmentally significant areas	Technical & Scientific	Lead: PLWMP Support: Mun, GoA, PLWMP	02 Medium Term	Task Completed
OB-2 Land Use & Phosphorous	2a-i	Statutory Plans & Land Use Bylaws: Lakeshore Environmental Area: Adopt an 800 metre "Lakeside Environmental Area" as per the Model Land Use Bylaw, that gives priority to land uses, policies, and environmental provisions designed to protect the lake from nutrient runoff. Policy provisions to include: · Requiring construction management plans with new development permit applications. · Restricting land uses within riparian areas that may increase runoff, increase the potential for contamination of groundwater, and/or impede the effectiveness of important recharge areas. · Restricting land uses within 800 metres of the lake where phosphorus and other nutrients, chemicals, or nutrient-rich sediment may pollute the waters of Pigeon Lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% municipal participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-2 Land Use & Phosphorous	2a-ii	. Requiring a development permit and providing guidelines for the stripping and grading of lands within 800 metres of the bank of Pigeon Lake. Where possible this activity should be discouraged and or sediment controls be implemented during and post construction to eliminate sediment loading of the lake during construction. · Requiring the application of local topsoil and native plants to be included in landscaping plans for new development and redevelopment areas. · Prescribing a maximum site coverage percentage for non-permeable surfaces on new development and re-development sites within 800 metres of Pigeon Lake. · Prescribing site coverage guidelines for natural vegetation cover that is compatible with FireSmart development principals. · Discouraging the compaction of soils during stripping and grading activities that may interfere with natural groundwater recharge and increase surface water runoff. · Prohibiting the excavation or filling in or clearing of all wetlands and stream courses and their associated riparian lands within 800 metres of the legal bank of Pigeon Lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% municipal participation
OB-2 Land Use & Phosphorous	2b	Lawn Fertilizers and Pesticides: Continue to provide education and support for watershed residents to eliminate lawn fertilizers and pesticides on residential properties and to promote alternative practices.	Community Action	Lead: PLWA Support: Mun	05 Largely Completed	Annual Programs,
OB-2Land Use &Phosphorous	2d	Existing Agricultural Operations: Encourage agricultural operators to participate in whole farm reductions in phosphorus runoff using the Alberta Agriculture and Forestry Phosphorus Management Tool and the Environmental Farm Plan Program, and to adopt beneficial management practices that reduce nutrient runoff. Promote agricultural erosion and sediment control practices (e.g. low tillage).	Community Action	Lead: CountiesSupport: PLWA, PLWMP, APLM, GoA	00 Ongoing	Sector Participation
OB-2 Land Use & Phosphorous	2e	New or Expanded Intensive Livestock Operations: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan	Policy	Lead: Mun Support: APLM, GoA, PLWA	00 Ongoing	No Intensive Livestock Operations

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-2 Land Use & Phosphorous	2f	Recreational Operations: Encourage recreational land uses (e.g. golf courses, campgrounds) to adopt beneficial management practices (e.g. Audubon Certification) that reduce nutrient run off and promote biodiversity.	Community Action	Lead: PLWA Support: PLWMP, Mun, NGO, GOA	00 Ongoing	Sector Participation
OB-2 Land Use & Phosphorous	2g	Oil and Gas Operations: Encourage all oil and gas operations to adopt a best management practices on all well sites, batteries, and processing operations to reduce contaminants and phosphorous rich runoff. Encourage future operations to minimize land disturbances.	Community Action	Lead: PLWA Support: PLWMP, NGO, GOA	02 Medium to 03 Long Term	Sector Participation
OB-3 Clean Runoff	3a	Roads: Eliminate salt and pesticide applications for all road allowances within 800 metres of the lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3b	Statutory Plans & Land Use Bylaws: New Subdivision Stormwater: Require all new developments to: · provide a storm water quality management plan that is net neutral or better in phosphorus release rates and incorporates low impact development drainage practices. · Regulating post development storm drainage flow to no net increase in amount or rate of water flow offsite. · When applicable, requiring developers to submit and follow Stormwater Site Implementation Plans (SSIPs) that comply with a Master Drainage Guidelines for the Watershed.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3c	Statutory Plans & Land Use Bylaws: Sediment and Erosion Control: all new developments and redevelopment to institute a construction erosion and sediment control plan.	Policy	Lead: APLM Support: Mun, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3d	Beaver Management: Manage beaver populations and natural structures in tributaries to promote nutrient trapping while adequately protecting infrastructure and property.	Policy	Lead: PLWA Support: PLWMP, Mun, GOA	00 Ongoing	100% Participation
OB-3 Clean Runoff	3e	Clean Runoff: Promote clean runoff practices on private and public properties as per the Alberta Clean Runoff Action Guide.	Community Action	Lead: PLWA Support: Mun, NGO, GoA	00 Ongoing	Increased Participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-3 Clean Runoff	3f	Water Quality Guideline: Develop a drainage water quality guide with quality and release rates guidelines for new major developments and proposed retrofits for existing drainage systems. Phosphorus is to be recognized as the water quality parameter of greatest concern for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Mun	02 Medium Term	Task Completion
OB-4 Ground Water	4a	Statutory Plans & Land Use Bylaws: Groundwater Conservation: Incorporate water conservation guidance tools into municipal statutory plans and development requirements.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	02 Medium Term	Task Completion
OB-4 Ground Water	4b	Statutory Plans & Land Use Bylaws: Groundwater Impact Assessments: Require new major developments in the watershed to demonstrate no negative impacts on existing groundwater users or the lake water supply.	Policy	Lead: MunSupport: APLM, PLWMP, PLWA	02 Medium Term	Task Completion
OB-4 Ground Water	4c	Wastewater Collection: Support the extension of a regional waste water system to lakeside communities including the two Pigeon Lake Provincial Park campsites.	Policy	Lead: Mun Support: APLM, PLWA, Local Authorities, GOA	02 Medium Term	Completion of system
OB-4 Ground Water	4d	Septic Fields: Eliminate septic fields for residential lots within the Lakeside Environmental Area	Policy	Lead: Mun Support: APLM, PLWA, Local Authorities, GOA	02 Medium Term	Elimination of remaining fields
OB-4 Ground Water	4e	Wastewater System Inspections: Promote regular inspections of both private and communal wastewater systems for integrity and leakage. Systems that fail are to be reported and repaired.	Policy	Lead: Mun Support: APLM, Local Authorities	00 Ongoing	100% Participation
OB-4 Ground Water	4f	Water Wells: Encourage home owners to adopt water conservation and well maintenance practices (e.g. GoA Working Well program)	Communit y Action	Lead: PLWA Support: Mun, NGO, GOA	00 Ongoing	Consistent Program
OB-4 Ground Water	4g	Industrial Groundwater Extraction: Monitor permit applications and Intervene where warranted on behalf of the watershed to maintain groundwater flows to the lake.	Communit y Action	Lead: PLWA Support: Mun, NGO,	00 Ongoing	Effective Monitoring

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-5 Shorelines	5a	Statutory Plans & Land Use Bylaws: Shoreline and Tributary Setbacks: · For Sensitive shore lands: implement restrictive land use designations that preserve natural buffers · For new subdivisions: implement development setbacks from the surveyed shoreline of the Lake for new development, based on riparian setback guidelines with a minimum of 30 m, including restrictions for tree and vegetation clearing. At time of subdivision, where existing development would not make the provision of an environmental reserve inappropriate, require the provision of a 30-metre-wide environmental reserve adjacent to the shoreline of the lake. · For existing lot redevelopment: establish a minimum building setback as per guidelines set out in the Model Land Use Bylaw.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	Task Completed 100% municipal participation
OB-5 Shorelines	5b	Statutory Plans & Land Use Bylaws: Shoreline Modification: Require bylaw provisions consistently across the watershed that any shoreline modification requires a development permit for lands above and abutting the legal bank. Municipal policies need to ensure that above legal bank modification approvals are conditional to a Provincial permit being in place for related modifications to the shore below the legal bank. Except for reasonable access shore lines are to be kept in a natural state. Modifications include regrading, natural vegetation clearing, drainage modifications.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	00 Ongoing	No shoreline modifications without approvals
OB-5 Shorelines	5c	Restoration of Aquatic Vegetation: Retain and re-establish cattail and reed beds to support fish habitat, provide erosion protection and filter nutrients.	Policy	Lead: GoA Support: Mun PLWA	00 Ongoing	Increased compliance
OB-5 Shorelines	5d	Lake Shoreline Property Management Guidelines: Develop a checklist and reference guide to assist development officers and lot owners in addressing the special development requirements for shore line lots. (e.g. On the Living Edge Update)	Community Action	Lead: PLWMP Support: PLWA, APLM, Mun	01 Short Term	Task Completion
OB-5 Shorelines	5e	Shoreline Practices and Restoration: Provide guidance documents, incentive programs, technical information, and support to shoreline landowners to implement healthy shoreline practices, shoreline restoration, and lake-friendly landscaping.	Community Action	Lead: PLWA Support: Mun, NGO, GOA	01 Short Term	50% Participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-5Shorelines	5f	Algal Biomass: Provide guidance and support for landowners on addressing algal biomass accumulation along shorelines.	Community Action	Lead: MUN / PLWMP, Support: APLM GoA	00 Ongoing	Consistent information
OB-5 Shorelines	5g	Noxious Weeds: Continue invasive species eradication programs, including education, monitoring, and eradication of prohibited noxious weeds.	Community Action	Lead: MUN + PLWA Support: NGO	00 Ongoing	Outbreaks under control
OB-5 Shorelines	5h	Shoreline Health Assessment: update the Pigeon Lake shoreline and tributary shoreline health (riparian) assessment	Technical & Scientific	Lead: PLWMP Support: PLWA GOA	01 Short Term	Task Completion
OB-5 Shorelines	5i	Mapping: Undertake a comprehensive inventory of critical fish and wildlife habitat (such as Sensitive Habitat Inventory Mapping)	Technical & Scientific	Lead: PLWMP Support: PLWA	02 Medium Term	Task Completion
OB-6 Improve Knowledge	6a	Advancement of Science: Identify knowledge gaps relating to the formation of cyanobacteria blooms and techniques for meaningful reductions. Prioritize specific investigations and research projects. Source funds and implement ongoing research for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Technical Specialists, PLWA, GoA	00 Ongoing	Coordinated Published program.
OB-7 Invasive Species	7a	Invasive Species: Complement the Government of Alberta's province-wide efforts with local initiatives to improve education and build local defenses to keep out aquatic invasive species. Measures include monitoring, public education, signage, and other initiatives	Community Action	Lead: PLWA Support: APLM, Mun, Technical Specialists, PLWMP, GoA	00 Ongoing	Effective local program
OB-7 In-Lake Management	7b	In-Lake Management: Evaluate potential management options including project description, costs and financing; effectiveness in reducing phosphorus and algal blooms; reapplication frequency; environmental, social, and economic risks; and regulatory concerns. Implement where feasible.	Technical & Scientific	Lead: Mun Support: APLM, Technical Specialists	00 Ongoing	Coordinated published program.
OB-8 Working Together	8a	Statutory Regional Plans: Work toward a watershed-wide Intermunicipal Development Plan (IDP), Regional Collaboration Framework and a sub-regional plan under the North Saskatchewan Regional Plan that all align with the Pigeon Lake Watershed Management Plan. Measures of the Pigeon Lake Watershed Plan 2000 not addressed in the 2018 version will remain in effect until addressed in statutory Plan updates.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA, GoA	01 Short Term	Task Completion

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-8 Working Together	8b	Municipal Development Plans: Work toward consistent municipal development plans for all Summer Villages, that incorporate the environmental protection policies of the Watershed Management Plan and the Model Land Use Bylaw	Policy	Lead: Mun/APLM Support: PLWMP, PLWA, GoA, TS	01 Short Term	Task Completion
OB-8 Working Together	8c	First Nations: Engage the First Nations of IR 138A Pigeon Lake Reserve in the Watershed Management Plan.	Policy	Lead: PLWMP/ First Nations Support: APLM, PLWA, GoA	01 Short Term, to Ongoing	Ongoing
OB-8 Working Together	8d	Watershed Management Plan Updates: Revisit and update the Watershed Management Plan every five years and rewrite the Plan every ten years to accommodate the changing condition of the lake, success of current recommendations, new scientific knowledge, new legislation, and new stakeholder and organizational assets and interests.	Policy	Lead: PLWMP Support: APLM, PLWA, GoA	02 Medium to Long Term	Task Completion
OB-8 Working Together	8e	Assess Organizational Assets: Investigate organizational options to increase effectiveness, staff resources, financing, risk management, and accountability in undertaking watershed and lake management tasks, including coordination of scientific inquiry, action by municipalities, and community action.	Policy	Lead: PLWMP Support: APLM. PLWA, GoA	Short to 02 Medium Term	Task Completion
OB-8 Working Together	8f	Incentives to Promote Voluntary Action: Develop non-monetary and monetary incentive programs to promote voluntary action for individuals, municipalities and organizations	Community Action	Lead: PLWA Support: PLWMP, APLM, GoA, NGO	00 Ongoing	Program of Incentives
OB-8WorkingTogether	8g	Communication and Engagement Plan: Establish a communications and engagement plans for disseminating and reporting Plan progress to and amongst stakeholders.	Community Action	Lead: PLWASupport: PLWMP, APLM, PLWA, GoA	01 Short Term, Ongoing	Consistent Program
OB-8 Working Together	8h	Monitoring Plan: Develop a monitoring plan for environmental trends including lake and tributary water quality and for plan performance including fulfillment of success measures.	Technical & Scientific	Lead: PLWMP Support: PLWA APLM GoA	02 Medium Term, Ongoing	Effective Monitoring Program
OB-8 Working Together	8i	Phosphorous Budget: Continue to update and refine the phosphorus budget.	Technical & Scientific	Lead: GoA Support: PLWA PLMMP, APLM	02 Medium Term	Task Completion

APPENDIX B: COMMUNITY ENGAGEMENT

Background

The Pigeon Lake Watershed Association was formed in 2007 in response to a need for organized and science-based actions to be taken by the watershed residents to address ongoing concerns of diminishing water quality. In 2008, a State of the Watershed report was completed. Included was a recommendation for the preparation of a watershed management plan, which inspired the PLWA to begin work on the plan. This initiative took several years to get started, and to achieve support from the PLWA Board, the Pigeon Lake Municipalities and to build the necessary leadership resources.

In 2012 a Steering Committee was formed to undertake the preparation of the Pigeon Lake Watershed Management Plan. This initiative was funded by the PLWA and supported by the Battle River Watershed Alliance (BRWA), Alberta Environment, and various individuals and municipalities from around the lake.

Further support for the preparation of the Plan was obtained when the Alliance of Pigeon Lake Municipalities (APLM) made a commitment to the preparation of the plan and provided members to sit on the Pigeon Lake Watershed Management Plan (PLWMP) Steering Committee.

It was recognized that a multi-pronged watershed, in-lake and united approach was needed to achieve meaningful action. This was later confirmed by a PLWA membership poll (See *Synopsis of Responses on the PLWA Summary Report on the Methods for the Control of Nuisance Blue-Green Algae (Cyanobacteria),* January 2013). The APLM and the PLWA agreed that a cooperative approach was needed to undertake the important tasks identified for this project. This included increased communication between the two organizations and with the watershed residents. It was recognized that the lake needed more leaders to be involved and to work together in a meaningful way. On April 28th, 2012, the first meeting of Pigeon Lake leaders, the "Gathering for the Health of Pigeon Lake", was held with representation by many municipal councillors and members from two of the First Nations bands, including one Chief and an Elder. This meeting provided focus for the planning process. Based on the success of this meeting, it continued on an annual basis as the Annual Leaders Session.

The work on the plan moved forward by expanding the Steering Committee membership to include local organizations and our Healthy-Lake Partners, (i.e. non-governmental organizations such as the Battle River Watershed Association, and the Alberta Lake Management Society.

Recognizing the importance of engagement, the Steering Committee formed an Engagement Sub-Committee to create a PLWMP Engagement Strategy to ensure that engagement would be an integral part of all the PLWMP work.

During the 2013/14 timeframe, a Terms of Reference for the Plan was developed. The work of the PLWMP was defined in the Terms of Reference as a series of topics leading to the creation of Beneficial Management Practices. Topics were to be addressed over a number of years. Each topic was to have its own terms of reference, committee structure and an engagement component to help build consensus around each new topic. Engagement activities leading to the approval of the Terms of Reference included:

- ✓ Public on line survey entitled "Are we on Track?"
- ✓ Creation of a PLWMP website (www.plwmp.ca)
- ✓ Advertised public workshops
- ✓ 2013 Leaders Session and workshop
- ✓ 2013 PLWA AGM presentations
- ✓ Representations to federal and provincial elected officials and Cabinet ministers.

The 2013 Leaders Session supported topic priorities and also highlighted the need for Government of Alberta support and involvement in the Plan.

A new PLWMP website (www.plwmp.ca) was launched to ensure that the initiative would stand alone and be seen as everyone's plan. Other methods of communication for the PLWMP include PLWA emails and survey invitations, updates on municipal websites, joint APLM/PLWA newsletters, print media advertising for events and PLWA displays at local markets. The PLWA continues to fund and resource much of the engagement and communications. The PLWA contact list includes PLWA members plus key municipal, provincial, federal and Muskwacis Cree contacts. Engagement with the Muskwacis Cree run PL Reserve 138A is a priority, including participation in the Annual Leaders Sessions.

In 2013, three PLWMP open houses and presentations were marketed by various media methods and held on different sides of the lake.

In August of 2013, a survey of 618 community members was conducted and a local paper ad invited other watershed residents to participate. The survey "PLWMP – Are We On Track?" received 184 responses on behalf of at least 386 people. Over 95% of the survey respondents were either fully or somewhat supportive of the goal, guiding principles, PLWMP process and need to create a watershed plan for Pigeon Lake. A sense of urgency and concern for the degradation of the water quality and natural habitat permeated many responses. These responses gave a clear endorsement for the direction and focus of the PLWMP being taken by the Steering Committee.

The Steering Committee moved forward on the highest priority topics. Two topics were chosen as a starting point: Soil Management and Cosmetic Fertilizers, and the Model Land Use Bylaw.

A "Cosmetic Fertilizers: What do you think? Survey was conducted". This time, 344 surveys were completed on behalf of at least 745 people. The responses called for an immediate call for action which led to the municipalities writing bylaws prohibiting lawn fertilizers and, in some cases, lawn herbicides. In addition, the Healthy Lake Lawn campaign was born. Reports on the surveys are created and made available to the public via the PLWA websites.

Starting in 2014, the PLWA has hired summer staff to increase our outreach, disseminate information and receive the views of those in the watershed.

In 2015, a three-year Healthy Lake Clean Runoff Project was initiated given responses to a survey that told us: "We will make changes if you; "Tell us what to do", "Tell us how to do it", and "Make it easy". We focused on actions to clean the runoff from the near shore communities. It involved the creation of the Alberta Clean Runoff Action Guide to tell what and how, demonstration sites, a rain barrel campaign, many communications such as local press articles, and bringing resources to events such as native plants and grass seed; and a video to encourage residents to "Be Part of the Solution and to add some of the clean runoff approaches on their lot.

336 responses on behalf of at least 751 people to an end of project survey informed us that people were reading the CR Action Guide; were talking with neighbours about the need to make changes; that at least 350 changes had been made; and that another 375 were planned.

Each year, updates and progress made on the PLWMP is communicated through various means:

- ✓ Newsletters – spring and fall since 2007, and joint APLM/APLM since 2016
- ✓ Summer Students - since 2014
- ✓ Local Notice Boards
- ✓ PLWA AGM Presentations and Open House
- ✓ PLWMP and PLWA websites
- ✓ Annual Pigeon Lake Leaders Session
- ✓ Facebook (Pigeonlakewatershedassociation) since 2014
- ✓ Pigeon Lake Twitter

Pigeon Lake Watershed Management Plan 2017

In 2016, the Steering Committee initiated the writing of a Pigeon Lake watershed management plan for Pigeon Lake that addressed a complete range of topics related to: the watershed, the shore, the lake and working together. Support for this initiative came from the Government of Alberta, the Board of the PLWA and the Alliance of Pigeon Lake Municipalities plus our Healthy Lake Partners. Engagement strategies and techniques for PLWMP 2017 were adapted from earlier work of the Steering Committee.

The PLWMP engagement continued throughout 2017 in stages including:

- **Preparation of the Science Summary and Initial Drafts:** A day-long meeting was held in January of 2017 at the University of Alberta, organized by the PLWMP Chair. Attendees were a mix of researchers from the University of Alberta, Alberta Health, Consultants including Aquality Consultants Ltd., CPP Environmental, Hutcheson Environmental, Alberta Lake Management Society, Government of Alberta and members of Pigeon Lake organizations including PLWMP Steering Committee, the PLWA, and the APLM including their In-Lake Technical Committee. The objective was to identify the state of knowledge for Pigeon Lake, current initiatives, and critical information gaps. This information provided background to the introductory material in each section of the main report and to the technical summary in this appendix.

Leader's Session Draft – April 2017

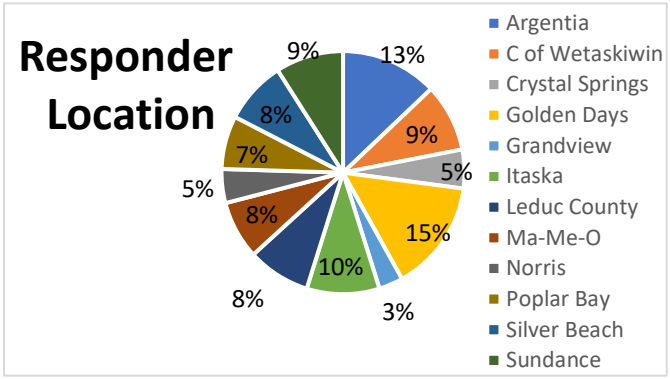
- April 2017, Leader's Session Draft of the Plan: This draft was prepared and issued to the 2017 attendees of the Annual Leader's Session. Forty-eight Pigeon Lake leaders participated including councillors, First Nations, PLWA directors, lake experts and planners. The draft Plan was discussed, and input gathered to improve it. An online survey was completed by 15 participants. This feedback resulted in revisions and updates for the next version.

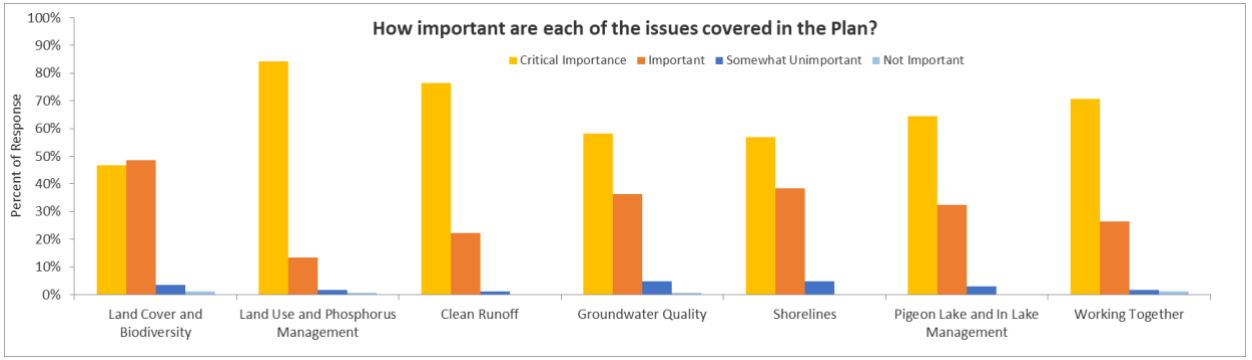
- June 2017, Public Draft of the Plan - Open Houses: the public draft was posted to the PLWMP website and invitations were issued to attend two public workshops and to complete and online survey. Sixty-five people attended the two PLWMP Open Houses. These were advertised in local newspapers, local websites, PLWA emails, Facebook, Twitter and a County of Wetaskiwin 'news flash.'

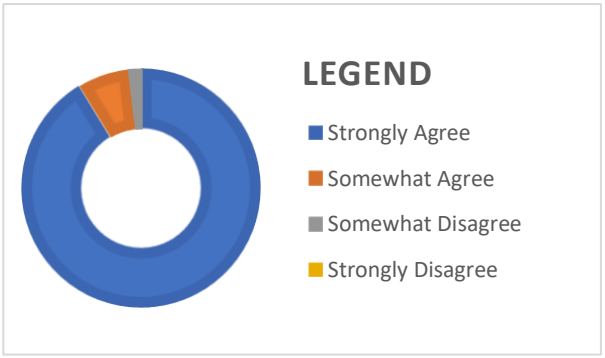
- June- September 2017, Various Events - The PLWA highlighted the Plan at:
    - Summer Village Annual Information Meetings
    - PLWA Annual General Meeting
    - Several Farmer's markets

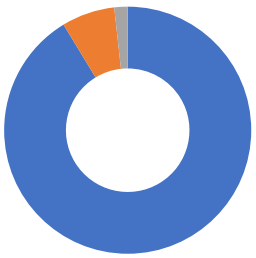
  Panels about the Plan were displayed to encourage discussions and people were asked to read it and complete the on-line survey.

- June 2017, Public Draft of the Plan- On Line Survey: An on-line survey ran over the summer. This was advertised by emails, Facebook posts, and a local paper article (Pipestone Flyer July 12, 2017). A total of 176 people filled in the survey on behalf of at least 397 people of which 95.5% own property around Pigeon Lake. Strong support was indicated for the Plan (see graphs next page)

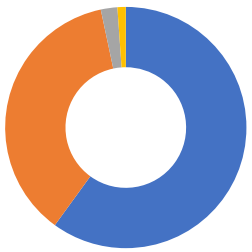




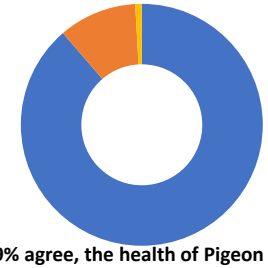




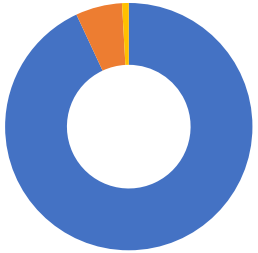
91% Agree with the Plan Vision



95% agree or somwhat agree, The Plan can be implemented.



89% agree, the health of Pigeon Lake requires urgent, decisive, and collective actions across all sectors.



93% agree, Improve the health of the watershed & the lake.

Adoption Draft – September 2017 – June 2018

In September 2017, the Plan was revised based on the public feedback and published to the PLWMP web site as the "adoption draft". A summary of the response to the online public survey was also posted to the site. This version of the Plan was then taken to all municipalities, Healthy Lake Partners and the Maskwacis Cree and the Government of Alberta for statements of adoption, endorsement or support. Organizations were invited to review the document and provide comment and or statements of support. A number of comments and concerns were addressed throughout this process that resulted in changes to the recommendations or text of the final PLWMP document.

- **September 20,** 2017, the Alliance of Pigeon Lake Municipalities voted to endorse the PLWMP.
- **September 09, 2017 –** the PLWA Executive Director gave an update to the Pigeon Lake Regional Chamber of Commerce board. They were asked to consider endorsing the PLWMP. The PLWA is a member of the PLRCC and the PLRCC participates in the annual Leaders Session and sits on the PLWMP Steering Committee.
- **September 29, 2017 –**, PLWMP Chair presented the PLWMP at the Annual Conference of the Alberta Lake Management Society
- **December 4,2017** the Pigeon Lake Watershed Association voted to endorse the PLWMP.
- **September 2017– May 2018 On-going –** The PLWMP Chair and Vice Chair presented the PLWMP to all watershed municipalities and organizations who have sat on the Steering Committee, with the intention of firstly obtaining comments and secondly to obtain resolutions in support of the plan.

Maskwacis Cree and the Pigeon Lake Reserve Engagement. Since the PLWA began, engagement with our First Nation neighbours has been important. In 2017, the PLWMP adoption draft gave further impetus for working together. Examples of past engagement of First Nations include:

- **Annual Leaders Sessions:** All four nations have always been invited, and we usually have a handful attend including Chiefs, Councillors and Elders.
- **PLWA Events:** On occasion First Nations have attended our workshops and Annual General Meetings including a few people from the PL Reserve.
- **POW WOW's:** On occasion the PLWA has attended the local Pow Wow and the 2015 PLWA President was honoured to be invited in the Samson Cree Nation POW WOW and participate in the Grand Entrance

- **PLWA Representations at First Nations Organized Events:** the PLWA has made a handful of presentations to different First Nations groups: A TSAG arranged meeting with Elders and a Technical Committee who were working with Imperial Oil to address the abandoned wells on the reserve.

- **First Nation Representation on the PLWA Board**: Chief Leonard Standing-On-The-Road (Elected Chief of the Montana Nation in 2017) served on the PLWA Board from 2012 through 2015, as the PLWA First Nations Liaison. In 2017, past Erminskin First Nation Councillor, Samuel Minde began to sit on the PLWA Board as the First Nation Liaison. Samuel has worked to form the First Nation working group called: Mamawo Group (Together).

- Muskwacis Cree Mamamo Group (Together).

  In 2017, the PLWA Director and Muskwacis Cree Nations liaison took it upon himself to pull together a group representing all four Nations to see if there was any interest in getting involved with the PLWA and work going on around the lake. At an initial meeting a lot of concern for the lake and how its health impacts people living on the Reserve; the fishery and more was expressed. A series of meetings which also included the GoA, the BRWA, and three PLWA Directors. Four of these people were also members of the PLWMP Committee including the Chair and all were members of the Engagement Sub-committee.

  The outcome of the initial meetings were two documents to be presented to the Maskwacis Cree Council of Chiefs and Councillors for endorsement. One is a Letter of Support for the PLWMP and the second a Terms of Reference for the Mamawo Working Group to:

  - Explore how the PLWMP may be important for the Pigeon Lake Reserve.
  - Build bridges with the PLWMP steering committee and have a voice in the work being done.
  - Provide the Maskwacis Cree Nations and the Pigeon Lake Reserve Residents with opportunities to be informed and to participate in the implementation of the PLWMP.
  - Identify and share the tools and knowledge from this work, for the benefit of the Maskwacis Cree Nations.

APPENDIX C: TECHNICAL SUMMARY

PREFACE

The Technical Summary has been assembled as a foundation to the development of the Pigeon Lake Watershed Management Plan 2017 ("the Plan"). It is intended to update information found in the 2006 State of The Watershed Report and to provide benchmark updates to many of the environmental indicators relevant to Pigeon Lake and its watershed. General watershed planning implications are also identified related to the various topics. These have generally been the background to many of the specific recommendations in the Plan, that were then further refined to address planning policies and tools available.

This summary was prepared by Adam Kraft and Théo Charette from CPP Environmental, with hydrological contributions from Alberta Environment and Parks.

Pigeon Lake is a relatively well-studied lake; several studies have examined the complex interactions between watershed activities and the lake's ecological health. These studies have improved our understanding of Pigeon Lake and have indicated potential natural and human-caused drivers of the nuisance algal blooms (or Harmful Algal Blooms, HABs). The intent of this document is to summarize the current scientific knowledge around the water quality concerns of Pigeon Lake and to highlight where further research or remedial efforts are needed.

The document is organized into three main sections, which outline the state of knowledge at different spatial scales: (i) the Pigeon Lake watershed (Section 1: "Watershed Lands"), (ii) the lake's streams and shorelines (Section 2 "The Shoreline"), and (iii) Pigeon Lake itself (Section 3:"Pigeon Lake").

1 SUMMARY OF THE SCIENCE: WATERSHED LANDS

Nutrient Production and Transport

Surface water flows (overland runoff and streams) make up an estimated 29% of Pigeon Lake's water inputs (Worley Parsons 2010) and transport nearly half of the externally-loaded phosphorus (P, an important nutrient for biological growth) into the waterbody (FIGURE C1). This indicates that both the water quantity and quality of the lake are influenced by the land cover composition of the watershed. The amount of forest and wetland cover is important for aquatic health, yet only 39% of ecological lands remain in the Pigeon Lake watershed. Human activity is extensive, with 61% of the land converted into agricultural or built-up areas (e.g., roads, residential, recreation areas) as of 2013 (FIGURES C2, C3).

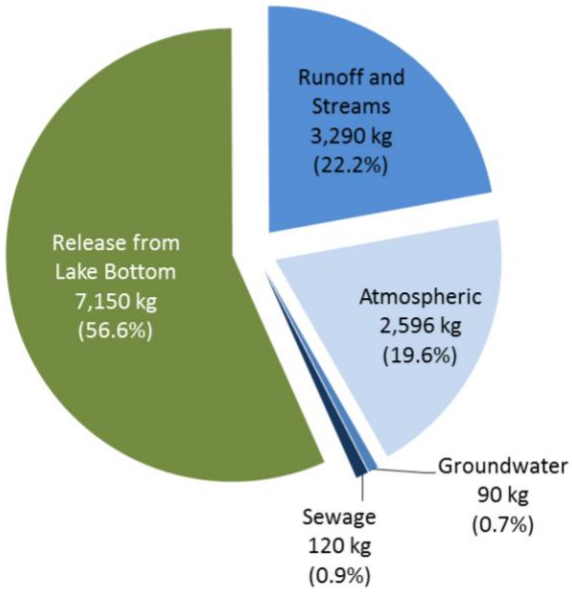


Figure C1: Annual open water season total phosphorus loadings, both bioavailable and particulate forms, into Pigeon Lake in 2013, indicating the relative partitioning between internal and external loadings (Teichreb 2014). Internal loadings refer to the release of P from the lake bottom sediments, whereas external loadings include the runoff from the watershed (i.e., measured flow from streams and creeks that enter the lake and unmeasured diffuse runoff), as well as atmospheric deposition, groundwater inputs and sewage. It is important to note that these results come from one year (2013) of stream sampling data, and thus do not represent average or typical conditions.

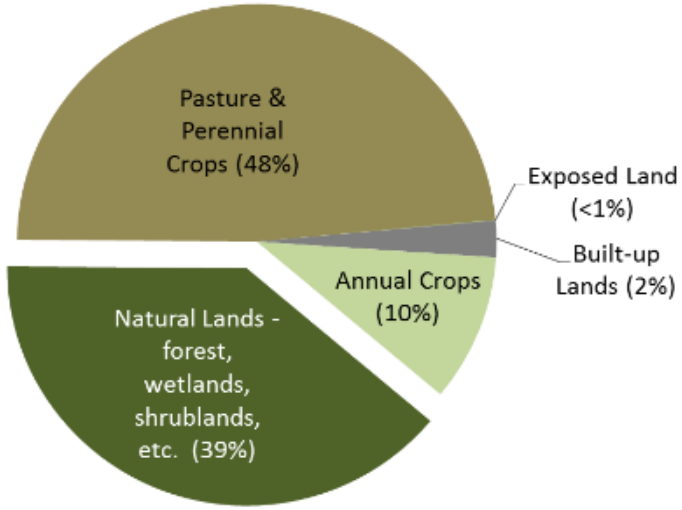


Figure C2: Landscape composition of the Pigeon Lake watershed based on 2013 conditions, showing the relative cover of natural and non-natural land cover types (AAFC 2013).

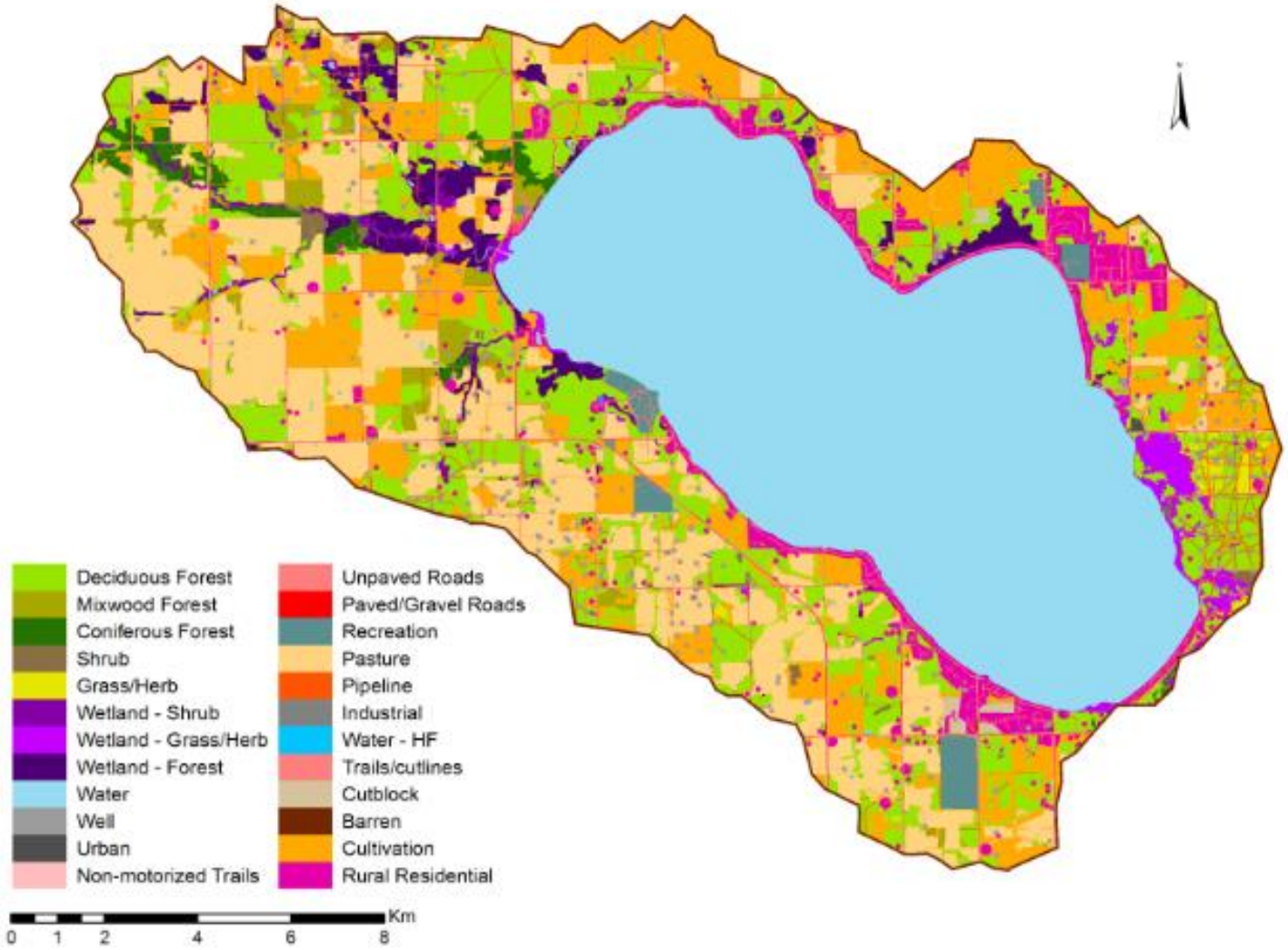


Figure C3: Landscape composition of the Pigeon Lake watershed based on 2012 conditions (Habib 2017).

Runoff from developed areas occurs mainly during spring snowmelt and following rainfall events, and can contain large quantities of nutrients from fertilizers, manure, decayed plant material, and loosened soil particles which will ultimately enter Pigeon Lake. Unlike point source pollution from industrial sites or sewage treatment plants (where the source of pollution is easily identified), sources of pollution resulting from runoff, precipitation or atmospheric deposition are difficult to identify and control due to the multiple sources of pollution and the large transport capacity. These sources of pollution are called non-point (or diffuse) and are mainly influenced by the type of land cover (e.g., agricultural activities, urban areas or natural vegetation cover) and the human activities in the watershed (e.g., pesticides and nutrients from lawns and gardens, land clearing and disruption of the riparian area).

The Pigeon Lake watershed contains considerable rural development and seasonal activity, with extensive cottage and municipal development along the lakeshore and over 100,000 seasonal visitors. While the direct impact of this population on lake water quality is challenging to quantify, a considerable proportion of the external nutrient loading into Pigeon Lake can be attributed to human presence. Human-generated land cover changes and use increase nutrient loading in two main ways:

1. Increasing the nutrient availability in the watershed:
    - Nutrient additions related to lawn fertilizers and agricultural operations.
    - Release of some proportion of sewage and pollutants produced from cottages, campgrounds and day-use areas
2. Facilitating the introduction of nutrients into the lake:
    - Removing natural vegetation and riparian buffers, which act as filters for nutrients and other pollutants
    - Increasing the percentage of hard surfaces, which decreases infiltration, increases the overland flow, and entrains pollutants
    - Land disturbances that release sediment containing phosphorus

Nutrients – notably phosphorus (P) and nitrogen (N) – enter Pigeon Lake directly through seven inflowing streams and many drainage ditches. Nutrient loading rates (annual export quantity; FIGURE C4) varied among streams and with the stream's discharge rate (FIGURE C5). Peaks for P- and N-loading in streams typically occurred in April, decreased through May-June, increased again in July-August (due to storm events) and continued to decline into September-October. 2013 data showed that the streams contributed a relatively small proportion of total external nutrient inputs into Pigeon Lake (collectively, approximately 377 kg/year, or about 11% of total external loadings). However, this information should be used with caution since the 2013 sampling missed a portion of spring runoff as sampling began on April 25th of that year. Generally, comprehensive annual water quality data for the inflowing streams are largely lacking relative to data records for the lake itself.

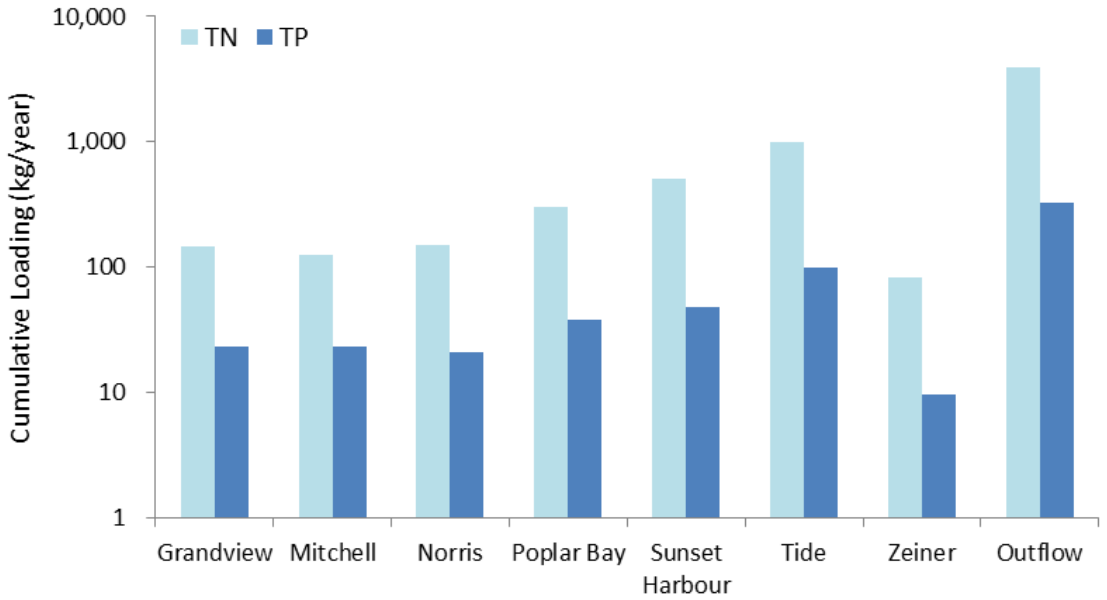


Figure C4: Summary of cumulative annual total nitrogen (TN) and phosphorus (TP) loading from inflowing streams into Pigeon Lake and exports from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

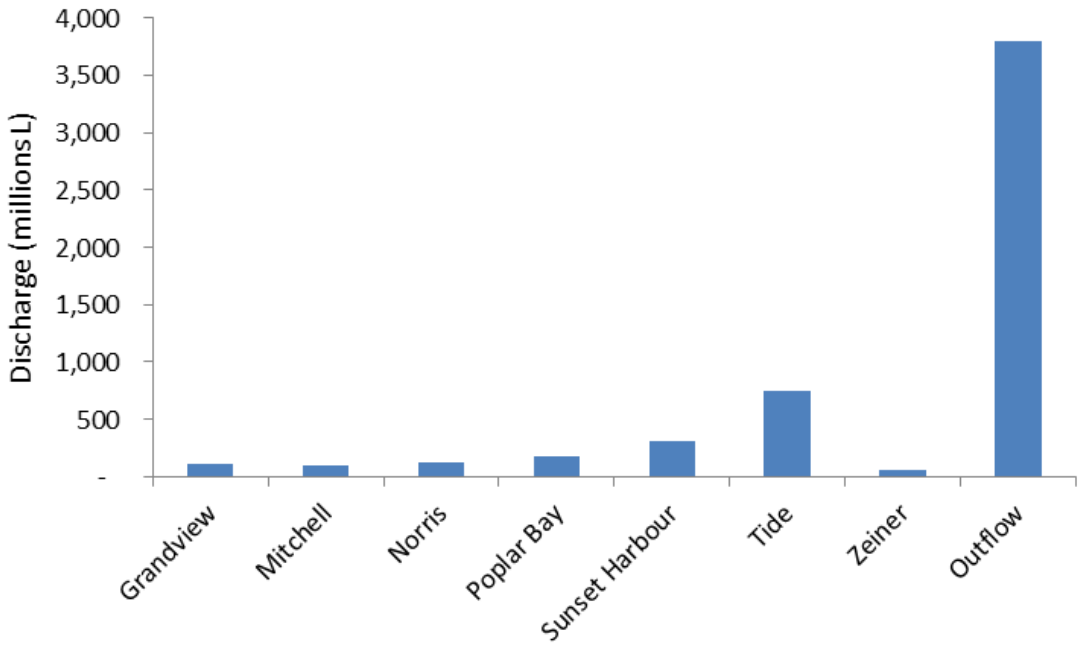


Figure C5: Summary of cumulative annual discharge from inflowing streams into Pigeon Lake and export from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

Land disturbance and development within the watershed contribute to soil erosion and accelerate the rate of nutrient transport to the lake. In particular, the clearing of forests greatly increases the rate of snow melt and thus runoff from the land. Historically, riparian vegetation immediately adjacent to the banks of Pigeon Lake and its inflowing streams are thought to naturally mitigate the rates at which runoff-borne nutrients directly enter the water. Ongoing development has led to the degradation and destruction of these natural buffers, resulting in minimal filtration (i.e. removal of excess nutrients) before they reach the water. Increased land disturbance and the loss of riparian areas increase the rates at which both diffuse and point-source nutrient inputs enter Pigeon Lake. This has other consequences for water quality such as an increase in suspended materials due to increased shoreline erosion.

Phosphorus Forms, Cycle and Sources

In most temperate lakes the nutrient that is in shortest supply, and is therefore limiting to biological productivity, is P. Once P exists in sufficient quantities, growth of phytoplankton can proceed until limited by another factor (e.g., light, nitrogen (N) or wind). Excessive quantities of P can promote problematic overgrowth of cyanobacteria, also known as blue-green algae blooms. Cyanobacteria blooms can sometimes produce dangerous toxins, negatively impacting water quality and causing problems for human and ecological health. While many central Alberta lakes, including Pigeon Lake, are naturally productive, increased human development and land cover changes within watersheds over the past century appear to have increased the rates of P input into waterbodies and accelerated eutrophication rates. Thus, quantifying P inputs into waterbodies is an important first step towards controlling eutrophication to help prevent future water quality issues.

Phosphorus compounds enter the lake in different forms and compositions, depending on their origin. Once in a water body, P undergoes complex chemical and biological reactions which result in it entering the water column. There are two main forms of P: dissolved (soluble) and particulate (as a component of organic and particulate matter). The primary dissolved form of P (orthophosphate, or PO_4^{3-}) is readily available for phytoplankton and plant uptake. In response to varying environmental conditions, particulate P can change from one chemical form to another (a process known as P cycling). For example, microbial decomposition of organic matter can turn organic particulate P into its dissolved form, while in the mineral form, such as clay particles, the process is of a much longer term. Other chemical and physical changes in the water column and the lake sediments can also convert P in soil mineral particles to dissolved P.

FIGURE C6 shows a simplified P cycle in lakes. Phytoplankton and bacteria assimilate dissolved inorganic P and transform P into particulate organic P as it becomes part of their tissues. As plants and animals excrete waste or die, the organic P sinks to the bottom, where bacterial decomposition turns it back to inorganic P. This inorganic P ultimately returns to the water column and becomes again available for uptake. In the sediment, inorganic P will not pass freely into the water column if the sediment-water interface is well oxygenated. In this situation, P is bound to clays and different compounds, such as iron (Fe), calcium (Ca) or aluminium (Al). In some circumstances, increased P release in well oxygenated sediment has been observed at high pH values following resuspension events in the summer when pH increases due to the high photosynthetic activity. However, anoxic (non-oxygenated) sediments release phosphate to the overlying waters at a much faster rate.

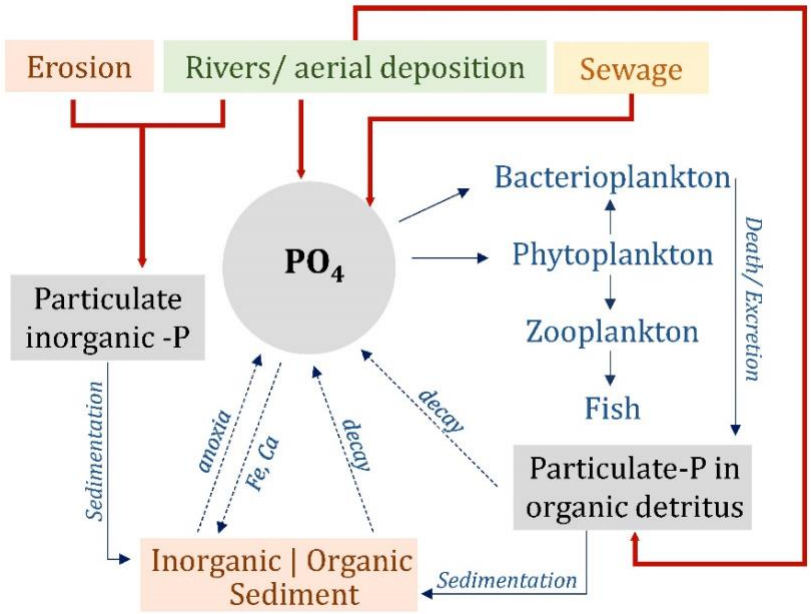


Figure C6: A simplified P cycles in lakes. Red lines = external loading. Dotted blue lines = internal loading. Solid blue lines = internal recycling.

Due to the changes in P forms, the term Total Phosphorus (TP) is used to determine the total amount of P present in the water body, regardless of its chemical identity (dissolved and particulate). However, this term does not inform about the availability of P for plant or phytoplankton uptake – a concept named "bioavailability". The relative proportion of dissolved vs particulate P that enters to a water body will therefore influence algal growth. Particulate forms of P typically enter the lake via wind transport, atmospheric deposition or through erosive processes and subsequent sediment transport. Orthophosphate (i.e., dissolved) forms are generally produced by natural processes. Point sources (e.g. effluents from treatment plants or untreated water), and nonpoint or diffuse sources (e.g. runoff from agricultural sites and application of some lawn fertilizers) largely contribute to the input of dissolved P forms.

In 2014, the Government of Alberta developed a P budget for Pigeon Lake to quantify the total P inputs into and outputs from the lake (Teichreb 2014). The report included external and internal sources (i.e., P from the watershed or atmosphere, and P released from the lake sediments, respectively) and concluded that both contribute to elevated nutrient levels. Relative annual contributions of the total P inputs were estimated to be approximately 43% (5,755 kg/year) from external and 57% (7,510 kg/year) from internal sources (FIGURE C1). Most importantly, this report determined that there is no single problematic external source of P for Pigeon Lake. Of the P that comes from external sources, it was estimated that approximately 48% (2,913 kg/year) comes from diffuse runoff, 43% (2,596 kg/year) comes from dustfall and precipitation, and 9% (587 kg/year) comes from groundwater, point-source inflows and sewage combined (FIGURE C1). Point-source and sewage contribution might seem proportionally small when compared to the contribution of other sources to the total amount of P entering the lake, yet most of the P supplied by these sources correspond to the more readily bioavailable fraction and as such are critically important. Additionally, the specific P contributions from each of these sources may vary among seasons and years according to factors such as wind and precipitation patterns or land use activities (e.g., whether a field is in fallow or being actively tilled and fertilized).

A recent report from the Alberta Biodiversity Monitoring Institute (ABMI; Habib, 2014) expanded upon the initial Pigeon Lake P budget work by using an updated and more-detailed land cover data set (FIGURE C3 and C7), as well as a range of future development scenarios based on the Leduc County's North Pigeon Lake Area Structure Plan (Leduc County 2011) and the County of Wetaskiwin Pigeon Lake Watershed Area Concept Plan (County of Wetaskiwin 2014). This study aimed at evaluating changes in P load into the lake under a variety of development scenarios (new rural and lakeshore development) and land management practices (reforestation and restoration of riparian buffers). However, this model only estimated stream and overland inflows into the lake, and did not consider other external sources (e.g., atmospheric or groundwater inputs) or internal sources (from the lake

sediments). The simulation for the current land scenario indicated that the annual point source and diffuse P loading was 3,707 Kg/year, about 12.6% larger than the input from surface runoff estimated in the original P budget (i.e., 3,290 Kg/y). Despite the differences, both estimates were in the same order of magnitude and discrepancies were likely the result of the inherent model structure and methods for the estimation of complex processes such as nutrient export or retention in a highly developed watershed. Thus, the *relative proportions of P contributions*, rather than the precise loading values, should be considered when determining how to control excess nutrient loading into Pigeon Lake.

Figure C7: Map of watershed-level phosphorus exports into Pigeon Lake, modelled according to current land use intensities. Inflowing and outflowing creeks are indicated (Habib 2017).

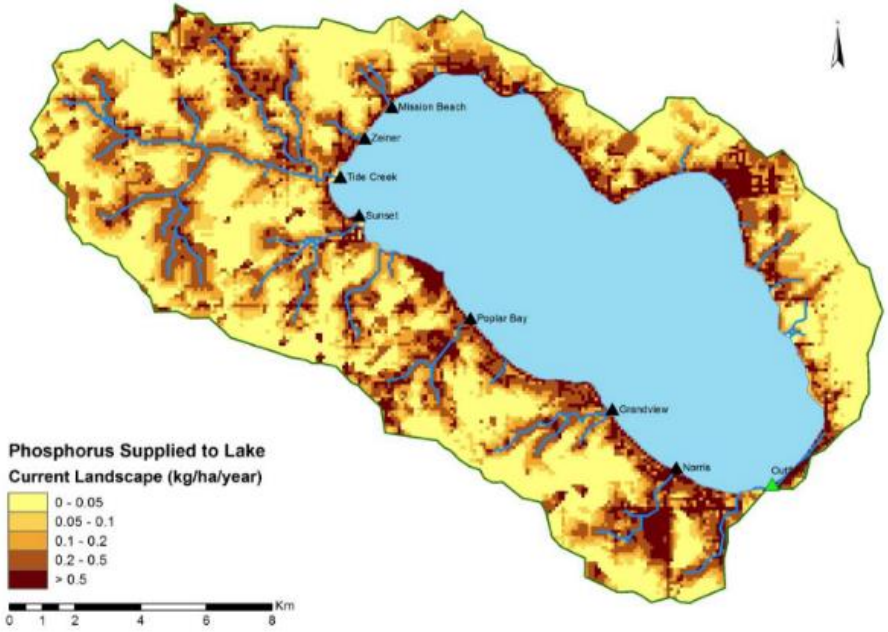
The ABMI simulation also found that relative to the current development conditions (FIGURE C7), the amounts of P that will be exported into Pigeon Lake from the watershed depend on the intensity of future development, though significant reductions were possible in all scenarios if riparian area protection and restoration occurred. Overall, although the ABMI model only accounts for the P input from surface runoff, it provides an effective management tool for evaluating the relative contribution of P from different sources in the watershed as well as for quantifying the efficiency of land management practices.

At the watershed level, P reduction initiatives should focus on reducing diffuse, point-source and sewage inputs of P (FIGURE C1). While diffuse P sources may be the most challenging to effectively reduce and measure success, they represent nearly half of the external P loading into Pigeon Lake and are the largest controllable portion; thus, it is important to explore management options. Sources of atmospheric deposition and groundwater influx of P require further determination; however, implementing beneficial management practices such as conservation tillage practices may help reduce the volatility of cultivated soils to wind erosion, reduce overland transfer of nutrients, and reduction of excess P application to the land may reduce downward migration to groundwater.

Plan Implications

- About 25% of the P inputs into Pigeon Lake come from watershed-level sources making the land cover types and land use activities within the watershed highly influential to the water quality and quantity of the lake. Watershed stewardship and incorporation of Beneficial Management Practices (BMPs; AAFRD 2004) are recommended to decrease both the nutrient concentrations in the inflowing streams and the rates at which overland flow enters the streams.
- The removal of riparian vegetation and watershed tree cover has exacerbated the rates of nutrient export from watershed sources into Pigeon Lake. Modelling has shown that riparian restoration along the lake and stream shores can result in a reduction in external nutrient loading into the water, even when the watershed itself is highly developed. Hence, a riparian and watershed conservation and restoration program should be initiated in the Pigeon Lake watershed, with efforts prioritized in areas of high P loading potential (FIGURE C8).

- Municipalities should adopt riparian setback policies to establish appropriate setbacks from all waterbodies in the watershed to maintain water quality, flood water conveyance and storage, bank stability, and habitat. Tools such as the Riparian Matrix Setback Model (Aquality Environmental Consulting 2010) can be used to manage riparian areas in a local municipality (broad brush approach).
- A significant function of wetlands is their ability to trap and retain nutrients. To increase this function in Pigeon Lake's watershed, wetlands should be conserved and restored. Thus, a list of candidate wetlands for restoration within the watershed should be developed and will streamline watershed improvement efforts under the Alberta Wetland Policy. Also, riparian buffers around wetlands are required to protect function.
- The coverage and ecological condition of natural land cover (e.g., forests and wetlands) should be maintained or improved. Conversion of remaining ecological lands to agricultural, residential, or recreational areas should be limited.
- Diffuse runoff over altered (agricultural, developed, etc.) lands comprises a significant portion of external P loadings into Pigeon Lake. Current practice does not allow for enforcement or rejection of activity based on cumulative impacts decision making. In the context of Pigeon Lake, development decisions should be thoroughly assessed to ensure that there is either a decrease or, at a minimum, no increase in nutrient export relative to current conditions. Municipal governments must ensure their review of impacts is neither too narrow nor too broad. Approvals for any work should also consider the increases to nutrient and sediment loading as a result of alterations in pre-development hydrology and watershed-level land use changes.
- Adoption of clean runoff BMPs by individual land owners and municipalities into their developments and operations will contribute to water quality improvement and increase water use efficiency.
- In agricultural lands, existing BMPs that promote soil health and responsible resource use should be continued and encouraged (e.g., AAFRD 2004). Conservation tillage programs can reduce the erodibility of soils and the subsequent potential for export via runoff. Similarly, precision agriculture approaches can be taken to avoid the export of excess nutrients off the land and into waterways by care



fully controlling the application rate, timing, and placement of inorganic fertilizers or manure. BMPs specific to ranching include reducing the intensity of grazing and trampling near riparian areas and providing water alternatives away from streams.

- In residential areas (i.e. Lakeshore developments, county residential) BMPs and implementation of Low Impact Development (LID) practices in existing and new developments will be very important to reduce P export. Principles and practices for implementing LID practices at Pigeon Lake are detailed in in the Alberta Clean Runoff Action Guide (PLWA and ALIDP 2016). Incorporating low-phosphorus development standards in Land Use Bylaws and statutory plans will be very important to achieve compliance on the part of individual land owners and developers.
- Removal of septic fields, in addition to upgrades to wastewater infrastructure of cottages and public use areas (where antiquated or

ineffective) should be encouraged to improve the water quality of Pigeon Lake. Although sewage inputs to the lake are a relatively small source of P, reducing seepage into the lake will have benefits to water quality since the P forms present in sewage are largely bioavailable for algal and plant uptake (i.e., dissolved forms of P).

- BMPs should include prohibitions on cosmetic fertilizers. A previous initiative to restrict the application of fertilizers and pesticides for cosmetic purposes in the watershed was well-supported by shoreline residents and has been implemented by municipalities throughout the watershed.
- While the dust deposition into Pigeon Lake is very technically difficult to control, atmospheric sources of P represent a significant component of the nutrient inputs to the lake. As such, the source of these inputs, as well as its form and bioavailability, should be better studied to understand where reductions are possible.

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Riparian Health

Riparian areas are biologically rich and productive areas at the edges of lakes, wetlands and streams. Riparian areas are important habitat and provide essential ecosystem functions to protect the lake's health.

In 2002 and 2008, low-altitude videography was used to conduct a riparian health assessment of Pigeon Lake (SRD 2008). The riparian area surveyed included the collective near-shore area consisting of the lake's shallow water zone (littoral) and the strip of public lakeshore, and the immediately adjacent private land that surrounds the lake. Criteria evaluated to assess riparian "health" included proportion of area covered by natural vegetation, presence of cattails (*Typha latifolia*) and bulrushes (*Scirpus* spp. and *Schoenoplectus* spp.), abundance of trees and shrubs, and the amount of human-caused vegetation removal or physical alteration. The shoreline was divided into consecutive sections and these criteria were used to classify each section into one of three impairment categories: healthy, moderately impaired, or highly impaired. The total length of shoreline in each impairment category was calculated and expressed as a percentage of the total shoreline length.

In both sampling years, the majority of Pigeon Lake's shoreline (65%) was classified as being highly impaired. In 2002, 24% of the shoreline was considered to be healthy and the remaining 11% was moderately impaired, while in 2008 (FIGURE C8) there was a slight improvement in shoreline health, with 29% of the shoreline classified as healthy and 6% classified as moderately impaired. This improvement is attributed to land purchases by the Government of Alberta along the northwest shore, though some improvement in riparian health was offset by poorer health scores elsewhere along the lake. The extensive impairment around Pigeon Lake is associated with the extensive removal of riparian vegetation and shoreline modification (e.g., maintenance of beaches, erosion control structures, installations of docks, boat lifts and marinas, and the construction of cottages adjacent to the shoreline). Notably, sections of highly impaired shoreline were very long and continuous, with healthier sections being largely restricted to areas of minimal cottage development on the northwest and east shores at the Provincial Park and First Nations Reserve (FIGURE C8)

The Government of Alberta has recommended that a similar shoreline assessment should be performed every five years on Pigeon Lake to monitor the extent and integrity of remaining riparian areas (SRD 2008). In addition, assessments of both the health of the lake and tributary riparian areas would highlight priority areas for protection and restoration.

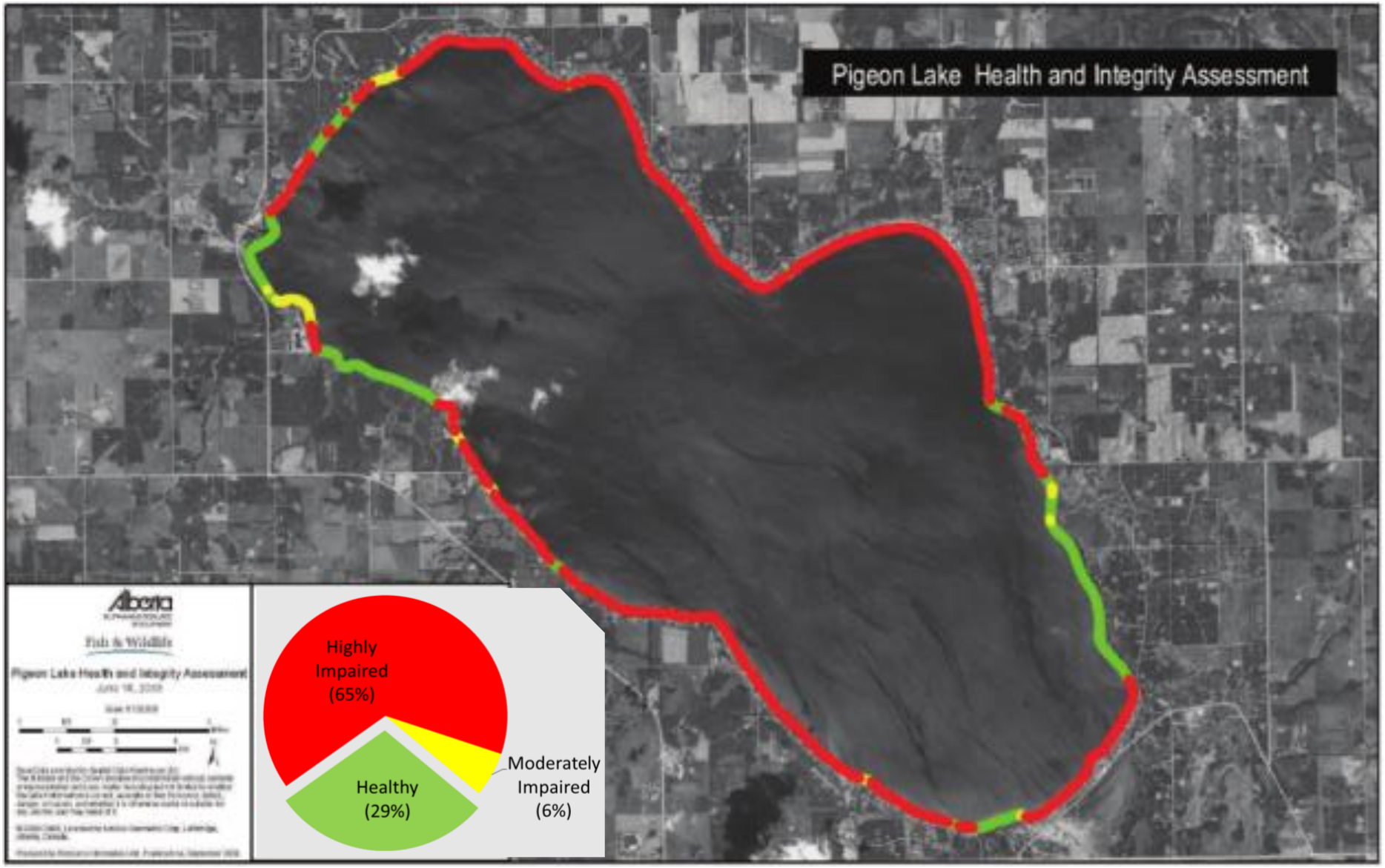

Figure C8: Pigeon Lake shoreline integrity assessment results from a June 2008 survey, indicating the extent of lakeshore degradation around the lake (SRD 2008).

Near-shore Vegetation

Aquatic vegetation (i.e., near-shore within the littoral zone) perform a wide range of ecologically-important functions, including nutrient and contaminant sequestration, shoreline stabilization, buffering water flows, and supporting rich biodiversity. Destruction of littoral habitats entails some loss of these ecological services and will have negative consequences for the biological communities of Pigeon Lake. For example, Northern Pike (*Esox lucius*), hide among vegetation such as cattails and bulrushes to ambush their prey, and rely heavily on the vegetation for spawning and rearing. Removal of the littoral vegetation compromises not only Northern Pike success but may also adversely affect other trophic levels in Pigeon Lake.

The distribution of littoral vegetation around Pigeon Lake is dependent on the extent of shoreline development and substrate type, with finer sediments and sheltered areas being most suitable for growth of aquatic vegetation. Submersed aquatic vegetation communities occur along much of Pigeon Lake's shore, with community composition and density influenced by factors such as water depth, turbulence, and sediment accumulation patterns.

In general, vegetation cover is related to the extent of shoreline development, with the lowest cover occurring in areas of high cottage density. However, no formal vegetation mapping of Pigeon Lake has occurred since the early 1980s. Continued disturbance and vegetation control activities further alter and limit the distribution of both riparian and aquatic vegetation communities, to the detriment of a healthy ecosystem.

Plants commonly found in Pigeon Lake's littoral and riparian vegetation communities are listed in TABLE C1.

Table C1: List of plants typical of Pigeon Lake's littoral and riparian vegetation communities.

Habitat	Growth Form	Common Name	Scientific Name
Littoral	Floating-leaved	Bur-reeds	*Sparaganium* spp.
Littoral	Floating-leaved	Common Duckweed	*Lemna minor*
Littoral	Floating-leaved	Star Duckweed	*Lemna trisulca*
Littoral	Floating-leaved	Variegated Pond-lily	*Nuphar variegatum*
Littoral	Floating-leaved	Water Smartweed	*Persicaria amphibia*
Littoral	Submerged	Autumn Water-starwort	*Callitriche hermaphroditica*
Littoral	Submerged	Common Bladderwort	*Utricularia vulgaris*
Littoral	Submerged	Common Water Moss	*Fontinalis* spp.
Littoral	Submerged	Coontail	*Ceratophyllum demersum*
Littoral	Submerged	Flat-stem Pondweed	*Potamogeton zosteriformis*
Littoral	Submerged	Fries' Pondweed	*Potamogeton friesii*
Littoral	Submerged	Lesser Pondweed	*Potamogeton pusillus*
Littoral	Submerged	Northern Watermilfoil	*Myriophyllum sibiricum*
Littoral	Submerged	Pondweeds	*Potamogeton* spp.
Littoral	Submerged	Richardson's Pondweed	*Potamogeton richardsonii*
Littoral	Submerged	Sago Pondweed	*Stuckenia pectinata*
Littoral	Submerged	Sheathed Pondweed	*Stuckenia vaginata*
Littoral	Submerged	Slender Water-nymph	*Najas flexilis*
Littoral	Submerged	Stonewort	*Chara* spp.

Habitat	Growth Form	Common Name	Scientific Name
Littoral	Submerged	Various-leaved Pondweed	*Potamogeton gramineus*
Littoral	Submerged	Water Buttercup	*Ranunculus aquatilis*
Littoral	Submerged	White-stem Pondweed	*Potamogeton praelongus*
Littoral	Submerged	Widgeon Grass	*Ruppia cirrhosa*
Riparian	Emergent Macrophyte	Bluejoint	*Calamagrostis canadensis*
Riparian	Emergent Macrophyte	Common Cattail	*Typha latifolia*
Riparian	Emergent Macrophyte	Creeping Spike-rush	*Eleocharis palustris*
Riparian	Emergent Macrophyte	Horsetails	*Equisetum* spp.
Riparian	Emergent Macrophyte	Knotted Rush	*Juncus nodosus*
Riparian	Emergent Macrophyte	Sedges	*Carex* spp.
Riparian	Emergent Macrophyte	Sloughgrass	*Beckmannia syzigachne*
Riparian	Emergent Macrophyte	Small-fruited Bulrush	*Scirpus microcarpus*
Riparian	Emergent Macrophyte	Soft-stem Bulrush	*Schoenoplectus tabernaemontani*
Riparian	Emergent Macrophyte	Wire Rush	*Juncus balticus*
Riparian	Forb	American Brooklime	*Veronica americana*
Riparian	Forb	Arum-leaved Arrowhead	*Sagittaria cuneata*
Riparian	Forb	Celery-leaved Buttercup	*Ranunculus sceleratus*
Riparian	Forb	Docks	*Rumex* spp.
Riparian	Forb	Fireweed	*Chamerion angustifolium*
Riparian	Forb	Marsh Ragwort	*Senecio congestus*
Riparian	Forb	Marsh Yellow Cress	*Rorippa palustris*
Riparian	Forb	Nodding Beggar-ticks	*Bidens cernua*
Riparian	Forb	Northern Stitchwort	*Stellaria borealis*
Riparian	Forb	Northern Willow-herb	*Epilobium ciliatum*
Riparian	Forb	Pale Persicaria	*Persicaria lapathifolium*
Riparian	Forb	Philadelphia Fleabane	*Erigeron philadelphicus*
Riparian	Forb	Purple-stemmed Aster	*Symphyotrichum puniceum*
Riparian	Forb	Silverweed	*Potentilla anserina*
Riparian	Forb	Stinging Nettle	*Urtica dioica*
Riparian	Forb	Water Hemlock	*Cicuta maculata*
Riparian	Forb	Water Parsnip	*Sium suave*
Riparian	Forb	Western Willow Aster	*Symphyotrichum lanceolatum*
Riparian	Forb	Wild Mint	*Mentha arvensis*
Riparian	Forb	Yellow Avens	*Geum aleppicum*
Riparian	Forb	Yellow Water Crowfoot	*Ranunculus gmelinii*
Riparian	Non-native Forb (Weed)	Bladder Campion	*Silene vulgaris*
Riparian	Non-native Forb (Weed)	Canada Thistle	*Cirsium arvense*
Riparian	Non-native Forb (Weed)	Caraway	*Carum carvi*
Riparian	Non-native Forb (Weed)	Common Groundsel	*Senecio vulgaris*
Riparian	Non-native Forb (Weed)	Common Mullein	*Verbascum thapsus*
Riparian	Non-native Forb (Weed)	Common Tansy	*Tanacetum vulgaris*

Habitat	Growth Form	Common Name	Scientific Name
Riparian	Non-native Forb (Weed)	Common Toadflax	*Linaria vulgaris*
Riparian	Non-native Forb (Weed)	Creeping Bellflower	*Campanula rapunculoides*
Riparian	Non-native Forb (Weed)	Himalayan Balsam	*Impatiens glandulifera*
Riparian	Non-native Forb (Weed)	Leafy Spurge	*Euphorbia esula*
Riparian	Non-native Forb (Weed)	Meadow Hawkweed	*Hieracium caespitosum*
Riparian	Non-native Forb (Weed)	Orange Hawkweed	*Hieracium auranticum*
Riparian	Non-native Forb (Weed)	Ox-eye Daisy	*Leucanthemum vulgare*
Riparian	Non-native Forb (Weed)	Perennial Sow-thistle	*Sonchus arvensis*
Riparian	Non-native Forb (Weed)	Purple Loosestrife (rare)	*Lythrum salicaria*
Riparian	Non-native Forb (Weed)	Scentless Chamomile	*Anthemis arvensis*
Riparian	Non-native Forb (Weed)	Stinkweed	*Thlaspi arvense*
Riparian	Non-native Forb (Weed)	Tansy Ragwort	*Senecio jacobaea*
Riparian	Non-native Forb (Weed)	White Cockle	*Silene latifolia*
Riparian	Shrub	Alders	*Alnus* spp.
Riparian	Shrub	Bush Cranberries	*Viburnum* spp.
Riparian	Shrub	Chokecherry	*Prunus virginiana*
Riparian	Shrub	Currants and Gooseberries	*Ribes* spp.
Riparian	Shrub	Prickly Rose	*Rosa acicularis*
Riparian	Shrub	Raspberry	*Rubus idaeus*
Riparian	Shrub	Red Osier Dogwood	*Cornus sericea*
Riparian	Shrub	Saskatoon	*Amelanchier alnifolia*
Riparian	Shrub	Willows	*Salix* spp.
Riparian	Tree	Balsam Poplar	*Populus balsamifera*
Riparian	Tree	Paper Birch	*Betula papyrifera*
Riparian	Tree	Trembling Aspen	*Populus tremuloides*
Riparian	Tree	White Spruce	*Picea glauca*

Invasive Species

Existing and ongoing threat: Himalayan Balsam (*Impatiens glandulifera*), a plant listed as a Prohibited Noxious Weed under Alberta's Weed Control Act, was discovered on Pigeon Lake shorelines in the early 2000's. The plant's fast growth rates and aggressive seed dispersal mechanism (including transport in lake water) allowed it to rapidly invade lakeshores and replace native riparian vegetation. Himalayan Balsam infestations can increase shoreline erosion because the plants die off every year (leaving the shoreline bare and exposed for part of the year) and their shallow root systems are ineffective at retaining soil. An action plan for the eradication of this plant from the watershed was developed in 2009, and the Pigeon Lake shoreline was tentatively declared free of Himalayan Balsam in 2015. An ongoing monitoring and control effort is continuing to prevent a repeat infestation and support the re-establishment of native riparian vegetation. Other invasive plants such as Common Tansy and Creeping Bell Flower are rapidly becoming established in the riparian area. Non-chemical actions should be taken by all lakeside communities to combat this invasion.

Emerging Threats: Waterbodies are under constant threat from the unintentional introduction of invasive species. These organisms, whether they are plants, fish or invertebrates, can cause significant damage to the lake's ecosystem. Other areas in Alberta have already seen the effects of waterbody-choking plants such as Eurasian Watermilfoil or Flowering Rush and fish such as Prussian Carp, while species such as zebra and quagga mussels have caused immense devastation elsewhere in Canada. The introduction of these species

was the result of improper care of boats and other recreational items and by the inter-lake transfer of live fish. Extreme care must be taken with water vessels (boats, canoes, fishing gear, etc.) to ensure removal of any plants or animals. The *Clean, Drain, Dry* program has been introduced as a means of protecting lakes from these invasive species.

Some of the species of concern are:

- Zebra mussels (*Dreissnea polymorpha*) and quagga mussels (*D. bugensis*) were introduced to North America via ballast water from Eurasia and have severely disrupted aquatic ecosystems in the Great Lakes Region and elsewhere. These organisms attach to hard surfaces (e.g., boat hulls or propellers) in very high densities and their veligers (larvae) are readily transported in bait containers, live wells and internal ballast tanks. Thus, boats are the primary form of zebra and quagga mussel introduction to new waterbodies. In addition to disrupting aquatic food webs, zebra and quagga mussels pose a considerable nuisance to recreation and impediment to infrastructure; once colonies have established, they are extremely difficult to eradicate. Zebra and quagga mussels have not been detected in Pigeon Lake as of 2017, but similar to Eurasian Watermilfoil, early detection and action is necessary to prevent infestation and potentially irreversible consequences.
- Eurasian Watermilfoil (*Myriophyllum spicatum*), listed as a Prohibited Noxious Weed in Alberta, is a rooted aquatic plant that can be highly disruptive to lake ecosystems. It is an unpalatable food source for native waterfowl and fish, and its rapid growth and ability to grow from stem fragments allow it to out-compete native aquatic vegetation. The plant grows close to the water surface and can restrict swimming and boating access, as well as block water outlets. Eurasian Watermilfoil fragments are easily spread between waterbodies via boats, trailers, anchors and propellers. Lakes in British Columbia, Ontario and Quebec have already become infested. Although the plant has not been found in Pigeon Lake as of yet, some localized infestations exist elsewhere in Alberta. Early detection and a proactive boat maintenance program (clean, drain and dry) will be critical to prevent a serious lake-wide threat in Pigeon Lake.
- Flowering Rush (*Butomus umbellatus*), also listed as a Prohibited Noxious Weed in Alberta, is an aquatic plant that can severely disrupt wetland, river and lake ecosystems. It resembles a large sedge or bulrush but has showy pink flowers and can grow in both emergent and submerged forms. The plant has an extensive root system and – in addition to producing seeds – can reproduce vegetatively from root fragments if they are broken. These root fragments can travel long distances in water and create dense colonies where they establish, crowding out and displacing native aquatic vegetation. Flowering Rush can interfere with boat propellers and its large, dense stands can restrict waterbody access for a variety of lake users. Flowering Rush was sold commercially as an ornamental garden plant but has established in some lakes, rivers, creeks, irrigation canals, and stormwater ponds elsewhere in Alberta. This pant has not yet been observed in Pigeon Lake, though prevention of a Flowering Rush infestation will require early detection and proper control techniques if any plants establish in the waterbody.
- Prussian Carp (*Carassius gibelio*) are relatives of common goldfish and pose a serious threat to Alberta freshwater ecosystems. These fish are extremely hardy, able to survive in conditions of very poor water quality which would be intolerable for other fish species. Additionally, Prussian carp can reproduce asexually and effectively create clones of themselves, contributing to rapid population increases. The source of Prussian carp introduction into Alberta's aquatic ecosystems is unclear, though the impacts on aquatic ecosystems of these fish are well-documented. Prussian carp out-compete native fish species for food and habitat resources and can cause fundamental changes in the aquatic invertebrate communities, possibly leading to trophic collapses. There are established breeding populations in some ponds, lakes and rivers in Alberta, but no fish have been reported in Pigeon Lake as of 2017. Eradication of Prussian carp is very difficult once they are established in a

waterbody; hence, education efforts and prevention of introduction into Pigeon Lake are paramount.

Riparian BMPs

Riparian BMPs involve actions that can be taken by land owners and users within the Pigeon Lake watershed to improve the water quality of the lake and streams. These may include:

- Avoiding where possible activities that involve the removal of riparian vegetation such as mowing, trimming, herbicide applications, cultivating, and land clearing. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.
- Educating watershed property owners and lake visitors about the importance of littoral vegetation. The current perception of many is that most aquatic plants are all "weeds" and are a nuisance to lake users. However, educating the public on the ecological value of aquatic vegetation is important for the maintenance and improvement of these areas.
- Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
- Encouraging the use of shared docks and day use areas, instead of individual ones.
- Ensuring adequate naturalized setbacks for upland activities such as residential development, cropping, or livestock grazing. This will include leaving a natural vegetation buffer around waterbodies and streams, reducing grazing intensity and access within riparian areas, and planting additional riparian vegetation.
- Eliminating the use of fertilizers and herbicides along the lakeshore.
- Limiting the use of salts on shoreline roads to limit the increase in lake salinity via runoff.

Plan Implications

- BMPs, such as those highlighted above, should be implemented for riparian areas all around Pigeon Lake. Given the extensive development around the lake, educating property owners and municipalities on riparian stewardship will be essential to ensure continued riparian health and function.
- The lake-wide riparian health assessment program should be continued and updated every five years. The last assessment was in 2008, indicating that Pigeon Lake is overdue for an updated shoreline assessment. This monitoring provides important information on how impaired the lakeshore as a whole is, and will inform where to prioritize riparian restoration efforts.
- A similar riparian assessment and monitoring program should be initiated for the inflowing streams into Pigeon Lake, as the ecological integrity of streams will directly affect that of the lake. This may include sensitive habitat mapping and assessment of littoral vegetation at stream tributaries and other key fish habitat areas.
- Consider a comprehensive inventory of critical fish and wildlife habitats such as Sensitive Habitat Inventory Mapping (e.g., Mason and Knight 2001) to identify sensitive shoreline features and habitats surrounding the lake. The resulting Aquatic Habitat Index can be used to inform local mapping and planning initiatives specific to Pigeon Lake.
- To increase the provision of important ecological functions and services, such as fish production and nutrient sequestration, restoration of riparian vegetation all around Pigeon Lake and along the inflowing streams and tributaries should be made a priority.
- Shoreline restoration and strict environmental controls on future development is necessary. Examples of such tools to implement include a regional plan, inter-municipal development plans and/or municipal bylaws.
    - Lake Shoreline Management Guidelines (e.g., EKILMP 2010) can inform municipal development planning specifically to manage the sensitive shoreline features of Pigeon Lake.
    - Implementation of Low Impact Development practices can greatly reduce the runoff of pollutants from the shoreline into the lake (see Alberta Low Impact Development Partnership).

    - Adoption of Sediment and Erosion Control BMP's and Environmental Construction Operations plans for construction activities near sensitive areas to ensure that contractors identify and mitigate their environmental impacts that may result from their activities.
- Ongoing monitoring and proactive efforts are necessary to prevent the infestation of aquatic and riparian invasive species, at both the citizen and government levels.

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3 SUMMARY OF THE SCIENCE: PIGEON LAKE

Historical Climate and Lake Level Fluctuations

Pigeon Lake is a permanent waterbody and has likely existed for thousands of years; due to its large size and low outflow rates, it has a very long residence time (the amount of time that water will remain in the lake) of >100 years. The watershed of Pigeon Lake is small relative to the lake itself, with a ~2:1 watershed (187 km^2) to lake (96.7 km^2) surface area ratio (FIGURE C3; Table C2). This small drainage basin and large evaporative area makes Pigeon Lake particularly sensitive to climatic variability, with changes to precipitation or evaporative rates having a considerable impact on lake water levels.

Pigeon Lake has a very long residence time (the amount of time that water will remain in the lake) of >100 years.

Table C2: Physical properties of Pigeon Lake and its watershed.

Physical Property	Value
Lake Surface Area	96.7 km^2
Lake Water Volume	603,000,000 m^3
Maximum Depth	9.1 m
Mean Depth	6.2 m
Shoreline Length	46 km
Mean Annual Lake Evaporation	664 mm
Mean Annual Precipitation	534 mm
Mean Annual Inflow	17,000,000 m^3
Mean Residence Time	Greater than 100 Years
Lake Weir Sill Elevation	849.935 m (Above Sea Level)
Watershed Land Drainage Area	187 km^2
Watershed to Lake Area Ratio	2:1

(From Mitchell and Prepas 1990)

Climate varies naturally over seasons and years following general atmospheric patterns (e.g., El Nino Southern Oscillation and the Pacific Decadal Oscillation). For example, FIGURE C9 shows mean annual temperature and precipitation for the Pigeon Lake watershed from 1961 to 2016. (Source: Alberta Agriculture and Forestry (interpolated weather data since 1961 for Alberta townships: https://agriculture.alberta.ca/acis/township-data-viewer.jsp). Mean annual precipitation for this period is 519 mm and mean annual temperature is 2.8°C. For precipitation patterns, there are several episodes of multiyear above average and below average periods: a relatively wet period occurred from 1988 to 1991 and from 1996 to 2001. Drier than normal precipitation consecutive periods (below the long-term mean) were observed from 1966 to 1971 and from 2001 to 2003. Mean annual temperature for the same period is 2.8°C, with values showing an increase over time. Climate change scenarios for the region indicate that an increase in precipitation, warmer temperatures, and particularly less cold winters are expected in the future (Davidson 2010).

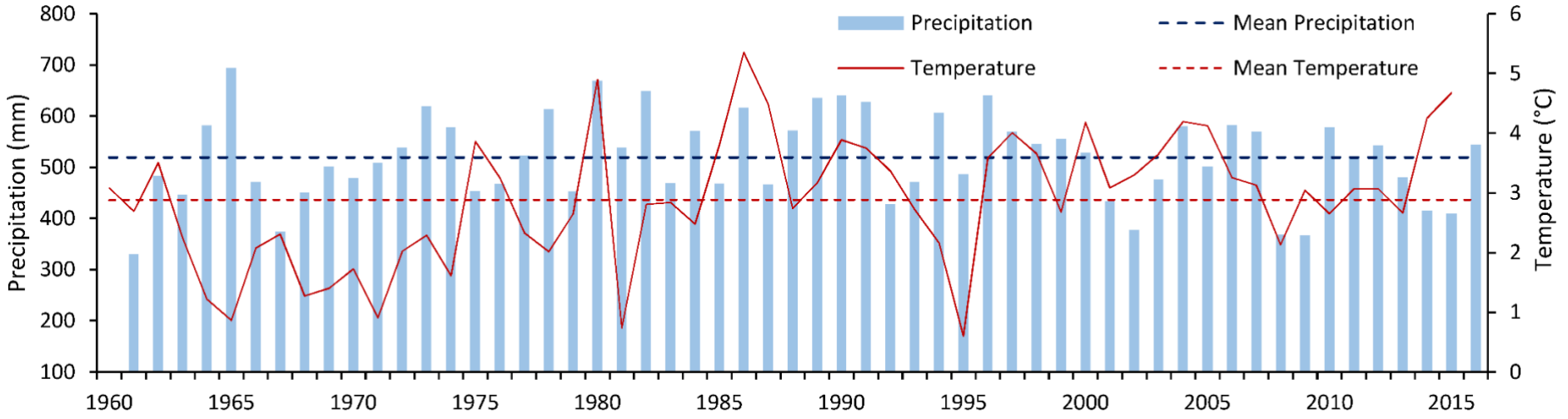

Figure C9. Mean annual temperature and total annual precipitation for the Pigeon Lake watershed.

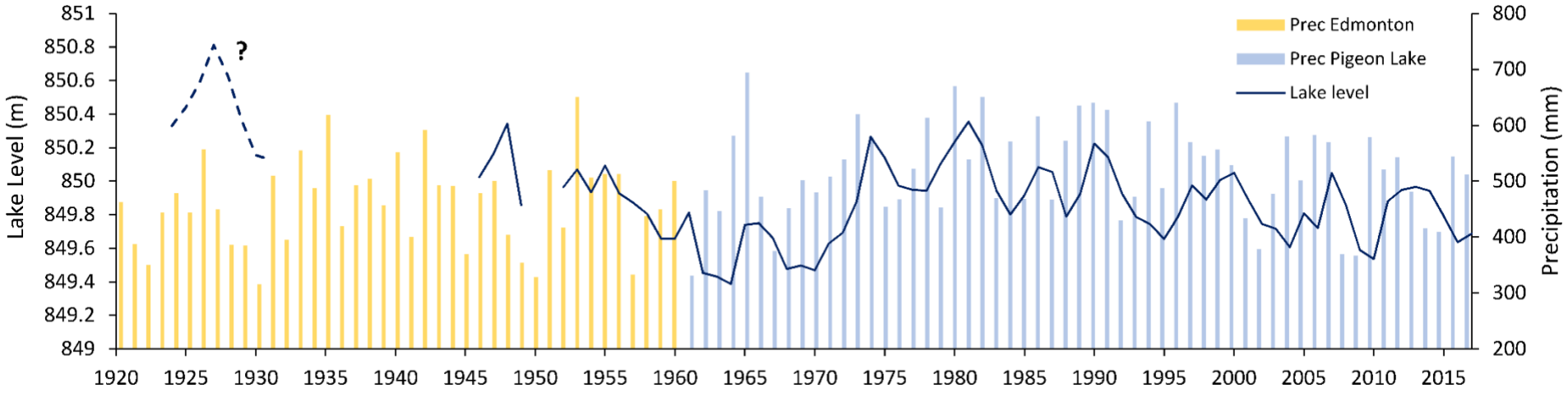

Figure C10. Pigeon Lake mean annual water levels and annual precipitation from 1920 to 2016.

Pigeon Lake historic annual precipitation and mean annual lake levels are shown in FIGURE C10. The annual precipitation from 1920 to 1960 is for the City of Edmonton (yellow bars) and from 1961-2016, shows when climate data became available for Pigeon Lake (blue bars). Data sources include Alberta Environment and Parks, Unpublished data (lake levels for Pigeon Lake); Environment and Climate Change Canada City of Edmonton precipitation data (http://climate.weather.gc.ca/); and Alberta Agriculture and Forestry (https://agriculture.alberta.ca/acis/township-data-viewer.jsp) Pigeon Lake watershed precipitation data.

Pigeon Lake water levels tend to rise and fall in response to cumulative wet and dry precipitation cycles. For example, a 7-year (1967 to 1973) steady increase in annual precipitation resulted in a 5-year (1970 to 1974) rise in Pigeon Lake mean annual water levels. Conversely a 4-year (1999 to 2002) annual precipitation decline caused Pigeon Lake mean annual water levels to decline from 2000 to 2004.

Intermittent water levels have been recorded for Pigeon Lake since 1924 with continuous daily water level monitoring from 1972 to present by Water Survey Canada. Lake levels prior to 1946 were omitted from the analysis because they were based on an assumed datum and could not be reliably converted to geodetic elevations.

Lake levels have not significantly decreased over time at the 95% confidence level during the period 1946-2017, as shown in Figure C11 (p-test = 0.414 and trend slope = -0.001). The shaded box represents the range of most (90 percent) of the historical data (5th and 95th percentiles). The historical data was outside of this range 10 percent of the time. The horizontal dashed line represents the long term median elevation (849.874 m) of the weir sill at the outlet of Pigeon Lake.

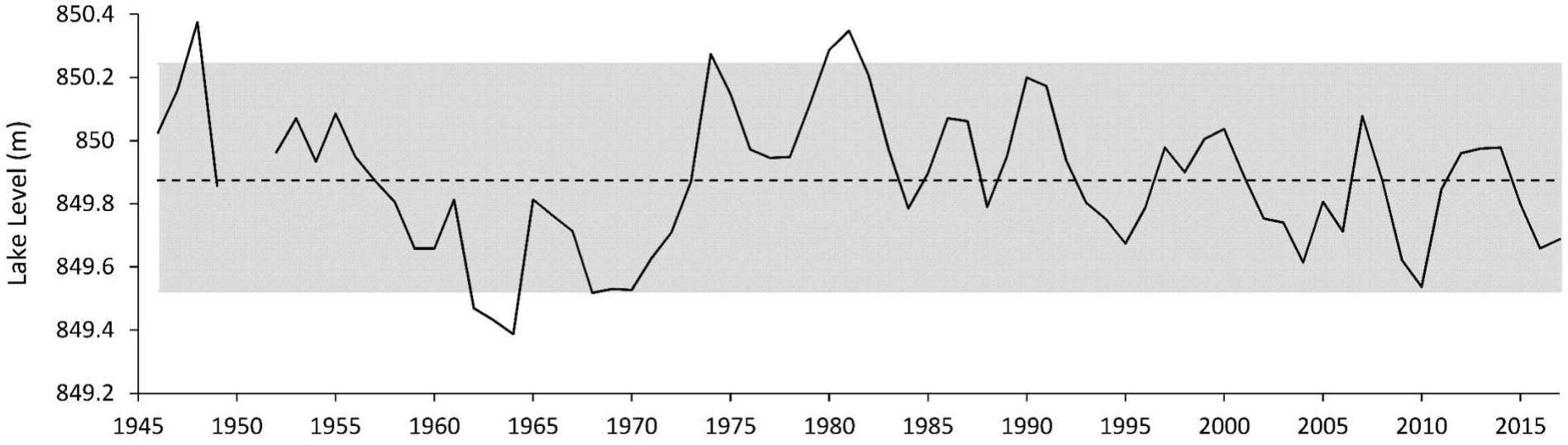

Figure C11: Pigeon Lake mean water level trends (1945-2016). The shaded box represents 5th and 95th percentiles. The horizontal dashed line represents the long-term median elevation (849.874 m) of the weir sill at the outlet of Pigeon Lake.

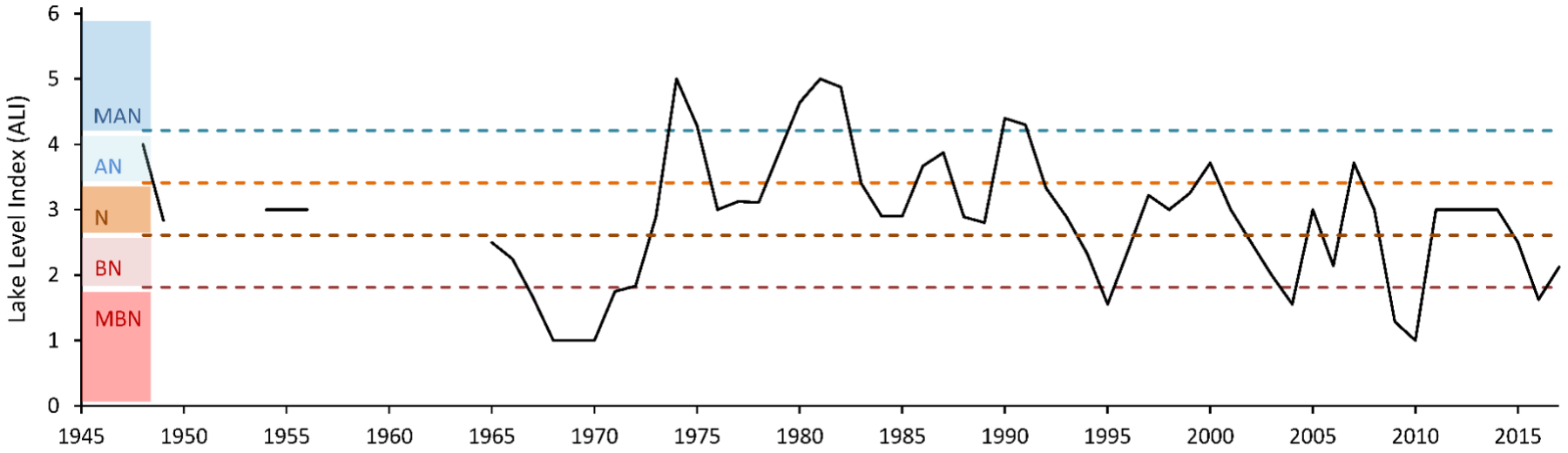

Figure C12. Lake Level Index for Pigeon Lake (1946-2017). Colored areas indicated the range of values for each of the five categories: MAN (Much Above Normal), AN (Above Normal), N (Normal), BN (Below Normal), MBN (Much Below Normal). Note that the index does not include those years with less than 3 lake level measurements.

Alberta Environment and Parks developed the "Alberta Lake Level Index" (ALI; Islam and Seneka 2015) to evaluate the status of lake levels across the province. This method takes into account intra-annual long-term changes in lake levels and has been proved to work well in lakes with limited measurements per year. Annual ALI values for Pigeon Lake, as well as the corresponding category, are provided in FIGURE C12. Lake level oscillations above and below normal are observed and seem to have followed a 20-year cycle: levels were normal or below normal in the 1950s and 1960s; they were normal to above normal from the early 1970s to the early 1990s; they have been normal to below normal from the early 1990s to 2017. Colored areas indicated the range of values for each of the five categories: MAN (Much Above Normal), AN (Above Normal), N (Normal), BN (Below Normal), MBN (Much Below Normal). Note that the index does not include those years with less than three lake level measurements.

FIGURE C13 shows the percent of time Pigeon Lake historic mean daily water levels from 1945 to 2016 equalled or exceeded a certain water level. For example the 70% exceedance is 849.80 m which means historically Pigeon Lake's mean daily water levels equalled or exceed 849.80 m 70% of the time. The 50% exceedance or median historic water level, is 849.922 m, which is 13 mm below the Pigeon Lake Full Supply Level of 849.935m. The 50% exceedance means historically Pigeon Lake's water levels have been above or equal to 849.922 m 50% of the time and below 849.922 m 50% of the time.

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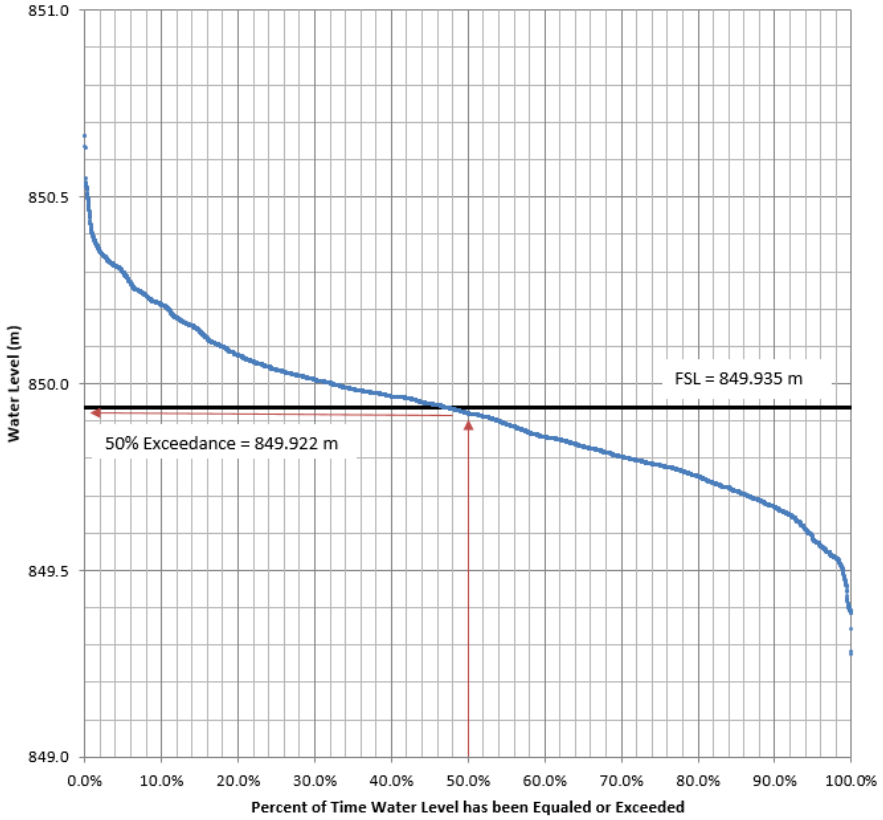

Figure C13: Pigeon Lake Historic Daily Water Levels Percent of Time Equaled or Exceeded (1945-2016).

Worley Parsons modelled the Pigeon Lake water balance from 1993-2009 (17-years) and concluded the mean annual lake input was 684.1 mm, including precipitation (64%), surface runoff (29%) and groundwater contributions (7%). Mean annual lake output was estimated at 701.8 mm and included lake evaporation (93%) and lake outflow (7%, including withdrawals). These results indicated that water losses (mainly through evaporation) exceeded water inputs to the lake, resulting in a mean annual water deficit of 17.7 mm (or 1,730 dam^3/year), matching the observed deficit of 18.7 mm/year for the 1993 to 2009 water balance evaluation period. Alberta Environment and Parks developed a 21-year (1986-2006) Pigeon Lake water balance model (unpublished) and found a mean annual 860 dam^3/year lake volume deficit. The Worley Parsons and Alberta Environment and Parks Pigeon Lake water balance results are summarized in TABLE C3. Although the two Pigeon Lake water balance models were developed independently, simulated different time periods and time intervals, the results were similar. Both concluding Pigeon Lake has similar mean annual surface inflow (19,233 dam^3/year vs 21,539 dam^3/year), groundwater represented a significant inflow component (20% vs. 23%), and there was a net water balance deficit during the simulation period (17.7 mm/year vs 8.5 mm/year) as shown in Table C3. The net deficit suggested by both Pigeon Lake water balance models reflect a relatively short simulation period (17 years vs 21 years) when Pigeon Lake levels were in a downward trend as shown by *Trend 3* in FIGURE C14.

Table C3: Pigeon Lake Water Balance Modelling Results.

Study Author	Worley Parsons		AEP	
Modelled Period	1993-2009		1986-2006	
Total Years	17		21	
	(mm/year)	*(cu.dam/year)*	*(mm/year)*	*(cu.dam/year)*
Inputs:				
Precipitation	438.0	42,653	523.0	50,930
Groundwater Inflow	48.6	4,733	67.1	6,539
Surface Inflow	197.5	19,233	221.2	21,539
Total Inputs	*684.1*	66,619	*811.3*	79,008
Ratio GW to GW&SW	20%		23%	
Outputs:				
Lake Evaporation	657.0	63,979	762.9	74,289
Withdrawals	3.6	347	3.6	355
Lake Discharge	41.3	4,020	53.6	5,224
Total Outputs	*701.8*	68,346	*820.2*	79,868
Net Deficit:	17.7	1,727	8.8	860

FIGURE C14 C14 shows three historic water level trends for Pigeon Lake between 1945 and 2010. Pigeon Lake water levels dropped significantly for 20-years (1950-1970) shown as Trend 1. Pigeon Lake water levels rebounded during the wet years in the 1970s indicated by Trend 2. Trend 3 shows Pigeon Lake in another decreasing cyclic and it was during this time period the two water balance models were developed and why both models correctly demonstrated a net deficit for Pigeon Lake. Both water balance models simulated a relatively short hydrologic time period when Pigeon Lake was in a decreasing trend (Trend 3) therefore the modelling results do not reflect the long-term historic variability of Pigeon Lake climate nor cyclic water level trends (Trends 1 and 2). There is no evidence that the long term average water volume in Pigeon Lake is decreasing beyond historical natural variability

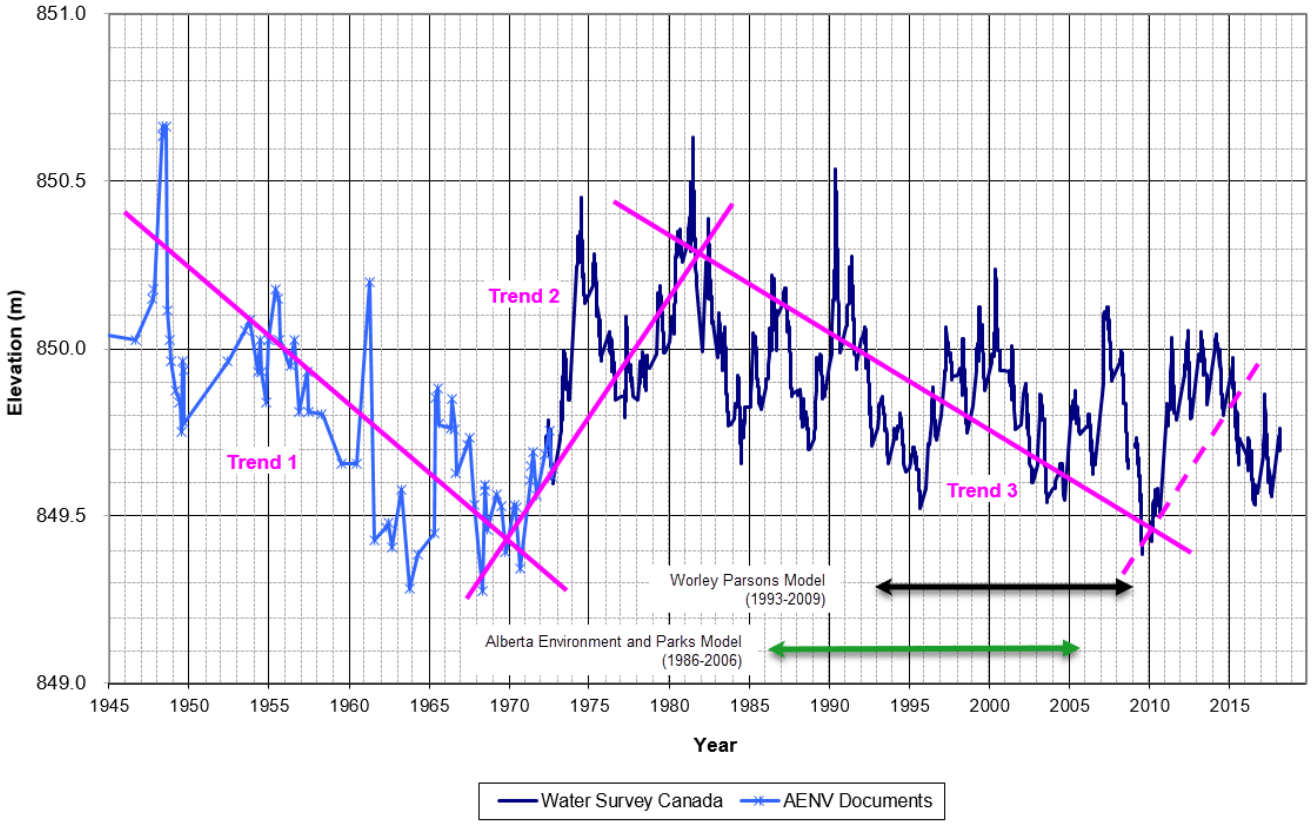

Figure C14: Pigeon Lake Mean Daily Water Level Trends and Water Balance Model Simulation Period.

Overall, extensive historical water level data has demonstrated that Pigeon Lake experiences ongoing water level cycles of both increasing and decreasing trends when considered over a longer time-period as a result of variability in weather patterns (FIGURES C9, C10, C11, C12, C14). In a manner similar to other prairie lakes, the water level varies by approximately 1.3 m. There is no evidence that the long-term average water volume in Pigeon Lake is decreasing beyond historical variability.

The outflow creek that drains Pigeon Lake into the Battle River is fitted with a weir with a sill elevation of 849.935 masl. When the water level reaches this elevation, outflow occurs, including nominal export of nutrients (FIGURES C4, C5). Attempts to maintain water levels above the weir sill elevation may benefit recreational users and may result in the removal of some nutrients from the water column, but issues of nutrient input (both internal and external loadings) would still need to be addressed. Proposals to manage lake levels at

an artificial level above the weir crest elevation entails that supplemental water would have to be introduced into Pigeon Lake from beyond its watershed to increase the lake volume flushing rate (i.e., decrease the lake residence time). Due to the significant regulatory implications and resources required for such a project, further study of the efficacy of such an option should be completed and must address issues such as:

- Implications for downstream flooding and nutrient flushing on water quality of waterbodies downstream of Pigeon Lake.
- Enhanced flood risk for shoreline properties, as well as the potential for ice damage and associated erosion potential.
- Nutrient additions and risk of invasive species from water importation.
- Long-term financial and liability issues for such a project.
- Environmental effects in the water body where the water would be withdrawn from.
- Estimates of nutrient removal recognizing that nutrients concentrations are very low for most of the year and peak only in the months of July, August and September.

Lake Water Quality Studies

Phosphorus is known to be the major nutrient limiting biological growth in lake ecosystems as it is often present in low concentrations relative to other nutrients (e.g., Nitrogen). Consequently, increases in its availability (particularly in the dissolved form) can result in undesirable production of phytoplankton such as cyanobacteria.

Detailed monitoring of P has occurred in Pigeon Lake to determine whether recent cyanobacteria blooms are a response to excess nutrient concentrations in the water. While Pigeon Lake was confirmed to be P-limited relative to N, the blooms are not solely a consequence of external nutrient loading into the lake. Based on the 2014 Pigeon Lake P budget, internal sources of P (internal loading) are estimated to contribute about 57% of the total available P into the lake's water column (FIGURE C1). Mechanisms behind Pigeon Lake P release involve complex chemical and biological reactions and require further study.

Sediment analysis in 2013 detected higher concentrations of dissolved forms of P (such as orthophosphate) in waters near the sediment layer than at the surface, confirming internal release of P from the sediments (Teichreb et al. 2014). Dissolved forms of P are preferentially taken up by phytoplankton and are thought to be released from lake sediments under periodic anoxic conditions associated with minimal wind mixing and de-oxygenation of deeper waters and also from direct uptake from the phytoplankton. Internal P loading can occur even when lake-bottom waters are well-oxygenated, due to warm temperatures facilitating high rates of organic matter decomposition rates and P release.

Chlorophyll-*a* is a photosynthetic pigment produced by phytoplankton and is commonly used to represent phytoplankton biomass. Elevated levels of chlorophyll-*a* indicate high phytoplankton biomass, which are typically caused by an excess of dissolved (bioavailable) nutrients (i.e., PO_4^{3-}) in the water body. This dissolved phosphorus is taken up by phytoplankton, where it becomes part of its biomass. Because of this, a significant amount of phosphorus is stored in phytoplankton. Analysis of chlorophyll-*a* and TP in Pigeon Lake from 1983-2016 show that both parameters fluctuated considerably and, on average, neither had a statistically significant increase over this 33-year period (FIGURES C15, C16). These data indicate that the variability and peaks in P and chlorophyll-*a* may have been higher in recent years, although this requires further examination (e.g., this could be caused by a change in laboratories).

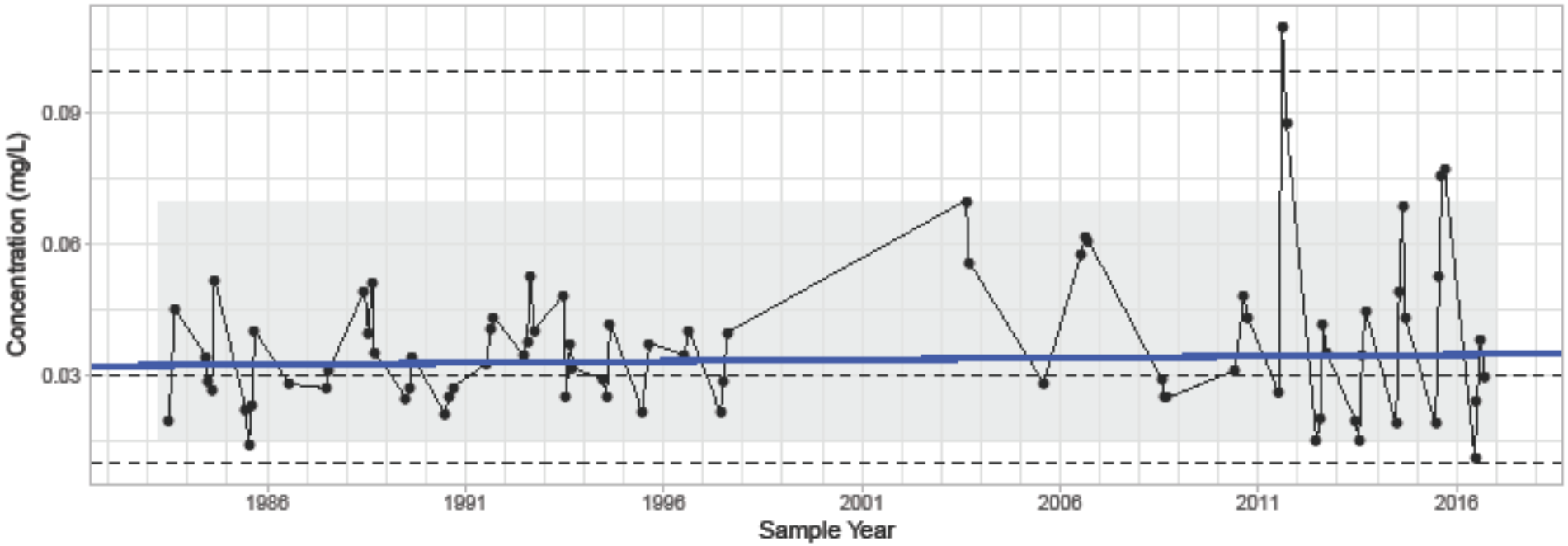

Figure C15: Trend analysis of total phosphorus concentrations in Pigeon Lake over time (1983-2016, June-September data). There is no significant change in total phosphorus concentrations over time (trend test *p*-value = 0.508). The blue line represents the trend line (slope <0.001). The shaded box represents the range of most (90 percent) of the historical data (5th and 95th percentiles). The historical data was outside of this range 10 percent of the time. Horizontal dashed lines represent trophic state cut-offs: oligotrophic <0.01 mg/L; mesotrophic = 0.01 – 0.03 mg/L; eutrophic = 0.03 – 0.1 mg/L; hypereutrophic >0.1 mg/L.

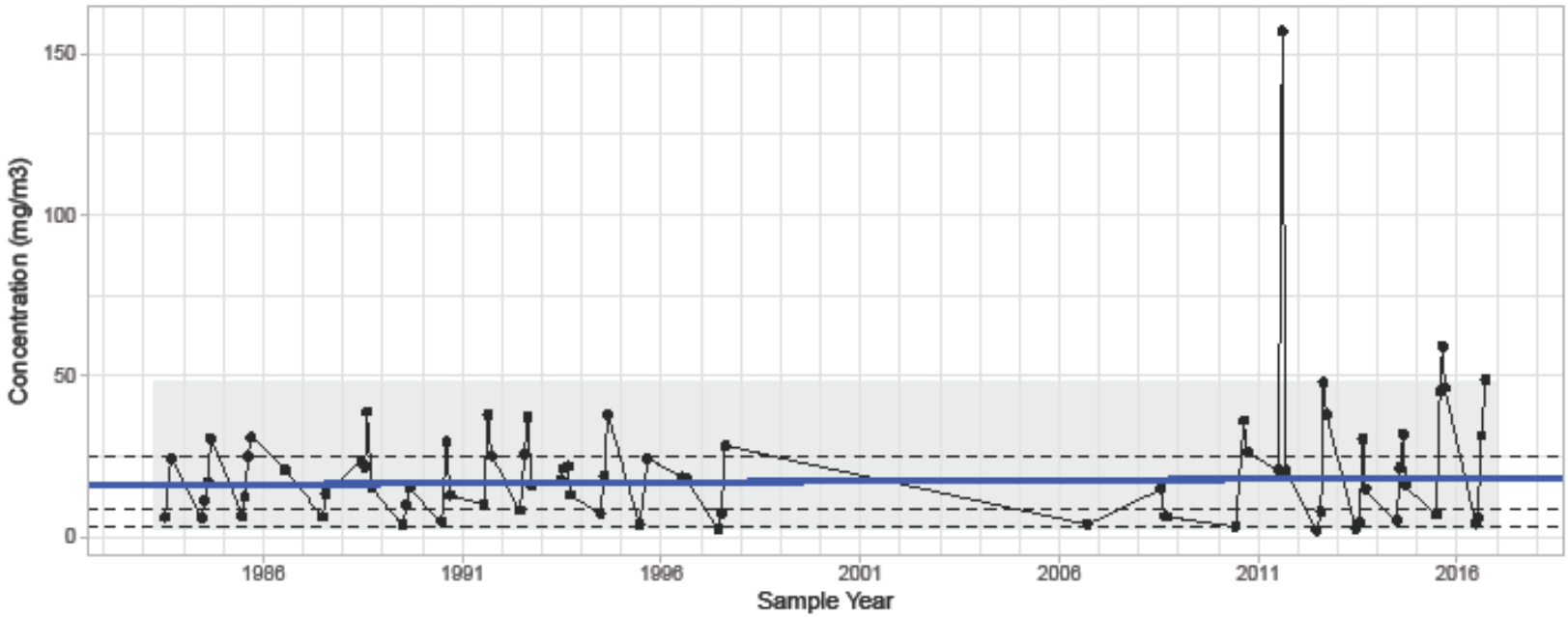

Figure C16: Trend analysis of chlorophyll-*a* concentrations in Pigeon Lake over time (1983-2016, June-September data). There is no significant change in total chlorophyll-*a* concentration over time (trend test *p*-value = 0.529). The blue line represents the trend line (slope = 0.064). The shaded box represents the range of most (90 percent) of the historical data (5^{th} and 95^{th} percentiles). The historical data was outside of this range 10 percent of the time. Horizontal dashed lines represent trophic state cut-offs: oligotrophic <3.5 mg/m^3; mesotrophic = 3.5 – 9 mg/m^3; eutrophic = 9 – 25 mg/m^3; hypereutrophic >25 mg/m^3.

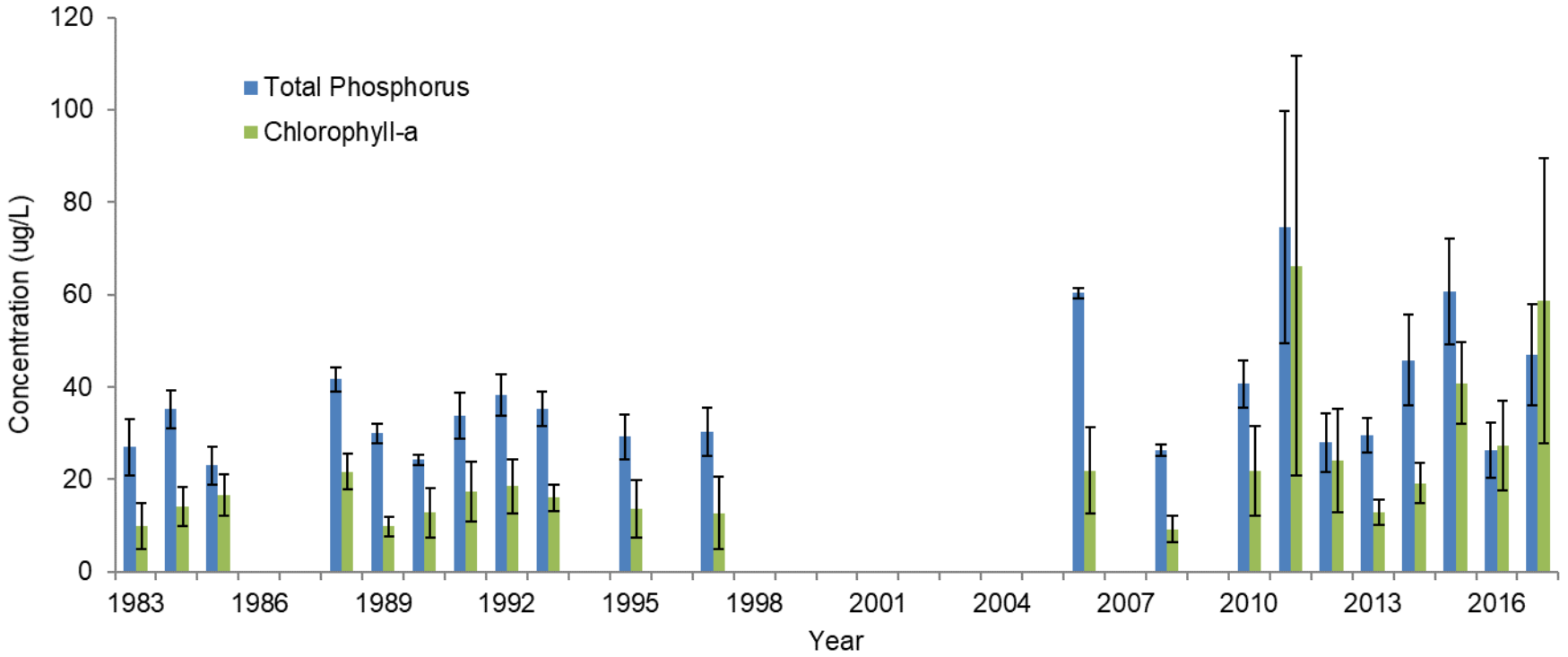

Figure C17: Average annual total phosphorus and chlorophyll-*a* concentrations in Pigeon Lake over time (1983-2017). Note that these variables were analyzed from monthly (May to September) samples taken at 10 sites around the lake, which together represent the conditions of the entire lake. Bars represent standard errors.

FIGURE C17 depicts the variation in average P and chlorophyll-*a* over time. However, there is an incomplete understanding of factors that result in the inter-annual variation in both P and chlorophyll-*a* concentrations. In most years, concentration of TP and chlorophyll-*a* followed an annual pattern, with a steady increase from June and July, peak concentration in August, and a plateau or decrease in September (FIGURE C18). This increase in mid-summer is typical of many shallow lakes, where dissolved nutrients from the decomposition at the lake bottom can be repeatedly distributed to the surface water due to weak thermal stratification.

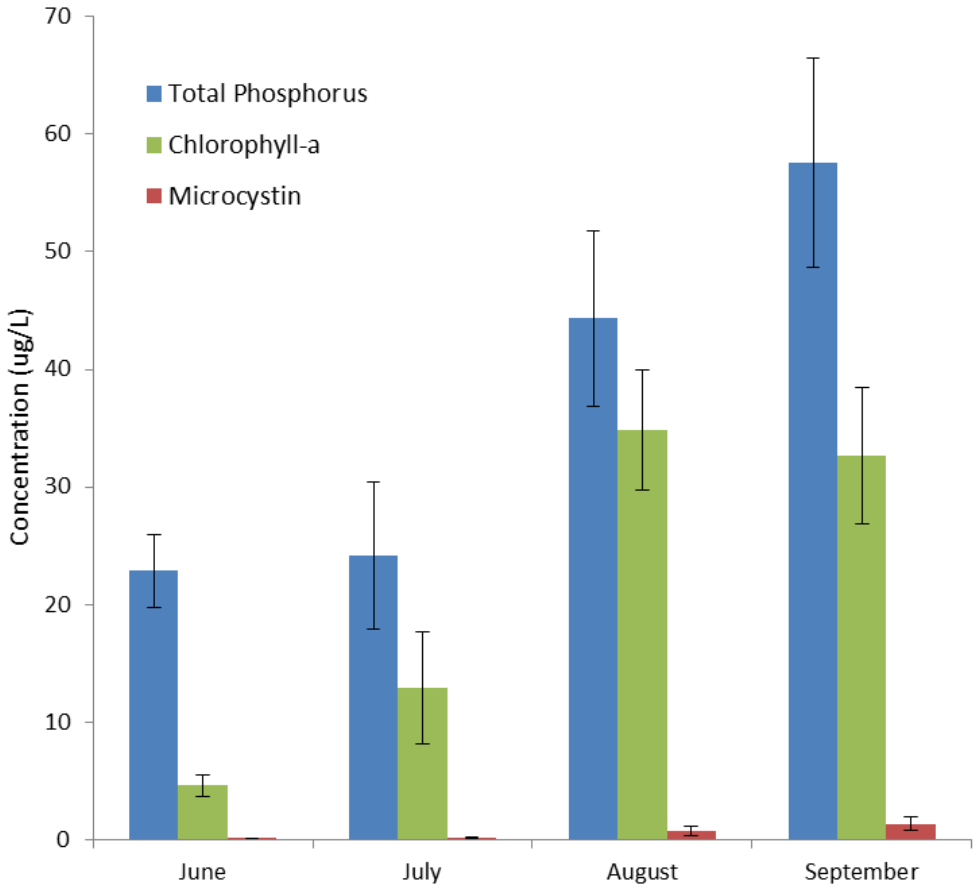

Figure C18: Monthly total phosphorus, chlorophyll-*a*, and microcystin concentrations during the open water season, averaged between 2010-2017. Bars represent standard errors.

Microcystins are toxins produced by certain species of cyanobacteria and sometimes accompany algal blooms. In sufficient concentrations, microcystins can pose a serious threat to human and animal health. In light of the recent cyanobacteria blooms in Pigeon Lake, the Alberta Lake Management Society has conducted annual monitoring of microcystins as part of their whole-lake monitoring program since 2010. Microcystin concentrations were generally low, never exceeding Alberta Surface Water Quality Guidelines for Recreation and Aesthetics (20 µg/L) in open water. Since 2012, Alberta Health Services has been monitoring microcystin concentrations and amount of cyanobacteria consistently at six beaches on Pigeon Lake: Grandview, Ma-Me-O, Mission, Provincial Park, Silver, and Zeiner. As seen in Table C4, these data are very variable, given the dynamic nature of beach ecosystems. Beach microcystin is generally low, except in 2015 when it surpassed the Alberta Guidelines for Recreation and Aesthetics at beach locations at Grandview Beach, Pigeon Lake Provincial Park, and Silver Beach. The amount of total cyanobacteria frequently surpasses the Recreation and Aesthetics Guidelines (100,000 cells/ml) at all beaches, which is not uncommon in Alberta.

Table C4: Microcystin-LR concentration and cyanobacteria cell counts measured at six Pigeon Lake beaches by Alberta Health.

Beach	Minimum value		Average value		Maximum value	
	Microcyst (µg/L)	Cell Count (#/ml)	Microcyst (µg/L)	Cell Count (#/ml)	Microcyst (µg/L)	Cell Count (#/ml)
Grandview	0.03	0	2.32	696,926	59.84	6,787,472
Ma-Me-O	0.03	0	0.88	505,177	13.26	5,610,115
Mission	0.03	0	0.84	583,629	8.25	15,788,134
Prov. Park	0.03	0	2.09	379,846	60.47	3,556,608
Silver	0.03	0	8.92	138,784	483.50	953,094
Zeiner Park	0.05	0	0.73	532,364	15.86	8,040,846

Besides favorable environmental conditions, the success and proliferation of cyanobacteria in Pigeon Lake may be partly attributable to certain aspects of their biology. These include fast reproductive rates, lower light requirements relative to other phytoplankton, decreased palatability to some grazing zooplankton, buoyancy-promoting gas vesicles in certain species, N-fixing capability of certain species, and the ability of certain species to extract P from the sediments directly.

While cyanobacteria-ecosystem dynamics are not yet fully understood in Pigeon Lake, ecological perturbations observed in other eutrophic lakes may indicate some of the potential impacts that cyanobacteria blooms have on Pigeon Lake's biota. For example, the increased turbidity of lake water during and following cyanobacteria blooms decreases light penetration into the water, which suppresses the growth of rooted aquatic vegetation. The capacity of the vegetation to uptake P from the sediments and retain it in biomass is reduced, resulting in more nutrients available for internal loading and feeding cyanobacteria blooms, thereby promoting a positive feedback cycle.

The water temperature of Pigeon Lake is another important factor affecting water quality, as cyanobacteria are known to have a competitive advantage over other phytoplankton in warmer waters. Water temperature varies both seasonally and diurnally, though the shallow basin in Pigeon Lake limits thermal stratification and results in largely consistent temperatures and dissolved oxygen levels throughout the water column.

Metals are naturally present in aquatic environments as an artifact of rock weathering, though elevated levels of certain metals may be indicative of industrial pollution. While 27 metals were detected in Pigeon Lake water column samples in 2003, 2012, and 2014-2017, all of these occurrences were well below their respective water quality guidelines.

Paleolimnological Sediments Studies

The water quality of Pigeon Lake has been well monitored within recent decades in response to the eutrophication and frequent cyanobacteria bloom events that currently affect the lake. However, the existing water quality data record do not cover large periods of Pigeon Lake's watershed development during the mid-20th century, resulting in limited data available to determine whether the lake water quality and algal dynamics baselines have changed over time.

In 2013, a paleolimnological study of Pigeon Lake was undertaken to examine changes in lake water quality over the past century (~1900-2013) using multiple indicators in lake sediments (Köster et al. 2014). Analysis of sediment cores revealed that Pigeon Lake is naturally rich in nutrients and cyanobacteria, with an enrichment of organic materials, P and cyanobacteria counts in the 1950s corresponding to watershed development. Over the entire study period, a slight increase in cyanobacteria abundance relative to other phytoplankton taxa was observed. Additionally, calmer waters and increased lake ion content within the past 20 years were inferred based on phytoplankton community data.

As Pigeon Lake is a naturally productive lake, a realistic water quality management target would be to maintain a water quality standard sufficient for normal recreational use with limited algae blooms. In other words, an acceptable water management target would be to lower nutrient concentrations to a point where the lake maintains excellent fish and wildlife productivity, but enough to reduce the frequency and intensity of algal blooms. As such, realistic expectations of watershed and water quality improvements are necessary. Cyanobacterial blooms are driven not only by watershed activities but also by water temperatures, wind and solar radiation, and internal nutrient loadings.

Food Web Studies

Manipulation of the relative abundances of organisms higher up in the food chain can be an effective approach to regulate cyanobacteria populations under certain conditions. One such approach is to increase the abundance of herbivorous zooplankton and thereby increase the amount of grazing pressure on the cyanobacteria. Researchers from the University of Alberta have begun to conduct such experiments in enclosed systems in Pigeon Lake. More research needs to be conducted to determine if a reduction in cyanobacteria levels in Pigeon Lake may be achieved through a top-down grazing approach before biomanipulation efforts can proceed.

Paleolimnological analysis of sediment cores indicates that cyanobacteria have been part of the phytoplankton community at Pigeon Lake for at least a century. However, favorable water conditions in recent years may have facilitated the excess proliferation of cyanobacteria into blooms. These conditions include not only excess nutrient (i.e., P) availability but also may include climate-related factors such as increased water column stability (due to altered wind patterns) and warmer surface water temperatures. While the exact mechanisms leading to bloom formation in Pigeon Lake are currently unknown, warmer and calmer waters likely give cyanobacteria a competitive advantage over true algae. Because these environmental conditions change seasonally and annually, however, prediction of cyanobacterial bloom occurrence, intensity, duration and location is difficult.

Due to its large size and shallow depth, the waters of Pigeon Lake are relatively well-mixed and thus well-oxygenated. Both dissolved oxygen levels and temperature are relatively consistent throughout the water column (albeit with seasonal variation), with anoxic conditions (dissolved oxygen concentrations < 2 mg/L) developing at depths of 7 m or deeper. As a by-product of photosynthesis, phytoplankton release oxygen into the water column, meaning that during a bloom there is typically an initial increase in the

dissolved oxygen content of the water column. However, when the colony of phytoplankton eventually dies, the decomposition of such a large quantity of biomass consumes much of the dissolved oxygen in the water column and may deplete the oxygen content of the water to critically low levels. Extensive asphyxiation and mortality of other aquatic life can occur, resulting in fish kills.

The fish populations of Pigeon Lake have been monitored for decades, though the precise interactions between cyanobacteria and the fish community are unknown. Dominance of the phytoplankton community by cyanobacteria may disrupt the balance in the natural food web structure of the lake, and thus affect the amount and quality of food for fish. Similarly, blooms may also cause environmental conditions unfavorable to fish health such water high in turbidity and low in oxygen.

In addition to these environmental stressors, fishes such as Walleye (*Sander vitreus*), Northern Pike (*Esox lucius*), Lake Whitefish (*Coregonus clupeaformis*), and Yellow Perch (*Perca flavescens*) have been subject to direct anthropogenic pressures such as habitat modification, angling, and commercial fishing. Despite being a large lake, Pigeon Lake is subject to greater fishing pressure than smaller lakes due to deeper areas of the lake being unusable as fish habitat. Consequently, both fish and anglers are concentrated into the small areas of suitable habitat. Any changes to the amount of available habitat or the existing angling rates will place more pressure on the fish populations and may contribute to a fishery collapse.

Overharvesting appears to have led to the extirpation of Walleye from Pigeon Lake in the 1950s, and the current sustainable population in the lake is the result of intensive stocking efforts in the 1990s. Lake Whitefish populations have fluctuated considerably over the past century but are currently considered to be stable. A large Lake Whitefish mortality event in 2012 was thought to be due to lake temperature but does not seem to have negatively affected overall populations. In Alberta the commercial fishery was ended in 2014. The Northern Pike populations in Pigeon Lake are considered collapsed, and a zero-catch limit was imposed as of April 1, 2016. Factors which may have contributed to this decline include the extirpation of this species in the 1950's, loss of littoral spawning and feeding habitat, direct competition with the reintroduction of Walleye as an apex predator, and overfishing. Similarly, Yellow Perch populations are considered to be in a vulnerable to collapsed state. All species are under threat from ongoing habitat loss and overfishing.

BMPs from Other Jurisdictions

The APLM technical committees have reviewed several methods that have been implemented in other jurisdictions to address excess lake nutrient levels and harmful algal blooms. Treatment options which may be feasible include:

- Short-term treatment options (removal of phytoplankton)
    - Biomanipulation to support top-down biological control of cyanobacteria
    - Harvesting phytoplankton from the water surface and shorelines and
- Longer term treatment options (inactivation of nutrients)
    - Chemical inactivation of P in the water column via addition of alum, calcium, iron or lanthanum-enriched bentonite clay (e.g., Phoslock®)

These approaches are currently being reviewed to determine their viability to treat the current water quality problems in Pigeon Lake; however, the circumstances supporting their efficacy at one lake may not be true when applied to another. Review of these strategies requires lake-specific research, environmental and socio-economic risk assessments (including evaluation of potential risks to the lake, financial costs, and overall efficacy), and formal stakeholder consultation and regulatory approval prior to implementation.

Plan Implications

- To maintain the natural functioning of an aquatic ecosystem adapted to nutrient-rich conditions, an appropriate management target would be to maintain a water quality level amenable for recreational use with a minimal occurrence of algae blooms.
- Pigeon Lake is naturally nutrient-rich, with the P loading into the water column from both the watershed and lake sediments. Thus, actions should be taken to reduce both external and internal nutrient loading into Pigeon Lake, though the allocation of efforts between these sources may vary due to technical, financial, and feasibility considerations. Development of a nutrient reduction model may be an effective approach to determine what combination of activities will result in the most effective remediation with a relatively low level of risk.
- The existing P budget for Pigeon Lake should be recalculated with the additional P data collected from the lake and inflowing streams, including the importance of the spring runoff (freshet), with updates to better reflect the true imports and export rates. For example, the current P budget does not account for biological sources of P, such as that in water-bird excrement or in the biomass of stocked fishes. In addition, the nutrient budget should consider the impact of bioavailable vs particulate P for source identification.
- In addition to increased nutrient availability, cyanobacteria blooms are likely driven by several additional factors such as increased water stability (both turbulence and thermodynamically), changing climate conditions, increased light availability, and shoreline modification. Further research is necessary to identify the interactions of these and other factors and to determine the mechanisms responsible for cyanobacteria bloom dynamics. For example, analysis of long-term water quality and phytoplankton community data may reveal the physical or chemical drivers behind seasonal phytoplankton community shifts favoring cyanobacteria dominance.
- A comprehensive water quality model should be developed for Pigeon Lake to assist with lake management. This could allow various management scenarios to be run and their effects on the lake ecosystem to be predicted, such anticipating potential trophic cascades or simulating the effects of supplemental water inputs on nutrient dynamics. Such a model would ideally incorporate all available hydrological, ecological, and water quality data for Pigeon Lake and its watershed to support informed decision-making.
- Accurate and up-to-date water quality data for Pigeon Lake are essential for updating the P budget and the development of an effective lake- and watershed-scale water quality model.
- Robust fish populations are important to both the ecology of Pigeon Lake and the sustainability of recreational and First Nations fisheries. Additional study of how fish populations interact with cyanobacterial blooms is warranted. Managing fish populations may provide a tool to assist in managing cyanobacterial blooms. In the meantime, a conservative fisheries management approach is recommended.

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APPENDIX D: GLOSSARY

Preface

This Glossary defines technical terms used in the Pigeon Lake Watershed Management Plan 2017 and Appendix C Technical Summary. These are technical terms which are in use by professionals for the management of Lakes and Watersheds in Alberta. Technical terms have been derived from two primary Alberta authorities. Environmental planning terms are derived largely from the latter GoA collection plus broadly sourced.

- Alberta Lake Management Society (ALMS): https://alms.ca/educational-resources/
- Government of Alberta: http://aep.alberta.ca/water/programs-and-services/water-for-life/partnerships/documents/8043.pdf

The reader is referred to the source authorities (above) for technical definitions not found below and for the definition source authorities.

Selected terms have been retained in this collection which are relevant to the Pigeon Lake Watershed Management Plan.

TECHNICAL TERMS – WATERSHED, LAKE MANAGEMENT & ENVIRONMENTAL PLANNING

Adaptive Management

A dynamic system or process of task organization and execution that recognizes the future cannot be predicted perfectly. Planning and organizational strategies are reviewed and modified frequently as better information becomes available. Adaptive management applies scientific principles and methods to improve management activities incrementally as decision-makers learn from experience, collect new scientific findings, and adapt to changing social expectations and demands. (SEM)

Algae

Aquatic, nonvascular organisms which typically contain chlorophyll and usually include the green, yellow-green, brown, and red algae and the blue-green algae (also known as cyanobacteria). (ALMS)

Algal Bloom

Population explosion of algae in surface waters due to an increase in plant nutrients such as nitrates and phosphates.[8] Usually due to excessive blue green algae growth. (ALMS)

Bacteria

Tiny, unicellular organisms that reproduce by cell division and usually have cell walls; can be shaped like spheres, rods or spirals and can be found in virtually any environment. (ALMS)

Beneficial Management Practices (BMPs)

Techniques and procedures that have been proven through research, testing, and use to be the most effective and appropriate for use in Alberta.

Effectiveness and appropriateness are determined by a combination of: (1) the efficiency of resource use, (2) the availability and evaluation of practical alternatives, (3) the creation of social, economic, and environmental benefits, and (5) the reduction of social, economic, and environmental negative impacts. (BRBC)

Benthic

Referring to bottom zones or bottom-dwelling forms. (ALMS)

Benthos

Animals and plants living on or within the substrate of a water body (freshwater, estuarine or marine). (ALMS)

Bioavailability

The amount of a nutrient that is in a form that is available for uptake and use by biological organisms. (ALMS)

Biodiversity

The existence of a wide range of different types of organisms in a given place at a given time. (ALMS)

Chlorophyll

A green, light-absorbing pigment found in plants and other photosynthetic organisms. A magnesium-porphyrin complex, it is an essential electron donor in photosynthesis. The amount of chlorophyll present in lake water depends on the amount of algae and is therefore used as a common indicator of water quality. (ALMS)

Clarity

A measure of the light penetration of water, generally measured using a Secchi disk. (ALMS)

Conservation

1. The planning, management, and implementation of an activity with the objective of protecting the essential physical, chemical, and biological characteristics of the environment against degradation. (EPEA)

2. The process of managing biological resources (e.g., timber, fish) to ensure replacement by re-growth or reproduction of the part harvested before another harvest occurs. A balance between economic growth and environmental and natural resource protection. (G&G glossary)

Cumulative Effects

The combined effects on the aquatic environment or human developments arising from the combined environmental impacts of several individual projects. (WCAG)

Cyanobacteria

A group of aquatic bacteria (also known as blue-green algae) that are capable of photosynthesis. Excessive amounts of cyanobacteria (harmful algal blooms) can negatively impact water quality through production of natural toxins (e.g., microcystin) and through depleting water oxygen levels. (ALMS)

Decomposition

The breakdown of dead organic material through physical, chemical and biological processes. (ALMS)

Detritus

Undissolved organic or inorganic matter resulting from the decomposition of biological parent material. (ALMS)

Dissolved Oxygen

The amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of

water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water (ppm). (ALMS)

Drainage Basin

The total area of land that contributes water and materials to a lake, river, or other water body, either through streams or by localized overland runoff along shorelines. (SWQG)

Diffuse Phosphorus Load

Diffuse is associated with particular land uses as opposed to individual points of origin or discharge. Diffuse phosphorus loading can arise from activities related to agriculture, forestry, urban development, mining, oil and gas, construction, and recreation. Such diverse sources along with the fact that diffuse sources can be transported by rainwater, snowmelt, runoff, air deposition and groundwater, make it difficult to prevent, measure, control, quantify and manage this type of pollution. Land surface (e.g., slope), soil texture, geology, vegetation, hydrology and climate also affect the timing and extent of Diffuse loads. (also known as non-point source pollution; also see pollution)

Ecosystem

A community of interdependent organisms together with the environment they inhabit and with which they interact. (BRBC)

Ecosystem Functions

Processes that are necessary for the self-maintenance of an Ecosystem such as primary production, nutrient cycling and decomposition. The term is used primarily as a distinction from values. (NALMS)

Environment

The components of the earth, including air, land, and water, all layers of the atmosphere, organic and inorganic matter, living organisms, and their interacting natural systems. (EPEA)

Environmental Indicator

A measurement, statistic or value that provides a proximate gauge or evidence of the effects of environmental management programs or of the state or condition of the environment. (NALMS)

Environmental Outcome

The desired environmental end state defining the specific conditions or functions that one expects for the environment. An outcome is an event, occurrence, or condition that results from an activity or program that has an actual effect on resources, the environment, or Albertans. (IHCR

Environmentally Significant Area (ESA)

ESA's are identified areas containing rare or unique elements in the province, or areas that include elements that may require special management consideration due to their conservation needs. ESAs do not represent government policy and are not necessarily areas that require legal protection, but instead are intended to be an information tool to help inform land use planning and policy at local, regional and provincial scales.

Erosion

Movement of soil by water or wind. (ALMS)

Eutrophic

Rich in dissolved nutrients, photosynthetically productive and often deficient in oxygen during warm weather. (ALMS)

Eutrophication

The process by which lakes and streams are enriched by nutrients, and the

resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients–mostly nitrates and phosphates–from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile). (ALMS)

Evapotranspiration

Loss of water by evaporation from the soil and transpiration from plants. (ALMS)

Exotic Species

Plant or animal species introduced into an area where they do not occur naturally; non-native species.1 Examples area Eurasian Milfoil and Purple Loosestrife. (ALMS)

Flushing Rate/Retention Time

Flushing rate is the rate of water replacement in a lake. Its unit of measure is times/year. Conversely, retention time is the average length of time water resides in a lake, ranging from several days in small impoundments to many years in large seepage lakes. Retention time is important in determining the impact of nutrient inputs. Long retention times result in recycling and greater nutrient retention in most lakes. Calculate retention time by dividing the lake volume by the volume of water passing through the lake in one year. (ALMS)

Food Chain

The transfer of food energy from plants through herbivores to carnivores. An example: insect-fish-bear or the sequence of algae being eaten by small aquatic animals (zooplankton) which in turn are eaten by small fish which are eaten by larger fish and eventually by people or predators. (ALMS)

Geographic Information Services (GIS)

A set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes.

Geospatial

Fusion of geography and information technology collection, management, analysis and integration of geo/location-based data to enable improved decision and policy making.

Geospatial Data

Data pertaining to the geographic location and characteristics of natural/constructed features and boundaries on, above, or below the Earth's surface.

Healthy Aquatic Ecosystem (Healthy Lake)

An aquatic environment that sustains its ecological structure, processes, functions, and resilience within its range of natural variability. Alberta Water Council. 2008

Hydrological Cycle

Refers to the processes by which water moves in the global environment. Includes condensation, precipitation, runoff, storage and evapotranspiration, and quantitatively measured using distribution and concentration. (ALMS)

Kjeldhal Nitrogen

The most common analysis run to determine the amount of organic nitrogen in water. The test includes ammonium and organic nitrogen. (ALMS)

Littoral

Pertaining to or along the shore, particularly to describe currents, deposits, and drift. (ALMS)

Macrophytes

A member of the rooted aquatic plant life of an area, especially of a body of water. Typically refers to emergent plants such as cattails and reeds. (ALMS)

Microcystin

A group of toxins naturally produced by certain species of cyanobacteria. Harmful to human, animal and ecological health in sufficient concentrations. (ALMS)

Morphometry

Measurement of external form.[7] Lake morphometry includes maximum and average depth, surface area, volume, shoreline length, basin shape, etc. (ALMS)

Nitrogen Fixation

The conversion of atmospheric nitrogen (N_2) into an organic form usable by plants and other organisms; nitrogen is typically fixed by bacteria that live in nodules on the roots of legumes and similar plants. (ALMS)

Nutrients

Elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth. (ALMS)

Oligotrophic

Describes a body of water in which nutrients are in low supply. (ALMS)

Orthophosphorus

Dissolved inorganic phosphorus. The dissolved inorganic form of phosphorus that is immediately bio-available for absorption by algae. Also, can be referred to as soluble reactive phosphorus (SRP). Chemical formula is PO_4^{3-}.(ALMS)

Pathogen

A disease-producing agent; usually applied to a living organism. Generally, any viruses, bacteria, protozoans or fungi that cause disease. (ALMS)

Phosphorus

Key nutrient influencing plant growth. Soluble reactive phosphorus (orthophosphorus) is the amount of phosphorus in solution that is readily available or Bioavailable to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form. (ALMS)

Photosynthesis

Process through which light energy, water, and carbon dioxide are converted to carbohydrate and oxygen in the presence of chlorophyll. Occurs in plants, algae, cyanobacteria and lichens. (ALMS)

Phytoplankton

Microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short. (ALMS)

Plankton

Small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly though the water. (ALMS)

Point-Source Pollution or Non-Point Source Pollution

Pollution that originates from one, easily identifiable cause or location, such as a sewage treatment plant or feedlot. (WFL)

Pollutant

A contaminant in a concentration or amount that adversely alters the physical, chemical, or biological properties of the natural environment.

Pollution

Cumulative effect of a pollutant or combination of pollutants on the natural environment of a location or locations. Two types are:

- Point-Source Pollution: that originates from one, easily identifiable cause or location, such as a sewage treatment plant, outfall or feedlot.
- Non-Point Source Pollution: that enter a water body from diffuse or undefined sources and are usually carried by runoff. Examples of non-point sources include agricultural land, coal mines, construction sites, roads, and urban areas. Because non-point sources are diffuse, they are often difficult to identify or locate precisely, and are therefore difficult to control.

Restoration

Measures undertaken to return a degraded ecosystem's functions and values, including its hydrology, plant and animal communities, and/or portions thereof, to a less degraded ecological condition. (ALMS)

Riparian

Pertaining to the banks of a river, stream, waterway, or other, typically, flowing body of water as well as to plant and animal communities along such bodies of water. (NALMS)

Riparian lands are transitional areas between upland7 and aquatic ecosystems. They have variable width and extent above and below ground and perform various functions. These lands are influenced by and exert an influence on associated water bodies8, including alluvial aquifers9 and floodplains. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and hydrological processes. Alberta Water Council

Residence Time

Length of time that water will remain in a lake or other water body.

Secchi Disk

A 20 cm (8 inch) diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days. (ALMS)

Sedimentation

The process of or accumulation of sand and dirt settling on the bottom of a lake. (ALMS)

Shore

The edge of a body of water and includes the land adjacent to a body of water that has been covered so long by water as to wrest it from vegetation or as to mark a distinct character on the vegetation where it extends into the water or on the soil itself. (PSSSPH)

Stakeholder

An individual, organization, or government with a direct interest in a particular process or outcome. (SEM)

State of the Watershed Report

A document that identifies the current condition of a watershed including the physical, chemical, and biological characteristics of its surface and groundwater and the pressures acting on it. (Partnerships)

Stewardship

Stewardship

A principle or approach whereby citizens, industry, communities, and government work together as stewards of the province's natural resources and environment. In general terms, stewardship means managing one's life, property, resources, and environment with regard for the rights or interests of others. This can apply to a person, company, community, government or group. Stewardship is an ethic and a value that results from public education and partnerships. It is people-focused in the sense that it relies on the desire

and ability of people to make good decisions on their own accord that help resource and environmental outcomes. (SEM)

Stratification

The layering of water due to differences in density. Water's greatest density occurs at 4 °C (39 °F). As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to a depth of about 6.5 m (20 feet). The narrow transition zone between the epilimnion and cold bottom water (hypolimnion) is called the metalimnion or thermocline. (ALMS)

Surface Water

Water bodies such as lakes, ponds, wetlands, rivers, and streams, as well as groundwater with a direct and immediate hydrological connection to surface water (for example, water in a well beside a river). (SSRB)

Suspended Solids

A measure of the particulate matter in a water sample, expressed in milligrams per liter. When measured on inflowing streams, it can be used to estimate the sedimentation rate of lakes or impoundments. (ALMS)

Sustainability

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (UN)

The balancing of opportunities for growth with the need to protect the environment. It reflects a vision of a vibrant economy and a healthy environment. Regarding renewable resources (e.g.: water, timber, fish, and wildlife), sustainability involves managing renewable natural resources so that their status, condition, or use is maintained over time. In this context, the use of a renewable resource, or impacts on it from other human activities, should not exceed its capacity to maintain itself through re-growth, reproduction, and management practices. Regarding non-renewable resources (e.g.: coal, oil, gas, and minerals), sustainability involves the development of resources in a responsible manner. This means protecting the environment during the construction and operation phases and ultimately reclaiming the land disturbed by development. In this context, non-renewable resource development is a temporary land use. (SEM)

Transpiration

The passage of water in plants from the roots through the vascular system to the stoma of the leaves and into the atmosphere. (ALMS)

Trophic Levels

A classification of organisms according to what they eat and their relative position in the food chain (e.g., primary producers, herbivores, predators, decomposers). (ALMS)

Trophic State

Eutrophication is the process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lake's trophic classification or state: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile). (ALMS)

Turbidity

Degree to which light is blocked in water because water is muddy or cloudy. (ALMS)

Upland

An area of dry land surrounding or upstream of a water body. (WCW)

Water Act

A piece of provincial legislation in Alberta used to protect the quality of water and manage its distribution. The Water Act regulates all developments and activities that might affect rivers, lakes, or groundwater. (WFL)

Water Body

Any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent, or occurs only during a flood. This includes, but is not limited to, wetlands and aquifers. (WFL)

Water for Life: Alberta's Strategy for Sustainability

The Government of Alberta's water management approach, outlining a comprehensive set of strategies and actions that will ensure Albertans have safe, secure drinking water, healthy aquatic ecosystems, and a reliable quality water supply for a sustainable economy. (GWMT)

Water Management

The protection and conservation of water and aquatic ecosystems, including their associated riparian area. In Alberta, several agencies have a mandate in this area. Alberta Environment is responsible for water quality, quantity monitoring, and water allocations. Under the Water Act a Director can set Water Conservation Objectives to protect minimum flow and aquatic ecosystem health. Stakeholders can recommend Water Conservation Objectives to a Director via a Water Management Plan or an Approved Water Management Plan. Alberta Sustainable Resource Development (SRD) manages crown lands including the bed and shores of all water bodies. SRD, through its Fish and Wildlife Division, is also responsible for fisheries and wildlife management. In addition, the Federal Department of Fisheries and Oceans upholds a no-net-loss policy in its mandate to protect fisheries habitat under the Federal Fisheries Act. (Partnerships)

Water Quality

A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. (ALMS)

Water Quantity

The volume or amount of water. (FWMP)

Watercourse

The bed and shore of a river, stream, lake, creek, lagoon, swamp, marsh or other natural body of water, or a canal, ditch, reservoir or other artificial surface feature made by humans, whether it contains or conveys water continuously or intermittently. (EPEA)

Watershed

Watershed - An area of land, bounded by topographic features, that drains into a shared destination such as a river, stream, lake, pond or ocean. The size of a watershed can be tiny or immense and its boundaries and velocity of flow are determined by land forms such as hills, slopes and mountain ranges that direct water. Within each large watershed, there are many smaller watersheds.

Watershed Approach - Place-Based Approach

A way of thinking and acting that focuses efforts within a watershed, taking into consideration both ground and surface water flow. This approach recognizes and plans for the interaction of land, water, plants, animals, and people. Focusing efforts at the watershed level gives the local watershed community a comprehensive understanding of local management needs and encourages locally led management decisions. (WFL)

Watershed Management / Water Management

The protection and conservation of water and aquatic ecosystems, including their associated riparian area. Because land use activities on the uplands of a watershed can affect ground and surface water quality and quantity, a

broader, more comprehensive approach to planning is often required. A Watershed Management Plan may look at water quantity, water quality, aquatic ecosystems, riparian area, as well as a variety of land use issues as they impact water. Watershed management plans require water and land use managers to work together to ensure healthy watersheds. (Partnerships)

Watershed Management Plan Water Management Plan

A comprehensive document that addresses many issues in a watershed including water quantity, water quality, point and non-point-source pollution, and source water protection. It may or may not include a Water Management Plan. It may also examine ways to better integrate land and resource management within a watershed. (Partnerships)

Watershed Management Planning /Watershed Management Plan

A comprehensive, multi-resource management planning process involving all stakeholders within the watershed, who, together as a group, cooperatively work toward identifying the watershed's resource issues and concerns as well as develop and implement a watershed plan with solutions that are environmentally, socially and economically sustainable. (NSWA)

Watershed Planning and Advisory Council (WPAC)

Collaborative, independent, volunteer organizations with representation from all key partners within the watershed. Their mandate is to engage governments, stakeholders, other partnerships, and the public in watershed assessment and watershed management planning, while considering the existing land and resource management planning processes and decision-making authorities. (Partnerships)

Watershed Stewardship Group (WSG)

Community-based groups made up of volunteer citizens, often supported by local businesses and industries, who have taken the initiative to protect their local creek, stream, stretch of river, or lake. These proactive groups develop on-the-ground solutions to ensure the protection of their specific watersheds. (WFL)

Wetland

Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, water-loving vegetation, and various kinds of biological activity which are adapted to a wet environment.

Zooplankton

A community of floating, aquatic, minute animals and non-photosynthetic protists. (ALMS)

GENERAL PLANNING TERMS

Collaboration

A process through which parties that see different aspects of a problem can explore constructively their differences and search for (and implement) solutions that go beyond their own limited vision of what is possible. Collaboration is a mechanism for leveraging resources; dealing with scarcities; eliminating duplication; capitalizing on individual strengths; building internal capacities; and increasing participation and ownership strengthened by the potential for synergy and greater impact.

Intermunicipal Dispute

A municipality holding the opinion that a statutory plan, land use bylaw or amendment adopted by an adjacent municipality will have a detrimental effect on it.

Dispute Resolution

The process to inform and negotiate a mutually beneficial resolution of a defined intermunicipal dispute. If a mutually beneficial negotiation cannot be achieved the municipalities can seek a resolution through mediation and, ultimately through an appeal to the Municipal Government Board.

Framework

An organized structure of policies, legislation, programs and tasks created to achieve a specific outcome. There can be frameworks for broad policies and strategic initiatives at various scales (e.g. provincial, regional, sector, media); programs and program delivery; and short-term tasks and projects. (SEM)

Growth

Growth of a region or municipality is defined as increase in its size, population or employment.

Governance

The process of decision-making and the process by which these decisions are implemented.

Guideline

A specific performance measure that is not legally binding unless designated in legislation. It is a guide or indication of a future course of action. It describes how something will be accomplished. It may contain numerical performance measures and may deal with multiple uses of water.

Objective

The result of either planned or unplanned actions. For planning purposes, "objectives" are the desired endpoint and should guide the development and implementation of related programs. Outcomes can be broad and long-term in nature or focused. They are used in both direction setting and performance measurement.

Partnership

A relationship in which individuals or organizations share resources and responsibility to achieve a common objective, as well as any resulting rewards or recognition. It often includes a formal contract, new resources and shared risks and rewards. The structure includes a central body of decision-makers whose roles are defined. The links are formalized. Communication is frequent, the leadership is autonomous, and the focus is on specific issues. Partnerships are a form of collaboration.

Methods

The methods are formal agreements between organizations that are sharing people, technology, process or data and explain how the item is being shared and sets out the means and systems CRGIS will adopt when they collect, store, access, compile and analyze information about the region

Policy

1. A governing principle, plan, or consistent course of action developed in order to meet recognized needs and to achieve specific measurable outcomes. Policies are normally broad, conceptual documents that outline approaches and/or considerations to be taken into account by decision makers. Policies do not act as constraints, but provide information. (SEM)

2. A statement of intent that is not legally binding. It sets direction and expectations for activities.

Provincial Land Use Framework

A policy of the Government of Alberta to introduce and implement regional land use plans to ensure the long-term health of Alberta's communities, economy and the environment.

Public and Stakeholder Involvement

The process used to obtain advice or recommendations from a community and engage them in decision-making. Public and stakeholder involvement is an umbrella term that includes a range of interactive approaches including information and education, consultation, collaboration, partnerships, and delegated authority.

Referral

Involves informing adjacent jurisdictions of new or amended plans, land use bylaws or new development proposals providing opportunity to comment on how the proposal may impact them.

Recreation Corridor

Inter-connected crown, public or private lands that are generally linear in form and are of regional significance for the purpose of providing recreational opportunities, such as the Trans Canada Trail, walking trails and parks and open space in the North Saskatchewan River Valley. Regional Recreation Corridors may also provide access to municipal recreation opportunities.

Region

Region, specifically the geographic area contained within the participating jurisdictions.

Regional

Relating to the Region, whether by geographic proximity or by the impact that actions or decision may have on others.

Stakeholder

An individual, organization, or government with a direct interest in a particular process or outcome.

Strategy / Strategic

A perspective, position, or plan developed and undertaken to achieve goals. It is the bridge between policy and concrete actions that outlines how a policy will be implemented to achieve its goals. (SEM)

MUNICIPAL AND REGIONAL PLANNING TERMS

Area Structure Plan (ASP)

A statutory plan identifying many neighbourhoods where residential, commercial, institutional and recreational areas will be located in a previously undeveloped area. These plans also describe the number of people expected to live in the new area and how development will be staged over time.

Development

A change in the use or intensity of use of land or a building or an act done in relation to land or a building that results in or is likely to result in a change in the intensity of use of land or building.

Intermunicipal Development Plan (IDP)

A statutory plan containing broad-based policies that are prepared by two or more neighbouring municipalities. Their main purpose is to ensure that future growth reflects the mutual and individual interests of the municipalities involved. Typically, the focus is on the boundary area between rural and urban municipalities.

Land Use Bylaw (LUB)

A Bylaw that divides a municipality into land use districts and establishes procedures for processing and deciding upon development applications. It sets out rules that affect how each parcel of land in a municipality may be used and developed.

Liveability / Quality of Life

The environmental and social quality of an area as perceived by residents, employees, customers and visitors. This includes safety and health (traffic safety, personal security, and public health), local environmental conditions (cleanliness, noise, dust, air quality, and water quality), the quality of social interactions (neighbourliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics, and existence of unique cultural and environmental resources (e.g. historic structures, mature trees, traditional architectural styles).

Low Impact Development (LID)

A land planning and engineering design approach for managing stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. This approach implements engineered small scale hydrologic controls to replicate the predevelopment hydrologic regime of watersheds through infiltrating, storing, evaporating, and detaining runoff close to its source.

Municipal Development Plan (MDP)

A statutory plan that functions as a municipality's overall policy guide for future growth and development. The Plan outlines the direction of future development, the provision of transportation systems and municipal services, the coordination of municipal services and programs, environmental matters and economic development.

Municipal Government Act (MGA)

The primary provincial legislation that governs municipalities is known as the Municipal Government Act or MGA. The MGA sets out legislated roles and responsibilities of municipalities and municipal officials.

Municipal Reserve (MR)

Lands designated as "Municipal Reserve" are lands for schools, parks and public recreation purposes provided by the developer as part of the subdivision process.

Non-statutory Plan

A plan adopted by a municipality by resolution to address land use planning or master planning needs.

Redevelopment

The creation of new units, uses or lots on previously developed land in existing urban communities, including brownfield sites.

Statutory Plan

A plan approved by a municipality under the authority of the Municipal Government Act (MGA) with the passage of a municipal bylaw. Examples of a statutory plan are: an inter-municipal development plan, a municipal development plan (MDP), area structure plans (ASP), neighbourhood structure plan (NSP) and area redevelopment plans (ARP).

Social Infrastructure

Social infrastructure, or soft infrastructure, can refer to services provided by or in municipalities such as hospitals, community and recreational facilities, public spaces, social housing, volunteer networks and community-based agencies.

INFRASTRUCTURE TERMS

Infrastructure

Physical assets to provide services to citizens and to support the functioning of a local or regional economy, including roads, sewer lines, transit, emergency response vehicles, recreational facilities, parks, information technology and more.

Infrastructure, Local

Infrastructure that has capital investment and maintenance requirements, including roadways, sidewalks, street lights and traffic signals, transit facilities, solid waste and water delivery systems, potable water distribution systems, storm sewers, sanitary sewers, sports fields, playgrounds, arenas, pools, police and emergency stations, civic buildings and parks to support the concept of complete communities.

Infrastructure, Regional

Infrastructure developed by the federal government, Province, municipality, and/or regional service and provincial commissions to provide services to citizens and businesses, and to support the function of a regional economy (e.g. major interchanges, post-secondary institutions, hospitals, bridges, highways, extension of light rail transit, regional water and/or sewer systems, power systems).

Utilities - Franchised

Facilities for gas, electricity, telephone, cable television, water, storm and sanitary sewer.

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PIGEON LAKE

watershed management plan 2018

appendices

Pigeon Lake Watershed Management Plan Steering Committee
Issued Aug 24, 2018

Working Together for a Healthy Watershed, Healthy Lake, and Healthy Community

TECHNICAL SUPPORT

(RECOMMENDED CITATION)

Pigeon Lake Watershed Management Plan Steering Committee (plwmp.ca). August 2018.
The Pigeon Lake Watershed Management Plan 2018 – Appendices.
Pigeon Lake Watershed Association (plwa.ca) and Alliance of Pigeon Lake Municipalities (aplm.org)

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ACKNOWLEDGEMENTS

Pigeon Lake Watershed Management Plan Steering Committee

Members *(alphabetical order)*

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Doris Bell**	Former Deputy Mayor, SV of Crystal Springs
Glenn Belozer	Councillor, Leduc County, APLM Rep
Wiebe Buruma	Alberta Agriculture & Rural Development
Don Davidson (Deputy Chair)**	Mayor, SV of Grandview, APLM Rep
Susan Ellis**	Executive Director, PLWA
Robert (Bob) Gibbs, (Chair)**	PLWA Director, WMP Committee Chair
Ruth Harrison	Former PLWA Board, AFGA, NSWA
Tom Karpa	Pigeon Lake Regional Chamber of Commerce
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APPENDIX A: IMPLEMENTATION PRIORITES

PLWMP 2018 Implementation Priorities

Updated 2018 - 0

Implementation priorities from the Pigeon Lake Watershed Management Plan-2018 found in the attached table. Notes regarding the use and interpretation of the tables are as follows:

1) PRESENTATION ORDER: The forty-six recommendations of the PLWMP 2018 are presented below sorted first by lead agency and second by time frame. This presentation of the recommendations sorted in this order is intended to facilitate the annual review of action priorities by each "Lead Agency" (see Roles column).
2) OBJECTIVE: Coloured Boxes in the first column visually relate to the eight objectives described in the main body of the Plan document and are repeated below.
3) TYPE: Three types of actions or recommendation are identified in the main body of the report and described on page 17. They include Policy, Community Action and Technical/Scientific.
4) ROLES: Roles are allocated into two types: Lead and Support. Being a "Lead" means that this agency or group is best suited to track and organize resources to make progress on the recommendation. Achieving outcomes with Lead organization internal resources is not necessarily expected or required. A Lead agency needs to work with organizations or resources can accomplish the identified outcomes. Descriptors for lead roles are as follows:

Roles:	Roles:	Roles:
Mun= Municipalities	PLWMP= Steering Committee	TS= Technical Specialist/ Researcher
SV= Summer Villages	LA= Local Authorities	FN= First Nation
APLM= Municipal Alliance	GoA= Government of Alberta	O= Operators (farm, golf course, etc.)
PLWA= Watershed Assoc.	NGO= Non-Governmental Organization	LA= Local Authorities

Note: Mun: the authority remains with each Municipality to separately act on a given recommendation. APLM (Alliance of Pigeon Lake Municipalities) provides a forum for municipalities to discuss practices and may recommend consideration by member councils, but final authority remains with the member councils

5) Time Frame: refers to time for substantial completion of recommendation. Lead time is often needed for movement on a given recommendation. Early actions are identified under Annual Priorities
6) Success Measure: Measures have been chosen based on the ability to measure outcomes.
7) Annual Priorities- 2018: An annual review of past progress and annual priorities would be conducted by The PLWMP Steering Committee.
8) LIVING PLAN & ANNUAL REVIEW: Lead agencies are requested to annually review recommendations under their purview, to determine and reassess priorities and report to the PLWMP Steering Committee.
9) PLWMP Steering Committee: this multi-stakeholder committee is the overall steward and coordinator of the PLWMP 2018. The Steering Committee needs to monitor progress and make course corrections as warranted, including reallocation of tasks and redefining time frames and success measures.

PLWMP 2018 OBJECTIVES

LAND COVER & BIODIVERSITY
OBJECTIVE 1: Increase land cover types (e.g. forest, wetlands) that have lower nutrient release rates, trap nutrients, and that promote biodiversity

LAND USE & PHOSPHORUS MANAGEMENT
OBJECTIVE 2: Improve phosphorus management for all land use activities to achieve a net reduction in nutrient runoff and promote biodiversity.

CLEAN RUNOFF
OBJECTIVE 3: Promote clean runoff practices to reduce the transport of nutrients to Pigeon Lake

GROUNDWATER QUALITY
OBJECTIVE 4: Protect groundwater that feeds into Pigeon Lake.

SHORELINES
OBJECTIVE 5: Improve the health and resilience of the shoreline and near-shore areas

PIGEON LAKE & IN-LAKE MANAGEMENT
OBJECTIVE 6: Improve knowledge about phosphorus and cyanobacteria dynamics affecting the lake to reduce phosphorus loading and the intensity of algae blooms.

OBJECTIVE 7: Investigate the feasibility and safety of in-lake options to reduce bloom formation and/or mitigate the effects of blooms and also to build local defences against harmful invasive species.

WORKING TOGETHER
OBJECTIVE 8: Improve regional collaboration, partnerships and organizational effectiveness to promote collective action for a healthy watershed, healthy lake and healthy community.

PLWMP 2018 Implementation Priorities

Arranged by: Recommendation Code

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-1 Land Cover & Biodiversity	1a	Land Conservation: Conserve watershed priority areas with protective designations, including: the Provincial Park, private land conservation purchases, conservation easements, environmental reserves, and land use districts.	Policy	Lead: PLWMP Support: NGO, GoA, Mun, PLWA	00 Ongoing	Additional 10% over entire watershed

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-1 Land Cover & Biodiversity	1b	Statutory Plans & Land Use Bylaws: Retain Natural Vegetation: Develop guidelines and implement policies and regulations within statutory planning documents and municipal land use bylaws to retain natural areas and wildlife corridor (e.g. 80% tree cover for 20-acre lots) within new subdivisions; and for the requirement for development permits for tree and natural vegetation removal on residential lots.	Policy	Lead: Mun Support: APLM, PLWMP	01 Short Term	100% municipal participation
OB-1 Land Cover & Biodiversity	1c	Statutory Plans & Land Use Bylaws: Wetlands: Implement policies and regulations in municipal planning documents to retain all wetlands and peatlands as nutrient traps. Implementation tools may include: · Requiring the delineation and classification of wetlands as a component of statutory plan development, subdivision or development permit applications. · Implementing development setbacks from wetlands and peatlands based on their classification	Policy	Lead: Mun Support: APLM, PLWMP	01 Short Term	100% municipal participation
OB-1 Land Cover & Biodiversity	1d	Restoration: Implement programs to encourage the restoration of natural vegetation on lands throughout the watershed including reforestation and restoration of wetlands using incentives such as the Alternative Land Use Services Program (alus.ca)	Community Action	Lead: PLWMP Support: Operators, Mun, GoA, PLWA, NGO	00 Ongoing	One project per year
OB-1 Land Cover & Biodiversity	1e	Mapping: map watershed priority areas such as wetlands, wildlife habitat, environmentally significant areas	Technical & Scientific	Lead: PLWMP Support: Mun, GoA, PLWMP	02 Medium Term	Task Completed
OB-2 Land Use & Phosphorous	2a-i	Statutory Plans & Land Use Bylaws: Lakeshore Environmental Area: Adopt an 800 metre "Lakeside Environmental Area" as per the Model Land Use Bylaw, that gives priority to land uses, policies, and environmental provisions designed to protect the lake from nutrient runoff. Policy provisions to include: · Requiring construction management plans with new development permit applications. · Restricting land uses within riparian areas that may increase runoff, increase the potential for contamination of groundwater, and/or impede the effectiveness of important recharge areas. · Restricting land uses within 800 metres of the lake where phosphorus and other nutrients, chemicals, or nutrient-rich sediment may pollute the waters of Pigeon Lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% municipal participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-2 Land Use & Phosphorous	2a-ii	. Requiring a development permit and providing guidelines for the stripping and grading of lands within 800 metres of the bank of Pigeon Lake. Where possible this activity should be discouraged and or sediment controls be implemented during and post construction to eliminate sediment loading of the lake during construction. · Requiring the application of local topsoil and native plants to be included in landscaping plans for new development and redevelopment areas. · Prescribing a maximum site coverage percentage for non-permeable surfaces on new development and re-development sites within 800 metres of Pigeon Lake. · Prescribing site coverage guidelines for natural vegetation cover that is compatible with FireSmart development principals. · Discouraging the compaction of soils during stripping and grading activities that may interfere with natural groundwater recharge and increase surface water runoff. · Prohibiting the excavation or filling in or clearing of all wetlands and stream courses and their associated riparian lands within 800 metres of the legal bank of Pigeon Lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% municipal participation
OB-2 Land Use & Phosphorous	2b	Lawn Fertilizers and Pesticides: Continue to provide education and support for watershed residents to eliminate lawn fertilizers and pesticides on residential properties and to promote alternative practices.	Community Action	Lead: PLWA Support: Mun	05 Largely Completed	Annual Programs,
OB-2Land Use &Phosphorous	2d	Existing Agricultural Operations: Encourage agricultural operators to participate in whole farm reductions in phosphorus runoff using the Alberta Agriculture and Forestry Phosphorus Management Tool and the Environmental Farm Plan Program, and to adopt beneficial management practices that reduce nutrient runoff. Promote agricultural erosion and sediment control practices (e.g. low tillage).	Community Action	Lead: CountiesSupport: PLWA, PLWMP, APLM, GoA	00 Ongoing	Sector Participation
OB-2 Land Use & Phosphorous	2e	New or Expanded Intensive Livestock Operations: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan	Policy	Lead: Mun Support: APLM, GoA, PLWA	00 Ongoing	No Intensive Livestock Operations

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-2 Land Use & Phosphorous	2f	Recreational Operations: Encourage recreational land uses (e.g. golf courses, campgrounds) to adopt beneficial management practices (e.g. Audubon Certification) that reduce nutrient run off and promote biodiversity.	Community Action	Lead: PLWA Support: PLWMP, Mun, NGO, GOA	00 Ongoing	Sector Participation
OB-2 Land Use & Phosphorous	2g	Oil and Gas Operations: Encourage all oil and gas operations to adopt a best management practices on all well sites, batteries, and processing operations to reduce contaminants and phosphorous rich runoff. Encourage future operations to minimize land disturbances.	Community Action	Lead: PLWA Support: PLWMP, NGO, GOA	02 Medium to 03 Long Term	Sector Participation
OB-3 Clean Runoff	3a	Roads: Eliminate salt and pesticide applications for all road allowances within 800 metres of the lake.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3b	Statutory Plans & Land Use Bylaws: New Subdivision Stormwater: Require all new developments to: · provide a storm water quality management plan that is net neutral or better in phosphorus release rates and incorporates low impact development drainage practices. · Regulating post development storm drainage flow to no net increase in amount or rate of water flow offsite. · When applicable, requiring developers to submit and follow Stormwater Site Implementation Plans (SSIPs) that comply with a Master Drainage Guidelines for the Watershed.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3c	Statutory Plans & Land Use Bylaws: Sediment and Erosion Control: all new developments and redevelopment to institute a construction erosion and sediment control plan.	Policy	Lead: APLM Support: Mun, PLWMP, PLWA	01 Short Term	100% Participation
OB-3 Clean Runoff	3d	Beaver Management: Manage beaver populations and natural structures in tributaries to promote nutrient trapping while adequately protecting infrastructure and property.	Policy	Lead: PLWA Support: PLWMP, Mun, GOA	00 Ongoing	100% Participation
OB-3 Clean Runoff	3e	Clean Runoff: Promote clean runoff practices on private and public properties as per the Alberta Clean Runoff Action Guide.	Community Action	Lead: PLWA Support: Mun, NGO, GoA	00 Ongoing	Increased Participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-3 Clean Runoff	3f	Water Quality Guideline: Develop a drainage water quality guide with quality and release rates guidelines for new major developments and proposed retrofits for existing drainage systems. Phosphorus is to be recognized as the water quality parameter of greatest concern for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Mun	02 Medium Term	Task Completion
OB-4 Ground Water	4a	Statutory Plans & Land Use Bylaws: Groundwater Conservation: Incorporate water conservation guidance tools into municipal statutory plans and development requirements.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	02 Medium Term	Task Completion
OB-4 Ground Water	4b	Statutory Plans & Land Use Bylaws: Groundwater Impact Assessments: Require new major developments in the watershed to demonstrate no negative impacts on existing groundwater users or the lake water supply.	Policy	Lead: MunSupport: APLM, PLWMP, PLWA	02 Medium Term	Task Completion
OB-4 Ground Water	4c	Wastewater Collection: Support the extension of a regional waste water system to lakeside communities including the two Pigeon Lake Provincial Park campsites.	Policy	Lead: Mun Support: APLM, PLWA, Local Authorities, GOA	02 Medium Term	Completion of system
OB-4 Ground Water	4d	Septic Fields: Eliminate septic fields for residential lots within the Lakeside Environmental Area	Policy	Lead: Mun Support: APLM, PLWA, Local Authorities, GOA	02 Medium Term	Elimination of remaining fields
OB-4 Ground Water	4e	Wastewater System Inspections: Promote regular inspections of both private and communal wastewater systems for integrity and leakage. Systems that fail are to be reported and repaired.	Policy	Lead: Mun Support: APLM, Local Authorities	00 Ongoing	100% Participation
OB-4 Ground Water	4f	Water Wells: Encourage home owners to adopt water conservation and well maintenance practices (e.g. GoA Working Well program)	Communit y Action	Lead: PLWA Support: Mun, NGO, GOA	00 Ongoing	Consistent Program
OB-4 Ground Water	4g	Industrial Groundwater Extraction: Monitor permit applications and Intervene where warranted on behalf of the watershed to maintain groundwater flows to the lake.	Communit y Action	Lead: PLWA Support: Mun, NGO,	00 Ongoing	Effective Monitoring

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-5 Shorelines	5a	Statutory Plans & Land Use Bylaws: Shoreline and Tributary Setbacks: · For Sensitive shore lands: implement restrictive land use designations that preserve natural buffers · For new subdivisions: implement development setbacks from the surveyed shoreline of the Lake for new development, based on riparian setback guidelines with a minimum of 30 m, including restrictions for tree and vegetation clearing. At time of subdivision, where existing development would not make the provision of an environmental reserve inappropriate, require the provision of a 30-metre-wide environmental reserve adjacent to the shoreline of the lake. · For existing lot redevelopment: establish a minimum building setback as per guidelines set out in the Model Land Use Bylaw.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	01 Short Term	Task Completed 100% municipal participation
OB-5 Shorelines	5b	Statutory Plans & Land Use Bylaws: Shoreline Modification: Require bylaw provisions consistently across the watershed that any shoreline modification requires a development permit for lands above and abutting the legal bank. Municipal policies need to ensure that above legal bank modification approvals are conditional to a Provincial permit being in place for related modifications to the shore below the legal bank. Except for reasonable access shore lines are to be kept in a natural state. Modifications include regrading, natural vegetation clearing, drainage modifications.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA	00 Ongoing	No shoreline modifications without approvals
OB-5 Shorelines	5c	Restoration of Aquatic Vegetation: Retain and re-establish cattail and reed beds to support fish habitat, provide erosion protection and filter nutrients.	Policy	Lead: GoA Support: Mun PLWA	00 Ongoing	Increased compliance
OB-5 Shorelines	5d	Lake Shoreline Property Management Guidelines: Develop a checklist and reference guide to assist development officers and lot owners in addressing the special development requirements for shore line lots. (e.g. On the Living Edge Update)	Community Action	Lead: PLWMP Support: PLWA, APLM, Mun	01 Short Term	Task Completion
OB-5 Shorelines	5e	Shoreline Practices and Restoration: Provide guidance documents, incentive programs, technical information, and support to shoreline landowners to implement healthy shoreline practices, shoreline restoration, and lake-friendly landscaping.	Community Action	Lead: PLWA Support: Mun, NGO, GOA	01 Short Term	50% Participation

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-5Shorelines	5f	Algal Biomass: Provide guidance and support for landowners on addressing algal biomass accumulation along shorelines.	Community Action	Lead: MUN / PLWMP, Support: APLM GoA	00 Ongoing	Consistent information
OB-5 Shorelines	5g	Noxious Weeds: Continue invasive species eradication programs, including education, monitoring, and eradication of prohibited noxious weeds.	Community Action	Lead: MUN + PLWA Support: NGO	00 Ongoing	Outbreaks under control
OB-5 Shorelines	5h	Shoreline Health Assessment: update the Pigeon Lake shoreline and tributary shoreline health (riparian) assessment	Technical & Scientific	Lead: PLWMP Support: PLWA GOA	01 Short Term	Task Completion
OB-5 Shorelines	5i	Mapping: Undertake a comprehensive inventory of critical fish and wildlife habitat (such as Sensitive Habitat Inventory Mapping)	Technical & Scientific	Lead: PLWMP Support: PLWA	02 Medium Term	Task Completion
OB-6 Improve Knowledge	6a	Advancement of Science: Identify knowledge gaps relating to the formation of cyanobacteria blooms and techniques for meaningful reductions. Prioritize specific investigations and research projects. Source funds and implement ongoing research for Pigeon Lake.	Technical & Scientific	Lead: PLWMP Support: APLM, Technical Specialists, PLWA, GoA	00 Ongoing	Coordinated Published program.
OB-7 Invasive Species	7a	Invasive Species: Complement the Government of Alberta's province-wide efforts with local initiatives to improve education and build local defenses to keep out aquatic invasive species. Measures include monitoring, public education, signage, and other initiatives	Community Action	Lead: PLWA Support: APLM, Mun, Technical Specialists, PLWMP, GoA	00 Ongoing	Effective local program
OB-7 In-Lake Management	7b	In-Lake Management: Evaluate potential management options including project description, costs and financing; effectiveness in reducing phosphorus and algal blooms; reapplication frequency; environmental, social, and economic risks; and regulatory concerns. Implement where feasible.	Technical & Scientific	Lead: Mun Support: APLM, Technical Specialists	00 Ongoing	Coordinated published program.
OB-8 Working Together	8a	Statutory Regional Plans: Work toward a watershed-wide Intermunicipal Development Plan (IDP), Regional Collaboration Framework and a sub-regional plan under the North Saskatchewan Regional Plan that all align with the Pigeon Lake Watershed Management Plan. Measures of the Pigeon Lake Watershed Plan 2000 not addressed in the 2018 version will remain in effect until addressed in statutory Plan updates.	Policy	Lead: Mun Support: APLM, PLWMP, PLWA, GoA	01 Short Term	Task Completion

OBJECTIVE	Code	RECOMMENDATIONS	TYPE	ROLES	TIME FRAME	SUCCESS MEASURE
OB-8 Working Together	8b	Municipal Development Plans: Work toward consistent municipal development plans for all Summer Villages, that incorporate the environmental protection policies of the Watershed Management Plan and the Model Land Use Bylaw	Policy	Lead: Mun/APLM Support: PLWMP, PLWA, GoA, TS	01 Short Term	Task Completion
OB-8 Working Together	8c	First Nations: Engage the First Nations of IR 138A Pigeon Lake Reserve in the Watershed Management Plan.	Policy	Lead: PLWMP/ First Nations Support: APLM, PLWA, GoA	01 Short Term, to Ongoing	Ongoing
OB-8 Working Together	8d	Watershed Management Plan Updates: Revisit and update the Watershed Management Plan every five years and rewrite the Plan every ten years to accommodate the changing condition of the lake, success of current recommendations, new scientific knowledge, new legislation, and new stakeholder and organizational assets and interests.	Policy	Lead: PLWMP Support: APLM, PLWA, GoA	02 Medium to Long Term	Task Completion
OB-8 Working Together	8e	Assess Organizational Assets: Investigate organizational options to increase effectiveness, staff resources, financing, risk management, and accountability in undertaking watershed and lake management tasks, including coordination of scientific inquiry, action by municipalities, and community action.	Policy	Lead: PLWMP Support: APLM. PLWA, GoA	Short to 02 Medium Term	Task Completion
OB-8 Working Together	8f	Incentives to Promote Voluntary Action: Develop non-monetary and monetary incentive programs to promote voluntary action for individuals, municipalities and organizations	Community Action	Lead: PLWA Support: PLWMP, APLM, GoA, NGO	00 Ongoing	Program of Incentives
OB-8WorkingTogether	8g	Communication and Engagement Plan: Establish a communications and engagement plans for disseminating and reporting Plan progress to and amongst stakeholders.	Community Action	Lead: PLWASupport: PLWMP, APLM, PLWA, GoA	01 Short Term, Ongoing	Consistent Program
OB-8 Working Together	8h	Monitoring Plan: Develop a monitoring plan for environmental trends including lake and tributary water quality and for plan performance including fulfillment of success measures.	Technical & Scientific	Lead: PLWMP Support: PLWA APLM GoA	02 Medium Term, Ongoing	Effective Monitoring Program
OB-8 Working Together	8i	Phosphorous Budget: Continue to update and refine the phosphorus budget.	Technical & Scientific	Lead: GoA Support: PLWA PLMMP, APLM	02 Medium Term	Task Completion

APPENDIX B: COMMUNITY ENGAGEMENT

Background

The Pigeon Lake Watershed Association was formed in 2007 in response to a need for organized and science-based actions to be taken by the watershed residents to address ongoing concerns of diminishing water quality. In 2008, a State of the Watershed report was completed. Included was a recommendation for the preparation of a watershed management plan, which inspired the PLWA to begin work on the plan. This initiative took several years to get started, and to achieve support from the PLWA Board, the Pigeon Lake Municipalities and to build the necessary leadership resources.

In 2012 a Steering Committee was formed to undertake the preparation of the Pigeon Lake Watershed Management Plan. This initiative was funded by the PLWA and supported by the Battle River Watershed Alliance (BRWA), Alberta Environment, and various individuals and municipalities from around the lake.

Further support for the preparation of the Plan was obtained when the Alliance of Pigeon Lake Municipalities (APLM) made a commitment to the preparation of the plan and provided members to sit on the Pigeon Lake Watershed Management Plan (PLWMP) Steering Committee.

It was recognized that a multi-pronged watershed, in-lake and united approach was needed to achieve meaningful action. This was later confirmed by a PLWA membership poll (See *Synopsis of Responses on the PLWA Summary Report on the Methods for the Control of Nuisance Blue-Green Algae (Cyanobacteria),* January 2013). The APLM and the PLWA agreed that a cooperative approach was needed to undertake the important tasks identified for this project. This included increased communication between the two organizations and with the watershed residents. It was recognized that the lake needed more leaders to be involved and to work together in a meaningful way. On April 28th, 2012, the first meeting of Pigeon Lake leaders, the "Gathering for the Health of Pigeon Lake", was held with representation by many municipal councillors and members from two of the First Nations bands, including one Chief and an Elder. This meeting provided focus for the planning process. Based on the success of this meeting, it continued on an annual basis as the Annual Leaders Session.

The work on the plan moved forward by expanding the Steering Committee membership to include local organizations and our Healthy-Lake Partners, (i.e. non-governmental organizations such as the Battle River Watershed Association, and the Alberta Lake Management Society.

Recognizing the importance of engagement, the Steering Committee formed an Engagement Sub-Committee to create a PLWMP Engagement Strategy to ensure that engagement would be an integral part of all the PLWMP work.

During the 2013/14 timeframe, a Terms of Reference for the Plan was developed. The work of the PLWMP was defined in the Terms of Reference as a series of topics leading to the creation of Beneficial Management Practices. Topics were to be addressed over a number of years. Each topic was to have its own terms of reference, committee structure and an engagement component to help build consensus around each new topic. Engagement activities leading to the approval of the Terms of Reference included:

- ✓ Public on line survey entitled "Are we on Track?"
- ✓ Creation of a PLWMP website (www.plwmp.ca)
- ✓ Advertised public workshops
- ✓ 2013 Leaders Session and workshop
- ✓ 2013 PLWA AGM presentations
- ✓ Representations to federal and provincial elected officials and Cabinet ministers.

The 2013 Leaders Session supported topic priorities and also highlighted the need for Government of Alberta support and involvement in the Plan.

A new PLWMP website (www.plwmp.ca) was launched to ensure that the initiative would stand alone and be seen as everyone's plan. Other methods of communication for the PLWMP include PLWA emails and survey invitations, updates on municipal websites, joint APLM/PLWA newsletters, print media advertising for events and PLWA displays at local markets. The PLWA continues to fund and resource much of the engagement and communications. The PLWA contact list includes PLWA members plus key municipal, provincial, federal and Muskwacis Cree contacts. Engagement with the Muskwacis Cree run PL Reserve 138A is a priority, including participation in the Annual Leaders Sessions.

In 2013, three PLWMP open houses and presentations were marketed by various media methods and held on different sides of the lake.

In August of 2013, a survey of 618 community members was conducted and a local paper ad invited other watershed residents to participate. The survey "PLWMP – Are We On Track?" received 184 responses on behalf of at least 386 people. Over 95% of the survey respondents were either fully or somewhat supportive of the goal, guiding principles, PLWMP process and need to create a watershed plan for Pigeon Lake. A sense of urgency and concern for the degradation of the water quality and natural habitat permeated many responses. These responses gave a clear endorsement for the direction and focus of the PLWMP being taken by the Steering Committee.

The Steering Committee moved forward on the highest priority topics. Two topics were chosen as a starting point: Soil Management and Cosmetic Fertilizers, and the Model Land Use Bylaw.

A "Cosmetic Fertilizers: What do you think? Survey was conducted". This time, 344 surveys were completed on behalf of at least 745 people. The responses called for an immediate call for action which led to the municipalities writing bylaws prohibiting lawn fertilizers and, in some cases, lawn herbicides. In addition, the Healthy Lake Lawn campaign was born. Reports on the surveys are created and made available to the public via the PLWA websites.

Starting in 2014, the PLWA has hired summer staff to increase our outreach, disseminate information and receive the views of those in the watershed.

In 2015, a three-year Healthy Lake Clean Runoff Project was initiated given responses to a survey that told us: "We will make changes if you; "Tell us what to do", "Tell us how to do it", and "Make it easy". We focused on actions to clean the runoff from the near shore communities. It involved the creation of the Alberta Clean Runoff Action Guide to tell what and how, demonstration sites, a rain barrel campaign, many communications such as local press articles, and bringing resources to events such as native plants and grass seed; and a video to encourage residents to "Be Part of the Solution and to add some of the clean runoff approaches on their lot.

336 responses on behalf of at least 751 people to an end of project survey informed us that people were reading the CR Action Guide; were talking with neighbours about the need to make changes; that at least 350 changes had been made; and that another 375 were planned.

Each year, updates and progress made on the PLWMP is communicated through various means:

- ✓ Newsletters – spring and fall since 2007, and joint APLM/APLM since 2016
- ✓ Summer Students - since 2014
- ✓ Local Notice Boards
- ✓ PLWA AGM Presentations and Open House
- ✓ PLWMP and PLWA websites
- ✓ Annual Pigeon Lake Leaders Session
- ✓ Facebook (Pigeonlakewatershedassociation) since 2014
- ✓ Pigeon Lake Twitter

Pigeon Lake Watershed Management Plan 2017

In 2016, the Steering Committee initiated the writing of a Pigeon Lake watershed management plan for Pigeon Lake that addressed a complete range of topics related to: the watershed, the shore, the lake and working together. Support for this initiative came from the Government of Alberta, the Board of the PLWA and the Alliance of Pigeon Lake Municipalities plus our Healthy Lake Partners. Engagement strategies and techniques for PLWMP 2017 were adapted from earlier work of the Steering Committee.

The PLWMP engagement continued throughout 2017 in stages including:

- **Preparation of the Science Summary and Initial Drafts:** A day-long meeting was held in January of 2017 at the University of Alberta, organized by the PLWMP Chair. Attendees were a mix of researchers from the University of Alberta, Alberta Health, Consultants including Aquality Consultants Ltd., CPP Environmental, Hutcheson Environmental, Alberta Lake Management Society, Government of Alberta and members of Pigeon Lake organizations including PLWMP Steering Committee, the PLWA, and the APLM including their In-Lake Technical Committee. The objective was to identify the state of knowledge for Pigeon Lake, current initiatives, and critical information gaps. This information provided background to the introductory material in each section of the main report and to the technical summary in this appendix.

Leader's Session Draft – April 2017

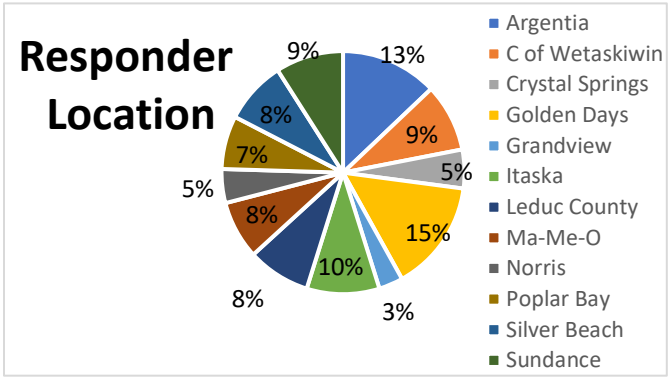
- April 2017, Leader's Session Draft of the Plan: This draft was prepared and issued to the 2017 attendees of the Annual Leader's Session. Forty-eight Pigeon Lake leaders participated including councillors, First Nations, PLWA directors, lake experts and planners. The draft Plan was discussed, and input gathered to improve it. An online survey was completed by 15 participants. This feedback resulted in revisions and updates for the next version.

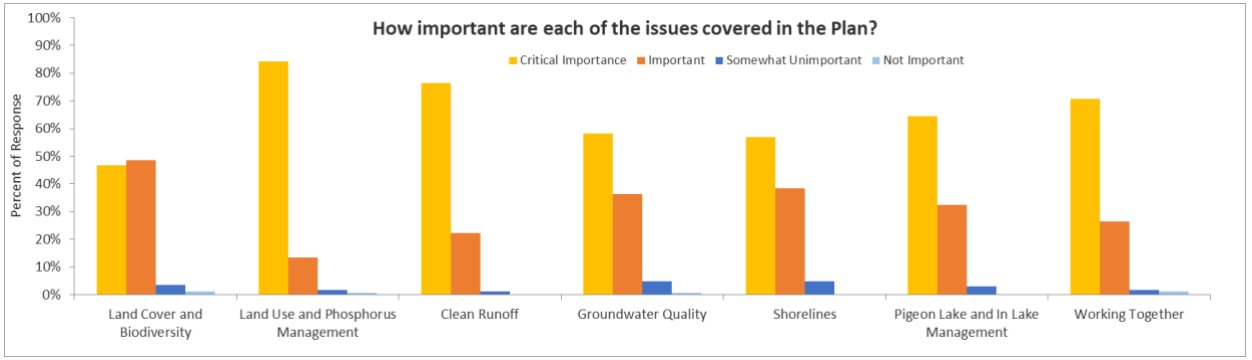
- June 2017, Public Draft of the Plan - Open Houses: the public draft was posted to the PLWMP website and invitations were issued to attend two public workshops and to complete and online survey. Sixty-five people attended the two PLWMP Open Houses. These were advertised in local newspapers, local websites, PLWA emails, Facebook, Twitter and a County of Wetaskiwin 'news flash.'

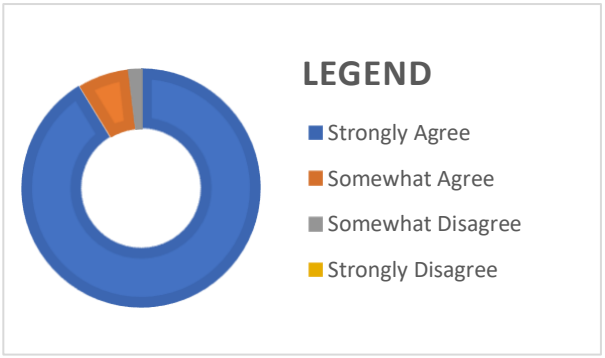
- June- September 2017, Various Events - The PLWA highlighted the Plan at:
    - Summer Village Annual Information Meetings
    - PLWA Annual General Meeting
    - Several Farmer's markets

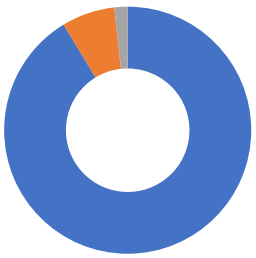
  Panels about the Plan were displayed to encourage discussions and people were asked to read it and complete the on-line survey.

- June 2017, Public Draft of the Plan- On Line Survey: An on-line survey ran over the summer. This was advertised by emails, Facebook posts, and a local paper article (Pipestone Flyer July 12, 2017). A total of 176 people filled in the survey on behalf of at least 397 people of which 95.5% own property around Pigeon Lake. Strong support was indicated for the Plan (see graphs next page)

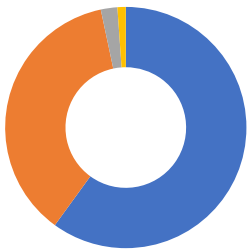




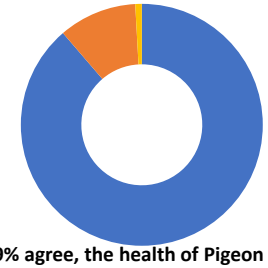




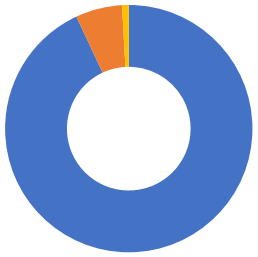
91% Agree with the Plan Vision



95% agree or somwhat agree, The Plan can be implemented.



89% agree, the health of Pigeon Lake requires urgent, decisive, and collective actions across all sectors.



93% agree, Improve the health of the watershed & the lake.

Adoption Draft – September 2017 – June 2018

In September 2017, the Plan was revised based on the public feedback and published to the PLWMP web site as the "adoption draft". A summary of the response to the online public survey was also posted to the site. This version of the Plan was then taken to all municipalities, Healthy Lake Partners and the Maskwacis Cree and the Government of Alberta for statements of adoption, endorsement or support. Organizations were invited to review the document and provide comment and or statements of support. A number of comments and concerns were addressed throughout this process that resulted in changes to the recommendations or text of the final PLWMP document.

- **September 20,** 2017, the Alliance of Pigeon Lake Municipalities voted to endorse the PLWMP.
- **September 09, 2017 –** the PLWA Executive Director gave an update to the Pigeon Lake Regional Chamber of Commerce board. They were asked to consider endorsing the PLWMP. The PLWA is a member of the PLRCC and the PLRCC participates in the annual Leaders Session and sits on the PLWMP Steering Committee.
- **September 29, 2017 –**, PLWMP Chair presented the PLWMP at the Annual Conference of the Alberta Lake Management Society
- **December 4,2017** the Pigeon Lake Watershed Association voted to endorse the PLWMP.
- **September 2017– May 2018 On-going –** The PLWMP Chair and Vice Chair presented the PLWMP to all watershed municipalities and organizations who have sat on the Steering Committee, with the intention of firstly obtaining comments and secondly to obtain resolutions in support of the plan.

Maskwacis Cree and the Pigeon Lake Reserve Engagement. Since the PLWA began, engagement with our First Nation neighbours has been important. In 2017, the PLWMP adoption draft gave further impetus for working together. Examples of past engagement of First Nations include:

- **Annual Leaders Sessions:** All four nations have always been invited, and we usually have a handful attend including Chiefs, Councillors and Elders.
- **PLWA Events:** On occasion First Nations have attended our workshops and Annual General Meetings including a few people from the PL Reserve.
- **POW WOW's:** On occasion the PLWA has attended the local Pow Wow and the 2015 PLWA President was honoured to be invited in the Samson Cree Nation POW WOW and participate in the Grand Entrance


- **PLWA Representations at First Nations Organized Events:** the PLWA has made a handful of presentations to different First Nations groups: A TSAG arranged meeting with Elders and a Technical Committee who were working with Imperial Oil to address the abandoned wells on the reserve.

- **First Nation Representation on the PLWA Board**: Chief Leonard Standing-On-The-Road (Elected Chief of the Montana Nation in 2017) served on the PLWA Board from 2012 through 2015, as the PLWA First Nations Liaison. In 2017, past Erminskin First Nation Councillor, Samuel Minde began to sit on the PLWA Board as the First Nation Liaison. Samuel has worked to form the First Nation working group called: Mamawo Group (Together).

- Muskwacis Cree Mamamo Group (Together).

  In 2017, the PLWA Director and Muskwacis Cree Nations liaison took it upon himself to pull together a group representing all four Nations to see if there was any interest in getting involved with the PLWA and work going on around the lake. At an initial meeting a lot of concern for the lake and how its health impacts people living on the Reserve; the fishery and more was expressed. A series of meetings which also included the GoA, the BRWA, and three PLWA Directors. Four of these people were also members of the PLWMP Committee including the Chair and all were members of the Engagement Sub-committee.

  The outcome of the initial meetings were two documents to be presented to the Maskwacis Cree Council of Chiefs and Councillors for endorsement. One is a Letter of Support for the PLWMP and the second a Terms of Reference for the Mamawo Working Group to:

  - Explore how the PLWMP may be important for the Pigeon Lake Reserve.
  - Build bridges with the PLWMP steering committee and have a voice in the work being done.
  - Provide the Maskwacis Cree Nations and the Pigeon Lake Reserve Residents with opportunities to be informed and to participate in the implementation of the PLWMP.
  - Identify and share the tools and knowledge from this work, for the benefit of the Maskwacis Cree Nations.

APPENDIX C: TECHNICAL SUMMARY

PREFACE

The Technical Summary has been assembled as a foundation to the development of the Pigeon Lake Watershed Management Plan 2017 ("the Plan"). It is intended to update information found in the 2006 State of The Watershed Report and to provide benchmark updates to many of the environmental indicators relevant to Pigeon Lake and its watershed. General watershed planning implications are also identified related to the various topics. These have generally been the background to many of the specific recommendations in the Plan, that were then further refined to address planning policies and tools available.

This summary was prepared by Adam Kraft and Théo Charette from CPP Environmental, with hydrological contributions from Alberta Environment and Parks.

Pigeon Lake is a relatively well-studied lake; several studies have examined the complex interactions between watershed activities and the lake's ecological health. These studies have improved our understanding of Pigeon Lake and have indicated potential natural and human-caused drivers of the nuisance algal blooms (or Harmful Algal Blooms, HABs). The intent of this document is to summarize the current scientific knowledge around the water quality concerns of Pigeon Lake and to highlight where further research or remedial efforts are needed.

The document is organized into three main sections, which outline the state of knowledge at different spatial scales: (i) the Pigeon Lake watershed (Section 1: "Watershed Lands"), (ii) the lake's streams and shorelines (Section 2 "The Shoreline"), and (iii) Pigeon Lake itself (Section 3:"Pigeon Lake").

1 SUMMARY OF THE SCIENCE: WATERSHED LANDS

Nutrient Production and Transport

Surface water flows (overland runoff and streams) make up an estimated 29% of Pigeon Lake's water inputs (Worley Parsons 2010) and transport nearly half of the externally-loaded phosphorus (P, an important nutrient for biological growth) into the waterbody (FIGURE C1). This indicates that both the water quantity and quality of the lake are influenced by the land cover composition of the watershed. The amount of forest and wetland cover is important for aquatic health, yet only 39% of ecological lands remain in the Pigeon Lake watershed. Human activity is extensive, with 61% of the land converted into agricultural or built-up areas (e.g., roads, residential, recreation areas) as of 2013 (FIGURES C2, C3).

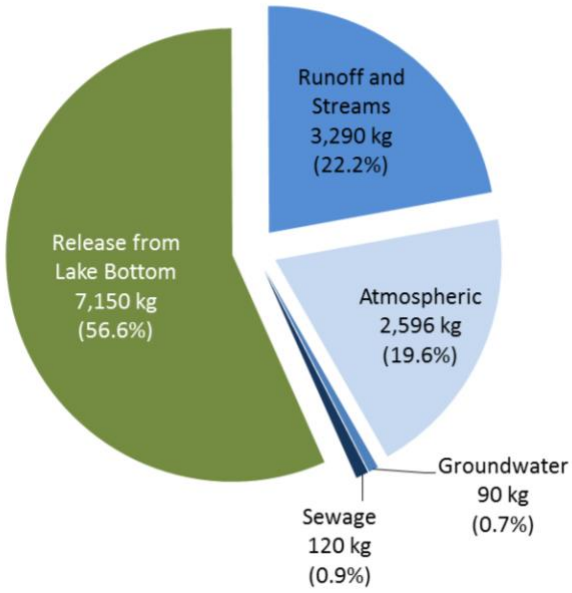


Figure C1: Annual open water season total phosphorus loadings, both bioavailable and particulate forms, into Pigeon Lake in 2013, indicating the relative partitioning between internal and external loadings (Teichreb 2014). Internal loadings refer to the release of P from the lake bottom sediments, whereas external loadings include the runoff from the watershed (i.e., measured flow from streams and creeks that enter the lake and unmeasured diffuse runoff), as well as atmospheric deposition, groundwater inputs and sewage. It is important to note that these results come from one year (2013) of stream sampling data, and thus do not represent average or typical conditions.

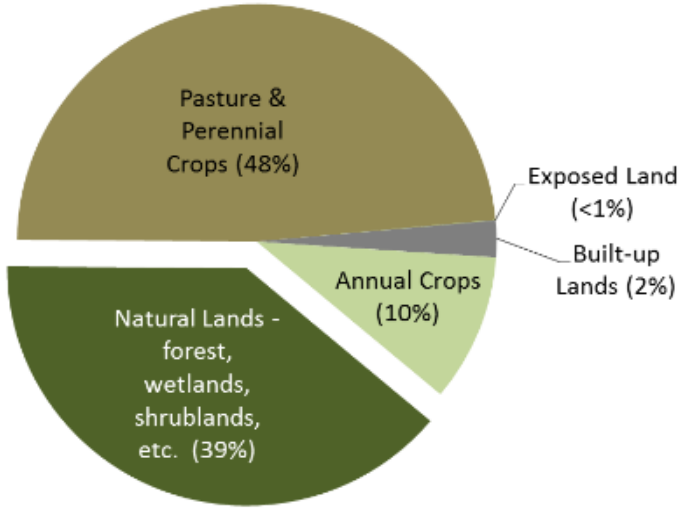


Figure C2: Landscape composition of the Pigeon Lake watershed based on 2013 conditions, showing the relative cover of natural and non-natural land cover types (AAFC 2013).

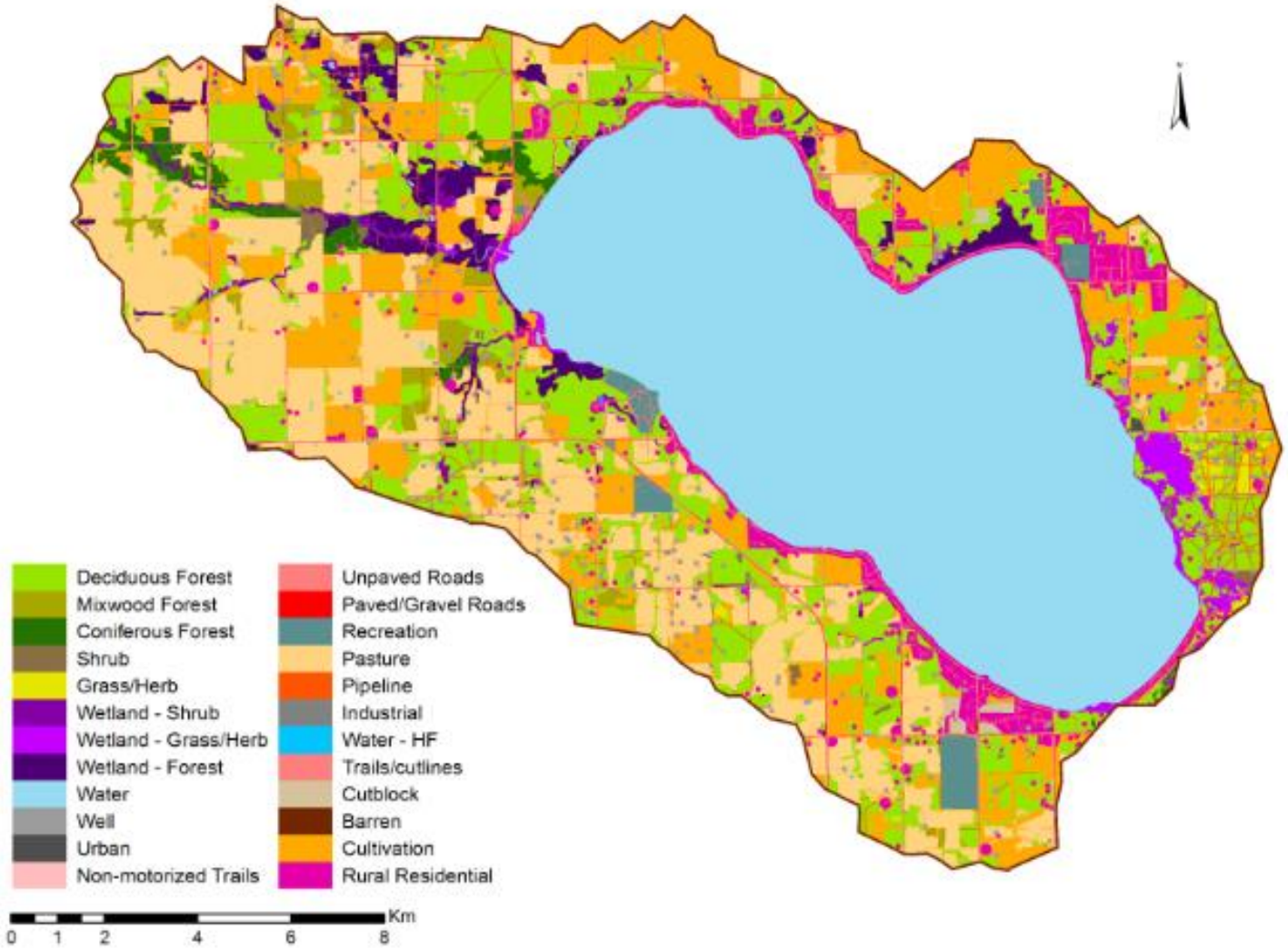


Figure C3: Landscape composition of the Pigeon Lake watershed based on 2012 conditions (Habib 2017).

Runoff from developed areas occurs mainly during spring snowmelt and following rainfall events, and can contain large quantities of nutrients from fertilizers, manure, decayed plant material, and loosened soil particles which will ultimately enter Pigeon Lake. Unlike point source pollution from industrial sites or sewage treatment plants (where the source of pollution is easily identified), sources of pollution resulting from runoff, precipitation or atmospheric deposition are difficult to identify and control due to the multiple sources of pollution and the large transport capacity. These sources of pollution are called non-point (or diffuse) and are mainly influenced by the type of land cover (e.g., agricultural activities, urban areas or natural vegetation cover) and the human activities in the watershed (e.g., pesticides and nutrients from lawns and gardens, land clearing and disruption of the riparian area).

The Pigeon Lake watershed contains considerable rural development and seasonal activity, with extensive cottage and municipal development along the lakeshore and over 100,000 seasonal visitors. While the direct impact of this population on lake water quality is challenging to quantify, a considerable proportion of the external nutrient loading into Pigeon Lake can be attributed to human presence. Human-generated land cover changes and use increase nutrient loading in two main ways:

1. Increasing the nutrient availability in the watershed:
    - Nutrient additions related to lawn fertilizers and agricultural operations.
    - Release of some proportion of sewage and pollutants produced from cottages, campgrounds and day-use areas
2. Facilitating the introduction of nutrients into the lake:
    - Removing natural vegetation and riparian buffers, which act as filters for nutrients and other pollutants
    - Increasing the percentage of hard surfaces, which decreases infiltration, increases the overland flow, and entrains pollutants
    - Land disturbances that release sediment containing phosphorus

Nutrients – notably phosphorus (P) and nitrogen (N) – enter Pigeon Lake directly through seven inflowing streams and many drainage ditches. Nutrient loading rates (annual export quantity; FIGURE C4) varied among streams and with the stream's discharge rate (FIGURE C5). Peaks for P- and N-loading in streams typically occurred in April, decreased through May-June, increased again in July-August (due to storm events) and continued to decline into September-October. 2013 data showed that the streams contributed a relatively small proportion of total external nutrient inputs into Pigeon Lake (collectively, approximately 377 kg/year, or about 11% of total external loadings). However, this information should be used with caution since the 2013 sampling missed a portion of spring runoff as sampling began on April 25th of that year. Generally, comprehensive annual water quality data for the inflowing streams are largely lacking relative to data records for the lake itself.

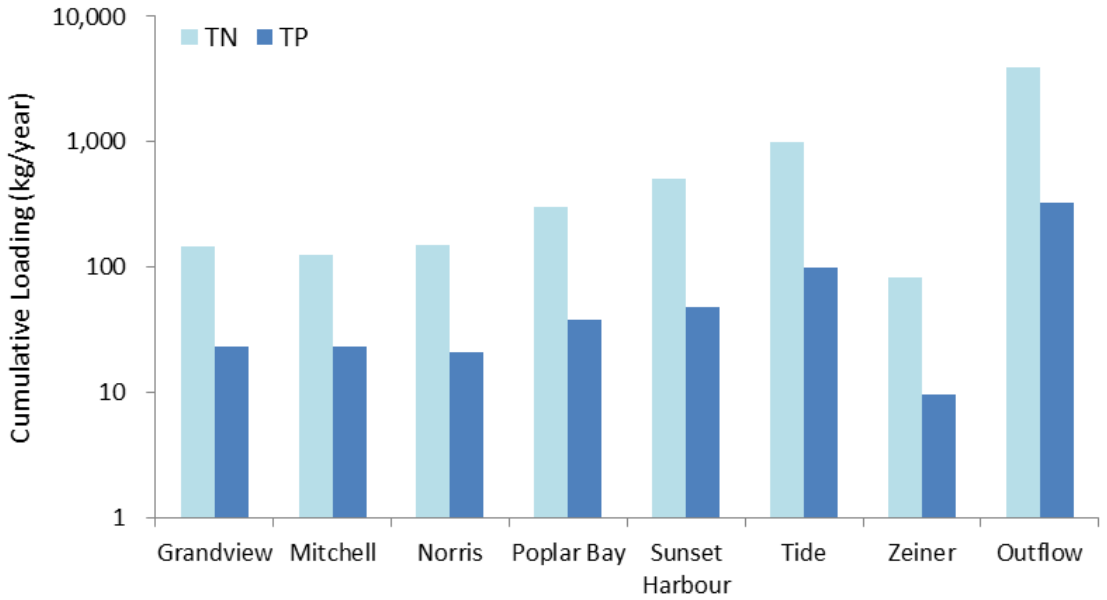


Figure C4: Summary of cumulative annual total nitrogen (TN) and phosphorus (TP) loading from inflowing streams into Pigeon Lake and exports from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

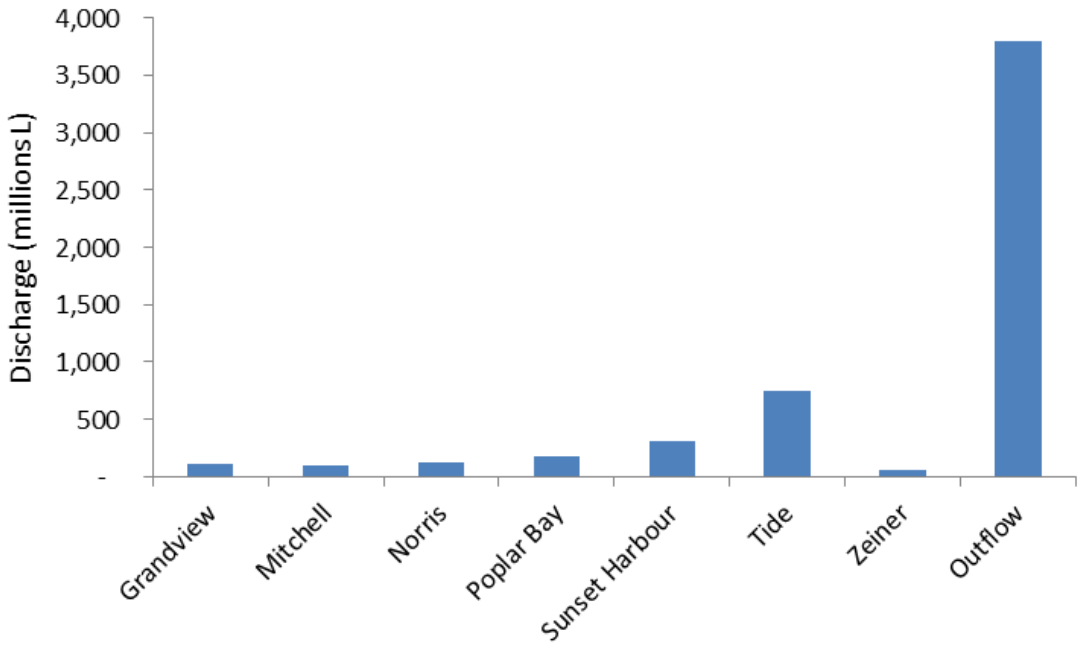


Figure C5: Summary of cumulative annual discharge from inflowing streams into Pigeon Lake and export from the outflowing stream in 2013. Data are from Teichreb et al. 2014.

Land disturbance and development within the watershed contribute to soil erosion and accelerate the rate of nutrient transport to the lake. In particular, the clearing of forests greatly increases the rate of snow melt and thus runoff from the land. Historically, riparian vegetation immediately adjacent to the banks of Pigeon Lake and its inflowing streams are thought to naturally mitigate the rates at which runoff-borne nutrients directly enter the water. Ongoing development has led to the degradation and destruction of these natural buffers, resulting in minimal filtration (i.e. removal of excess nutrients) before they reach the water. Increased land disturbance and the loss of riparian areas increase the rates at which both diffuse and point-source nutrient inputs enter Pigeon Lake. This has other consequences for water quality such as an increase in suspended materials due to increased shoreline erosion.

Phosphorus Forms, Cycle and Sources

In most temperate lakes the nutrient that is in shortest supply, and is therefore limiting to biological productivity, is P. Once P exists in sufficient quantities, growth of phytoplankton can proceed until limited by another factor (e.g., light, nitrogen (N) or wind). Excessive quantities of P can promote problematic overgrowth of cyanobacteria, also known as blue-green algae blooms. Cyanobacteria blooms can sometimes produce dangerous toxins, negatively impacting water quality and causing problems for human and ecological health. While many central Alberta lakes, including Pigeon Lake, are naturally productive, increased human development and land cover changes within watersheds over the past century appear to have increased the rates of P input into waterbodies and accelerated eutrophication rates. Thus, quantifying P inputs into waterbodies is an important first step towards controlling eutrophication to help prevent future water quality issues.

Phosphorus compounds enter the lake in different forms and compositions, depending on their origin. Once in a water body, P undergoes complex chemical and biological reactions which result in it entering the water column. There are two main forms of P: dissolved (soluble) and particulate (as a component of organic and particulate matter). The primary dissolved form of P (orthophosphate, or PO_4^{3-}) is readily available for phytoplankton and plant uptake. In response to varying environmental conditions, particulate P can change from one chemical form to another (a process known as P cycling). For example, microbial decomposition of organic matter can turn organic particulate P into its dissolved form, while in the mineral form, such as clay particles, the process is of a much longer term. Other chemical and physical changes in the water column and the lake sediments can also convert P in soil mineral particles to dissolved P.

FIGURE C6 shows a simplified P cycle in lakes. Phytoplankton and bacteria assimilate dissolved inorganic P and transform P into particulate organic P as it becomes part of their tissues. As plants and animals excrete waste or die, the organic P sinks to the bottom, where bacterial decomposition turns it back to inorganic P. This inorganic P ultimately returns to the water column and becomes again available for uptake. In the sediment, inorganic P will not pass freely into the water column if the sediment-water interface is well oxygenated. In this situation, P is bound to clays and different compounds, such as iron (Fe), calcium (Ca) or aluminium (Al). In some circumstances, increased P release in well oxygenated sediment has been observed at high pH values following resuspension events in the summer when pH increases due to the high photosynthetic activity. However, anoxic (non-oxygenated) sediments release phosphate to the overlying waters at a much faster rate.

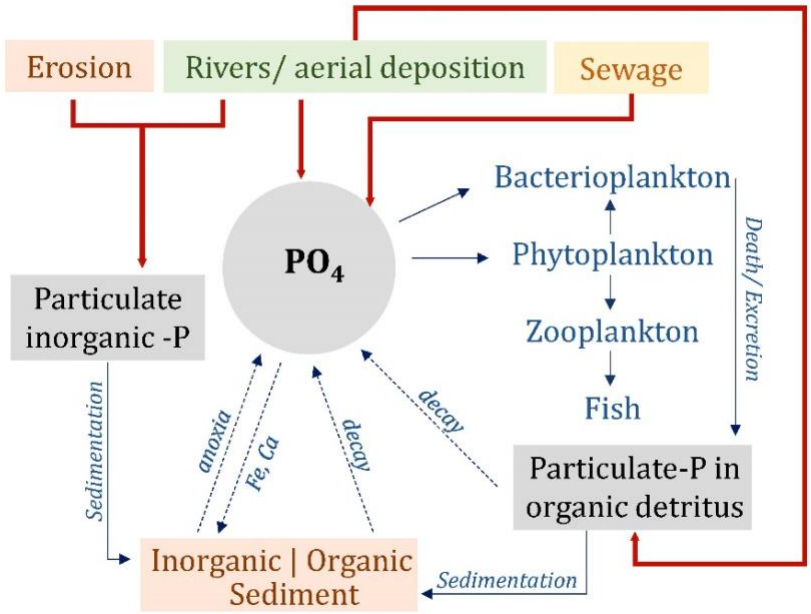


Figure C6: A simplified P cycles in lakes. Red lines = external loading. Dotted blue lines = internal loading. Solid blue lines = internal recycling.

Due to the changes in P forms, the term Total Phosphorus (TP) is used to determine the total amount of P present in the water body, regardless of its chemical identity (dissolved and particulate). However, this term does not inform about the availability of P for plant or phytoplankton uptake – a concept named "bioavailability". The relative proportion of dissolved vs particulate P that enters to a water body will therefore influence algal growth. Particulate forms of P typically enter the lake via wind transport, atmospheric deposition or through erosive processes and subsequent sediment transport. Orthophosphate (i.e., dissolved) forms are generally produced by natural processes. Point sources (e.g. effluents from treatment plants or untreated water), and nonpoint or diffuse sources (e.g. runoff from agricultural sites and application of some lawn fertilizers) largely contribute to the input of dissolved P forms.

In 2014, the Government of Alberta developed a P budget for Pigeon Lake to quantify the total P inputs into and outputs from the lake (Teichreb 2014). The report included external and internal sources (i.e., P from the watershed or atmosphere, and P released from the lake sediments, respectively) and concluded that both contribute to elevated nutrient levels. Relative annual contributions of the total P inputs were estimated to be approximately 43% (5,755 kg/year) from external and 57% (7,510 kg/year) from internal sources (FIGURE C1). Most importantly, this report determined that there is no single problematic external source of P for Pigeon Lake. Of the P that comes from external sources, it was estimated that approximately 48% (2,913 kg/year) comes from diffuse runoff, 43% (2,596 kg/year) comes from dustfall and precipitation, and 9% (587 kg/year) comes from groundwater, point-source inflows and sewage combined (FIGURE C1). Point-source and sewage contribution might seem proportionally small when compared to the contribution of other sources to the total amount of P entering the lake, yet most of the P supplied by these sources correspond to the more readily bioavailable fraction and as such are critically important. Additionally, the specific P contributions from each of these sources may vary among seasons and years according to factors such as wind and precipitation patterns or land use activities (e.g., whether a field is in fallow or being actively tilled and fertilized).

A recent report from the Alberta Biodiversity Monitoring Institute (ABMI; Habib, 2014) expanded upon the initial Pigeon Lake P budget work by using an updated and more-detailed land cover data set (FIGURE C3 and C7), as well as a range of future development scenarios based on the Leduc County's North Pigeon Lake Area Structure Plan (Leduc County 2011) and the County of Wetaskiwin Pigeon Lake Watershed Area Concept Plan (County of Wetaskiwin 2014). This study aimed at evaluating changes in P load into the lake under a variety of development scenarios (new rural and lakeshore development) and land management practices (reforestation and restoration of riparian buffers). However, this model only estimated stream and overland inflows into the lake, and did not consider other external sources (e.g., atmospheric or groundwater inputs) or internal sources (from the lake

sediments). The simulation for the current land scenario indicated that the annual point source and diffuse P loading was 3,707 Kg/year, about 12.6% larger than the input from surface runoff estimated in the original P budget (i.e., 3,290 Kg/y). Despite the differences, both estimates were in the same order of magnitude and discrepancies were likely the result of the inherent model structure and methods for the estimation of complex processes such as nutrient export or retention in a highly developed watershed. Thus, the *relative proportions of P contributions*, rather than the precise loading values, should be considered when determining how to control excess nutrient loading into Pigeon Lake.

Figure C7: Map of watershed-level phosphorus exports into Pigeon Lake, modelled according to current land use intensities. Inflowing and outflowing creeks are indicated (Habib 2017).

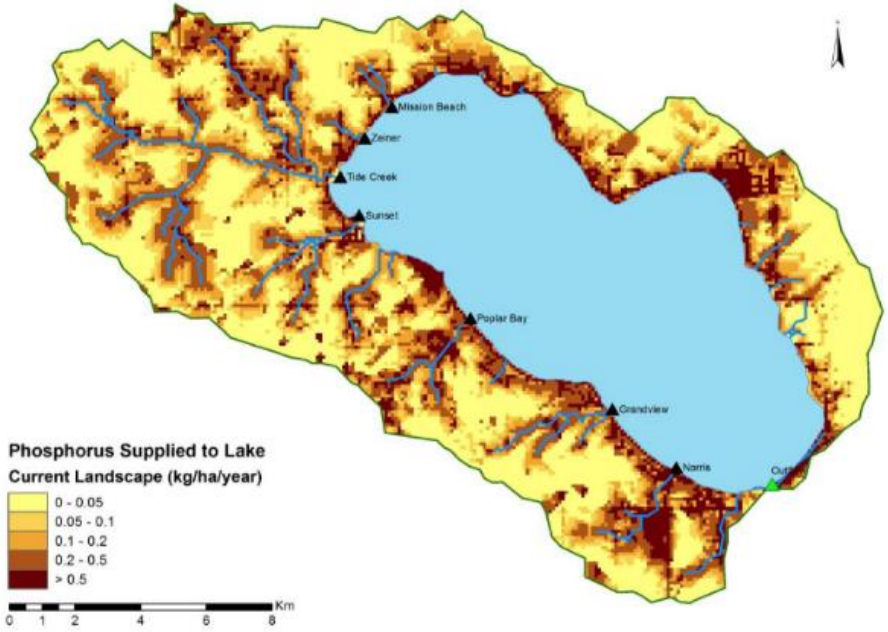
The ABMI simulation also found that relative to the current development conditions (FIGURE C7), the amounts of P that will be exported into Pigeon Lake from the watershed depend on the intensity of future development, though significant reductions were possible in all scenarios if riparian area protection and restoration occurred. Overall, although the ABMI model only accounts for the P input from surface runoff, it provides an effective management tool for evaluating the relative contribution of P from different sources in the watershed as well as for quantifying the efficiency of land management practices.

At the watershed level, P reduction initiatives should focus on reducing diffuse, point-source and sewage inputs of P (FIGURE C1). While diffuse P sources may be the most challenging to effectively reduce and measure success, they represent nearly half of the external P loading into Pigeon Lake and are the largest controllable portion; thus, it is important to explore management options. Sources of atmospheric deposition and groundwater influx of P require further determination; however, implementing beneficial management practices such as conservation tillage practices may help reduce the volatility of cultivated soils to wind erosion, reduce overland transfer of nutrients, and reduction of excess P application to the land may reduce downward migration to groundwater.

Plan Implications

- About 25% of the P inputs into Pigeon Lake come from watershed-level sources making the land cover types and land use activities within the watershed highly influential to the water quality and quantity of the lake. Watershed stewardship and incorporation of Beneficial Management Practices (BMPs; AAFRD 2004) are recommended to decrease both the nutrient concentrations in the inflowing streams and the rates at which overland flow enters the streams.
- The removal of riparian vegetation and watershed tree cover has exacerbated the rates of nutrient export from watershed sources into Pigeon Lake. Modelling has shown that riparian restoration along the lake and stream shores can result in a reduction in external nutrient loading into the water, even when the watershed itself is highly developed. Hence, a riparian and watershed conservation and restoration program should be initiated in the Pigeon Lake watershed, with efforts prioritized in areas of high P loading potential (FIGURE C8).

- Municipalities should adopt riparian setback policies to establish appropriate setbacks from all waterbodies in the watershed to maintain water quality, flood water conveyance and storage, bank stability, and habitat. Tools such as the Riparian Matrix Setback Model (Aquality Environmental Consulting 2010) can be used to manage riparian areas in a local municipality (broad brush approach).
- A significant function of wetlands is their ability to trap and retain nutrients. To increase this function in Pigeon Lake's watershed, wetlands should be conserved and restored. Thus, a list of candidate wetlands for restoration within the watershed should be developed and will streamline watershed improvement efforts under the Alberta Wetland Policy. Also, riparian buffers around wetlands are required to protect function.
- The coverage and ecological condition of natural land cover (e.g., forests and wetlands) should be maintained or improved. Conversion of remaining ecological lands to agricultural, residential, or recreational areas should be limited.
- Diffuse runoff over altered (agricultural, developed, etc.) lands comprises a significant portion of external P loadings into Pigeon Lake. Current practice does not allow for enforcement or rejection of activity based on cumulative impacts decision making. In the context of Pigeon Lake, development decisions should be thoroughly assessed to ensure that there is either a decrease or, at a minimum, no increase in nutrient export relative to current conditions. Municipal governments must ensure their review of impacts is neither too narrow nor too broad. Approvals for any work should also consider the increases to nutrient and sediment loading as a result of alterations in pre-development hydrology and watershed-level land use changes.
- Adoption of clean runoff BMPs by individual land owners and municipalities into their developments and operations will contribute to water quality improvement and increase water use efficiency.
- In agricultural lands, existing BMPs that promote soil health and responsible resource use should be continued and encouraged (e.g., AAFRD 2004). Conservation tillage programs can reduce the erodibility of soils and the subsequent potential for export via runoff. Similarly, precision agriculture approaches can be taken to avoid the export of excess nutrients off the land and into waterways by care



fully controlling the application rate, timing, and placement of inorganic fertilizers or manure. BMPs specific to ranching include reducing the intensity of grazing and trampling near riparian areas and providing water alternatives away from streams.

- In residential areas (i.e. Lakeshore developments, county residential) BMPs and implementation of Low Impact Development (LID) practices in existing and new developments will be very important to reduce P export. Principles and practices for implementing LID practices at Pigeon Lake are detailed in in the Alberta Clean Runoff Action Guide (PLWA and ALIDP 2016). Incorporating low-phosphorus development standards in Land Use Bylaws and statutory plans will be very important to achieve compliance on the part of individual land owners and developers.
- Removal of septic fields, in addition to upgrades to wastewater infrastructure of cottages and public use areas (where antiquated or

ineffective) should be encouraged to improve the water quality of Pigeon Lake. Although sewage inputs to the lake are a relatively small source of P, reducing seepage into the lake will have benefits to water quality since the P forms present in sewage are largely bioavailable for algal and plant uptake (i.e., dissolved forms of P).

- BMPs should include prohibitions on cosmetic fertilizers. A previous initiative to restrict the application of fertilizers and pesticides for cosmetic purposes in the watershed was well-supported by shoreline residents and has been implemented by municipalities throughout the watershed.
- While the dust deposition into Pigeon Lake is very technically difficult to control, atmospheric sources of P represent a significant component of the nutrient inputs to the lake. As such, the source of these inputs, as well as its form and bioavailability, should be better studied to understand where reductions are possible.

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Riparian Health

Riparian areas are biologically rich and productive areas at the edges of lakes, wetlands and streams. Riparian areas are important habitat and provide essential ecosystem functions to protect the lake's health.

In 2002 and 2008, low-altitude videography was used to conduct a riparian health assessment of Pigeon Lake (SRD 2008). The riparian area surveyed included the collective near-shore area consisting of the lake's shallow water zone (littoral) and the strip of public lakeshore, and the immediately adjacent private land that surrounds the lake. Criteria evaluated to assess riparian "health" included proportion of area covered by natural vegetation, presence of cattails (*Typha latifolia*) and bulrushes (*Scirpus* spp. and *Schoenoplectus* spp.), abundance of trees and shrubs, and the amount of human-caused vegetation removal or physical alteration. The shoreline was divided into consecutive sections and these criteria were used to classify each section into one of three impairment categories: healthy, moderately impaired, or highly impaired. The total length of shoreline in each impairment category was calculated and expressed as a percentage of the total shoreline length.

In both sampling years, the majority of Pigeon Lake's shoreline (65%) was classified as being highly impaired. In 2002, 24% of the shoreline was considered to be healthy and the remaining 11% was moderately impaired, while in 2008 (FIGURE C8) there was a slight improvement in shoreline health, with 29% of the shoreline classified as healthy and 6% classified as moderately impaired. This improvement is attributed to land purchases by the Government of Alberta along the northwest shore, though some improvement in riparian health was offset by poorer health scores elsewhere along the lake. The extensive impairment around Pigeon Lake is associated with the extensive removal of riparian vegetation and shoreline modification (e.g., maintenance of beaches, erosion control structures, installations of docks, boat lifts and marinas, and the construction of cottages adjacent to the shoreline). Notably, sections of highly impaired shoreline were very long and continuous, with healthier sections being largely restricted to areas of minimal cottage development on the northwest and east shores at the Provincial Park and First Nations Reserve (FIGURE C8)

The Government of Alberta has recommended that a similar shoreline assessment should be performed every five years on Pigeon Lake to monitor the extent and integrity of remaining riparian areas (SRD 2008). In addition, assessments of both the health of the lake and tributary riparian areas would highlight priority areas for protection and restoration.

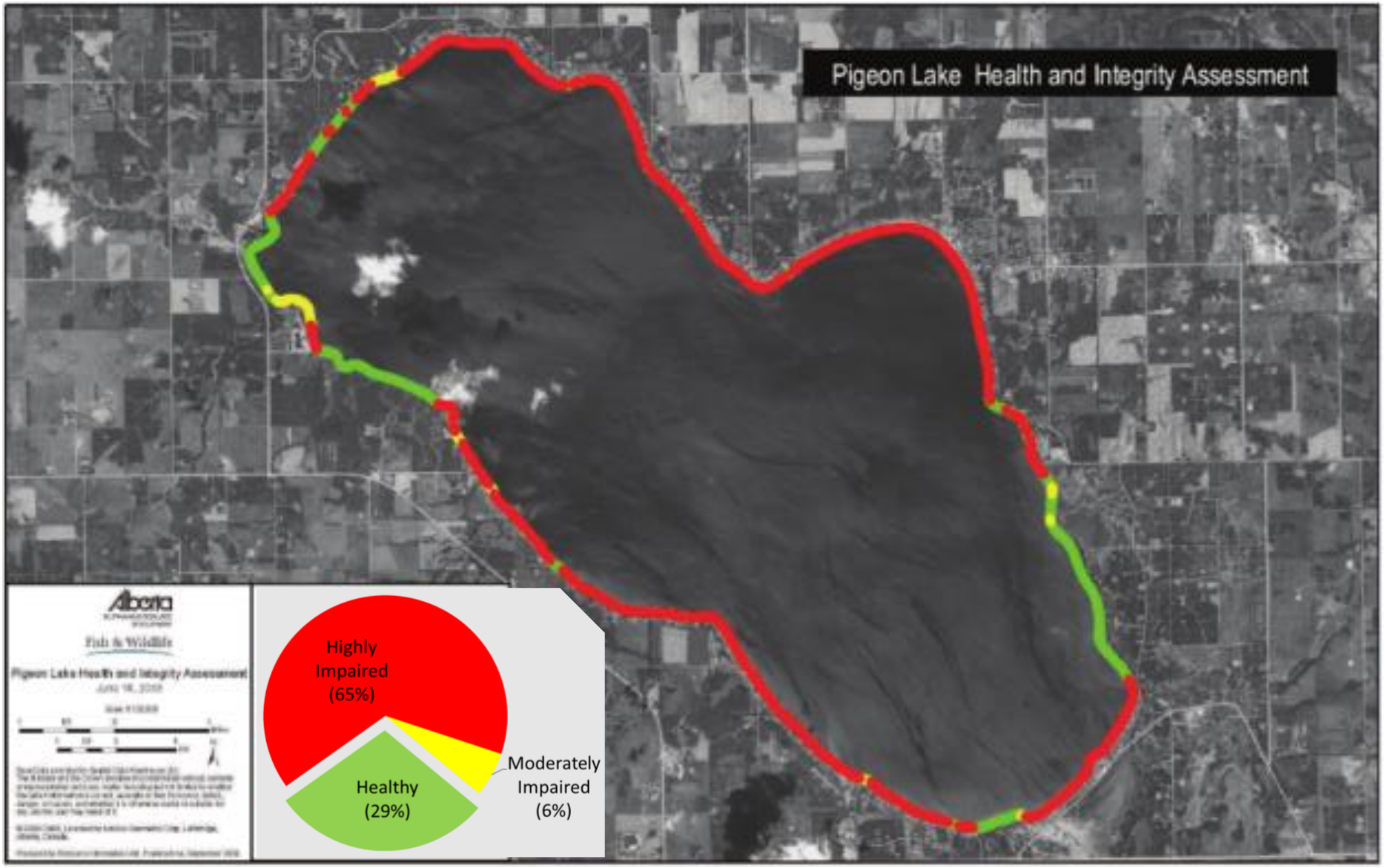

Figure C8: Pigeon Lake shoreline integrity assessment results from a June 2008 survey, indicating the extent of lakeshore degradation around the lake (SRD 2008).

Near-shore Vegetation

Aquatic vegetation (i.e., near-shore within the littoral zone) perform a wide range of ecologically-important functions, including nutrient and contaminant sequestration, shoreline stabilization, buffering water flows, and supporting rich biodiversity. Destruction of littoral habitats entails some loss of these ecological services and will have negative consequences for the biological communities of Pigeon Lake. For example, Northern Pike (*Esox lucius*), hide among vegetation such as cattails and bulrushes to ambush their prey, and rely heavily on the vegetation for spawning and rearing. Removal of the littoral vegetation compromises not only Northern Pike success but may also adversely affect other trophic levels in Pigeon Lake.

The distribution of littoral vegetation around Pigeon Lake is dependent on the extent of shoreline development and substrate type, with finer sediments and sheltered areas being most suitable for growth of aquatic vegetation. Submersed aquatic vegetation communities occur along much of Pigeon Lake's shore, with community composition and density influenced by factors such as water depth, turbulence, and sediment accumulation patterns.

In general, vegetation cover is related to the extent of shoreline development, with the lowest cover occurring in areas of high cottage density. However, no formal vegetation mapping of Pigeon Lake has occurred since the early 1980s. Continued disturbance and vegetation control activities further alter and limit the distribution of both riparian and aquatic vegetation communities, to the detriment of a healthy ecosystem.

Plants commonly found in Pigeon Lake's littoral and riparian vegetation communities are listed in TABLE C1.

Table C1: List of plants typical of Pigeon Lake's littoral and riparian vegetation communities.

Habitat	Growth Form	Common Name	Scientific Name
Littoral	Floating-leaved	Bur-reeds	*Sparaganium* spp.
Littoral	Floating-leaved	Common Duckweed	*Lemna minor*
Littoral	Floating-leaved	Star Duckweed	*Lemna trisulca*
Littoral	Floating-leaved	Variegated Pond-lily	*Nuphar variegatum*
Littoral	Floating-leaved	Water Smartweed	*Persicaria amphibia*
Littoral	Submerged	Autumn Water-starwort	*Callitriche hermaphroditica*
Littoral	Submerged	Common Bladderwort	*Utricularia vulgaris*
Littoral	Submerged	Common Water Moss	*Fontinalis* spp.
Littoral	Submerged	Coontail	*Ceratophyllum demersum*
Littoral	Submerged	Flat-stem Pondweed	*Potamogeton zosteriformis*
Littoral	Submerged	Fries' Pondweed	*Potamogeton friesii*
Littoral	Submerged	Lesser Pondweed	*Potamogeton pusillus*
Littoral	Submerged	Northern Watermilfoil	*Myriophyllum sibiricum*
Littoral	Submerged	Pondweeds	*Potamogeton* spp.
Littoral	Submerged	Richardson's Pondweed	*Potamogeton richardsonii*
Littoral	Submerged	Sago Pondweed	*Stuckenia pectinata*
Littoral	Submerged	Sheathed Pondweed	*Stuckenia vaginata*
Littoral	Submerged	Slender Water-nymph	*Najas flexilis*
Littoral	Submerged	Stonewort	*Chara* spp.

Habitat	Growth Form	Common Name	Scientific Name
Littoral	Submerged	Various-leaved Pondweed	*Potamogeton gramineus*
Littoral	Submerged	Water Buttercup	*Ranunculus aquatilis*
Littoral	Submerged	White-stem Pondweed	*Potamogeton praelongus*
Littoral	Submerged	Widgeon Grass	*Ruppia cirrhosa*
Riparian	Emergent Macrophyte	Bluejoint	*Calamagrostis canadensis*
Riparian	Emergent Macrophyte	Common Cattail	*Typha latifolia*
Riparian	Emergent Macrophyte	Creeping Spike-rush	*Eleocharis palustris*
Riparian	Emergent Macrophyte	Horsetails	*Equisetum* spp.
Riparian	Emergent Macrophyte	Knotted Rush	*Juncus nodosus*
Riparian	Emergent Macrophyte	Sedges	*Carex* spp.
Riparian	Emergent Macrophyte	Sloughgrass	*Beckmannia syzigachne*
Riparian	Emergent Macrophyte	Small-fruited Bulrush	*Scirpus microcarpus*
Riparian	Emergent Macrophyte	Soft-stem Bulrush	*Schoenoplectus tabernaemontani*
Riparian	Emergent Macrophyte	Wire Rush	*Juncus balticus*
Riparian	Forb	American Brooklime	*Veronica americana*
Riparian	Forb	Arum-leaved Arrowhead	*Sagittaria cuneata*
Riparian	Forb	Celery-leaved Buttercup	*Ranunculus sceleratus*
Riparian	Forb	Docks	*Rumex* spp.
Riparian	Forb	Fireweed	*Chamerion angustifolium*
Riparian	Forb	Marsh Ragwort	*Senecio congestus*
Riparian	Forb	Marsh Yellow Cress	*Rorippa palustris*
Riparian	Forb	Nodding Beggar-ticks	*Bidens cernua*
Riparian	Forb	Northern Stitchwort	*Stellaria borealis*
Riparian	Forb	Northern Willow-herb	*Epilobium ciliatum*
Riparian	Forb	Pale Persicaria	*Persicaria lapathifolium*
Riparian	Forb	Philadelphia Fleabane	*Erigeron philadelphicus*
Riparian	Forb	Purple-stemmed Aster	*Symphyotrichum puniceum*
Riparian	Forb	Silverweed	*Potentilla anserina*
Riparian	Forb	Stinging Nettle	*Urtica dioica*
Riparian	Forb	Water Hemlock	*Cicuta maculata*
Riparian	Forb	Water Parsnip	*Sium suave*
Riparian	Forb	Western Willow Aster	*Symphyotrichum lanceolatum*
Riparian	Forb	Wild Mint	*Mentha arvensis*
Riparian	Forb	Yellow Avens	*Geum aleppicum*
Riparian	Forb	Yellow Water Crowfoot	*Ranunculus gmelinii*
Riparian	Non-native Forb (Weed)	Bladder Campion	*Silene vulgaris*
Riparian	Non-native Forb (Weed)	Canada Thistle	*Cirsium arvense*
Riparian	Non-native Forb (Weed)	Caraway	*Carum carvi*
Riparian	Non-native Forb (Weed)	Common Groundsel	*Senecio vulgaris*
Riparian	Non-native Forb (Weed)	Common Mullein	*Verbascum thapsus*
Riparian	Non-native Forb (Weed)	Common Tansy	*Tanacetum vulgaris*

Habitat	Growth Form	Common Name	Scientific Name
Riparian	Non-native Forb (Weed)	Common Toadflax	*Linaria vulgaris*
Riparian	Non-native Forb (Weed)	Creeping Bellflower	*Campanula rapunculoides*
Riparian	Non-native Forb (Weed)	Himalayan Balsam	*Impatiens glandulifera*
Riparian	Non-native Forb (Weed)	Leafy Spurge	*Euphorbia esula*
Riparian	Non-native Forb (Weed)	Meadow Hawkweed	*Hieracium caespitosum*
Riparian	Non-native Forb (Weed)	Orange Hawkweed	*Hieracium auranticum*
Riparian	Non-native Forb (Weed)	Ox-eye Daisy	*Leucanthemum vulgare*
Riparian	Non-native Forb (Weed)	Perennial Sow-thistle	*Sonchus arvensis*
Riparian	Non-native Forb (Weed)	Purple Loosestrife (rare)	*Lythrum salicaria*
Riparian	Non-native Forb (Weed)	Scentless Chamomile	*Anthemis arvensis*
Riparian	Non-native Forb (Weed)	Stinkweed	*Thlaspi arvense*
Riparian	Non-native Forb (Weed)	Tansy Ragwort	*Senecio jacobaea*
Riparian	Non-native Forb (Weed)	White Cockle	*Silene latifolia*
Riparian	Shrub	Alders	*Alnus* spp.
Riparian	Shrub	Bush Cranberries	*Viburnum* spp.
Riparian	Shrub	Chokecherry	*Prunus virginiana*
Riparian	Shrub	Currants and Gooseberries	*Ribes* spp.
Riparian	Shrub	Prickly Rose	*Rosa acicularis*
Riparian	Shrub	Raspberry	*Rubus idaeus*
Riparian	Shrub	Red Osier Dogwood	*Cornus sericea*
Riparian	Shrub	Saskatoon	*Amelanchier alnifolia*
Riparian	Shrub	Willows	*Salix* spp.
Riparian	Tree	Balsam Poplar	*Populus balsamifera*
Riparian	Tree	Paper Birch	*Betula papyrifera*
Riparian	Tree	Trembling Aspen	*Populus tremuloides*
Riparian	Tree	White Spruce	*Picea glauca*

Invasive Species

Existing and ongoing threat: Himalayan Balsam (*Impatiens glandulifera*), a plant listed as a Prohibited Noxious Weed under Alberta's Weed Control Act, was discovered on Pigeon Lake shorelines in the early 2000's. The plant's fast growth rates and aggressive seed dispersal mechanism (including transport in lake water) allowed it to rapidly invade lakeshores and replace native riparian vegetation. Himalayan Balsam infestations can increase shoreline erosion because the plants die off every year (leaving the shoreline bare and exposed for part of the year) and their shallow root systems are ineffective at retaining soil. An action plan for the eradication of this plant from the watershed was developed in 2009, and the Pigeon Lake shoreline was tentatively declared free of Himalayan Balsam in 2015. An ongoing monitoring and control effort is continuing to prevent a repeat infestation and support the re-establishment of native riparian vegetation. Other invasive plants such as Common Tansy and Creeping Bell Flower are rapidly becoming established in the riparian area. Non-chemical actions should be taken by all lakeside communities to combat this invasion.

Emerging Threats: Waterbodies are under constant threat from the unintentional introduction of invasive species. These organisms, whether they are plants, fish or invertebrates, can cause significant damage to the lake's ecosystem. Other areas in Alberta have already seen the effects of waterbody-choking plants such as Eurasian Watermilfoil or Flowering Rush and fish such as Prussian Carp, while species such as zebra and quagga mussels have caused immense devastation elsewhere in Canada. The introduction of these species

was the result of improper care of boats and other recreational items and by the inter-lake transfer of live fish. Extreme care must be taken with water vessels (boats, canoes, fishing gear, etc.) to ensure removal of any plants or animals. The *Clean, Drain, Dry* program has been introduced as a means of protecting lakes from these invasive species.

Some of the species of concern are:

- Zebra mussels (*Dreissnea polymorpha*) and quagga mussels (*D. bugensis*) were introduced to North America via ballast water from Eurasia and have severely disrupted aquatic ecosystems in the Great Lakes Region and elsewhere. These organisms attach to hard surfaces (e.g., boat hulls or propellers) in very high densities and their veligers (larvae) are readily transported in bait containers, live wells and internal ballast tanks. Thus, boats are the primary form of zebra and quagga mussel introduction to new waterbodies. In addition to disrupting aquatic food webs, zebra and quagga mussels pose a considerable nuisance to recreation and impediment to infrastructure; once colonies have established, they are extremely difficult to eradicate. Zebra and quagga mussels have not been detected in Pigeon Lake as of 2017, but similar to Eurasian Watermilfoil, early detection and action is necessary to prevent infestation and potentially irreversible consequences.
- Eurasian Watermilfoil (*Myriophyllum spicatum*), listed as a Prohibited Noxious Weed in Alberta, is a rooted aquatic plant that can be highly disruptive to lake ecosystems. It is an unpalatable food source for native waterfowl and fish, and its rapid growth and ability to grow from stem fragments allow it to out-compete native aquatic vegetation. The plant grows close to the water surface and can restrict swimming and boating access, as well as block water outlets. Eurasian Watermilfoil fragments are easily spread between waterbodies via boats, trailers, anchors and propellers. Lakes in British Columbia, Ontario and Quebec have already become infested. Although the plant has not been found in Pigeon Lake as of yet, some localized infestations exist elsewhere in Alberta. Early detection and a proactive boat maintenance program (clean, drain and dry) will be critical to prevent a serious lake-wide threat in Pigeon Lake.
- Flowering Rush (*Butomus umbellatus*), also listed as a Prohibited Noxious Weed in Alberta, is an aquatic plant that can severely disrupt wetland, river and lake ecosystems. It resembles a large sedge or bulrush but has showy pink flowers and can grow in both emergent and submerged forms. The plant has an extensive root system and – in addition to producing seeds – can reproduce vegetatively from root fragments if they are broken. These root fragments can travel long distances in water and create dense colonies where they establish, crowding out and displacing native aquatic vegetation. Flowering Rush can interfere with boat propellers and its large, dense stands can restrict waterbody access for a variety of lake users. Flowering Rush was sold commercially as an ornamental garden plant but has established in some lakes, rivers, creeks, irrigation canals, and stormwater ponds elsewhere in Alberta. This pant has not yet been observed in Pigeon Lake, though prevention of a Flowering Rush infestation will require early detection and proper control techniques if any plants establish in the waterbody.
- Prussian Carp (*Carassius gibelio*) are relatives of common goldfish and pose a serious threat to Alberta freshwater ecosystems. These fish are extremely hardy, able to survive in conditions of very poor water quality which would be intolerable for other fish species. Additionally, Prussian carp can reproduce asexually and effectively create clones of themselves, contributing to rapid population increases. The source of Prussian carp introduction into Alberta's aquatic ecosystems is unclear, though the impacts on aquatic ecosystems of these fish are well-documented. Prussian carp out-compete native fish species for food and habitat resources and can cause fundamental changes in the aquatic invertebrate communities, possibly leading to trophic collapses. There are established breeding populations in some ponds, lakes and rivers in Alberta, but no fish have been reported in Pigeon Lake as of 2017. Eradication of Prussian carp is very difficult once they are established in a

waterbody; hence, education efforts and prevention of introduction into Pigeon Lake are paramount.

Riparian BMPs

Riparian BMPs involve actions that can be taken by land owners and users within the Pigeon Lake watershed to improve the water quality of the lake and streams. These may include:

- Avoiding where possible activities that involve the removal of riparian vegetation such as mowing, trimming, herbicide applications, cultivating, and land clearing. Maintaining natural vegetation cover on shores is preferred to artificial armoring and modification of shorelines.
- Educating watershed property owners and lake visitors about the importance of littoral vegetation. The current perception of many is that most aquatic plants are all "weeds" and are a nuisance to lake users. However, educating the public on the ecological value of aquatic vegetation is important for the maintenance and improvement of these areas.
- Educating lake users and residents on how to recognize aquatic invasive species is critical for early detection and eradication.
- Encouraging the use of shared docks and day use areas, instead of individual ones.
- Ensuring adequate naturalized setbacks for upland activities such as residential development, cropping, or livestock grazing. This will include leaving a natural vegetation buffer around waterbodies and streams, reducing grazing intensity and access within riparian areas, and planting additional riparian vegetation.
- Eliminating the use of fertilizers and herbicides along the lakeshore.
- Limiting the use of salts on shoreline roads to limit the increase in lake salinity via runoff.

Plan Implications

- BMPs, such as those highlighted above, should be implemented for riparian areas all around Pigeon Lake. Given the extensive development around the lake, educating property owners and municipalities on riparian stewardship will be essential to ensure continued riparian health and function.
- The lake-wide riparian health assessment program should be continued and updated every five years. The last assessment was in 2008, indicating that Pigeon Lake is overdue for an updated shoreline assessment. This monitoring provides important information on how impaired the lakeshore as a whole is, and will inform where to prioritize riparian restoration efforts.
- A similar riparian assessment and monitoring program should be initiated for the inflowing streams into Pigeon Lake, as the ecological integrity of streams will directly affect that of the lake. This may include sensitive habitat mapping and assessment of littoral vegetation at stream tributaries and other key fish habitat areas.
- Consider a comprehensive inventory of critical fish and wildlife habitats such as Sensitive Habitat Inventory Mapping (e.g., Mason and Knight 2001) to identify sensitive shoreline features and habitats surrounding the lake. The resulting Aquatic Habitat Index can be used to inform local mapping and planning initiatives specific to Pigeon Lake.
- To increase the provision of important ecological functions and services, such as fish production and nutrient sequestration, restoration of riparian vegetation all around Pigeon Lake and along the inflowing streams and tributaries should be made a priority.
- Shoreline restoration and strict environmental controls on future development is necessary. Examples of such tools to implement include a regional plan, inter-municipal development plans and/or municipal bylaws.
    - Lake Shoreline Management Guidelines (e.g., EKILMP 2010) can inform municipal development planning specifically to manage the sensitive shoreline features of Pigeon Lake.
    - Implementation of Low Impact Development practices can greatly reduce the runoff of pollutants from the shoreline into the lake (see Alberta Low Impact Development Partnership).

    - Adoption of Sediment and Erosion Control BMP's and Environmental Construction Operations plans for construction activities near sensitive areas to ensure that contractors identify and mitigate their environmental impacts that may result from their activities.
- Ongoing monitoring and proactive efforts are necessary to prevent the infestation of aquatic and riparian invasive species, at both the citizen and government levels.

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3 SUMMARY OF THE SCIENCE: PIGEON LAKE

Historical Climate and Lake Level Fluctuations

Pigeon Lake is a permanent waterbody and has likely existed for thousands of years; due to its large size and low outflow rates, it has a very long residence time (the amount of time that water will remain in the lake) of >100 years. The watershed of Pigeon Lake is small relative to the lake itself, with a ~2:1 watershed (187 km^2) to lake (96.7 km^2) surface area ratio (FIGURE C3; Table C2). This small drainage basin and large evaporative area makes Pigeon Lake particularly sensitive to climatic variability, with changes to precipitation or evaporative rates having a considerable impact on lake water levels.

Pigeon Lake has a very long residence time (the amount of time that water will remain in the lake) of >100 years.

Table C2: Physical properties of Pigeon Lake and its watershed.

Physical Property	Value
Lake Surface Area	96.7 km^2
Lake Water Volume	603,000,000 m^3
Maximum Depth	9.1 m
Mean Depth	6.2 m
Shoreline Length	46 km
Mean Annual Lake Evaporation	664 mm
Mean Annual Precipitation	534 mm
Mean Annual Inflow	17,000,000 m^3
Mean Residence Time	Greater than 100 Years
Lake Weir Sill Elevation	849.935 m (Above Sea Level)
Watershed Land Drainage Area	187 km^2
Watershed to Lake Area Ratio	2:1

(From Mitchell and Prepas 1990)

Climate varies naturally over seasons and years following general atmospheric patterns (e.g., El Nino Southern Oscillation and the Pacific Decadal Oscillation). For example, FIGURE C9 shows mean annual temperature and precipitation for the Pigeon Lake watershed from 1961 to 2016. (Source: Alberta Agriculture and Forestry (interpolated weather data since 1961 for Alberta townships: https://agriculture.alberta.ca/acis/township-data-viewer.jsp). Mean annual precipitation for this period is 519 mm and mean annual temperature is 2.8°C. For precipitation patterns, there are several episodes of multiyear above average and below average periods: a relatively wet period occurred from 1988 to 1991 and from 1996 to 2001. Drier than normal precipitation consecutive periods (below the long-term mean) were observed from 1966 to 1971 and from 2001 to 2003. Mean annual temperature for the same period is 2.8°C, with values showing an increase over time. Climate change scenarios for the region indicate that an increase in precipitation, warmer temperatures, and particularly less cold winters are expected in the future (Davidson 2010).

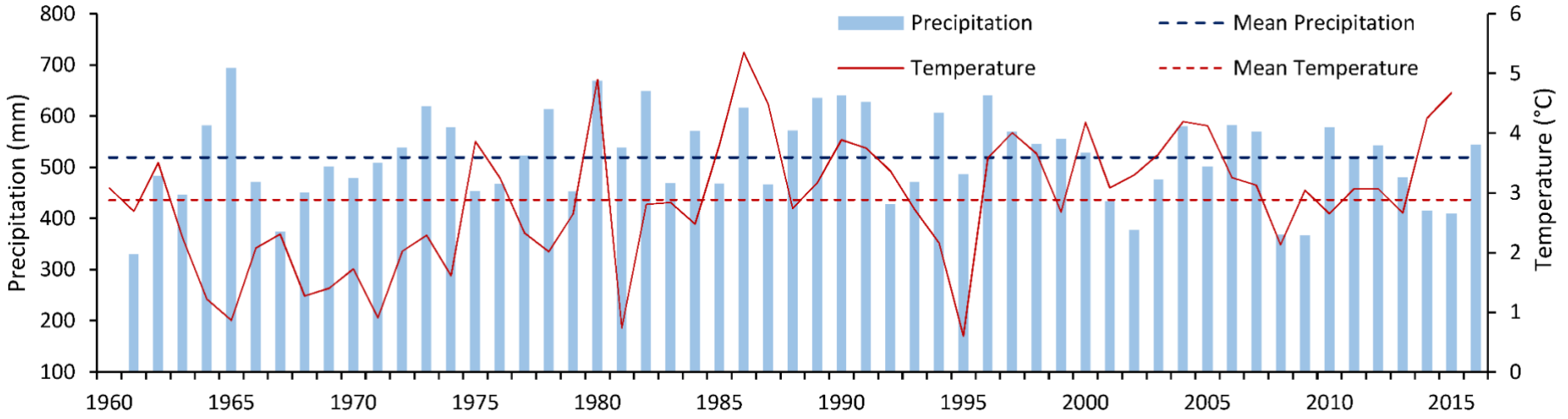

Figure C9. Mean annual temperature and total annual precipitation for the Pigeon Lake watershed.

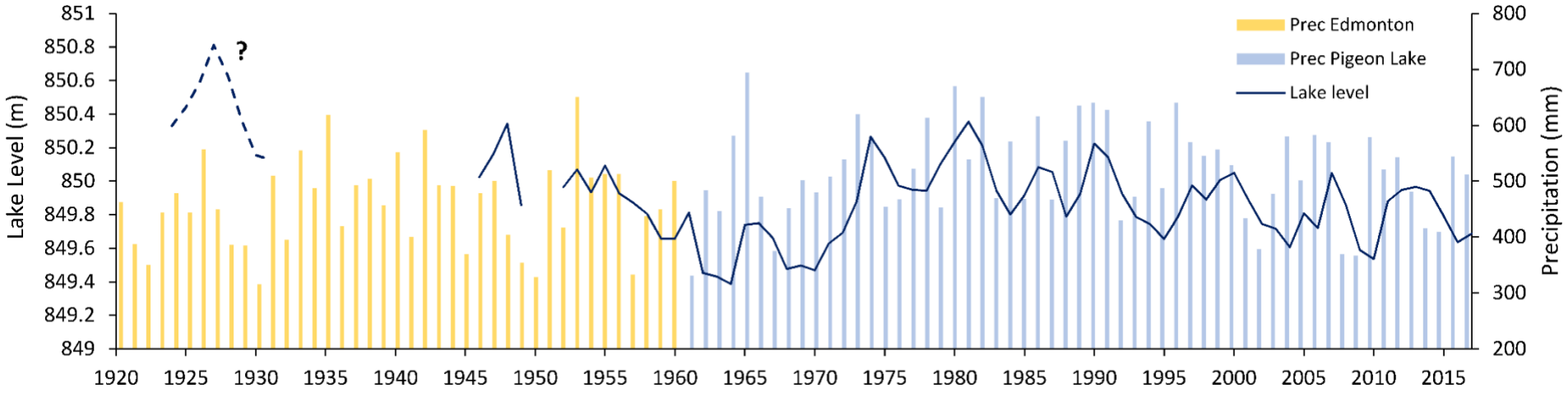

Figure C10. Pigeon Lake mean annual water levels and annual precipitation from 1920 to 2016.

Pigeon Lake historic annual precipitation and mean annual lake levels are shown in FIGURE C10. The annual precipitation from 1920 to 1960 is for the City of Edmonton (yellow bars) and from 1961-2016, shows when climate data became available for Pigeon Lake (blue bars). Data sources include Alberta Environment and Parks, Unpublished data (lake levels for Pigeon Lake); Environment and Climate Change Canada City of Edmonton precipitation data (http://climate.weather.gc.ca/); and Alberta Agriculture and Forestry (https://agriculture.alberta.ca/acis/township-data-viewer.jsp) Pigeon Lake watershed precipitation data.

Pigeon Lake water levels tend to rise and fall in response to cumulative wet and dry precipitation cycles. For example, a 7-year (1967 to 1973) steady increase in annual precipitation resulted in a 5-year (1970 to 1974) rise in Pigeon Lake mean annual water levels. Conversely a 4-year (1999 to 2002) annual precipitation decline caused Pigeon Lake mean annual water levels to decline from 2000 to 2004.

Intermittent water levels have been recorded for Pigeon Lake since 1924 with continuous daily water level monitoring from 1972 to present by Water Survey Canada. Lake levels prior to 1946 were omitted from the analysis because they were based on an assumed datum and could not be reliably converted to geodetic elevations.

Lake levels have not significantly decreased over time at the 95% confidence level during the period 1946-2017, as shown in Figure C11 (p-test = 0.414 and trend slope = -0.001). The shaded box represents the range of most (90 percent) of the historical data (5th and 95th percentiles). The historical data was outside of this range 10 percent of the time. The horizontal dashed line represents the long term median elevation (849.874 m) of the weir sill at the outlet of Pigeon Lake.

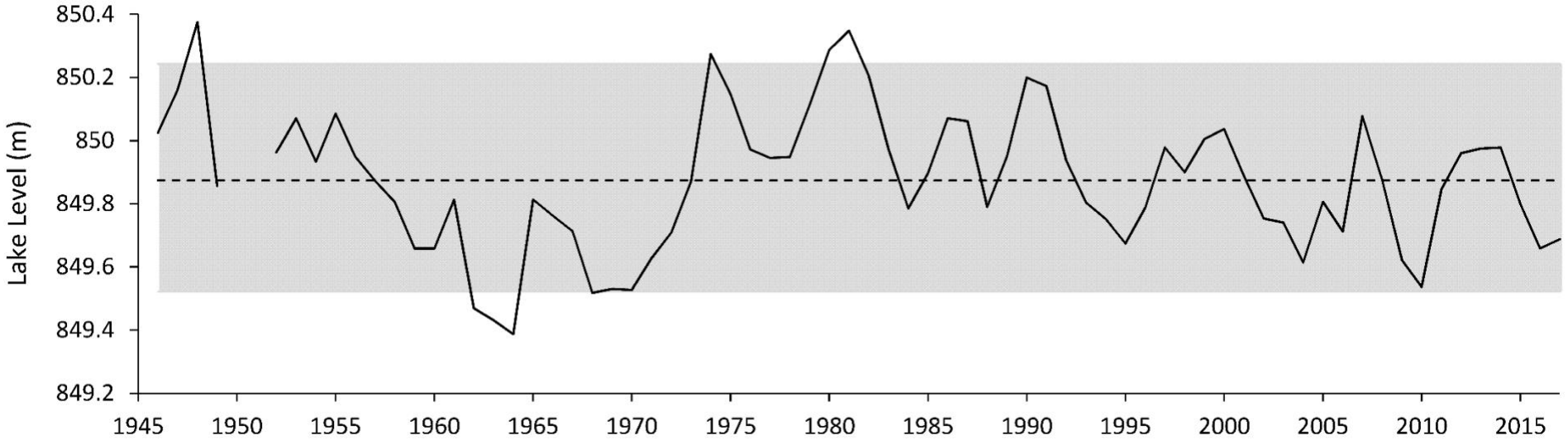

Figure C11: Pigeon Lake mean water level trends (1945-2016). The shaded box represents 5th and 95th percentiles. The horizontal dashed line represents the long-term median elevation (849.874 m) of the weir sill at the outlet of Pigeon Lake.

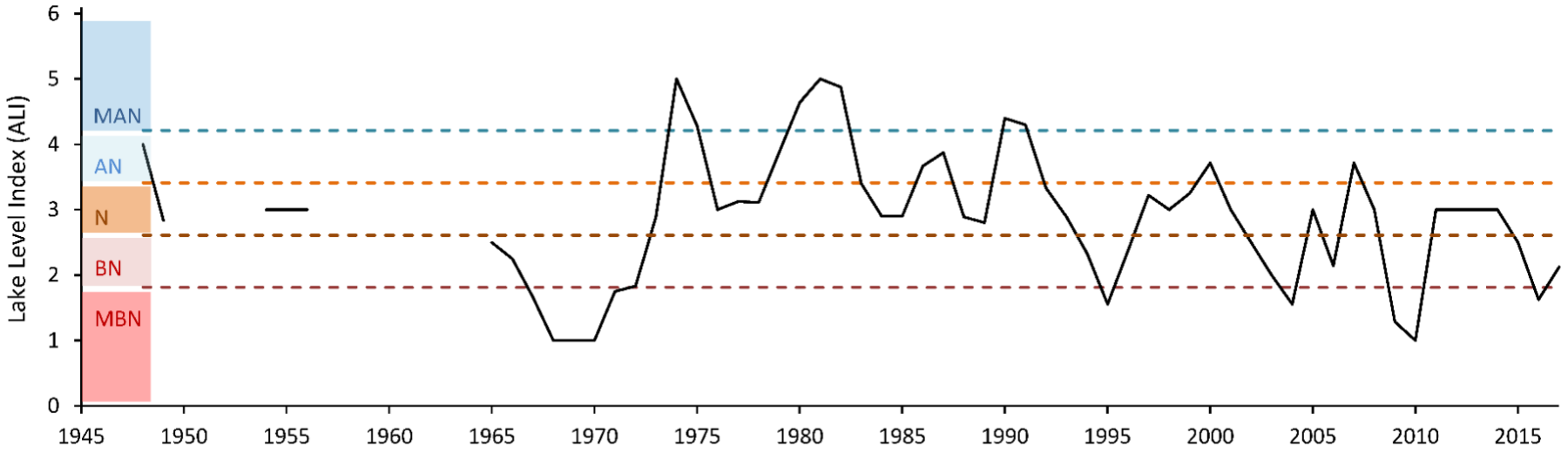

Figure C12. Lake Level Index for Pigeon Lake (1946-2017). Colored areas indicated the range of values for each of the five categories: MAN (Much Above Normal), AN (Above Normal), N (Normal), BN (Below Normal), MBN (Much Below Normal). Note that the index does not include those years with less than 3 lake level measurements.

Alberta Environment and Parks developed the "Alberta Lake Level Index" (ALI; Islam and Seneka 2015) to evaluate the status of lake levels across the province. This method takes into account intra-annual long-term changes in lake levels and has been proved to work well in lakes with limited measurements per year. Annual ALI values for Pigeon Lake, as well as the corresponding category, are provided in FIGURE C12. Lake level oscillations above and below normal are observed and seem to have followed a 20-year cycle: levels were normal or below normal in the 1950s and 1960s; they were normal to above normal from the early 1970s to the early 1990s; they have been normal to below normal from the early 1990s to 2017. Colored areas indicated the range of values for each of the five categories: MAN (Much Above Normal), AN (Above Normal), N (Normal), BN (Below Normal), MBN (Much Below Normal). Note that the index does not include those years with less than three lake level measurements.

FIGURE C13 shows the percent of time Pigeon Lake historic mean daily water levels from 1945 to 2016 equalled or exceeded a certain water level. For example the 70% exceedance is 849.80 m which means historically Pigeon Lake's mean daily water levels equalled or exceed 849.80 m 70% of the time. The 50% exceedance or median historic water level, is 849.922 m, which is 13 mm below the Pigeon Lake Full Supply Level of 849.935m. The 50% exceedance means historically Pigeon Lake's water levels have been above or equal to 849.922 m 50% of the time and below 849.922 m 50% of the time.

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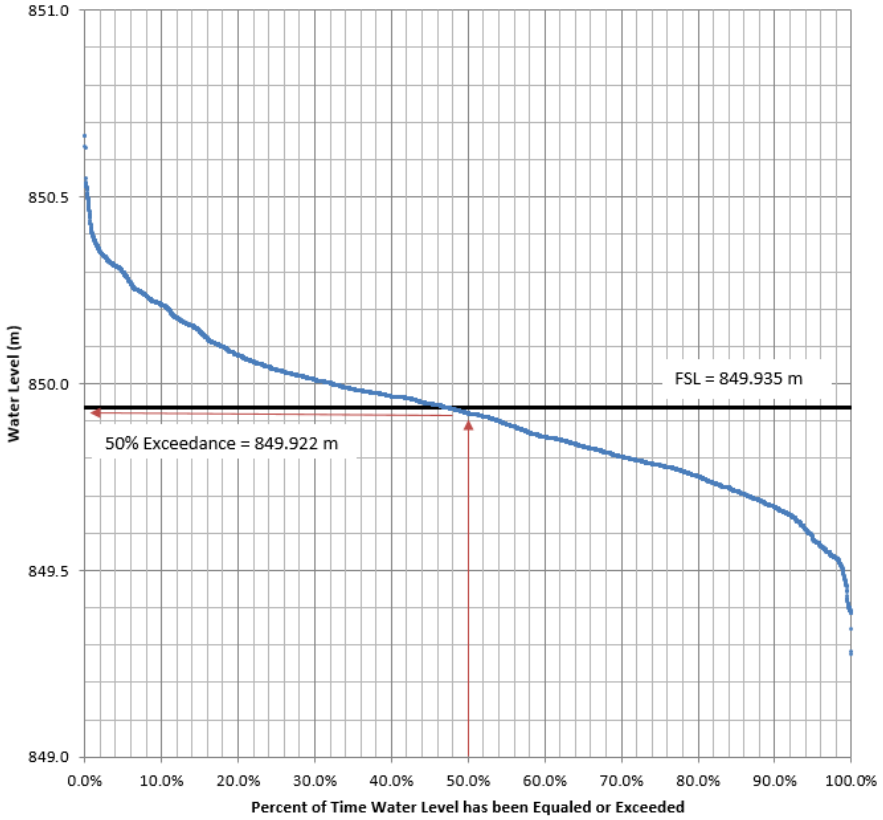

Figure C13: Pigeon Lake Historic Daily Water Levels Percent of Time Equaled or Exceeded (1945-2016).

Worley Parsons modelled the Pigeon Lake water balance from 1993-2009 (17-years) and concluded the mean annual lake input was 684.1 mm, including precipitation (64%), surface runoff (29%) and groundwater contributions (7%). Mean annual lake output was estimated at 701.8 mm and included lake evaporation (93%) and lake outflow (7%, including withdrawals). These results indicated that water losses (mainly through evaporation) exceeded water inputs to the lake, resulting in a mean annual water deficit of 17.7 mm (or 1,730 dam^3/year), matching the observed deficit of 18.7 mm/year for the 1993 to 2009 water balance evaluation period. Alberta Environment and Parks developed a 21-year (1986-2006) Pigeon Lake water balance model (unpublished) and found a mean annual 860 dam^3/year lake volume deficit. The Worley Parsons and Alberta Environment and Parks Pigeon Lake water balance results are summarized in TABLE C3. Although the two Pigeon Lake water balance models were developed independently, simulated different time periods and time intervals, the results were similar. Both concluding Pigeon Lake has similar mean annual surface inflow (19,233 dam^3/year vs 21,539 dam^3/year), groundwater represented a significant inflow component (20% vs. 23%), and there was a net water balance deficit during the simulation period (17.7 mm/year vs 8.5 mm/year) as shown in Table C3. The net deficit suggested by both Pigeon Lake water balance models reflect a relatively short simulation period (17 years vs 21 years) when Pigeon Lake levels were in a downward trend as shown by *Trend 3* in FIGURE C14.

Table C3: Pigeon Lake Water Balance Modelling Results.

Study Author	Worley Parsons		AEP	
Modelled Period	1993-2009		1986-2006	
Total Years	17		21	
	(mm/year)	*(cu.dam/year)*	*(mm/year)*	*(cu.dam/year)*
Inputs:				
Precipitation	438.0	42,653	523.0	50,930
Groundwater Inflow	48.6	4,733	67.1	6,539
Surface Inflow	197.5	19,233	221.2	21,539
Total Inputs	*684.1*	66,619	*811.3*	79,008
Ratio GW to GW&SW	20%		23%	
Outputs:				
Lake Evaporation	657.0	63,979	762.9	74,289
Withdrawals	3.6	347	3.6	355
Lake Discharge	41.3	4,020	53.6	5,224
Total Outputs	*701.8*	68,346	*820.2*	79,868
Net Deficit:	17.7	1,727	8.8	860

FIGURE C14 C14 shows three historic water level trends for Pigeon Lake between 1945 and 2010. Pigeon Lake water levels dropped significantly for 20-years (1950-1970) shown as Trend 1. Pigeon Lake water levels rebounded during the wet years in the 1970s indicated by Trend 2. Trend 3 shows Pigeon Lake in another decreasing cyclic and it was during this time period the two water balance models were developed and why both models correctly demonstrated a net deficit for Pigeon Lake. Both water balance models simulated a relatively short hydrologic time period when Pigeon Lake was in a decreasing trend (Trend 3) therefore the modelling results do not reflect the long-term historic variability of Pigeon Lake climate nor cyclic water level trends (Trends 1 and 2). There is no evidence that the long term average water volume in Pigeon Lake is decreasing beyond historical natural variability

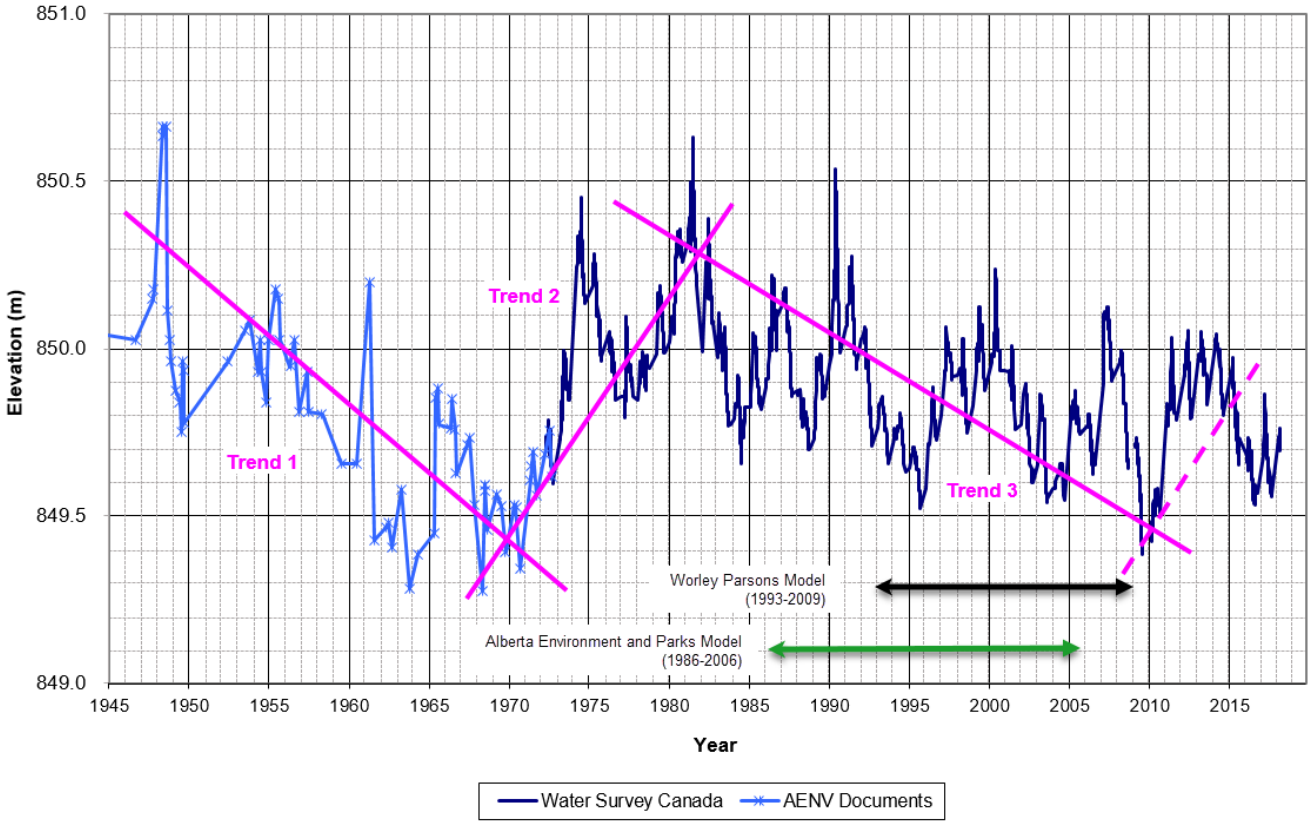

Figure C14: Pigeon Lake Mean Daily Water Level Trends and Water Balance Model Simulation Period.

Overall, extensive historical water level data has demonstrated that Pigeon Lake experiences ongoing water level cycles of both increasing and decreasing trends when considered over a longer time-period as a result of variability in weather patterns (FIGURES C9, C10, C11, C12, C14). In a manner similar to other prairie lakes, the water level varies by approximately 1.3 m. There is no evidence that the long-term average water volume in Pigeon Lake is decreasing beyond historical variability.

The outflow creek that drains Pigeon Lake into the Battle River is fitted with a weir with a sill elevation of 849.935 masl. When the water level reaches this elevation, outflow occurs, including nominal export of nutrients (FIGURES C4, C5). Attempts to maintain water levels above the weir sill elevation may benefit recreational users and may result in the removal of some nutrients from the water column, but issues of nutrient input (both internal and external loadings) would still need to be addressed. Proposals to manage lake levels at

an artificial level above the weir crest elevation entails that supplemental water would have to be introduced into Pigeon Lake from beyond its watershed to increase the lake volume flushing rate (i.e., decrease the lake residence time). Due to the significant regulatory implications and resources required for such a project, further study of the efficacy of such an option should be completed and must address issues such as:

- Implications for downstream flooding and nutrient flushing on water quality of waterbodies downstream of Pigeon Lake.
- Enhanced flood risk for shoreline properties, as well as the potential for ice damage and associated erosion potential.
- Nutrient additions and risk of invasive species from water importation.
- Long-term financial and liability issues for such a project.
- Environmental effects in the water body where the water would be withdrawn from.
- Estimates of nutrient removal recognizing that nutrients concentrations are very low for most of the year and peak only in the months of July, August and September.

Lake Water Quality Studies

Phosphorus is known to be the major nutrient limiting biological growth in lake ecosystems as it is often present in low concentrations relative to other nutrients (e.g., Nitrogen). Consequently, increases in its availability (particularly in the dissolved form) can result in undesirable production of phytoplankton such as cyanobacteria.

Detailed monitoring of P has occurred in Pigeon Lake to determine whether recent cyanobacteria blooms are a response to excess nutrient concentrations in the water. While Pigeon Lake was confirmed to be P-limited relative to N, the blooms are not solely a consequence of external nutrient loading into the lake. Based on the 2014 Pigeon Lake P budget, internal sources of P (internal loading) are estimated to contribute about 57% of the total available P into the lake's water column (FIGURE C1). Mechanisms behind Pigeon Lake P release involve complex chemical and biological reactions and require further study.

Sediment analysis in 2013 detected higher concentrations of dissolved forms of P (such as orthophosphate) in waters near the sediment layer than at the surface, confirming internal release of P from the sediments (Teichreb et al. 2014). Dissolved forms of P are preferentially taken up by phytoplankton and are thought to be released from lake sediments under periodic anoxic conditions associated with minimal wind mixing and de-oxygenation of deeper waters and also from direct uptake from the phytoplankton. Internal P loading can occur even when lake-bottom waters are well-oxygenated, due to warm temperatures facilitating high rates of organic matter decomposition rates and P release.

Chlorophyll-*a* is a photosynthetic pigment produced by phytoplankton and is commonly used to represent phytoplankton biomass. Elevated levels of chlorophyll-*a* indicate high phytoplankton biomass, which are typically caused by an excess of dissolved (bioavailable) nutrients (i.e., PO_4^{3-}) in the water body. This dissolved phosphorus is taken up by phytoplankton, where it becomes part of its biomass. Because of this, a significant amount of phosphorus is stored in phytoplankton. Analysis of chlorophyll-*a* and TP in Pigeon Lake from 1983-2016 show that both parameters fluctuated considerably and, on average, neither had a statistically significant increase over this 33-year period (FIGURES C15, C16). These data indicate that the variability and peaks in P and chlorophyll-*a* may have been higher in recent years, although this requires further examination (e.g., this could be caused by a change in laboratories).

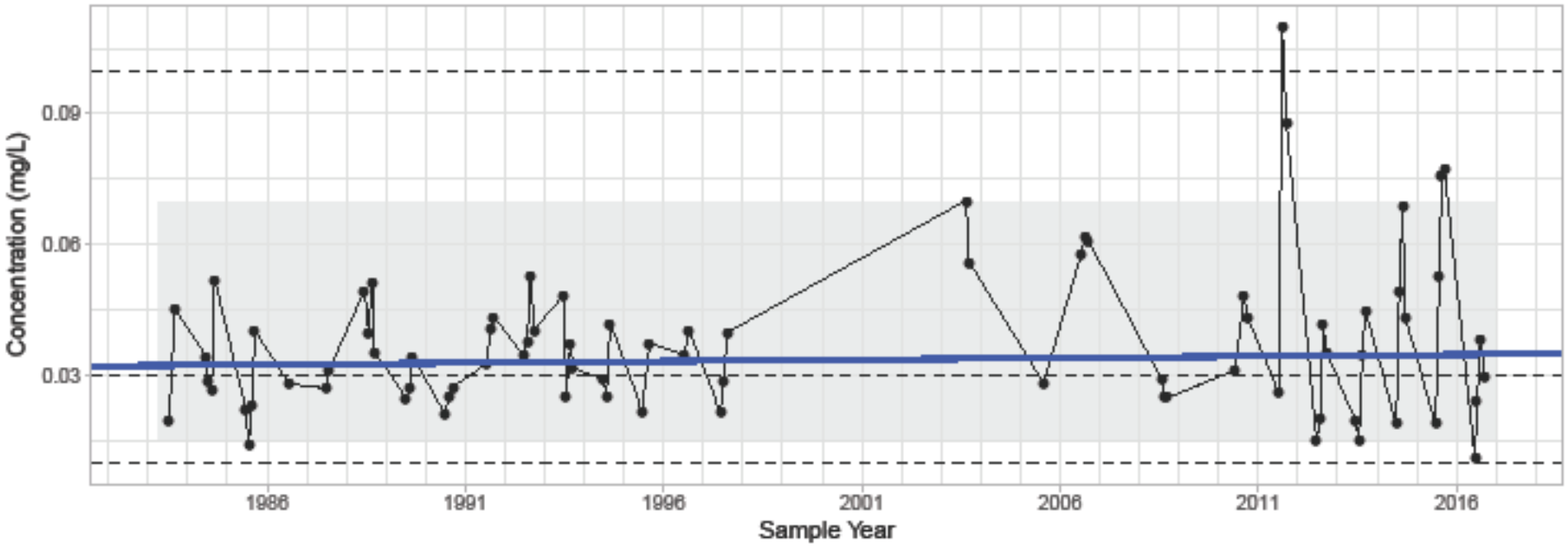

Figure C15: Trend analysis of total phosphorus concentrations in Pigeon Lake over time (1983-2016, June-September data). There is no significant change in total phosphorus concentrations over time (trend test *p*-value = 0.508). The blue line represents the trend line (slope <0.001). The shaded box represents the range of most (90 percent) of the historical data (5th and 95th percentiles). The historical data was outside of this range 10 percent of the time. Horizontal dashed lines represent trophic state cut-offs: oligotrophic <0.01 mg/L; mesotrophic = 0.01 – 0.03 mg/L; eutrophic = 0.03 – 0.1 mg/L; hypereutrophic >0.1 mg/L.

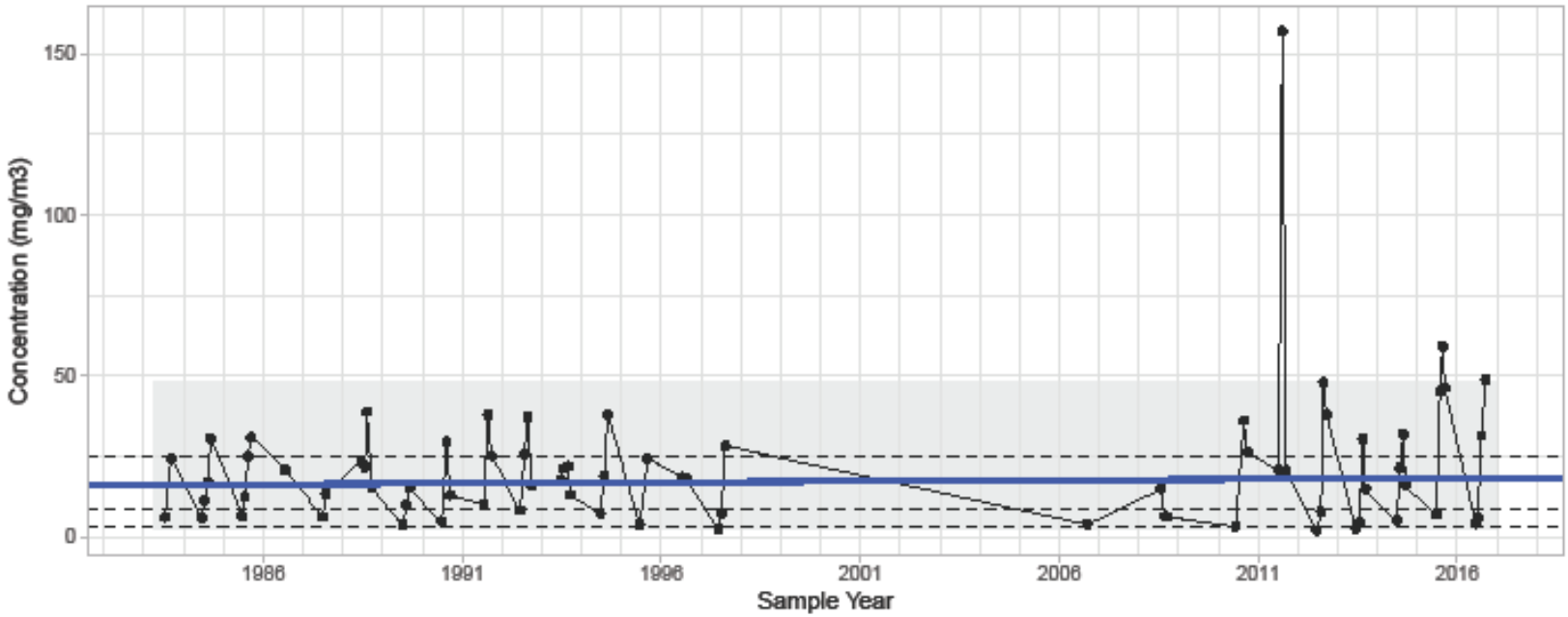

Figure C16: Trend analysis of chlorophyll-*a* concentrations in Pigeon Lake over time (1983-2016, June-September data). There is no significant change in total chlorophyll-*a* concentration over time (trend test *p*-value = 0.529). The blue line represents the trend line (slope = 0.064). The shaded box represents the range of most (90 percent) of the historical data (5^{th} and 95^{th} percentiles). The historical data was outside of this range 10 percent of the time. Horizontal dashed lines represent trophic state cut-offs: oligotrophic <3.5 mg/m^3; mesotrophic = 3.5 – 9 mg/m^3; eutrophic = 9 – 25 mg/m^3; hypereutrophic >25 mg/m^3.

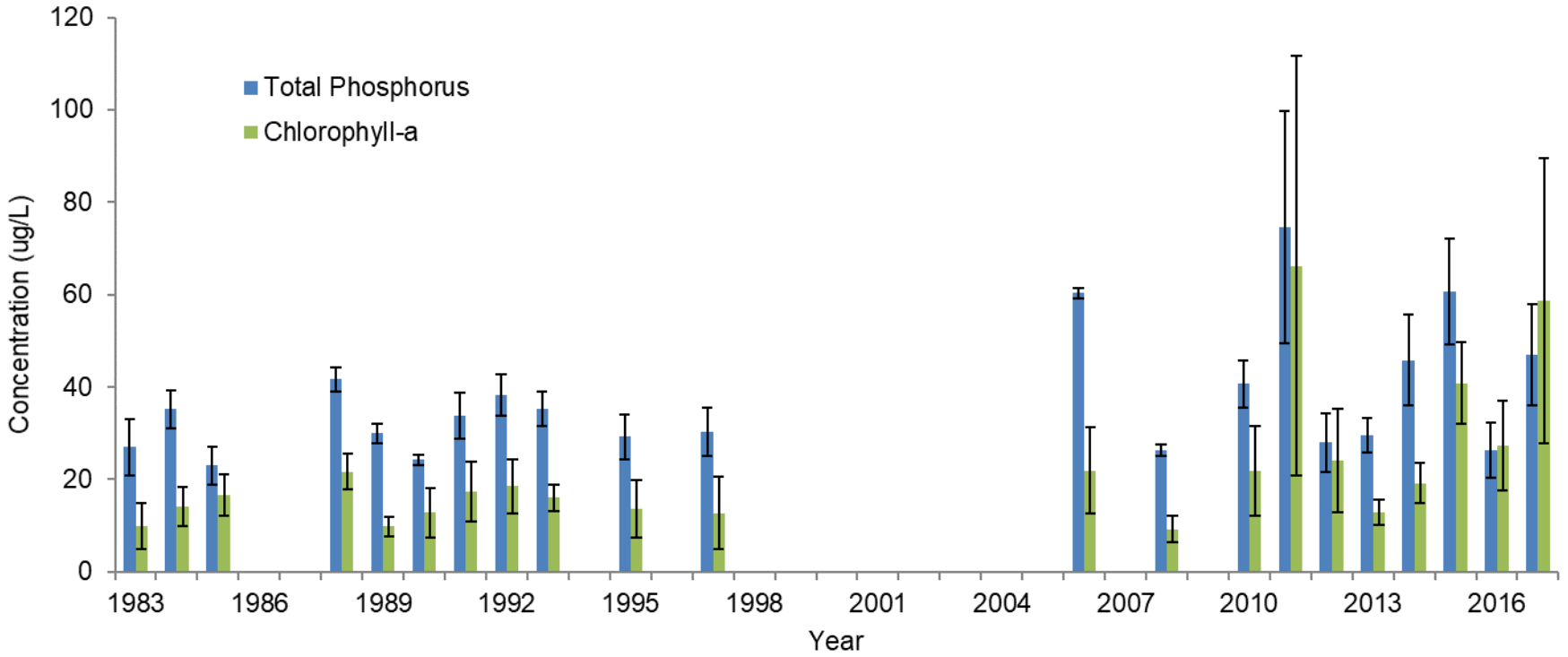

Figure C17: Average annual total phosphorus and chlorophyll-*a* concentrations in Pigeon Lake over time (1983-2017). Note that these variables were analyzed from monthly (May to September) samples taken at 10 sites around the lake, which together represent the conditions of the entire lake. Bars represent standard errors.

FIGURE C17 depicts the variation in average P and chlorophyll-*a* over time. However, there is an incomplete understanding of factors that result in the inter-annual variation in both P and chlorophyll-*a* concentrations. In most years, concentration of TP and chlorophyll-*a* followed an annual pattern, with a steady increase from June and July, peak concentration in August, and a plateau or decrease in September (FIGURE C18). This increase in mid-summer is typical of many shallow lakes, where dissolved nutrients from the decomposition at the lake bottom can be repeatedly distributed to the surface water due to weak thermal stratification.

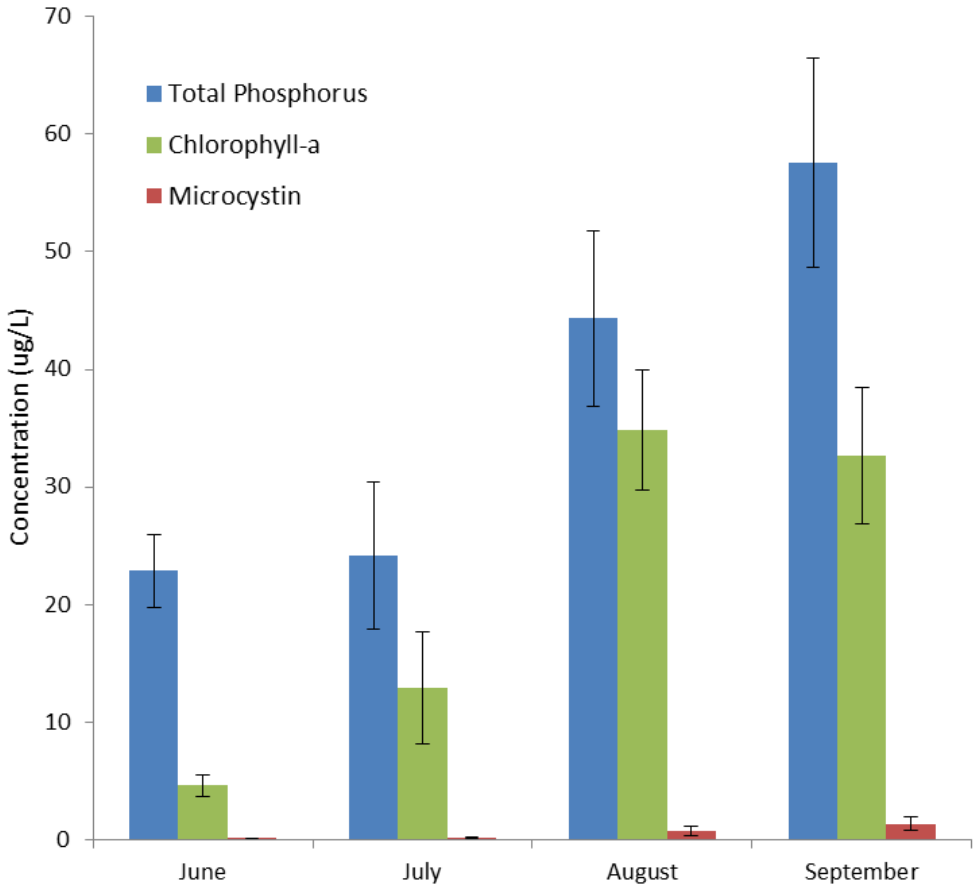

Figure C18: Monthly total phosphorus, chlorophyll-*a*, and microcystin concentrations during the open water season, averaged between 2010-2017. Bars represent standard errors.

Microcystins are toxins produced by certain species of cyanobacteria and sometimes accompany algal blooms. In sufficient concentrations, microcystins can pose a serious threat to human and animal health. In light of the recent cyanobacteria blooms in Pigeon Lake, the Alberta Lake Management Society has conducted annual monitoring of microcystins as part of their whole-lake monitoring program since 2010. Microcystin concentrations were generally low, never exceeding Alberta Surface Water Quality Guidelines for Recreation and Aesthetics (20 µg/L) in open water. Since 2012, Alberta Health Services has been monitoring microcystin concentrations and amount of cyanobacteria consistently at six beaches on Pigeon Lake: Grandview, Ma-Me-O, Mission, Provincial Park, Silver, and Zeiner. As seen in Table C4, these data are very variable, given the dynamic nature of beach ecosystems. Beach microcystin is generally low, except in 2015 when it surpassed the Alberta Guidelines for Recreation and Aesthetics at beach locations at Grandview Beach, Pigeon Lake Provincial Park, and Silver Beach. The amount of total cyanobacteria frequently surpasses the Recreation and Aesthetics Guidelines (100,000 cells/ml) at all beaches, which is not uncommon in Alberta.

Table C4: Microcystin-LR concentration and cyanobacteria cell counts measured at six Pigeon Lake beaches by Alberta Health.

Beach	Minimum value		Average value		Maximum value	
	Microcyst (µg/L)	Cell Count (#/ml)	Microcyst (µg/L)	Cell Count (#/ml)	Microcyst (µg/L)	Cell Count (#/ml)
Grandview	0.03	0	2.32	696,926	59.84	6,787,472
Ma-Me-O	0.03	0	0.88	505,177	13.26	5,610,115
Mission	0.03	0	0.84	583,629	8.25	15,788,134
Prov. Park	0.03	0	2.09	379,846	60.47	3,556,608
Silver	0.03	0	8.92	138,784	483.50	953,094
Zeiner Park	0.05	0	0.73	532,364	15.86	8,040,846

Besides favorable environmental conditions, the success and proliferation of cyanobacteria in Pigeon Lake may be partly attributable to certain aspects of their biology. These include fast reproductive rates, lower light requirements relative to other phytoplankton, decreased palatability to some grazing zooplankton, buoyancy-promoting gas vesicles in certain species, N-fixing capability of certain species, and the ability of certain species to extract P from the sediments directly.

While cyanobacteria-ecosystem dynamics are not yet fully understood in Pigeon Lake, ecological perturbations observed in other eutrophic lakes may indicate some of the potential impacts that cyanobacteria blooms have on Pigeon Lake's biota. For example, the increased turbidity of lake water during and following cyanobacteria blooms decreases light penetration into the water, which suppresses the growth of rooted aquatic vegetation. The capacity of the vegetation to uptake P from the sediments and retain it in biomass is reduced, resulting in more nutrients available for internal loading and feeding cyanobacteria blooms, thereby promoting a positive feedback cycle.

The water temperature of Pigeon Lake is another important factor affecting water quality, as cyanobacteria are known to have a competitive advantage over other phytoplankton in warmer waters. Water temperature varies both seasonally and diurnally, though the shallow basin in Pigeon Lake limits thermal stratification and results in largely consistent temperatures and dissolved oxygen levels throughout the water column.

Metals are naturally present in aquatic environments as an artifact of rock weathering, though elevated levels of certain metals may be indicative of industrial pollution. While 27 metals were detected in Pigeon Lake water column samples in 2003, 2012, and 2014-2017, all of these occurrences were well below their respective water quality guidelines.

Paleolimnological Sediments Studies

The water quality of Pigeon Lake has been well monitored within recent decades in response to the eutrophication and frequent cyanobacteria bloom events that currently affect the lake. However, the existing water quality data record do not cover large periods of Pigeon Lake's watershed development during the mid-20th century, resulting in limited data available to determine whether the lake water quality and algal dynamics baselines have changed over time.

In 2013, a paleolimnological study of Pigeon Lake was undertaken to examine changes in lake water quality over the past century (~1900-2013) using multiple indicators in lake sediments (Köster et al. 2014). Analysis of sediment cores revealed that Pigeon Lake is naturally rich in nutrients and cyanobacteria, with an enrichment of organic materials, P and cyanobacteria counts in the 1950s corresponding to watershed development. Over the entire study period, a slight increase in cyanobacteria abundance relative to other phytoplankton taxa was observed. Additionally, calmer waters and increased lake ion content within the past 20 years were inferred based on phytoplankton community data.

As Pigeon Lake is a naturally productive lake, a realistic water quality management target would be to maintain a water quality standard sufficient for normal recreational use with limited algae blooms. In other words, an acceptable water management target would be to lower nutrient concentrations to a point where the lake maintains excellent fish and wildlife productivity, but enough to reduce the frequency and intensity of algal blooms. As such, realistic expectations of watershed and water quality improvements are necessary. Cyanobacterial blooms are driven not only by watershed activities but also by water temperatures, wind and solar radiation, and internal nutrient loadings.

Food Web Studies

Manipulation of the relative abundances of organisms higher up in the food chain can be an effective approach to regulate cyanobacteria populations under certain conditions. One such approach is to increase the abundance of herbivorous zooplankton and thereby increase the amount of grazing pressure on the cyanobacteria. Researchers from the University of Alberta have begun to conduct such experiments in enclosed systems in Pigeon Lake. More research needs to be conducted to determine if a reduction in cyanobacteria levels in Pigeon Lake may be achieved through a top-down grazing approach before biomanipulation efforts can proceed.

Paleolimnological analysis of sediment cores indicates that cyanobacteria have been part of the phytoplankton community at Pigeon Lake for at least a century. However, favorable water conditions in recent years may have facilitated the excess proliferation of cyanobacteria into blooms. These conditions include not only excess nutrient (i.e., P) availability but also may include climate-related factors such as increased water column stability (due to altered wind patterns) and warmer surface water temperatures. While the exact mechanisms leading to bloom formation in Pigeon Lake are currently unknown, warmer and calmer waters likely give cyanobacteria a competitive advantage over true algae. Because these environmental conditions change seasonally and annually, however, prediction of cyanobacterial bloom occurrence, intensity, duration and location is difficult.

Due to its large size and shallow depth, the waters of Pigeon Lake are relatively well-mixed and thus well-oxygenated. Both dissolved oxygen levels and temperature are relatively consistent throughout the water column (albeit with seasonal variation), with anoxic conditions (dissolved oxygen concentrations < 2 mg/L) developing at depths of 7 m or deeper. As a by-product of photosynthesis, phytoplankton release oxygen into the water column, meaning that during a bloom there is typically an initial increase in the

dissolved oxygen content of the water column. However, when the colony of phytoplankton eventually dies, the decomposition of such a large quantity of biomass consumes much of the dissolved oxygen in the water column and may deplete the oxygen content of the water to critically low levels. Extensive asphyxiation and mortality of other aquatic life can occur, resulting in fish kills.

The fish populations of Pigeon Lake have been monitored for decades, though the precise interactions between cyanobacteria and the fish community are unknown. Dominance of the phytoplankton community by cyanobacteria may disrupt the balance in the natural food web structure of the lake, and thus affect the amount and quality of food for fish. Similarly, blooms may also cause environmental conditions unfavorable to fish health such water high in turbidity and low in oxygen.

In addition to these environmental stressors, fishes such as Walleye (*Sander vitreus*), Northern Pike (*Esox lucius*), Lake Whitefish (*Coregonus clupeaformis*), and Yellow Perch (*Perca flavescens*) have been subject to direct anthropogenic pressures such as habitat modification, angling, and commercial fishing. Despite being a large lake, Pigeon Lake is subject to greater fishing pressure than smaller lakes due to deeper areas of the lake being unusable as fish habitat. Consequently, both fish and anglers are concentrated into the small areas of suitable habitat. Any changes to the amount of available habitat or the existing angling rates will place more pressure on the fish populations and may contribute to a fishery collapse.

Overharvesting appears to have led to the extirpation of Walleye from Pigeon Lake in the 1950s, and the current sustainable population in the lake is the result of intensive stocking efforts in the 1990s. Lake Whitefish populations have fluctuated considerably over the past century but are currently considered to be stable. A large Lake Whitefish mortality event in 2012 was thought to be due to lake temperature but does not seem to have negatively affected overall populations. In Alberta the commercial fishery was ended in 2014. The Northern Pike populations in Pigeon Lake are considered collapsed, and a zero-catch limit was imposed as of April 1, 2016. Factors which may have contributed to this decline include the extirpation of this species in the 1950's, loss of littoral spawning and feeding habitat, direct competition with the reintroduction of Walleye as an apex predator, and overfishing. Similarly, Yellow Perch populations are considered to be in a vulnerable to collapsed state. All species are under threat from ongoing habitat loss and overfishing.

BMPs from Other Jurisdictions

The APLM technical committees have reviewed several methods that have been implemented in other jurisdictions to address excess lake nutrient levels and harmful algal blooms. Treatment options which may be feasible include:

- Short-term treatment options (removal of phytoplankton)
    - Biomanipulation to support top-down biological control of cyanobacteria
    - Harvesting phytoplankton from the water surface and shorelines and
- Longer term treatment options (inactivation of nutrients)
    - Chemical inactivation of P in the water column via addition of alum, calcium, iron or lanthanum-enriched bentonite clay (e.g., Phoslock®)

These approaches are currently being reviewed to determine their viability to treat the current water quality problems in Pigeon Lake; however, the circumstances supporting their efficacy at one lake may not be true when applied to another. Review of these strategies requires lake-specific research, environmental and socio-economic risk assessments (including evaluation of potential risks to the lake, financial costs, and overall efficacy), and formal stakeholder consultation and regulatory approval prior to implementation.

Plan Implications

- To maintain the natural functioning of an aquatic ecosystem adapted to nutrient-rich conditions, an appropriate management target would be to maintain a water quality level amenable for recreational use with a minimal occurrence of algae blooms.
- Pigeon Lake is naturally nutrient-rich, with the P loading into the water column from both the watershed and lake sediments. Thus, actions should be taken to reduce both external and internal nutrient loading into Pigeon Lake, though the allocation of efforts between these sources may vary due to technical, financial, and feasibility considerations. Development of a nutrient reduction model may be an effective approach to determine what combination of activities will result in the most effective remediation with a relatively low level of risk.
- The existing P budget for Pigeon Lake should be recalculated with the additional P data collected from the lake and inflowing streams, including the importance of the spring runoff (freshet), with updates to better reflect the true imports and export rates. For example, the current P budget does not account for biological sources of P, such as that in water-bird excrement or in the biomass of stocked fishes. In addition, the nutrient budget should consider the impact of bioavailable vs particulate P for source identification.
- In addition to increased nutrient availability, cyanobacteria blooms are likely driven by several additional factors such as increased water stability (both turbulence and thermodynamically), changing climate conditions, increased light availability, and shoreline modification. Further research is necessary to identify the interactions of these and other factors and to determine the mechanisms responsible for cyanobacteria bloom dynamics. For example, analysis of long-term water quality and phytoplankton community data may reveal the physical or chemical drivers behind seasonal phytoplankton community shifts favoring cyanobacteria dominance.
- A comprehensive water quality model should be developed for Pigeon Lake to assist with lake management. This could allow various management scenarios to be run and their effects on the lake ecosystem to be predicted, such anticipating potential trophic cascades or simulating the effects of supplemental water inputs on nutrient dynamics. Such a model would ideally incorporate all available hydrological, ecological, and water quality data for Pigeon Lake and its watershed to support informed decision-making.
- Accurate and up-to-date water quality data for Pigeon Lake are essential for updating the P budget and the development of an effective lake- and watershed-scale water quality model.
- Robust fish populations are important to both the ecology of Pigeon Lake and the sustainability of recreational and First Nations fisheries. Additional study of how fish populations interact with cyanobacterial blooms is warranted. Managing fish populations may provide a tool to assist in managing cyanobacterial blooms. In the meantime, a conservative fisheries management approach is recommended.

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APPENDIX D: GLOSSARY

Preface

This Glossary defines technical terms used in the Pigeon Lake Watershed Management Plan 2017 and Appendix C Technical Summary. These are technical terms which are in use by professionals for the management of Lakes and Watersheds in Alberta. Technical terms have been derived from two primary Alberta authorities. Environmental planning terms are derived largely from the latter GoA collection plus broadly sourced.

- Alberta Lake Management Society (ALMS): https://alms.ca/educational-resources/
- Government of Alberta: http://aep.alberta.ca/water/programs-and-services/water-for-life/partnerships/documents/8043.pdf

The reader is referred to the source authorities (above) for technical definitions not found below and for the definition source authorities.

Selected terms have been retained in this collection which are relevant to the Pigeon Lake Watershed Management Plan.

TECHNICAL TERMS – WATERSHED, LAKE MANAGEMENT & ENVIRONMENTAL PLANNING

Adaptive Management

A dynamic system or process of task organization and execution that recognizes the future cannot be predicted perfectly. Planning and organizational strategies are reviewed and modified frequently as better information becomes available. Adaptive management applies scientific principles and methods to improve management activities incrementally as decision-makers learn from experience, collect new scientific findings, and adapt to changing social expectations and demands. (SEM)

Algae

Aquatic, nonvascular organisms which typically contain chlorophyll and usually include the green, yellow-green, brown, and red algae and the blue-green algae (also known as cyanobacteria). (ALMS)

Algal Bloom

Population explosion of algae in surface waters due to an increase in plant nutrients such as nitrates and phosphates.[8] Usually due to excessive blue green algae growth. (ALMS)

Bacteria

Tiny, unicellular organisms that reproduce by cell division and usually have cell walls; can be shaped like spheres, rods or spirals and can be found in virtually any environment. (ALMS)

Beneficial Management Practices (BMPs)

Techniques and procedures that have been proven through research, testing, and use to be the most effective and appropriate for use in Alberta.

Effectiveness and appropriateness are determined by a combination of: (1) the efficiency of resource use, (2) the availability and evaluation of practical alternatives, (3) the creation of social, economic, and environmental benefits, and (5) the reduction of social, economic, and environmental negative impacts. (BRBC)

Benthic

Referring to bottom zones or bottom-dwelling forms. (ALMS)

Benthos

Animals and plants living on or within the substrate of a water body (freshwater, estuarine or marine). (ALMS)

Bioavailability

The amount of a nutrient that is in a form that is available for uptake and use by biological organisms. (ALMS)

Biodiversity

The existence of a wide range of different types of organisms in a given place at a given time. (ALMS)

Chlorophyll

A green, light-absorbing pigment found in plants and other photosynthetic organisms. A magnesium-porphyrin complex, it is an essential electron donor in photosynthesis. The amount of chlorophyll present in lake water depends on the amount of algae and is therefore used as a common indicator of water quality. (ALMS)

Clarity

A measure of the light penetration of water, generally measured using a Secchi disk. (ALMS)

Conservation

1. The planning, management, and implementation of an activity with the objective of protecting the essential physical, chemical, and biological characteristics of the environment against degradation. (EPEA)

2. The process of managing biological resources (e.g., timber, fish) to ensure replacement by re-growth or reproduction of the part harvested before another harvest occurs. A balance between economic growth and environmental and natural resource protection. (G&G glossary)

Cumulative Effects

The combined effects on the aquatic environment or human developments arising from the combined environmental impacts of several individual projects. (WCAG)

Cyanobacteria

A group of aquatic bacteria (also known as blue-green algae) that are capable of photosynthesis. Excessive amounts of cyanobacteria (harmful algal blooms) can negatively impact water quality through production of natural toxins (e.g., microcystin) and through depleting water oxygen levels. (ALMS)

Decomposition

The breakdown of dead organic material through physical, chemical and biological processes. (ALMS)

Detritus

Undissolved organic or inorganic matter resulting from the decomposition of biological parent material. (ALMS)

Dissolved Oxygen

The amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of

water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water (ppm). (ALMS)

Drainage Basin

The total area of land that contributes water and materials to a lake, river, or other water body, either through streams or by localized overland runoff along shorelines. (SWQG)

Diffuse Phosphorus Load

Diffuse is associated with particular land uses as opposed to individual points of origin or discharge. Diffuse phosphorus loading can arise from activities related to agriculture, forestry, urban development, mining, oil and gas, construction, and recreation. Such diverse sources along with the fact that diffuse sources can be transported by rainwater, snowmelt, runoff, air deposition and groundwater, make it difficult to prevent, measure, control, quantify and manage this type of pollution. Land surface (e.g., slope), soil texture, geology, vegetation, hydrology and climate also affect the timing and extent of Diffuse loads. (also known as non-point source pollution; also see pollution)

Ecosystem

A community of interdependent organisms together with the environment they inhabit and with which they interact. (BRBC)

Ecosystem Functions

Processes that are necessary for the self-maintenance of an Ecosystem such as primary production, nutrient cycling and decomposition. The term is used primarily as a distinction from values. (NALMS)

Environment

The components of the earth, including air, land, and water, all layers of the atmosphere, organic and inorganic matter, living organisms, and their interacting natural systems. (EPEA)

Environmental Indicator

A measurement, statistic or value that provides a proximate gauge or evidence of the effects of environmental management programs or of the state or condition of the environment. (NALMS)

Environmental Outcome

The desired environmental end state defining the specific conditions or functions that one expects for the environment. An outcome is an event, occurrence, or condition that results from an activity or program that has an actual effect on resources, the environment, or Albertans. (IHCR

Environmentally Significant Area (ESA)

ESA's are identified areas containing rare or unique elements in the province, or areas that include elements that may require special management consideration due to their conservation needs. ESAs do not represent government policy and are not necessarily areas that require legal protection, but instead are intended to be an information tool to help inform land use planning and policy at local, regional and provincial scales.

Erosion

Movement of soil by water or wind. (ALMS)

Eutrophic

Rich in dissolved nutrients, photosynthetically productive and often deficient in oxygen during warm weather. (ALMS)

Eutrophication

The process by which lakes and streams are enriched by nutrients, and the

resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients–mostly nitrates and phosphates–from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile). (ALMS)

Evapotranspiration

Loss of water by evaporation from the soil and transpiration from plants. (ALMS)

Exotic Species

Plant or animal species introduced into an area where they do not occur naturally; non-native species.1 Examples area Eurasian Milfoil and Purple Loosestrife. (ALMS)

Flushing Rate/Retention Time

Flushing rate is the rate of water replacement in a lake. Its unit of measure is times/year. Conversely, retention time is the average length of time water resides in a lake, ranging from several days in small impoundments to many years in large seepage lakes. Retention time is important in determining the impact of nutrient inputs. Long retention times result in recycling and greater nutrient retention in most lakes. Calculate retention time by dividing the lake volume by the volume of water passing through the lake in one year. (ALMS)

Food Chain

The transfer of food energy from plants through herbivores to carnivores. An example: insect-fish-bear or the sequence of algae being eaten by small aquatic animals (zooplankton) which in turn are eaten by small fish which are eaten by larger fish and eventually by people or predators. (ALMS)

Geographic Information Services (GIS)

A set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes.

Geospatial

Fusion of geography and information technology collection, management, analysis and integration of geo/location-based data to enable improved decision and policy making.

Geospatial Data

Data pertaining to the geographic location and characteristics of natural/constructed features and boundaries on, above, or below the Earth's surface.

Healthy Aquatic Ecosystem (Healthy Lake)

An aquatic environment that sustains its ecological structure, processes, functions, and resilience within its range of natural variability. Alberta Water Council. 2008

Hydrological Cycle

Refers to the processes by which water moves in the global environment. Includes condensation, precipitation, runoff, storage and evapotranspiration, and quantitatively measured using distribution and concentration. (ALMS)

Kjeldhal Nitrogen

The most common analysis run to determine the amount of organic nitrogen in water. The test includes ammonium and organic nitrogen. (ALMS)

Littoral

Pertaining to or along the shore, particularly to describe currents, deposits, and drift. (ALMS)

Macrophytes

A member of the rooted aquatic plant life of an area, especially of a body of water. Typically refers to emergent plants such as cattails and reeds. (ALMS)

Microcystin

A group of toxins naturally produced by certain species of cyanobacteria. Harmful to human, animal and ecological health in sufficient concentrations. (ALMS)

Morphometry

Measurement of external form.[7] Lake morphometry includes maximum and average depth, surface area, volume, shoreline length, basin shape, etc. (ALMS)

Nitrogen Fixation

The conversion of atmospheric nitrogen (N_2) into an organic form usable by plants and other organisms; nitrogen is typically fixed by bacteria that live in nodules on the roots of legumes and similar plants. (ALMS)

Nutrients

Elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth. (ALMS)

Oligotrophic

Describes a body of water in which nutrients are in low supply. (ALMS)

Orthophosphorus

Dissolved inorganic phosphorus. The dissolved inorganic form of phosphorus that is immediately bio-available for absorption by algae. Also, can be referred to as soluble reactive phosphorus (SRP). Chemical formula is PO_4^{3-}.(ALMS)

Pathogen

A disease-producing agent; usually applied to a living organism. Generally, any viruses, bacteria, protozoans or fungi that cause disease. (ALMS)

Phosphorus

Key nutrient influencing plant growth. Soluble reactive phosphorus (orthophosphorus) is the amount of phosphorus in solution that is readily available or Bioavailable to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form. (ALMS)

Photosynthesis

Process through which light energy, water, and carbon dioxide are converted to carbohydrate and oxygen in the presence of chlorophyll. Occurs in plants, algae, cyanobacteria and lichens. (ALMS)

Phytoplankton

Microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short. (ALMS)

Plankton

Small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly though the water. (ALMS)

Point-Source Pollution or Non-Point Source Pollution

Pollution that originates from one, easily identifiable cause or location, such as a sewage treatment plant or feedlot. (WFL)

Pollutant

A contaminant in a concentration or amount that adversely alters the physical, chemical, or biological properties of the natural environment.

Pollution

Cumulative effect of a pollutant or combination of pollutants on the natural environment of a location or locations. Two types are:

- Point-Source Pollution: that originates from one, easily identifiable cause or location, such as a sewage treatment plant, outfall or feedlot.
- Non-Point Source Pollution: that enter a water body from diffuse or undefined sources and are usually carried by runoff. Examples of non-point sources include agricultural land, coal mines, construction sites, roads, and urban areas. Because non-point sources are diffuse, they are often difficult to identify or locate precisely, and are therefore difficult to control.

Restoration

Measures undertaken to return a degraded ecosystem's functions and values, including its hydrology, plant and animal communities, and/or portions thereof, to a less degraded ecological condition. (ALMS)

Riparian

Pertaining to the banks of a river, stream, waterway, or other, typically, flowing body of water as well as to plant and animal communities along such bodies of water. (NALMS)

Riparian lands are transitional areas between upland7 and aquatic ecosystems. They have variable width and extent above and below ground and perform various functions. These lands are influenced by and exert an influence on associated water bodies8, including alluvial aquifers9 and floodplains. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and hydrological processes. Alberta Water Council

Residence Time

Length of time that water will remain in a lake or other water body.

Secchi Disk

A 20 cm (8 inch) diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days. (ALMS)

Sedimentation

The process of or accumulation of sand and dirt settling on the bottom of a lake. (ALMS)

Shore

The edge of a body of water and includes the land adjacent to a body of water that has been covered so long by water as to wrest it from vegetation or as to mark a distinct character on the vegetation where it extends into the water or on the soil itself. (PSSSPH)

Stakeholder

An individual, organization, or government with a direct interest in a particular process or outcome. (SEM)

State of the Watershed Report

A document that identifies the current condition of a watershed including the physical, chemical, and biological characteristics of its surface and groundwater and the pressures acting on it. (Partnerships)

Stewardship

Stewardship

A principle or approach whereby citizens, industry, communities, and government work together as stewards of the province's natural resources and environment. In general terms, stewardship means managing one's life, property, resources, and environment with regard for the rights or interests of others. This can apply to a person, company, community, government or group. Stewardship is an ethic and a value that results from public education and partnerships. It is people-focused in the sense that it relies on the desire

and ability of people to make good decisions on their own accord that help resource and environmental outcomes. (SEM)

Stratification

The layering of water due to differences in density. Water's greatest density occurs at 4 °C (39 °F). As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to a depth of about 6.5 m (20 feet). The narrow transition zone between the epilimnion and cold bottom water (hypolimnion) is called the metalimnion or thermocline. (ALMS)

Surface Water

Water bodies such as lakes, ponds, wetlands, rivers, and streams, as well as groundwater with a direct and immediate hydrological connection to surface water (for example, water in a well beside a river). (SSRB)

Suspended Solids

A measure of the particulate matter in a water sample, expressed in milligrams per liter. When measured on inflowing streams, it can be used to estimate the sedimentation rate of lakes or impoundments. (ALMS)

Sustainability

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (UN)

The balancing of opportunities for growth with the need to protect the environment. It reflects a vision of a vibrant economy and a healthy environment. Regarding renewable resources (e.g.: water, timber, fish, and wildlife), sustainability involves managing renewable natural resources so that their status, condition, or use is maintained over time. In this context, the use of a renewable resource, or impacts on it from other human activities, should not exceed its capacity to maintain itself through re-growth, reproduction, and management practices. Regarding non-renewable resources (e.g.: coal, oil, gas, and minerals), sustainability involves the development of resources in a responsible manner. This means protecting the environment during the construction and operation phases and ultimately reclaiming the land disturbed by development. In this context, non-renewable resource development is a temporary land use. (SEM)

Transpiration

The passage of water in plants from the roots through the vascular system to the stoma of the leaves and into the atmosphere. (ALMS)

Trophic Levels

A classification of organisms according to what they eat and their relative position in the food chain (e.g., primary producers, herbivores, predators, decomposers). (ALMS)

Trophic State

Eutrophication is the process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lake's trophic classification or state: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile). (ALMS)

Turbidity

Degree to which light is blocked in water because water is muddy or cloudy. (ALMS)

Upland

An area of dry land surrounding or upstream of a water body. (WCW)

Water Act

A piece of provincial legislation in Alberta used to protect the quality of water and manage its distribution. The Water Act regulates all developments and activities that might affect rivers, lakes, or groundwater. (WFL)

Water Body

Any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent, or occurs only during a flood. This includes, but is not limited to, wetlands and aquifers. (WFL)

Water for Life: Alberta's Strategy for Sustainability

The Government of Alberta's water management approach, outlining a comprehensive set of strategies and actions that will ensure Albertans have safe, secure drinking water, healthy aquatic ecosystems, and a reliable quality water supply for a sustainable economy. (GWMT)

Water Management

The protection and conservation of water and aquatic ecosystems, including their associated riparian area. In Alberta, several agencies have a mandate in this area. Alberta Environment is responsible for water quality, quantity monitoring, and water allocations. Under the Water Act a Director can set Water Conservation Objectives to protect minimum flow and aquatic ecosystem health. Stakeholders can recommend Water Conservation Objectives to a Director via a Water Management Plan or an Approved Water Management Plan. Alberta Sustainable Resource Development (SRD) manages crown lands including the bed and shores of all water bodies. SRD, through its Fish and Wildlife Division, is also responsible for fisheries and wildlife management. In addition, the Federal Department of Fisheries and Oceans upholds a no-net-loss policy in its mandate to protect fisheries habitat under the Federal Fisheries Act. (Partnerships)

Water Quality

A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. (ALMS)

Water Quantity

The volume or amount of water. (FWMP)

Watercourse

The bed and shore of a river, stream, lake, creek, lagoon, swamp, marsh or other natural body of water, or a canal, ditch, reservoir or other artificial surface feature made by humans, whether it contains or conveys water continuously or intermittently. (EPEA)

Watershed

Watershed - An area of land, bounded by topographic features, that drains into a shared destination such as a river, stream, lake, pond or ocean. The size of a watershed can be tiny or immense and its boundaries and velocity of flow are determined by land forms such as hills, slopes and mountain ranges that direct water. Within each large watershed, there are many smaller watersheds.

Watershed Approach - Place-Based Approach

A way of thinking and acting that focuses efforts within a watershed, taking into consideration both ground and surface water flow. This approach recognizes and plans for the interaction of land, water, plants, animals, and people. Focusing efforts at the watershed level gives the local watershed community a comprehensive understanding of local management needs and encourages locally led management decisions. (WFL)

Watershed Management / Water Management

The protection and conservation of water and aquatic ecosystems, including their associated riparian area. Because land use activities on the uplands of a watershed can affect ground and surface water quality and quantity, a

broader, more comprehensive approach to planning is often required. A Watershed Management Plan may look at water quantity, water quality, aquatic ecosystems, riparian area, as well as a variety of land use issues as they impact water. Watershed management plans require water and land use managers to work together to ensure healthy watersheds. (Partnerships)

Watershed Management Plan Water Management Plan

A comprehensive document that addresses many issues in a watershed including water quantity, water quality, point and non-point-source pollution, and source water protection. It may or may not include a Water Management Plan. It may also examine ways to better integrate land and resource management within a watershed. (Partnerships)

Watershed Management Planning /Watershed Management Plan

A comprehensive, multi-resource management planning process involving all stakeholders within the watershed, who, together as a group, cooperatively work toward identifying the watershed's resource issues and concerns as well as develop and implement a watershed plan with solutions that are environmentally, socially and economically sustainable. (NSWA)

Watershed Planning and Advisory Council (WPAC)

Collaborative, independent, volunteer organizations with representation from all key partners within the watershed. Their mandate is to engage governments, stakeholders, other partnerships, and the public in watershed assessment and watershed management planning, while considering the existing land and resource management planning processes and decision-making authorities. (Partnerships)

Watershed Stewardship Group (WSG)

Community-based groups made up of volunteer citizens, often supported by local businesses and industries, who have taken the initiative to protect their local creek, stream, stretch of river, or lake. These proactive groups develop on-the-ground solutions to ensure the protection of their specific watersheds. (WFL)

Wetland

Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, water-loving vegetation, and various kinds of biological activity which are adapted to a wet environment.

Zooplankton

A community of floating, aquatic, minute animals and non-photosynthetic protists. (ALMS)

GENERAL PLANNING TERMS

Collaboration

A process through which parties that see different aspects of a problem can explore constructively their differences and search for (and implement) solutions that go beyond their own limited vision of what is possible. Collaboration is a mechanism for leveraging resources; dealing with scarcities; eliminating duplication; capitalizing on individual strengths; building internal capacities; and increasing participation and ownership strengthened by the potential for synergy and greater impact.

Intermunicipal Dispute

A municipality holding the opinion that a statutory plan, land use bylaw or amendment adopted by an adjacent municipality will have a detrimental effect on it.

Dispute Resolution

The process to inform and negotiate a mutually beneficial resolution of a defined intermunicipal dispute. If a mutually beneficial negotiation cannot be achieved the municipalities can seek a resolution through mediation and, ultimately through an appeal to the Municipal Government Board.

Framework

An organized structure of policies, legislation, programs and tasks created to achieve a specific outcome. There can be frameworks for broad policies and strategic initiatives at various scales (e.g. provincial, regional, sector, media); programs and program delivery; and short-term tasks and projects. (SEM)

Growth

Growth of a region or municipality is defined as increase in its size, population or employment.

Governance

The process of decision-making and the process by which these decisions are implemented.

Guideline

A specific performance measure that is not legally binding unless designated in legislation. It is a guide or indication of a future course of action. It describes how something will be accomplished. It may contain numerical performance measures and may deal with multiple uses of water.

Objective

The result of either planned or unplanned actions. For planning purposes, "objectives" are the desired endpoint and should guide the development and implementation of related programs. Outcomes can be broad and long-term in nature or focused. They are used in both direction setting and performance measurement.

Partnership

A relationship in which individuals or organizations share resources and responsibility to achieve a common objective, as well as any resulting rewards or recognition. It often includes a formal contract, new resources and shared risks and rewards. The structure includes a central body of decision-makers whose roles are defined. The links are formalized. Communication is frequent, the leadership is autonomous, and the focus is on specific issues. Partnerships are a form of collaboration.

Methods

The methods are formal agreements between organizations that are sharing people, technology, process or data and explain how the item is being shared and sets out the means and systems CRGIS will adopt when they collect, store, access, compile and analyze information about the region

Policy

1. A governing principle, plan, or consistent course of action developed in order to meet recognized needs and to achieve specific measurable outcomes. Policies are normally broad, conceptual documents that outline approaches and/or considerations to be taken into account by decision makers. Policies do not act as constraints, but provide information. (SEM)

2. A statement of intent that is not legally binding. It sets direction and expectations for activities.

Provincial Land Use Framework

A policy of the Government of Alberta to introduce and implement regional land use plans to ensure the long-term health of Alberta's communities, economy and the environment.

Public and Stakeholder Involvement

The process used to obtain advice or recommendations from a community and engage them in decision-making. Public and stakeholder involvement is an umbrella term that includes a range of interactive approaches including information and education, consultation, collaboration, partnerships, and delegated authority.

Referral

Involves informing adjacent jurisdictions of new or amended plans, land use bylaws or new development proposals providing opportunity to comment on how the proposal may impact them.

Recreation Corridor

Inter-connected crown, public or private lands that are generally linear in form and are of regional significance for the purpose of providing recreational opportunities, such as the Trans Canada Trail, walking trails and parks and open space in the North Saskatchewan River Valley. Regional Recreation Corridors may also provide access to municipal recreation opportunities.

Region

Region, specifically the geographic area contained within the participating jurisdictions.

Regional

Relating to the Region, whether by geographic proximity or by the impact that actions or decision may have on others.

Stakeholder

An individual, organization, or government with a direct interest in a particular process or outcome.

Strategy / Strategic

A perspective, position, or plan developed and undertaken to achieve goals. It is the bridge between policy and concrete actions that outlines how a policy will be implemented to achieve its goals. (SEM)

MUNICIPAL AND REGIONAL PLANNING TERMS

Area Structure Plan (ASP)

A statutory plan identifying many neighbourhoods where residential, commercial, institutional and recreational areas will be located in a previously undeveloped area. These plans also describe the number of people expected to live in the new area and how development will be staged over time.

Development

A change in the use or intensity of use of land or a building or an act done in relation to land or a building that results in or is likely to result in a change in the intensity of use of land or building.

Intermunicipal Development Plan (IDP)

A statutory plan containing broad-based policies that are prepared by two or more neighbouring municipalities. Their main purpose is to ensure that future growth reflects the mutual and individual interests of the municipalities involved. Typically, the focus is on the boundary area between rural and urban municipalities.

Land Use Bylaw (LUB)

A Bylaw that divides a municipality into land use districts and establishes procedures for processing and deciding upon development applications. It sets out rules that affect how each parcel of land in a municipality may be used and developed.

Liveability / Quality of Life

The environmental and social quality of an area as perceived by residents, employees, customers and visitors. This includes safety and health (traffic safety, personal security, and public health), local environmental conditions (cleanliness, noise, dust, air quality, and water quality), the quality of social interactions (neighbourliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics, and existence of unique cultural and environmental resources (e.g. historic structures, mature trees, traditional architectural styles).

Low Impact Development (LID)

A land planning and engineering design approach for managing stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. This approach implements engineered small scale hydrologic controls to replicate the predevelopment hydrologic regime of watersheds through infiltrating, storing, evaporating, and detaining runoff close to its source.

Municipal Development Plan (MDP)

A statutory plan that functions as a municipality's overall policy guide for future growth and development. The Plan outlines the direction of future development, the provision of transportation systems and municipal services, the coordination of municipal services and programs, environmental matters and economic development.

Municipal Government Act (MGA)

The primary provincial legislation that governs municipalities is known as the Municipal Government Act or MGA. The MGA sets out legislated roles and responsibilities of municipalities and municipal officials.

Municipal Reserve (MR)

Lands designated as "Municipal Reserve" are lands for schools, parks and public recreation purposes provided by the developer as part of the subdivision process.

Non-statutory Plan

A plan adopted by a municipality by resolution to address land use planning or master planning needs.

Redevelopment

The creation of new units, uses or lots on previously developed land in existing urban communities, including brownfield sites.

Statutory Plan

A plan approved by a municipality under the authority of the Municipal Government Act (MGA) with the passage of a municipal bylaw. Examples of a statutory plan are: an inter-municipal development plan, a municipal development plan (MDP), area structure plans (ASP), neighbourhood structure plan (NSP) and area redevelopment plans (ARP).

Social Infrastructure

Social infrastructure, or soft infrastructure, can refer to services provided by or in municipalities such as hospitals, community and recreational facilities, public spaces, social housing, volunteer networks and community-based agencies.

INFRASTRUCTURE TERMS

Infrastructure

Physical assets to provide services to citizens and to support the functioning of a local or regional economy, including roads, sewer lines, transit, emergency response vehicles, recreational facilities, parks, information technology and more.

Infrastructure, Local

Infrastructure that has capital investment and maintenance requirements, including roadways, sidewalks, street lights and traffic signals, transit facilities, solid waste and water delivery systems, potable water distribution systems, storm sewers, sanitary sewers, sports fields, playgrounds, arenas, pools, police and emergency stations, civic buildings and parks to support the concept of complete communities.

Infrastructure, Regional

Infrastructure developed by the federal government, Province, municipality, and/or regional service and provincial commissions to provide services to citizens and businesses, and to support the function of a regional economy (e.g. major interchanges, post-secondary institutions, hospitals, bridges, highways, extension of light rail transit, regional water and/or sewer systems, power systems).

Utilities - Franchised

Facilities for gas, electricity, telephone, cable television, water, storm and sanitary sewer.

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TAB 7

From: [redacted]
Sent: Thursday, April 7, 2022 4:31 PM
To: Nathan Shirley
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; premier@gov.ab.ca
Subject: RE: CFO application #RA21045

Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.
This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and

corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

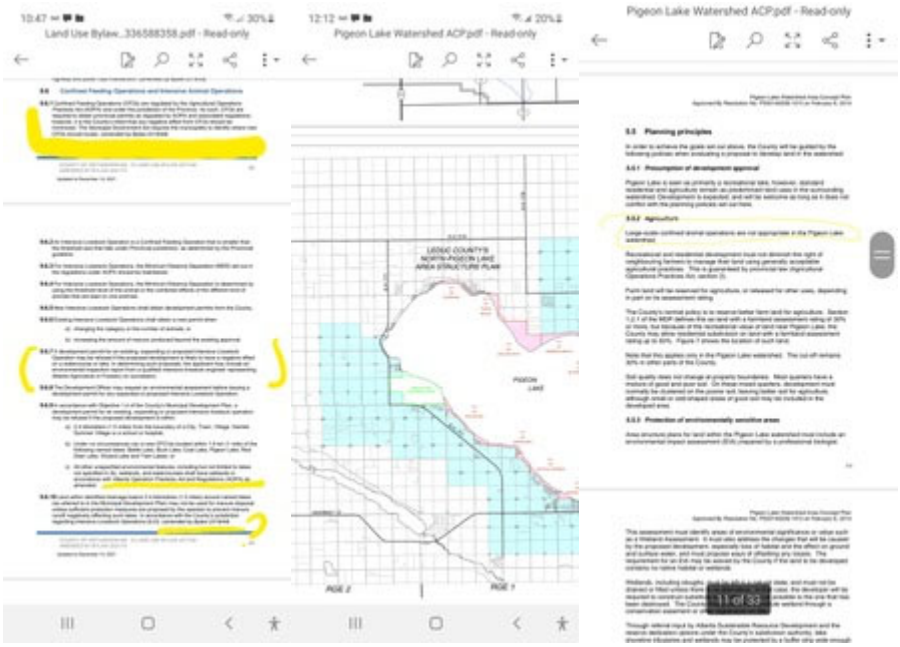
Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a

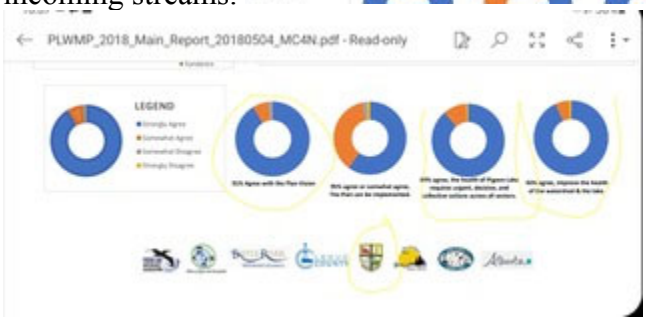
while. https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-contemplate-2017-municipal-election/



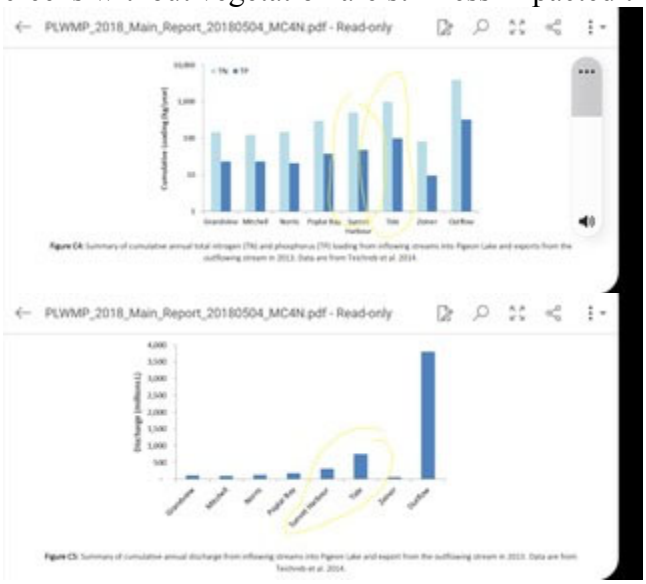
It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.



The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP.
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 

However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.



The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.

From: Nicole Klatt <nickyk@me.com>
Sent: Thursday, April 7, 2022 4:36 PM
To: Nathan Shirley
Cc: premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: Re: CFO application #RA21045

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

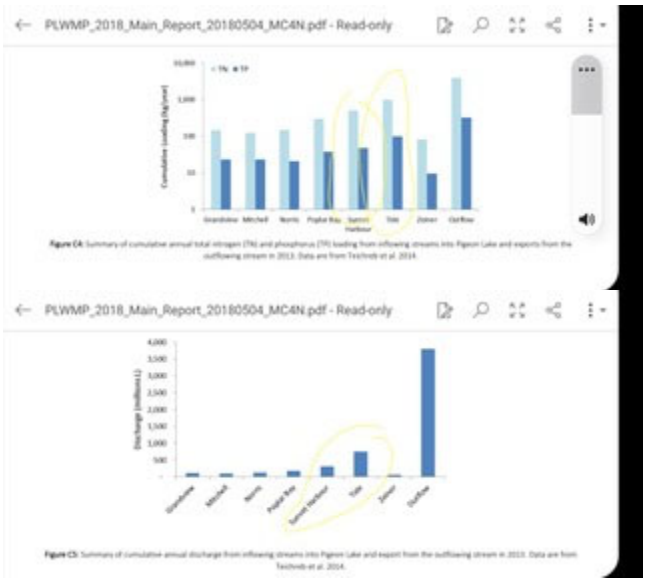
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic

environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning. Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Stephanie Labutis

NAME: STEPHANIE LABUTIS April 06, 2022
OWNER: [redacted]
PHONE: [redacted]
EMAIL: [redacted]
MAILING ADDRESS: [redacted]

Nathan

My property is directly east of this proposal.
I am directly affected by this application.

I am third generation land owner. My quarter of land borders the land proposed for feedlot.
There are creeks running through this quarter that run into the lake. The majority of the quarter is treed. Even so I can smell the manure running down the creeks on its way to the lake.
This is occurring due to the intensive cow/calf in operation now. The land and the creeks will not sustain an increase of waste from 4000 cattle. Even though there will be actions to attempt to contain it, some of the manure will be eventually spill over to my property and onto the lake. The environment will not be able to tolerate the concentration of this manure along with what is running down the creeks now. I do not wish to lose what I have strived to preserve. The smell at times is and will be even more intolerable.
Medications, disease and bacteria found in the manure that is spread in the field will run in the waters due to water runoff. I do not want this on my land as the stream carrying the water laden with manure goes the full length on my quarter and I am angry that I am being asked to accept this.
This operation will dramatically decrease the value of my property. The noise of the cattle, the smell, the contaminated water has been imposed on me already.
Is it fair to me to degrade my property, to contaminate my creeks, to affect the quality of the air, to have to listen to the noise! I am a good steward of the land and what is being proposed to me is not.

Why would G&S Cattle Ltd. choose a lake area to propose a feedlot? There is a lot of recreation land here. We enjoy the wildlife, the creeks, the lake, the clean air. Why does G&S Cattle Ltd. impose this risk of me losing this at my cost!

I am requesting this application is denied.

Sincerely,

Stephanie Labutis

TAB 8

County of Wetaskiwin
Pigeon Lake Watershed Area Concept Plan
February 6, 2014

1 Introduction

1.1 Background

The Pigeon Lake area continues to attract significant attention from landowners wanting to pursue a mixture of residential, recreational and commercial development. With this demand expected to increase over time, concerns have been raised about the lake's ability to support an increase in development and ultimately the added growth pressures. There are also concerns regarding whether there is sufficient infrastructure to support existing and future developments, and the potential for adverse environmental impacts on the lake and surrounding lands. The County of Wetaskiwin recognizes that increased development and growth pressures need to be addressed on a cooperative basis to ensure the long-term protection and sustainability of Pigeon Lake.

Through the County's strategic planning process, Council recognized the need for long range plans in areas experiencing growth pressures. The 2010 Municipal Development Plan draws specific attention to areas in the County meriting special attention for administration to develop plans to better guide future development, and Pigeon Lake is named as one of these areas.

The *Municipal Government Act* is the provincial legislation which empowers municipalities to govern the development of lands within their boundaries in a manner that is logical, timely, economic and environmentally responsible. The planning and development process is based on the cooperation of public and private goals and objectives to achieve harmony.

1.2 Plan Area

Figure 1 shows Pigeon Lake's location in Central Alberta. The study area, as depicted in Figure 2, inexactly follows the Pigeon Lake Watershed. Some allowances were made to include selected growth nodes. Within the plan boundaries are multiple jurisdictional holders. Located on the south side of the lake are the summer villages of Grandview, Crystal Springs, Norris Beach, Ma-Me-O Beach and Poplar Bay. While on the north side of the Lake the summer villages of Silver Beach and Argentia Beach are also within the boundary of the plan. Pigeon Lake Provincial Park, administered by Alberta Tourism, Parks and

Recreation, is located on the west shores of the lake. The Pigeon Lake Indian Reserve is located on the east side of the lake. Although not within the study area, Leduc County and the summer villages of Sundance Beach, Itaska Beach and Golden Days are located on the north side of Pigeon Lake.

1.3 Purpose

The purpose of the Pigeon Lake Area Concept Plan (PLACP) is to set out principles and policies to act as a guideline for new development and redeveloped areas. This will help minimize land use conflicts, mitigate environmental pressure and reduce overall impacts in areas currently experiencing, or those areas forecasted to experience development pressure. This plan helps direct subdivision and development authorities when making decisions on subdivision and development within the PLACP boundary. The PLACP is a long-range planning document that will remain in effect until repealed or amended.

Areas where new development may be considered will be identified. However, no defined limits for new development are set as the County intends to rely on further site-specific analysis; Area Structure Plans and pertinent studies, to determine the level or density of development that can be supported at any particular location.

1.4 What is an Area Concept Plan?

An Area Concept Plan is a non-statutory planning document, adopted by Council through resolution. Although Council intends to follow the policies and strategies outlined in the plan, they are not bound by the content and may exercise discretion.

2 POLICY CONTEXT

2.1 Provincial legislation regulating development

2.1.1 The Water Act

For the subdivision of six or more residential lots per quarter section, the Water Act requires that a detailed Groundwater Assessment be conducted by a professional engineer, geologist or geophysicist, verifying that the current Alberta Environment standard of 1,250 cubic metres of water per year are available for each individual lot. This ensures that there is sufficient water for the proposed development without compromising or depleting the existing water supply. The

County, as part of the Area Structure Plan process, requires a certified engineer's report commenting on the water supply.

2.1.2 Subdivision and Development Regulation

The Subdivision and Development Regulation is a regulatory document outlining the specific rules and regulations relating to the subdivision and development of land in Alberta. This includes the subdivision and development process, the appeal process and mandatory setbacks from certain land uses.

There are a wide variety of land uses within the PLACP boundary (see Section 4.1); as a result it is important to consult the Subdivision and Development Regulation in order to determine what development limitations exist due to mandatory setbacks. Some of the most pertinent legislation includes:

- Setbacks from sewer lagoons: The PLACP area includes the Mulhurst Sewage Lagoon. A development permit cannot be issued and construction cannot occur for a school, hospital, food establishment or residence within 300 metres of the working area of an operating wastewater treatment plant. A subdivision of land for these uses will also not be allowed unless there is a building site more than 300 metres away from the wastewater treatment plant. Setbacks will also be applied to other wastewater containment, storage or treatment facilities including, communal waste water treatment systems.

- Setbacks from waste management sites: Waste management sites with the PLACP boundaries include inactive landfills and waste transfer stations. For an inactive landfill development is restricted within 300 metres from the site. For a waste transfer station, a facility that receives waste materials from a community where it is consolidated by transferring it to a larger vehicle for more efficient and economical transport to a distant waste disposal facility, development is restricted within 300 metres of the site. For an active landfill development is restricted within 450 metres of the site.

- Setbacks from oil and gas operations: There are numerous oil and gas wells within the area. Subdivision or development applications will not be approved if it would result in overnight accommodation or a public facility being within 100 metres of a gas or oil well, although lesser distances may be approved in writing by the Energy Resource Conservation Board (ERCB). Sour gas facilities may require larger setbacks.

- Setbacks from highways: Highways 13, 13A, 771 and 616 pass through the PLACP area. These are within the jurisdiction of Alberta Transportation. Subdivision of land is restricted within 0.8 kilometres of the centre line of a highway where the posted speed limit is 80 kilometres per

hour or greater, unless you meet the conditions laid out. This is within the jurisdiction of Alberta Transportation.

- Other requirements: The provincial regulations also require the municipality to consider soils, topography, water supply, and waste water disposal.

2.2 County policies regulating development

County documents may be divided into two types: statutory and non-statutory.

Statutory Plans	A Statutory Plan is a legal document that must have a public hearing and three readings before being adopted by bylaw. Once adopted, there is a legal obligation on part of both the municipality and the landowners to adhere to the plan. Examples of these plans are the County's Municipal Development Plan and Area Structure Plans adopted by Council.
Non-Statutory Plans	Non-statutory plans are passed by Council through resolution and do not require a public hearing before being adopted, although, it is at Council's discretion to hold a non-statutory public hearing. They are often developed to help encourage a certain direction for development or growth in a particular area. Because these plans are non-statutory they can be less prescriptive, and Council can adapt to changing circumstances. The PLACP falls under this category as a non-statutory plan.

2.2.1 Municipal Development Plan (MDP)

The MDP is a long-range statutory plan that guides land use in the County. In the MDP Council identified the Pigeon Lake area as one that needs careful study and guidance so that development can continue in a sustainable manner; the PLACP addresses this need.

Along with outlining key areas where analysis and specific plans are needed, the MDP influences day to day development through its policies and objectives. These objectives focus on the protection of agricultural land where agriculture is seen as the predominant land use, the development of land in an efficient and sustainable manner, the protection of environmentally sensitive areas, and ensure that development respects existing community character. The Area Concept Plan must comply with the MDP and so these objectives play an important role in guiding development within the plans area and directing the

content of the PLACP. Additionally, when an application for subdivision, development or rezoning is submitted within the area concept plan boundaries, the PLACP in addition to the Municipal Development Plan will be examined to ensure the development, subdivision or rezoning is in compliance and ultimately within the County's long range planning vision.

The MDP provides guidance for land use in the County and is a long-range statutory plan adopted as a bylaw, which directs decision making for everyday development matters.

2.2.2 Land Use-Bylaw (LUB)

The purpose of the LUB is to regulate and control the use and development within the municipality to achieve the orderly, economic and beneficial development of land. To achieve this goal, this Bylaw, among other things:

(a) divides the municipality into districts;

(b) prescribes and regulates for each district, other than Direct Control districts, purposes for which land and buildings may be used;

(c) prescribes and regulates for each district, other than Direct Control districts, subdivision and development standards;

(d) establishes a process for making decisions on development permit applications and the issuance of development permits; and

(e) establishes a process for notification of landowners affected by development permits issued.

2.2.3 Requirements for Area Structure Plans: Policy #6606

In addition to statutory and non-statutory plans, the County ensures sustainable development through a number of policies, specifically Policy #6606, Requirements for Area Structure Plans (ASPs). An ASP maybe required for any development that creates three or more lots in a quarter section, with the exception of those lots created under the Second Yard Subdivision Policy #6607. The purpose of these requirements is to provide the County with comprehensive information about the proposed subdivision and allow stakeholders to comment and provide input. Through the ASP process administration and Council can make informed decisions and identify the impact, whether positive or negative, it may have on the surrounding community.

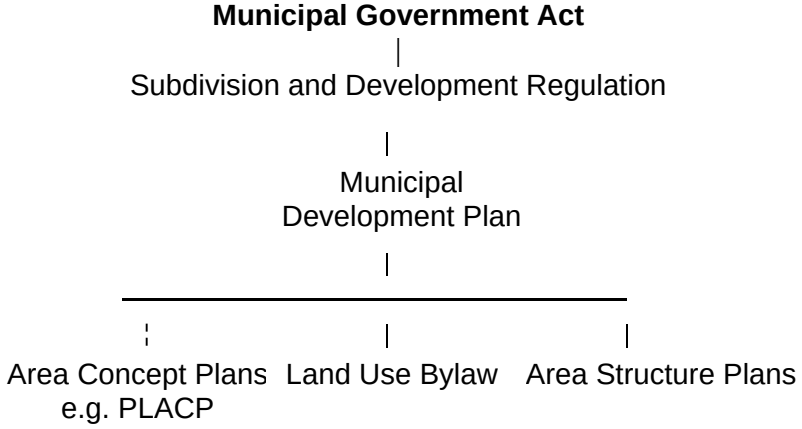
Some pertinent studies and plans that maybe required as part of Policy #6606, Requirements for Area Structure Plans include, but are not limited to:

- Geotechnical report;
- Groundwater Percolation report;
- Storm water management plan;
- Detailed information relating to waste water treatment;
- Water supply (must be in compliance with the *Water Act*);
- Environmental Assessment;
- A traffic impact assessment;
- Public consultation.

The required studies and plans allow for careful consideration of applications to help protect the environment and ensure that development is compatible with the surrounding community.

The Municipal Development Plan, Land Use Bylaw and County Policies, including Policy #6606, Requirements for Area Structure Plans, all work together and play an integral role to support Area Concept Plans.

Figure 3: How the PLACP aligns with other documents



Note: the dashed line represents non-statutory plans

3 Public Engagement in the Planning Process

Public engagement was a recognized, pertinent aspect of the concept plan. Nine varying stakeholder groups were consulted throughout the entirety of developing the PLACP through the use of a focus group. In addition to multiple focus group meetings, an open house was held and the general public was invited to share their opinions and/or concerns. It was important that the plan reflected the broad interests of all the residents, interest groups and adjacent Municipalities alike.

Two different methods of public consultation were used to gather the public's views regarding the PLACP. A focus group with representation of nine varying stakeholder groups was created. The focus group was made up of volunteers representing Summer Villages, Pigeon Lake Watershed Association, agriculture sector, including intensive livestock operations, County of Wetaskiwin, County of Leduc, commercial representation, residential developers, First Nations, Alberta Environment and Alberta Sustainable Resource Development. The focus group played a vital role in the development of the concept plan.

Focus group participants volunteered to partake in the planning process. Advertising for focus group members was publicized concurrently in the Pipestone paper and on the County's website for two consecutive weeks and open to the general public.

4 The Study Area

4.1 Present Land Uses

Present land uses within the plan area are extremely diverse, ranging from agricultural to industrial (oil and gas) to residential to recreational. Agriculture has always been the backbone of the economy with grazing also being a prominent use. The Canada Land Inventory System ranks soil quality, with the highest quality soil as Class 1 and the poorest as Class 7. The soil within the PLACP is mostly ranked Class 3 with poorer soil existing in certain areas (see Figure 4.0).

The oil and gas industry is significant in the area, with numerous oil and gas wells and pipelines located within the PLACP's boundary (see Figures 5.0 & 6.0). Recreation is also important, with facilities like campsites, boat launches, golf courses and hotels located around Pigeon Lake. Recreation draws people into the area during the summer months to enjoy the numerous amenities offered. The range of zoning classification within the area allows for a wide variety of uses and parcel sizes. The Land Use Bylaw 95/54 should be consulted for an explanation of the different land classifications within the PLACP boundaries and the permitted and discretionary uses.

4.2 Present and Future land Use Conflicts

Due to the wide variety of land uses within the PLACP land use conflict is inevitable. As development pressure within the area increases there is the potential for even more conflict. The creation of thorough planning policy and long term plans helps to mitigate some of these conflicts.

Of particular importance is the conflict between residential, agriculture and in some instances, recreational uses in the area, three of the most important land uses. Within the plan boundary are many agricultural operations, ranging in size and type. The policies of the MDP set out as a priority conserving farmland and protecting it from uncontrolled development. However, accepted farming practices can result in dust, odours, and noise which may hamper the enjoyment for those who use the area for recreational purposes. These recreational opportunities are also important to the community and the Province as a whole. It is important that these uses are also protected. Through careful planning and development the needs of these groups and others can be nurtured to create a thriving area based around recreation while still supporting agriculture and reducing land use conflicts.

4.3 Constraints

Pigeon Lake and its surrounding area do not fall under just one jurisdiction, making inter-jurisdictional communication and planning essential. The ten summer villages control land use within their boundaries. Outside the summer villages, the north part of Pigeon Lake falls under Leduc County and their North Pigeon Lake Area Structure Plan, 2010. The Pigeon Lake Indian Reserve is also located within the study area. Additionally, Pigeon Lake itself falls under provincial and federal jurisdiction. These different jurisdictions limit what the County of Wetaskiwin is able to carry out and demands cooperation amongst different stakeholders.

5 Policies

5.1 A Vision for the Watershed and Lake

Our vision for the Pigeon Lake watershed is a healthy natural environment supporting sustainable development coexisting with the recreational value of the lake.

5.2 Goals

In support of this vision, the concept plan adopts the following goals:

- Maintain the quality of the watershed around the lake.
- Protect fish and wildlife habitat and, where possible, restore damaged habitat to a productive natural condition.

- Ensure groundwater will be protected and its use will not exceed sustainable levels.
- Maintain/enhance a visually appealing landscape with ample tree cover.
- Support the types of agriculture that are compatible with the watershed.
- Carefully plan residential and recreational development and redevelopment to be consistent with these goals, using cluster development wherever possible.
- Provide necessary municipal services.
- Involve residents and landowners in all decisions.

The County, acting alone, does not have the power to achieve all these goals, but in areas where municipalities have jurisdiction, these goals will guide the County's decisions.

5.3 Economic drivers

The County benefits from the oil and gas industry for a large part of its tax base. In 2010, linear assessment (mostly pipelines) paid $9.68m to the County in taxes, and machinery and equipment (which includes above-ground oil and gas facilities) paid $2.59m, for a total of $12.27m. This was 53% of the County's total tax revenue.

The oil and gas industry in this part of Alberta has matured, and older facilities and lines are being taken out of service. It is likely that the oil and gas industry will pay less in taxes in future. The County needs to replace this revenue. Residential and recreational development is one of the most promising sources, and Pigeon Lake is the most promising location. This concept plan therefore supports sustainable residential and recreational development in the Pigeon Lake watershed, provided that this development is consistent with a healthy environment that will help support a good economic outlook for the region.

5.4 Reconciling economic and environmental goals

In a recreational lake, good water quality means safe levels of pathogens, and low levels of nutrients. This will result in clear water with minimal algae and plant growth (although too low a level will reduce fish populations).

Pathogens can be minimized by public health education and enforcement, by the installation of municipal sewer systems, and by keeping livestock away from surface water and groundwater recharge areas. These issues are addressed later in the document.

Plant growth is limited by the supply of nutrients, light and temperature in lake water. Although many nutrients are required for plant growth, phosphorus is the limiting factor in most Alberta lakes. Phosphorus may enter the water from various sources: atmospheric deposition, release from bottom sediments, or runoff from the land through streams or groundwater. The first two are outside our control, but surface runoff is, in part, controllable.

The amount of phosphorus entering a lake from the land depends mainly on the use of that land. Forested land contributes about 10 kg/km2/year. Farm land contributes 20 to 50 kg/km2/yr (less from hay land, and more from crops). Urban areas contribute about 100 kg/km2/yr from surface runoff, plus 0.1 to 0.9 kg per person depending on how sewage is treated. (Figures are taken from the 1998 *Pigeon Lake Water Quality Study* by Lilley Environmental Consulting and Dr. Chris Earle of Concordia University College.)

The County's municipal development plan (MDP) gives a very high priority to agriculture. "As a rural municipality with an agricultural base, the County will take responsibility to maintain the farmland for viable agricultural production" (MDP, page 7), however, the Statement of Purpose at the beginning of the MDP says that its first goal is to "maintain a clean environment (with) no negative impact on air, natural resources, water, or soil quality" (page 3). In this regard, the County supports farmers using “best agriculture practices.”

The figures quoted above show that properly designed recreational and residential development can have less of an impact on the environment, and especially water quality, than traditional types of agriculture. For this reason, plus the gains in taxation noted above, the concept plan welcomes properly designed recreational and residential development, ***even on soils which, elsewhere in the municipality, would be protected for agriculture.***

To assist with the restoration of lands back to natural conditions, thereby assisting water quality, the County at its discretion will use its right during the subdivision process to secure Environmental and Municipal Reserves within those lands that most benefit the watershed.

Having said that, we must be clear that no farmer will be forced to sell his land, or to convert it to non-agricultural uses, and he will not be forced to curtail legitimate farm operations because of objections by his neighbours. He must be able to carry on farming responsibly for as long as he wants, and, when the time comes, to pass it on to the next generation or to sell it to another farmer. Any conversion from agricultural to other uses must be voluntary.

5.5 Planning principles

In order to achieve the goals set out above, the County will be guided by the following policies when evaluating a proposal to develop land in the watershed.

5.5.1 Presumption of development approval

Pigeon Lake is seen as primarily a recreational lake, however, standard residential and agriculture remain as predominant land uses in the surrounding watershed. Development is expected, and will be welcome as long as it does not conflict with the planning policies set out here.

5.5.2 Agriculture

Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.

Recreational and residential development must not diminish the right of neighbouring farmers to manage their land using generally acceptable agricultural practices. This is guaranteed by provincial law (Agricultural Operations Practices Act, section 2).

Farm land will be reserved for agriculture, or released for other uses, depending in part on its assessment rating.

The County's normal policy is to reserve better farm land for agriculture. Section 1.2.1 of the MDP defines this as land with a farmland assessment rating of 30% or more, but because of the recreational value of land near Pigeon Lake, the County may allow residential subdivision on land with a farmland assessment rating up to 50%. Figure 7 shows the location of such land.

Note that this applies only in the Pigeon Lake watershed. The cut-off remains 30% in other parts of the County.

Soil quality does not change at property boundaries. Most quarters have a mixture of good and poor soil. On these mixed quarters, development must normally be clustered on the poorer soil, leaving better soil for agriculture, although small or odd-shaped areas of good soil may be included in the developed area.

5.5.3 Protection of environmentally sensitive areas

Area structure plans for land within the Pigeon Lake watershed must include an environmental impact assessment (EIA) prepared by a professional biologist.

This assessment must identify areas of environmental significance or value such as a Wetland Assessment. It must also address the changes that will be caused by the proposed development, especially loss of habitat and the effect on ground and surface water, and must propose ways of offsetting any losses. The requirement for an EIA may be waived by the County if the land to be developed contains no native habitat or wetlands.

Wetlands, including sloughs, must be left in a natural state, and must not be drained or filled unless there is no alternative. In that case, the developer will be required to construct substitute wetlands as close as possible to the one that has been destroyed. The County may protect the substitute wetland through a conservation easement or other registration on title.

Through referral input by Alberta Sustainable Resource Development and the reserve dedication options under the County's subdivision authority, lake shoreline tributaries and wetlands may be protected by a buffer strip wide enough to prevent damage to these water features.

Land adjacent to creeks, including seasonal flows, must be dedicated as environmental reserve when land is subdivided into small lots. On large lots, the County may take environmental reserve easements instead of land where the circumstances justify it. This decision will be made by council at the time of subdivision. The area to be protected -- the setback --will be determined with input from professional biologists.

If a development area contains a damaged or dried-up creek, it must, as far as practical, be brought back to its natural state, and included in environmental reserve.

On quarters that are only partly tree covered, recreational and residential development must not result in a net loss of tree cover. Where trees must be removed, they must be replaced in such a way as to fill a similar role in the local ecosystem. Normally the lost trees must be replaced within the parcel being developed. However, in special cases, and acting on the advice of professional biologists, the County may allow the replacements at other locations within the Pigeon Lake watershed.

Where a quarter section is partly tree covered and partly cleared, new development must normally be restricted to the cleared areas. Note: That restrictions on the removal of tree cover apply on parcels of land under the Watershed and Rural Conservation districts. Lands under an Agriculture district are allowed clearing for agricultural purposes, however, it would be a disadvantage for the owner of an Agriculturally districted property to clear tree cover if another use for the land were contemplated that would benefit from the attractiveness that tree cover provides to a property. The tree covered areas must be left in their natural state. They may be:

- dedicated as reserve, or
- transferred to a conservation organization (which attracts an income tax credit), or
- registered as the common property of the private lots, or
- retained by a single individual.

In the last two cases, the County will register a conservation easement or similar encumbrance on title to restrict land clearance in perpetuity.

When development is proposed on a quarter which is mostly tree covered, the loss of trees must be minimized, and the County may require the loss to be offset by planting elsewhere in the watershed.

5.5.4 Cleaning up inflows

New development must be laid out in such a way that the surface runoff does not contaminate watercourses or the lake. This will be accomplished through setbacks (see policy 2.5.3 above) and controls, where appropriate, by directing runoff through a treatment wetland (artificial marsh) or storm water ponds where solids will settle out and nutrients will be absorbed by water plants. (Those interested can look at the Olds College website to see the work being done by the College's School of Innovation.)

5.5.5 Sewer service

Subject to the sewage treatment provisions under Sections 5.6 “Land Near the Lake”, all new lots in multi-lot subdivisions under 5 acres in size must be served by a sewage gathering system. (Anything over about two acres is too large to service economically, so developers will be driven to create lots that are small enough to service economically.) On the north side of the lake this will require hooking up to the existing NEPL line. Around the rest of the lake, because there is no line in place at present, on-site holding tanks may be allowed as an interim measure, provided they are designed and constructed to connect to the municipal line in future. This imposes a higher standard but is otherwise consistent with County Policy 6611.

There may be cases where a proposed multi-lot development is so far from a sewer line that building a connecting line is prohibitively expensive. In that case,

the County may allow the developer to install a mechanical treatment system serving that development. The County will investigate amendments to Policy 6611 to require systems to remove phosphorous if the development is within one mile of the lake. These systems will require the approval and regulatory consistency with both the County and Provincial regulators.

In multi-lot subdivisions more than half a mile from the lake, lots over 5 acres in size may continue to use individual sewer systems provided that site conditions are suitable. The area structure plan must include evidence that the land is suitable for such systems which shall include compliance with Provincial regulations that do not allow open discharge systems unless the discharge point is a minimum of 90 metres (295 ft) from all property lines. Along with several site and design pre-requisites, this generally requires a parcel to be a minimum of 3.4 hectares (8.5 acres) in order for the system to comply with property line setbacks (parcels this size are rarely approved in Lakeshore or other districts adjacent to a lake).

Subject to Section 5.6.6, yard site subdivisions (existing first parcel from a quarter section), may continue to use individual sewer systems that conform to the Alberta Private Sewage Treatment Systems Standard of Practice in effect at the time.

In addition to the provisions above, where private sewage treatment systems are proposed in a multi-lot development, the Alberta Association of Municipal Districts and Counties “The Model Process for Subdivision Approval and Private Sewage” should be consulted as a guideline.

5.5.6 Efficient servicing

Multi-lot residential development will be encouraged to locate close to existing services such as present and future water and sewer lines, recreation, and paved roads.

Where the existing road in to a subdivision does not meet current municipal standards, the developer will be required to upgrade it at his own expense.

Multiple lot residential subdivisions will also be subject to the County's Policy 6615, which sets standards for road paving.

5.5.7 Access to recreational opportunities

In order to reduce pressure on lake access points, developers will be required to provide on-site recreation. This may be passive (such as walking and equestrian

trails), conserved natural areas with trails and opportunities for wildlife viewing or social (club houses).

5.5.8 A trail system

Municipal and environmental reserves must be laid out to facilitate the creation of a regional trail system. Developers will normally be required to build the trail within their developments.

5.6 Land near the lake

The planning policies set out above will apply to all new development in the Pigeon Lake watershed. On land within half a mile of the lake, additional policies will apply:

5.6.1 Environmental and Municipal Reserve required

(NOTE: County Council may designate either one under subdivision approval.)

The County will require a strip of environmental and/or municipal reserve between subdivided lots and the lake shore. The width of this strip will be determined by council, bearing in mind section 664 of the Municipal Government Act and the recommendations of professional biologists. Council may also consult the following:

a) *Riparian Setback Matrix Model* endorsed by the Alberta Lake Management Society; and
b) *Stepping Back from the Water* completed by Alberta Environment and Water which can assist with determining standards for setbacks and buffers;
c) Provincial Departments including Alberta Sustainable Resource Development.

5.6.2 High densities preferred

Land close to the lake shore is in high demand. In order to meet this demand, the County will encourage high density development provided it meets the other policies in this document.

5.6.3 Demonstrate access

Within half a mile of the lake shore (Figure 8), developments will not be approved unless people living there will have adequate, legal access to the lake. The rule of ten linear feet of lake front per back lot, which has been in effect since the 1970s, will continue to guide but not bind the County.

5.6.4 Limited development in the riparian area

The lake shoreline must be protected by a buffer strip wide enough to prevent damage to the shoreline. The width of the buffer in each case will be determined by the County after consulting independent professionals. Within this buffer area, the land must normally be left in its natural state, and remediated if necessary, although small areas may be developed for public access. Any lost habitat must be replaced to the satisfaction of provincial regulators.

5.6.5 Walking trails

The County will require developers to build a walking trail on reserve land adjacent to private lots. These trails not only have a value in themselves; they will also help define the edge of public land and prevent encroachment by private landowners.

5.6.6 Sewage treatment

Once a municipal sewer line has been built outside the NEPL area, all new developments within half a mile of the lake, regardless of lot size, will be required to connect at the developer's cost.

The only exception to this rule is where an isolated house is being constructed so far from the sewer line that it is impractical to connect to sewer. In this case, a holding tank will be acceptable but not a septic field. This will be determined by council on a case-by-case basis. Section 5.5.5 should be referred to for more detail.

5.6.7 Stormwater Management

Storm water management facilities are to be designed in accordance with the principles and strategies of low impact development.

5.7 Upland areas

Upland areas are defined as land more than half a mile from the lake. Both large and small lots will be acceptable in these areas.

5.7.1 Small lots

The County will encourage the development of lots which are smaller than the traditional three to five acres. Lots under two acres are preferred. This will make it economic to serve them with piped sewer. However, no more than 48 lots will be approved per quarter section *[this is the limit under CR zoning in the present land use bylaw].* This means that large areas will be left undeveloped to create a rural feel to the development, and to preserve tree cover and better farm land. These large areas may be dedicated as reserve, transferred to a conservation organization, registered as the common property of the private lots, or retained by a single individual. In the last two cases, the County will register a conservation easement or similar encumbrance on title to guarantee future use.

5.7.2 Large lots

The County will be open to requests to zone land in the Pigeon Lake watershed to Rural Conservation. This allows lots of ten acres or more to be created on tree covered land. Sixty per cent of the lot must remain tree covered, and the County may register a conservation easement to guarantee this. (In practice, most owners keep much more of their land in trees.) Detailed requirements are set out in Bylaw 95/54, Schedule B, section 8.

5.7.3 Hobby farms

The County will encourage small-scale agriculture such as horse breeding and training, exotic animal breeding, greenhouses, market gardens, tree farms, and horticulture. Lots of an appropriate size are allowed under Agricultural zoning, but subdivision approval is granted only if the applicant proves his bona fides and his ability to run the proposed operation. Detailed requirements are set out in Bylaw 95/54, Schedule B, section 1.4(b). Alternatively, the County may establish a new district in the land use bylaw to regulate hobby farms.

Applicants will be reminded that it may be difficult to get a water licence to irrigate their land, so they should consider other options, such as trapping and managing on-site surface water.

5.7.4 Severed parcels

The County's land use bylaw allows agricultural land to be subdivided where it is severed by natural features such as creeks and ravines (Bylaw 95/64. Schedule B, section 21). Normally, zoning and subdivision are only granted if the creek flows year round, or the ravine is deep or steep enough to be a real barrier to farming. In the Pigeon Lake area, the County will accept seasonal streams and shallower ravines, but these streams and ravines must be dedicated as environmental reserve and fenced so that the natural vegetation will grow back.

Some of these policies for reconciling conservation and development in upland areas are illustrated in Figure 9.

5.8 Policies for existing developments

5.8.1 Sewage treatment

The County will continue to work with the summer villages and senior governments to establish a municipal sewage gathering and treatment system outside the NEPL area.

Once a municipal sewer system has been built on the south and west side of the lake, the County will encourage the owners of existing lots to connect to it and abandon their existing systems. Connection to the Municipal sewer system will be required if a private existing system requires maintenance and repair, the land is subdivided or a Development Permit is issued to rebuild or replace an existing house. Upon completion of the regional sewer collection system any existing system which has not already connected to the regional system shall upon the passing of supporting bylaws, be required to connect no later than 5 years from the date of completion of the regional system. One way of covering the cost is to consider, where appropriate, re-subdivision of existing lots on condition that they abandon their existing individual systems and connect to the municipal system.

5.8.2 Protecting creeks

The County will encourage farmers and ranchers to keep cattle out of the creeks that flow into Pigeon Lake. This may be achieved by installing off-creek waterers. Construction funds will be sought from senior governments and from conservation organizations. The County's Agricultural Services Board may provide technical help.

5.8.3 Rehabilitating damaged lands

The County will support effects by landowners and third parties to remediate damaged creeks and other areas of environmental value. This support may include direct assistance from the County's parks department.

If a parcel of municipal reserve has been cleared, but is not being used for active recreation, the County may re-establish native tree cover with the advice of conservation organizations.

5.8.4 Redevelopment

Where an existing parcel is being developed, the County will use its development control powers to bring the lot into conformity with the policies set out elsewhere in this Area Concept plan. This will apply particularly to

- setting buildings and other improvements back from water bodies,
- treating waste water in a manner that does not damage the environment,
- protecting and/or restoring tree cover, and
- remediating damaged wetlands.

5.8.5 Testing the water entering the lake

The County will encourage qualified third parties to test the nutrient content of water in the creeks and streams that enter Pigeon Lake. Where a problem is identified, and it is under municipal jurisdiction, the County will take appropriate action.

5.8.6 Fertilizer near Lake

Many newer subdivisions often have restrictive covenants imposed by the developer to limit the application of phosphorus-rich fertilizer on residential lots near the lake. The County will support this and is keen to work with Leduc County and the 10 Summer Villages adjacent to Pigeon Lake to implement a total ban on cosmetic lawn fertilizers.

5.8.7 Groundwater supply

Where a subdivision will result in there being six or more lots on a quarter section, and those lots will use groundwater, the Water Act requires the developer to prove that there is enough groundwater to serve the new lots without depleting the supply to farms and other residences in the area. However, these tests look at each development separately; they do not consider cumulative effects: how much development, in total, can safely be accommodated in the Pigeon Lake watershed.

Much of the necessary background material has already been assembled in the Regional Groundwater Assessment Study undertaken for the County in 2008 by Hydrogeological Consultants Ltd.

When Ponoka County commissioned two cumulative impact studies in the Gull Lake area, it found ample water for all proposed development. There were four separate aquifers at different depths. One of these fed the lake through springs.

Ponoka now requires that new high-capacity wells use a deeper aquifer that is not hydraulically connected to the lake. Wetaskiwin may do the same.

Depending on the results of the cumulative impact analysis, the County may set a cap on the amount of development allowed in the watershed. If any such cap is contemplated, it will be subject to public hearings.

The costs of the regional groundwater study may be recaptured by placing a per-lot levy on new development in the watershed.

6 Implementation

6.1 Changes proposed to the Municipal Development Plan

There is a potential conflict between this Area Concept Plan (ACP) and the policies set out in the Municipal Development Plan. The MDP, in section 1.2.1, defines productive agricultural land as:

(a) land in production with a farmland assessment value of 30% or more;

(b) grey wooded soil producing hay, forage, or other crops; and

(c) land currently used for grazing.

The next section of the MDP says that

1.2.2 Area structure plan[s] or rezoning will not be considered if the land is classified as productive agricultural land as defined above except as allowed elsewhere in the Municipal Development Plan.

In order to bring the ACP into conformity with the MDP, section 1.2.2 of the MDP should be amended by adding the underlined words:

1.2.2 Area structure plans or rezoning will not be considered if the land is classified as productive agricultural land as defined above except as allowed elsewhere in the Municipal Development Plan <u>or an Area Concept Plan</u>.

6.2 Changes proposed to the Land Use Bylaw

The County's land use bylaw is being reviewed, and this is a good time to draft new requirements that will support the policies set out in this Area Concept Plan.

6.2.1 Change the definition of good agricultural land

The present land use bylaw says, in section 1.2:

> *Good agricultural land means:*
>
> *(a) land with a farmland assessment value of 30% or more;*
>
> *(b) grey wooded soil producing hay, forage, or other crops; and*
>
> *(c) bush-covered land with agricultural potential (where potential is determined on the basis of the farmland assessment value the land would have if cleared).*

In order to allow the sort of subdivision proposed in this Area Concept Plan, the definition should be re-written as follows:

> *Good agricultural land is defined as follows.*
>
> *(a) Where an Area Concept Plan has been adopted by council, good agricultural land has the meaning set out in that plan.*
>
> *(b) Where there is no Area Concept Plan in place, good agricultural land means*
>
> *(i) land with a farmland assessment value of 30% or more;*
>
> *(ii) grey wooded soil producing hay, forage, or other crops; and*
>
> *(iii) bush-covered land with agricultural potential (where potential is determined on the basis of the farmland assessment value the land would have if cleared).*

6.2.2 Establish an Agricultural Smallholding district

The following wording from Ponoka County's land use bylaw may act as a model, although some wording may have to be changed to fit the Wetaskiwin situation:

> ***704 Agricultural Smallholding (AS) District***
>
> *704.1 Purpose*
>
> *The purpose of the Agricultural Smallholding District is to provide land for commercial agriculture on parcels smaller than would otherwise be allowed. At the request of the owner, Council may classify land to this*

district if it is convinced that the proposed parcel will support a viable agricultural operation.

704.2 Permitted Uses

Permitted uses are the same as those in the Agricultural District.

704.3 Discretionary Uses

Discretionary uses are the same as those in the Agricultural District.

704.4 Lot Size

The minimum lot size shall be at the discretion of the Municipal Planning and shall be based on the land requirements of the agricultural operation proposed for the site.

703.4 Other regulations

The other regulations for the Restricted Agricultural district are identical to those in the Agricultural District.

6.2.3 Establish a Watershed Remediation district

Part 5 of this Area Concept Plan establishes a goal of remediating creeks that have been damaged by the removal of natural vegetation. As always, incentives work better than regulation, so it is proposed that the County create a new district in the land use bylaw under which these damaged creeks are taken into municipal ownership as environmental reserves, with the upland areas subdivided into private lots. The incentive to the landowner is that, by giving up the damaged creek valley, he obtains saleable lots. A possible wording for the new district is as follows:

Watershed Remediation District

1 Purpose

The purpose of the watershed remediation district is to reduce flooding, improve water quality, and maintain or rebuild wildlife habitat by allowing a pattern of subdivision in which damaged watercourses are taken into municipal ownership as environmental reserves, fenced to exclude livestock and negative human impacts, and managed so that the natural vegetation will regenerate, and the upland areas between those watercourses are subdivided into private lots.

2 Approval Process

2.1 No land shall be classified to Watershed Remediation until an area structure plan or conceptual scheme for that land has been adopted, and in this regard "conceptual scheme" has the meaning given in section 653(4.4)(b) of the Municipal Government Act [and includes an Area Concept Plan].

2.2 An area structure plan or conceptual scheme shall show, among other things, all watercourses and the valleys in which they run, and all wetlands, and shall indicate that the watercourses and valleys and wetlands are to be dedicated as environmental reserve.

2.3 The Subdivision Authority may require the developer to fence all reserve land as a condition of subdivision approval.

3 Permitted Uses

The following uses are permitted:

3.1 Extensive agriculture, subject to the restrictions on land clearance set out in section 8
3.2 Single detached houses, including new manufactured and modular houses
3.3 Parks, recreation areas, and conservation projects
3.4 Public utilities
3.5 Buildings and uses accessory to the above

4 Discretionary Uses

The following uses may be allowed at the discretion of the Development Authority:

4.1 Home occupations
4.2 Bed and breakfast operations
4.3 Extensive recreational uses
4.4 Non-new manufactured and modular houses
4.5 Buildings and uses accessory to the above

5 Number of dwellings on a lot

No more than one dwelling shall be placed on a lot, except where a development permit has been issued under section 8 of Schedule A, Number of Dwellings on a Lot.

6 Lot Sizes

6.1 Lots shall have an area of no less than 8 hectares (20 acres).

6.2 Despite the preceding section,

(a) the area of a lot may be reduced if that is necessary to follow natural boundaries, and

(b) a smaller size may be allowed for a lot containing an existing farm yard site, using the standards of the Rural Residential district, and

(c) the size of lots for utilities, reserves and other public uses shall be as required by the Subdivision Authority.

7 <u>Building locations</u>

Buildings must be set back the following distances from property lines and other features:

7.1	*From a road*	*by the distances set out in section 9 of Schedule A, and illustrated by Figure 1*
7.2	*From a side property line*	*by 5 metres*
7.3	*From a rear property line*	*by 10 metres*

7.4 From a creek, stream, or ravine by 30 metres

8 <u>Maintenance of Natural Vegetation</u>

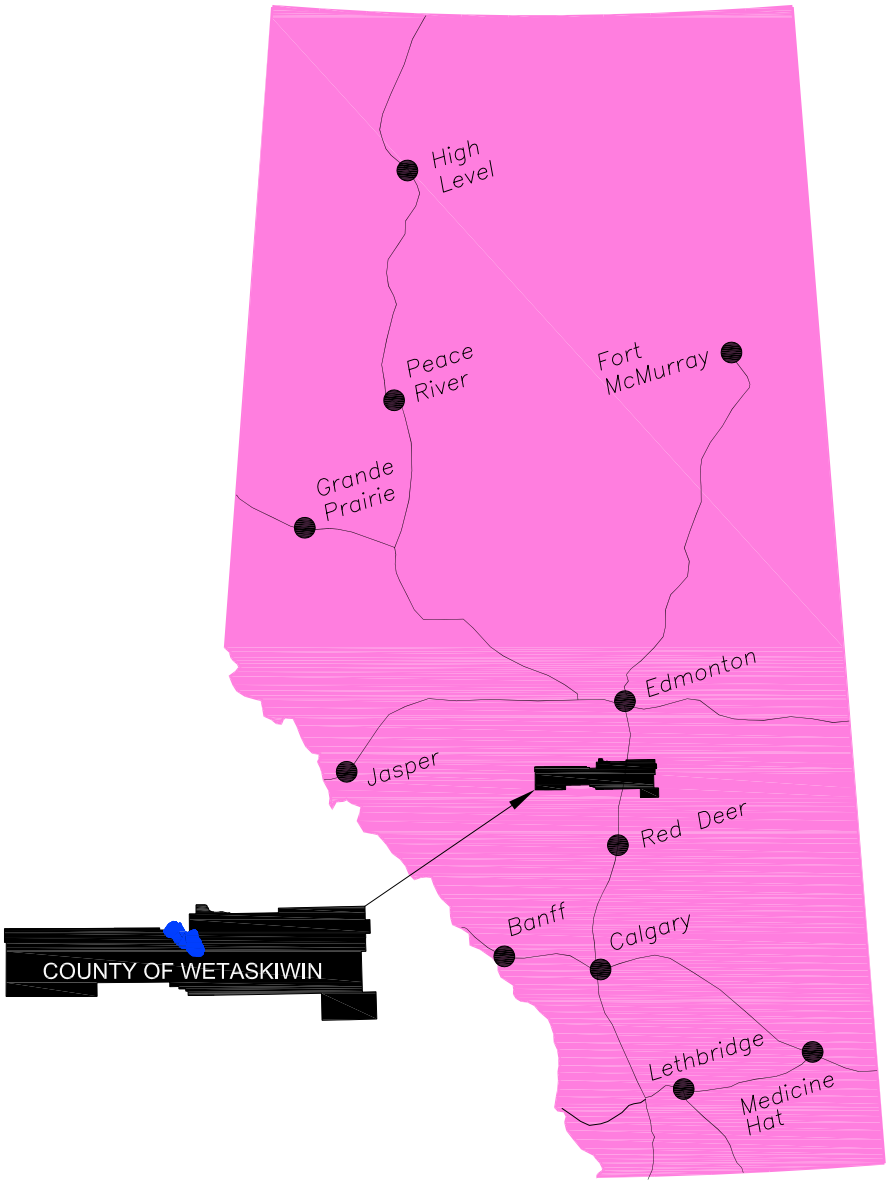
When a lot is created by subdivision after being rezoned to Watershed Remediation ,

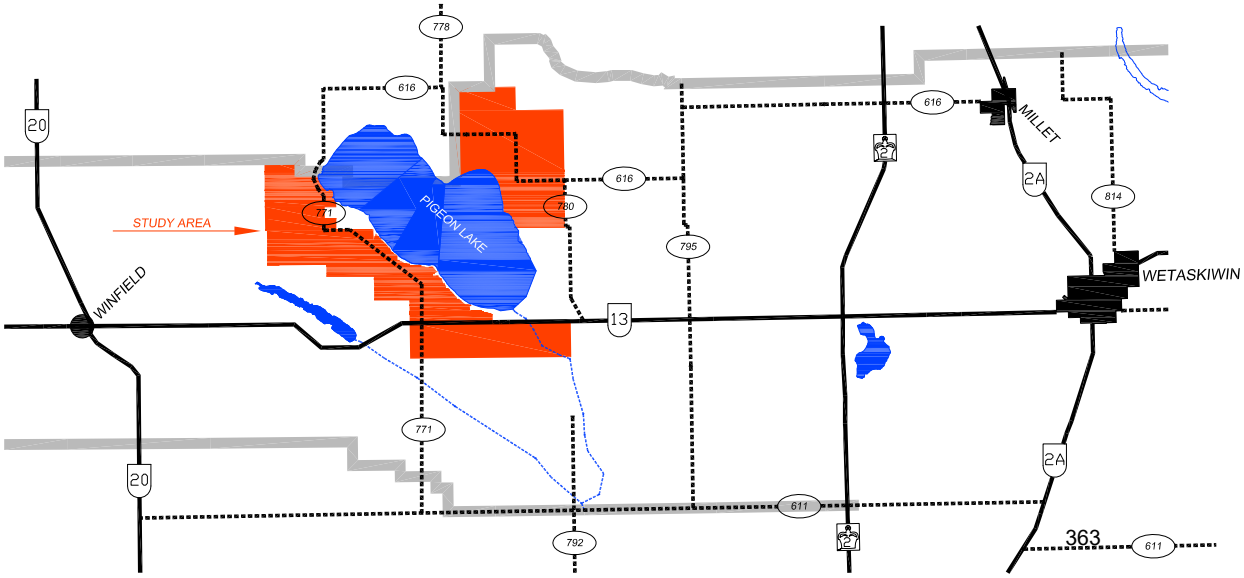
8.1 no more than 20% of its natural vegetation shall be cleared or removed, and

8.2 the Subdivision Authority may require, as a condition of subdivision approval, that a restrictive covenant, conservation easement, or other agreement be registered on the title to enforce restrictions on the clearance of natural vegetation.

Figure 1.0

PIGEON LAKE CONCEPT PLAN LOCATION





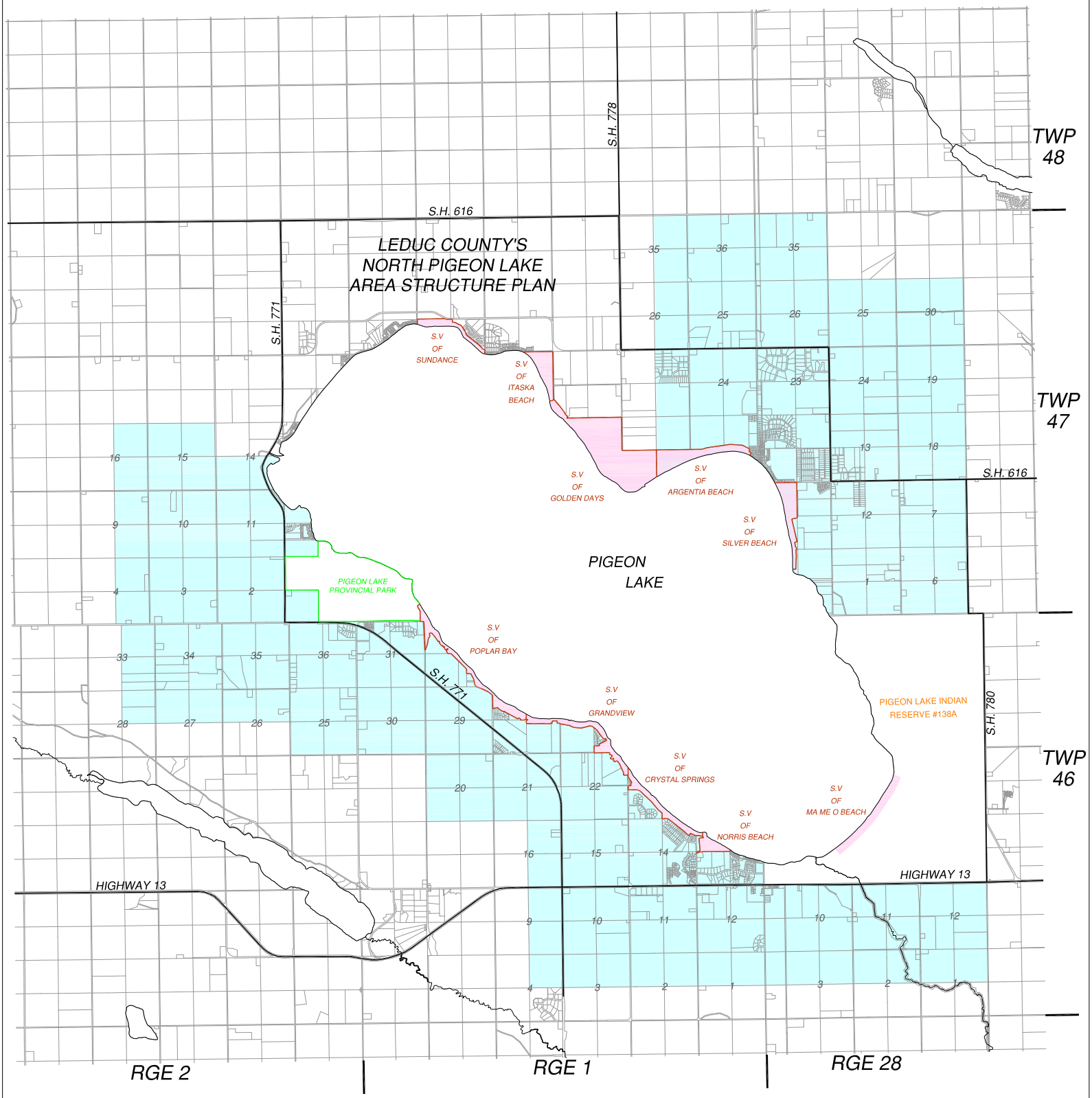


FIGURE 2.0
PIGEON LAKE AREA CONCEPT PLAN
STUDY AREA

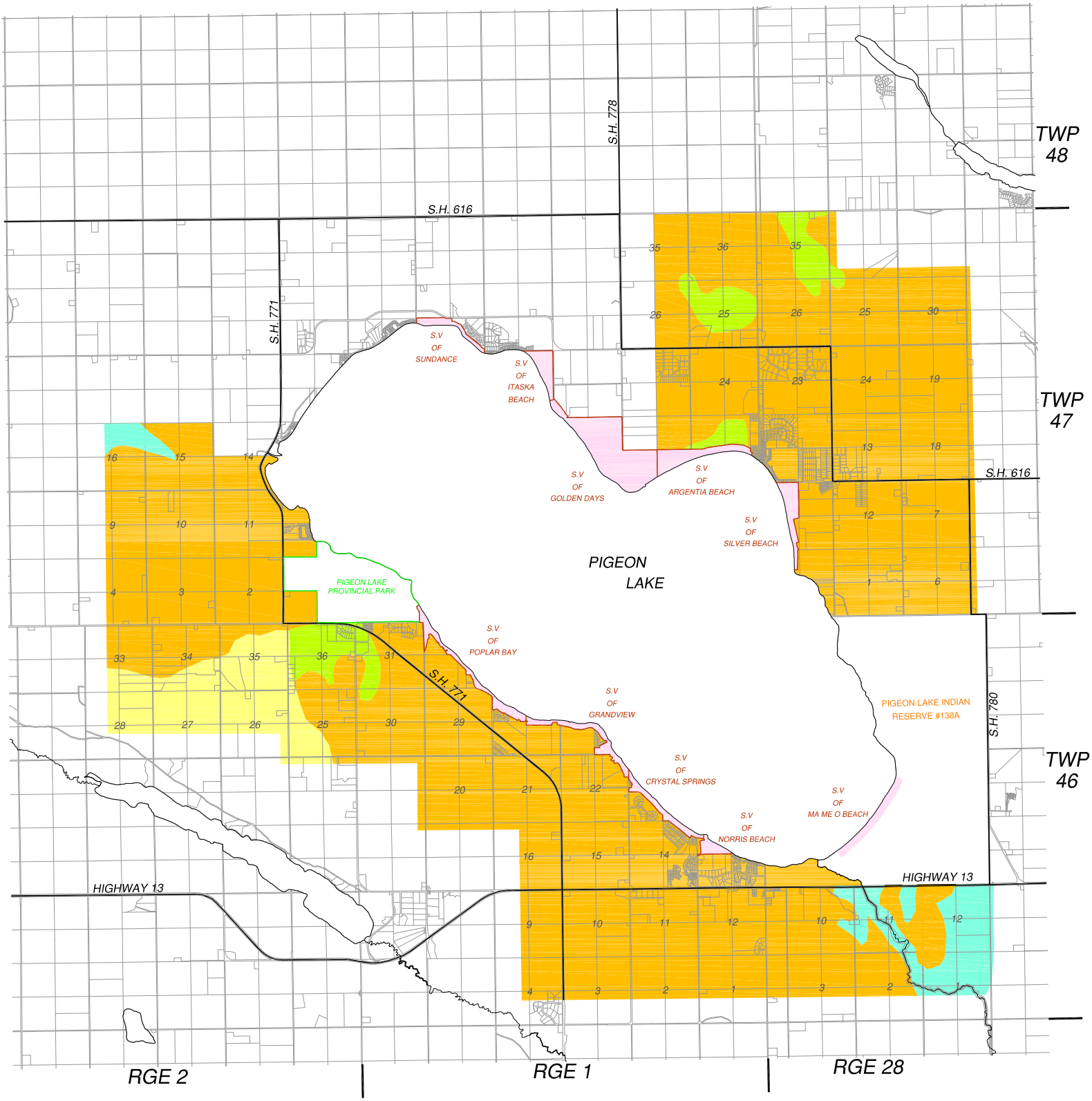


FIGURE 4.0
PIGEON LAKE AREA CONCEPT PLAN
SOIL CLASSIFICATIONS

CLASS 2
CLASS 3
CLASS 4
CLASS 5
CLASS 0

N

365

0 500 1000 2000 3000
METRES

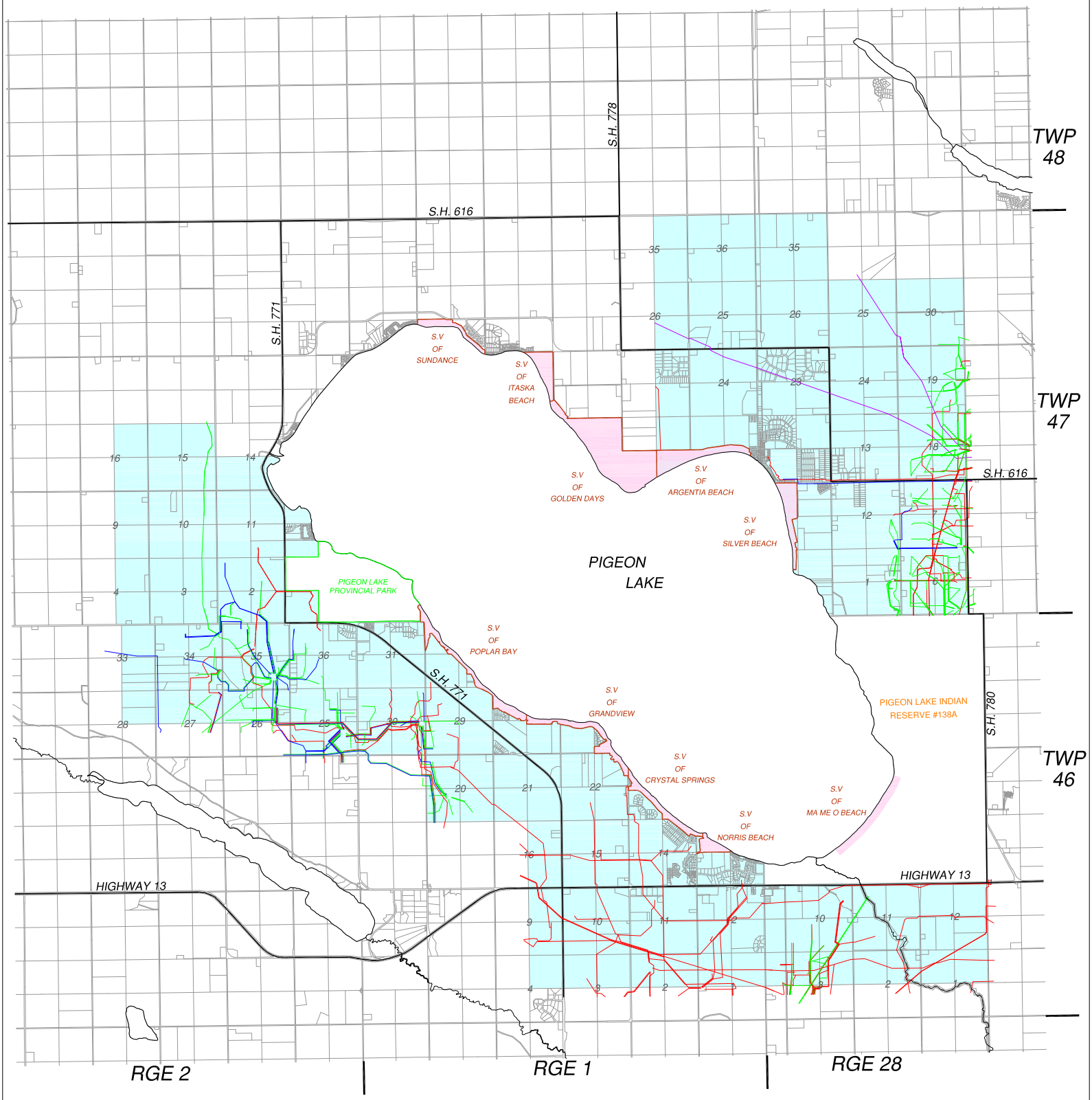


FIGURE 5.0
PIGEON LAKE AREA CONCEPT PLAN
OIL & GAS PIPELINES

GAS PIPELINE
OIL PIPELINE
WATER PIPELINE
LVP/HVP PIPELINE

Note: In addition to these registered pipelines unregistered pipelines may exist.

N

0 500 1000 2000 3000
METRES

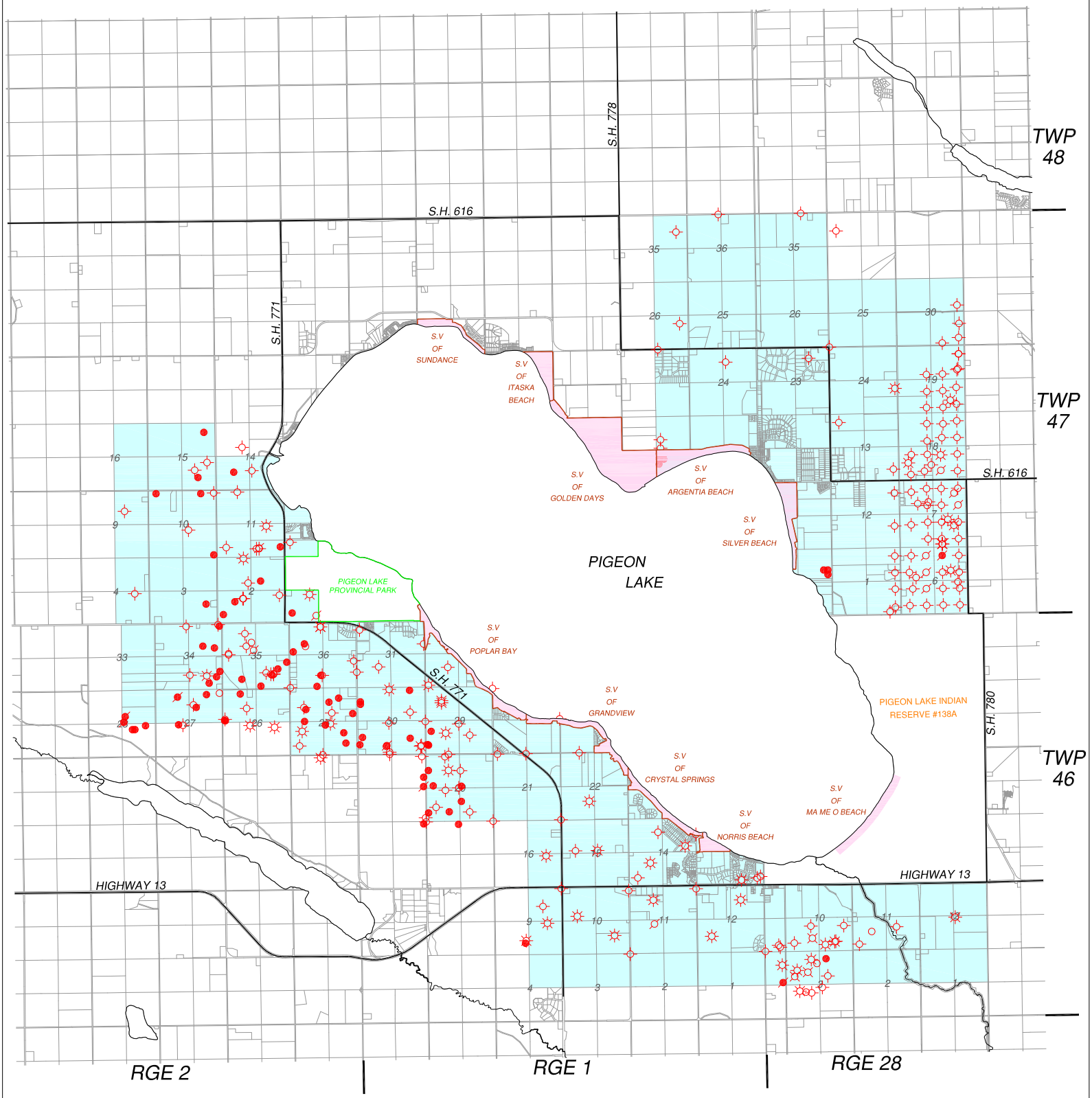


FIGURE 6.0
PIGEON LAKE AREA CONCEPT PLAN
OIL & GAS WELLS

ABANDDONED WELLHEAD
SUSPENDED GAS WELLHEAD
SUSPENDED OIL WELLHEAD
FLOWING GAS WELLHEAD
FLOWING OIL WELLHEAD

N

367

0 500 1000 2000 3000
METRES

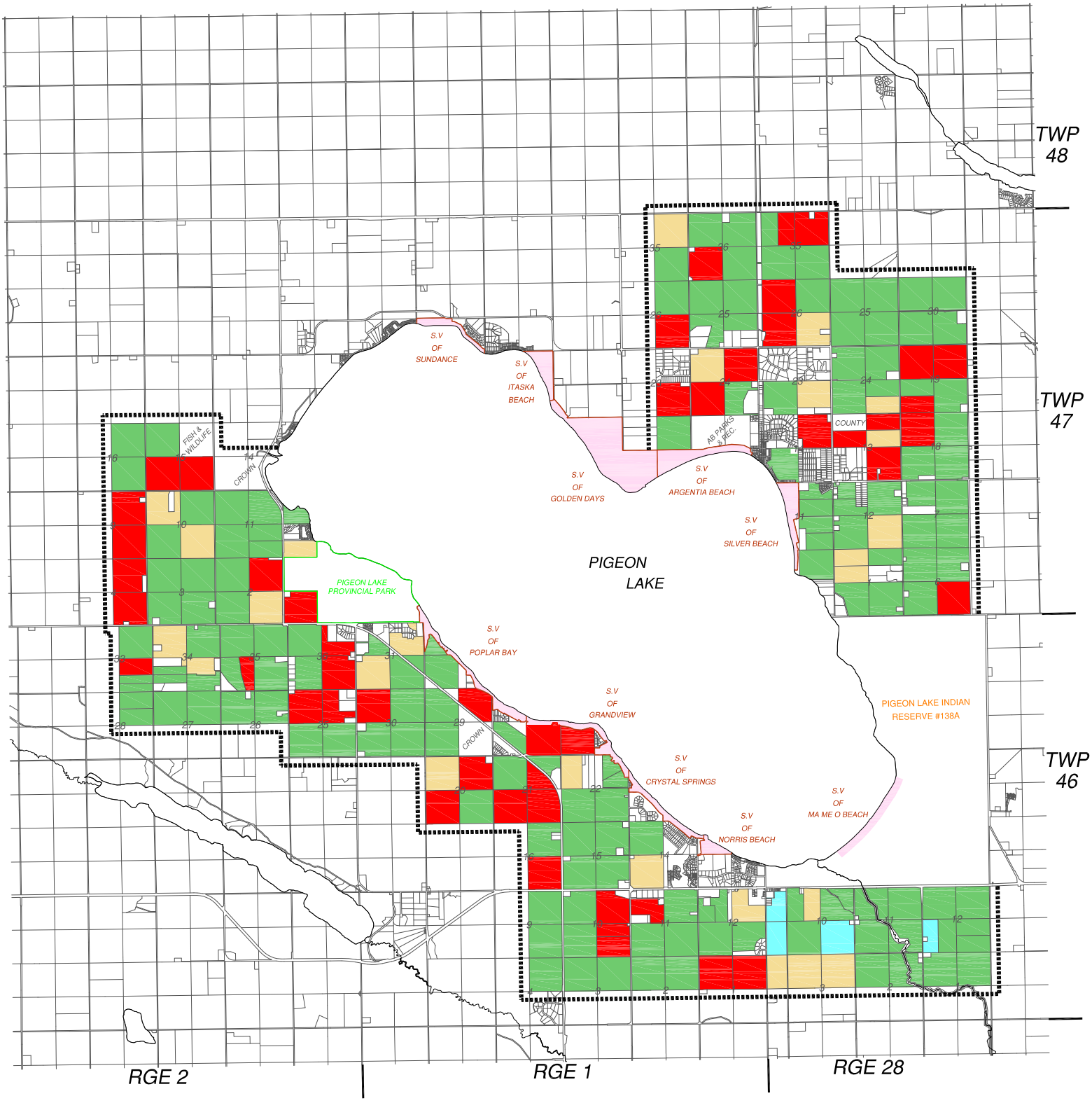


FIGURE 7.0
PIGEON LAKE
FARMLAND ASSESSMENT MAP

Land with at least 40 acres assessed at 30% or less

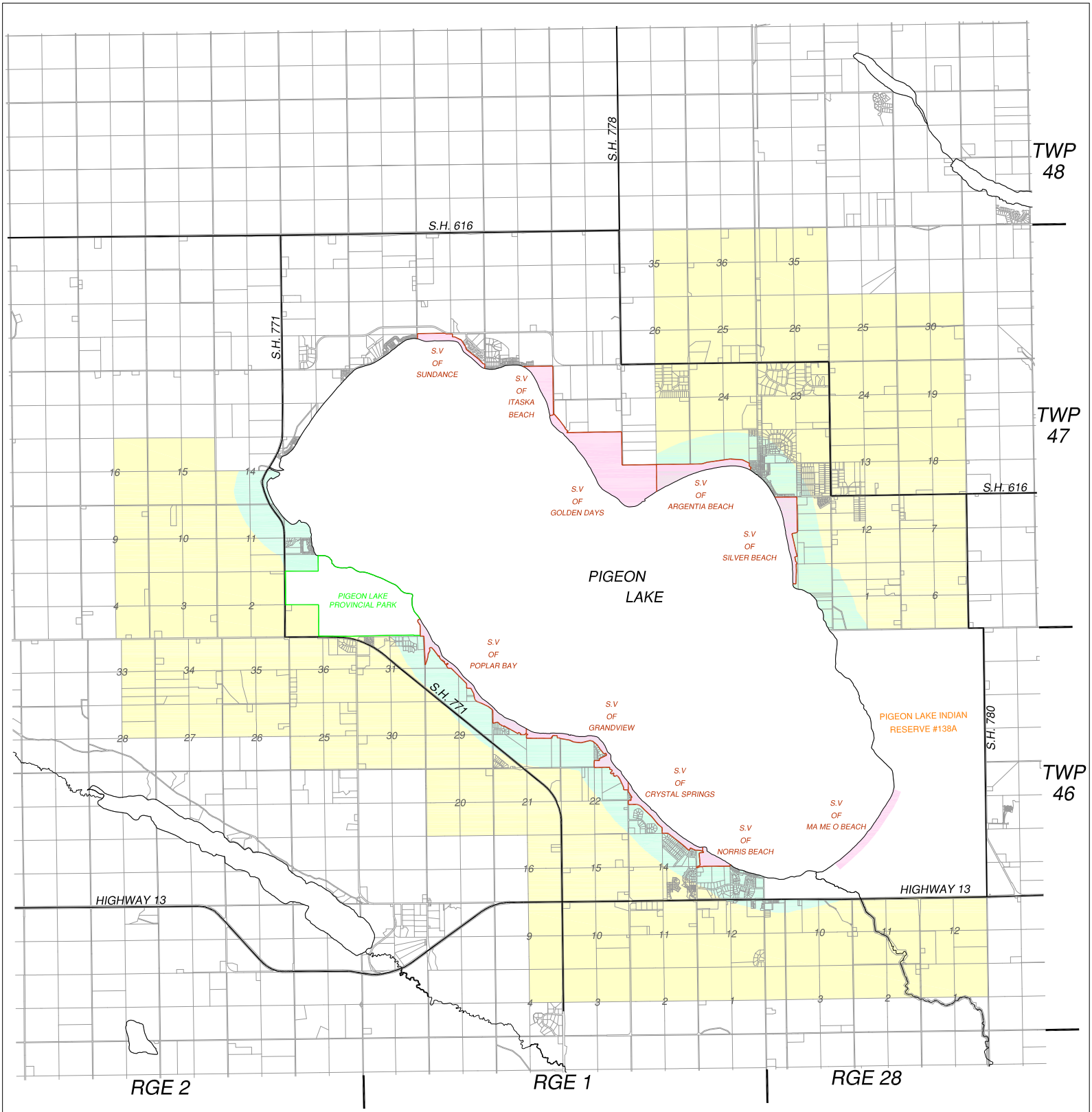
Land with at least 40 acres assessed at 40% or less

Land with at least 40 acres assessed at 50% or less

Land with less than 40 acres assessed at 50% or less

N

0 500 1000 2000 3000
METRES



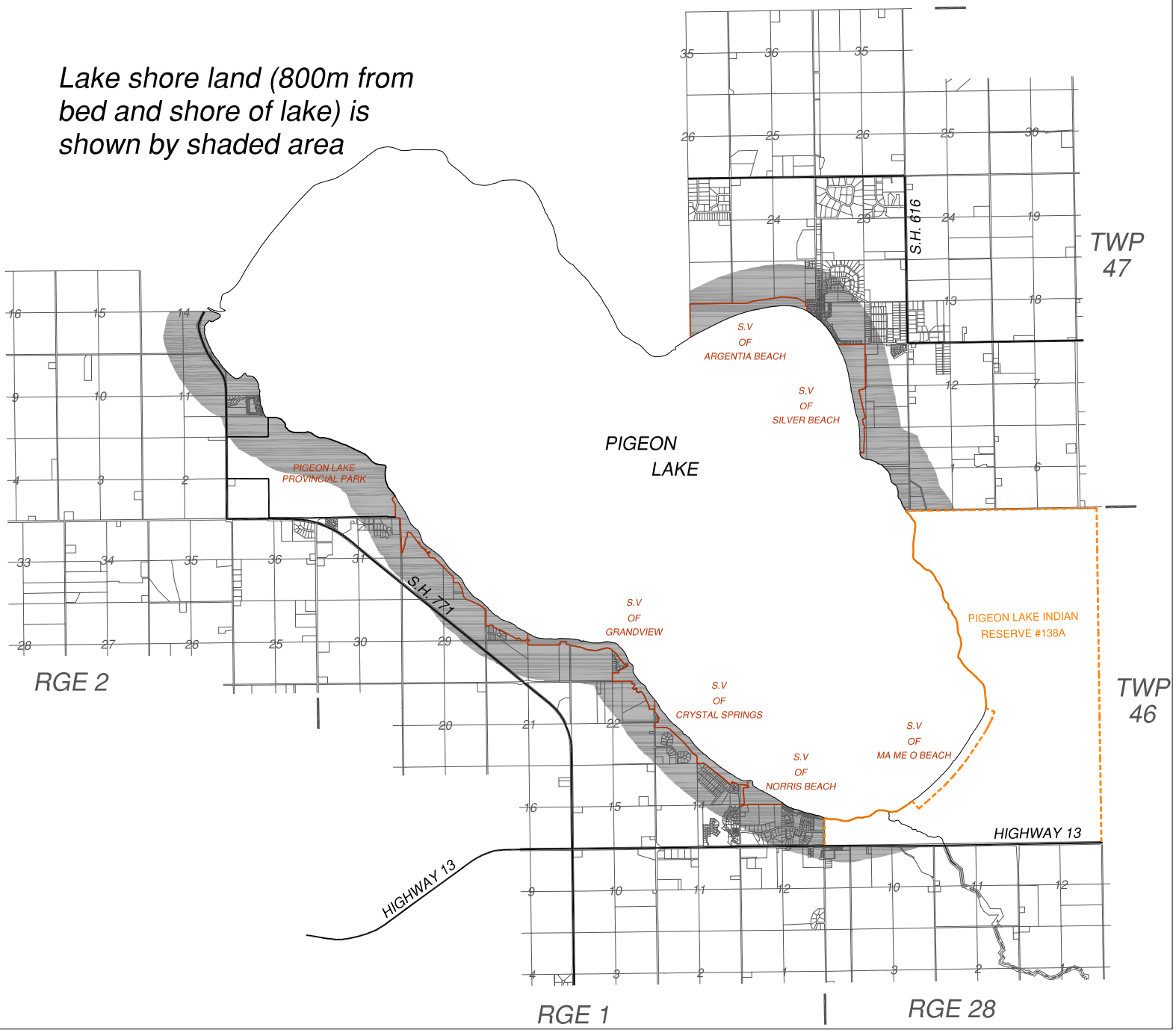
Lake shore land (800m from bed and shore of lake)

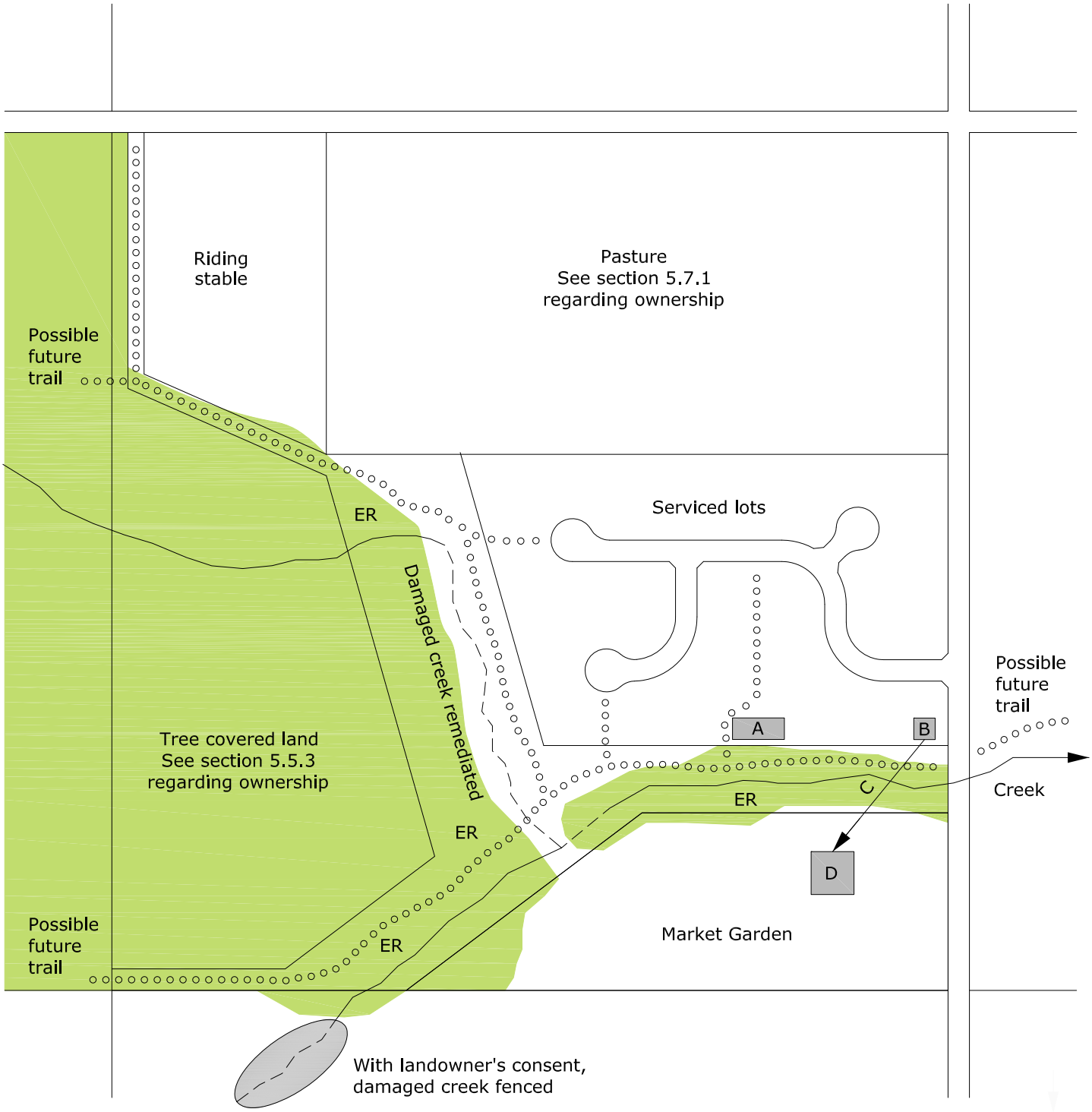
Mixed Use

FIGURE 8.0
PIGEON LAKE AREA CONCEPT PLAN
LAND USE MAP

0 500 1000 2000 3000
METRES

FIGURE 9
PIGEON LAKE
STUDY AREA





Pigeon Lake Area Concept Plan
Figure 10: Reconciling Conservation and Development

- Creek in good condition
- Damaged creek
- Walking trails
- Tree covered land

A	Artificial marsh cleans runoff
B	Mechanical sewage treatment plant
C	Pipeline carries treated effluent
D	Irrigation pond
ER	Environmental Reserve

TAB 9

From: Nicole Klatt [redacted] >
Sent: Thursday, April 7, 2022 4:41 PM
To: Nathan Shirley
Cc: premier@gov.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca
Subject: CFO APPLICATION # RA21045 (amended with contact info)

Re: Application # RA21045

Attention Mr. Shirley

Hello, Nathan. My name is Nicole Klatt. I reside on the [redacted] As such, I am a directly affected individual of the above named application. One of the unnamed creeks that connects with the Sunset Creek runs the entirety of my 80 acres; entering from the SW corner and exiting the NE corner.

I would like to start off by presenting some personal background to you. There are numerous multi generational traditional farmers in this area, myself being of the 4th generation. Myself and my family have always held both the respect for nature and fellow man in high regard. As such, our farming and lifestyle practices continue to directly reflect this.

Firstly, much of the land has been kept in a condition that echoes how my great grandfather homesteaded it; well over 100 years ago. Should this CFO be approved, myself and my children, along with generations to come, will no longer be able to enjoy or maintain this land as such; a heritage farm, both traditionally and culturally *sound*. Pigeon Lake will be affected in just the same manner(s). I will present my numerous reasons and supporting documentation in point form, further in the letter.

Secondly, the fact that we have much respect for our fellow man, we have not complained and therefore have tolerated the current operation. This directly reflects our strong sense of community, unity, and support. To my knowledge, there have been no complaints issued in regards to any of the generational, traditional farms that operate today. The applicants for this CFO live approximately 50 kilometres away from the proposed CFO location. Therefore, any and all impact(s) that would result in the approval of this CFO will not affect the applicants homes or lifestyles. This CFO can in no way be compared to a traditional farming practice. I am completely opposed and this application must be denied.

Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you

have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.
This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation

would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

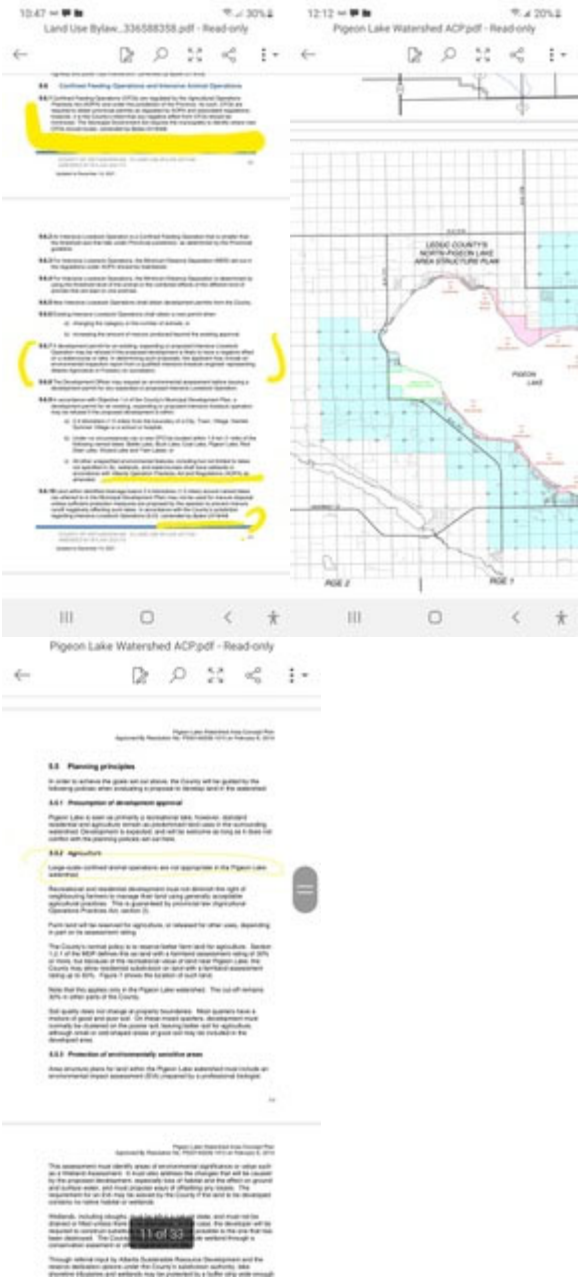
● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a while. https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-contemplate-2017-municipal-election/

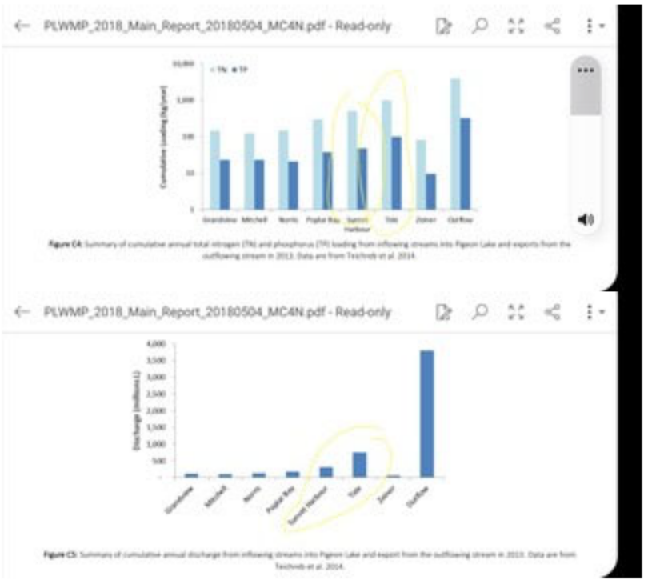


It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming
streams.

The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP.
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the
cleanest.

However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.



The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.
Nicole Klatt

[redacted]

NICOLE KLATT
[redacted]

APRIL 7, 2022

Natural Resources Conservation Board
Attn: Nathan Shirley, Approval Officer

Via email: Nathan.shirley@nrcb.ca

Re: Application RA21045 - Statement of Concern

a) It will be shown in this submission that there is significant flow from the exact position of the manure storage facility and the manure spreading area through Sunset Harbour Creek to Pigeon Lake. Also, measurements have been presented to show that this flow has already has alarmingly high concentrations of phosphorus from an existing intensive livestock operation. It is well known, particularly to the Natural Resources Conservation Board as the regulator of confined feeding operations, that phosphorus is a nutrient that causes the formation of cyanobacteria blooms. It is also well known by the Government of Alberta, which has provided millions of dollars in funding to reduce the amount of phosphorus entering Pigeon Lake as well as other lakes.

b) *The detrimental effects of phosphorus on water quality are likely to occur*. Pigeon Lake is perhaps one of the most studied lakes in Alberta from a scientific perspective, and without exception, all studies recognize the importance of reducing phosphorus migration into the lake as the primary goal for watershed stewardship. The occurrence of cyanobacteria blooms ("blooms") in 2006 and periodically in subsequent years, spurred on the formation of the Pigeon Lake Watershed Association, the passing of many bylaws and Intermunicipal Development Plans, the implementation of multimillion dollar investments by local communities in wastewater projects, and most importantly, a change in the habits and level of respect of the watershed residents for the watershed. Simply put, if an abundance of phosphorus runs to the lake, the lake will be critically damaged.

c) *The effect will not be trivial*. Anyone who has lived through a significant bloom knows the damaging effects a bloom can have on the quality of life at the lake, the property values and the local economy. Dr. David Schindler, the internationally acclaimed scientist and recipient of the Alberta Order of Excellence in 2008, was largely responsible for identifying the causal relationship between phosphorus and water quality. He gave ample warning of the risks of not controlling phosphorus runoff into streams and lakes. The minimization of nutrients from manure is a foundational conclusion of the *State of the Watershed Report* (Aquality, 2008). The consequential effect of algae blooms is also a major cause of fish kills, the latest

of which occurred during July 2021. Cyanobacteria blooms can be dangerous to human life to the extent that Alberta Health Services monitors beaches and issues an advisory if specified limits are exceeded. A significant bloom occurred during the summer of 2015. This bloom made national headlines as shown below and will happen again unless we take action. Pigeon Lake cannot sustain such an ongoing load of nutrients from this cattle operation.

Pigeon Lake algae warning dashes hopes of scum-free summer

Dave Lazzarino
Aug 05, 2016 • August 5, 2016 • 1 minute read • Join the conversation

Large piles of algae wash up on shore at Pigeon Lake near Mulhurst Bay on September 13, 2015
PHOTO BY GREG SOUTHAM /Edmonton Journal

3. Status of Pigeon Lake

Pigeon Lake has been the victim of many years of improper development practices on both the lakeshore and throughout the watershed. The cumulative effects of a vast number of developments have pushed our lake to the breaking point. This lake has an extremely low flushing rate, estimated to be greater than 100 years, which means the effects of added pollutants are significant. The increase in the number and frequency of harmful algae blooms (HABs) in recent years resulted in the formation of the Pigeon Lake Watershed Association (PLWA) and a flurry of research into what was causing this change.

It soon became apparent that the cause of HABs is directly associated with the external load of nutrients from the adjoining land. Watershed residences became engaged with one common purpose – protecting the lake as a valuable resource for future generations. The PLWA's practices and goals of watershed stewardship are now considered as a gold standard for other watershed groups throughout the province.

The State of the Watershed Report was written in 2008 to establish a starting point and a path forward: where we were then and where we were going (ref: *Pigeon Lake State of the Watershed Report*, Aquality Environmental Consulting Ltd, 2008). This report concluded "External and internal nutrient inputs are a concern to the health of Pigeon Lake. Land use

practices, sewage, and *manure management* around the lake should be managed to *minimize further nutrient loadings to the lake."* (ref: ibid. p.38) (Emphasis added).

The efforts of watershed residents are already having a positive effect on the water quality of Pigeon Lake. Through the implementation of beneficial management practices, nutrient loading into the lake has been decreasing, and the results are starting to show. The intensity of the algae blooms is reducing, and we no longer get the almost yearly health advisories for cyanobacteria. But to sustain the momentum of this improvement, we must not let down our guard. The introduction of a 4000 cattle CFO, with the resulting manure spread over many sections of land in this well-drained area of the watershed, will put a dire strain on the capacity of the lake and set back, perhaps irreversibly, the advances made over the past decades, including the benefit of the regional wastewater system.

4. Topography of Western End of Watershed

The majority of land in the Pigeon Lake watershed lies to the west of the lake. It includes rolling land and many forested areas; however, much of the land has been cleared for agricultural purposes. The area around the proposed CFO is adjacent to an existing intensive livestock operation. This existing operation has approximately 1200 head of cattle that can be readily observed moving around unrestrained in the vicinity of the streams and ponds. This proposed project will more than triple the effects of manure contamination to the environment. The area is drained mainly by Tide Creek and its tributaries but also by other streams and tributaries, including the Sunset Harbour Creek, as it is locally known.

Figure 1 shows the quarter section (NW3-47-2 W5M) in which the proposed CFO is located. This site is drained by the Sunset Harbour Creek and its tributaries, which are ephemeral streams that flow to the northeast approximately 2½ km to Pigeon Lake. There are also other drainage patterns in the area where manure spreading is proposed. During the spring freshet, the rapid runoff of the snow melt has been measured to have a high concentration of dissolved phosphorus. As part of a nutrient loading study, water samples were taken in March 2022 from the two stream crossings on Range Road 22, which are shown in Figure 1. The values for dissolved phosphorus were reported at alarmingly high values of 2.0 and 1.6 mg/L for the north and south tributaries respectively. Dissolved phosphorus is a parameter that gives an indication of the amount of bioavailable phosphorus, which contributes directly to the formation of cyanobacteria blooms.

Sample Description	: RR 22, North, #1	Bureau Veritas Sample Number	: AQL761
Sample Date & Time	: 2022/03/22 16:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	2.0	mg/L	KONE	2010	A535183	0.075	0.0030

Sample Description	: RR 22, S, #1	Bureau Veritas Sample Number	: AQL762
Sample Date & Time	: 2022/03/21 15:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	1.6	mg/L	KONE	2010	A535183	0.15	0.0030

Note: full sample results are available upon request

Previous work by Alberta Environment and Parks on their study of the phosphorus budget for Pigeon Lake (ref: Pigeon Lake Phosphorus Budget, Chris Teichreb, 2014) measured values of Total Phosphorus and Dissolved Phosphorus in Sunset Harbour Creek at values much smaller. The results show that the values of Dissolved Phosphorus have increased by a factor of almost 20 in less than 10 years! (ref: *2013 Overview of Pigeon Lake Water Quality, Sediment Quality and Non-Fish Biota*, Teichreb, Peter and Dyer, May 2014, page A22). The high values of Dissolved Phosphorus suggest that the land being drained, i.e., Section 3-47-2 W5M, is not being subject to proper stewardship practices. It is recommended that the approval officer visit this land to see what agricultural practices are currently being followed to help determine the starting point of a cumulative effects evaluation.

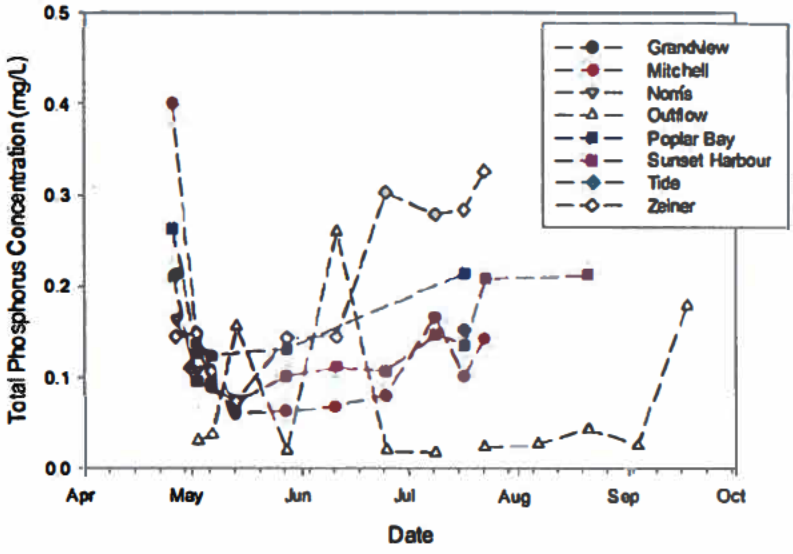


Figure 4-3 Pigeon Lake Streams Total Phosphorus Concentrations, 2013

Ref: *Pigeon Lake Phosphorus Budget*, Teichreb 2014 shows maximum values of Total Phosphorus in Sunset Harbour Creek of 0.2 mg/L compared to 2022 values of greater than 1.6 mg/L of Dissolved Phosphorus in the 2 tributaries

Figure 1. Drainage streams flowing north east to Pigeon Lake. The location of the proposed CFO is highlighted. The white arrows show the locations where the photographs in Figures 3 and 4 were taken.

5. Location of Proposed CFO

The location of the proposed manure lagoon is directly opposite a stream in the drainage pattern for this sub-watershed, which drains to the lake near Sunset Harbour. An enlargement of Section NW3-47-2 W5M is shown in Figure 2. It appears that a current feeding operation is located directly north of the proposed manure lagoon. This structure is also located very close to the stream and should be reviewed, especially in view of the high phosphorus runoff from this area. This stream must have some long-lasting significance as it forms a demarcation between the cleared land and the forested area in the southeast part of this quarter section.

Figure 2. Location of proposed manure lagoon in NW3-47-2-W5M (highlighted) is directly adjacent to a drainage stream.

During periods of heavy rainfall and during the spring freshet, this tributary of Sunset Harbour Creek experiences heavy flows. Photographs taken during the freshet on March 19, 2022, are shown in Figures 3 and 4 of the stream crossing on Range Road 22 and on Hwy 771 respectively. The locations of these steam crossings are indicated on Figure 1 by white arrows.

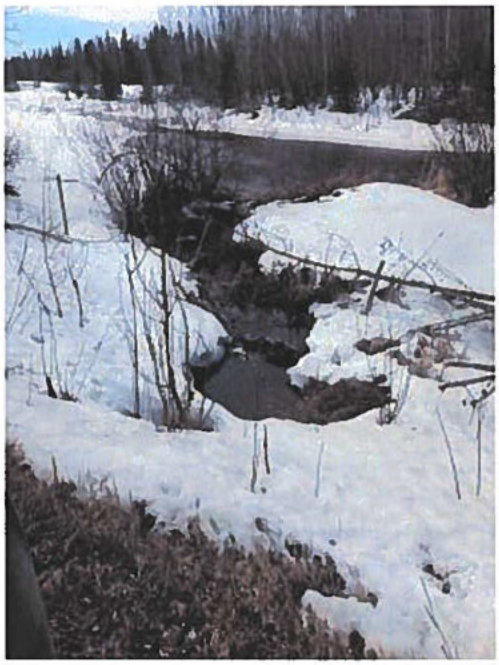


Figure 3. Steam Crossing on Range Road 22 during spring freshet March 19, 2022.

Figure 4. Stream crossing at Hwy 771 near Sunset Harbour during spring freshet, March 19, 2022.

It is readily apparent from the dark brown colour of the water that the streams are carrying a significant nutrient load from draining the land proposed to be the disposal area for the manure from 4000 cattle. The resulting increase in phosphorus load to Pigeon Lake could well bring Pigeon Lake to the breaking point.

6. Plan for Manure Disposal

If constructed properly, neither the CFO nor the collection area for the produced manure presents any real environmental problems other than perhaps the odour associated with such operations. The true problem arises from the disposal of such a large amount of manure. It appears that this manure will be in liquid form and will be dispersed on a large area of land drained by streams and tributaries that all flow into Pigeon Lake.

The high phosphorus concentrations found in Sunset Harbour Creek, as evidenced by water samples, can only be expected to increase as the load of manure increases. This manure will be applied year after year into the foreseeable future. With the cumulative effects of this proposed operation added to the existing intensive livestock operation on the property and to the effects of development that has already impaired Pigeon Lake, we are basically risking the survival of one of Alberta's premier lakes for a cattle operation that actually contravenes development policies established by the Pigeon Lake Watershed Management Plan, the County of Wetaskiwin, and the Natural Resources Conservation Board. These issues are discussed in the following sections.

7. The Pigeon Lake Watershed Management Plan

The *Pigeon Lake Watershed Management Plan* (the "Plan") was adopted in 2018 by the 12 municipalities of Pigeon Lake and supported by the Chiefs of the Maskwacis Cree Four Nations, the Pigeon Lake Regional Chamber of Commerce, and other key stakeholders. It is a roadmap to guide development in the watershed with the incorporation of beneficial management practices. The Plan recognizes that CFOs have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, Objective 2e from the Plan (p. 17), shown below, states that there should be no CFOs within the watershed:

2e	**New or Expanded Intensive Livestock Operations** Statutory land use restrictions on new or expanded intensive livestock operations (including CFOs) are supported in this Watershed Management Plan	Policy	Lead Mun Support APLM GoA PLWA	Ongoing	No Intensive Livestock Operations

(Note: the Plan can be found at www.PLWA.ca)

8. County of Wetaskiwin Plans

The County of Wetaskiwin (the "County") recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. The County has adopted by resolution the *Pigeon Lake Area Concept Plan* ("ACP") in recognition of the need for long-range plans in areas experiencing growth pressures. *"The County of Wetaskiwin recognizes that increased development and growth pressures need to be addressed on a cooperative basis to ensure the long-term protection and sustainability of Pigeon Lake*" (ref: ACP section 1.1). In Section 5.5, policies are presented to guide the County when evaluating a proposal to develop land in the

watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFOs should not be in the watershed:

> ***5.5.2 Agriculture***
> *Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.*

The County's *Land Use Bylaw* (LUB) also provides some direction on CFOs within the County. In Section 9.6.1 of the LUB, the County recognizes that CFOs are regulated by the Agricultural Operation Practices Act and Regulations (AOPA) and under the jurisdiction of the Province but clearly states *"it is the County's intent that any negative effect from CFOs should be minimized, and that the Municipal Government Act requires the municipality to identify where new CFOs should locate."*

This is a sensible and responsible approach being taken by the County to achieve their goal of protecting Pigeon Lake. The Area Concept Plan, discussed above, clearly states that CFOs should not be located within the watershed. Although CFOs are not under County jurisdiction, the County addresses a high standard for a similar operation – Intensive Livestock Operations. Section 9.6.7 states that "an existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

Their LUB addresses the spreading of manure in Section 9.6.10 as shown below:

> **9.6.10** Land within identified drainage basins 2.4 kilometres (1.5 miles) around named lakes (as referred to in the Municipal Development Plan) may not be used for manure disposal unless sufficient protection measures are proposed by the operator to prevent manure runoff negatively affecting such lakes. In accordance with the County's jurisdiction regarding Intensive Livestock Operations (ILO). (*amended by Bylaw 2019/44*)

The Application specifies land area that will be used for the spreading of manure. It appears that SE10-47-2 W5M is within the specified distance of 2.4 km, as shown in Figure 5.

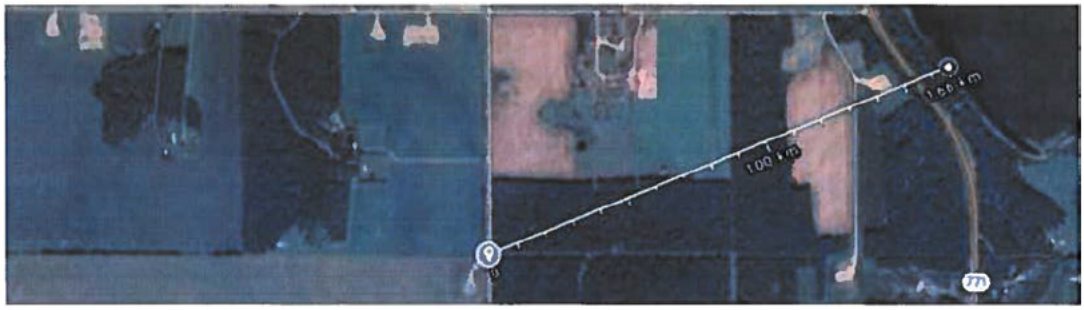


Figure 5. Distance from SE10-47-2W5M to Pigeon Lake is 1.66 km.

The County recognizes that spreading of manure has a negative effect on waterbodies.

The County's *Municipal Development Plan* also provides direction over the concern about the environment. Environmental protection is a focus of this plan as stated in Section 3 shown below:

3 Environmental Protection

Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

9. The Adequacy of the Application

The Regulations are specific as to what is required in the application. Two important items do not appear to be included: water courses and drainage patterns. Drawing C04 appears to show a phantom outline of a water course, but it is not specifically highlighted in the application. Also, the drainage pattern is not shown.

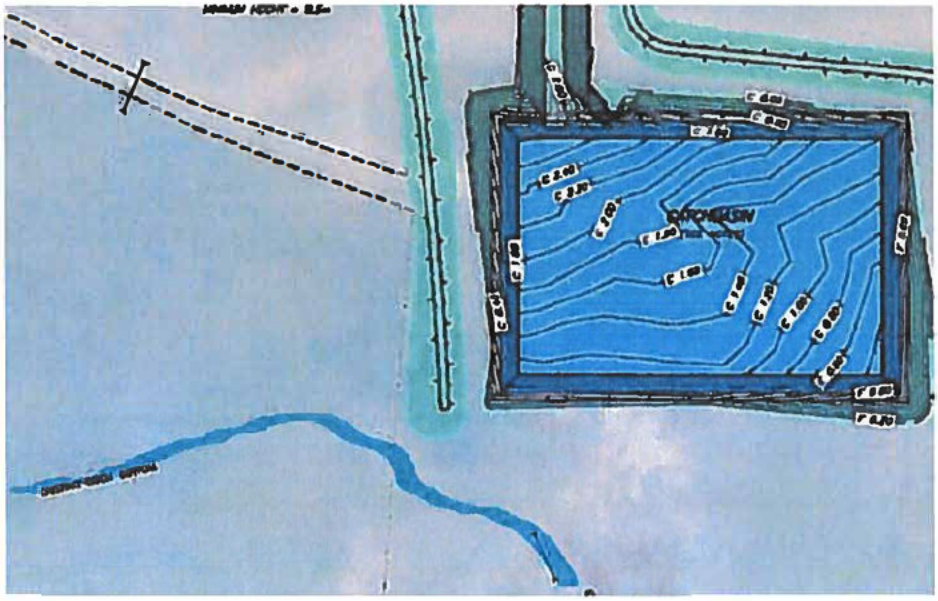


Figure 6. Excerpt from drawing C04 from Application showing adjacent stream highlighted. Notations are illegible on the provided copy.

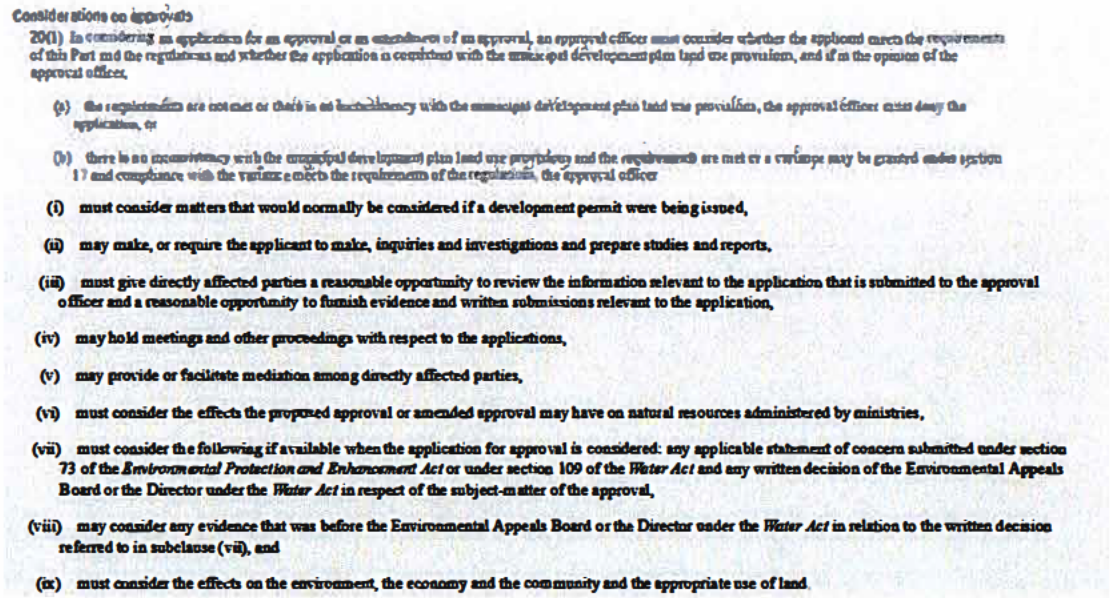
Figure 1 shows this is a water course directly adjacent to a manure lagoon. An excerpt from the referenced drawing is shown as Figure 6 with the water course highlighted for reference purposes. The published application does not show the location of the water wells, nor is the description of the water course legible. However, Figure 6 clearly shows that the manure storage facility fails to meet the minimum setback provisions in AOPA of 30 m.

The drainage pattern is not shown; however, it can be inferred that the area drains towards the stream. This is also implied by the satellite image in Figure 2, which appears to show drainage from a feed lot towards this stream.

10. Regulation by the Natural Resources Conservation Board

CFOs are regulated by the Natural Resources Conservation Board under the requirements of AOPA. While the requirements of AOPA seem to be quite minimal in that the setback distances

seem very small, some important responsibilities are bestowed on the board. Section 20 of AOPA provides these requirements:



Considerations on approvals

20(1) In considering an application for an approval or an amendment of an approval, an approval officer must consider whether the applicant meets the requirements of this Part and the regulations and whether the application is consistent with the municipal development plan and the provincial, and if in the opinion of the approval officer,

(a) the requirements are not met or there is an inconsistency with the municipal development plan and the provincial, the approval officer must deny the application, or

(b) there is no inconsistency with the municipal development plan land use provisions and the requirements are met or a variance may be granted under section 17 and compliance with the variance meets the requirements of the regulations, the approval officer

(i) must consider matters that would normally be considered if a development permit were being issued,

(ii) may make, or require the applicant to make, inquiries and investigations and prepare studies and reports,

(iii) must give directly affected parties a reasonable opportunity to review the information relevant to the application that is submitted to the approval officer and a reasonable opportunity to furnish evidence and written submissions relevant to the application,

(iv) may hold meetings and other proceedings with respect to the applications,

(v) may provide or facilitate mediation among directly affected parties,

(vi) must consider the effects the proposed approval or amended approval may have on natural resources administered by ministries,

(vii) must consider the following if available when the application for approval is considered: any applicable statement of concern submitted under section 73 of the *Environmental Protection and Enhancement Act* or under section 109 of the *Water Act* and any written decision of the Environmental Appeals Board or the Director under the *Water Act* in respect of the subject-matter of the approval,

(viii) may consider any evidence that was before the Environmental Appeals Board or the Director under the *Water Act* in relation to the written decision referred to in subclause (vii), and

(ix) must consider the effects on the environment, the economy and the community and the appropriate use of land.

Basically, this section of AOPA states the Approval Officer must determine if the application meets with the requirements of the AOPA, the Regulations, and the Municipal Development Plan. If there is an inconsistency, then the Approval Officer must deny the application. If not, then the Approval Officer must consider the following:

- matters normally considered if a development permit were being issued (such as the cumulative environmental impact and location of the CFO),
- the effects on natural resources administered by ministries (such as Pigeon Lake, which is controlled by Alberta Environment and Parks), and
- the effects on the environment.

The NRCB has a clear and well defined obligation to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to properly consider factors which cause the degradation of Pigeon Lake will place the responsibility squarely on the NRCB who will be held accountable.

11. Effect and Process

This project is perhaps the most significant perceived threat to Pigeon Lake in recent history. It has the potential of impacting all watershed residents whether or not they are in the Minimum Setback Distance. It will certainly affect the Ministry of Environment and Parks in that there is a Provincial Park campground just over 2 miles downwind of this facility. Anyone that has driven in the vicinity of Gull Lake or other areas of the province where liquid manure is spread knows all too well the enduring smell of liquid cattle manure. This Park will soon gain a reputation of being a "stinky" campground with a consequential loss of tourism. This ministry will also be faced with the challenges of increased fish kills and a possible loss of a major sports fishing lake. The increased flow of truck traffic hauling cattle, grain, manure, and hay unfortunately, as with odours, also expend past the Minimum Setback Distance.

One other aspect that must not be forgotten is highlighted in the following excerpt from the Alberta Water Council, which needs no further elaboration:

> *Cultural and Spiritual Values*
> Since time immemorial, Indigenous peoples have used lakes for all manner of life-supporting and life-affirming purposes, including for travel and as basic sources of food, drinking water and medicinal plants. Lakes are also important areas of cultural, spiritual and aesthetic significance for Indigenous communities. Many Indigenous people believe the Creator gave instructions to respect water, air and the land by keeping it pure, and these original instructions are reflected in many Indigenous beliefs, values and traditions to this day.

Ref: Alberta Water Council *Recommendations to Improve Lake Watershed Management in Alberta,* (2017)

The basic question to be answered is why should such an operation be approved when it will have such detrimental effects on so many watershed residents and visitors. As can be seen from the satellite image in Figure 7, when a bloom appears, it is both transient and ubiquitous, and it affects all lake residents.

Figure 7. Satellite image of Pigeon Lake during an algae bloom Oct. 17, 2018 (ref: ABMI.ca)

The process for considering this application is also a concern. Section 20(1)(iii) and (iv) state that the officer must give affected parties reasonable opportunity to review the application and also that public meetings may be held. With less than one month notice being given and at a time when many of the affected parties are not at the lake, it does not appear that this condition is satisfied. With the resounding outcry of concern from residents near and far, it is a fair question to ask why a public meeting is not being held.

12. Conclusion

I will be harmfully impacted by my quality of life, property values, additional phosphorus load, disease, medications, etc that will migrate on to my properties as well as the creeks and Pigeon lake.

11.2 This application does not meet the requirements of the Regulations in that the CFO manure storage facility is located within the minimum setback of 30 m of a stream.

11.3 The requirements of the County of Wetaskiwin's Municipal Development Plan are not met in that the County can stipulate where CFOs can be located and clearly declare, through their Area Concept Plan, that the CFO should not be located within the boundaries of the watershed of Pigeon Lake. Also the MDP specifies manure spreading may not be done within 2.4 km of a named lake (including Pigeon Lake). The measured distance from SE10-47-2 W5M, a quarter designated for manure spreading, is 1.66 km as shown in Figure 5. The Application does not comply with the requirements of the County's development plans and therefore must be denied.

11.4 Legislation requires that the approval process must consider the cumulative environmental impacts this CFO will have on Pigeon Lake. Evidence provided from stream analyses shows that there is already a significantly high nutrient runoff occurring from this area of the watershed.

11.5 Approval of this application would impact natural resources under the purview of the Ministry of Environment, which has jurisdiction over Pigeon Lake, and

11.6 This project is not in the public interest.

13. Recommendation

I strongly suggest that this application be denied on the basis of its environmental impact to Pigeon Lake and its failure to meet the legislated requirements.

NICOLE KLATT

From: [redacted]
Sent: Thursday, April 7, 2022 4:25 PM
To: Nathan Shirley
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: RE: CFO APPLICATION # RA21045

Re: Application # RA21045

Attention Mr. Shirley

Hello, Nathan. My name is Nicole Klatt. I reside on the [redacted]. As such, I am a directly affected individual of the above named application. One of the unnamed creeks that connects with the Sunset Creek runs the entirety of my 80 acres; entering from the SW corner and exiting the NE corner.

I would like to start off by presenting some personal background to you. There are numerous multi generational traditional farmers in this area, myself being of the 4th generation. Myself and my family have always held both the respect for nature and fellow man in high regard. As such, our farming and lifestyle practices continue to directly reflect this.

Firstly, much of the land has been kept in a condition that echoes how my great grandfather homesteaded it; well over 100 years ago. Should this CFO be approved, myself and my children, along with generations to come, will no longer be able to enjoy or maintain this land as such; a heritage farm, both traditionally and culturally *sound*. Pigeon Lake will be affected in just the same manner(s). I will present my numerous reasons and supporting documentation in point form, further in the letter.

Secondly, the fact that we have much respect for our fellow man, we have not complained and therefore have tolerated the current operation. This directly reflects our strong sense of community, unity, and support. To my knowledge, there have been no complaints issued in regards to any of the generational, traditional farms that operate today. The applicants for this CFO live approximately 50 kilometres away from the proposed CFO location. Therefore, any and all impact(s) that would result in the approval of this CFO will not affect the applicants homes or lifestyles. This CFO can in no way be compared to a traditional farming practice. I am completely opposed and this application must be denied.

Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.

This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate

division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

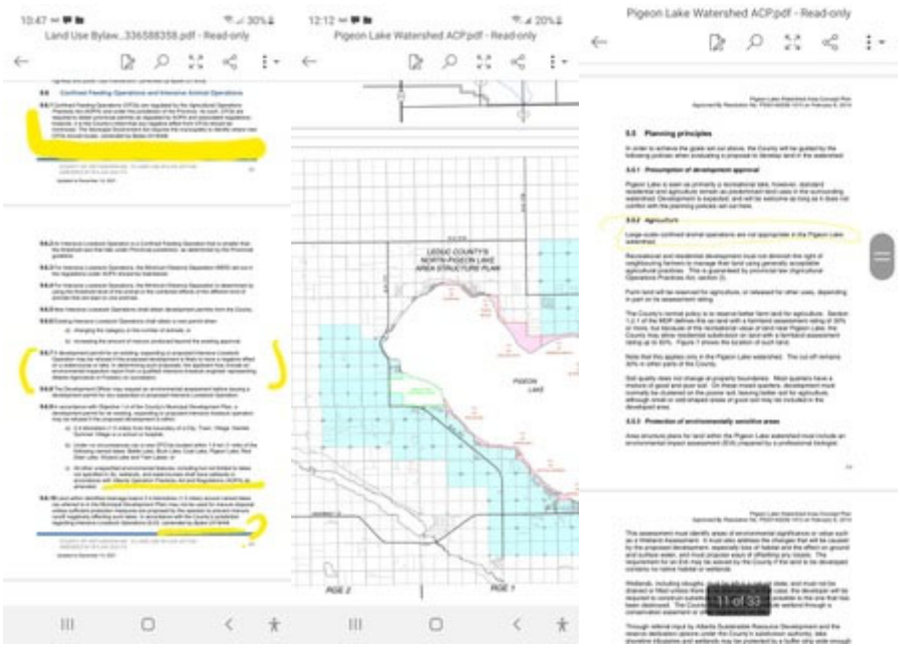
● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a while. https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-contemplate-2017-municipal-election/

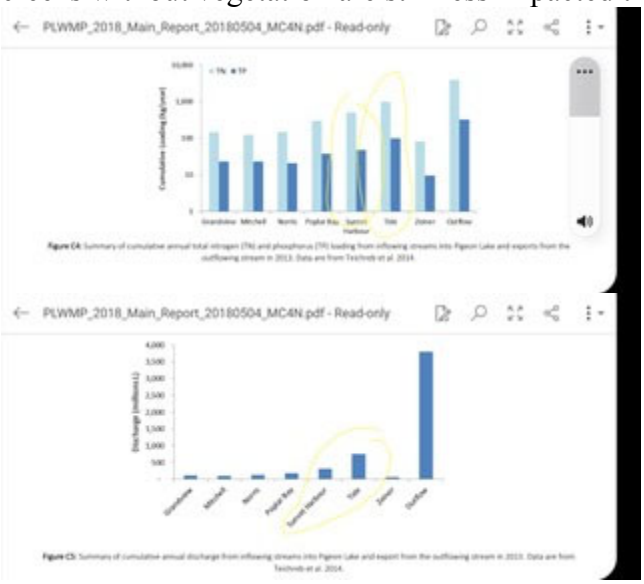


It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.

The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP.
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 

However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.



The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.
Nicole Klatt

From:	Nicole Klatt
To:	Nathan Shirley
Cc:	Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca
Subject:	Re: CFO application #RA21045 - Concern on behalf of impacted zone party
Date:	Thursday, April 7, 2022 3:58:29 PM

Hello,
>
> The attached documents show that the power over whether CFO's are in the Watershed or not lie within the watershed plans, and supersede the Development Plan and Land use Bylaw.
>
> https://www.dropbox.com/s/9lyl3aix4eizhbn/County%20Documents%20.pdf?dl=0
>
> https://www.dropbox.com/s/2aq84ua1xqxac8u/2022-04-07%2013.31.25.jpg?dl=0
>
> https://www.dropbox.com/s/x2hi5elo000xm40/2022-04-07%2013.32.19.jpg?dl=0
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> https://www.dropbox.com/s/qqvjdfp0jpnm2bd/2022-04-07%2013.33.23.jpg?dl=0
>
> https://www.dropbox.com/s/e9ch1gh9et6hymh/2022-04-07%2013.33.38.jpg?dl=0

Thank you
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Cc: Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca
Subject: Re: CFO application #RA21045 - Concern on behalf of impacted zone party
Date: Thursday, April 7, 2022 3:58:32 PM

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>
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>
> https://www.dropbox.com/s/9lyl3aix4eizhbn/County%20Documents%20.pdf?dl=0
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> https://www.dropbox.com/s/2aq84ua1xqxac8u/2022-04-07%2013.31.25.jpg?dl=0
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> https://www.dropbox.com/s/x2hi5elo000xm40/2022-04-07%2013.32.19.jpg?dl=0
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> https://www.dropbox.com/s/e9ch1gh9et6hymh/2022-04-07%2013.33.38.jpg?dl=0

Thank you
Nicole Klatt

From: Nicole Klatt [redacted]
Sent: Thursday, April 7, 2022 4:34 PM
To: Nathan Shirley
Cc: premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: Re: CFO application #RA21045

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

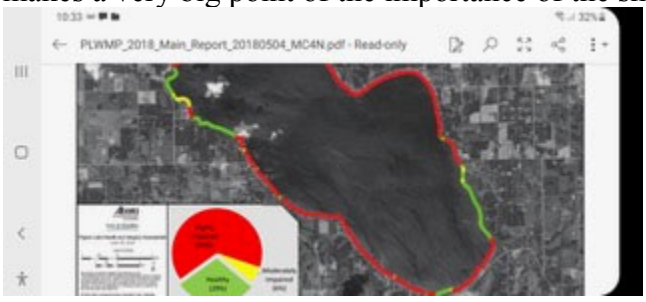
Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

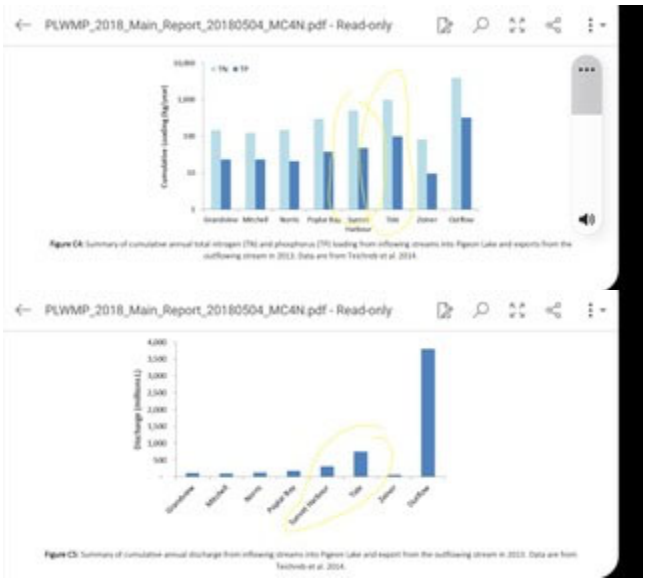
The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.



However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic

environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning. Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Nicole Klatt

From: Nicole Klatt [redacted]
Sent: Thursday, April 7, 2022 5:36 PM
To: Nathan Shirley
Cc: Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca
Subject: Re: RA21045

Furthermore to the above CFO application, please see the attached documents:

Section 4.2 in the MDP gives oversight regarding a very specific area near the lake. They did two management plans. Both of the plans say the CFO can't be there.
The county wanted to protect the lake. The councillors actually violated 4.2.2 of their own MDP.

3.5.5 Environmental Reserves must remain their natural state.

4 Lakes

Lakes in the County are recognized as a great asset by residents a
Activities around the lakes and development of the lakeshore land hav

There are Provincial and Municipal regulations to prevent water con
discharge entering the lake while Provincial and Federal regulations

use of the lakes. The County will continue to work with Provincial and
bring regional solutions for sewage collection and treatment systems.

Buck Lake Management Plan (2002), Pigeon Lake Watershed Manag
Wizard Lake Management Plan (2000) were prepared for the Count
general guidelines for development around the lakes.

Objective 4.1 Lakes in the County are categorized acco

5:24

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Hierarchy › Area Concept Plans

Area Concept P

The purpose of an Area Concep
(ACP) is to present a comprehe
planning policy framework and
generalized future land use con
which will be used by the Coun

- Guide the preparation of

Thank you
Nicole Klatt

From: Nicole Klatt [redacted]
Sent: Thursday, April 7, 2022 11:10 AM
To: Calgary.Lougheed@assembly.ab.ca
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; Nathan Shirley
Subject: Natural Resource Conservation Board (NCRB) APPLICATION for Confined Feeding Operation (CFO) #RA21045

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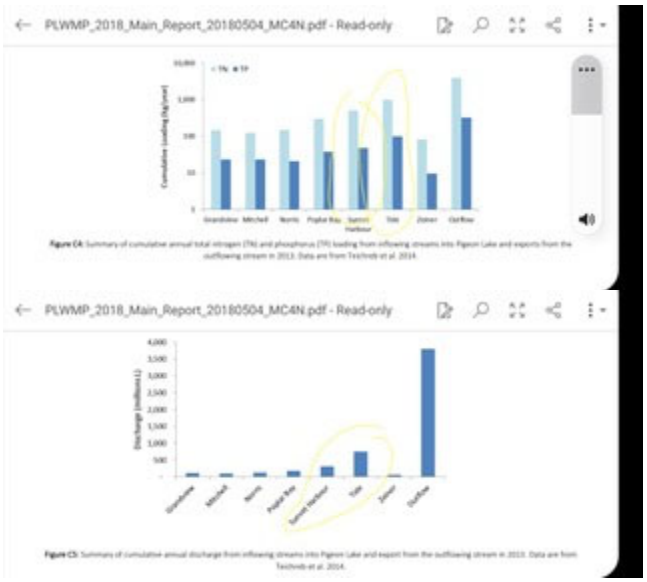

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The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Nicole Klatt

From: [redacted]
To: Nathan Shirley
Cc: premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: Re: CFO application #RA21045
Date: April 7, 2022 4:35:50 PM
Attachments: Screenshot_20220405-223328_Word.jpg
Screenshot_20220405-221131_Word.jpeg
Screenshot_20220405-221217_Word.jpeg

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.

The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning.
Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for people. All efforts are undermined by the significant loads in Tide creek. People

want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Nicole Klatt

TAB 10

From: Nathan Shirley
To: Carolyn Taylor
Subject: FW: Application RA21045 - Greg Thalen and G&S Cattle Ltd., NW 3-47-2 W5M
Date: Monday, March 28, 2022 2:35:56 PM
Attachments: CFO Application - Thalen.pdf

From: Wildman Ranches [redacted]
Sent: Monday, March 28, 2022 1:57 PM
To: Nathan Shirley <Nathan.Shirley@nrcb.ca>
Subject: Application RA21045 - Greg Thalen and G&S Cattle Ltd., NW 3-47-2 W5M

Names: Terence A Wildman and Barbara D Wildman (DIRECTLY AFFECTED PARTIES)
Legal Land Description: [redacted]
Mailing Address: [redacted]
Phone Nos: [redacted] or [redacted]
Email: [redacted]

This is in response to an Application from Greg Thalen (G&S Catte Ltd.) for a Permit to construct a new 4000-head CFO located on NW 3-47-2-W5M. This Application was submitted to the Natural Resources Conservation Board (NRCB) on 11 Sept. 2021.

Parties directly affected: T and B Wildman (Wildman Ranches). We ranch on two adjoining quarters [redacted] and [redacted] We have lived on the property for 29 years and are well known in the area. I (Terry) have done a lot of volunteer work since moving to the Westerose area, several years as a community representative on the Battle Lake Synergy Group, and a 3-year term on the Board of the Lakedell Agricultural Society, as well as volunteering for many Society events. Also, my wife Barbara has spent many years volunteering for community organizations such as Lakedell Agricultural Society and the Yeoford Community Hall.

The location of our farm is only a mile from the proposed CFO site and less than 150 metres from our house and yard site to where manure will be spread on NW 33-46-2 W5M. We are therefore a "**Directly Affected Neighbour**".

We are extremely concerned about the negative effects and therefore definitely **opposed to the permitting** of the CFO proposed by G&S Cattle Ltd. To support our position we would appreciate the NRCB reviewing and considering our fourteen attached "Issues and Comments".

T & B Wildman

APPLICATION RA21045 - Greg Thalen and G&S Cattle Ltd.

ISSUES AND COMMENTS - T AND B WILDMAN

1. Pigeon Lake - Watershed Contamination
2. Blue-Green Algae
3. Ecological Fragility of the Lake
4. Impact on Indigenous Lands
5. Latest Technology re Manure Management
6. Environmental and Risk Assessment Report
7. Potable Water Issues
8. Noise and Light Pollution
9. Traffic Problems
10. Future Expansion
11. Alternate Location

12 Minimizing Stress on Cattle

13. Chronic Wasting Disease
14. Permitting Process - Concept Plan

APPLICATION RA21045 - GREG THALEN AND G&S CATTLE LTD.

1. Pigeon Lake - Watershed Contamination

The proposed CFO is in the watershed drainage area of Pigeon Lake, which is the largest body of water between Calgary and Edmonton. It is the centre of a thriving tourist zone, winter and summer alike.

Unfortunately, the lake is very sensitive to contaminants because it is fairly shallow and the total volume of water in the lake turns over only once in 100 years. The location of the proposed CFO is on land which slopes naturally down into the lake. There are intermittent streams that feed into the creek which enters the lake on the west side; as well as drainage towards the lakeside homes, particularly around Sunset Harbour. All of this is downstream of the proposed CFO! Therefore any contaminants draining into the lake from the CFO's operations will poison the water for many decades and beyond. Be assured that leaks of urine and liquid manure will occur and will certainly end up in the lake!

2. Blue-Green Algae

Blue-green Algae (Cyanobacteria) is a very serious issue. It is toxic to humans, pets and fish. When present in a lake, the Provincial Health Authority posts advisories to not swim in the lake or eat the fish. What promotes the growth of blue-green algae are warm water and nutrients such as nitrates and phosphorus - both of these chemicals are found in cattle manure! The Cyanobacteria load, from both the CFO facility as well as from the spreading of manure on the 15 quarter sections specified in the Application, will be overwhelming. Every year the bloom of blue-green algae will move further and further out into the lake. Finally it will be found on all parts of the shoreline. When this happens Pigeon will be a dead lake! Anyone owning a property on or close to Pigeon Lake should be extremely concerned about this CFO development, not just because of human and aquatic health concerns but also because of potential property devaluation.

3. Ecological Fragility of the Lake

Because of the ecological sensitivity of the lake, a permit to build a CFO in the water drainage area is tantamount to giving a permit to kill the lake. The consequences of a dead Pigeon Lake - the campground closed, no fishing, no boating, no water sports and the Indigenous Lands (Pigeon Lake 138A) impaired and polluted for ever!

4. Impact on Indigenous Lands

Pigeon Lake is approximately 17 km long and 6 km wide. As described above, because of warm water and high nutrient loading, the poisoning of the lake will migrate to its east end and reach the shoreline of the Indian Reserve (Pigeon Lake 138A). Poisoning of Indigenous Lands is not acceptable. In fact, if this is allowed to happen it will show complete disrespect to the Indigenous peoples of the Pigeon Lake area.

We (T and B Wildman) respectfully request Nathan Shirley of the NRCB that a copy of the Application (No. RA21045) be forwarded to the Maskwacis Cree Tribal Council, and also to the Federal Department of Indigenous & Northern Affairs Canada, for their review and input.

5. Latest Technology re Manure Management

From the minimal information on the Application, it appears that the simple process of spreading manure on the 14 quarters of land owned by the Thalens on the west end of Pigeon Lake and contiguous with the pen area of the CFO is the technique that will be used to “manage” the many tonnes of daily manure collected in the pens.

The applicant should also present information related to latest techniques and technologies that have been developed to minimize the environmental impacts of spreading solid effluents on adjacent land

6. Environmental and Risk Assessment Report.

Based on all the negative impacts to the environment and specifically to Pigeon Lake, it is essential that, as part of the Permitting Process, an environmental investigation and risk assessment be conducted and the subsequent report be made public.

7. Potable Water Issues

A beef steer, depending on ambient temperature, will drink about 10-15 gallons of water per day. Thus, for a 4,000 head feedlot this equates to 40,000 gallons/day (i.e., 152,000 litres per day). Drawing this amount from the groundwater is significant enough to affect the water table and impair production from neighbouring wells. A ranch is nothing without water, so this is a serious issue to the surrounding farmers and ranchers! As a baseline, domestic wells should be tested by a certified well driller to establish the capacity of all wells within 2 miles of the CFO. Similarly, water quality should also be baselined before the startup of the CFO. An indication of water quality should be done through a water chemical analysis and a coliform analysis (total coliform and E.Coli). Coliform bacteria can be a serious health issue to animals and humans, causing vomiting, fever and diarrhoea. As you may be aware, cattle produce manure laden with nitrates, phosphorus and a host of different diseases. Interestingly, there is enough dissolved phosphorus in the manure from one cow to cause an algae bloom in 1 million litres of water (Source: Alberta Agriculture). In essence, the leaching of toxic water into the groundwater will be a horrible health risk to farmers/ranchers in the water drainage area of the CFO. This threat alone should dictate that the CFO permit be denied.

8. Noise and Light Pollution

We ourselves, as well as our animals, live in very quiet and peaceful surroundings. However a CFO just a mile or so away will destroy our tranquility from both noise and light pollution. Noise will emanate from cows and calves bawling and the operation of trucks and farm machinery. Lights of course will be on 24/7 so as to safely monitor the animals as well as the various component facilities.

These intrusion issues, besides others, will definitely be a detriment to our quality of life, for which we will get no compensation. So we definitely do not want this CFO to be our neighbour.

9. Traffic Problems

The Yeoford Road (Twp. Rd. 470) and Hwy 771 will be the main access roads to/from the CFO. Hwy 771 is already in terrible shape and we

complain every year to the Province about the many potholes in this section of 771. Also, Twp. Rd. 470 is only paved from Hwy 771 to the Yeoford Corner, thus the remainder of this road all the way west to Hwy 20 is unpaved, a distance of 6 miles. The super-heavy cattle liners and large feed trucks will degrade the unpaved section to the west in no time, as well as causing even worse break-up of Hwy 771 to the east. Definitely the western 6 miles must be paved for heavy use before the CFO is approved. There is also the problem of adding additional traffic when people are travelling to and from their homes around Pigeon Lake. Even without this additional CFO traffic, there is traffic congestion on local roads all summer long. We foresee, for all these reasons, serious road safety issues in the future if the CFO is approved.

10. Future Expansion

Out of the 150 or more Feedlots in Alberta, there are 38 in the 10,000 to 20,000 head size. In essence, one-third of all feedlots have a 10,000 plus carrying capacity. It is therefore quite reasonable to expect the Applicant, at some future time, to expand their facility to a 10,000 plus CFO for economies of scale. This would have a transformative and draconian effect on this community, multiplying all the other negative factors by a large margin!

11. Alternate Location

The proposed location (NW 3-47-2 W5M) of the CFO is untenable because of the extreme threat of pollution that will affect Pigeon Lake. The pollution, of course, will be from two sources, the CFO facility itself, and from the constant and frequent manure spreading operation.

One of the quarters specified for manure spreading (NW 33 46 2 W5M) is adjacent to our home quarter and the manure spreading will occur less than 150 metres from our house and yard. Obviously this is completely unacceptable to us.

We note from the General Information and Disclosure form supplied by Greg Thalen that his home is just outside of Ponoka, Alberta. Also the Thalen family owns the Ponoka Auction Mart, so why not locate the CFO in the Ponoka area?

12. Minimizing Stress on Cattle

Presumably the Thalen business plan is to use their Ponoka Auction Mart as a hub to buy cattle that would be fattened in the Pigeon Lake CFO. Then once fattened they would be shipped back to Ponoka to market. Assuming, for the sake of simplicity, that 4000 head are hauled to the Pigeon Lake CFO and then returned to Ponoka after finishing, the round trip is approximately 160 km. If one multiplies this by 4000 head, this comes to 640,000 km every year! All this unnecessary hauling could be avoided, thus saving wear and tear on the roads and the cost of repairs funded by taxpayers.

More importantly, it would save an awful lot of unnecessary stress to the animals.

13. Chronic Wasting Disease

In 2008/09, the Baumans, prior owners of the fifteen quarters now owned by the Thalens, had health issues with their elk herd. As a consequence, the herd, of around 90 mature elk, was slaughtered. The bodies were buried in a long pit located on SE 8-47-2-W5M. The burial pit is of course in the Pigeon Lake watershed area and thus part of the area where it is planned to spread manure. We obviously do not know how well the pit was constructed and whether an appropriate liner was installed; however, it is quite conceivable that the manure from the CFO will leach down through the corpses, commingle with the buried remains, and eventually migrate to the Lake.

It should be mentioned that each of the elk had its head removed on site and the heads were sent to the Alberta Government Laboratories to check for Chronic Wasting Disease (CWD).

All this pollution will threaten the Lake at some time. Definitely, this is another reason to deny the application for a CFO permit.

14. Permitting Process - Concept Plan

It is very important to quote the Pigeon Lake Watershed Area (PLWA) Concept Plan which states "*While the Area Structure Plan is not statutory and CFOs are determined by the Natural Resources Conservation Board, land use planning for the County of Wetaskiwin clearly indicates that CFOs are not appropriate in the Pigeon Lake Watershed*".

In conclusion, based on all the arguments and commentaries put forward above, this Concept Plan should not be violated and we strongly request that the NRCB should immediately deny Application RA21045.

Submitted by:

Terry and Barbara Wildman [redacted]

TAB 11

Hi Nathan,

I'm writing this letter to you on behalf of myself and my wife Roxanne and to voice our opposition to, and concerns about application RA21045, by Greg Thalen and G&S Cattle Ltd. Our contact information is as follows:

Tom and Roxanne Rose
[redacted]

Email: [redacted]
Phone: [redacted]

We own and reside for the majority of the year in our residence at:

[redacted]

We have a number of concerns with this application, which I will summarize below. As an aside, the applicant already appears to be feeding a number of head at this site, and it is unclear to us is whether this application is intended to be in addition to, or a replacement for, the current activity.

Increased traffic

By my conservative, and simplified calculations (see below), this operation, if approved, would add an average of at least 5 trips of heavy semi truck traffic per day, every day onto range road 23, township road 470 and presumably provincial highway 771 for hauling cattle and feed. If manure is also hauled on any of these roads, that could add up to another 8 trips per day. Township road 470 is a small 2 lane paved road with minimal shoulders. The entrance to range road 23 that trucks would be using is below a rise in the road, and visibility is limited to eastbound traffic along township road 470. The trucks entering now often swing wide as they enter the range road. We think that for safety, even for the number of trucks now servicing the existing operation, a dedicated turn lane should be considered on range road 470. Highway 771, 3 miles east of the proposed site, which services two provincial campgrounds and many of the residences in the summer villages, is already in rough shape with heaves, ruts, and potholes, and increased heavy truck traffic will certainly be hard on that surface.

Aquifer quality

We are concerned about the amount of water potentially removed from the area aquifers. The amount of water needed to service the number of head in the application would require 28 gallons per minute, 24 hours a day (see calculation below). The application lists three useable wells with a total capacity of 28 gallons per minute, which on paper is minimally adequate.

However, only one well report contains recovery information, which is critical information for evaluating the well. Additionally, the reports for these wells are dated 1987, 1993, and 1997, and therefore what limited data is available is not up to date. Our concern is depletion of the aquifer, as it certainly hasn't been tested to this level before. Our own well, which has a recommended pumping rate of 5 gpm, cannot sustain that recommended volume for a few hours, let alone continuously.

Also of concern is the potential for contamination of the aquifer through the containment, spreading, and runoff of the manure. We did not find any information about the direction of flow of aquifers in the area, but it's not a valid assumption that the subsurface strata conforms to surface topography. With the catchbasin located within a mile and a half of our well, and manure potentially being spread as close as about 2000 feet, we have concerns about potential contamination of our aquifer.

Airborne emissions

Particulate matter emissions from these operations are often associated with unpleasant odors as well as with health effects such as impaired lung function and allergic reactions. The coarser particulates from things such as hoof action on the manure, and traffic on the unpaved road, contribute to local air pollution, while ammonia emissions will have local, as well as a much larger, regional significance.[1] Obviously this is a concern for us, being in a location that is often downwind of the proposed CFO, exposed to the constant stench and potential health effects of these emissions.

Manure spreading

The application lists approximately 2650 acres of land available for spreading. An estimate of the manure the operation would produce is 37960 tons of manure a year (see calculation below), which at an estimated 12 pounds of nitrogen/ton of manure,[2] translates to 172 lb/acre of nitrogen. With a soil nitrogen limit in the first 60 cm of anywhere from 75 – 200 lb/acre, depending on soil type,[3] it would seem that there may not be enough land available to viably spread the manure produced. Phosphorus loads are a concern in localities where large-scale individual livestock operations are situated.[4] Although we haven't researched actual numbers for this application, it stands to reason that this statement may apply to a 4000 head CFO within the watershed area.

Lake and environment

The proposed operation lies within the Pigeon Lake watershed,[5] and adjacent to the Battle Lake Water Protection District. Our property lies within the Battle Lake Water Protection District. Much of the proposed land for spreading manure lies within 2 to 3 miles of Pigeon Lake, and 2 of the proposed quarters abut with the Battle Lake Water Protection District.[6] While this appears to fall within any guidelines in the county land use bylaw which states that "under no circumstance can a new CFO be located within 1 mile of (Battle/Pigeon Lake)",[7] we

believe it does not adhere to the spirit of the Pigeon Lake Watershed Area Concept Plan, which states that “Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed”.[8] The proposed CFO lies entirely within the Pigeon Lake watershed study area as defined in that plan. Also of note are multiple tributary creeks that run north and east through much of the proposed land in 47-2-W5, joining into Tide Creek, the main watercourse which flows directly into the environmentally sensitive northwest corner of Pigeon Lake.[9] In addition to the quality of the fisheries, this area of North Pigeon Lake is potential habitat for a number of sensitive or may be at risk species.[10]

Pigeon Lake has a chronic problem with an over-abundance of nutrients including nitrogen and phosphorous compounds, which results in large amounts of algae growth. The main possibility of the source of these nutrients being the shores around the lake.[11] It would seem a shame after all the past and ongoing efforts that have been made by the county and villages around Pigeon Lake to clean up the lake, and keep nitrogen and phosphorous out of the lake by proper septic disposal, limited fertilization, and such, that a CFO would be allowed within the watershed, in such close proximity to the lake, spreading nutrients where there is a risk of runoff into the lake.

The county has identified residential and recreational development around Pigeon Lake as an important economic driver of the area.[12] The potential unpleasant odors, as well as potential lake contamination and algal blooms resulting from phosphate runoff created by the proposed CFO, would reduce recreational enjoyment of the lake, and seems at odds to this goal.

Quality of life

We were prepared when we moved into the area, 20 years ago, to live within a rural community, with all that that entails – livestock grazing and transportation, crop care, farm machinery tending to crops at all hours of the day, etc. We also recognize the right of farmers to not be forced out of continuing with generally acceptable agricultural practice, and have happily coexisted with previous owners and land use in the area. However, in our mind, a CFO should be considered an industrial installation rather than a conventional agricultural installation. This is not a case of us moving into the area and complaining about normal existing farming practices. Rather it is a case of a corporate entity recently buying the land in the locale and wanting to impose an intensive operation on the area and its residents. We feel that noise from trucks on the road, engine brakes, cattle bawling at feeding time, foul odors and ammonia, potential problems with our well, and potential loss of lake enjoyment, have a large potential to negatively affect our quality of life on our property, as well as the property value of our investment.

Thank you for your time and consideration.

Regards,

Tom and Roxanne Rose

Calculations used for traffic

Assume a semi tandem/tridem trailer on a municipal road has an axle allowance of 6000 kg for the steer axle, 17,000 kg for the tractor tandems, and 17,000 kg for the trailer tandem/tridem, for a maximum GVW of 40,000 kg, or 88000 lb. Assume tractor and trailer tare weight of about 35,000 lb, for a payload of 53,000 lb.[13] Roughly 2 months of 75% road bans are not considered.

Cattle hauling

Assume feeder cattle weight of 600 lb when brought in, and 1400 lb when finished, for an average weight of 1000 lb.[14]

Assume 2 turnovers of 4000 head per year, giving 2 trips of cattle in, and 2 trips out.

This gives:

4000 head x 1000 lb/head = 4,000,000 lb
4,000,000 lb / 53,000 lb/load = 76 loads
76 loads x 2 trips/load x 2 /year = 304 trips/year

Feed hauling

Assume average of 25 lbs of feed per head per day in grain and forage,[15] 1 trip in and 1 trip out.

This gives:

4000 head x 25 lb/head/day x 365 day/year = 36,500,000 lb/year
36,500,000 lb/year / 53,000 lb/load = 689 loads/year
689 loads/year x 2 trips/load = 1378 trips/year

Manure hauling

Assume 52 lb /head/day of manure,[16] 1 trip in and 1 trip out.

This gives:

4000 head x 52 lb/head/day x 365 day/year = 75,920,000 lb/year (37,960 tons/year)
79,920,000 lb/year / 53,000 lb/load = 1433 loads/year
1433 loads/year x 2 trips/load = 2866 trips/year

Total truck trips

Cattle and feed: 304 + 1378 = 1682 trips/year = 5 trips/day
Manure: 2866 trips/year = 8 trips/day

Calculations used for water requirements

Assume 10 gallons/head/day.[17]

This gives:

4000 head x 10 gal/head/day = 40000 gal/day = 28 gal/minute continuous.

References

1. Dust Emissions from Cattle Feeding Operations
https://agrilifeextension.tamu.edu/library/ranching/dust-emissions-from-cattle-feeding-operations/

2. Manure value
https://water.unl.edu/manure/manure-value

3. Manure application
https://www.alberta.ca/manure-application.aspx

4. Economic Analysis of Soil Phosphorus Limits on Farms in Alberta, page iv
https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag11864/$FILE/vol-4-economic-analysis.pdf

5. County of Wetaskiwin Pigeon Lake Watershed Area Concept Plan, Figure 2.0
https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/2394/Pigeon-Lake-Watershed-Area-Concept-Plan

6. Wetaskiwin County Digital Municipal Map
https://app.munisight.com/CountyofWetaskiwin/Content/Site/MainPage.aspx?siteId=1

7. County of Wetaskiwin No. 10 Land Use Bylaw 2017/48, page 69
https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/444/Land-Use-Bylaw-201748

8. County of Wetaskiwin Pigeon Lake Watershed Area Concept Plan, page 11
https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/2394/Pigeon-Lake-Watershed-Area-Concept-Plan

9. Area Structure Plan For North Pigeon Lake, Leduc County, page 82
https://www.cip-icu.ca/pdf/2011-HM-Environmental-Planning.pdf

10. Area Structure Plan For North Pigeon Lake, Leduc County, page 94
https://www.cip-icu.ca/pdf/2011-HM-Environmental-Planning.pdf

11. Area Structure Plan For North Pigeon Lake, Leduc County, page 21
https://www.cip-icu.ca/pdf/2011-HM-Environmental-Planning.pdf

12. County of Wetaskiwin Pigeon Lake Watershed Area Concept Plan, page 9
https://www.county.wetaskiwin.ab.ca/DocumentCenter/View/2394/Pigeon-Lake-Watershed-Area-Concept-Plan

13. Maximum Allowable Weight for Tractor Semi-trailer
https://www.transportation.alberta.ca/4779.htm

14. What Goes On In a Feedlot?
https://cattlefeeders.ca/feedlot-101/

15. Steer Feeding Guidelines Based on Hip Height Measurements
https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/4h9457/$file/SteerFeedingGuidelines.pdf?OpenElement

16. Manure Management in Canada, page 38.
https://publications.gc.ca/Collection/Statcan/21-021-M/21-021-MIE2004001.pdf

17. Average Daily and Annual Water Requirements
https://www.agric.gov.ab.ca/app19/calc/livestock/waterreq_dataentry1.jsp

TAB 12

Montana
First Nation

Phone: (780) 585-3744
Toll Free: 1-866-585-3744
Main Fax: (780) 585-3264

P.O. Box 70
MASKWACIS, ALBERTA T0C 1N0

April 8, 2022

Natural Resources Conservation Board
#303, 4920-51 Street
Red Deer, Alberta T4N 6K8

Email: Nathan.Shirley@nrcb.ca

Dear Nathan Shirley:

RE: Statement of Concern for Montana First Nation for Application RA21045, Greg Thalen and G&S Cattle Ltd.

Montana First Nation (MFN) is filing this Statement of Concern on the above-mentioned application on behalf of the Nation as a whole and its individual members. This Application may impact the Treaty and Aboriginal rights and interests of MFN.

MFN has not been contacted by the Natural Resources Conservation Board ("NRCB") or the Applicant in relation to Application RA21045 (the "Application"). The Application was only brought to our attention a week ago by another concerned party. Accordingly, we have had less than one week to review the Application and our Statement of Concern is from a preliminary perspective.

From that preliminary perspective, it is MFN's position that we are directly affected by the Application and that there should be consultation with Montana First Nation.

Application RA21045:

The Applicant submitted the Application RA21045 to the NRCB seeking to obtain an approval to construct a new confined feeding operation (CFO) on NW 3-47-2 W5M in Wetaskiwin County, Alberta. The Application is to construct a new 4,000 beef finisher CFO, with the construction to include 4 rows of pens and a catch basin.

This Application is approximately sixteen kilometers from Pigeon Lake 138A, which is shared by Montana First Nation, Samson Cree Nation, Louis Bull Tribe and Ermineskin Cree Nation.

Please be advised that:

1. MFN requests to be considered "directly affected" by this Application; and

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2. That MFN has concerns of adverse effects on our Aboriginal and/or treaty rights that will occur if this CFO expands; and
3. MFN requests that actual consultation and engagement occur with our community as it relates to the proposed project.

Concerns regarding adverse effects on Aboriginal or treaty rights if the Application is granted:

On a preliminary basis, MFN identifies the following Aboriginal and Treaty rights that may be impacted if the CFO expands:

- Impacts to the area for the purpose of traditional/cultural use;
- Impacts to the plant and tree harvesting for medicinal, ceremonial purpose and food;
- Impacts to hunting and trapping; and
- Potential disturbance of historical, archeological, anthropological and/or ceremonial sites.

As mentioned, the location of this proposed CFO is in our traditional land use territory, near areas where our members frequent for traditional/cultural reasons, such hunting, trapping and to harvest plants and trees for medicinal and ceremonial purposes. Indeed, the proposed CFO is only approximately sixteen kilometers from Pigeon Lake 138A.

MFN also has serious concerns about the potential effects from the Application, which may negatively impact member rights, interests, and health. After reviewing the application, MFN categorizes and identified the following potential impacts:

- Potential Application Impacts to Human Health;
- Potential Application Impacts to Water;
- Potential Application Impacts to Air Quality; and
- Potential Application Increases to Greenhouse Gases and Climate Change.

Potential Application Impacts to Human Health:

One impact from the Application that MFN is concerned about is the impacts to human health to its members. CFO's can expel disease-causing pathogens, pharmaceuticals, heavy metals, or other pollutants. Numerous gases are emitted from CFO waste, including dangerous chemicals such as ammonia, hydrogen sulfide, and methane. Airborne particulate matter is also found near CFOs and can carry disease-causing bacteria, fungus, or other pathogens. The most pressing human health issue associated with CFOs

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comes from the amount of manure produced. CFO manure can contain potential contaminants. It can contain plant nutrients such as nitrogen and phosphorus, pathogens such as E. coli, growth hormones, antibiotics, chemicals used as additives to the manure or to clean equipment and facilities. There are over 150 pathogens in manure that could impact human health.

Exposure to these gases, matter, and pathogens can cause serious health problems, especially those already at risk such as Elders, young children, and pregnant women. Contact with hydrogen sulfide can cause neurological problems, including extreme anger, depression, and illness. Many of these substances can cause disease or infection in humans.

Potential Application Impacts to Water:

Another impact identified by MFN is potential impacts to groundwater and surface water. Groundwater pollution from the CFO can be caused by leaking waste storage structures or runoff from land application of manure. Nutrients such as phosphorus can get into groundwater and drinking water due to these impacts.

These concerns are set out in the Statement of Concern submitted by the Pigeon Lake Watershed Association, including the Adverse Effects Background Report, which MFN echoes and relies on without duplicating. These concerns are deeply concerning since pollution can be caused by the application in terms of surface discharges or other types of discharges. Surface discharges can be caused by storms or floods that cause storage lagoons to overfill, which can run off into nearby bodies of water, including the Battle River. Pollutants such as ammonia can cause oxygen depletion from water, which can impact aquatic and plant life. Ammonia also converts into nitrates, which can cause nutrient overloads in surface waters and nutrient over-enrichment causes algal blooms. These specific types of contamination result in reduced water quality. The introduction of these contaminants also leads to reduced confidence in the quality of resources required for activities vital to Cultural Continuity such as ceremonies and harvesting for MFN.

Potential Application Impacts to Air Quality:

MFN has also identified air pollution and reduced air quality as potential impacts from the CFO. Impacts can be things such as overpowering odors, but the breathing of dangerous gases from manure is the greatest risk. Methane, ammonia, and hydrogen sulfide only are some of the gases found in manure and urine. If there is an increase in cattle, there will be an increase

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of concentration levels of these gases. All people living near the CFO can be affected by these impacts, but again young children, Elders, and pregnant women will be more at risk.

Sensory disturbances (smell) and perceived contamination from the presence of application activities and increase of cattle will negatively impact MFN's sense of place and peaceful enjoyment of our lands and resources.

Potential Application Increases to Greenhouse Gases and Climate Change:

MFN is concerned about the emission of greenhouse gases and the contributions to climate change that CFOs could have. Livestock operations such as CFOs are responsible for approximately 18% of greenhouse gas production. Carbon dioxide is considered the primary greenhouse gas of concern, but manure emits methane and nitrous oxide which are 23 and 300 times more potent as greenhouse gases than carbon dioxide.

Montana First Nation – Rights and Interests:

It is MFN's position that this Application may impact our Aboriginal and Treaty rights and that NRCB and the Government of Alberta has been put on notice of that potential impact and that this triggers the Government of Alberta's duty to consult and accommodate MFN during this process, given that our Aboriginal and Treaty rights may be adversely affected by the NRCB's decision as it relates to this application.

It is MFN's position, that the process that has unfolded to date has fallen well short of what is required to meet the duty to consult and accommodate from a procedural standpoint. Similarly, there has not been any support provided to MFN to allow us to participate in a meaningful manner such as the financial assistance in retaining an expert to review the application, to prepare our own study or legal counsel to provide advice on this application. The NRCB has not even provided with us sufficient procedural notice or rights to take the above-mentioned steps at our own expense if no capacity support is forthcoming.

The NRCB process appears to be a gap in the consultation framework in Alberta. By way of example, if this were an application to the Alberta Energy Regulator, given the proximity to MFN, it would be referred to the Alberta Consultation Office and the Applicant would have a duty to consult with MFN.

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This Application is just as significant and pertinent as the notices we receive from the ACO, if not more so, given the proximity to our Nation and traditional territory and the potential consequences if the Application is granted.

To be direct, it makes no sense that the NRCB would not have reached out to MFN for comment or to provide us with an opportunity to take part in the application process, unless it is the perspective of the NRCB that it has no obligation to consult with Indigenous Communities on proposed applications before it that may impact the traditional land use and treaty rights of Indigenous communities.

Conclusion:

Due to the above-mentioned impacts and concerns, the inadequacies in the *Agricultural Operations Practices Act*, the NRCB practices and policies in addressing Indigenous Peoples and Rights, MFN has significant concerns as it relates to the Application.

It is MFN's position that no meaningful consultation has occurred in this process. MFN requests direct consultation to address the proposed expansion's impact on our treaty and Aboriginal rights and traditional land use. Any questions or concerns arising out of the above, may be directed to the Montana First Nation – Consultation Department:

- Jodie Currie – jodiecurrie@montanafirstnation.com
- Jocelyn Rabbit – jocelynrabbit@montanafirstnation.com

Yours truly,

JODIE B. CURRIE
CONSULTATION MANAGER – MONTANA FIRST NATION

CC: Montana First Nation, Chief and Council
George Addai, Administrator
Gina Longjohn, Director of Operations

TAB 13

Métis Nation of Alberta
A strong Métis Nation embracing Métis rights
(780) 455-2200 | 1-800-252-7553 | albertametis.com | mna@metis.org
11738 Kingsway NW | 100 Delia Gray Building | Edmonton, AB | T5G 0X5

May 27, 2022

VIA EMAIL
(Nathan.Shirley@nrcb.ca)

Natural Resources Conservation Board
Provincial Building
201, 10008 – 107 Street
Morinville AB, T8R 1L3
780-939-1493

Attention: Nathan Shirley, Approvals Officer

Dear: Mr. Shirley,

Re: Métis Nation of Alberta response to Application #RA21045

We write on behalf of the Métis Nation of Alberta ("MNA") regarding Application #RA21045 (the "Application") to demonstrate that the MNA is properly authorized to represent its citizens in any Crown directed process or proceeding which may adversely impact the collectively-held rights, claims, and interests of the Métis within Alberta, as affirmed and protected by s. 35 of the *Constitution Act, 1982.,* and that the Métis citizens the MNA represents will be directly and adversely impacted to an extent which warrants the National Resources Conservation Board granting the MNA standing as an affected party.

The Métis Nation of Alberta (MNA) is authorized to advance and protect the collectively-held, s. 35 Métis rights, claims, and interests in Alberta. This authorization comes from each individual MNA member voluntarily and willingly applying to the MNA's centralized registry for membership. Specifically, through this registration process, each member agrees to the MNA Bylaws that expressly mandate the MNA to pursue the following on their behalf:

> 1.2 To stand as the political representative of all Métis in Alberta and to promote self-determination and self-government for Métis in Alberta and Canada;
>
> 1.3 To promote pursue and defend aboriginal, legal, constitutional, and other rights of Métis in Alberta and Canada;

1.4 Re-establish land and resource bases;

Alberta's Court of Queen's Bench has confirmed that the MNA "represents its registered members on the terms and for the purposes set out in the bylaws."[1]

In addition, the MNA Bylaws include an oath of membership, which all new members must sign.

The oath highlights the authorization that each member grants to the MNA:

> *I agree to the Métis Nation's Bylaws and Policies, as amended from time to time and voluntarily authorize the Métis Nation to assert and advance collectively-held Métis rights, interests and claims on behalf of myself, my community and the Métis in Alberta, including negotiating and arriving at agreements that advance, determine, recognize and respect Métis rights. In signing this oath, I also recognize that I have the right to end this authorization at any time, by terminating my membership within the Métis Nation.*

Alberta's Court of Queens Bench has confirmed that this oath of membership "allows the Association to assert a representative capacity on behalf of the members of the Association."[2]

In order to register as a Métis Harvester, citizens of the MNA complete the Métis Nation of Alberta Harvester Application Form wherein each citizen:

a) Certifies that "[they] have a history of harvesting and/or intention to harvest in the Métis Harvesting Area(s) to which [they] ancestrally connect"; and

b) "authorize(s) the MNA (in keeping with its bylaws, policies, and the MNA Regional Consultation Protocol Agreements) to defend, assert, and advance collectively-held Métis harvesting rights, interests, and claims on my behalf by conducting consultations and negotiating accommodations..."

Additionally, the Alberta Utilities Commission has previously ruled that "the MNA is authorized to represent the interests of its members for the purpose of asserting and defending the collectively-held rights of the historical and contemporary Métis communities to which its members belong."[3]

Below is our response to the five elements you outlined as necessary to determine directly affected party status, as well as outlining the concerns the MNA has of the

[1] McCargar v Métis Nation of Alberta Association, 2018 ABQB 553 at para. 19, aff'd 2019 ABCA 172.
[2] McCargar v Métis Nation of Alberta Association, 2018 ABQB 553 at para. 38, aff'd 2019 ABCA 172.
[3] Alberta Utilities Commission Ruling on Standing of the Métis Nation of Alberta (20 November 2020) Proceeding 25469 at para. 11.

Application that may directly and adversely impact the collective aboriginal rights, claims, and interests of the MNA and its citizens.

1. A plausible chain of causality exists between the proposed project and the effect asserted

Pigeon Lake has a local water supply from a small watershed and is particularly vulnerable to added nutrients because it does not flush and has already demonstrated a higher than ideal concentration of nutrients. More than one third of Pigeon Lake's annual water budget comes from surface runoff and groundwater and the lake has a turnover rate of more than 100 years.[4] The proposed feedlot would impose a significant increase in nutrients into the watershed and subsequently the lake. This imposed increase would adversely affect the lake by promoting the growth of harmful algal blooms (HAB).[5] These blooms can then migrate to any part of the lake and even wash up on shore.[6] Events such as these will necessarily affect not only the Métis citizens across the province of Alberta who utilize Pigeon Lake for the exercise of rights, but also impact the Métis citizens who live along the lake in Mulhurst and Westerose.

The specific effects from the proposed project that the Métis Nation of Alberta is concerned with on behalf of its citizens using the area for s.35 harvesting (in this case fishing) rights are as follows, but not necessarily limited to:

- Increase in nitrogen in the lake from run off of the project and manure spreading sites;
- Increase in phosphorous in the lake from run off of the project and manure spreading sites;
- The above nutrients directly contributing to an increase in HABs in the upstream watershed creeks, namely the Sunset Harbour Creek Basin and Tide Creek Basin drainage systems;
- Increase in pathogens such as listeria, salmonella, E. Coli, and drug resistant bacteria;
- Increased fecal bacteria in the lake from run off of the project and manure spreading sites;
- Increased levels of ammonia, hydrogen sulfide, and particulate matter negatively affecting surrounding air quality;
- Increased levels of dissolved ammonia and hydrogen sulfide in the lake from run off of the project and manure spreading sites;
- Increased concentrations of fecal matter in the lake from run off of the project and manure spreading sites;

[4] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 1
[5] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 5
[6] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 7-8

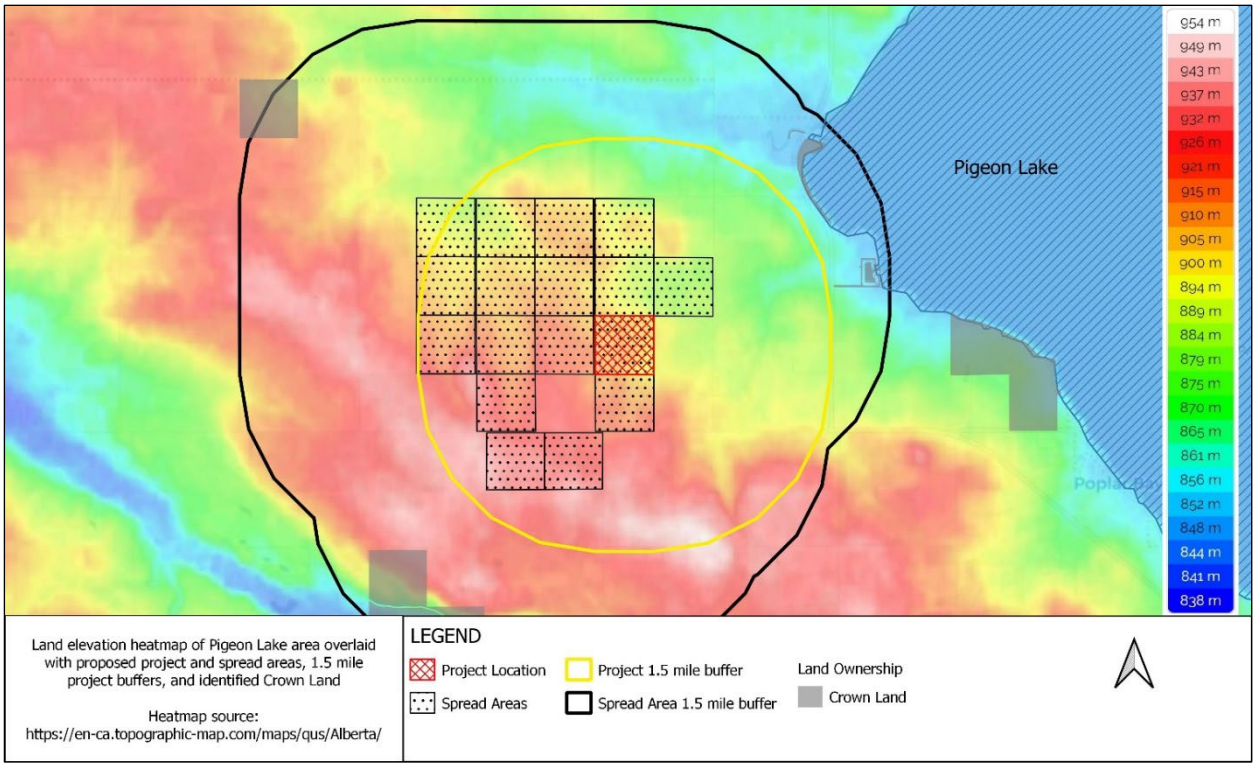
More details on the vulnerable receptors (humans, fish, other aquatic species), exposure routes, and pathways of illness or contamination (ingestion, dermal or mucus membrane exposure, or inhalation) are in the following sections below.

2. The effect would probably occur

A series of satellite images taken from 2017 to 2020 shows that there is a direct correlation between the amount of HABs in Pigeon Lake and the size of the freshet. This demonstrates that freshets containing higher concentrations of nutrients and chemicals contained in manure would directly impact the health of the lake.[7] Alberta Health Services (AHS) has identified two public health risks associated with Pigeon Lake through annual testing: blue green algae and fecal bacteria (coliforms). As a result, beaches are closed, water recreation activities are limited, and fishing is prevented,8 directly impacting the Métis ability to practice traditional activities and rights exercises affirmed and protected by s.35 of the Canadian Constitution. Both blue green algae and fecal bacteria are directly associated with CFOs when the manure feeds into a watershed, especially in bodies of water which are not flushed (like Pigeon Lake).

The following map was created by our Consultation Technicians to show the application project footprint, the plan manure spread areas referenced in writing by the legal land descriptions, and 1.5-mile buffers from these locations. As well, this map shows areas of particular concern for Métis harvesters such as crown land where Métis harvesting can occur. The land elevation heat map clearly shows at least 15 of the 16 spreading areas for the manure of the CFO are up hill from creek basins for which run off water will flow into pigeon lake. The MNA is deeply concerned about the effects of run off from the manure spread and project footprint into pigeon lake and the effects outlined in the following paragraphs.

[7] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 7, 9-12
[8] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 15



This map indicates the location of the proposed CFO and associated spread areas overlaid on a land elevation heatmap. The MNA is in the process of obtaining more detailed land elevation of the area that will further demonstrate how coliforms and chemical contributors to blue-green algae blooms present in spread areas will migrate into Pigeon Lake.

The Union Street Geotechnical report submitted with the Application under the *Agricultural Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies) to the NRCB describes "the proposed feedlot development site within the N.W. ¼ [as] relatively flat draining to a gully to the south with the geological drainage of the area sloping east/northeast towards Pigeon Lake, located approximately 4.0 km northeast of the site".[9] All land associated with this project drain into Pigeon Lake via the Sunset Harbour Creek Basin and Tide Creek Basin drainage systems.[10] Manure pollutants produced by the CFO, "including nitrogen and phosphorus, and pathogens such as listeria, salmonella, E. coli, growth supplements, antibiotics and other chemicals" will enter Pigeon Lake through surface run off that entrails these pollutants.[11] Accumulation of nutrients such as nitrogen and phosphorus in waterbodies such as Pigeon Lake "can increase algal growth, decrease water clarity, and increase ammonia concentrations which can be toxic to fish".[12] When concentrations of fecal bacteria increase in the water, it poses a great risk to human health. Some associated illnesses and conditions resulting from exposure to water with heightened concentrations of fecal matter in the water include gastroenteritis; eye, ear,

[9] "G & S Cattle Ltd. Proposed Confined Feedlot Expansion" 2021. Union Street Geotechnical. Letter correspondence to Eagle Builders LP, p. 2 (section 3.1)

[10] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 2

[11] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 13

[12] Wolfson and Harrigan. 2010. *Cows, Streams, and E. Coli: What everyone needs to know*, p. 2

nose, skin, and throat infections; respiratory illnesses; and “more serious conditions such as hepatitis, salmonellosis, or dysentery”.[13]

The application is unclear on their exact plans for ongoing maintenance, monitoring, inspection, fencing, or other mitigation measures outside of construction plans. The report provided by Union Street Geotechnical clearly states that “general recommendations herein do not constitute a design, in whole, or in part, of any of the structural elements of the proposed work,”[14] and therefore it does not appear that G&S cattle are bound to the standards and proposed measures recommended by Union Street. The MNA is concerns about the effects of the CFO, especially if the important steps to the maintenance of the CFO are not held to a high standard and may be subject to failure, leading to damage to the lake caused by run off of the various substances and pathogens commonly found in CFO and associated manure spread operations.

3. The effect could reasonably be expected to impact the party

Harvesting (including fishing) is significant to Métis culture; harvesting plays a key role in the mental, physical, and spiritual health of Métis people. Records indicate that several prominent Métis families have taken residence at Pigeon Lake since as early as 1849.[15] Furthermore, Pigeon Lake is in the MNA’s Harvesting Area D (**Appendix B**) which is open to as many as 8,486 approved harvesters from across the province. Pigeon Lake is one of the most frequented Lakes by MNA harvesters in the province. Pigeon Lake was recently identified by MNA harvesters as one of seven lakes in Alberta that is of concern and should be monitored.[16]

Algae and related bacteria have been proven to have significant adverse effects on both the water and air quality surrounding and in bodies of water. CFOs “can affect air quality through emissions of gases (ammonia and hydrogen sulfide), particulate matter, volatile organic and odour” particularly from animal housing, and land application of manure.[17]

Pigeon Lake is of specific concern due to the ongoing issues related to the already heightened accumulation of nutrients and subsequent production of HABs associated with manure produced by feedlots. The proposed project would significantly increase the already heightened nutrient levels in Pigeon Lake.[18] As previously stated, blue green algae has been identified specifically as a public health risk in Pigeon Lake by AHS. Blue green algae produces cyanotoxins which pose a health risk to humans and

[13] Wolfson and Harrigan. 2010. *Cows, Streams, and E. Coli: What everyone needs to know*, p. 2
[14] “G & S Cattle Ltd. Proposed Confined Feedlot Expansion” 2021. Union Street Geotechnical. Letter correspondence to Eagle Builders LP, p. 15-16
[15] Barkwell n.d. *Pigeon Lake, Alberta, Métis Scrip Applications*. Louis Riel Institute.
[16] Glasier, Mosicki, and York. 2021. *Safe to Harvest: Analysis of Fish Health through a Métis Lens*, p. 8
[17] “A Primer on Livestock Air Quality” n.d. p.1
[18] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report*, p. 1, 4

animals alike.[19] Métis harvesters are particularly at risk – harvesters can be exposed to toxins through skin contact, through consumption of contaminated water or fish/shellfish, or through breathing in toxins released in the air. Furthermore, the large amounts of the toxins can asphyxiate fish and aquatic animals and make it difficult for gilled animals to breathe,[20] not only reducing the volume of fish available to harvest but also adversely and significantly impacting the health of the fish in general, and subsequently, the harvesters.

Citizens of the Métis Nation of Alberta continue to use this lake to practice their s.35 right to harvest via fishing on Pigeon Lake. The Métis Nation of Alberta holds two annual camps at Camp Wohelo on the northwest shore of Pigeon Lake. These camps consist of a cultural youth camp during the summer called Oskâyak Kapayshiw Youth Camp, as well as a family camp around February/March called the Cabin Fever Family Camps (**Appendix A, fig A1, A2, A3, A4, A5**). The address of these camps is Pigeon Lake West, Pigeon Lake, Alberta T0C 2C0 Canada.

The 2022 Oskâyak Kapayshiw (Youth Camp) will take place from Sunday, August 21st – Friday, August 26th, 2022. Oskâyak Kapayshiw immerses Métis youth in experiences that will build relationships, create mentorship opportunities, and create opportunities to participate in cultural activities on the land. Some of these activities include canoeing; plant gathering; daily lessons in Métis culture and history; voyageur games; survival skills training; storytelling; trapping; beading; fish scale art; hide tanning; fiddle lessons and Métis dance (jigging). The camp has been run once before in 2019 but was cancelled in 2020 and 2021 due to the ongoing COVID-19 pandemic. The MNA has the intention to run the camp annually moving forward. The camp hosts MNA youth citizens between the ages of 12-17 from across the province, as well as Métis Knowledge Holders (including traditional harvesters). In 2019, 29 youth were in attendance, and we are expecting at least 30 youth to attend the 2022 Oskâyak Kapayshiw Youth Camp.

The annual Métis family camp has a goal of allowing families to connect with each other, build community, and participate in cultural activities. The main objective of the Cabin Fever Family Camps was to bring Métis families together from across the province and connect them in a fun, safe environment that is specific to teaching and learning Métis history and culture. This was done through culturally specific activities such as Métis jigging, beading, snow shoeing, storytelling, and shelter building. The most extensive activity that is ran at the camp is ice fishing, in which the families are introduced to Métis harvesters, who speak to them about local history, ice fishing, Métis jigger invention, and ice safety. Each participant is then given an ice fishing bucket, a rod, and hooks before they engage in the ice fishing practice. Families are taught by the harvesters how to set up traditional nets (using an ice saw and jigger). As the nets are pulled up, harvesters continue to teach the families about the fish that has been caught and do a demonstration of how to fillet the fish. The caught fish are then harvested by

[19] "Illness and Symptoms: Cyanobacteria in Fresh Water" n.d. Centers for Disease Control. https://www.cdc.gov/habs/illness-symptoms-freshwater.html
[20] "Illness and Symptoms: Cyanobacteria in Fresh Water" n.d. Centers for Disease Control. https://www.cdc.gov/habs/illness-symptoms-freshwater.html

the families and the families and harvesters (as well as staff) engage in a fish fry on the ice. Following the harvest and fry, the families are taught how to use the scales in fish scale art by a Métis artist. The goal of these activities is to teach and encourage citizens how to efficiently harvest fish from beginning to end. In the first camp that was run in March 2019, 24 Métis families from across the province participated, equating to about 120 total participants. The following year, in March 2020, 130 participants were enrolled and participated but unfortunately the camp was cut short midway through due to the then emerging COVID-19 pandemic. The camp was not run in 2021 due to the COVID-19 pandemic. In March 2022, 148 Métis people from across the province participated over four weekends in the MNA's Cabin Fever Family Camp, of which 79 of these participants were children and 69 participants were adults.

The site was chosen for the family camps because of Pigeon Lake's long standing and rich Métis history, as well as offering reasonable and central geographic access for Métis citizens which are dispersed across the province, and because it has the appropriate accommodations.

4. The effect would not be trivial

The potential impacts of the proposed project are far reaching to the Métis across Alberta, as well as to regional harvesters through the decrease in fish health or other aquatic species' health, decrease in fish or other aquatic species' population, decreased in water quality, decreased in air quality, and the increased risk to human health as a result of: direct skin or mucus membrane exposure to the contaminated lake water, inhalation of contaminants in the air, and/or ingestion of fish exposed to contaminates (such as blue-green algae, pathogenic bacteria, drug resistant bacteria).

The health impacts on the fish and on Métis harvesters will have an impact on numerous levels, not only to the environment, but on human health, the community/culture, and the Métis traditional economy (for example the trading of fish within the community, and the creation of fish scale art at family and youth camps). The right of Métis within Alberta to practice in their traditional economy has not been extinguished.

As previously mentioned, the annual camps held by the MNA at Camp Wahelo is located on the northwest shore of Pigeon Lake. These camps offer MNA citizens the opportunity to engage in cultural practices, intergenerational knowledge transfer, and community bonding. The associated northwest shore is at particular risk of forming HAB[21] as "it is shallower and captures the largest part of the watershed drainage."[21] This poses a significant risk to Métis youth, Knowledge Holders, Elders, and MNA staff (many of whom are Métis themselves) who attend the camp, as they will be in closest to the part of Pigeon Lake most vulnerable to HAB. Attendants of the camps will be engaging in extensive activity on the lake as well as consuming any fish caught from the lake during the ice fishing activity. The effects due to the proposed feedlot would

[21] The Pigeon Lake Watershed Association. 2022. CFO *Adverse Effects Background Report,* p. 7

significantly affect the ability of Métis harvesters to pass on their knowledge, the ability of Métis citizens to engage in cultural activities, and the health of any citizens who engage in harvesting activities on and around Pigeon Lake and the proposed feedlot. Camp Wohelo and Pigeon Lake have been used by the MNA for several reoccurring camps and must remain useable for harvesting or recreational purposes for any future camps or cultural gatherings hosted by the MNA.

General harvesting practices will also be significantly impacted by the effects of the proposed feedlot. Harvesters who rely on Pigeon Lake to feed their families and communities would likely need to find new locations to harvest from or would need to stop their harvesting practices altogether. If neither of these options is suitable to the harvester, they may have to resort to continuing to harvest at Pigeon Lake and become subject to the risks and dangers that will be heightened at the direct cause of the proposed CFO, experience economic hardship by being required to purchase fish in the absence of being able to exercise their right to subsistance harvesting, or experience food insecurity. The proposed CFO will therefore have significant and adverse effects on Métis rights, claims, interests, culture, physical and mental health, and economy. Harvesting and its place in Métis culture is an extremely important aspect of Métis health, both as a means of subsistence, as well as a means of cultural well-being through the intergenerational transmission of Indigenous Knowledge. Culture is an integral part of the mental, emotional, and physical health of Métis.

Métis health is directly impacted by the ability to harvest. Removing access to Pigeon Lake would discourage both healthy eating and physical activity that otherwise would have been engaged in through harvesting. Furthermore, harvesters who cannot afford to buy healthy food will have no option but to resort to eating unhealthy, cheaper food. This will directly impact the quality of life amongst such harvesters and contribute to negative health trends that are already exasperated amongst the Métis community in Alberta, such as (but not limited to) diabetes[22] and hypertension.[23]

CFO's have also been known to introduce quantities of both hydrogen sulfide and ammonia into the air. Both chemicals are hazardous substances and are recognized as such by both the provincial and federal governments. When introduced into the air in an area used by harvesters, Métis health is directly impacted. Both through direct exposure and via secondary exposure through harvested species. As both substances can contribute to or worsen known negative health trends in the Alberta Métis community, such as (but not limited to) Chronic Obstructive Pulmonary Disease (COPD)[24].

The Métis right to harvest is protected under s. 35 of the *Constitution Act, 1982* and affirmed by the Métis Nation of Alberta-Government of Alberta Métis Harvesting Agreement. The Métis Nation of Alberta is recognized as the representative government

[22] Randall et al. 2019. *Diabetes Amongst the Métis Nation of Alberta*. Métis Nation of Alberta.
[23] Randall et al. n.d. *The Burden of Hypertension and Heart Disease Among the Métis Nation of Alberta.* Métis Nation of Alberta.
[24] Ospina et al. *Epidemiological and Health Services Indicators of Chronic Obstructive Pulmonary Disease Among Métis in Alberta.* Métis Nation of Alberta.

of Métis people within Alberta by Canada in the Métis Nation of Alberta-Canada Consultation Agreement (2018). Furthermore, as previously mentioned, the MNA is authorized voluntarily and willingly by each citizen to represent them politically as well as promote, pursue, and defend their Aboriginal, legal, constitutional, and other rights when they apply to be added to the MNA's central membership registry. These effects to the health of Métis people and the fish they harvest within their s.35 rights is irreplaceable and immeasurable on a quantifiable dollar scale. The current numbers of known Métis citizens using the lake in March and August camps, and of confirmed harvesters in harvesting area D are only the current number of effected citizens and can be expected to increase overtime as the Métis population is projected to increase by 2.8%-3.3% in the next two decades.[25]

The ability to practice Métis rights is of extreme significance to both the community as a whole and to individual members of the community. Areas such as the proposed site of the CFO at Pigeon Lake allow the community to practice these rights as well as transfer cultural knowledge to the next generation so that the community can continue to practice these rights in the future. Access to general harvesting practices and intergenerational knowledge transfer would be significantly harmed by the development of the proposed CFO project.

5. The effect falls within the NRCB's regulatory mandate under AOPA

The mandate of the Natural Resource Conservation Board "conducts hearings and issues decisions with respect to the public interest of all no-fossil fuel projects that require an environmental impact assessment, or other larger projects referred to the Agency by order-in-council,"[26] (NRCB Mandate and Roles document, 2009). The effects of concern of the Métis Nation of Alberta, on behalf of their citizen base as it relates to impacts to the s.35 rights of Métis within Alberta, are all directly related to the Confined Feeding Operation, and its associated feedlots, catch basin, and manure spread plans, within the application RA21045 by G & S Cattle.

Furthermore, the Union Street Geotechnical report submitted with the Application under the *Agricultural Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies) to the NRCB has raised some concerns. A review of the report by our team exposed at least one mistake; section 6.2 of the report asserted that the NRCB "requires naturally occurring protective layers for solid manure collection and storage facilities, such as feedlots, to have a minimum thickness of 2.0 m and a maximum hydraulic conductivity of 1.0x1.0-6 cm/s". However, the section (6.2) goes on to say that the "[h]ydraulic conductivity test result of the till in Borehole BH102 is

[25] "Métis in Canada – Projections to 2041" 2021. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2021068-eng.htm

[26] "Natural Resource Conservation Board Mandate and Roles Document" 2009. p.3

4.51x10^{7}", remarkably higher than the previously stated maximum. [27] However, references to this number are thereafter referred to as "4.51x10^{-7} cm/s". Given that the Application contains significant error(s) and/or omissions of fact, it therefore cannot be considered complete by the Approval Officer, and approval should be denied on the basis of such substantive error(s) and/or omissions. Should Approval be granted by the Approval Officer, the inclusion of such substantive error(s) and/or omissions by the Applicant in the Application are sufficient cause for the Application to be ordered to further review by the Board. If this application is approved and ordered for further review by the Board, the MNA should be entitled to make such submissions necessary to address the relevant error(s) and/or omissions, through the Board review and hearing process, with the support of any independent expert analyses as may be required.

The Métis Nation of Alberta appreciates the NRCB's recognition of responsibility to practice genuine reconciliation, and the importance of establishing and maintaining respectful relationships. We trust that the NRCB will continue to strive to fulfill its mandate to respect the public interest of those living near and using the affected area and lake.

As stated previously, should you have any questions or require any further information in respect to the contents of this letter, please direct them to the undersigned at (780) 618-3794 or GTomlinson@metis.org. We look forward to your positive response.

Sincerely,

Maren Jensen-Joyce

Maren Jensen-Joyce
Consultation Policy & Research Team Lead – MNA
Métis Nation of Alberta

cc: Garrett Tomlinson, Manager of Consultation – MNA
Theo Peters, Consultation Regulatory & Process Development Team Lead – MNA
Maren Jensen-Joyce, Consultation Policy & Research Team Lead – MNA
Jordan York, Environmental Manager – MNA
Reagan Bartel, Health Director – MNA
Craig Letendre, Harvesting Manager – MNA
Madison Tipler, Youth Director – MNA
Kelsey Bradburn, Children & Family Services Director – MNA
Fiona Vance, Chief Legal Officer – Operations - NRCB

[27] "G & S Cattle Ltd. Proposed Confined Feedlot Expansion" 2021. Letter correspondence, p. 5 (section 6.2)

Appendix A

Camp Posters

Figure A1. Poster for Family Camp 2020.

Figure A2. Poster for Youth Camp 2019.

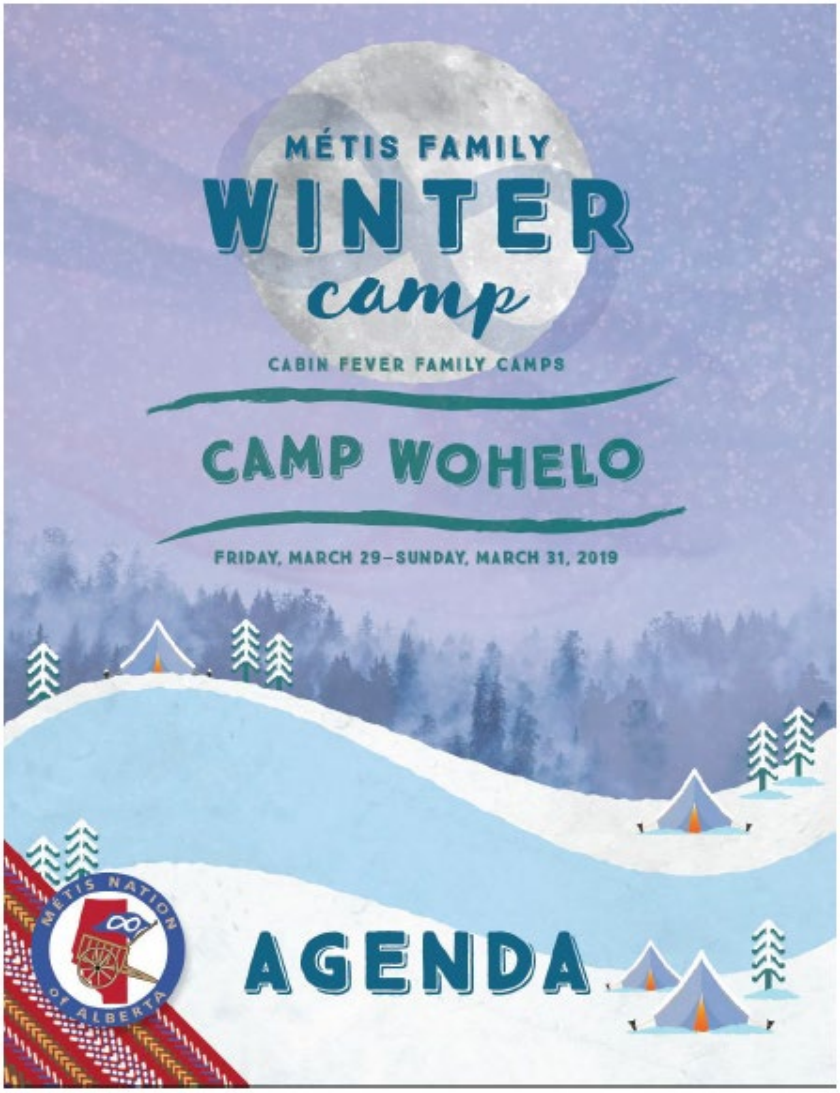


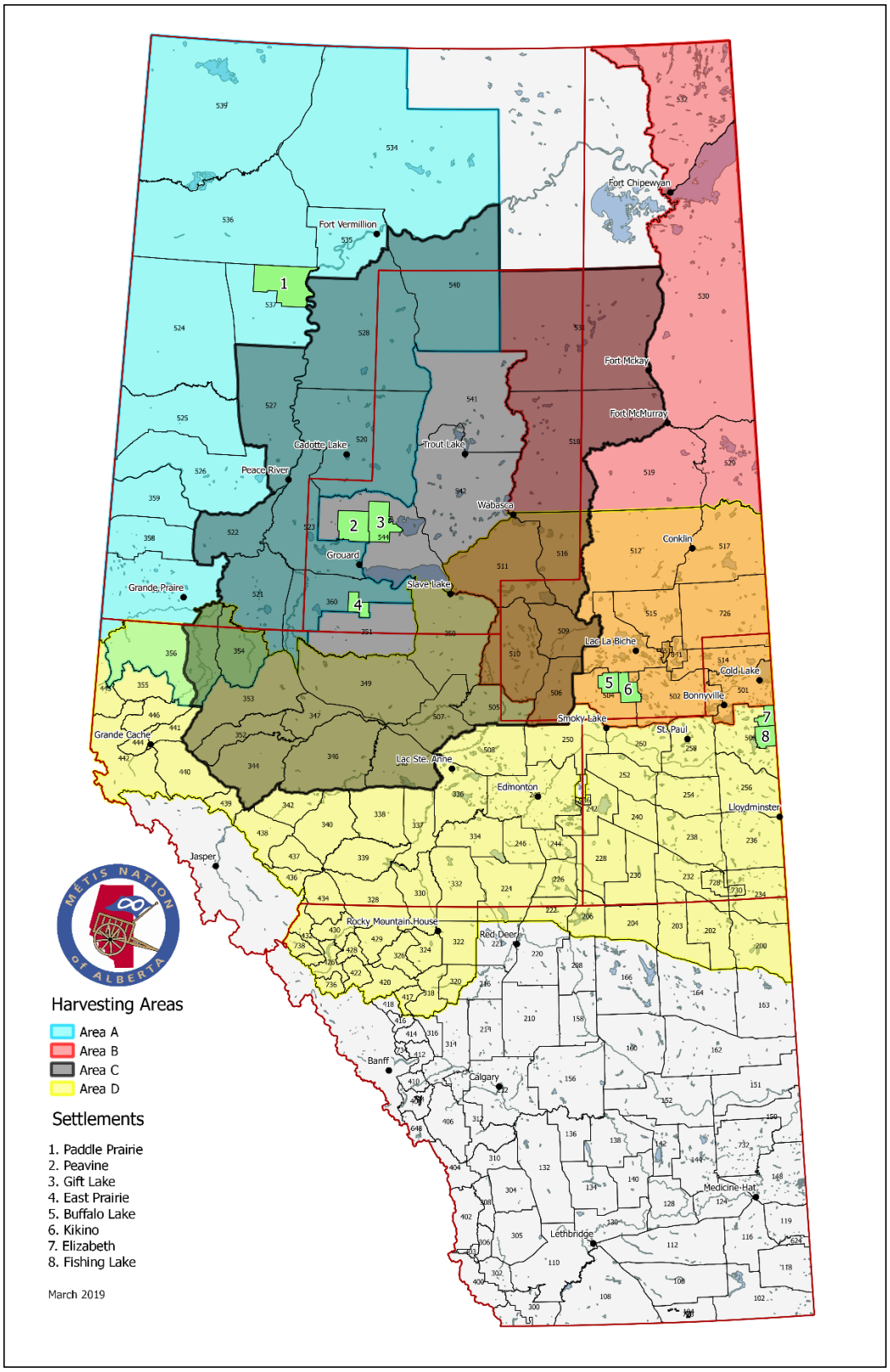
Figure A3. Cover for Family Camp 2019 agenda.

Figure A4. Second page of Family Camp 2019 agenda.

Figure A5. Page three of Family Camp 2019 agenda.

Appendix B

Métis Nation of Alberta Harvesting Areas



TAB 14

From: Nicky K [redacted]
Sent: Thursday, April 7, 2022 6:38 PM
To: Nathan Shirley
Cc: Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca; premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca
Subject: Statement of concern: CFO application #RA21045

STATEMENT OF CONCERN

For directly affected property owners near Pigeon Lake

Re: Natural Resources Conservation Board Application RA21045 – Confined Feeding Operation, Greg Thalen and G&S Cattle Ltd.

CFO Location: NW 3-47-2 W5M, Wetaskiwin County

Filer Information

Name (s): Makenna and Jaxon Klatt

Legal Land Description:
[redacted]

Mailing Address: [redacted]

Phone: [redacted]

Email: [redacted]

STATEMENT OF CONCERN

The Confined Feeding Operation, Application RA21045, **should be declined**

Response from a Directly Affected Party

Our Background:

We are a 4th and 5th generation farming family. I have chosen to live and raise my family in the country. We chose to live in a tranquil, peaceful environment. We enjoy listening to the birds, having fires, weiner roasts and BBQ'ing with friends and family. Also this was an investment for our future generations.

We are not against farming in a responsible manner, however we do not agree with having a feedlot so close to our home and a lake. We have never been approached by the landowner in question, about our concerns or to even have a discussion about the proposal.

With our property being in the Watershed zone we never dreamed we would be facing this crisis.

We live on our acreage full time and have invested hundreds of thousands of dollars to improve our home and our property. This does not include the countless labour of love hours to complete all of these renovations and upgrades.

At the current time, we are having issues being in our yard due to the smell of the cows that are already at the operation in question. When the prevailing north westerly winds are blowing we cannot be outside due to the smell. The unnamed creek that runs the full length of our land almost always runs brown, which connects to Sunset creek that feeds into Pigeon Lake. Please note: Our home is downhill and directly across the road from one of the proposed manure spreading sites.

We also question whether the operation at the current time is following the rules and regulations they should be.

We are **directly affected** due to the close proximity of this operation. Please look at the location of our property as we are **DIRECTLY AFFECTED**.

CONCERNS:

1. Health and Safety – Water quality (E-Coli, salmonella, also viruses and parasites in the water). We have 1 well on our property that if affected, we would have to haul water to live and at a considerable expense. I do not allow my children to touch or play in the creek, due to the frequent brown color and frequent smell of manure in the water.
2. Air quality – Some members of my family have asthma. Should this feedlot be approved, it will impact the health of our family severly.
3. Property Value – If this feedlot is approved our property value will be decreased immensely, and the years of sacrifice to create our country generational lifestyle is all for naught.

4. Predators – The number of coyotes, foxes,ravensandhawks have increased since the current owner purchased this property. This is due to the excessive number of dead animals on their property. The current operation purchases a lot of it's cows at auction, often of marginal condition (sick, mistreated, etc). Therefore, the mortality rates are high.These predators are direct threats to our pets and livestock, and also ourselves, especially the children, when we are out walking or working in the yard.

5. Traffic – We have already noticed an increase in traffic on RG RD 470 past our property. This will lead to road destruction also, and currently the roads around Pigeon Lake do not need any further destruction as they are almost impassable at the current time.

    a. All road bans are in effect between March 1st and June 1st. Who is monitoring the vehicle traffic that may be overweight at the current time, with their current operation? This proposed CFO wil only be an increased problem in the future with more truck traffic. As they will hauling feed, livestock and waste in greater quantities.

6. We also support the local businesses at Pigeon Lake. However, if this is approved many businesses will close and move elsewhere if the recreational value of the lake is destroyed. Tourism will suffer greatly. Algal blooms from the already phosphorus overloaded water will only spike & be detrimental with the nutrient overloaded run off throughout the year.

7. When the water quality (not only at our home) but at Pigeon Lake declines, including harmful algal blooms and fish kills, there will be no water activities at the Lake. We will not be able to go swimming, float, boating or any other sports without the possibility of being sick.

8. Runoff is inevitable and will occur from feedlot operations surfaces with rainfall or snowmelt. Runoff from a feedlot will transport large quantities of organic matter, nutrients and pathogens and will pollute our drinking water sources and public waters and will pose a risk to fish and ducks as well as to livestock and humans.

9. We have followed the process of the Pigeon Lake Watershed's efforts to clean Pigeon Lake and applaud all of their efforts and the time they have spent trying to save this valuable resource – not only for the lake dwellers but the farmers and all of the generations to follow.

10. We are also very worried about the health of the environmentally sensitive creeks that drain from the proposed location of the feedlot into Pigeon Lake, including the one that runs the length of our property.

11. This proposal also contravenes the following development policies:

    a. **The Pigeon Lake Watershed Management Plan** – recognizes that CFO's have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, **Objective 2e** from the Plan states there should be **NO** CFO's within the watershed.

b. **County of Wetaskiwin Plans** – recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. In **Section 5.5** policies are presented to guide the County when evaluating a proposal to develop land in the watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFO's should **not** be in the watershed. **Section 5.5.2 Agriculture** – Large-scale confined operations are not appropriate in the Pigeon Lake Watershed.
    i. The County's Land Use Bylaw – **Section 9.6.10** – "An existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."
    ii. The County's Municipal Development Plan also provides direction over the concern of the environment. **Section 3** – Protecting the environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

c. **Natural Resources Conservation Plan –** The **NRCB** has an obligation which is well defined to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to consider factors which will degrade Pigeon Lake and the community surrounding Pigeon Lake will place responsibility both legally and morally on the NRCB and they will be held accountable.

12. The process this application has been through is a very real concern to the landowners surrounding this feedlot. We feel we have **not** had adequate time to review and research this application. No public meetings have been scheduled to discuss any of our concerns or questions. We feel that this is being pushed down our throats and that we have no say in our lives. Because the letter was only sent to landowners within 1.5 miles of this proposal and we were given less than a months notice – brings up the valid concerns of:
    1. What is going on behind the scenes that you do not want us to be aware of?
        a. This is a very valid transparency issue
    2. Why would this not be sent to everyone around Pigeon Lake who this may affect in years to come.
13. This application does not meet the requirements that states a minimum setback of 30M from a stream from a manure storage facility.
14. Legislation requires the approval process must consider the environmental impacts this CFO will have on Pigeon Lake and the surrounding areas affected. Stream analysis evidence already shows there is a significantly high nutrient runoff (more specifically phosphorus) occurring from this area.
15. The County of Wetaskiwin's Municipal Development Plan specifies manure spreading may not be done within 2.4 km of a named lake (Pigeon Lake). The measured distance from SE10-47-2 W5M a quarter which is designed for manure spreading is 1.66 kms. This application does not comply with these requirements and should be **denied.**
16. We are also concerned about the Wildlife Refuge that is directly north of our property on RG RD 22. The impact of this feedlot will also push our native wildlife away, compromising the habitat they currently rely on to live.

17. This application has turned neighbours against neighbours and family members against family members.
18. I would also like to know if the 4000 head are in addition to the cattle that are already on the property in question.

Cumulative effect

The application does not reference the current operation and condition of the land, which is relevant for an impact and environmental assessment.A large number of cattle and feed transport trucks, manure haulers, and other large vehicles move on and off the property suggesting a large scale operation is already run on the property. The decision should account for the current condition of the property such as the streams, fields, increased number of predatory animals, water use, and use of public roads to accurately determine the impact of intensifying operations in this location.

Sunset Harbour Creek: This creek is located next to the proposed manure catchment basin. It is not effectively represented in the application. Set back information that is provided should be reviewed carefully. The creek is an environmentally sensitive area. An accurate representation and assessment of the set back is required. The state of the water quality, as a result of the current operation must be assessed. Considering the cumulative effects, the impact of heavy rain and diversion rights should be addressedin the risk assessment. [Insert information about current sample levels. This could be compared to the numbers provided by PLWA, include sampling comparison and/or photo]

Inaccurate representation of the drainage basin: The application indicates the land is in the South Saskatchewan Watershed. Pigeon Lake is a sub watershed of the Battle River Watershed and joins with the North Saskatchewan River in Saskatchewan.While this may have been an administrative error on the application, drainage considerations in Pigeon Lake watershed is significant in this application.

Water well Information**:** The proposed CFO application does not address water diversion based on the requirements of the Water Act. The water need is not defined. Is the water use for a 4000 head operation or the cumulative demand?
Under the water act, testing must be completed to identify the draw from an operation of the proposed size. Without accurate information on the water access, calculated against accurate information about the intensity of the operation, me and my neighbours do not have documentation as a legally binding assurance that water access (quality and quantity) will not be compromised.

Coyotes, ravines and flies: As a neighbour, we have observed an increase in the number of coyotes and ravines that are in the area. The coyotes and the ravine's movements suggest they are attracted to the property. We already must be vigilant with our animals because they are at greater risk of attack from the coyotes. Flies are becoming a more significant issue as well. Intensification on the land and a confined feeding operation in particular will only compound the current problem.

Odour and airborne disease: With the current operation, there are days when our windows have to remain closed because the smell is so strong. Manure from a new CFO, spread over 16-acre, will compound the frequency and intensity of the existing odour problem. In light of the pandemic, airborne pathogens also raise concerns for my family and the neighbours.

Agricultural land in a small watershed: At Pigeon Lake, agricultural land offers the unique benefit of vistas within a closeproximity to the lake. Recreational opportunities and amenities are available in close proximity and many multigeneration farmers reside on the land with predominately small to medium sized operations. Spreading manure from a confined feeding operation around Tide Creek and Sunset Harbour creek introduces a new risk that pollutants such as growth promoters, antibiotics, nitrogen and phosphorus that will adversely impact our personal health and will also contribute nutrient runoff in the lake that will lead to harmful algal blooms in Pigeon Lake.

Property Value If this operation is allowed to proceed, the odour, and increased risk from predatory is enough to dimmish the value of our family's property. In addition, the economic health of the community is closely linked to the health of Pigeon Lake. If the lake is not healthy, our property values will drop.

The County of Wetaskiwin's, Municipal Development Plan states "The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment." P 3. In doing so this land use plan reinforces that it supports a high quality of life for residents. It supports economic growth and development but only if it is appropriate to the location and so long as there is no negative impact on air, natural resources, water or soil quality.

Pigeon Lake Watershed Management Plan was adopted as a guide to help reduce the number of algal blooms in Pigeon Lake. The Plan calls for a net reduction in nutrient runoff into Pigeon Lake and states that statutory land use restriction on new or expanded intensive livestock operations (including CFOs), are supported.

Please consider in your decision the CFO Adverse Effects Background Report and Statement of Concern from the Pigeon Lake Watershed Association .

Also please consider the Statement of Concern from the Summer Village of Grandview.

As a family, we have taken care of the resources provided by the land and the water to run effective operations and to enjoy what we have.

Also, if this application is approved, we will be seeking compensation for the destruction of our investment in our livelihood and our quality of life. We will also be encouraging our neighbours to seek damages. We will be naming all parties that have requested and/or approved this application, including the County of Wetaskiwin.

Please do not approve application RA21045.

Thank you
Makenna and Jaxon Klatt

TAB 15

From: Karin Brodersen [redacted]
Sent: Wednesday, April 6, 2022 8:34 PM
To: Nathan Shirley
Subject: Re: Natural Resources Conservation Board Application RA21045 – Confined Feeding Operation, Greg Thalen and G&S Cattle Ltd. CFO Location: NW 3-47-2 W5M

Re: Natural Resources Conservation Board Application RA21045 – Confined Feeding Operation, Greg Thalen and G&S Cattle Ltd. CFO Location: NW 3-47-2 W5M,

Wetaskiwin County Filer Information
Name (s): Karin and Cole Brodersen
Municipal or Rural Address: [redacted]
Legal Land Description (lot, block, plan number, quarter section): [redacted]
Mailing Address: [redacted]
Phone: [redacted]
Email: [redacted]

Directly and adversely affected

We, Karin and Cole Brodersen hereby submit this Statement of Concern as a directly and adversely affected party to the proposed Confined Feeding Operation (CFO). Our property is on or near the shores of Pigeon Lake which is downstream of proposed Confined Feeding and Manure Spreading Operation. Seeking Directly Affected Party Status. Our property will be directly and adversely affected by the proposed CFO and manure spreading operation. The CFO will increase nutrient runoff into Pigeon Lake via the connecting creeks in our watershed. This lake has already experienced harmful algal blooms from an already excessive nutrient load. The lake has very little flushing or turnover and so each year additional nutrient releases will accumulate in the lake which in turn will most likely result in the increased frequency and intensity of harmful algal blooms. The consequences are not trivial to our family. Blue-green algae spreads around the lake and can affect everyone around the lake. Toxins from the algal bloom can cause health effects in humans, pets and livestock. In extreme cases it can result in death. When algal blooms are present there are beach closures and an unsafe environment for water recreation. There will also be the losses to local businesses, loss of biodiversity, and a compromised real estate market, all of which will directly affect our community. The effect of manure impacted area runoff control falls within the NRCB's Regulatory Mandate Under AOPA CONCERNS As a property owner at Pigeon Lake, I object to the proposed Confined Feeding Operation (CFO). The Pigeon Lake Watershed Management Plan was adopted as a guide to help reduce the number of algal blooms in Pigeon Lake. The Plan calls for a net reduction in nutrient runoff into Pigeon Lake and states that statutory land use restriction on new or expanded intensive livestock operations (including CFOs), are supported. Spreading manure from a confined feeding operation around Tide Creek and Sunset Harbour creek introduces a new risk that pollutants will adversely impact the lake and lead to harmful algal blooms. Poor water quality, including harmful algal blooms and fish kills prevent us from enjoying our time at the lake. If the water quality degrades, our property values will decline and we will require compensation for the investments we made on our properties, including millions of dollars spent by residents, municipalities, and the province to connect properties to a wastewater treatment system. This lake is a well-studied lake. There has been a considerable effort and investment to protect the lake. • The municipalities have banned cosmetic lawn fertilizer to reduce phosphorus • Community members, including our family, are adding native plants to help slow and filter runoff from the watershed to reduce the frequency of algal bloom. We have seen some improvements in the lake health over the past several years and do not wish to see a reoccurrence.

In addition to concerns about the health of Pigeon Lake, I am also concerned about the potential health risks that could befall our family. Our daughter was born quite premature in 2019 and as a result her immune system is weakened and she suffers from respiratory issues. We worry that the dust, stench, and bacteria from the CFO and manure spreading operation can potentially be carried to our property by the wind and aggravate her respiratory issues. These same bacteria and debris could also potentially blow all over our yard, garden, and home and I don't want my daughter playing in E. Coli covered grass or toys. I don't want my garden to become contaminated.

Another concern is bacteria from the CFO and manure spreading operation seeping in to our water supply and affecting our well water. Alberta has some of the world's highest rates of E. Coli infection due to it's abundance of cattle operations, sloped terrain, and well water (among other factors). This worries me as our property is downhill from the CFO and manure spreading operations. As is Pigeon Lake and Battle Lake. We are concerned that this operation will make our drinking water unsafe.

We also have concerns about the amount of water this operation will need and where it will draw it's water from. An operation of this scale will need a huge amount of water. We do not want our well to run dry because of this project.

Please consider in your decision the CFO Adverse Effects Background Report and Statement of Concern from the Pigeon Lake Watershed Association We are a community committed to keeping the lake healthy, please do not approve application RA21045. Help protect Pigeon Lake and the environmentally sensitive creeks that drain from this property into Pigeon Lake. Do not allow a confined feeding operation in the Pigeon Lake watershed.

I want to close by saying that we fully support agriculture, traditional farming and even CFOs, however given the proximity to Pigeon Lake, I think this operation needs to find a different location because the environmental consequences will be devastating to this area.

Thank you,

Karin and Cole Brodersen

TAB 16

STATEMENT OF CONCERN

Re: Natural Resources Conservation Board Application RA21045 Confined Feeding Operation, Greg Thalen and G&S Cattle Ltd. Location: NW 3-47-2 W5M, Wetaskiwin County

Filer Information

Name: Pigeon Lake Watershed Association
Municipal or Rural Address: 6B Village Drive, Village of Pigeon Lake, Westerose, Alberta
Mailing Address: Box 219, Mulhurst Bay, Alberta
Phone: 587-487-2044
Email: info@plwa.ca

STATEMENT OF CONCERN

The Pigeon Lake Watershed Association (PLWA) is submitting a statement of concern about the adverse effects on the environment from the proposed confined feeding operation (CFO) in the Pigeon Lake watershed.

PLWA requests directly affected party status. The PLWA is a non-profit, member-based watershed group at Pigeon Lake. PLWA is registered under the Society's Act (5012999784) and has charitable status in Alberta. PLWA was formed by concerned residents in 2007 to address diminishing water quality in the lake. The organization is made up of a voluntary Board of Directors, one staff member, and over 1100 members who are full and part-time residents in the watershed.

Our mission is to enhance, preserve and protect Pigeon Lake and its watershed as a healthy and environmentally sustainable ecosystem for current and future generations. PLWA collaborates with the Alliance of Pigeon Lake Municipalities and the Pigeon Lake Watershed Management Plan Steering Committee, to implement the Pigeon Lake Watershed Management Plan 2018 (the "Plan"). The goal of the Plan is to reduce the frequency and intensity of harmful algal blooms, to improve the health of the watershed and the lake, and improve the recreational value of the lake and economic health of the region.

PLWA supports research and stewardship to protect the lake, environmentally sensitive areas in the watershed, and biodiversity, with a focus on reducing pollutants and contaminants from entering the lake. Our work is based on Alberta's *Water for Life* strategy. PLWA has:

- Raised over 1.5 million dollars for environmental initiatives from the province, local municipalities, environmental grants, and donations from families in the watershed.
- Released the Alberta Clean Runoff Action Guide to help residents implement low impact development solutions to slow and filter pollutants before they enter the lake.
- Installed clean runoff demonstration gardens, with provincial and local funding to improve runoff on more than 20 hectares of land and have additional funding for projects in 2021-2023 to support clean runoff initiatives on public and private land.

- PLWA has contributed resources to elevate environmental protections in statutory plans, as outlined by the community in the Pigeon Lake Watershed Management Plan.

For all the above reasons and our 15-year history in the watershed, the Pigeon Lake Watershed Association is best positioned to represent watershed-based concerns affecting directly affected members of PLWA and the concerned parties listed on this application.

The Pigeon Lake Watershed Association submits evidence in the Adverse Effects Background Report to demonstrate reasonable linkages between the proposed CFO, the environmental damages and the elevated risk of harm to residents, fish, and wildlife habitat for Pigeon Lake and its watershed.

THERE IS AN UNINTERRUPTED CHAIN OF CAUSE AND EFFECT

The Adverse Effects Background Report summarizes six major areas impacted by the CFO and describes the linkages between the proposed CFO on downstream habitat, conservation areas, and recreational users of Pigeon Lake. Those causal linkages include the elevated export of manure pollutants and nutrients including the mechanisms of timing and release, an integrally connected drainage network of two sub basins connecting the CFO to Pigeon Lake, the effect of increased runoff laden nutrients on the western basin of Pigeon Lake, the increased intensity of Harmful Algal Blooms (HAB's), and the circulation of HAB's to all parts and shorelines of Pigeon Lake, all of which will affect a variety of residents. This unbroken chain means that all watershed residents and visitors of Pigeon Lake are directly affected by the proposed CFO.

DETRIMENTAL EFFECTS OF HARM ARE LIKELY TO OCCUR

- Monitoring data for Sunset Harbour Creek in 2013 and 2022 show elevated levels of phosphorus and nitrogen. This sampling area is only a short distance downstream from the current feeding operation.
- Satellite imagery demonstrates how HABs move around the lake impacting all lake residents as well as fish and wildlife habitat along the shoreline.
- Pigeon Lake's history with Harmful Algal Blooms demonstrates that the lake is near a tipping point from nutrient overload. Watershed stewardship actions which reduce nutrients from watershed sources have been effective but new sources such as the CFO will have a significant adverse effect on water quality and the lake's ecosystem.
- Blue-green algae and fecal bacteria health advisories at Pigeon Lake demonstrate risk of harm to human health as well as risk for pets.
- Alberta Fisheries monitoring data from 2020 show that the risk to walleye has increased.
- Studies on the impact of runoff from intensive agricultural operations in other waterbodies in Alberta show evidence that livestock pharmaceuticals (promoters) used in CFOs is linked to adverse effects on fish.
- Research shows property values near a lake with an algal bloom can decline by 22% (*Bloom and bust: Toxic algae's impact on nearby property values*, Wolfe & Klaiber)

THE EFFECTS WILL NOT BE TRIVIAL

Harmful Algal Blooms have enormous significant health, social, and economic effects for a very large population of people who depend on Pigeon Lake for live, work and play. These adverse effects also extend to fish and wildlife. The public outcry and the economic consequences for this region and the province will not be trivial.

DEFICIENCY, OMMISSIONS, AND ERRORS IN THE APPLICATION

- Information about the existing operation, which is understood to be an intensive cow-calf operation is omitted from the application. Assessments of environmental risks from the current application will not adequately reflect land use and risk without understanding the impact of the existing operation.
- The South Saskatchewan Watershed is referenced on the application, which may impact information about resource availability, water diversion rights, and runoff calculations.
- Groundwater sources and quality can not be effectively assessed because water well information for the new CFO is not included but is required for the NRBC environmental screening and approvals under the Water Act.
- Water conservation objectives under the Water Act extend to the protection of Sunset Harbour Creek, Tide Creek and Pigeon Lake and must be considered under the Alberta Environmental Protection and Enhancement Act.
- The catch basin as shown is only 70% of the capacity recommended in the geotechnical report. Extreme weather events present a high risk of overflows which will end up in Pigeon Lake.
- The application is required to provide ground contours and water courses including ephemeral channels that penetrate the sections of land for manure spreading and the CFO. Neither are identified in the application nor are the required NRCB setbacks.

STATUTORY PLANS & PROCEDURAL FAIRNESS

1. PLWA requests referral agency involvement as outlined in the attached CFO Referral
2. Considerations of environmental goals for the County as set out in the Municipal Development Plan and Land Use Bylaw are relevant to this application. These include the following environmentally sensitive areas:
    a. Sunset Harbour Creek, and Tide Creek (proximity to manure spreading area)
    b. Conservation lands, two protected sites along Tide Creek managed by Alberta Conservation Association, Alberta Fish and Game Association, and Alberta Environment and Park
    c. Protected spawning grounds at Tide Creek and Sunset Harbour Creek
3. The Pigeon Lake Watershed Management Plan is a guide for development in the watershed. It was endorsed by the 12 municipalities around Pigeon Lake, including the County of Wetaskiwin, and requires consideration of the following commitments to meet the goal of reducing the frequency and intensity of algal blooms:
    - *Objective* 2: Improve phosphorus management for all land uses to achieve a net reduction in nutrient runoff and promote biodiversity.
    - New or Expanded Intensive Livestock Operations: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan

CONCLUSION

With regards to this CFO Application, the Pigeon Lake Watershed Association has been contacted by rural agricultural landowners and cottage owners and been asked to provide this statement of concern and

technical information to demonstrate the adverse effects of a CFO in the watershed and the community's commitment to protecting the lake and its watershed.

The Pigeon Lake Watershed Association contends that:

1. As a community group with a large membership of full and part-time residents at Pigeon Lake, PLWA is a directly affected party.
2. This submission includes statements of concern from over 300 residents.
3. Legislation requires that the approval process must consider the cumulative environmental impacts this CFO will have on Pigeon Lake. PLWA submits the *CFO Adverse Effects Background Report* as supplemental resource material for support of the Statement of Concern.
4. Approval of this application would impact natural resources under the purview of the ministry of Environment, which has jurisdiction over Pigeon Lake.
5. This application does not comply with environmental protection goals in the County of Wetaskiwin's municipal development plan.
6. This project goes against the spirit of many of the municipal statutory plans and non-statutory planning documents which were prepared to protect the watershed and lake from such risk-laden projects as CFO's.
7. Pigeon Lake is already combating the effects of development and cannot handle such an increase in nutrient load which is expected from such a development.

RECOMMENDATION

This statement of concern together with the supporting *CFO Adverse Effects Background Report*, and accompanying statements of concern from residents, demonstrate that the environmental impacts from the CFO are reasonably expected to adversely affect the Lake, watershed, Pigeon Lake Watershed Association, and the community at Pigeon Lake. It is recommended that this application be denied.

CFO ADVERSE EFFECTS BACKGROUND REPORT

Pigeon Lake Watershed Association
April 2022

Application RA21045 - Greg Thalen and G&S Cattle Ltd.
Location: Wetaskiwin County
Notice of Application: https://www.nrcb.ca/confined-feeding-operations/applications-decisions2/notice-of-applications

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Social, Economic, and Environmental Context

Pigeon Lake and its watershed have important ecological value in Alberta for migratory birds, fish, wildlife, and other ecosystem services. As a popular prairie lake, it also provides both livelihood and enjoyment for many generations of Albertans. The watershed is home to more than 5800 residents and welcomes over 100,000 seasonal visitors each year. Pigeon Lake is a popular spot for lake recreation and sport fishing. The watershed features agricultural land, hamlets, acreages and cottage communities, IR 138A, business centers, campgrounds and conservation land including Pigeon Lake Provincial Park, Zeiner Park, the George and Joan Mitchell and Pigeon Lake Conservation Areas at Tide Creek. A healthy lake and watershed optimize social experiences, agriculture, commerce and ultimately the economic strength of the region.

Pigeon Lake – a Vulnerable and Environmentally Sensitive Water Body

Pigeon Lake has been found to be especially vulnerable to nutrient inputs from the surrounding watershed causing Harmful Algal Blooms (HABS). As a result of HAB outbreaks since the early 2000's and public outcry, Pigeon Lake has been especially well studied and monitored[1]. Vulnerabilities of the lake are in part due to the physical and hydrological characteristics of the lake and its watershed.

Pigeon Lake does not have the benefit of flushing headwaters from the Rockies. Instead, the lake is supplied locally with water from its small watershed, with a ~2:1 watershed (187 km2) to lake (96.7 km2) surface area ratio. Over a third of Pigeon Lake's annual water budget comes from surface runoff and ground water. The lake has a long residency or turnover rate of over 100 years. These characteristics leave the lake vulnerable to the accumulation of nutrients such as nitrogen and phosphorus from watershed sources. Annually this nutrient accumulation contributes to aquatic plant growth and Harmful Algal Blooms that adversely affect everyone around the lake.

[1] See Pigeon Lake Watershed Management Plan 2018 – Page 4 for list of studies and Appendix C Technical Summary for an update of the State of the Watershed, found at: https://www.plwa.ca/pigeon-lake-watershed-management-plan

Community Commitment to the Health of Pigeon Lake and Its Watershed

Pigeon Lake municipalities, the provincial government, individual owners, and the Pigeon Lake Watershed Association together have invested millions of dollars to reduce nutrients from entering lake from the watershed. Initiatives have included regional sewer systems, the Pigeon Lake Watershed Management Plan, and community-based initiatives to implement nutrient reducing beneficial management practices

The Pigeon Lake Watershed Management Plan 2018 (the "Plan") was adopted through municipal resolution by all 12 municipalities that border Pigeon Lake including the County of Wetaskiwin where the proposed CFO will reside. The Plan was endorsed by Maskwacis Cree Four Nations, the Pigeon Lake Regional Chamber of Commerce, Alliance of Pigeon Lake Municipalities, Pigeon Lake Watershed Association, and the Battle River Watershed Alliance.

The goal of the Plan is to reduce the frequency and intensity of algal blooms, improve the health of the watershed and lake, improve the recreational value of the lake, and economic health of the region.

Community efforts to work together to steward the land and contribute to the liveability of this Alberta lake-centered region received provincial recognition with two awards in 2021 - Award for Environmental Excellence, Alberta Emerald Foundation and Alberta Professional Planners Institute (APPI) Award of Planning Merit

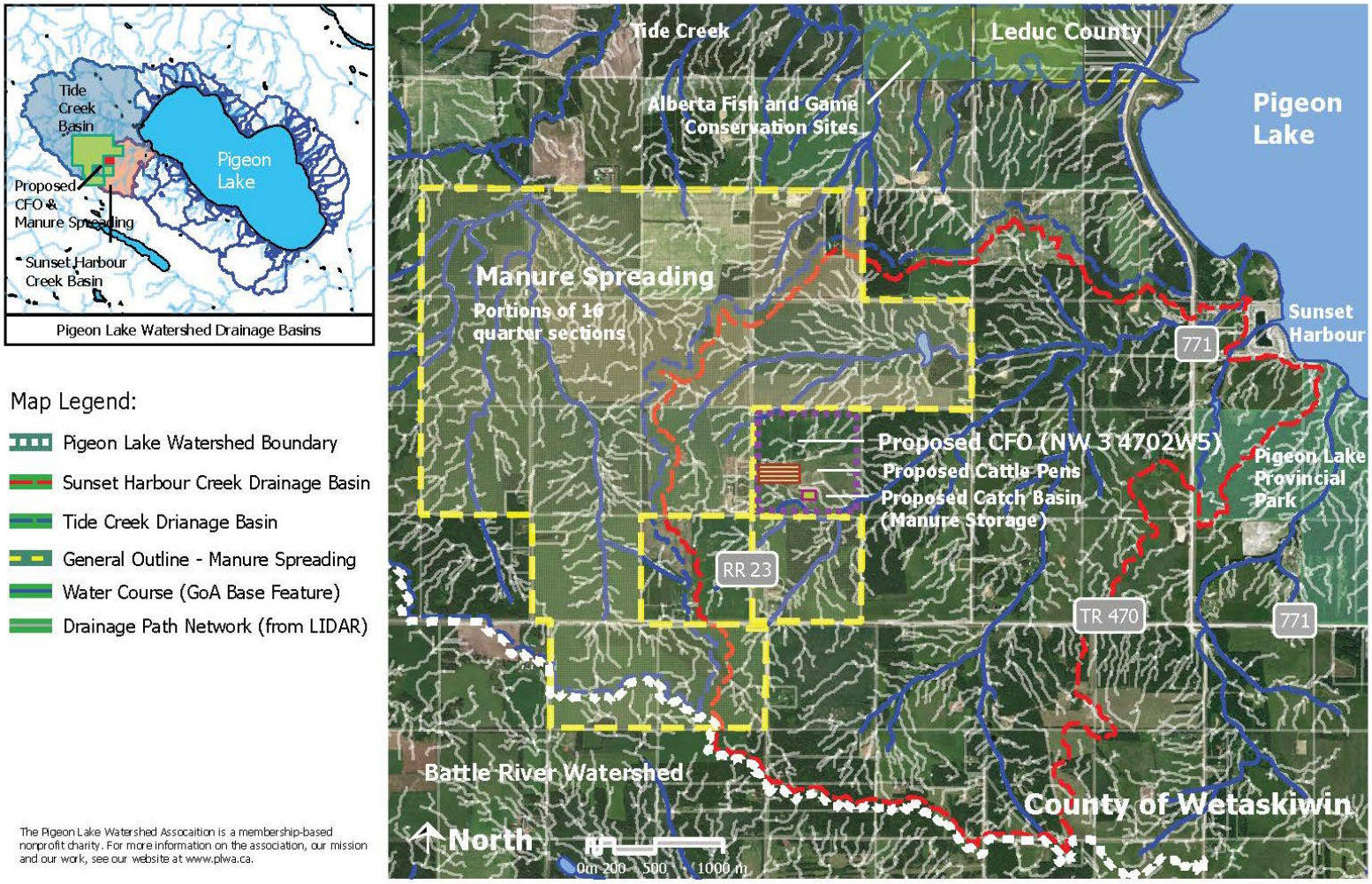
Proposed Confined Feeding Operation

Greg Thalen and G&S Cattle Ltd, an agri-business enterprise, has applied to the Natural Resources Conservation Board to build and run a 4000-head beef finisher confined feeding operation (CFO) on the west side of Pigeon Lake (NW 3-47-2 W5M, Wetaskiwin County).

The proposed location for the CFO is in the Pigeon Lake watershed. The current land use of a 17-quarter section operation is understood to include a large, existing livestock operation with quarter sections being used for grain, pastureland, and open pens. The assessment of risk and adverse effects must include consideration a new 4000-head CFO and the cumulative impact of the existing operation.

The proposed CFO facilities includes four pens, a catch basin, and manure spreading on 16 quarter sections of land. All land involved in this operation is integrally connected to Pigeon Lake via the drainage systems of Sunset Harbour Creek Basin and Tide Creek Basins (Figure 1). These are the two largest sub-watersheds in the Pigeon Lake watershed.

Figure 1 Pigeon Lake Watershed Sub Basin Context



PIGEON LAKE WATERSHED ASSOCIATION

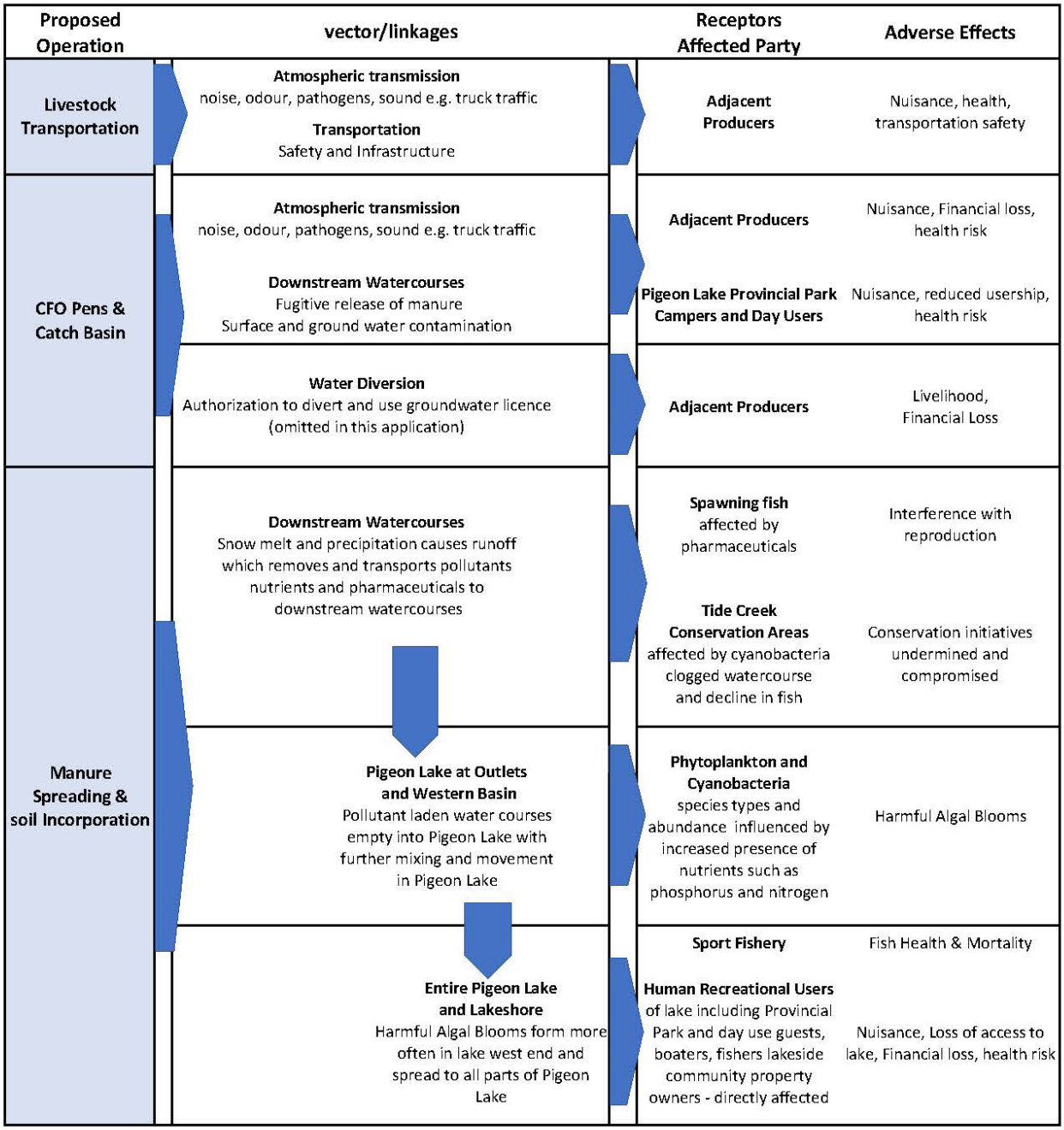
Data Sources:
Licensed and Open Source Spatial Data: GoA, AltaLIS
Earth Image: Bing Maps Satellite Streaing Service
Basins and Drainage Lines: Generated from 7.5m LIDAR Digital Elevation Model
CFO Details: from NRCB Application RA21045

March, 2022

Figure 1
Pigeon Lake Watershed Sub Basin Context
Proposed Confined Feeding Operation

Summary of Adverse Effects

The proposed CFO and manure spreading operation will cause direct adverse effects that impact the immediate surrounding agricultural producers, conservation areas and Pigeon Lake -- through cause-and-effect linkages directly tied to the CFO operation. A summary of the linkages and affected environments and parties is illustrated in the following diagram. We identify six major areas of adverse effect in the balance of this statement.



1) *The proposed CFO will adversely affect Pigeon Lake water quality including the increased frequency and intensity of harmful algal blooms, due to increased phosphorus and pollutant-laden surface runoff and ground water that flows from the CFO operation into a vulnerable Pigeon Lake*

The primary downstream environmental and community risk introduced by an intensive CFO finishing operation is the manure that is generated including its storage, spreading, and transportation. Manure includes nutrients such as nitrogen and phosphorus, pathogens (e.g., listeria, salmonella, E. coli), growth supplements, and antibiotics. Chemicals used to clean the animals and facilities are also found in the manure.

Manure Production and Contaminant Export

Approximately 13,120 metric tonnes or 17,700 cubic meters of manure[2] are anticipated to be produced annually from a 4000-head beef finishing CFO.

Compared to other forms of agriculture, Intensive livestock operations and feed lots are a significant source for total phosphorus and nitrogen release into watersheds, waterways, and lakes[3]. The nutrient footprint of these intensive livestock operations is displayed in a map of Ecosystem Services authored by the Alberta Biomonitoring Institute. Essentially the map indicates where the land is providing water purification services for high nutrient export sites. Two images below show locations in Alberta and the Pigeon Lake Watershed that are high

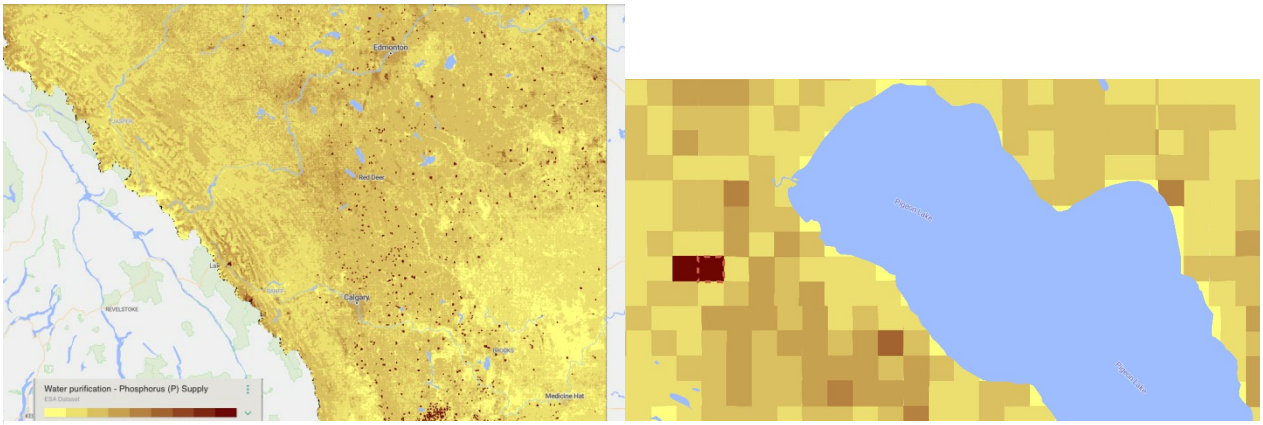


Figure 2 Ecosystem Services - Water Purification/ Phosphorus (P) Supply – Central and Southern Alberta on the left and Pigeon Lake Watershed on the right, ESA Dataset, Dark Burgundy indicates >2.00 Phosphorous Supply (kg/ha/year), Ecosystem services assessment is a system of metrics, information, and maps of ecosystem services and biodiversity across Alberta, Alberta Biodiversity Monitoring Institute

[2] Table 6.4 Beneficial Management Practices: Environmental Manual for Livestock Producers in Alberta, p. 58, found at: https://open.alberta.ca/publications/4851540

[3] Feedlots have recorded orders of magnitude higher TP and TN release rates compared to other land uses including cereal crops – see Table B4, page 43 of Donahue, Wm. 2013. Determining Appropriate Nutrient and Sediment Loading Coefficients for Modeling Effects of Changes in Land use and Landcover in Alberta Watersheds. Water Matters Society of Alberta

nutrient export sites. The concentration of high nutrient export sites in the Lethbridge area corresponds to the high density of CFO and ILO sites in the region. Locally, the highest nutrient export site is the current livestock operation which is the proposed CFO and manure spreading location.

While CFO and manure management beneficial practices are intended to minimize nutrient export, release rates from the proposed operation are still expected to increase over background levels compared to the balance of the watershed. Elevated nutrients will occur in the soil horizon in the lands designated for manure spreading -- leading to increased export nutrient volumes entrained in runoff from major storms and snow melt.

The watershed lands designated for manure spreading add up to 2656 acres or 10.75 square kilometers – close to 5.8% of the entire Pigeon Lake watershed and a major component of the Tide Creek and Sunset Harbour Creek sub-drainage basins. The size of the manure spreading areas is significant in relation to the watershed and the adverse effect this operation will have on Pigeon Lake.

Manure Pollutants Entering Water Courses Draining into Pigeon Lake

The applicant indicates that manure will be spread over 16 quarter sections in the watershed (Figure 1). The proposed CFO application does not fully address the impact of fugitive release of manure pollutants on downstream drainage courses and Pigeon Lake itself. At times of high flow, surface runoff entrains manure pollutants from the soil including nitrogen and phosphorus, and pathogens such as listeria, salmonella, E. coli, growth supplements, antibiotics and other chemicals.

Figure 3 Field Runoff west of Hwy 771 from 2020 Freshet

As shown in Figure 1, every part of the 16 quarters designated for manure spreading is linked to Pigeon Lake by and surface runoff, starting as sheet flow and becoming increasingly concentrated in ephemeral channels, then creeks and then into Pigeon Lake. Pigeon Lake gets most watershed-sourced nutrients in bursts. Late winter snow melt is an important period in the export of nutrients from the operation. Downstream water courses and lake TP/TN levels are strongly influenced by the period of snowmelt or freshet[4]. Freshets produce runoff flows

[4] One Canadian study measured 25–89 % of the total annual river volume, 42–92 % of the total annual TP load, and 41–81 % of the total annual TN load were delivered during snowmelt. Corriveau, J., Chambers, P.A. & Culp, J.M. Seasonal Variation in Nutrient Export Along Streams in the Northern Great Plains. Water Air Soil Pollut 224, 1594 (2013). https://doi.org/10.1007/s11270-013-1594-1

from farm fields which pick up manure pollutants and nutrients when the soil is bare, and biological processes are dormant. Beneficial Management Practices of manure spreading and incorporation into the soil cannot fully prevent the erosional forces of surface runoff and leaching into subsurface ground water to transport manure pollutants downstream toward the lake. The added nutrient load in runoff from lands treated with manure will reach Pigeon Lake via the drainage network and water courses of the Tide Creek and Sunset Harbour Creeks. There are concerns with high nutrients and pharmaceutical residue in the creeks including: harmful algae blooms, harm to fish spawning and harm to conservation efforts and use of the two conservation sites along Tide Creek managed by the Alberta Fish and Game Association with the Conservation Association and Alberta Environment and Parks

Manure Pollutants Entering Pigeon Lake from the Sub Drainage Basins

Nutrients entrained in spring melt and major storm runoff quickly reaches Pigeon Lake via the basin drainage system. Runoff from streams and disbursed sources accounts for 22% of the Pigeon Lake phosphorus budget. Runoff has an important influence on Pigeon Lake and the development of Harmful Algal Blooms. Firstly, nutrients such as Total Phosphorus and Total Nitrogen promote algal growth. Secondly runoff entrained nutrients resupply internal nutrients that are annually released into the water column and then returned to the bed during winter. Thirdly the variability in runoff volumes can influence the intensity of algal blooms in the years following a large release.

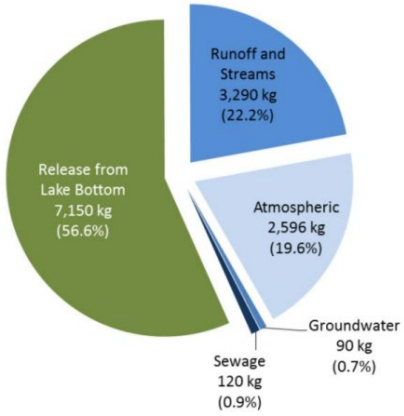


Figure 4 Phosphorus Loading Technical Report in the Pigeon Lake

The series of 2017 – 2020 satellite images (see pgs. 9-12) provide a prime example related to the large freshet that occurred in the spring of 2020. The satellite imagery for 2019 shows very little HAB development; however, following a strong 2020 freshet, a HAB resurgence occurred. Therefore, there is reasonable evidence that nutrients entrained in runoff from the watershed has a causal influence on the development of Harmful Algal Blooms in Pigeon Lake. Based on the satellite imagery, blooms quite often get started in the western basin of Pigeon Lake. The western basin is more vulnerable because it is shallower and captures the largest part of the watershed drainage.

Figure 5 August 2020 Harmful Algal Bloom Sampling following strong 2020 spring freshet.

The satellite imagery (see pgs. 9-12) shows that Harmful Algal Blooms once started in any part of the lake can migrate to all parts of the lake. Prevailing winds cause blooms to wash up on the shores all around the lake. Therefore, there is a direct unbroken causal

chain from the proposed CFO operation to all recreational users on the lake and all along the 76 kilometers of Pigeon Lake shoreline.

Pigeon Lake is particularly vulnerable to the added nutrient loads from this CFO operation:

A. Pigeon Lake does not flush. The residence time for lake turnover is over a hundred years. These added nutrients, particularly phosphorus, bio-accumulate, year after year.
B. Increased external nutrients in the lake are like fertilizing an agricultural field. Various organisms grow more abundant to out-of-control, including phytoplankton and cyanobacteria (blue green algae).
C. Pigeon Lake has a history of harmful algae blooms (HABS) over the last two decades, indicating that the lake is currently over supplied with nutrients and cannot process more nutrients without increasingly severe harmful algal blooms. During this time, significant effort has been expended to reduce the nutrient load to the lake and positive results are being achieved.

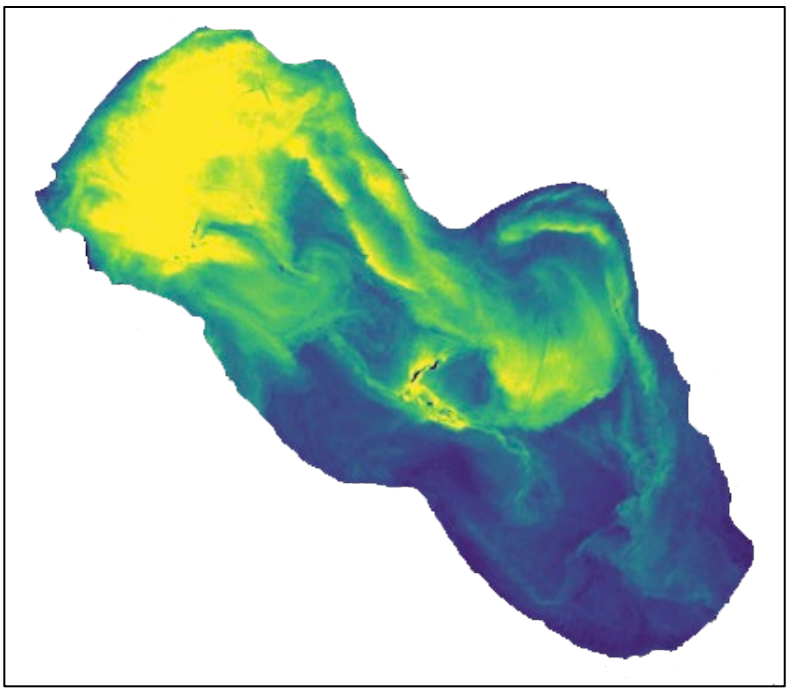
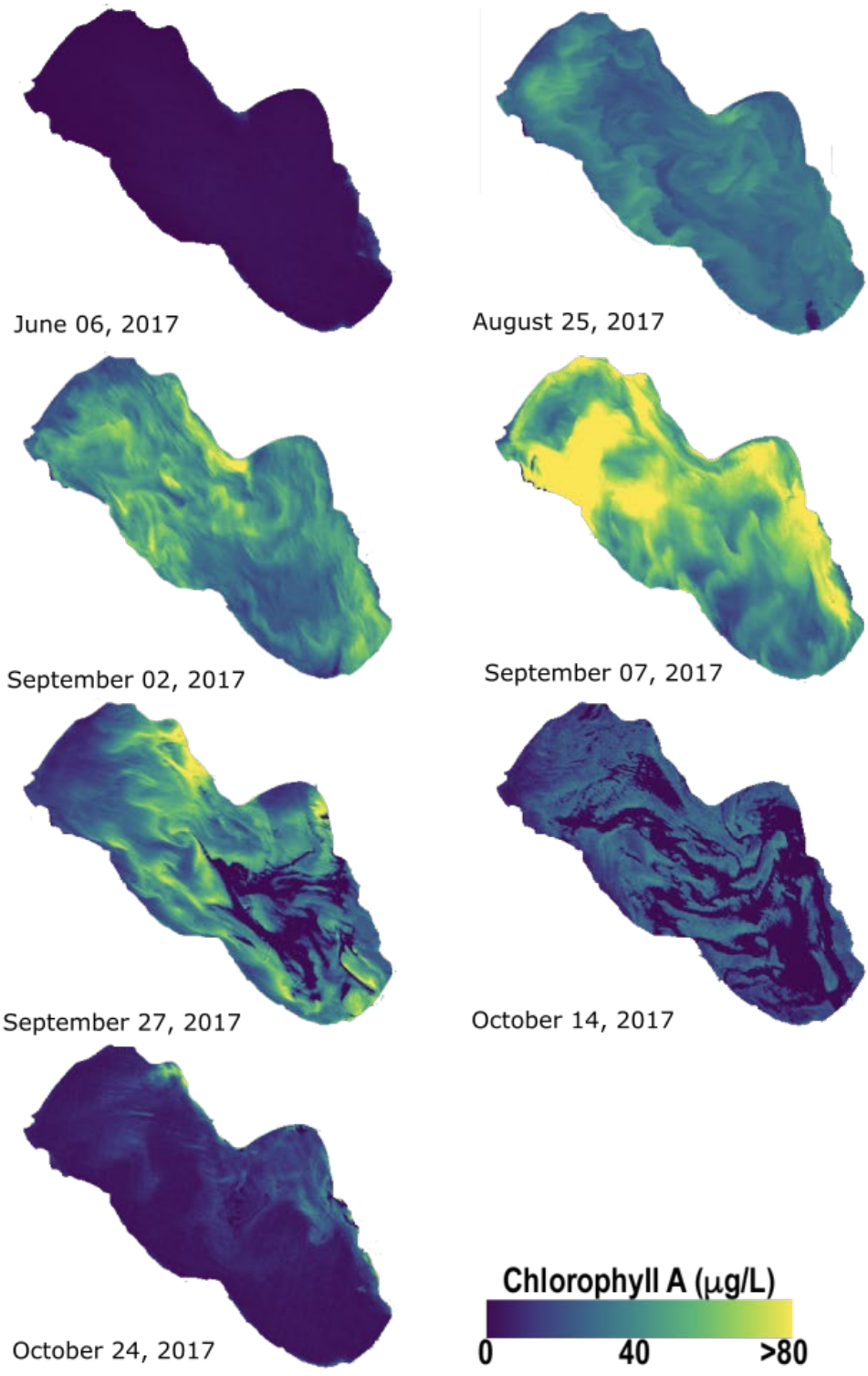


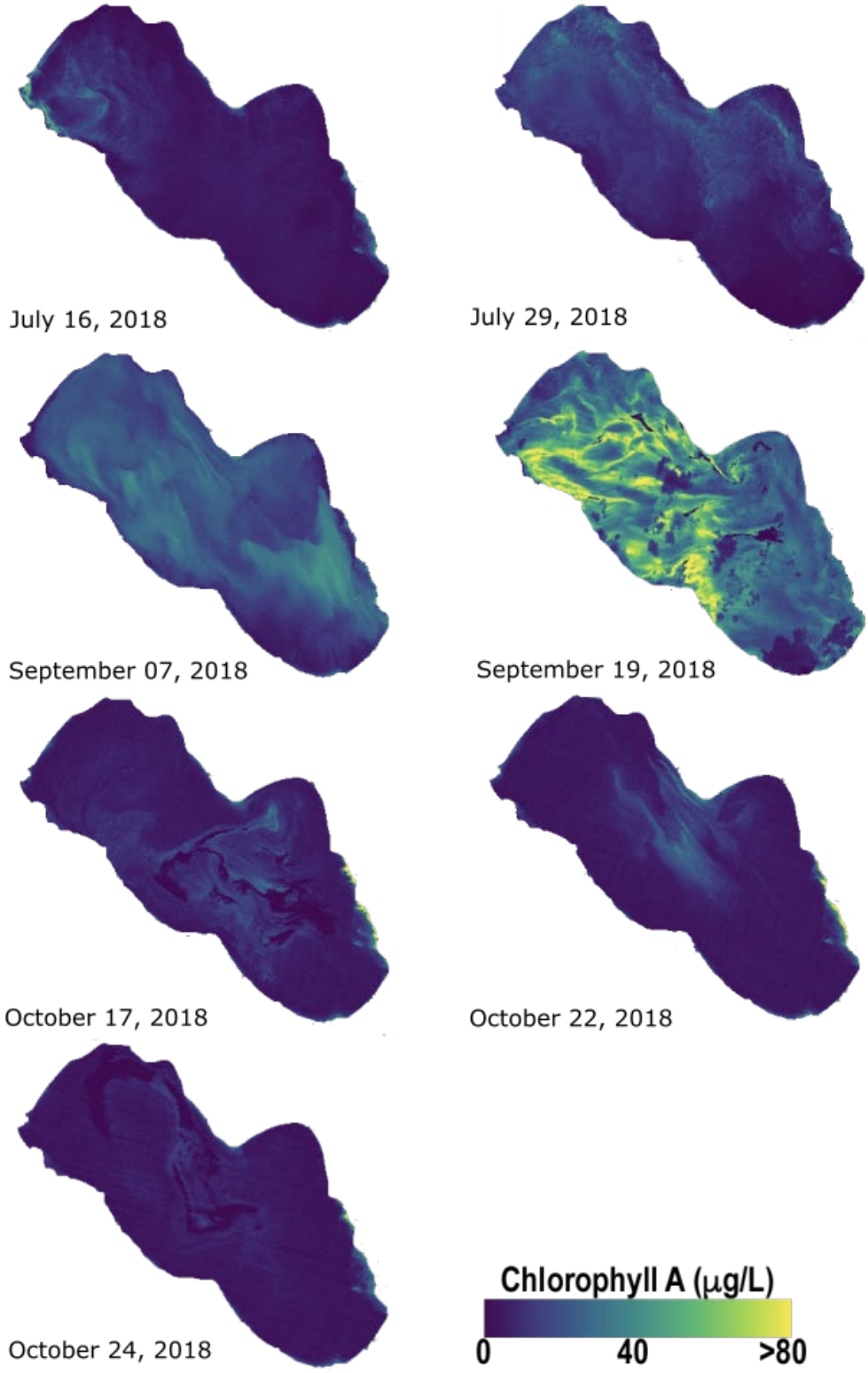
Figure 6. Satellite Image of Pigeon Lake - August 4, 2020. Bright yellow shows Chlorophyll A concentration sufficient to indicate a Harmful Algal Bloom (HAB) Source: Alberta Biomonitoring Institute: https://abmigc.users.earthengine.app/view/pigeonlake-monitoring

Since 2002, Harmful algal blooms in Pigeon Lake became noticeably more severe and frequent. Between 2006-2013 severe blooms were reported that covered the lake with an iridescent layer of impenetrable blooms. The satellite image galleries on the following pages present a snapshot of chlorophyll intensity, duration, and distribution for the Pigeon Lake Alberta open water seasons of 2017, 2018, 2019 and 2020. Chlorophyll has a distinctive pigment that is associated with Cyanobacteria (Blue Green Algae) and other phytoplankton species. This pigment intensity is considered a good representation of cyanobacteria intensity. While more research is needed, the satellite imagery suggests that blooms originate from the northwest end of the lake. The bright yellow colour on these images indicates the presence of chlorophyll A in sufficient density to indicate the presence of a Harmful Algal Bloom.

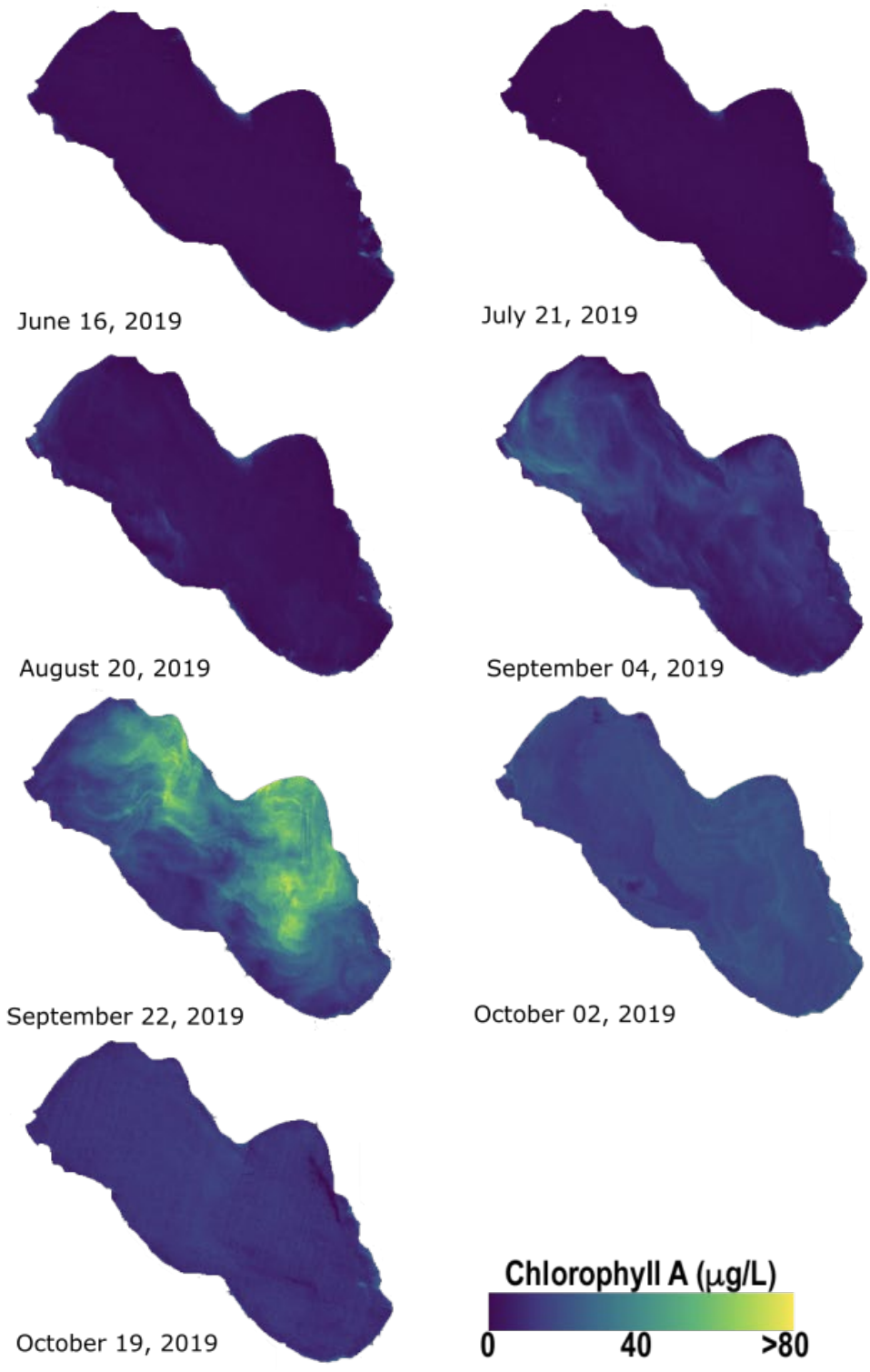
2017


June 06, 2017
August 25, 2017
September 02, 2017
September 07, 2017
September 27, 2017
October 14, 2017
October 24, 2017
Chlorophyll A (µg/L)
0
40
>80

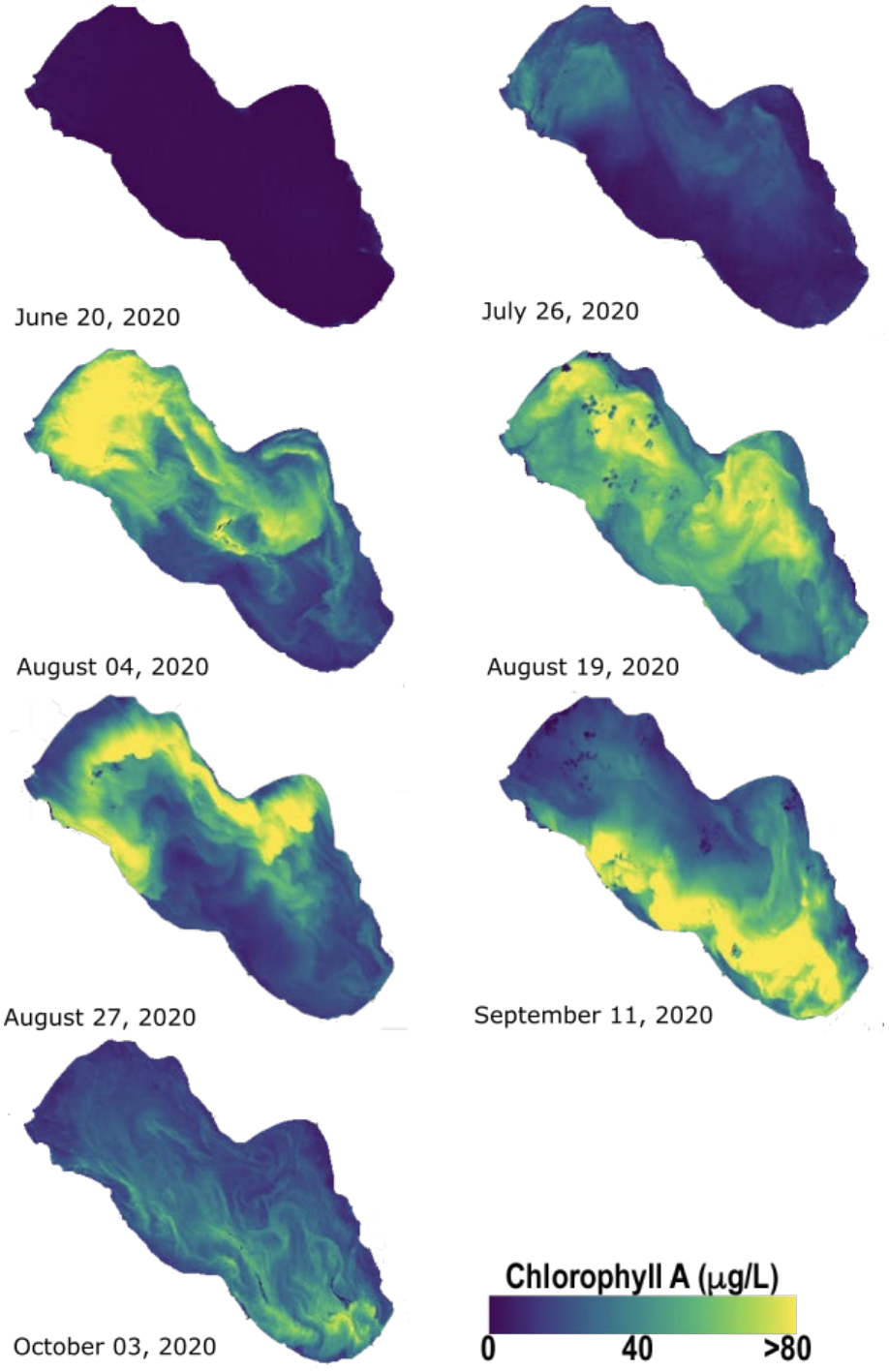
2018


July 16, 2018
July 29, 2018
September 07, 2018
September 19, 2018
October 17, 2018
October 22, 2018
October 24, 2018
Chlorophyll A (µg/L)
0
40
>80

2019


June 16, 2019
July 21, 2019
August 20, 2019
September 04, 2019
September 22, 2019
October 02, 2019
October 19, 2019
Chlorophyll A (µg/L)
0
40
>80

2020


June 20, 2020
July 26, 2020
August 04, 2020
August 19, 2020
August 27, 2020
September 11, 2020
October 03, 2020
Chlorophyll A (µg/L)
0
40
>80

Sunset Harbour Creek & Tide Creek - Adverse Effects

Studies completed by Alberta Environment and Parks, as outlined in the Pigeon Lake Watershed Management Plan Technical Report, demonstrate that pollutants in creeks at Pigeon Lake contribute to the frequency of algal blooms. In 2013, studies show that Tide Creek and Sunset Harbour Creek, which drains from the land of the proposed CFO, contribute to the phosphorus and nitrogen inputs to Pigeon Lake and thereby contribute to the frequency and intensity of harmful algal blooms. (Figure 5)

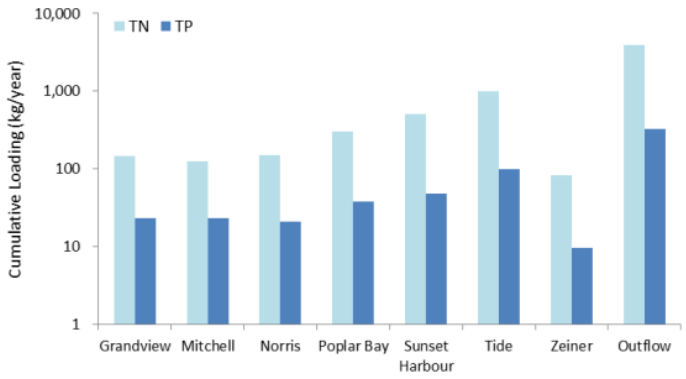


Figure 5 Summary of cumulative annual total nitrogen (TN) and phosphorus (TP) loading from inflowing streams into Pigeon Lake and exports from the outflowing stream in 2013. Data are from Teichreb et al. 2014. Technical Report in the Pigeon Lake Watershed Management Plan 2018, Appendix C, P. 23.

Water samples at in the Sunset Harbour Creek sub watershed show a substantial increase in dissolved phosphorus between 2013 & 2022. (Sunset Harbour Creek at Secondary HWY 771).

	Dissolved Phosphorus (mg/L)	
	2013	2022
Sunset Harbour Creek	0.0481	0.73

The stream chemistry from Sunset Harbour Creek at the culvert at RR 22, closer to the proposed site of the CFO, indicates even higher levels of dissolved phosphorus in 2022 of 1.6 to 2.0 mg/L.

Sources:2013, Pigeon Lake Stream Chemistry Data, Technical Summary, Pigeon Lake Watershed Management Plan Bureau Veritas Labs, Certified Report, March 21 and 29, 2022. (Appendix 2):

Fish Habitat – Adverse Effects

Pigeon Lake is considered a premier walleye fishery as a result of provincial conservation efforts. Studies of the fish population and recent events highlight increased risk to the sustainability of the fish population.

> *"From a severely collapsed status in the late 1990s, this lake has recovered to become one of Alberta's premier walleye fisheries."* **Pigeon Lake FIN Summary 2020.**

Alberta Environment and Parks monitors the health of fish at Pigeon Lake. Biologist assess the fish population, including spawning success, water quality, and threats to habitat to ensure Albertans can enjoy the benefits of sustainable fisheries and healthy ecosystem.

Results from the FIN report for Pigeon Lake in 2020, while overall positive, flag concern about population and habitat: the Walley Population status was degraded from very low risk to low risk, and Northern Pike are considered to be at very high risk with stringent conservation-based management required for the Northern Pike Population (Figure 6).

Mature Walleyes/net	Mature Pike/net	Risk to Sustainability
>29.0	>21.8	Very Low
20.3-29.0	15.3-21.8	Low
14.5-20.2	10.9-15.2	Moderate
5.8-14.4	4.4-10.8	High
<5.8	<4.4	Very High

Figure 6 Alberta's Fish Sustainability Index risk thresholds for Walleye and Northern Pike using the standardized Fall Index Net (FIN) method. Note: Thresholds align with species management frameworks.
Pigeon Lake FIN Summary 2020

White Fish Mortality Events at Pigeon Lake

In 2012 and 2021, large white fish mortality events coincided with poor water quality including depleted oxygen levels caused by decaying algae.
https://www.wetaskiwintimes.com/news/fish-kill-at-pigeon-lake
Technical Report, Pigeon Lake Watershed Management Plan 2018, Appendix C, P. 53.

The adverse effects of CFOs on fish have been demonstrated in studies from other regions in Alberta. The works outlined below shows evidence that supplements or pharmaceuticals that contaminate the environment in runoff, from intensive agricultural land, is resulting in hormone-like adverse effects on fish.

Evans J, Jackson L, Hamid HR, Ikonomou MG, Feminization of Longnose Dace (Rhinichthys cataractae) in the Oldman River, Alberta, (Canada) Provides Evidence of Widespread Endocrine Disruption in an Agricultural Basin: Scientifica, Vol. 2012, Article ID 521931, 2012.

Jeffries KM, Nelson ER, Jackson LJ, Hamid HR, Basin-Wide Impacts of Compounds with Estrogen-Like Activity on Longnose Dace (Rhinichthys Cataractae) in Two Prairie Rivers of Alberta, Canada, Environmental Toxicology and Chemistry, Vol. 27, No. 10, pp. 2042–2052, 2008.

2) *The proposed CFO adversely affects public health and safety in and around Pigeon Lake due to the increased presence of harmful algal blooms and bovine enterococcus which produce toxins and bacteria harmful to people and animals*

The discharge of pollutants from the CFO operation, i.e., pens, catch basin and manure spreading, increase the risk of contamination in ground water, surface runoff and airborne pathogens.

Annual testing by Alberta Health Services (AHS) at Pigeon Lake has identified two public health risks for residents and visitors - Blue green algae and fecal bacteria. Health warning trigger beach closures, limits water recreation, and prevents fishing.

- AHS issued water quality advisories for Zeiner Park Beach due to elevated levels of fecal bacteria in 2019 and 2021.
    - PCR Ruminant contaminants were found by AHS with the analysis of enterococcus data associated with the fecal bacteria warning in 2021
    - These health advisories warn gastrointestinal illness may result from ingestion of the water as well as the possibility of skin, ear and eye infections with water contact. Zeiner Park Beach is downstream from the proposed CFO.
- AHS issues the most recent Blue-Green Algae health warning in 2021.Blue Green Algae (cyanobacteria), can release toxins that are harmful for humans, pets and livestock.

3) The proposed CFO adversely effects downstream conservation and recreational sites

Tide Creek and Sunset Harbour Creek are environmentally sensitive water bodies that drain from the applicant's property to Pigeon Lake. The conservation lands are identified in Figure 1 and include: Pigeon Lake Conservation Area (D3-89) NE-15-047-02-W5M, George and Joan Mitchell Memorial Conservation Area (D3-26) NW-14-047-02-W5M, Pigeon Lake Provincial Park, and Zeiner Park (Figure 1). Alberta Environment and Parks manages or works in partnership with conservation groups to manage all of these sites.

Environmentally Sensitive Sites – Adverse Effects

- The northeast area proposed in the CFO application for manure spreading is within the Tide Creek drainage basin and is located approximately 1000 meters from the boundary of the nearest conservation area.
- Drainage courses penetrate each of the quarter sections proposed for the CFO and the manure spreading.
- Tide Creek at Sunset Harbour Creek are important spawning area for walleye, northern Pike and suckers. Branches of the creeks drain from the proposed areas where manure will be spread.
- The conservation areas are home to wildlife including white-tail deer, moose, black bear and grouse.
- The Pigeon Lake Provincial Park is directly east and downwind of the CFO operation and manure spreading area. Prevailing westerly winds increase the risk of carrying airborne odour and pathogens into the campground, potentially affecting visitor experience and respiratory health.

The applicant does not show drainage courses, ground topography and required setbacks from drainage courses and the ephemeral channels. Drainage courses are published by the Government of Alberta in base features maps for the site. The application does not demonstrate how the drainage courses will be protected from nutrient rich runoff.

4) *The proposed CFO undermines prior regional and provincial efforts to mitigate nutrient release in the watershed and improve water quality in Pigeon Lake:*

Millions of dollars have been invested by the Province of Alberta, in concert with the local municipalities and individual ratepayers, to clean up Pigeon Lake. These investments will be undermined by the addition of a CFO operation in the Pigeon Lake watershed.

Regional Waste Water System

Regional municipalities have collaboratively worked toward removing human waste generated nutrient sources from Pigeon Lake through the development of regional wastewater systems. Efforts began in the mid-1980's with the establishment of the Northeast Regional Wastewater Commission and sewer connections the northeast side of the lake. In the last decade, a regional trunk line and local collection systems were extended to south shore communities. All but a few septic fields were eliminated. The Province of Alberta has been a partner throughout and supported the initiative with major funding. Individual rate payers have had to invest in property connections to the new communal system.

Watershed Management

The municipalities have also worked together with the Pigeon Lake Watershed Association and the Province on developing and implementing a comprehensive Pigeon Lake Watershed Management Plan. The plan was together with a science-based technical report, was completed in 2018 and we now are in the fifth year of implementation.

Stewardship

Individual voluntary efforts to reduce nutrient release have occurred supported by community action initiates of the Pigeon Lake Watershed Association.

5) *The proposed CFO does not align with Alberta's Water for Life Action Plan, the Pigeon Lake Watershed Management Plan or Municipal Regional and Statutory Plans*

The Pigeon Lake Watershed Management Plan was created to support Alberta's Water for Life Strategy to improve and maintain the health of our aquatic ecosystems by managing the cumulative impacts of point and non-point sources, promoting watershed management, and establishing water conservation objectives on all major basins. The *Pigeon Lake Watershed Management Plan 2018* is an intermunicipal commitment, adopted by the County of Wetaskiwin and requires due regard.

A confined feeding operation is not in alignment with the Pigeon Lake Watershed Management Plan,

- **Objective 2: Improve phosphorus management** for all land uses to achieve a net reduction in nutrient runoff and promote biodiversity.

- **New or Expanded Intensive Livestock Operations**: Statutory land use restrictions on new or expanded intensive livestock operations (including CFO's) are supported in this Watershed Management Plan

Statutory Plans

All relevant statutory plans identify environmental protections as a priority and recognize the vulnerability of Pigeon Lake and its watershed. These plans recognize that environmentally sensitive lands need to be protected to support a high-quality life of people around the lake.

Leduc County / County of Wetaskiwin No. 10 Intermunicipal Development Plan Bylaw 2018/08

- Section F.1.f.i. Within both Counties there are environmental sensitive area around Pigeon Lake, Wizard Lake and Coal Lake.
- Section K.6. Environmental Matters: Both Counties agree that collaboration and cumulative impact analysis may be required when considering future development around the lakes within the Plan Area

Municipal Development Plan - County of Wetaskiwin No. 10

- Statement of Purpose: The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment.
- Planning Direction:
  Section 1: To maintain a clean environment - to support development so long as there is no negative impact on air, natural resources, water or soil quality;
- Environmental Protections:
  Section 3: Protecting the natural environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

County of Wetaskiwin Land Use Bylaw related to CFOs, found at:
https://www.county.wetaskiwin.ab.ca/630/Bylaw-Department

- Section 9.6.1: Confined Feeding Operations (CFOs) are regulated by the Agricultural Operations Practices Act (AOPA) and under the jurisdiction of the province. As such, CFOS are required to obtain provincial permits as regulated by AOPA and Associated regulations; however, it is the County's intent that any negative effect from CFOs should be minimized. The Municipal Government Act required the municipality to identify where new CFOs should locate. (Amended by Bylaw 2019/44)

- Section 9.6.9: In accordance with Object 1.4 of the County's Municipal Development Plan, A development permit for an existing, expanding or proposed intensive livestock operation may be refused if the proposed development is within: c) all other unspecified

environmental features, including but not limited to lakes not specified in (b), wetlands, and watercourses shall have setbacks in accordance with Alberta Operations Practices Act and Regulation (AOPA) as amended.

Other related planning documents:

- *Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed.* County of Wetaskiwin, Pigeon Lake Watershed Area Concept Plan, section 5.5.2 Agriculture, Located at: http://www.communityconserve.ca/wp-content/uploads/2017/05/County-of-Wetaskiwin-Pigeon-Lake-Watershed-Area-Concept-Plan-Excerpts.pdf.

Pigeon Lake municipalities have completed two Intermunicipal Development Plans (IDP) within the Pigeon Lake Watershed that embed the goals of the Plan. The Pigeon Lake South Intermunicipal Development Plan (PLSIDP), is nearing completion and will closely follow the precedents of the other approved IDPs.

6) The proposed CFO application does not address water diversion based on the requirements of the Water Act

Water wells identified on the application are used for the current operation. Water well placement and draw for the new CFO are not identified. Without disclosure of water wells for the proposed application, a complete environmental risk screening, which is required for all NRCB CFO applications cannot be completed.

Water conservation objectives i.e., the protection of the Sunset Harbour Creek and Tide Creek, which drain from designated manure spreading areas through neighbouring lands and conservation land, as a natural water body and their aquatic environment, and for the protection of tourism, recreation, and fish management under the Water Act, must be addressed for consideration under the Environmental Protection and Enhancement Act.

Request Referral Agency Involvement

The NRCB approval officer required to consider and address all responses from the referral agencies, the following agencies, information, and reports should be included:

1. **Alberta Health Services**:
    a. Enterococcus Health Advisory data from eDNA beach sampling analysis (2019 and 2021) including analysis of the enterococcus data in 202, which indicates evidence of PCR Ruminant contaminants.
    b. Blue green algae health advisory for 2021 and any additional years.
2. **Alberta Environment and Park:**
    a. Pigeon Lake Water Quality Reports from 2012-2013.

3. **Alberta Conservation Area, Alberta Fish and Game Association, Zone 3 Fish and Game clubs and Alberta Environment and Parks** as managers of the Pigeon Lake conservation area and the George and Joan Mitchell Memorial conservation area, which are located two quarter section downstream of the CFO by 1000 meters or less.
4. **Alberta Parks** should be asked to provide an impact assessment on Pigeon Lake Provincial Park and Zeiner Park. Both include conservation land in the drainage basins where 16 quarters have been designated for manure spreading.
5. **Alberta Fisheries and Wildlife** should be contacted to provide an explanation on the most recent fish kill at Pigeon Lake as well as the Pigeon Lake FIN Summary 2020.

The Pigeon Lake Watershed Association requests the Natural Resources Conservation Board deny Application RA21045 for a Confined Feeding Operation based on the adverse effects listed in this report.

2013 Pigeon Lake Stream Chemistry Data

Sample No.	Station No.	Station Name	QC Sample?	Sample Date	Oxygen Dissolved (Field Meter) (mg/L)	Oxygen Dissolved (Winkler) (mg/L)	pH (Field) (pH units)	Phosphate Dissolved Ortho (mg/L)	Phosphorus Total (P) (mg/L)	Phosphorus Total Dissolved (mg/L)	Residue Filterable (mg/L)	Residue Nonfilterable (mg/L)	Specific Conductance (Field) (uS/cm)	Temperature Air (Deg C)	Temperature Water (Deg C)	Turbidity (Visual) At Site (n/a)
13SWE02755	AB05FA2040	Grandview Heights Creek	N	26-Apr-13	4.16		7.57	0.113	0.214	0.171	157	5	195.7	16	6.5	0
13SWE02751	AB05FA2025	Mitchell Beach Creek	N	25-Apr-13	10.68		7.16	0.289	0.4	0.333	114	10	213.4	12	0.4	0
13SWE02758	AB05FA2025	Mitchell Beach Creek	N	2-May-13	7.37		6.83	0.0258	0.137	0.0728	252	L3	372		3.13	0
13SWE02768	AB05FA2025	Mitchell Beach Creek	N	6-May-13	7.12		6.68	0.0211	0.0936	0.0427	234	66	370.9	21	6.54	0
13SWE02776	AB05FA2025	Mitchell Beach Creek	N	13-May-13	6.75		7.54	0.023	0.0598	0.0371	245	L3	409	17	9.85	0
13SWE02780	AB05FA2025	Mitchell Beach Creek	N	27-May-13	6.27		7.29	0.0269	0.0637	0.0481	249	L3	420.9	15	11.26	0
13SWE02822	AB05FA2025	Mitchell Beach Creek	N	10-Jun-13	4.6		7.33	0.0318	0.0678	0.0475	348	L3	514	14	10.27	0
13SWE06622	AB05FA2025	Mitchell Beach Creek	N	24-Jun-13	4.1		7.16	0.0213	0.0811	0.0443	376	L3	567.7	17.7	12.02	0
13SWE06675	AB05FA2025	Mitchell Beach Creek	N	8-Jul-13	3.21		7.04	0.0126	0.166	0.0279	436	L3	666.7	21.3	12.42	0
13SWE06704	AB05FA2025	Mitchell Beach Creek	N	16-Jul-13	4.47		7.2	0.0334	0.102	0.0482	380	L3	589	16.7	10.99	0
13SWE06733	AB05FA2025	Mitchell Beach Creek	N	22-Jul-13	6.88		7.06	0.0184	0.143	0.0524	435	8	661	17.1	18.15	0
13SWE02754	AB05FA2045	Norris Beach Creek	N	26-Apr-13	10.74		7.5	0.0784	0.164	0.113	162	25	212.3	16	4.96	1
13SWE02762	AB05FA2045	Norris Beach Creek	N	2-May-13	10.92		7.4	0.0341	0.108	0.0745	231	5	346		8.11	1
13SWE02763	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13				0.0404	0.107	0.0752	236	8				
13SWE02764	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13				0.0426	0.108	0.0771	228	10				
13SWE02760	AB05FA2055	Pigeon Lake Creek	N	2-May-13	13.78		8.34	L0.001	0.031	0.0076	97	L3	144		3.1	0
13SWE02772	AB05FA2055	Pigeon Lake Creek	N	6-May-13	13.67		8.57	0.0061	0.0373	0.008	118	9	203.3	30	9.46	1
13SWE02779	AB05FA2055	Pigeon Lake Creek	N	13-May-13	10.32		7.74	0.0012	0.156	0.0115	168	109	281.6		9.49	0
13SWE02784	AB05FA2055	Pigeon Lake Creek	N	27-May-13			8.14	0.0037	0.0202	0.0053	189	4	321	23	13.75	0
13SWE02825	AB05FA2055	Pigeon Lake Creek	N	10-Jun-13	9.48		8.57	L0.001	0.26	0.0058	211	182	328.8		13.16	2
13SWE06629	AB05FA2055	Pigeon Lake Creek	N	24-Jun-13	10.11		8.56	L0.001	0.0198	0.0066	190	5	322	23.9	20.59	1
13SWE06682	AB05FA2055	Pigeon Lake Creek	N	8-Jul-13	10.12		8.72	L0.001	0.0179	0.0075	193	L3	316	26.2	19.22	0
13SWE06711	AB05FA2055	Pigeon Lake Creek	N	16-Jul-13	10.96		8.65				197	111	317		22.51	2
13SWE06740	AB05FA2055	Pigeon Lake Creek	N	22-Jul-13	9.39		8.55	0.001	0.0245	0.0069	198	L3	324	20	20.08	0
13SWE06792	AB05FA2055	Pigeon Lake Creek	N	6-Aug-13	8.82		8.57	L0.001	0.0261	0.0077	204	L3	325	21.7	20.87	0
13SWE06960	AB05FA2055	Pigeon Lake Creek	N	20-Aug-13	9.65		8.84	L0.001	0.0433	0.0071	179	4	268	19	19.37	0
13SWE07009	AB05FA2055	Pigeon Lake Creek	N	3-Sep-13	9.34		8.6	L0.001	0.0261	0.0081	204	L3	312	19.8	20.88	0
13SWE07040	AB05FA2055	Pigeon Lake Creek	N	17-Sep-13	8.77		8.38	L0.001	0.238	0.009	185	76	325	18.8	17.74	2
13SWE07041	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13				0.0031	0.111	0.0118	185	174				
13SWE07042	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13				L0.001	0.189	0.0085	188	212				
13SWE02752	AB05FA2035	Poplar Bay Creek	N	25-Apr-13	11.49		7.49	0.0526	0.263	0.0814	171	112	214.5	13	0.68	3
13SWE02766	AB05FA2035	Poplar Bay Creek	N	2-May-13	9.84		7.05	0.0185	0.127	0.0593	239	18	398.9		8.01	1
13SWE02771	AB05FA2035	Poplar Bay Creek	N	6-May-13	8.29		7.45	0.0197	0.124	0.0353	276	17	456.4	30	15.06	1
13SWE02783	AB05FA2035	Poplar Bay Creek	N	27-May-13	8.35		7.47	0.0421	0.132	0.068	255	16	417.1	24	12.12	0
13SWE06708	AB05FA2035	Poplar Bay Creek	N	16-Jul-13	8.09		7.66	0.0787	0.214	0.114	272	16	403	23	17.74	2
13SWE02753	AB05FA2030	Sunset Harbour Creek	N	25-Apr-13	11.58	11.1	7.55	0.0481	0.211	0.0844	157	82	197.5	13	2.11	3
13SWE02765	AB05FA2030	Sunset Harbour Creek	N	2-May-13	11.28		7.53	0.0198	0.0955	0.0526	209	11	314.7		4.86	0
13SWE02770	AB05FA2030	Sunset Harbour Creek	N	6-May-13	9.76		7.57	0.0218	0.0889	0.0445	243	12	377	30	10.01	0
13SWE02778	AB05FA2030	Sunset Harbour Creek	N	13-May-13	8.83		7.56	0.0102	0.0734	0.0301	270	4	447.5	19	11.39	0
13SWE02782	AB05FA2030	Sunset Harbour Creek	N	27-May-13	9.28		7.61	0.0324	0.102	0.0453	270	7	416.7	17.1	10.02	0
13SWE02824	AB05FA2030	Sunset Harbour Creek	N	10-Jun-13	7.99		7.91	0.0141	0.112	0.0354	298	13	448.2	14	12.58	0
13SWE06625	AB05FA2030	Sunset Harbour Creek	N	24-Jun-13	6.85		7.75	0.0293	0.108	0.0514	289	7	455.6	20.3	16.42	0
13SWE06678	AB05FA2030	Sunset Harbour Creek	N	8-Jul-13	6.74		7.68	0.0329	0.147	0.0581	338	8	519	17.5	15.3	1
13SWE06707	AB05FA2030	Sunset Harbour Creek	N	16-Jul-13	8.33		7.62	0.05	0.135	0.0762	239	10	363	21.3	15.1	2
13SWE06736	AB05FA2030	Sunset Harbour Creek	N	22-Jul-13	6.15		7.54	0.0556	0.209	0.091	294	7	440	19.1	17.21	1
13SWE06956	AB05FA2030	Sunset Harbour Creek	N	20-Aug-13	6.65		7.6	0.0388	0.213	0.0677	320	7	509	16.2	15.04	0
13SWE02757	AB05FA2027	Tide Creek	N	30-Apr-13	9.17		7.25	0.0296	0.11	0.0629	147	4	169		4.26	0
13SWE06706	AB05FA2027	Tide Creek	N	16-Jul-13	1.35		7.26	0.0593	0.153	0.101	229	3	305	22.6	14.7	2
13SWE02756	AB05FA2047	Zeiner Creek	N	26-Apr-13	9.96		7.13	0.0811	0.145	0.106	228	L3	309.5	15	0.36	0
13SWE02759	AB05FA2047	Zeiner Creek	N	2-May-13	7.74		6.82	0.045	0.148	0.0653	274	7	390.6		0.95	0
13SWE02769	AB05FA2047	Zeiner Creek	N	6-May-13	6.45		6.72	0.0709	0.107	0.0898	286	L3	405.2	20.6	4.48	0
13SWE02777	AB05FA2047	Zeiner Creek	N	13-May-13	5.92		7.03	0.0527	0.0736	0.0652	298	L3	456.2	19	7.97	0
13SWE02781	AB05FA2047	Zeiner Creek	N	27-May-13	5.91		7.29	0.092	0.144	0.134	279	L3	412.3	19	6.88	0
13SWE02823	AB05FA2047	Zeiner Creek	N	10-Jun-13	5.4		7.45	0.101	0.145	0.115	356	L3	502.5	14	8.77	0
13SWE06623	AB05FA2047	Zeiner Creek	N	24-Jun-13	4.68		7.14	0.193	0.303	0.295	315	L3	420.6	18.9	11.18	0
13SWE06676	AB05FA2047	Zeiner Creek	N	8-Jul-13	3.93		7.36	0.148	0.279	0.194	403	21	575	17.8	11.83	1
13SWE06705	AB05FA2047	Zeiner Creek	N	16-Jul-13	4.73		6.95	0.192	0.284	0.26	326	L3	424	21.3	10.22	1
13SWE06734	AB05FA2047	Zeiner Creek	N	22-Jul-13	4.25		7.25	0.275	0.326	0.313	389	L3	552	17.8	14.04	1
13SWE07043		Field Blank	Y (field blank)	17-Sep-13				L0.001	L0.001	L0.001	L10	L3				
13SWE07044		Trip Blank	Y (trip blank)	17-Sep-13				L0.001	L0.001	L0.001	L10	L3				

Site Location: Pigeon Lake
Your C.O.C. #: 46414

Attention: BRADLEY PETER

Alberta Environment and Parks c/o ALMS
4816-89 Street
Edmonton, AB
CANADA T6E 5K1

Report Date: 2022/03/28
Report #: R3152820
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C218604
Received: 2022/03/23, 10:40

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Phosphorus-Dissolved-Lab Filtered (1, 2)	4	2022/03/25	2022/03/25	AB SOP-00024	SM 23 4500-P A,B,F m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Calgary, 4000 - 19 St. , Calgary, AB, T2E 6P8
(2) Dissolved Phosphorus > Total Phosphorus Imbalance: When applicable, Dissolved Phosphorus and Total Phosphorus results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Amanda L'Hirondelle, Key Account Specialist
Email: Amanda.lhirondelle@bureauveritas.com
Phone# (780)577-7117
==========
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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Alberta Environment and Parks c/o ALMS
Attention: BRADLEY PETER
Client Project #:
P.O. #:
Site Location: Pigeon Lake

Sample Description	: Sun H, #2	Bureau Veritas Sample Number	: AQL759
Sample Date & Time	: 2022/03/21 15:00	Bureau Veritas Job Number	: EC218604
Sampled By	: ALM	Sample Access	:
Sample Type	:	Sample Matrix	: Water
Sample Received Date	: 2022/03/23	Report Date	: 2022/03/28
Sample Station Code	:		

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	0.22	mg/L	KONE	2010	A535183	0.0030	0.0030

DL = The lowest concentration that will be reported for a specific test
RDL = Reportable Detection Limit – Calculated on the basis of the detection limit, the dilution used, and the weight of the sample
Good Condition

Bureau Veritas Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Alberta Environment and Parks c/o ALMS
Attention: BRADLEY PETER
Client Project #:
P.O. #:
Site Location: Pigeon Lake

Sample Description : RR 22, North, #1
Sample Date & Time : 2022/03/22 16:00
Sampled By : ALM
Sample Type :
Sample Received Date : 2022/03/23
Sample Station Code :

Bureau Veritas Sample Number : AQL761
Bureau Veritas Job Number : EC218604
Sample Access :
Sample Matrix : Water
Report Date : 2022/03/28

PARAMETER DESCRIPTION	Results	UNITS	INST.	VMV Code	QA/QC BATCH	RDL	DL
Lab Filtered Nutrients							
Dissolved Phosphorus (P)	2.0	mg/L	KONE	2010	A535183	0.075	0.0030

DL = The lowest concentration that will be reported for a specific test
RDL = Reportable Detection Limit – Calculated on the basis of the detection limit, the dilution used, and the weight of the sample
Good Condition

Bureau Veritas Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

TAB 17

Estimation of Pollutant Loads in Surface Water Runoff Stemming from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed

Regarding Natural Resources Conservation Board Application RA 21045,
G&S Cattle Ltd., NW 03-047-02 W5M

Report for:
G. and R. Booth, D. Labutis, and the Pigeon Lake Watershed Association
September 2022

Prepared by

Margaret Allan, M.Eng., P.Eng., P.Geo., FGC, FEC

Executive Summary

Pigeon Lake is one of Alberta's most popular recreational areas, valued by community residents and visitors alike. Recurring water quality advisories (e.g., AHS 2022a) demonstrate that its watershed is a particularly sensitive ecosystem. Compared to other Alberta lakes, Pigeon Lake has a small outflow and a large evaporative area that promote accumulation and concentration of nutrients such as phosphorus. This situation leads to water quality issues and harmful algal blooms when nutrient levels exceed the carrying capacity of the lake.

This report assesses potential nutrient loading associated with the confined feeding operation (CFO) proposed by G&S Cattle Ltd. in Natural Resources Conservation Board Application RA 21045 (the Application). A computer model specially developed for the United States Environmental Protection Agency (US EPA) to calculate nutrient and sediment loads in runoff for land uses including feedlots and manure spreading operations was used for this assessment. This modelling estimates that under the CFO parameters proposed in the Application, which includes 4,000 head of cattle and manure spreading on 510 ha of land, there will be *just through surface runoff* an additional 262 kg/yr of phosphorus, 3,033 kg/yr of nitrogen, and 4,357 kg/yr of biochemical oxygen demand (BOD). Resulting increases in surface water concentrations within Sunset Harbour Creek (which drains to Pigeon Lake) are estimated at 1.0 mg/L of phosphorus, 18.6 mg/L of nitrogen, and 25.5 mg/L of BOD; concentrations in Tide Creek (which also drains to Pigeon Lake) are estimated to increase by 0.23 mg/L of phosphorus, 0.79 mg/L of nitrogen, and 1.5 mg/L of BOD. For Sunset Harbour Creek, these additions would represent more than an order of magnitude increase over its typical nutrient concentrations.

Pigeon Lake is already exhibiting limits in its ability to assimilate external nutrient loads and thus even small increases in runoff-sourced nutrients will have a significant impact. Where limited nutrient assimilation is already causing harmful algal blooms, new sources of nutrients will accumulate in the lake and drive further increased frequency, intensity, and duration of algal blooms. The *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018) recommend nutrients in lakes be limited to yield "No increase in nitrogen (total) or phosphorus over existing conditions." Given the substantial, non-zero predicted increases in nutrient concentrations stemming from the proposed CFO and the sensitivity of Pigeon Lake, the proposed operation will be out of compliance with AEP's surface water quality guidelines.

The NRCB's *Environmental Risk Screening Tool* (NRCB 2011) is not capable of capturing the degree of ecological and human health risk to Pigeon Lake and its users because the tool does not consider assimilative capacity.

Furthermore, criteria for establishing CFOs do not consider impacts of climate change. Climate change will exacerbate the adverse impacts of the CFO on the watershed. Canadian climate models predict that both temperature and storm activity will increase with global warming. Increased precipitation including increased intensity, frequency and duration of extreme rainfall events is likely to convey even greater amounts of phosphorus and nitrogen toward the lake. Increased temperature will bring about conditions for harmful algal blooms and oxygen depletion within the lake.

This report concludes that the development proposed in the Application would have unacceptable impacts on "the environment, the economy and the community and the appropriate use of land": factors that must be considered in accordance with section 20(1)(ix) of the Agricultural Operations

Practices Act (AOPA; RSA 2000, c. A-7). It is my expert opinion that introducing the proposed CFO will jeopardize the health and utility of Pigeon Lake because of its particular susceptibility to water quality issues such as harmful algal blooms. The addition of the CFO in the watershed would essentially negate nutrient load reductions achieved by the implementation of wastewater systems and other watershed beneficial management practices promoted by the PLWA.

Clearly, because of significant long-term adverse impacts, the Pigeon Lake watershed is not positioned to accommodate a CFO. The evidence indicates that, if the CFO is developed, nutrient loading would exceed limits for Alberta lakes (AEP 2018) and would not comply with the watershed management goals set out in the *Pigeon Lake Watershed Management Plan* (PLWA 2018). Maintaining water quality and ecosystem balance are crucial for the viability of Pigeon Lake as a valued water resource for current and future generations.

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1 Introduction

In response to Application RA21045 (the Application) to the Natural Resources Conservation Board (NRCB) by G&S Cattle Ltd. (the Proponent), adjacent landowners to the proposed CFO David Labutis and Gloria and Randy Booth (collectively, the Interveners), with the support of the Pigeon Lake Watershed Association (PLWA), retained an environmental engineer to assess potential impacts of the proposed confined feeding operation (CFO) on the Pigeon Lake watershed.

Margaret Allan, M.Eng., P.Eng., P.Geo., FGC, FEC is an engineer and geoscientist with 35 years consulting experience in Alberta. Much of her career has focused on risks to human health and the environment posed by contaminated sites, and included developing the NRCB's initial version of its *Environmental Risk Screening Tool* (NRCB 2011). She is familiar with challenges of managing cattle, as she and her husband operate a cow-calf operation northeast of Edmonton. Ms. Allan was retained by the Interveners to:

- assess facts and supporting evidence related to the sensitivity of the watershed and the likely impacts of CFO operations
- model contamination from a 4,000-head CFO including pens, catchment basin, and manure spreading areas and their impacts on surface runoff, stream flows, and the lake
- conduct a sensitivity analysis to analyse effects of potential increase in size of confined feeding operations and effects of larger precipitation events that may be expected with climate change
- highlight limitations of the NRCB *Environmental Screening Tool* in light of the particular sensitivity of the Pigeon Lake watershed

This report presents the results of the assessment.

2 Background

2.1 History

As a beautiful prairie lake, Pigeon Lake is one of the most intensely used recreational areas in Alberta. It has seen considerable activity, habitation and development that dates back more than 10,000 years to when the lake was formed by retreating glaciers. Currently, property on or near the shores of Pigeon Lake includes the following:

- Pigeon Lake Reserve 138A – a satellite reserve established under Treaty 6 for the Samson Cree Nation, Ermineskin Cree Nation, Louis Bull Tribe, and Montana First Nation
- 2 Provincial Park sites – Pigeon Lake Provincial Park & Campground and Zeiner Campground
- 10 incorporated summer villages – Argentia Beach, Crystal Springs, Golden Days, Grandview, Itaska Beach, Ma-Me-O Beach, Norris Beach, Poplar Bay, Silver Beach, and Sundance Beach
- Unincorporated communities within the County of Wetaskiwin and Leduc County – including Sunset Harbour, Fisher Home, Mission Beach, Mulhurst Bay, and The Village at Pigeon Lake
- Over 2,000 private cottages
- Recreational developments including golf courses, RV parks, and camps

Early settlement activities were based on logging, farming, and fishing. Incremental agricultural development in the watershed and lakeside residential development have increased nutrient releases into the lake, causing recurring water quality issues and ecological impairment. Algal blooms became

noticeably more frequent and severe about 20 years ago and prompted the formation of the PLWA in 2006.

Information published by the PLWA (2018) shows that since its formation, the PLWA has been working with stakeholders to manage nutrient loads -- initially through a series of beneficial management practices and later through the development and implementation of the *Pigeon Lake Watershed Management Plan*. Working collaboratively with community, municipal, Indigenous, traditional, and provincial partners in the watershed area, the PLWA commissioned scientific research to assess the state of the lake, the shoreline area, and the surrounding lands with a view toward identifying and encouraging beneficial management practices for improving ecological health (PLWA 2018). A multi-stakeholder steering committee was formed and, in 2012, the PLWA embarked on creating watershed management plan that would support beneficial management practices through education and bylaws.

The PLWA, in partnership with the Alliance of Pigeon Lake Municipalities (APLM) and Alberta Environment and Parks (AEP), committed to prepare a watershed management plan. The *Pigeon Lake Watershed Management Plan* was completed in 2018 (PLWA 2018); it is a comprehensive document that summarizes learnings from the scientific studies and presents a suite of beneficial management practices intended to limit nutrients (particularly phosphorus, which is implicated with harmful algal blooms) within the watershed lands, the shoreline area, and within the lake itself.

Recurring water quality issues demonstrate that the Pigeon Lake watershed is a particularly sensitive ecosystem. The most recent water quality advisory was in July 2022 (AHS 2022a). Reducing nutrient inflows to the lake has been a challenge since (i) some sources are difficult to curtail (e.g., phosphorus releases from lakebed sediments); (ii) substantial shoreline has been developed for recreational uses; and (iii) area agricultural lands generate nutrient-rich runoff that flows into Pigeon Lake.

2.2 Physiographic Setting

The Pigeon Lake watershed is positioned in a southerly extension of the Boreal Forest Natural Region, as shown on the inset image (Natural Regions Committee 2006, p. 122). Consequently, its climate and soils are more akin to Boreal parts of Alberta as opposed to the Parkland and Grassland Natural Regions to the east and south or the Foothills Natural Region to the west. Within the Boreal Forest Region, the Pigeon Lake area falls within the Dry Mixedwood Subregion, transitioning to the Central Mixedwood Subregion.

The natural setting has significant implications for CFO risk management because standard mitigation strategies addressed in the Agricultural Operation Practices Act (AOPA; RSA 2000 c. A-7) were developed at a time when most of the province's intensive livestock operations were sited in Parkland and Grassland locations. The framework for managing CFO impacts did not explicitly contemplate siting in Boreal Forest areas, which have different weather, soil, and vegetation than Parkland/Grassland areas. These factors affect attenuation and transport of CFO nutrients and their potential adverse effects on the land and watersheds.

2.3 Soils, Geology & Hydrogeology

The *Agricultural Regions of Alberta Soil Inventory Database* (AGRASID; GoA 2021) shows that the Proponent's site is located on two similar polygons that are both part of the Yeoford Plain soil unit. This soil unit is characterized by Dark Gray and Gray Luvisols developed on medium textured till; Chernozems may be present as minor components.

Surficial geology is mapped as draped moraine, indicating that glacial till sediment predominates (Barker et al. 2011). The landscape is undulating, with some rolling and hummocky terrain. The geotechnical report included with the Proponent's application determined that till containing clay and silty sand is underlain by mudstone bedrock (Union Street Geotechnical 2021); bedrock was encountered at depths of 1.5 m to 2.2 m below ground surface near the proposed cattle pens and at depths of 2.6 m to 5.8 m below ground surface near the proposed catch basin. Bedrock surrounding Pigeon Lake belongs to the Paskapoo Formation (Barker et al. 2011). This is a non-marine bedrock formation comprising sandstone, siltstone and mudstone that is of coarse enough texture to serve as an important groundwater resource.

The Edmonton–Calgary Corridor Groundwater Atlas (Barker et al. 2011) identifies the Paskapoo Formation as the unit with highest potential to host aquifer systems and maps all of the water supply wells near Pigeon Lake as drawing from this important formation.

2.4 Watershed and Hydrology

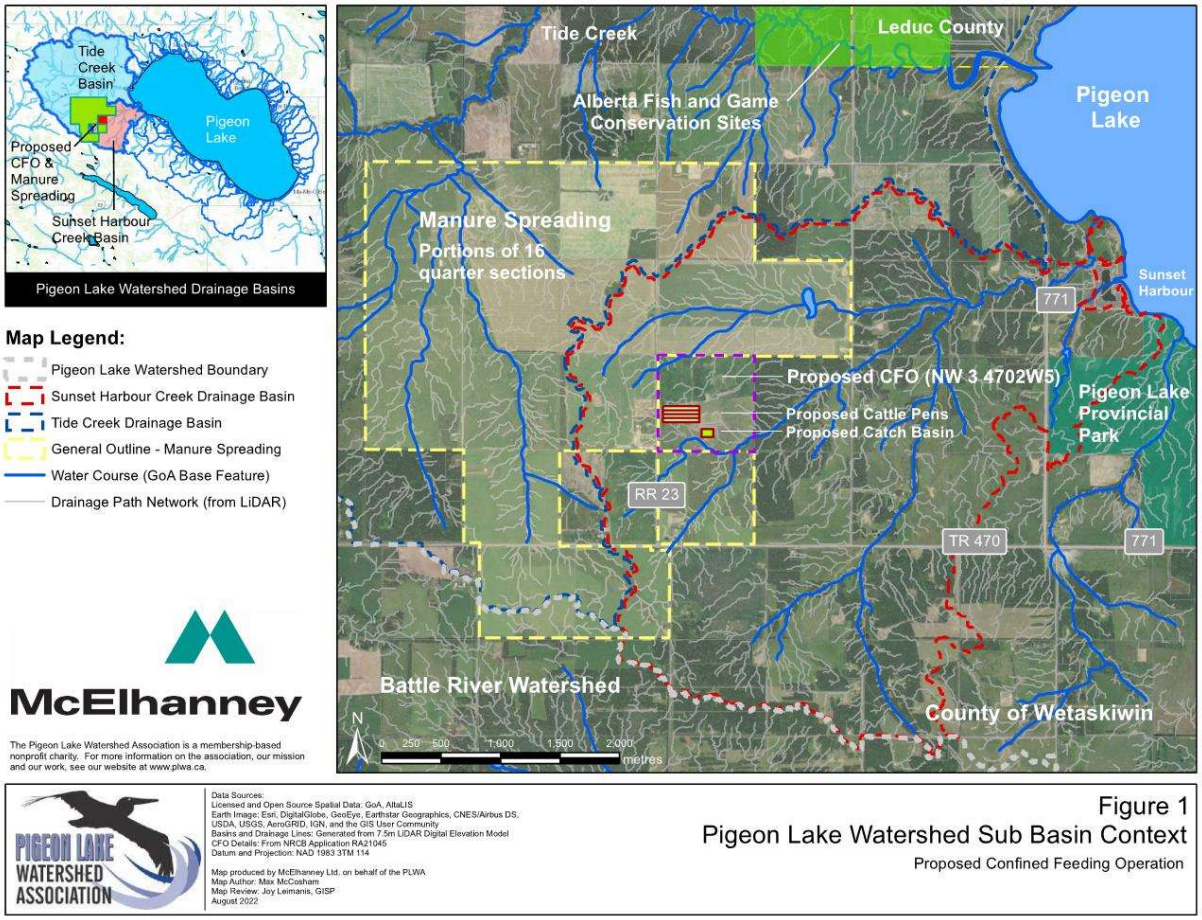
The Pigeon Lake Watershed encompasses an area of 284 km², including 96.7 km² for Pigeon Lake itself (PLWA 2018). Pigeon Lake is relatively shallow, with a mean depth of only 6.2 m. Inflow is from a number of intermittent streams that drain the west and northwest portions of the watershed. There is only one outlet, Pigeon Lake Creek, at the southeast margin of the lake; it drains toward the Battle River.

The lake's watershed is subdivided into 15 drainage basins that encircle the lake (Teichreb, Peter and Dyer 2014). The land proposed for the CFO and manure spreading straddles two of them, namely the Tide Creek and Sunset Harbour Creek drainage basins, illustrated on Figure 1. The yellow-outlined ranch lands designated for manure spreading are 70% within the Tide Creek drainage basin and 30% within the Sunset Harbour Creek drainage basin. The CFO quarter (NW 03-047-02 W5, indicated by the burgundy-dashed outline) is entirely within the Sunset Harbour Creek drainage basin.

Water levels in Pigeon Lake are controlled by a weir structure installed by AEP (formerly ESRD) in 1983. Because Pigeon Lake is shallow, its water column is frequently mixed by wind energy. Monitoring has shown little variation in temperature, dissolved oxygen, pH or conductivity relative to depth throughout the year (Teichreb, Peter and Dyer 2014).

The lake's water quality reflects local geology, resulting in high alkalinity, pH, and conductivity that create favourable conditions for the growth of cyanobacteria (blue-green algae). Total phosphorus accelerates algal growth in Pigeon Lake: even a slight increase of phosphorus can promote harmful algal blooms (Teichreb, Peter and Dyer 2014).

Figure 1 –Pigeon Lake Watershed Sub-Basin Context



3 Conceptual Site Model

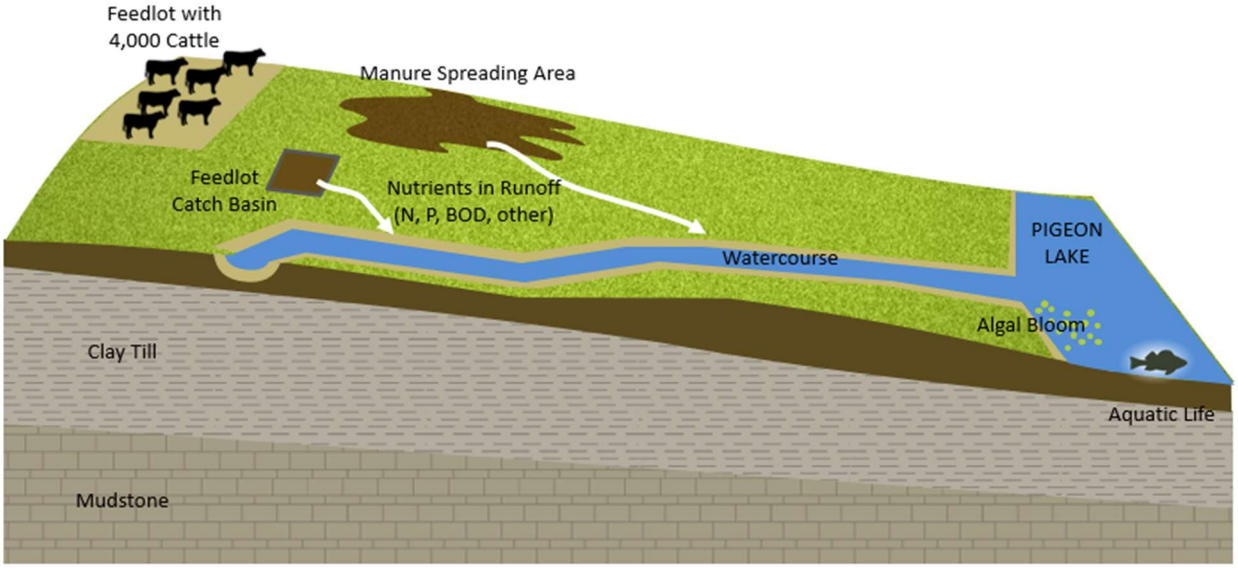
The purpose of a conceptual site model is to frame risk potential at a site by describing how the site did or could become contaminated (sources); how the contaminants are or may be transported (migration pathways); and where the contaminants will ultimately end up and whom or what they may affect (receptors).

3.1 Overview

CFOs pose a risk to watersheds because the confined herds produce large volumes of manure that must be disposed of, and manure spreading practices may exceed the assimilative capacity of land within economic transport distances. There is also the risk of catastrophic breach of manure holding facilities, and the risk of intermittent runoff of excess manure applied to water-saturated land under extreme precipitation events or during spring freshet (EPA 2004).

The Application proposes a feedlot for 4,000 head of cattle, a catchment basin downslope of their pens, and spreading their manure on 510 ha of land. Hydraulic transport of nutrients from cattle waste within the Pigeon Lake watershed, ultimately leading to Pigeon Lake, is the concern being addressed in this report. A conceptual site model illustrating surface water transport of nutrients from cattle waste toward Pigeon Lake is provided as Figure 2.

Figure 2 – Conceptual Site Model of Overland Transport



Intermittent watercourses and streams form a drainage network that conveys runoff and entrained nutrients from all parts of the watershed to the lake. The lower creeks and the lake support a wide range of freshwater aquatic life. People in the watershed region rely on groundwater for domestic purposes and use surface water for recreational purposes (e.g., fishing, swimming, water sports). Scientific research has shown that, compared to other Alberta lakes, Pigeon Lake has a small outflow and a large evaporative area that promote accumulation and concentration of pollutants that enter the lake (PLWA 2018).

In addition to the overland transport illustrated on Figure 2 and which is the focus of this report, there is potential for groundwater transport of nutrients.

3.2 Pollutant Sources

Manure from CFOs is associated with excess nutrients (e.g., phosphorus and nitrogen) and organic matter that can impair downstream water quality and affect aquatic organisms (EPA 2004). Secondary pollutants may include eroded sediment and substances associated with animal health or treatment (e.g., pathogens, hormones, and antibiotics). This report focuses on phosphorus, nitrogen, and organic matter.

3.2.1 Phosphorus

Phosphorus is typically present at high concentrations in manure but only at trace amounts in groundwater, partly because of its limited solubility and high soil/water partition coefficient. Transport of phosphorus away from CFOs is more likely to be via runoff than groundwater, partly because of the limited partitioning into groundwater and partly because undissolved phosphorus can be carried overland with particles of soil and organic matter.

Phosphorus is an essential element for all forms of biological growth and is readily taken up by plants. It is not directly toxic to humans, livestock, or fish. Phosphorus stimulates plant growth; excessive growth may occur in phosphorus-enriched environments. When manure is applied to land, phosphorus may easily exceed crop requirements for a given year and, if applications continue year after year, the soil

can become phosphorus-saturated and increase the risk of conveyance in surface runoff and groundwater (EPA 2004). In surface water, high concentrations of phosphorus may lead to harmful algal blooms. As the excessive plant matter dies and decomposes in surface water, oxygen is depleted and the water is rendered incapable of supporting aquatic life; this undesirable phenomenon is called eutrophication.

Cyanobacteria are photosynthetic blue-green algae that are common in surface water. They grow rapidly in response to high nutrient content, sunlight, and warm temperatures. The resulting harmful algal blooms cause not only unpleasant aesthetics for recreation enthusiasts, but also bring about fatal conditions for aquatic life and potential health risks to humans. Inhaling water droplets containing toxins from the algae may cause allergic responses such as runny nose or sore throat; direct contact can cause skin irritation, rashes, itchy eyes, and/or ear infections; and ingestion can cause potentially fatal hepatotoxic or neurotoxic effects (AHS 2022b).

3.2.2 Nitrogen

Livestock consume organic nitrogen present in plants and proteins and excrete the excess. In soil-water systems adjacent to CFOs, nitrogen will be present as ammonium under reducing conditions, as nitrate under oxidizing conditions, or as nitrite, an intermediate form that is created during oxidization of ammonium to nitrate.

3.2.2.1 Ammonium

Ammonium is highly water soluble and does not adsorb onto soil particles. However, its mobility in the ammonium form is limited because it tends to react with oxygen and oxidize to nitrite and nitrate. Consequently, ammonium plumes will transition to nitrite and nitrate plumes with increasing distances from CFOs.

Fish cannot tolerate large quantities of ammonium but effects on humans and livestock are minimal. Many plants can convert ammonium to organic nitrogen and grow vigorously when ammonium is present as a soil nutrient. Ammonium may promote excessive growth of aquatic plants and lead to eutrophication, which is fatal to fish and other aquatic life.

3.2.2.2 Nitrate

Like ammonium, nitrate is highly water soluble and does not adsorb onto soil particles. Hence, it is a highly mobile pollutant.

Plants exhibit stimulated growth in the presence of nitrate because they are capable of converting nitrate to organic nitrogen. Consequently, growth of aquatic plants can become excessive in surface water bodies with high nitrate concentrations and this can lead to eutrophication.

Nitrate is undesirable in domestic water supplies because it reduces the oxygen-carrying capacity of blood. At the extreme, bottle-fed infants are particularly at risk of developing a potentially fatal illness called methemoglobinemia (“blue baby syndrome”) if domestic water contains nitrates at concentrations higher than water quality standards. Livestock can be fatally poisoned by excessive nitrate consumption.

3.2.2.3 Nitrite

Nitrite, as an intermediate compound in the ammonium-nitrate oxidation-reduction process, is seldom detected in oxygen-rich water. Like ammonium and nitrate, nitrite stimulates plant growth and can lead to algal blooms and eutrophication.

Nitrite is more toxic to people and livestock than nitrate. In human drinking water supplies, nitrite is considered ten times more potent than nitrate.

3.2.3 Organic Matter

Organic matter is any substance containing an abundance of carbon-based compounds. Carbon is the dominant element in manure, and many carbon compounds contribute to oxygen depletion in water (EPA 2004).

Because the number of individual carbon compounds in organic matter can number in the millions, organic matter is quantified indirectly as biological oxygen demand (BOD), a bulk measure of the amount of oxygen required to decompose the organic matter under aerobic conditions. BOD is a commonly used measure of the degree of organic pollution in water.

In surface water with high BOD, oxygen is consumed during biodegradation of the organic matter and this can leave the water oxygen depleted and exhibiting eutrophication. In such situations, fish and other sensitive aquatic species may weaken or die.

3.3 Surface Water Receptors

As shown on Figure 1, there are many drainage paths and watercourses within the Tide Creek and Sunset Harbour Creek sub-watersheds. The nearest watercourse is a tributary of Sunset Harbour Creek; it is less than 30 m from the Proponent's proposed catch basin and 130 m from the proposed manure collection facility (not 400 m, as stated in the Application).

Drainage channels of the Sunset Harbour Creek and Tide Creek sub-watersheds pass through and collect runoff from the proposed manure spreading lands. Both Tide Creek and Sunset Harbour Creek drain into Pigeon Lake just downstream of the proposed CFO, as shown on Figure 1. The network of drainage paths and watercourses within the proposed manure spreading lands will serve to convey nutrient-rich runoff into Pigeon Lake.

The amount of water within each watercourse varies seasonally; peak flows have been observed during the spring freshet (snowmelt contributions) and after significant rainfall events (Teichreb, Peter and Dyer 2014).

3.4 Groundwater Receptors

Rural residents rely on groundwater wells. As noted in Section 2.3, the *Edmonton–Calgary Corridor Groundwater Atlas* (Barker et al. 2011) maps all of the water supply wells near Pigeon Lake as drawing from bedrock of the Paskapoo Formation. The Application includes drilling logs for six such wells near the proposed CFO development.

3.5 People and Wildlife

Pigeon Lake is one of the most intensely populated prairie lakes in Alberta. Area residents have responded to the proposed CFO with statements of concern. Many directly affected parties are household users and producers who, under the Water Act (RSA 2000, c. W-3), have the highest priority

to divert water from creeks. Statements of concern from neighbors to the proposed CFO area focus on contaminants in runoff and in creeks, which impact the viability of their traditional farming practices. For example, a number of downstream residents use creek water to irrigate their vegetable gardens and water their poultry/cattle. The health of the livestock and the safety of the non-processed foods grown in these gardens are vulnerable to the creeks becoming polluted by the proposed CFO. Creeks are also used by landowners for recreation and fishing, leaving them directly vulnerable to contaminants.

Wildlife diversity is high in the south-central portion of the Boreal Forest Natural Region in which the proposed CFO lands are situated (Natural Regions Subcommittee 2011). Bird populations are particularly rich and diverse, especially in forested and wetted areas. Western toads are also common in this area.

Fish populations are considered species-rich in the Boreal Forest region (Natural Regions Subcommittee 2011). With attention to water quality, Pigeon Lake recovered from a severely collapsed status in the late 1990s to become one of Alberta's premier Walleye fisheries (AEP 2020). However, Northern Pike have been at risk since at least 2015. In September 2020, monitoring nets captured 171 Walleye and 81 Lake Whitefish, but only 3 Northern Pike. Stringent conservation-based management was recommended to support the recovery of collapsed populations (AEP 2020).

4 Pollutant Load Estimation

Alberta's *Environmental Quality Guidelines for Alberta Surface Waters* advocate stringent guidelines for nutrient loads feeding into surface water bodies (AEP 2018):

> **Lakes** – "No increase in nitrogen (total) or phosphorus over existing conditions. Where nitrogen and/or phosphorus have increased due to human activity, develop lake-specific nutrient objectives and management plans where warranted."
>
> **Major Rivers** – "Nitrogen (total) and phosphorus concentrations should be maintained so as to prevent detrimental changes to algal and aquatic plant communities, aquatic biodiversity, oxygen levels, and recreational quality. Where priorities warrant, develop site-specific nutrient objectives and management plans."
>
> **Other** – "For surface waters not covered by specific guidelines, nitrogen (total) and phosphorus concentrations should be maintained so as to prevent detrimental changes to algal and aquatic plant communities, aquatic biodiversity, oxygen levels, and recreational quality. Where priorities warrant, develop site-specific nutrient objectives and management plans."

In this report, evaluation focuses on whether the proposed CFO will meet or exceed the standard of "no increase in nitrogen (total) or phosphorus over existing conditions," as recommended for Alberta lakes (AEP 2018), and on the mandatory obligation of the NRCB Approval Officer to consider "the effects on the environment, the economy and the community and the appropriate use of land" (AOPA, section 20(1)(ix)).

4.1 Approach

A computer model was selected to calculate nutrient loads on watersheds under the pressures of CFO activity. The *Spreadsheet Tool for Estimating Pollutant Loads* (STEPL; Tetra Tech 2020) is a computer model specially developed for the United States Environmental Protection Agency (US EPA) to calculate nutrient and sediment loads in runoff for land uses including feedlots and manure spreading operations.

The model uses a runoff curve approach to calculate annual runoff volumes based on precipitation and land characteristics, and determines how much CFO-sourced nutrients become mobilized into the runoff (i.e., the annual load).

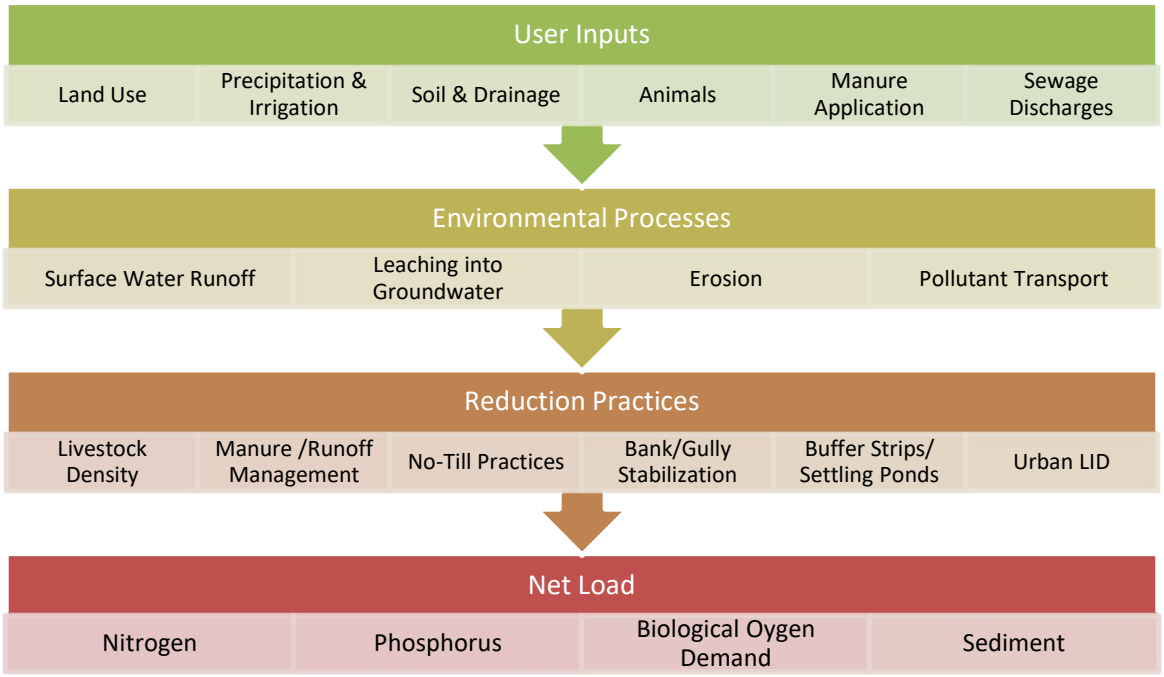
STEPL was recently superseded by the web-based *Pollution Load Estimation Tool* (PLET; Tetra Tech 2022). Both models use the same approach and logic but for the purposes of modelling conditions near Pigeon Lake, STEPL was selected because it accommodates overriding American weather station data and is therefore customizable to the Pigeon Lake watershed.

The STEPL model was populated with and without the proposed CFO inputs in order to determine quantities of nitrogen, phosphorus, and BOD likely to be transported via Tide Creek and Sunset Harbour Creek under pre- and post-development scenarios. The difference between the base case (no CFO) and the CFO case (as per the Application) indicates the nutrient loads above existing conditions, for comparison with Alberta's *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018). The computer model also facilitates evaluating sensitivity among input parameters (e.g., herd size and precipitation).

4.2 Model Structure

Loads to a watershed are calculated in STEPL from inputs describing terrain and precipitation, nutrient and sediment loads, and livestock management practices. The potential to reduce loading by applying best management practices (BMPs) can also be modelled. Figure 3 illustrates the model structure.

Figure 3 – Model Structure



For feedlots, the model calculates pollutant loads for the input livestock species and average weight (in this case, cattle). Feedlot runoff volumes are calculated based on contributing area in acres,

precipitation conditions, and amount of pavement. Similarly, runoff volumes for the manure spreading lands are based on the number of cattle, manure spreading area in acres, and precipitation conditions.

Since they are largely irrelevant to CFO operations, our set up of the model ignored sediment erosion and anthropogenic sources of nutrients (sewage discharges and urban runoff).

4.3 Inputs

4.3.1 Land Cover

Land cover affects what happens to precipitation. Pavement and bare rock generate more runoff than vegetated land, and the amount of infiltration and evapotranspiration depends to a large extent on the type of vegetation.

The STEPL model requires watershed areas to be characterized as urban, cropland, pastureland, forest and/or feedlot.

Teichreb, Peter and Dyer (2014) used land cover mapping to characterize the 15 drainage basins surrounding Pigeon Lake. For the two sub-watersheds straddled by the proposed CFO, land area under the various land cover types is summarized in Tables 1 and 2 (in both hectares and acres). The land cover types in Tables 1 and 2 were grouped as indicated to obtain the land use inputs for the STEPL model.

Land covered by open surface water represented no more than 2% of the land and was omitted for the sake of this exercise because of its essentially infinite runoff potential.

Currently, the quarter section proposed for the CFO's feedlot and about 14½ of the 16 quarter sections proposed for manure spreading appear to be used as pasture or for no-till hay production. To prevent buildup of manure, it is expected that the manure spreading lands will be disked or harrowed. Tilling will alter the runoff characteristics to be more similar to cropland; consequently, the developed scenarios assume these lands will take on the runoff characteristics of cropland. For the base case, it is assumed that 10% of the manure spreading lands are already cropland (i.e., the 109 acres in NE -09-047-02 W5 and 129 acres in NW -10-047-02 W5, as listed in the Application).

Table 1 – Land Cover Types in Tide Creek Sub-watershed

Area in hectares	Tide Creek Basin Total*	Proposed CFO in Tide Creek	Tide Creek Remainder	Area in acres	Tide Creek Basin Total*	Proposed CFO in Tide Creek	Tide Creek Remainder
URBAN		0.00	7.74	**URBAN**		0.00	19.13
Developed	7.74			Developed	19.13		
Exposed land	0.00			Exposed land	0.00		
FOREST		0.00	1,853.98	**FOREST**		0.00	4,581.27
Deciduous Forest	1,297.00			Deciduous Forest	3,204.94		
Coniferous Forest	294.60			Coniferous Forest	727.97		
Mixed forest	90.63			Mixed forest	223.95		
Shrubland	29.25			Shrubland	72.28		
Wetland	142.50			Wetland	352.12		
CROPLAND		357.00**	575.20	**CROPLAND**		882.16**	1,421.34
Annual Crops	610.90			Annual Crops	1,509.56		
PASTURELAND		0.00	2,700.80	**PASTURELAND**		0.00	6,673.80
Perennial Crops/Pasture	3,022.10			Perennial Crops/Pasture	7,467.74		
FEEDLOTS		0.00		**FEEDLOTS**		0.00	
Total Hectares	5,494.72	357.00	5,137.72	**Total Acres**	13,577.69	882.16	12,695.53

Table 2 – Land Cover Types in Sunset Harbour Creek Sub-watershed

Area in hectares	Sunset Harbour Creek Basin Total*	Proposed CFO in Sunset Harbour	Sunset Harbour Remainder	Area in acres	Sunset Harbour Creek Basin Total*	Proposed CFO in Sunset Harbour	Sunset Harbour Remainder
URBAN		0.00	4.86	**URBAN**		0.00	12.01
Developed	4.32			Developed	10.67		
Exposed land	0.54			Exposed land	1.33		
FOREST		0.00	513.89	**FOREST**		0.00	1,269.84
Deciduous Forest	467.90			Deciduous Forest	1,156.20		
Coniferous Forest	8.19			Coniferous Forest	20.24		
Mixed forest	21.96			Mixed forest	54.26		
Shrubland	8.55			Shrubland	21.13		
Wetland	7.29			Wetland	18.01		
CROPLAND		153.00**	91.70	**CROPLAND**		378.07**	226.59
Annual Crops	107.00			Annual Crops	264.40		
PASTURELAND		0.00	674.05	**PASTURELAND**		0.00	1,665.61
Perennial Crops/Pasture	816.40			Perennial Crops/Pasture	2,017.36		
FEEDLOTS		4.65		**FEEDLOTS**		11.50	
Total Hectares	1,442.15	157.65	1,284.50	**Total Acres**	3,563.62	389.57	3,174.06

Notes for Table 1 and Table 2:

* - from Teichreb, Peter and Dyer (2014); excludes open water

** - cropland for manure spreading within the CFO land base to be sourced 90% of from existing pastureland and 10% from existing cropland

4.3.2 Precipitation & Irrigation

The subject sub-watersheds (Sunset Harbour Creek and Tide Creek) are not under irrigation.

As regards precipitation, the STEPL model requires four parameters:

- Annual precipitation
- Number of rain days per year
- Percentage of rain days generating >5 mm precipitation
- Percentage of rain days generating runoff

For Canadian weather stations that have at least 15 years of data between 1981 to 2010, Canadian Climate Normals (ECCC 2022a) provide data for the first three parameters. The four nearest weather stations meeting Canadian Climate Normals criteria are profiled in Table 3 along with the CFO site.

Table 3 – Precipitation Statistics

	CFO Site	**Winfield**	Brightview	Dakota West	Calmar
Kilometres from CFO	0	**26**	34	36	37
Natural Region; Subregion	Boreal; Dry/Central Mixedwood	**Boreal; Central Mixedwood**	Parkland; Central Parkland	Boreal/Parkland; Dry Mixedwood/ Central Parkland	Parkland; Central Parkland
Annual precipitation (mm)	nm	**602.3**	525.8	528.8	515.8
Rain events/y	nm	**133.3**	133	97.2	105.4
Percent rain events >5mm	nm	**27.2%**	23.5%	34.1%	30.7%
Percent rain events generating runoff	nm	**28.4%**	26.1%	35.8%	33.2%

nm – not monitored

The percentage of rain days generating runoff is a supplemental parameter to characterize precipitation events. It is not a parameter reported by Environment and Climate Change Canada (ECCC 2022a). However, the STEPL model provides data for 4,999 American weather stations; multivariate regression using the reported annual precipitation and the number of days with precipitation ($R^2 = 0.75$) enabled estimation of this parameter for the Alberta sites. Sensitivity analysis using the upper and lower 95th percentile confidence limits for this parameter showed that it has 5% or less influence on the predicted pollutant loading estimates. Therefore, the values obtained by regression analysis were used (bottom row of Table 3).

On the basis of proximity to the CFO site and similar physiographic region, precipitation descriptors for the Winfield site were selected for the model. It is worthy to note that Calmar was identified in the Application as the comparable weather station. However, Calmar is located in the Central Parkland natural subregion, which is known to experience less precipitation than the Boreal Forest natural subregions in which the Proponent's lands are situated.

4.3.3 Soil & Drainage

Runoff potential is described in the STEPL model by hydrologic soil group (HSG), a parameter that relates to the rate of water infiltration through wetted, unvegetated soil. There are four soil/drainage options for HSG:

> A: High rate of water transmission (> 75 cm/hr) commonly associated with thick deposits of very well drained coarse sediments (e.g., sand, gravel)
>
> B: Moderate rate of water transmission (0.4 to 0.75 cm/hr) commonly associated with deep, well-drained soil ranging from moderately fine to moderately coarse texture (e.g., loam, silt).
>
> C: Low rate of water transmission (0.15 to 0.40 cm/hr) characteristic of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture (e.g., silty clay)
>
> D: Very low rate of water transmission (0 to 0.15 cm/hr) arising from high clay content, clay pan or clay layer at or near the surface, and possibly a perpetually high water table

Soil on the west side of Pigeon Lake ranges from silty sand to silty clay with underlying glacial till, and is likely to have a low rate of water transmission. Therefore, ***HSG category C*** is deemed the most appropriate selection.

Drainage is described in section 2.4. The proposed CFO cattle pens and catch basin are upslope of a tributary of Sunset Harbour Creek. This watercourse is about 30 m from the catch basin and 130 m from the manure collection facility (not 400 m, as stated in the Application). Terrain evaluation using LiDAR data indicates slope classes between the cattle pens, catch basin and the Sunset Harbour Creek tributary ranging up to 12% (greater slopes near the creek than near the cattle pens).

4.3.4 Cattle

The Application requests approval for a 4,000 head cattle CFO. This size of operation is assessed as the proposed development case using the STEPL model. To accommodate 4,000 head of cattle, the Application states that the CFO will comprise the following:

- feedlot pens totalling 40,197 m² including a roofed area of 11, 582 m²
- feedlot catch basin 6,336 m² footprint
- manure spreading lands totalling 510 ha

Manure storage capacity stated in the Application is identical to the footprint of the feedlot pens, indicating that a separate manure collection and storage facility is not planned. It is expected that manure will be collected from the cattle pens periodically but spread only when the ground is thawed and free of snow cover. For the purposes of the model, 6 months of manure application was assumed.

The STEPL model was run with two active BMPs to address modern CFO operations:

- a runoff collection system for the entire feedlot (cattle pens and catch basin)
- grass buffer strips between manure spreading areas and watercourses

Given the Application land base, AOPA regulations could permit a confined feedlot for up to as many as 10,000 head of cattle. Hence, a 10,000 head operation was also assessed. For the 10,000 head assessment, the analysis scaled up the 4,000 head facility 2.5 times:

- feedlot pens totalling 100,493 m² including a roofed area of 28,955 m²
- feedlot catch basin 15,840 m² footprint
- manure spreading lands totalling 1,075 ha (2.5 times would be 1,275 ha, but the Application shows that lands available for manure spreading total only 1,075 ha)

4.4 Results

Results of STEPL modelling are outlined below.

4.4.1 Runoff Production

Currently, the lands proposed for the CFO are largely used for pasture and/or no-till hay production (perennial crops). Disking or harrowing for the purpose of manure incorporation on the spreading lands will alter the land's runoff characteristics.

- For the 510 ha of manure incorporation lands associated with the proposed 4,000-head cattle CFO the STEPL model predicts a net 4% increase in runoff in the Sunset Harbour Creek sub-watershed and 3% increase in the Tide Creek sub-watershed.
- For a 10,000-head cattle operation (implying utilization of the full 1,075 ha of lands listed in the Application), the runoff increases are predicted at 7% for the Sunset Harbour Creek sub-watershed and 3% for the Tide Creek sub-watershed.

Implications of increased runoff include greater erosion potential along the watercourses and increased conveyance of pollutants.

4.4.2 Nutrient Loading

A 4,000-head beef cattle operation can be expected to yield 13,120 tonnes of manure annually (AARD 2010). Although the phosphorus and nitrogen content of cattle manure averages only 0.09% and 0.72%, respectively (AARD 2010), the vast quantities of manure translate to approximately 12,000 kg/yr of phosphorus and 94,000 kg/yr of nitrogen. Much of this load will be absorbed by vegetation/soils but a fraction will be transported overland with runoff.

The STEPL model estimates that the addition of a 4,000-head cattle CFO will release to the watershed phosphorus, nitrogen, and BOD in the amounts presented in Table 4.

Table 4 – Nutrient Loading Attributable to the Proposed CFO

	Tide Creek	Sunset Harbour Creek	Total
Phosphorus (kg/yr)	122	140	262
Nitrogen (kg/yr)	425	2,608	3,033
BOD (kg/yr)	787	3,570	4,357

The relative proportions of nutrients mobilized into runoff are unequal because of different physical, chemical, and biological processes affecting the attenuation of phosphorus versus nitrogen versus BOD.

The combined phosphorus plus nitrogen transported overland in the runoff is a mere 3% of what is present in the manure mass but is nonetheless a supplemental load for the sensitive Pigeon Lake watershed to attenuate.

For phosphorus, AEP (formerly Alberta Environment and Sustainable Resource Development) developed an annual budget for Pigeon Lake (Teichreb 2014). On account of the lake's small outlet, total inflows of 6,096 kg/yr (of which 3, 290 kg/yr stem from runoff) were offset by outflows of only 341 kg/yr. The addition of 262 kg/yr of phosphorus is a substantial increase that would further stress Pigeon Lake's susceptibility to algal blooms from already-high phosphorus concentrations.

4.4.3 Concentration Increases in Watercourses

The predicted phosphorus, nitrogen, and BOD loads can be combined with rates of runoff production to estimate average concentration increases in the streams that convey the runoff. The calculation is as follows:

$$C = \frac{L}{Q} \times \frac{10^6}{10^3}$$

Where:

C = pollutant concentration in mg/L
L = pollutant load in kg/yr
Q = runoff flow in m^3/yr
10^6 = a conversion factor (mg/kg)
10^3 = a conversion factor (L/ m^3)

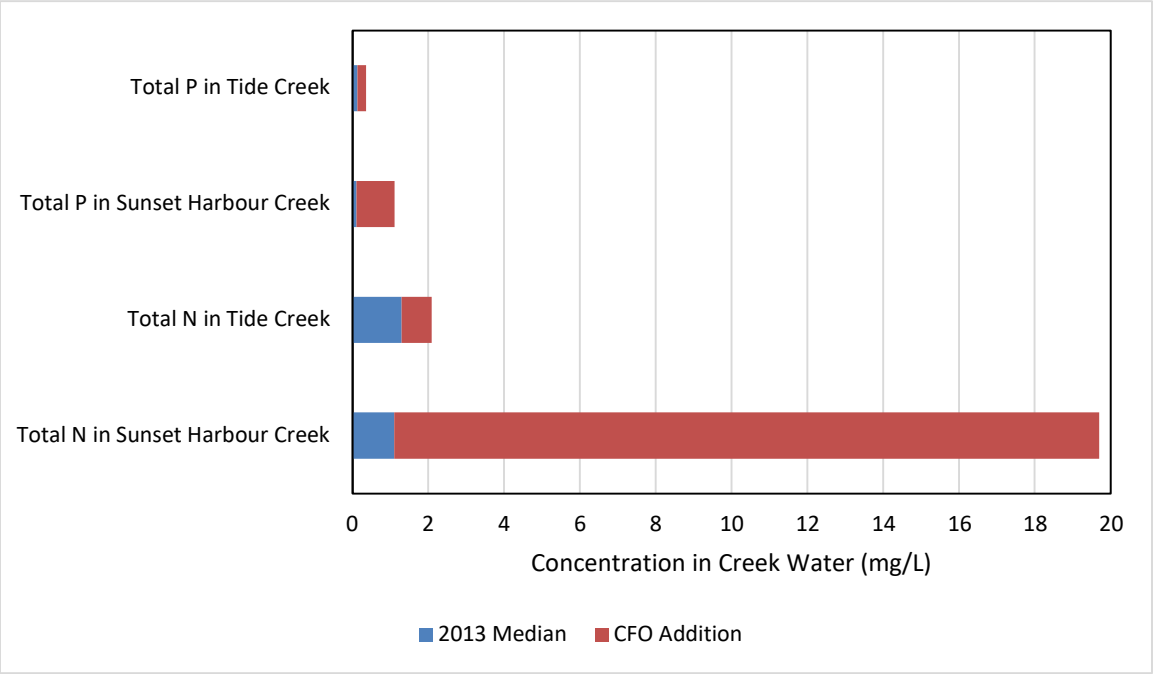
For this calculation, the total predicted runoff must be used rather than just the incremental increase associated with CFO operations. The results are summarized in Table 5. Concentrations estimated in Table 5 are average incremental increases *above existing concentrations*: net concentrations will be higher than these values.

Table 5 – Average Concentration Increases in Tide Creek and Sunset Harbour Creek

	Tide Creek *Q* = 536,806 m^3/yr	**Sunset Harbour Creek** *Q* = 140,189 m^3/yr
Load, *L* (kg/yr)		
Phosphorus	122	140
Nitrogen	425	2,608
BOD	787	3,570
Concentration, *C* (mg/L)		
Phosphorus	0.23	1.0
Nitrogen	0.79	18.6
BOD	1.5	25.5

Creek sampling in 2013 (Teichreb, Peter and Dyer 2014) assessed phosphorus and nitrogen in streams including Tide Creek and Sunset Harbour Creek. Figure 4 illustrates the addition of the concentrations in Table 5 to the median 2013 values. It is apparent that the inputs from the proposed CFO represent substantial increases: more than an order of magnitude in the case of Sunset Harbour Creek.

Figure 4 – Additive Concentrations of Phosphorus and Nitrogen in Creek Water



Water flow and manure production are not uniform throughout the year. Consequently, concentrations of phosphorus, nitrogen and BOD will fluctuate. Concentrations are likely to peak after events that convey more manure constituents than average, such as the spring freshet and large rainfall events (Teichreb, Peter and Dyer 2014); these events are expected to result in higher concentration increases than estimated in Table 5 and Figure 4. Conversely, dry spells are likely to result in less runoff and therefore less conveyance of nutrients toward the lake.

4.5 Sensitivity Assessment

The STEPL model is a deterministic model that does not inherently assess the implications of a range of possible input values. However, as a spreadsheet model, it accommodates sensitivity analysis by allowing the user to test the effect of varied inputs. Of particular interest in this evaluation are the effects of herd size (future expansion of a CFO) and larger precipitation events (climate change).

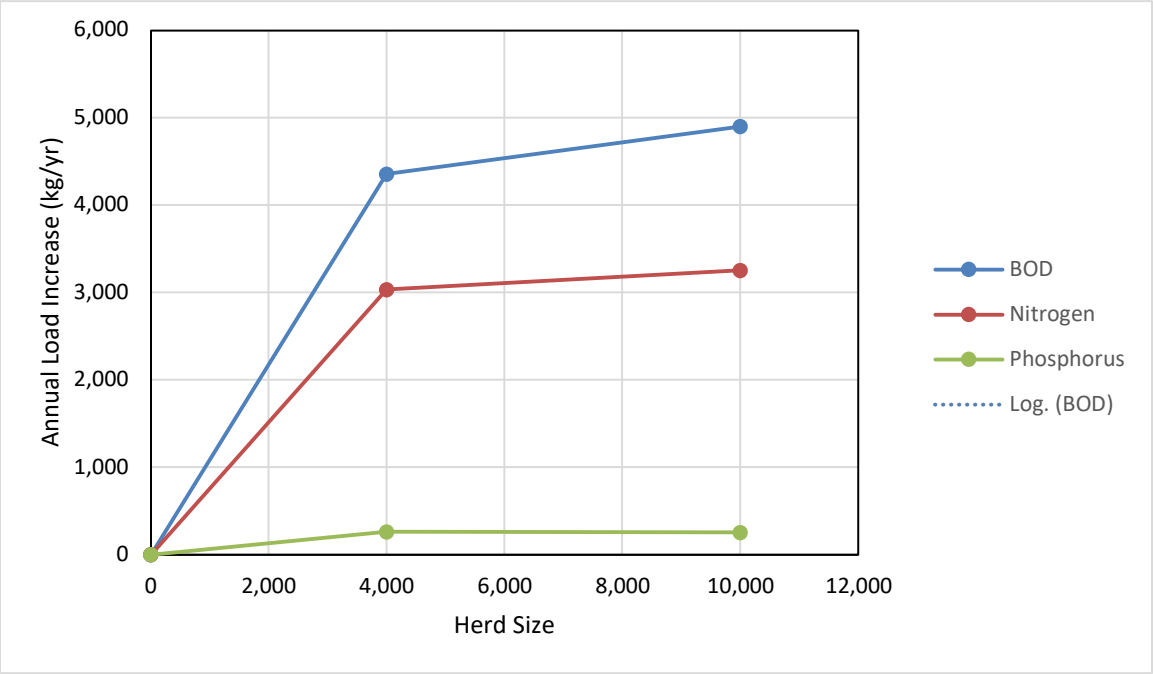
4.5.1 Herd Size

The STEPL model was run with three herd size inputs:

- zero head of cattle, representing no increase above current conditions
- 4,000 head of cattle, representing the Application
- 10,000 head of cattle, representing future herd expansion

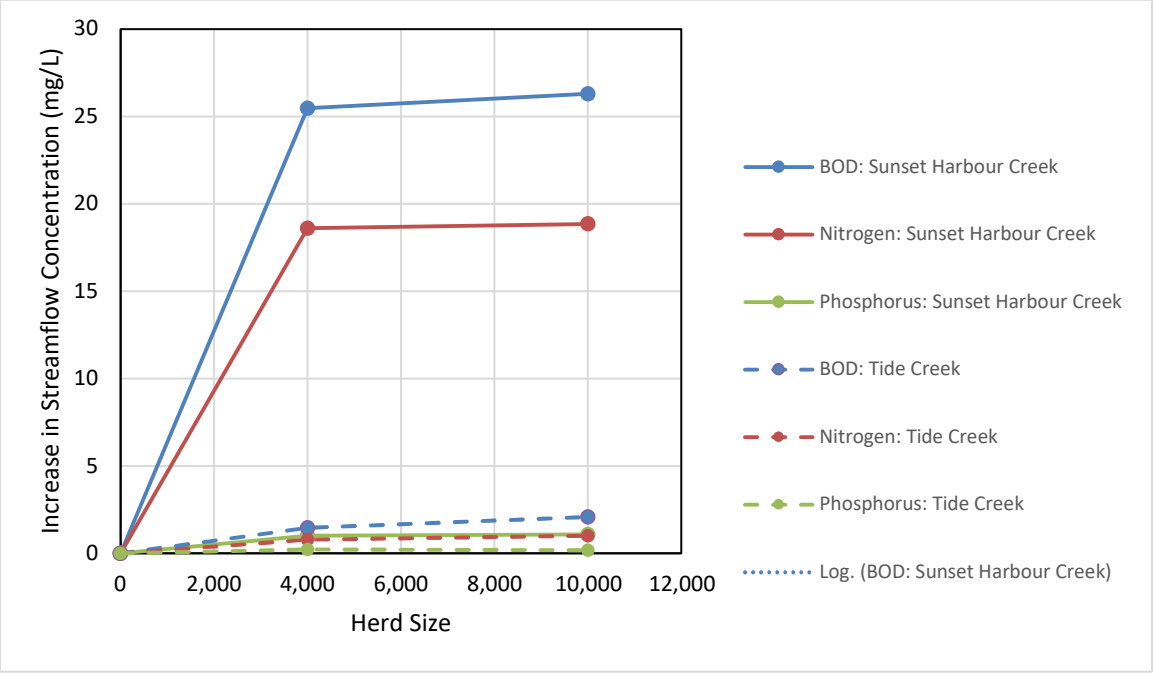
Results on predicted phosphorus, nitrogen and BOD loading are plotted on Figure 5. Values represent the total additional loading from both sub-watersheds combined (Tide Creek plus Sunset Harbour Creek), indicating total loads conveyed to Pigeon Lake. Having a larger number of animals in the CFO increases predicted loading, but not in a linear fashion (due to the presumed expansion from 510 ha of manure spreading lands to 1,075 ha to accommodate the increased manure load).

Figure 5 – Effect of Herd Size on Predicted Loading



Results on water quality may be assessed in the same manner. Predicted increases in phosphorus, nitrogen and BOD loading are plotted on Figure 6.

Figure 6 – Effect of Herd Size on Surface Water Concentration Increase



The number of animals in the CFO has a more pronounced effect on water quality in Sunset Harbour Creek than in Tide Creek; this is attributable to more concentrated development in the smaller Sunset Harbour Creek sub-watershed.

4.5.2 Precipitation

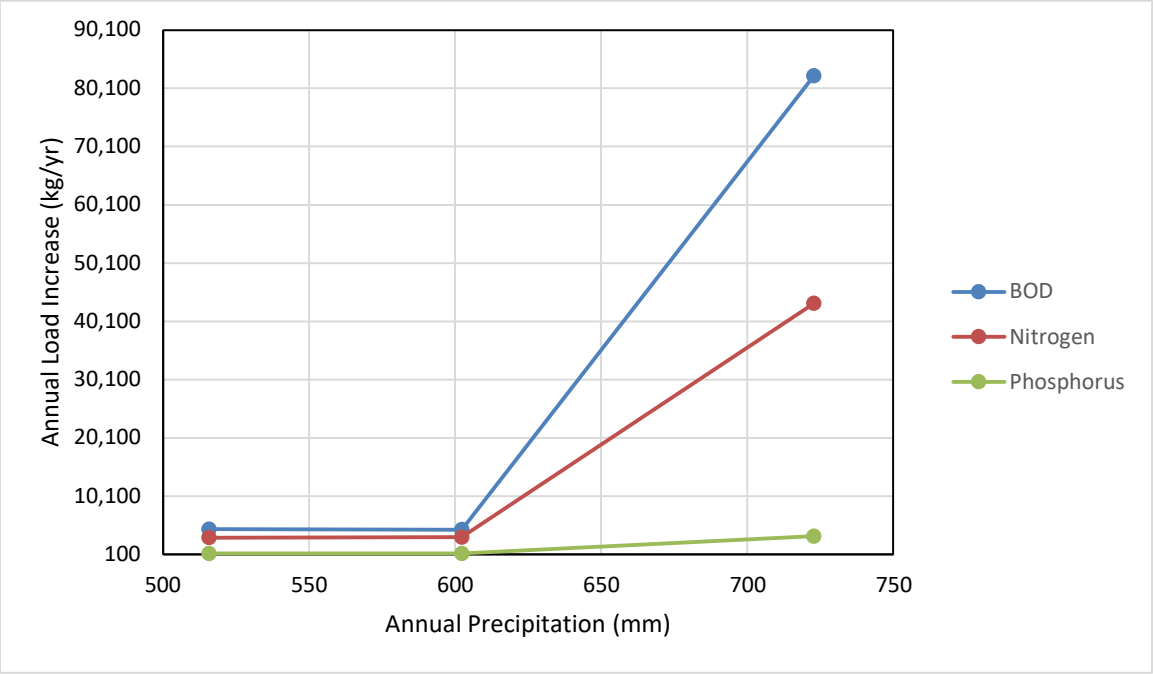
For a 4,000-head cattle operation, the STEPL model was run with three precipitation inputs:

- Annual precipitation of 515.8 mm, representing a drier-than-average year at Pigeon Lake (equivalent to Calmar's precipitation averaged over more than 20 years)
- Annual precipitation of 602.3 mm, representing conditions at Winfield (the nearest weather station in the same Natural Subregion) averaged over more than 20 years
- Annual Precipitation of 722.8 mm, representing a 20% increase over Winfield's average precipitation (a wetter-than-average year; possible future conditions in light of climate change)

For the dry and average precipitation cases, parameters for Calmar and Winfield were used (Table 3). For the wet case, the number of precipitation events greater than 5 mm was increased to 80% and the number of events generating runoff was increased to 30%, both based on review of STEPL values for weather stations exhibiting this much annual precipitation. The number of rain days was kept at 133.3.

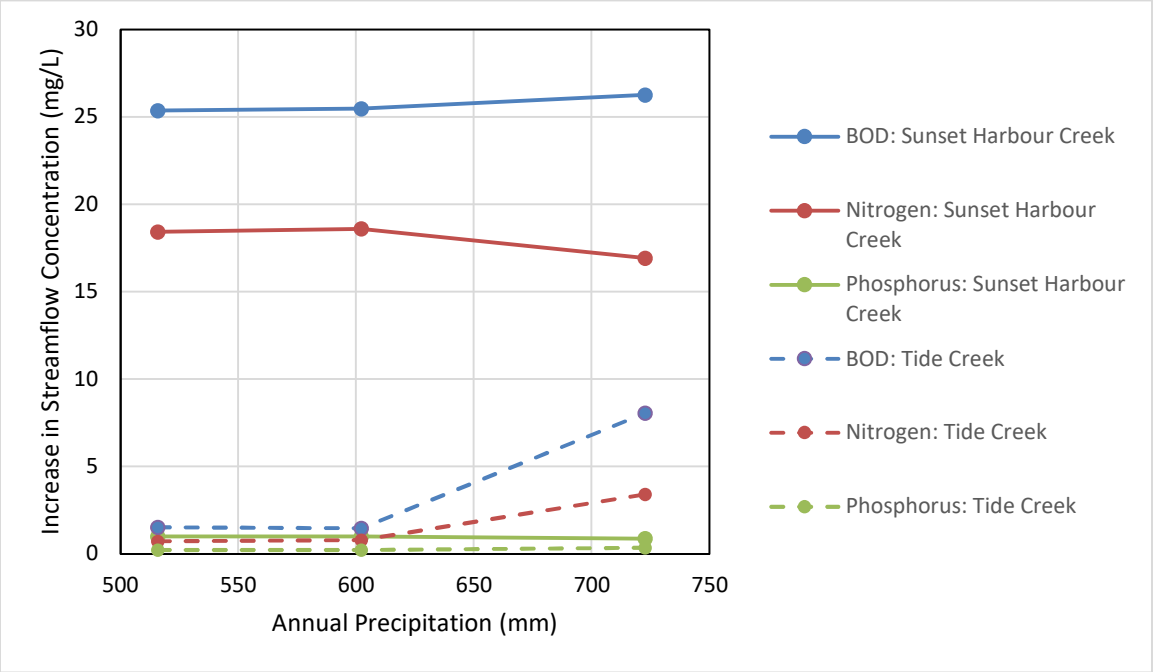
Results on predicted phosphorus, nitrogen and BOD loading are plotted on Figure 7. Values represent the total additional loading from both sub-watersheds combined (Tide Creek plus Sunset Harbour Creek), indicating the incremental loads conveyed to Pigeon Lake.

Figure 7 – Effect of Precipitation on Predicted Loading



Results on water quality were assessed similarly. Predicted phosphorus, nitrogen and BOD loading increases above the base case (Winfield precipitation; no CFO) are plotted on Figure 8. The increased concentrations from additional precipitation are not strongly pronounced and in the case of Sunset Harbour Creek decrease under the wettest scenario. This is rationalized by the increased precipitation conveying greater loads in runoff and, at the same time, diluting the runoff.

Figure 8 – Effect of Precipitation on Surface Water Concentration Increase



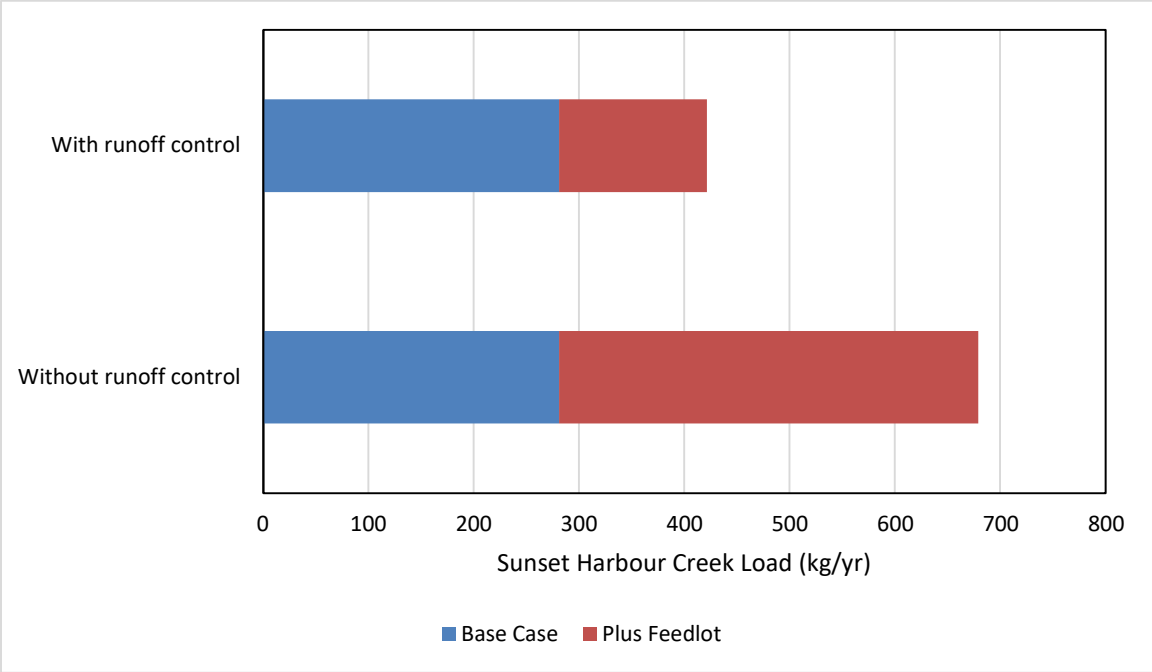
4.5.3 Catch Basin Overflow

A concern with waste containment basins is the potential for overflow, such as from repeated storm events (EPA 2004). Large precipitation events add stormwater to catch basins (reducing freeboard) and can make the surrounding ground too soggy to support heavy equipment for emptying the catch basin for a number of days.

The STEPL model was run assuming that the feedlot would maintain an effective runoff management system (drainage captured and conveyed to the feedlot catch basin). The catch basin dimensions provided in the Application (96 m × 66 m × 1.5 m) indicate an evacuation capacity of 8,451 m³ and a design containment (capacity minus freeboard) of 5,403 m³ (Alberta Agriculture 2012). The proponents' Request for Review revised the catch basin depth to 1.75 m, which would indicate an evacuation capacity of 9,664 m³ and a design containment (capacity minus freeboard) of 6,616 m³ (Alberta Agriculture 2012).

While the precipitation itself is essentially fresh water, the portion landing on the feedlot footprint will pick up cattle waste and convey it to the catch basin. The proposed feedlot and catch basin are both within the Sunset Harbour Creek sub-watershed; overflow will not affect the Tide Creek sub-watershed. To estimate the effect of overflow, the STEPL model was run assuming no feedlot runoff management system. The effect is particularly pronounced for phosphorus. Sunset Harbour Creek sub-watershed loadings above background with versus without the catch basin are illustrated on Figure 9.

- **Figure 9 – Sunset Harbour Creek Phosphorus Load with and without Runoff Control**



With a functioning catch basin and runoff control system, the proposed CFO would add 140 kg/yr to the current phosphorus load in the Sunset Harbour Creek sub-watershed; this expands to 398 kg/yr if the runoff control system fails. The difference of 258 kg/yr represents a full year's worth of catchment and is therefore a worst-case estimate. During an overflow event some portion of the fluid within the catch basin will be retained and lessen the load accordingly.

Because rain and snowmelt have the effect of diluting concentrations, effects on water quality in Sunset Harbour Creek will depend on the amount of precipitation and runoff associated with the freshet or storm event. If the flow is sufficiently large, concentrations within Sunset Harbour Creek may be very low. The greater and more long-lasting concern is the total loading being conveyed to Pigeon Lake (section 4.4.2) since the lake tends to retain nutrients and promote algal blooms (PLWA 2018; Teichreb 2014).

5 Discussion

Using inputs from NRCB Application RA21045, scientific studies on the Pigeon Lake watershed, and information in the public domain, the potential effects of the Proponent's proposed CFO on surface water quality was modelled. The chosen spreadsheet model (Tetra Tech 2020) was developed for the US EPA to aid in determining effects of feedlots, manure spreading and other operations on nutrient loading. The results provide insights into runoff water quality, creek water quality, and nutrient loading of Pigeon Lake. Results are discussed below.

5.1 Non-Zero Increases

Alberta's *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018) recognize that nutrient enrichment is detrimental to Alberta's lakes, rivers, and streams. Nutrient increases can lead to "undesirable growth of algae and aquatic macrophytes that can contribute to recreational and aesthetic impairments, outbreaks of toxic cyanobacteria, shifts in species assemblages, and ultimately, a reduction in dissolved oxygen levels and biodiversity" (AEP 2018). For this reason, the guidelines stipulate that lakes should see *no increase* in nitrogen or phosphorus over existing conditions and that in other surface water bodies such as streams nitrogen and phosphorus concentrations should be maintained so as to prevent detrimental changes to algal and aquatic plant communities, aquatic biodiversity, oxygen levels, and recreational quality.

Modelling showed that siting a 4,000-head cattle CFO as outlined in the Application is likely to lead to substantial increases in phosphorus, nitrogen, and BOD concentrations in creek water (Table 5 and Figure 4). These creeks convey runoff to Pigeon Lake, which is prone to concentrating contaminants on account of its small outflow and large evaporative area (PLWA 2018; Teichreb 2014).

Small increases in runoff-sourced nutrients will have a significant impact on Pigeon Lake, which is already exhibiting limits in its ability to assimilate external nutrient loads. Where limited nutrient assimilation is already causing harmful algal blooms, new sources of nutrients will accumulate in the lake and drive further increased frequency, intensity, and duration of algal blooms. This is the underlying reason for the no net increase in nutrients stipulated by the *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018), and why even small amounts matter.

5.2 Particularly Sensitive Ecosystem

Legislative standards and guidance developed by the NRCB for siting CFO operations are intended for use at candidate sites in Alberta but do not address especially sensitive ecosystems. In particular, the *Environmental Risk Screening Tool* (NRCB 2011) was developed bring consistency and transparency to the assessment of potential environmental risk from confined feeding operations and manure storage facilities. This tool is a simplification of the risk assessment process and considers the likelihood of impacts reaching a surface water body and the number of human users of that surface water body, but it does not consider the assimilative capacity of the surface water body nor its history of harmful algal blooms.

The recurring water quality issues in Pigeon Lake are evidence that the lake has limited ability to assimilate nutrient loads. To protect the lake and its value to residents and visitors alike, abiding by AEP's no-net-concentration-increase in lakes and complying with the watershed management goals set out in the *Pigeon Lake Watershed Management Plan* (2018) will be crucial. Allowing development of the proposed CFO will jeopardize the lake by increasing its nutrient loading, creating conditions favourable to harmful algal blooms, and causing human health and ecological risks attributable to cyanobacteria and eutrophication.

5.3 Expansion of Operations

While the Application is silent on expansion plans, AOPA regulations may allow later expansion that would bring about even greater damage to the Pigeon Lake watershed, which is in precarious balance with its existing nutrient sources and is subject to a comprehensive Watershed Management Plan (PLWA 2018). Watershed modelling has shown that expansion of the proposed 4,000-head cattle CFO would have a profound effect on nutrient loading in runoff and on concentrations in the two creeks that drain the CFO watershed (Figures 5 and 6). This would further increase the ecological and human health risk.

5.4 Climate Change

The NRCB guidance for establishing CFOs (e.g., NRCB 2011) has not been updated to address what Canadians are learning about climate change. Environment and Climate Change Canada (ECCC; 2022b) advises that increasing temperature, precipitation, and evapotranspiration are likely; model predictions include sites near the CFO (e.g., Fisher Home). Our modelling has shown that increased precipitation is likely to convey even greater amounts of phosphorus, nitrogen, and BOD and toward the lake (Figure 6); increased temperature will bring about conditions for algal blooms and oxygen depletion within the relatively shallow waters of Pigeon Lake. The ecological and human health risks attributable to cyanobacteria and eutrophication will be further increased under such scenarios.

5.5 Impacts Beyond Surface Water

This report focused on potential impacts to surface water between the proposed CFO and Pigeon Lake. While modelling was able to establish non-zero increases in phosphorus, nitrogen and BOD in runoff, there are other impacts that were not addressed. These include groundwater loading by nitrogen in particular (nitrate, nitrite and/or ammonium) and releases of ammonia and methane into air. Surface water is seen as the major receptor of CFO pollutants and is the subject of this report, but the existence of the other concerns should be acknowledged as well.

6 Conclusion and Recommendation

Watershed modelling using a pollutant load calculator provided by the US EPA (Tetra Tech 2020) indicates that the CFO described in the Application will result in substantial phosphorus, nitrogen, and BOD loads to Pigeon Lake. The lake is already ecologically sensitive, as evidenced by its repeated susceptibility to harmful algal blooms from already-high phosphorus concentrations (Teichreb 2014). Small increases in runoff-sourced nutrients will have a significant impact on Pigeon Lake. Cyanobacteria manifest both ecological and human health risks, and eutrophication from the algal blooms brings about toxic conditions for aquatic life.

Guidance for CFO applications and NRCB operational standards were not developed for sites as sensitive as Pigeon Lake. Our modelling took into consideration local precipitation patterns and soil hydrologic properties. Results indicate that even with runoff management at the feedlot and buffer strips alongside manure spreading areas, phosphorus, nitrogen and BOD loads will be conveyed in surface runoff to the lake at quantities exceeding *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018). Loading will be even higher if the CFO later expands to accommodate more cattle.

The criteria for establishing CFOs in Alberta (e.g., NRCB 2011) do not consider the likely impacts of climate change. Canadian climate models predict that both temperature and storm activity will increase with global warming (ECCC 2022b). Increased precipitation is likely to convey even greater amounts of

phosphorus and nitrogen toward the lake, and increased temperature will bring about conditions for algal blooms and oxygen depletion within the lake. The result will be increased ecological and human health risk.

Clearly, the Pigeon Lake watershed is not positioned to accommodate a CFO. It is recommended that the Application be denied because the development proposed in the Application would have unacceptable impacts on "the environment, the economy and the community and the appropriate use of land" (AOPA; RSA 2000, c. A-7, s. 20(1)(ix)).

Only in the absence of confounding load increases can nutrient loading be managed in accordance with the *Pigeon Lake Watershed Management Plan* (PLWA 2018). Maintaining water quality and ecosystem balance are crucial for the viability of Pigeon Lake as a valued water resource for current and future generations.

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TAB 18

Unit 154 Heritage Court
150 Chippewa Road
Sherwood Park, Alberta
T8A 6A2

CPP ENVIRONMENTAL Charette Pell Poscente

August 22, 2022

To Whom It May Concern,

I was asked by Rick Melia, Pigeon Lake Watershed Association Director and Confined Feedlot Operation lead to provide expert scientific input on the potential impacts of the proposed confined livestock feeding operation on Pigeon Lake, Alberta. I provide this letter on behalf of the PLWA, Dave Labutis, and Gloria and Randy Booth.

I am a registered Professional Biologist, a Qualified Aquatic Environmental Specialist (as defined by the Water Act), a Wetland Authenticating Professional, and a co-founder of CPP Environmental. As Operations Director, I oversee the technical division and water-related technical assessments in support of regulatory applications, reclamation plans, state of the watershed reports, and special scientific projects. I have over 20 years of experience in water quality science, aquatic ecosystems, watershed management planning, water policy, mine reclamation, and working in multi-stakeholder environments in Alberta. I was a co-author and advisor for the Pigeon Lake Watershed Management Plan, including directly supervising and co-authoring the technical appendix.

From a regulatory standpoint, federal and provincial acts, regulations, and guidelines prohibit the unauthorized deposition of deleterious substances to the environment. The Alberta Surface Water Quality Guidelines for the Protection of Aquatic Life (Table 1.5) states “no increase in nitrogen (total) or phosphorus over existing conditions” for lakes. Section 36 of the Fisheries Act states that “no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water”. The Environmental Protection and Enhancement Act (Part 5, s109) states that “no person shall knowingly release or permit the release into the environment of a substance in an amount, concentration or level or at a rate of release that causes or may cause a significant adverse effect”. These acts, regulations, and guidelines were put in place to protect aquatic ecosystems in Canada and Alberta.

Pigeon Lake is a very fragile ecosystem. The area that drains into Pigeon Lake (its watershed), is only about 2 times larger than the lake itself. As a result, the average amount of time that water stays in the lake (i.e., water residence time) is over 100 years. This means that once a pollutant enters the lake, it stays there for a very long time. Any pollutants that enter the lake (e.g., herbicides, fertilizers, sediment, sewage) are not readily flushed out of the system and remain in the lake for a long time. This highlights the tremendous importance of nutrient management.

Excessive quantities of nutrients can promote problematic overgrowth of cyanobacteria, also known as blue-green algae blooms. These algal blooms can sometimes produce dangerous toxins, negatively impacting water quality and causing problems for human and ecological health. While many central Alberta lakes, including Pigeon Lake, are naturally productive, increased human development and land cover changes within watersheds over the past century have increased the rates of nutrient input into waterbodies and accelerated eutrophication rates. Scientific research has shown that algal blooms have become more severe and frequent in Pigeon Lake, especially since 2002.

Currently, both external (i.e., P from the watershed or atmosphere) and internal (P released from the lake sediments) nutrient sources contribute to elevated nutrient levels in Pigeon Lake. Studies have estimated external nutrient inputs at between 43 and 55% of total nutrient inputs. However, it is important to realize that nutrients that are stored in lake sediments originate from external sources. Thus, reducing nutrient inputs from the watershed are critical to the long-term health of Pigeon Lake.

I have reviewed the report entitled "*Estimation of Pollutant Loads in Surface Water Runoff from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed*". This report assesses potential nutrient loading associated with the proposed CFO. Computer modelling has estimated an increase in surface water quality within Sunset Harbour Creek (which drains to Pigeon Lake) to be 1.0 mg/L of phosphorus, 18.6 mg/L of nitrogen, and 25.5 mg/L of BOD; concentrations in Tide Creek (which also drains to Pigeon Lake) are estimated at 0.23 mg/L of phosphorus, 0.79 mg/L of nitrogen, and 1.5 mg/L of BOD. At first glance, these numbers appear to be low. However, average phosphorus concentrations since 1986 in Pigeon Lake were much lower, between 0.015 mg/L and 0.072 mg/L. Due to the long water residence time of Pigeon Lake, even small increases in nutrient inputs into the lake will compound over time and affect lake health in the long term.

The Pigeon Lake Watershed Management Plan is a comprehensive document that presents a suite of beneficial management practices intended to limit nutrients within the watershed lands, the shoreline area, and the lake itself. What is clear is that, through the concerted efforts of many individuals, restoring a lake takes a long time. The goal of restoring Pigeon Lake to natural nutrient levels requires incremental efforts. Adding such a significant source of nutrients to Pigeon Lake would directly counter these efforts.

Sincerely,

Théo Charette, M.Sc., P.Biol.
Senior Aquatic Ecologist
Director of Operations

Office: (780) 570-5818 *Fax: (780) 570-5820* *www.cppenv.ca*

TAB 19

March 18-2022To

NRCB

We at the Appelman farm [redacted] have some concerns about the application from RA21045 Greg Thalen and G&S cattle ltd that we would like to address. First we are concerned about how this will affect the water table and quality of water for us. Second we are concerned about diseases being brought in. Third we will be affected by the smell of such a large concentration of animals

4,000 cows, above what's already there, drink a lot of water. What will it look like for us? Will we be forced to drill a deeper well in order to provide our animals and ourselves with water? Who is paying for that? Will the water quality be monitored?
A Lagoon will not catch all the manure and urine from the cows and will end up in the soil and waterways which is a big concern for water quality.

Before Thalens took over the Baumann farm our cows and calves were very healthy. We have a closed heard and rarely experienced sick calves. Since they brought in a large scale operation in such close proximity to our farm we have experienced a lot more sick cows and calves, forcing us to now vaccinate them to avoid loss. Bacteria and viruses will be brought into our farm by birds and through the air. What will this look like with an added 4,000 cows on top what's already there?

The whole area will be affected by the smell from this large concentration of cows. All these factors have a huge impact on our quality of living and on our property value

Hans & Jolanda Appelman

[redacted]

TAB 20

STATEMENT OF CONCERN

For directly affected property owners near Pigeon Lake

Re: Natural Resources Conservation Board Application RA21045-

Confined Feeding Operation, Greg Thalen and G and S Cattle Ltd.

Filer Information

Name: Ozzie and Jennie Labutis

Rural Address: [redacted]

Legal Land Description: [redacted]

Mailing Address: [redacted]

Phone: [redacted]

Email:

Statement of Concern

The Confined Feeding Operation, Application RA21045, should be declined

Response from a Directly Affected Party

My Background:

My parents were one of the first people in the area that settled and began farming this land back in 1928 and we now have our great grand children living on this land. My parents chose this particular location because of Pigeon Lake and the fact it had fish to harvest and lots of clean water. We cleared and developed the land over the next several decades until we ended up owning 3 quarters of land and made our living off that.

CONCERNS

1. Air quality issues-I spend a lot of time outdoors in my yard gardening and going for walks on trails. We are largely outdoors people and to have regular strong smells in our yard is pretty disappointing after having lived here for so many years without ever having this problem. We are basically retired wanting to enjoy our sunset years spending time enjoying . I have asthma and am concerned if odour levels were to get a lot higher maybe it becomes a health risk for me to be outside in my yard for extended periods of time on bad wind direction times. Also very concerning is they plan to site their manure storage pile a full half a kilometer closer to us with the new proposal making the odour problems likely much worse. We didn't chose to live in the

country to have to put up with smells from a neighbours operation considering we bought enough land that that should have never been a problem. Now with 4000 head next door and it being ½ kilometer closer will I have days where being outside where it might not be possible with my asthma. For that reason I would really like to see a Health Impacts Assessment done considering my advanced age and asthma issues.

2. Our Creek Water Quality-A creek runs directly from SE corner of the G and S feedlot location on to our land. They say the proposed manure catch basins location is 400 meters from the nearest seasonal creek -that's not correct-it actually looks far closer to 200 meters or far less from the nearest seasonal creek that ultimately flows in to Pigeon Lake via our land and in to Sunset Harbour Creek. The very creek that for roughly the last 3 years has had high amounts of cow manure in it during spring runoff season-so bad in recent years that a couple times we saw lots of manure stained snow and the strong smell of cow manure filled the air if you stood within 10 feet of the creek in the center of the NE ¼ of Sec 3-47-2W5M(our quarter immediately straight east of proposed feedlot)-and this in a creek flowing lots of volume of water in to Pigeon Lake at that time of year-plus we have had no pasture cattle or any other cattle on this bush quarter for over 5 years-so for sure the only cattle that could have runoff in to this area would be from G and S . We had a water sample taken using CCME Guidelines and analyzed by an accredited laboratory Element Labs in Edmonton on March 25/2022 for phosphorus and ammonia-it came back high with levels 10 to 25 times higher than any taken in 2013 in Total Phosphorus and was also high in ammonia.

3. Loss of Recreation on Pigeon Lake-Tide Creek and Sunset Harbour Creek are already high in phosphorus coming from the feedlot. We used to enjoy swimming and fishing on Pigeon Lake but with increasing algae blooms and health advisories its not something we can enjoy as often althouth we take the grandchildren down there sometimes on better days and would like to continue to do that. The Lake is already high phosphorus level damaged and the current flows out of Tide Creek and Sunset Harbour Creeks are right now adding more phosphorus with the current feedlot operation being identified as the single point source of the current high phosphorus readings in each creek. So in time we will likely not want to use Pigeon Lake at all if it becomes a manure nutrient killed lake. For these reasons of concern we would like to see an Environmental Assessment Impacts Study carried out with Mitigations.

4. Potential Loss of water wells-With the huge volumes of water needed to feed 4000 cattle there will be huge pressure on water tables. 160,000 liters a day needed. It's a big concern of how many of our wells could potentially go dry after years of pumping out of many wells at the feedlot. Who would be paying for our wells if they were to dry out.

5. Loss of Property Value and Use-For sure our land values will drop if we ever decide to sell some of our property as lots of its value now will be reduced because of its close proximity to the feedlot. No one wants to live with a constant strong odour around in their yard as we are in the direction the wind normally blows.

6. This proposal also seems to contravene the following development policies:

   a. **The Pigeon Lake Watershed Management Plan-**recognizes that CFO's have no place within the boundaries of the watershed due to concerns over phosphorus load. Specifically, **Objective 2e** from the Plan states there should be **NO** CFO's within the watershed

   b. **County of Wetaskiwin Plans-** recognizes the importance of Pigeon Lake and the need for protecting it from harmful impacts. In **Section 5.5** policies are presented to guide the County when evaluating a proposal to develop land in the watershed. The pertinent policy under the heading Agriculture is clear in recognizing that CFO's should **not** be in the watershed. **Section 5.5.2 Agriculture -**Large-scale confined operations are not appropriate in the Pigeon Lake Watershed.

      i. The County's Land Use Bylaw-**Section 9.6.10-** "An existing or proposed Intensive Livestock Operation may be refused if the proposed development is likely to have a negative effect on a watercourse or lake."

      ii. The County's Municipal Development Plan also provides direction over the concern of the environment. **Section 3-**Protecting the environment from over-development is another focus of this Plan. Concerns regarding lake water contamination, fish population decrease and ground water decline were expressed by the public during the Plan preparation.

   c. **Natural Resources Conservation Plan-** The **NRCB** has an obligation which is well defined to consider and evaluate the effects of the proposed CFO on the environment, the economy, the community and the appropriate use of the land. Failure to consider factors which will degrade or damage Pigeon Lake will place the responsibility both legally and morally on the NRCB and they will be held accountable.

7. The County of Wetaskiwin's Muncipal Development Plan states "The County of Wetaskiwin will strive to maintain a balanced approach to diverse development while protecting our agricultural heritage and rural environment. P3. IN doing so this land use plan reinforces that it supports a high quality of life for residents. It supports economic growth and development but only if it is appropriate to the location and so long as there is no negative impact on air, natural resources, water or soil quality.

8. Pigeon Lake Watershed Management Plan was adopted as a guide to help reduce the number of algae blooms in Pigeon Lake. The Plan calls for a net reduction in nutrient runoff into Pigeon Lake and states that statutory <u>land use restriction</u> on new or expanded intensive livestock operations (including CFO's), are supported

9. We really don't like to hear about the damage to Tide Creek a creek when I was a little girl and I used to swim across to go to a local store on north side of Tide creek when the water and lake were of the cleanest quality. Now we here of high phosporus levels out of that creek and it really is disheartening that the powers that be have let it get this bad. Concerned the right actions wont be taken and we wont save this creek with important fish breeding grounds all along it. Not a problem I ever thought we would let happen when I swam in it 70 years ago as a young girl.

Cumulative effect

The application does not reference the current operation and condition of the land, which is relevant for an impact assessment. A large number of cattle transport trucks and other large vehicles move on and off the property suggesting a large scale operation is run on the property. The decision should account for the current condition of the property such as streams, fields, increased number of predatory animals, water use, etc. Spreading high volumes of manure over land all sloping towards Tide Creek and Sunset Harbour Creek in volumes that could exceed 150 tons per day introduces a new risk that growth promoters, antibioitics, nitrogen, and phosphorus in the streams will adversely affect our cattle or maybe travel in to our water wells.

Again for all the many reasons listed above we truly believe Application RA21045 should not be approved.

From: [redacted]
To: Nathan Shirley
Cc: EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: RE: CFO APPLICATION #RA21045
Date: April 7, 2022 4:31:14 PM
Attachments: Screenshot_20220405-224752_Word.jpeg
Screenshot_20220406-001244_Word.jpg
Screenshot_20220406-000711_Word.jpeg
Screenshot_20220405-220650_Word.jpeg
Screenshot_20220405-220838_Word.jpeg
Screenshot_20220405-223328_Word.jpg
Screenshot_20220405-221131_Word.jpeg
Screenshot_20220405-221217_Word.jpeg

Thank you for your time and patience in reading my numerous submissions. My first few were generalized to help others understand and because I wasn't sure if you knew or had access to the long history of biology on the lake. This submission is a bit more technical knowing you have a background and capacity to understand the limitations of environmental technology and mitigation measures. Already, members of our community, myself included, have arguably dedicated more free time to this application and environmental considerations than the applicant. This is an exhausting process which makes me a target in my community and it is very unsettling, thank you for understanding the rushed and sometimes incoherent writing.

I would like to make an addition of my concerns to the CFO application.

The namesake of the lake is already extinct and we are on the pressapice of more extinction.

The top 5 objectives of the Pigeon Lake Watershed Management 2018 are all violated by this application. The municipalities that collaborated on the management plan obviously did not intend for CFOs this close as it was listed in an objective to put restrictions on lands around upstream tributaries. The science doesn't lie. Foundation calculations as a broad assumption, for the management plan recommends .8km buffer from shore. The 2 main drainage vectors for the feed lot are much closer than .8km. The buffer was calculated on the assumptions of soil and vegetation matrix filtering surface runoff. The drainage vectors prevent that buffer from happening and shortcut runoff directly into the lake. The intended management buffer of .8km should be applied along all tributaries within 2km of the lake to remain consistent with the mathematical determinations for water protection in the Alberta Water Act. Such that, the conservation restrictions on protected classes of waterbodies should be applied to 2km up a connecting waterbodies of a different class.

Even with state of the art retention ponds, double lined, built with rip resistant HDPE, to the highest standards of directive 085 for tailings holdings or the same specifications of landfill designs, with interstitial monitoring they all still leak. Even if we installed recovery wells for seepage we can't catch it all and the shallow ground water, connected to the lake in such a short distance doesn't allow for any buffer. The hard truth is there has never been any kind of retention pond that doesn't leak or any technologies or mitigation measures that can protect the lake.

Calculations the NRCB and Alberta Agriculture use to determine nutrient load are designed for cereal crops not pasture. It's a total gamble and a logistical nightmare spreading manure and slurry on rough pasture. The pasture is already grazed in spring and summer. Fall application, when vegetation has been grazed down is guaranteed to wash off with the snow melt. Spring is too wet and winter impossible. How long could this application last before nutrients on land are too excessive? There is already a high nutrient load in the existing soil.

The susceptibility to high runoff volume at this logistical location in the watershed elevates risk and likelihood of incident.

A clear undisputable history of impacts to Pigeon Lake from this very operation. As you read monitoring reports from years past, there is a consistent theme from the 1980s onwards that nutrient pollution is coming from agriculture upstream. Recreation and residential contributions were relatively low and constent efforts to reduce sewage and landscaping have made it almost negligible. Given this farm has been one of the only consistent livestock farms in such close proximity to the lake for such an extended period and an article on the farm from 2014 clearly stated they were maximizing livestock capacity with forage availability, it's evidenced this farm pushed it's maximum limits and loads for a very long time. Soil is already at its maximum nutrient loads with no rest years. Farms further upstream had the distinct advantage of distance and buffering from the lake, unlike this farm. The existing feedlot, very probably the only one of its size within a close proximity to a direct tributary and the lake, is realistically in of itself, the largest contributor of all outsource contaminates to the lake. It is perfectly possible that the decades of nutrient monitoring is a case of monitoring contamination from this very feedlot operation. Further investigation and a look at the raw data of sampling pointsnear the tributaries and outfalls at the northwest end of the lake might be able to correlate a direct effect from the feedlot, might lead to enough evidence to lay a charge or file a class action lawsuit of Albertans and of lake owners and users for damages to the lake. The NRCB would be wise to first take multiple samples of groundwater and soils down gradient of the existing feed lot and set back along the shores of tidal creek down gradient the existing pastures to determine future capacity, thresholds and accurate baselines of existing total nitrogens, nitrates and phosphorus as well as chloroforms.
This would also rule out or confirm previous impacts to the lake.

It's the busiest lake in Alberta and is already a taxed lake from 5000 plus residents. Phosphorus levels that recycle from sediments are constant and don't deplete. Growing algae blooms are clear indicators the lake is at its maximum carrying capacity of nutrients. Already in the 1980s over half of the addition Phosphorus came from agriculture runoff. More land has been cleared since then and wetlands that once buffered drained. What is the limit? Where is the stop line?

Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been

seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First

Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a while.
https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-

contemplate-2017-municipal-election/

It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.

The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP. The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 
However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.

The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land. The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.

Ozzie Labutis

From: [redacted]
To: Nathan Shirley
Cc: premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: Re: CFO application #RA21045
Date: April 7, 2022 4:36:50 PM
Attachments: Screenshot_20220405-223328_Word.jpg
Screenshot_20220405-221131_Word.jpeg
Screenshot_20220405-221217_Word.jpeg

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

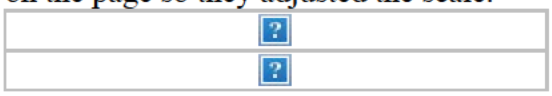
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning.
Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for

people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Ozzie Labutis

From:	[redacted]
To:	Nathan Shirley
Cc:	EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
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Have we calculated impacts of climate change? With the increasing hot days what effects on blooms are we considering?

We know even the best mitigation measures fail, if and when they do, even one release can kill the lake. The risk level is extreme, possibly so high it's never been

seen in Alberta. While it is not required to do an EIA for feedlots, given the history of impacts and the sensitive ecology and other site conditions there is more than enough justification to request the NRCB employ one. The NRCB has the means to do so.

Ultimately, the NRCB must ask itself, is Alberta's largest and busiest recreational lake worth loosing?

The answer is obvious. If after this, the process ofof thethe applicapplication is still continuing than we know the system is broken, policy has failed and we must apply an emergency break. The lake will simply not survive this. The system feels rigged, impossible to stop and like we're always fight a loosing battle.

The economic costs to 1000s would be in the billions compared to the million this one feedlot might make.

● This brings me to my next point, human health. Superbugs are already declared the most dominate bacteria for deadly infection in Canada and are predicted to kill 400,000 Canadians in the next 28 years.

https://www.aa.com.tr/en/health/superbugs-will-kill-nearly-400-000-canadians-by-2050/1643252

Fun fact! Do you know why dogs are not allowed on swimming beaches of Provincial Day Use Areas in Provincial Parks?

They are not allowed in the water of Day uses because dogs often deficate and urinate when they get in water. It was found that the levels of E-coli where above exposure limits when dogs were allowed in the water. Children, pregnant women and the elderly playing in the water are at an increased risk.

Now, imagine all the E-coli washing out of Tidal creek, sandwiched between two Provincial Parks Beaches.

The feedlot is located about 50 meters from one of the drainages that discharges next to the beach, loaded with superbugs and parasites children are playing in raw feces. E-coli can live 50 days on pasture and 91 days in slurry. The animals in feedlots and from auctions are often given high doses of wormers and antibiotics as soon as they arrive and are held for the duration of their withholding time before they are sent for slaughter.

The entire time they are in the feed lot any bacteria they shed survived the drugs and is resistant. That means me and my children sitting on the beach can easily pickup drug resistant bacteria that can kill or hospitalize us and cost me huge in lost wages and expenses.

Alberta already has one of the highest rates of E-coli infection.

-●Can the operators produce an assurety bond, trust fund with pay in, standby letter of credit from a bank as well as liability insurance? When children start dying from the inevitable contamination from this operation will there be money for the civil lawsuits and justice for these families or will they declare bankruptcy and run? Will there be money set aside to decommission the feedlot if the company goes bankrupt from civil proceedings or when it closes?

-●Will there be funds set aside to replace liners of retention ponds as they deteriorate?

-●Antibiotics and pesticides leaving the high volume of cows will have impacts on invertebrates and microbes essential for life in the lake. As new cows will always be treated waves of pesticides will flush into the water on a consistent base. FeedFeed will also be covered inin herbicides and make their way into the lake.

-●While we are on the topic of human health, the volume of trucks coming from all directions will destroy the already fragile roads in the county. This year alone several rural roads have sections washed out. Local municipalities are already scrambling as road maintenance funds were slashed by Provincial budgets. The county and the taxpayers can not take on the additional costs of 1000s of semi trucks ripping up the roads. I almost diedthis winter on the county road infront of my property. The county partly built a road and abandoned it. They will not maintain or plow 50 meters of road citing lack of funds among other things. Limited road maintenance funds allocated to accommodating the road upgrades will literally leave me with out access to medical help again. The third party cattle liner I hired this fall to drop off my livestock this fall refused to proceed through a massive rut on the county road and we had to offload our animals from the roadside instead of our turnaround and corals. We blocked the road and had to work around neighbors pulling bales off their fields. This is an actual impact to my daily life if I am pushed further down the counties priority.

What about all the weekend warriors and families towing campers on the roads concentrating around the lake roads. Adding large semi trucks into the already backed up volume of traffic can lead to serious incidents and fatalities. Will street lights be placed at intersections of the 771 and twp roads or additional turning lanes? Who will cover these costs? Mote roadsalt roadsalt? What impacts will these lights have on the insect biodiversity of the lake?

As auctions close for the day, trucks are loaded and drive into the night to drop of new cows. Thud, thud, thud, at all hours of the night as trucks roll in and kick up the dust on the roads near my home.

-● Salt deposited from cow uria and feed accumulate in the soil matrix. Salt impacts over the years change other properties in the soil like ph, nutrient capacity and plant species. How will these changes be monitored and will load rates be adjusted as years go by? Salt has been increasing in the lake as well and it has had impacts on aquatic life.

-●First Nations relations already strained. Failing to consult with the treaty 6 First

Nations would be detrimental to our collective community and add more hostility and racism to the community. Ermineskin Cree Nation has already documented han health impacts of Pigeon Lake pollution. The first nations also run a fishing enterprise on the lake. Furthering degrading their heritage and enterprises without even the curiosity of consultation would cause irreprebale hardships and agrivate division amongst europen and our first nations community members. In the era of reconciliation and inclusion and the significance of the heritage impacts any development impacting the First Nations of Treaty 6 should automatically include a consultation and their concerns should weigh heavily in decision-making with the NRCB.

-●The county council has acknowledged conflicts between various user groups within the county. Cottage and residential users impact agriculture users, agriculture impacts recreational users and first nation users often feel discriminated or unwelcome in a territory that is their home. The county has tried to mediate these divisions with understanding, education and compromise amongst all groups. Allowing a development that significantly hurts several 1000's of people and different users for the benefit of one individual has already created outrage and animosity in the community. The tension in public places and online is contributing to mental health stress, anger and fear of violence. It's hard to enjoy daily life when so many are frustrated as witnessed on the "Pigeon Lake Positivity Page".

● Capacity of enforcement with the NRCB also plays a major role. The catastrophic loss, extremely high likelihood of nutrient release and little diffusion or buffer space amplifies the limitations of NRCB Officers and enforcement. There are only a few, overworked and thinly spread officers covering a huge area. Enforcement is based on complaints after the fact, not prevention. Often officers may take several hours or a day to get to a spill complaint location and by then rainfall and flooding may have stopped and contaminates floated away. Its hard to prove an event after the fact unless complainants are running around with sample bottles and taking photos with high zoom cameras. Realistically, enforcement becomes education and there is no real consequences for a multi-millionaires polluting the lake. There just isn't the resources to protect Albertan's.

Thank you once again.

I also found in an article from 2014 Cattlemen magazine, the landowner was managing the land at capacity for a while.
https://www.canadiancattlemen.ca/features/home-for-the-winter-at-morsan-farms/

Pipestone Flyer link 1
https://www.google.com/amp/s/www.pipestoneflyer.ca/news/wetaskiwin-county-joins-pigeon-lake-watershed-management-plan/amp/

Pipestone flyer link 2
https://www.pipestoneflyer.ca/news/wetaskiwin-county-councillors-

contemplate-2017-municipal-election/

It is well documented in the PLWMP that all parties including, Wetaskiwin county supported the agreements, which included NO CFO's in the watershed, and the most critical issue that needed to be addressed is the phosphorous from incoming streams.

The existing Feedlot, or whatever they want to call it, is already polluting the lake and is proven in the data of the 2018 PLWMP. The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. 
However, Tide Creek has the highest phosphorus (100kg/yr) and nitrogen (1000kg/yr) out of all the creeks, and has at least double phosphorus and 10 times nitrogen the others, roughly 50kg/yr phosphorus and 150kg/yr nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts. That means most creeks without vegetation are still less impacted than these two with vegetation.

The common point source of contamination for both sunset harbour and tide creek is the existing feed lot and the manure spread land. The land is already at nutrient capacity if this is happening. The only significant source of contamination for sunset harbour is the feedlot.

The LOWEST contaminated stream is Zeiner which has vegetation, thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

Thank you for your time.

Jennie Labutis

From: [redacted]
To: Nathan Shirley
Cc: premier@gov.ab.ca; EDMONTON.GOLDBAR@assembly.ab.ca; Rimbey.RockyMountainhouse.Sundre@assembly.ab.ca
Subject: Re: CFO application #RA21045
Date: April 7, 2022 4:36:34 PM
Attachments: Screenshot_20220405-223328_Word.jpg
Screenshot_20220405-221131_Word.jpeg
Screenshot_20220405-221217_Word.jpeg

The most important submission you might read today. Point Source Contamination of Pigeon Lake request for CFO cancelation

Thank you PREMIER KENNY, MINISTER MARLIN SCHMIT, MINISTER JASON NIXON, NATHAN SHIRLEY AND THE NRCB BOARD,

I am writting today to bring to the attention contamination release on Pigeon Lake from a CFO and the manure management adjacent Pigeon Lake. The intensive management has been documented from the owner in various sources already sent to Mr.Shirley. The soil nutrient load is over capacity.

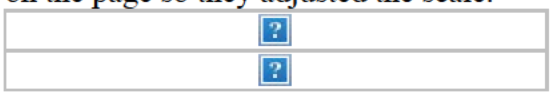
The existing feedlot at Pigeon Lake, is already polluting the lake and is proven in the data of the 2018 Pigeon Lake Watershed Management Plan (PLWMP). The PLWMP won an Emerald Award in 2021, is peer reviewed and was in collaberation with Alberta Environment. It can be found on the Pigeon Lake Watershed Association Website if you click *TECHNICAL REPORT* icon.
The PLWMP is not a point source report where we try to figure out causes. It is a report focused on consolidating management among Municipalities and steak-holders. All of which agreed they do not want CFOs in the Watershed. That doesn't mean there isn't enough data to determine point source or the major contributors to the lakes issues. This is Albertas largest and most used lake and it's in critical condition.

The recycled phosphorous is increasing yearly and is mostly animal waste. The main contributor to inflow total phosphorus is agriculture.

The area with vegetation is mainly the north end where water should be the cleanest. The report makes a very big point of the importance of the shoreline vegetation.

However, Tide Creek has the highest total phosphorus (aprox 100kg/yr) and total nitrogen (aprox 1,000kg/yr) out of all the creeks, and has at least double T-phosphorus and 10 times T-nitrogen as the others, (aprox 50kg/yr) T-phosphorus and (aprox150kg/yr) nitrogen. Tide Creek and adjacent Sunset Harbour have the highest impacts of all the streams. That means most creeks, even without vegetation, are still less impacted than these two with vegetation.

Notice the scale is not a gradual scale but a logarithmic scale. That is to say the levels of Tide creek and Sunset Harbour creek were so high the graph couldn't fit on the page so they adjusted the scale.



The common point source of contamination for both Sunset Harbour and Tide creek is the existing feed lot and the manure spread land.
The land is already at nutrient capacity if this is happening. The only significant source of contamination for Sunset Harbour creek is the existing feedlot.
Upstream of Tide creek could have cumulative impacts but, other smaller cow operations are further upstream is common with all the other streams so cumulative impacts on Tide creek are negligible and don't account for the sudden spike.

The LOWEST levels of T-phosphorous (10 kg/year) and T-Nitrogen (90 kg/yr) in a stream is Zeiner which has vegetation. This nearly 100 fold reduction in contaminates thus proves that vegetation can help reduce impacts and that removal of CFOs in the watershed keeps tributaries clean as evidenced at the other 4 streams. Zeiner creek is only 1.4km from Tide creek.

This data also proves a point source contamination on the lake from the already existing operations of the feedlots site. The site is beyond capacity and expansion should be dismissed and the current license revoked.

A meeting with area residents today brought up that the closed status of Tide creek was removed. I would like to encourage you to contact Ab Environment for data from the 1990s on tide creek. In the 90's several research and parks projects were cut and employees laid off as major budgets were cut. Lots of these yearly reports and data were typed with typewriters not in digital format. The Pigeon Lake Conservation Office had several of these reports and could provide baseline data. It was documented as walleye spawning grounds, if pesticides and glyphosphate from the feed lot have made their way to these spawning grounds, it is very probable the fish and aquatic environment were too severely impacted to remain habitable. also possible is as trees and vegetation were removed from adjacent land up stream higher velocities and more turbid water could have altered the physical conditions of the creek and made it unsuitable for spawning.
Most of the data in the 2018 PLWMP dates back to 2013 and the previous year the report was published.

The land owner of where Sunset creek enters the lake said he has reported pike spawning in that tributary. Pike in the lake are listed as critical. This could indicate a need to declare this area environmentally significant and sensitive.

The unified effort of management among municipalities is on a time-limit. Next year the plan is reviewed and in 6 years it ends.
1000's of people have come together to change in hopes of the lake making a recovery. Seeing no change in the lakes improvement is so disheartening for

people. All efforts are undermined by the significant loads in Tide creek. People want to see this creek recover. We want the underdog comeback story in a time when the environment is in crisis. I very strongly feel the feedlot is undermining the effort and will lead to complete destruction.

I urge very strongly that the NRCB with Alberta Environment <u>suspend and cancel</u> the intensive feedlot for a minimum of 6 years to allow the Watershed Management Plan and all 12 municipalities that agree one the management, a chance to work and the lake an opportunity to recover. If in 6 years there hasn't been recovery in the lake and a decrease in Tide creek than it would be worth while for the CFO operator to be involved in the next Watershed Management Plan.

As it is in the mandates of the NRCB to work as much as possible in accordance of municipalities intended management plans I feel cancelling the existing and expanded CFO is the most logical thing.

Thank you

Jennie Labutis

TAB 21

GOODWILL FARMS

[redacted]

April 6th, 2022

To: Natural Resources Conservation Board

Re: LANDOWNER'S RESPONSE TO APPLICATION RA21045

In response to application of said feedlot - it is NOT in the best interest of farms and acreages around said location of feedlot. It's too close to Pigeon Lake. Two creeks on the East side of the feedlot site go right to the Lake. Said 'catch basin' is a bandage that will fail in a heartbeat, depending on the year.

2 years ago, we had 40 inches of rain over the summer. The year before we had 32 inches of rain. 9 years ago, we had 149 inches of snow that winter. If we have normal weather in the area, it's 13 inches of rain in July alone. We have farmed here since 1968. The applicant (of said feedlot) hasn't been here 10 years and doesn't even live in the area!

It (the application) said that all these acres are cultivated to take care of the manure. Well, at this point of time only, at the most 480 acres are worked for growing silage. Rest of property is hay and pasture, which feeds up to +/- 1,500 head of cows, plus calves. So, amount of manure from 5 months of winter is manageable. They rent other lands to grow crops, so how are they cultivating enough acres for all this future manure?

Now add 3-4,000 head of cattle confined to, what, 10 acres of land (?) 12 months of the year. That's a lot of manure to get rid of! 480 acres is NOT enough, and zero till is NOT cultivating our land! Another fact to consider is, an animal on daily average consumes 10 gallons, or more, of water. At 4-6,000 head of cattle (with cows and calves) that is a LOT of piss and manure to deal with. As for 'No complaints yet' – the operation is fine as 'Cow/calf Grazing' - it does work fine. Some buildup over the winter isn't bad, but in a confined area it'll be a nightmare! They have had a mess already on the corner of TWP 470 & Rg Rd 23, with a mountain of manure surrounding the acreage there. A creek runs just east of that site, and it was a mess. Twp Rd 470 is a narrow road (thanks to the County of Wetaskiwin) for us Farmers trying to get machinery moved. All the future traffic

on top of this, plus the designated Rg Rd 23 North turnoff is halfway up a hill. A wreck just waiting to happen!

The feedlot site is NOT a good scenario. When a mess ends up in Pigeon Lake, who cleans it up? It inevitably WILL happen, and it will end up in our lap as Farmers. Anybody in the area with cattle will be targeted when the watershed board hands out lawsuits. Maybe it's time actual research is done, and the history of failed catch basins and locations of feedlots are remembered. Feedlots around Innisfail, the old Bonnet Feedlot at Ponoka, etc., etc.... I don't need problems from the folks at the Lake and their million-dollar homes, coming after farmers who are trying to be good stewards of the land. We just can't fold our tents and leave. Commercial farms are not good stewards – it's NOT farming, it's mining the land. This is not a good practice. Money is all it's about, and they (Commercial Farms) are never held accountable for their messes! Please let's NOT let the 'Greed of Man' destroy the Pigeon Lake area, where our Father literally sacrificed his life - to Build a Farm, from nothing more than his 'Blood, Sweat & Tears'. We want to live to see our Boys continue to till the Land that their Grandpa established, from HARDWORK and a DREAM to FARM!!

Also, there is a major creek going North of Section 8-47-02-W5, that curves back to Pigeon Lake. Mr. Roger Parker owns the land around a portion of the creek, and already receives phone calls from the County of Leduc, because he has 50 head of cattle drinking from the creek during Grazing season! Roger Parker does have a permit for the cattle drinking from the creek. Imagine putting another 3-4,000 head of cattle in the area, plus the already 1,200 head of cattle the applicant already keeps there?!

Another mess that could happen, is the fact that there is a pit full of Tuberculosis-infected, dead elk buried on SE-08-47-02-W5, that has been there since the 90's. Who will compensate all the farmers around here when the site is 'accidentally' exposed?!!

Sincerely, The Mitchell Family

Lance + Jaimie,

(Sons) Jesse + David

TAB 22

County of Wetaskiwin No. 10

P.O. Box 6960, Wetaskiwin, AB T9A 2G5
Phone: 780-352-3321
Fax: 780-352-3486
www.county.wetaskiwin.ab.ca

Strong Proactive Leadership • Safe Progressive Communities

March 23, 2022

NRCB
Attn: Nathan Shirley
#303, 4920-51 Street
Red Deer, Alberta
T4N 6K8

File #: 3269.00

via: Suzanne.leshchyshyn@nrcb.ca

Dear Mr. Shirley,

Re: Application RA21045 G&S Cattle Ltd. – NW 3-47-2-W5M

After receiving and reviewing the aforementioned application, these are the comments that the County would like to return to the NRCB for your consideration. The documents that will be referenced are the County of Wetaskiwin's Land Use Bylaw 2017/48 (2021), the County's Municipal Development Plan (2010), the County's Pigeon Lake Watershed Area Concept Plan (2014) and the County's Pigeon Lake Watershed Management Plan (2000).

Is the Application consistent with your municipal development plan (MDP)?

Within the County of Wetaskiwin's Municipal Development Plan (MDP), there are provisions made for the placement of new Confined Feeding Operations (CFO) and how to minimize conflicts with surrounding land uses. The *Municipal Government Act* (MGA) requires the County to identify where new CFOs should be located. The setback distances that have been created by the County that are further to that of the minimum distance setback of the Alberta Agriculture Code of Practice are as follows:

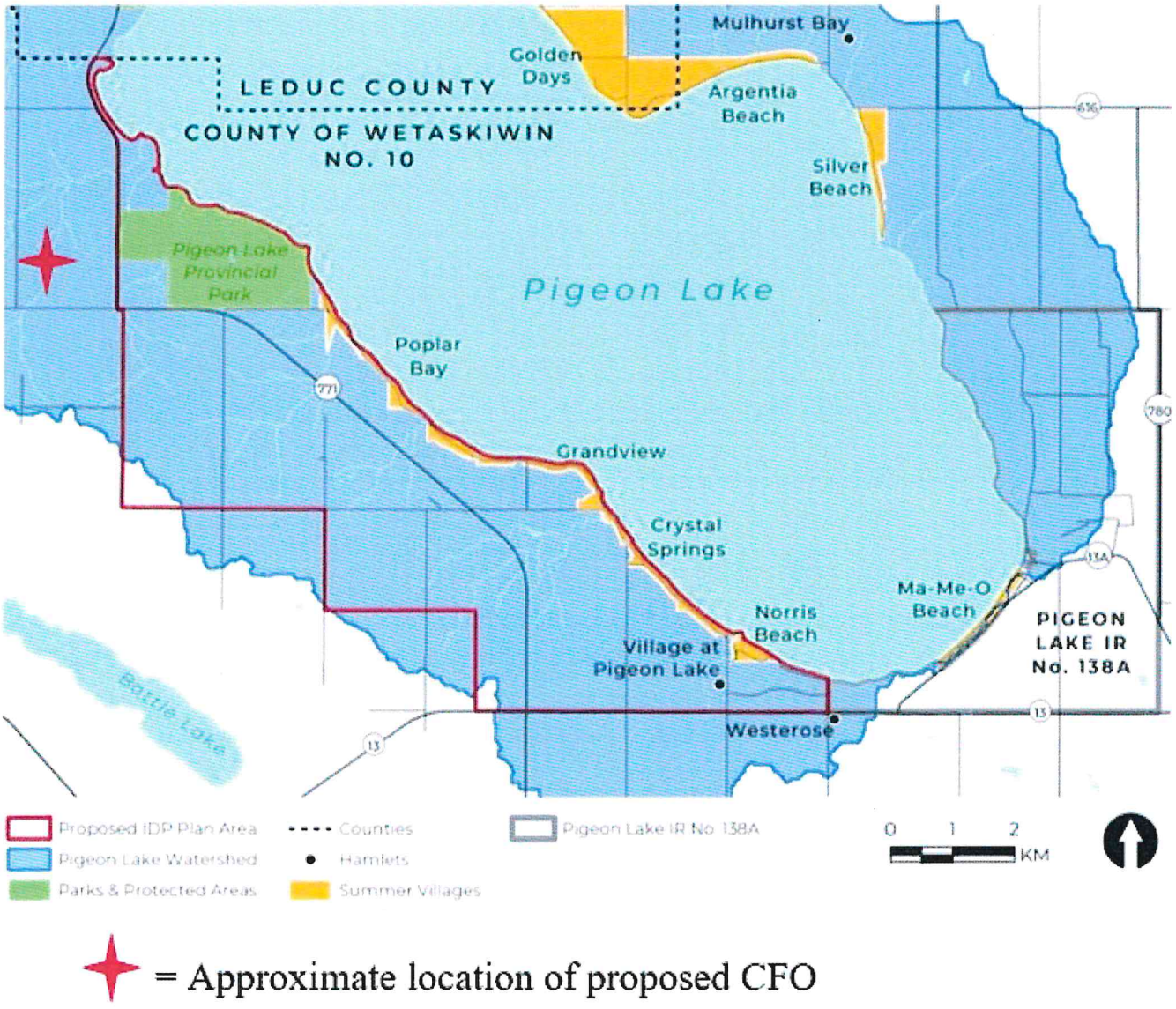
a) 2.4 km (1.5 miles) from the boundary of any city, town, village, hamlet, school and hospital.
b) Under no circumstances can a new CFO be located within 1.6 km (1 mile) of the following named lakes: Battle Lake, Buck Lake, Coal Lake, Pigeon Lake, Red Deer Lake, Wizard Lake and Twin Lakes.
c) All other unspecified environmental features, including but not limited to lakes not specified in (b), wetlands. and watercourses shall have setbacks in accordance with Alberta Operation Practices Act and Regulations (AOPA) as amended.

With the proposed development being to establish a new 4,000 head beef cow/finisher CFO, the aforementioned setbacks were applied to the proposal. It was determined that the proposed new CFO location meets the requirements of the County's MDP for CFOs.

Are there any planning-type documents incorporated by reference in the MDP that apply to the area covered by the Application (e.g. Area Structure Plans, Inter-Municipal Development Plans)? If yes, is the Application consistent with those documents?

At this point in time there are no Area Structure Plans (ASP) that have been submitted to the County for the lands on which the application is proposed for that may need to be taken into consideration. Further, the existing site is well away from any other municipal boundaries and therefore is not subject to an existing or proposed IDPs. It should be noted that the proposed Pigeon Lake South IDP area is east of this location by two (2) miles.

Proposed IDP Map



= Approximate location of proposed CFO

Further to the above, the County has a Pigeon Lake Watershed Management Plan and a Pigeon Lake Area Concept Plan in Place which encompass the lands on which the new CFO is proposed. The County's Pigeon Lake Watershed Management Plan states:

> *"**POLICY 1: RECOGNIZE THE RIGHTS OF THE FARMING COMMUNITY***
> ***The Management Committee recognizes that farming in this area pre-dates the recreational use of the lake.***
>
> *The report by John Lilley and Chris Earle shows that agriculture has a significant effect on water quality. Land clearance results in more runoff and less groundwater, and gives more fluctuations in streamflow. Runoff from farm land is richer in nutrients than from tree covered land, resulting in more plant and algae growth in the lake. However, agriculture is the backbone of the economy in the Counties of Leduc and Wetaskiwin, and the county councils will not demand any changes in accepted farming practices. Any desired changes must be achieved by education and incentive, not compulsion.*
>
> ***POLICY 2: MAINTAIN WATER QUALITY***
> ***The Management Committee believes that maintaining water quality must have the highest priority in lake and watershed management.***
>
> ***Review existing animal operations:*** *There are several intensive animal operations in the Pigeon Lake drainage basin. We do not know how well they are being managed at present. Although all existing farm operations are grandfathered under Policy 1, the operators would probably welcome an offer of help to improve their manure handling methods. County agricultural service board personnel should be made available to help them. The County of Wetaskiwin recently did this with a cattle operation near Coal Lake, with positive results.*
>
> *Improving manure storage and handling systems could be costly, but there may be funds available from the Alberta government. Alberta Agriculture's Environmentally Sustainable Agriculture (ESA) program provides technical advice and some funding. Municipalities may wish to contribute financially to cleaning up a source of pollution, even if it is located in another municipality. Where there is a definite local benefit, local improvement levies might be used as the source of funds.*
>
> ***Control new animal operations:*** *Alberta Agriculture provides technical support at no cost to municipalities and will advise whether a site is suitable from an environmental point of view. Among other things the department looks at manure handling and runoff. It is possible to design and run an intensive animal operation so as to contain all nutrients on site. The critical factors are runoff from the confinement area, and how the manure is spread on the land. The counties should amend their land use bylaws so that all new confined animal operations (including cow-calf confinement areas) require a development permit, and then, as a condition of giving a permit, have operators design a system with minimal offsite effects.*

Municipalities do not have the technical expertise to set operational standards for intensive animal operations. At present they depend on Alberta Agriculture to recommend standards.

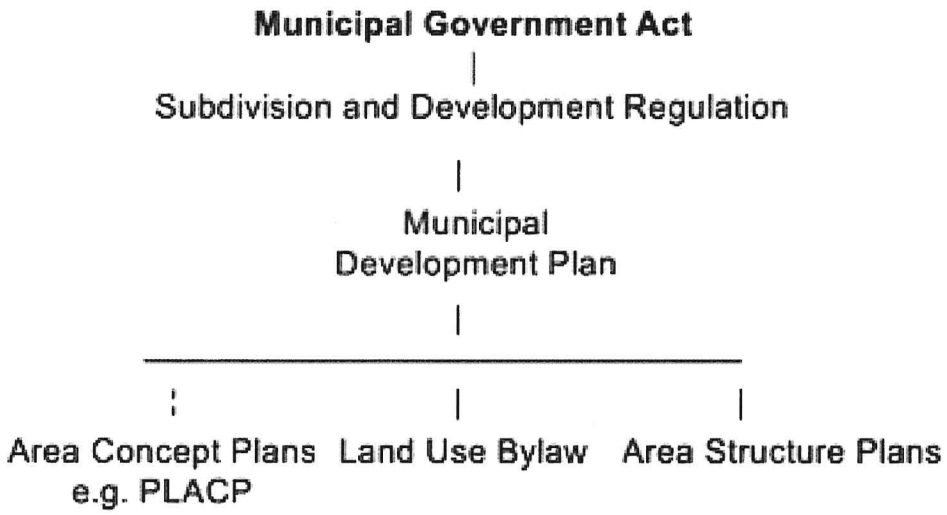
The department is currently reviewing its rules and practices on intensive livestock operations. The latest discussion draft of the Proposed Regulatory Framework for Livestock Feeding Operations in Alberta says that the province will set environmental siting requirements, construction standards, and the standards for manure storage and use. Municipal governments will retain responsibility for determining whether a proposed development is acceptable through the municipal planning process.

Some municipalities in Alberta are protecting recreational lakes by refusing to allow any new intensive livestock operations on land draining into those lakes. The County of Ponoka has done this in the Gull Lake basin, with surprisingly little opposition, even from the farm community. Leduc and Wetaskiwin should consider a similar policy, at least within a mile of the lake. Such a policy, being as land use and not an operational matter, appears to be compatible with the proposed provincial Regulatory Framework."

The County's Pigeon Lake Watershed Area Concept Plan states:

***"5.5.2 Agriculture** Large-scale confined animal operations are not appropriate in the Pigeon Lake watershed. Recreational and residential development must not diminish the right of neighbouring farmers to manage their land using generally acceptable agricultural practices. This is guaranteed by provincial law (Agricultural Operations Practices Act, section 2). Farm land will be reserved for agriculture, or released for other uses, depending in part on its assessment rating. The County's normal policy is to reserve better farm land for agriculture. Section 1.2.1 of the MDP defines this as land with a farmland assessment rating of 30% or more, but because of the recreational value of land near Pigeon Lake, the County may allow residential subdivision on land with a farmland assessment rating up to 50%. Figure 7 shows the location of such land. Note that this applies only in the Pigeon Lake watershed. The cut-off remains 30% in other parts of the County. Soil quality does not change at property boundaries. Most quarters have a mixture of good and poor soil. On these mixed quarters, development must normally be clustered on the poorer soil, leaving better soil for agriculture, although small or odd-shaped areas of good soil may be included in the developed area."*

However, it should be noted that the County's MDP supersedes both the Pigeon Lake Watershed Area Concept Plan and the Pigeon Lake Watershed Management Plan. The references from both of these Plans have been added for informational purposes and the maps outlining each of the areas covered by the respective Plans have been attached as Appendix A. Further to this, it should be mentioned that the Management Plan was adopted when CFO's where still under the jurisdiction of local municipalities, since that time CFO's have become the jurisdiction of the Province.



Note: the dashed line represents non-statutory plans

What is the land zoning of the Application site, and surrounding lands within 1600 metres of the proposed site, under your Land Use Bylaw? What is the status of the proposed development in the Application under the application zoning classification (e.g. permitted, discretionary or not listed)?

The Application site itself is located on land that is Agriculturally zoned, however, within 1,600 metres of the property in question there are three (3) different land zonings. The surrounding land parcels within 1,600 metres are composed of twenty-six (26) agriculturally zoned parcels and nine (9) Rural Residential parcels and three (3) Watershed Protection parcels (See attached maps below).

The status of the proposed development in the Application is neither permitted nor discretionary under the County's Land Use Bylaw 2017/048. This is because Confined Feeding Operations as defined under the Agricultural Operation Practices Act (AOPA), fall under the jurisdiction of the Natural Resources Conservation Board (NRCB). Some of the relevant specifics of the County's Agricultural district are as follows:

10.1 Agricultural District

10.1.1 Purpose
The purpose of the Agricultural District (AG) is to maintain and preserve land for productive agricultural uses and to allow for limited subdivision and development for residential use compatible in the farming community.

10.1.2 Permitted Uses

a) Agriculture, Extensive

b) Dwelling, Detached

c) Dwelling, Mobile – New

d) Dwelling, Modular – New

e) Intensive Livestock Operation - situated at least 400.0 meters (1312 feet) away from any land not districted as Agricultural or Severed Agricultural

f) Dwelling, Moved-in-New *(amended by Bylaw 2019/44)*

g) Buildings and uses accessory to the above

10.1.3 Discretionary Uses

a) Dwelling, Communal

b) Dwelling, Moved-in- Used *(amended by Bylaw 2019/44)*

c) Dwelling, Mobile – Used

d) Dwelling, Modular – Used

e) Dwelling, Secondary Suite

f) Agricultural, Intensive

g) Intensive Livestock Operation - within 400.0 meters (1312 feet) of any land not classified as Agricultural or Severed Agricultural under this Bylaw

h) Tree Farm

i) Bed and Breakfast

j) Industry Work Camp

k) Kennel

l) Public Utility

m) Public or Quasi-Public Use

n) Resource Extraction Operation Type A

o) Resource Extraction Operation Type B

p) Resource Processing Operation

q) Recreational, Extensive

r) Abattoir

s) Greenhouse

t) Veterinary Clinic

u) Equestrian Center

v) Recreational Units Use (greater than 32.0 hectares (80 acres), where no dwelling exists – maximum 3 year permit. If the landowner wishes the use to continue, they must re-apply for the use prior to the expiry of the permit).

w) Apiary *(amended by Bylaw 2019/44)*

x) Offsite Home Occupation (Type 1) *(amended by Bylaw 2019/55)*

y) Offsite Home Occupation (Type 2) *(amended by Bylaw 2019/55)*

z) Onsite Home Occupation (Type 1) *(amended by Bylaw 2019/55)*

aa) Onsite Home Occupation (Type 2) *(amended by Bylaw 2019/55)*

bb) Onsite Home Occupation (Type 3) *(amended by Bylaw 2019/55)*

cc) Market Garden *(amended by Bylaw 2019/55)*

dd) Buildings and uses accessory to the above

Zoning Map

*** Note *** The **yellow tan** coloured land is Agriculturally zoned while the **light blue** is Country Residential, the **red** is Rural Residential and **purple** is Watershed Protection

Does the Application meet the required municipal setbacks?

As per the submitted site plan the application meets the required municipal setbacks for development as stated under the County's Land Use Bylaw 2017/48.

In conclusion, the Development Authority has no concerns with the proposed new CFO as it aligns with the hierarchy of planning documents of the County. I hope that the information provided is sufficient and if you require more information or have any questions please contact me by email at jgrant@county10.ca or by phone at (780) 361-6222.

Sincerely,

Jarvis Grant
Development Officer

:jg

cc: County of Wetaskiwin Council
Mr. Rod Hawken, Chief Administrative Officer (CAO)
Mr. Jeff Chipley, Assistant CAO
Mr. Neal Sarnecki, Director of Planning & Economic Development

Appendix A

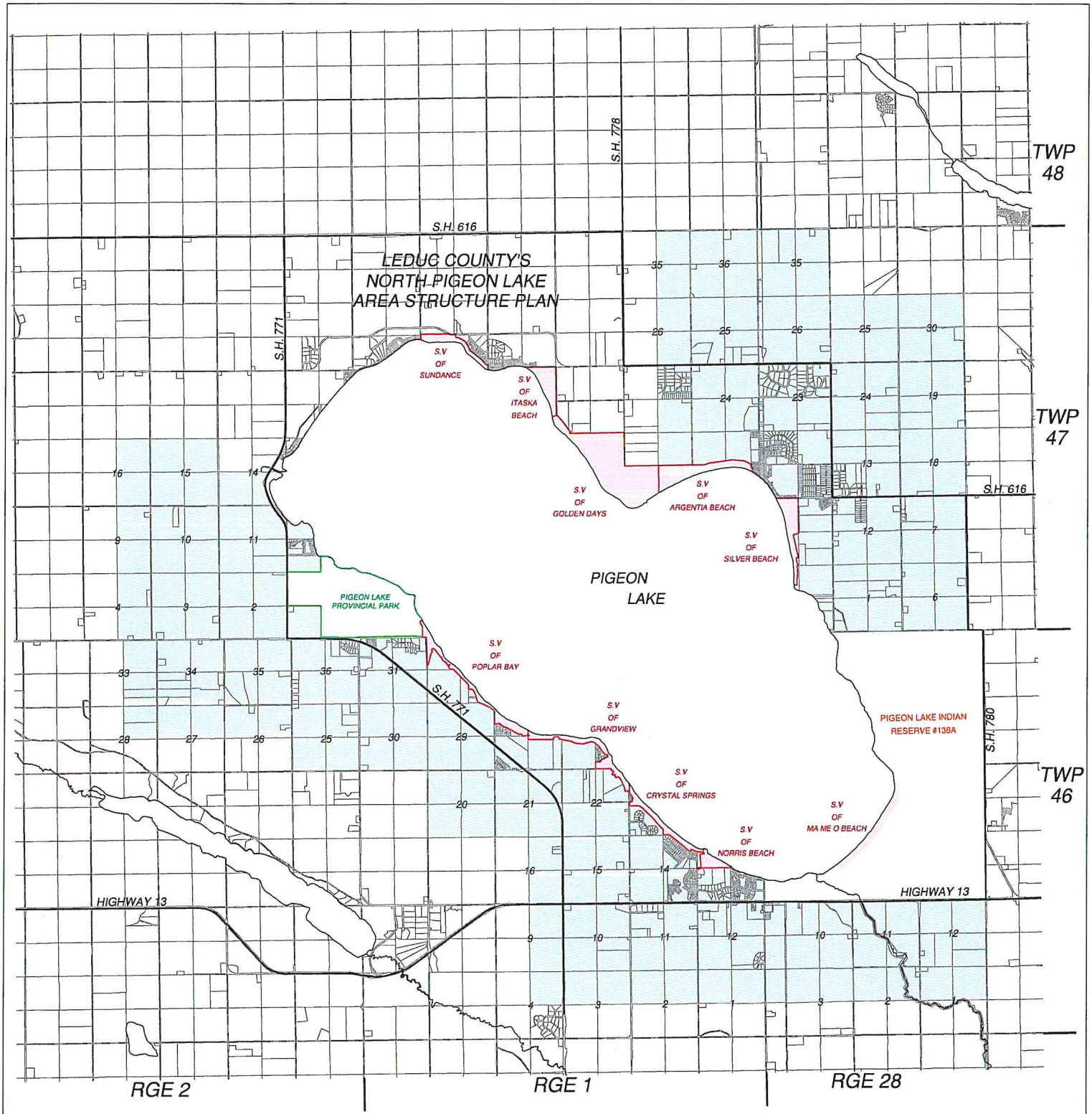
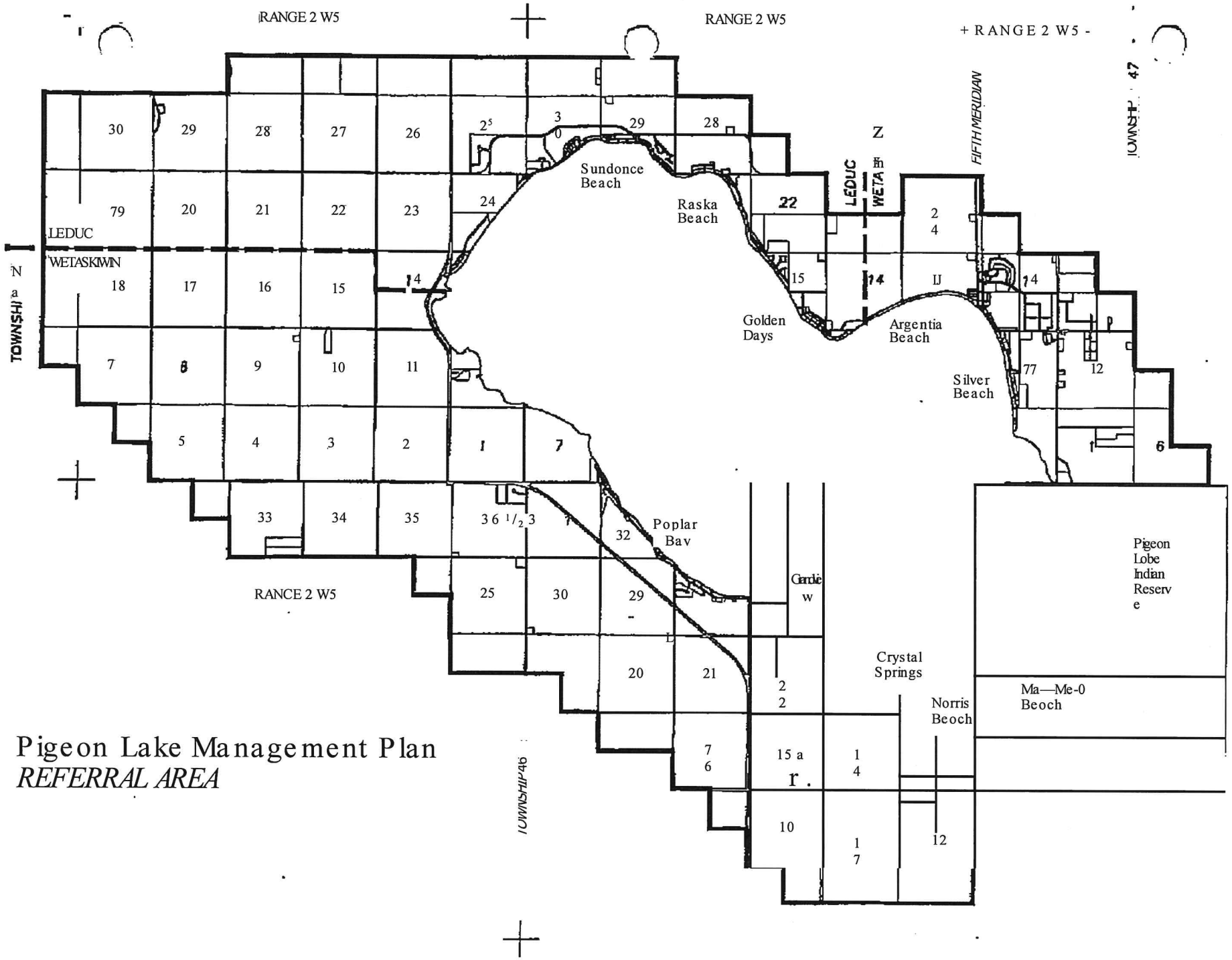


FIGURE 2.0
PIGEON LAKE AREA CONCEPT PLAN
STUDY AREA



Pigeon Lake Management Plan
REFERRAL AREA

County of Wetaskiwin No. 10

P.O. Box 6960, Wetaskiwin, AB T9A 2G5
Phone: 780-352-3321
Fax: 780-352-3486
www.county.wetaskiwin.ab.ca

Strong Proactive Leadership • Safe Progressive Communities

April 19, 2022

Natural Resources Conservation Board (NRCB)
#303, 4920 – 51 Street
Red Deer, Alberta
T4N 6K8

Attention: Mr. Nathan Shirley

Dear Mr. Shirley:

RE: Supplemental Referral Commentary – Application RA21045 – G&S Cattle Ltd. – NW 3-47-2-W5M

Over the past several weeks, the County of Wetaskiwin through both Council and Administration has received significant questions, comments, and concerns from a vast amount of adjacent property owners, municipalities, special interest groups, and citizens in general with respect to the aforementioned Confined Feeding Operation (CFO) application for 4,000 head of cattle on the lands legally described as above by G&S Cattle Ltd. Due to the large public interest in the matter and as suggested by numerous parties to Council, Council has resolved to send this additional correspondence to be in supplement to the correspondence sent by Mr. Jarvis Grant, Development Officer, on March 23, 2022 with respect to the matter on behalf of the County, which will outline additional points of emphasis that the County wishes for the Natural Resources Conservation Board (NRCB) to take into account.

First, should the NRCB be considering the approval of the proposed CFO, much like the other correspondence that the NRCB has received related to the proposal in which the County has been copied on, the County strongly recommends that the NRCB require an environmental impact assessment and also ensure that all environmental standards outlined by both the Government of Canada and Government of Alberta are mandated by the NRCB on the proposal to the fullest extent possible and adhered to by the Applicant as such, with failure to doing so being met with full enforcement action. Environmental impacts appear to be the most heightened area of concern and the County trusts that the NRCB will mandate provisions that are fully within their inherent jurisdiction related to this matter. Another item of concern is the increased volume of manure and how it is to be applied. Calculations need to be considered as to the ability of the land to retain the nutrients as well as the water quality leaving the land including pathogens, phosphorus and chemicals among a variety of other possible contaminants.

Secondly, with respect to County Infrastructure and the impacts upon it as a result of the proposed CFO, which is not explicitly contained within the relevant planning documents of the County as the approval of CFOs do not fall within our jurisdiction, the County is of the opinion that if approved, a CFO of 4,000 head of cattle will have a detrimental impact on County Infrastructure, specifically in terms of road and bridge infrastructure. This is due to the fact that if the CFO of 4,000 head of cattle is approved, there will undoubtedly be increased levels of heavy commercial and agricultural truck traffic heading to and from the CFO, all along roadways that are under the jurisdiction and maintenance of the County. With increased traffic that is heavy in nature, it will lead to the quality of the road and bridge infrastructure to be deteriorated much more rapidly that what would occur with more regular traffic for a rural area and as such, will have to be maintained and repaired to a more increased level than what would be traditionally expected. With the above being stated, the County would respectfully request that the NRCB first require the Applicant to complete a Traffic Impact Assessment (TIA) for the area based on the typical traffic patterns to the CFO and if deemed necessary through the TIA or based upon best practices for CFOs throughout Alberta, that the Applicant be required to enter into Road Use Agreements with the County and potentially Alberta Transportation that outlines commitment by the Applicant at their sole cost for the mitigation of their direct and indirect impacts to County Infrastructure including, but not limited to intersection treatments, provision of dust suppression, and payment of funds to the County for the ongoing repair and maintenance of road and bridge infrastructure at a minimum.

Lastly, it has came to the attention of the County that only references to the 2000 Edition of the Pigeon Lake Watershed Management Plan were made in the initial correspondence sent by the County by Mr. Grant and not the more recent 2018 Pigeon Lake Watershed Management Plan, with such oversight being completely unintentional in nature, but one in which the County unreservedly apologizes for. In reviewing the 2018 Plan, we do recognize that Objective 2(e) does state that *"Statutory land use restrictions on new or expanded intensive livestock operations (including CFOs) are supported in this Watershed Management Plan"*, but at this time, the Municipal Development Plan (MDP), nor the Land Use Bylaw of the County include restrictions of this nature as our previous correspondence states. Additionally, with respect to the resolution of Council related to this Plan, Council on June 8, 2018 did resolve the following, utilizing the wording recommended to the County by the Pigeon Lake Watershed Management Plan Steering Committee:

> *"That Council approve the recommendation presented by the Pigeon Lake Watershed Management Plan Steering Committee and having read and considered the Pigeon Lake Management Plan – 2018, resolves as follows:*
>
> 1. *The County of Wetaskiwin will work collaboratively with other Pigeon Lake watershed municipalities, the Pigeon Lake Watershed Association and the Pigeon Lake Watershed Steering Committee to implement the Pigeon Lake Management Plan – 2018.*
> 2. *The County of Wetaskiwin will reference and consider the recommendations of the Pigeon Lake Management Plan – 2018 in the development of new or updated Statutory Plans required under the Municipal Government Act and in the ordinary business of the municipality."*

Therefore, in summary, on behalf of the County of Wetaskiwin and the over 11,000 citizens in which we serve, we formally request that the NRCB take these supplementary comments into account and implement the following conditions on the Applicant prior to approving the application and further to

impose conditions sufficient to fully address the concerns should the application be approved as follows:

1. Mandating that an environmental impact assessment be conducted and all environmental standards outlined by both the Government of Canada and Government of Alberta are in effect on the proposal to the fullest extent possible and adhered to by the Applicant as such, with failure to doing so being met with full enforcement action.
2. Requiring the Applicant to complete a Traffic Impact Assessment (TIA) for the area based on the typical traffic patterns to the CFO and if deemed necessary through the TIA or based upon best practices for CFOs throughout Alberta, that the Applicant be required to enter into Road Use Agreements with the County and potentially Alberta Transportation that outlines commitment by the Applicant at their sole cost for the mitigation of their direct and indirect impacts to County Infrastructure including, but not limited to intersection treatments, provision of dust suppression, and payment of funds to the County for the ongoing repair and maintenance of road and bridge infrastructure at a minimum.

In closing, the County of Wetaskiwin has always enjoyed a strong and productive relationship with the NRCB, would greatly appreciate that the NRCB take our concerns serious, and make tangible progress in remedying concern to the benefit of all parties as best as possible if the proposal is approved. If there are any questions regarding this matter, please contact Mr. Rod Hawken, Chief Administrative Officer, by phone at (780) 361-6225, or by email at rhawken@county10.ca, or Mr. Jeff Chipley, Assistant Chief Administrative Officer, by phone at (780) 361-6223, or by email at jchipley@county10.ca.

Yours sincerely,

for Josh Bishop
Reeve

:jc

cc: County of Wetaskiwin Council
Mr. Rod Hawken, Chief Administrative Officer (CAO)
Mr. Jeff Chipley, Assistant CAO
Mr. Neal Sarnecki, Director of Planning & Economic Development
Mr. Jarvis Grant, Development Officer

TAB 23

TECHNICAL MEMO

OUR FILE: 2115-00111-00

To	From
Meaghan M. Conroy MLT Aikins LLP	Nav Sandhu, P.Eng. Michael Florendo, P.Eng.
Re	**Date**
Confined Feeding Operation G&S Feedlot, Range Road 23 **Drainage Review Report**	29 September 2022

1. Introduction

McElhanney Ltd. (McElhanney) was requested to prepare this Technical Memorandum by MLT Aikins, legal counsel for David Labutis and Gloria and Randy Booth. The Booths and Mr. Labutis own lands that neighbor the proposed Confined Feeding Operation (CFO).

The CFO is located in Wetaskiwin County, Alberta (NW ¼ of 03-47-02 W5), along Range Road 23. The project location is shown on Figure 1.

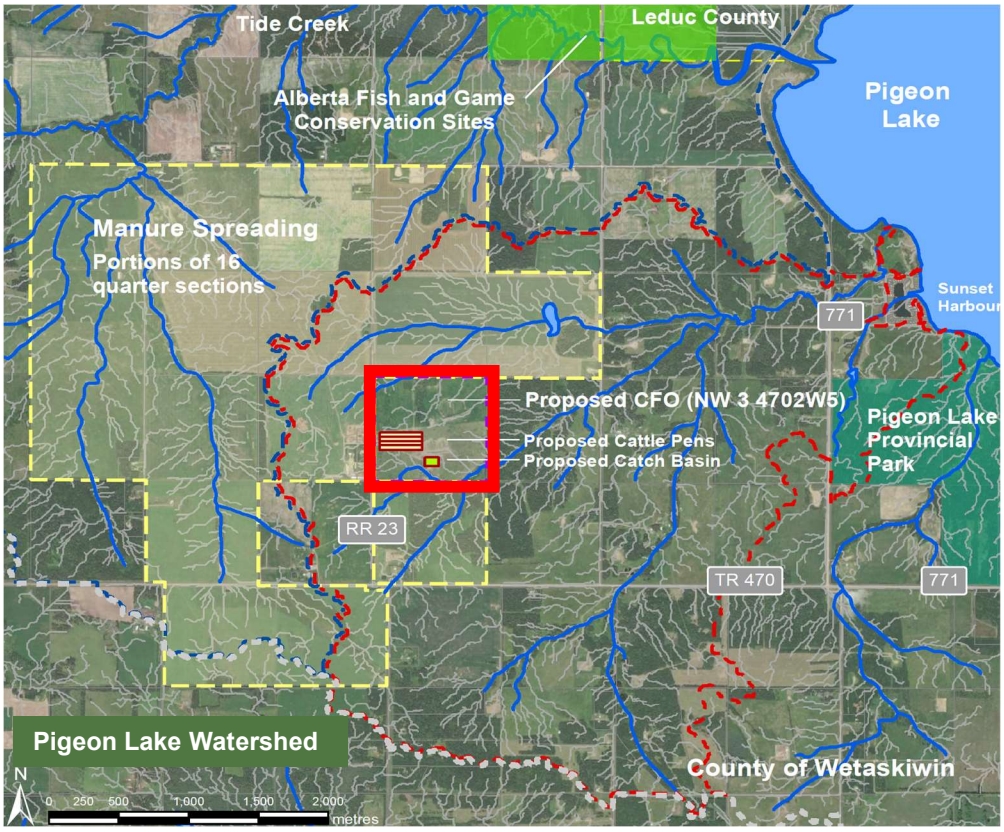


Figure 1 – Project Location (red square)

The project involves the design and construction of a feedlot (approx. 4000-head operation) with stormwater runoff being directed to and stored in a Catch Basin (CB) unit. Figure 2 shows the proposed design elements.

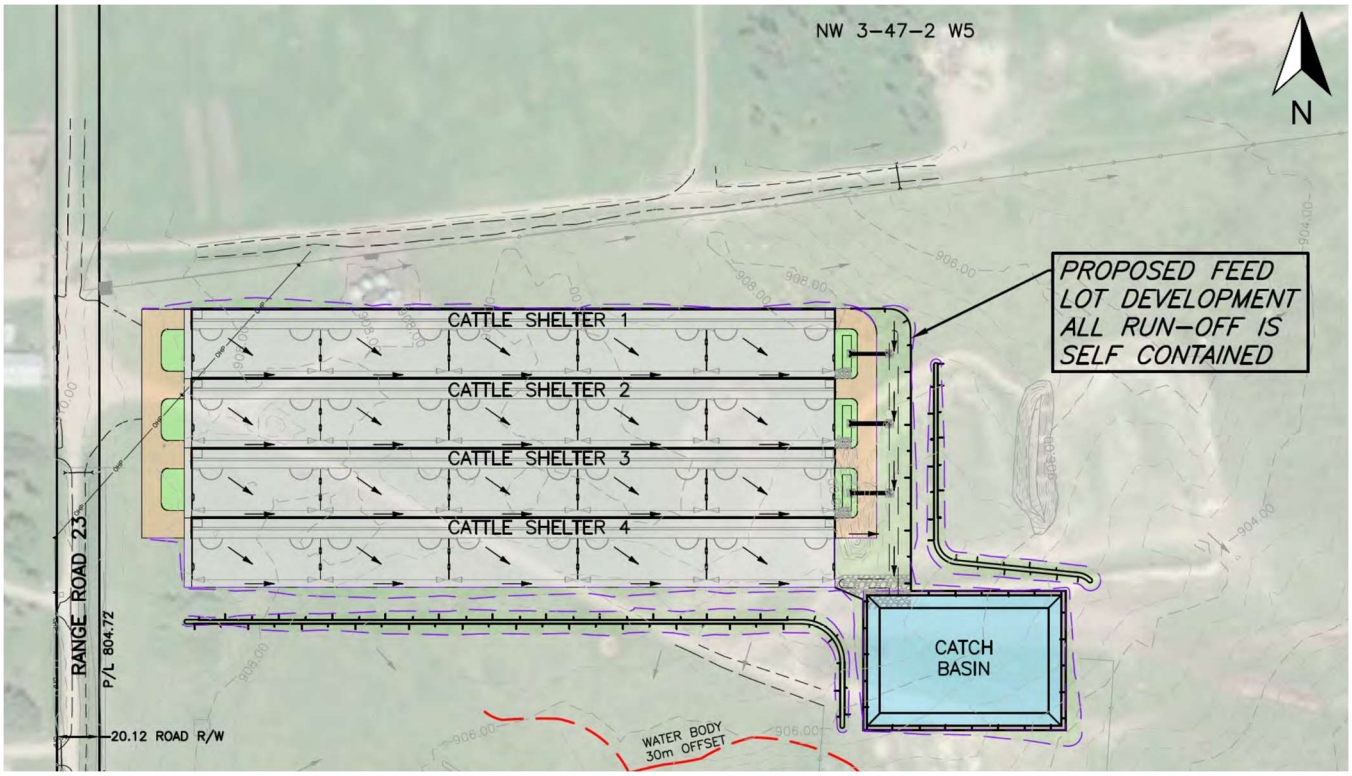


Figure 2 – Proposed Feed Lot Development and Catch Basin (Alterra, 2022)

At the request of MLT Aikins LLP, McElhanney reviewed the provided project data and this report summarizes our finding and design considerations and recommendations related to the proposed catch basin facility. The focus of our review and comments are on the design requirements (and applicability of said requirements) for the catch basin facility, identification of the current state of practice for the design of these types of facilities (i.e. stormwater management, detention/retention, etc.), and identification of design, operations and maintenance considerations and potential risks related to this specific facility.

2. Background Information

2.1. Project Location & Description

The proposed CFO is to be located at NW 3-47-2 W5M in Wetaskiwin County, roughly 6 km west from the Summer Village of Poplar Bay and 15 km northwest from the Hamlet of Westerose, AB. The terrain is sloping to the southeast towards an adjacent seasonal drain which flows into a tributary to Pigeon Lake. The Decision (*Decision Summary RA21045*) states that the drain is approximately 33m to the east of the proposed CFO. The CFO facility is located in the west end of the Pigeon Lake Watershed, in an extension of the Northern Boreal Forest Eco Region.

2.2. Information Reviewed

We were provided the following information to review:

- G&S Feedlot design drawings, Al-Terra Engineering (Red Deer) Ltd., August 16, 2022
- Geotechnical Report, Union Street Geotechnical, November 9, 2021
- Statement of Concern, Pigeon Lake Watershed Association, April 6, 2022
- CFO Adverse Effects Background Report, Pigeon Lake Watershed Association, April, 2022
- Decision Summary RA21045, Natural Resources Conservation Board, August 31, 2022
- Request for Board Review (#6 - REQUEST FOR REVIEW: RA21045 / G&S Cattle Ltd.), September 21, 2022
- Technical Document RA 21045
- Review letter, CPP Environmental, August 22, 2022
- Precipitation maps, Alberta Environment and Parks
- Agricultural Operation Practices Act, Province of Alberta, January 31, 2020
- Estimation of Pollutant Loads in Surface Water Runoff Stemming from a Proposed Confined Feeding Operation in the Pigeon Lake Watershed, Margaret Allen, September 28, 2022

2.3. Current Design Summary

We understand that a new CFO will be developed and its stormwater runoff will be collected to a centralized stormwater storage facility, the CB unit. Furthermore, the CB appears to have been sized to capture runoff from a 1:30 year 24-hour storm event, as per Alberta Operations Practices Act (AOPA) guidelines.

It appears that the current CB design has been sized with storage capacity to meet the above design standard. Note the current design does not include any release of runoff from the CB through a formal outlet structure. The design also does not include any emergency overflow or spillway. It is therefore assumed any emptying of the facility would occur by pumping.

3. Design Standard

The design standard being used for the CB design originates from the AOPA guidelines which states the CB must have a storage capacity to accommodate a 1:30 year one-day (or 24-hour) rainfall event in addition to providing a freeboard of 0.5 meters. The guideline does not provide any further direction and consideration of other aspects of stormwater design such as stormwater storage design methodology, stormwater quality, best management practices, or operation & maintenance of CB storage facility.

Following are a few inherent assumptions in the AOPA design standard to note:

- The approach used to size the storage facility is based solely on capturing a rainfall amount of specific probability of occurrence that could occur in a 24-hour period.
- The probability of a CB reaching its maximum capacity from a 24-hour storm event in any given year is 3.33%. This assumes the CB is completely empty prior to such a storm event occurring. If the CB is

partially full, the probability of a CB reaching or exceeding its maximum capacity from a 24-hour storm event would increase.

- Should a rainfall event exceeding the 1:30 year 24-hour storm occur, the CB would reach its full capacity and be at risk of overtopping.
- There is an accepted risk or probability that the CB facility would overtop in any given year.

A few key considerations regarding the design standard being used. Firstly, the design standard does not provide any indication on what are accepted methods of releasing effluent from the facility or any indication on frequency the facility should be emptied. The risk of the facility reaching its maximum capacity is dependent on several other factors. These include:

- Operation of the CB facility, particularly the scheduled emptying of the facility following extreme rainfall events
- The elapsed time between rainfall events (or inter-event time) in relation to emptying of the CB

The risk of the CB reaching its maximum capacity increases as the inter-event time decreases. Also, the risk of the CB reaching its maximum capacity increases with the time taken for the CB to be emptied prior to the next rainfall event. As such there is an increased risk of a CB reaching its maximum capacity in areas of regular and frequent rainfall events if the CB is not emptied.

Typically, stormwater storage facilities are designed to have some form of regular or continual release of runoff so the facility can be emptied to replenish capacity for the next storm event. In situations where no release of runoff is intended for prolonged periods (such long-term holding ponds or evaporation ponds), the design of a storage facility would need to consider long-term rainfall amounts. This would be completed using long-term continuous simulation modeling that take into account seasonal precipitation and potential releases of runoff from the facility such as evaporation, infiltration, or stormwater re-use (potable or non-potable use).

3.1. Other Design Guidelines

A common and widely accepted guideline for analysis and design of stormwater storage facilities is the *"Stormwater Management Guidelines for the Province of Alberta"* published by Alberta Environment and Parks (AEP). There are also numerous municipal stormwater design guidelines available for design of stormwater storage facility where municipal permitting and approvals are required for construction of stormwater storage facilities. Regardless of which design guidelines or criteria is referenced, stormwater designs need to adhere to the principles of sound engineering and follow the accepted standard of practice. In instances where design guidelines do not exist, reliance on other local guidelines or the AEP guidelines for managing stormwater would be prudent.

Also note, management of stormwater runoff and design of associated drainage infrastructure are dependent on and need to consider local conditions such as precipitation amounts and patterns, soils and groundwater conditions, downstream sensitivities, and property and environmental impacts.

3.2. Effects of Multi-Day Rainfall

Although the current AOPA design guidance for CB sizing is based on a single event (1:30 year, 1 day) storm, the industry standard design practice for stormwater runoff collection and storage facilities is to look at multi-day and

continuous rainfall modeling with storage volumes based on major system storage (i.e. 100-yr events and higher). It can be argued that this level of design is mainly due to the risk of failure and potential flood impacts to urban areas; however, with it's proximity to existing watercourses leading directly to Pigeon Lake, an overflow and release of the collected runoff/effluent would have a harmful impact to receiving waters.

An initial assessment of the CB performance based on a recent rainfall events in the watershed was conducted. The rainfall events occurred between June 13 and July 12, 2022 and produced a combined rainfall amount of over 340mm. Reviewing the 30-day precipitation accumulation data from AEP (*Figure 3*), it can be seen that the site is located along the edge of the 220-250mm and 250-280mm precipitation zones.

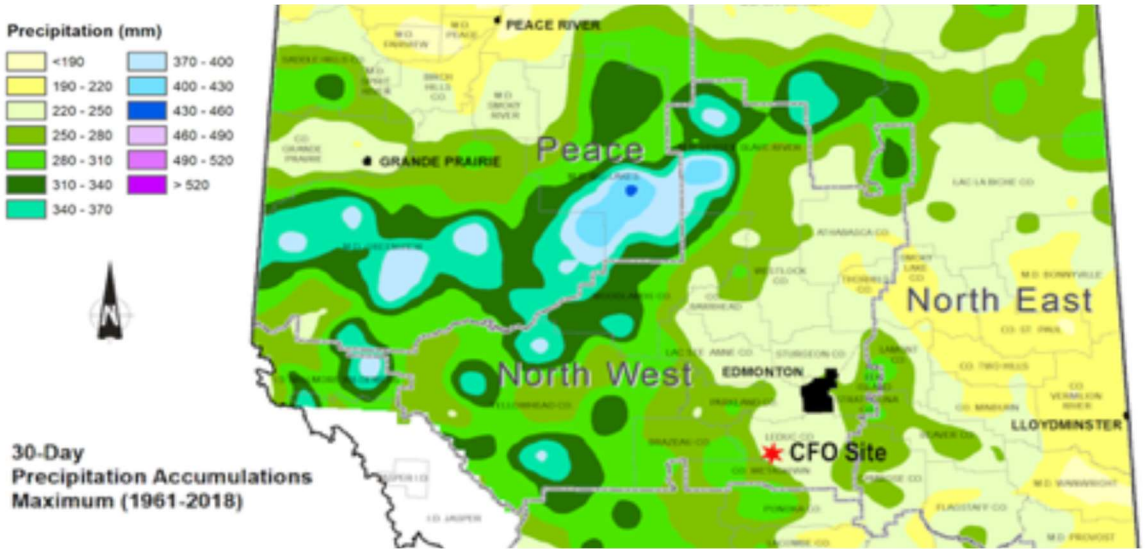


Figure 3 – 30-Day Precipitation Accumulations (1961-2018), Alberta Environment

Rainfall and evaporation data used in this assessment was taken from the Battle River Headwaters Weather Station, located approximately 16 kilometers to the south of the site (see *Figure 4*).

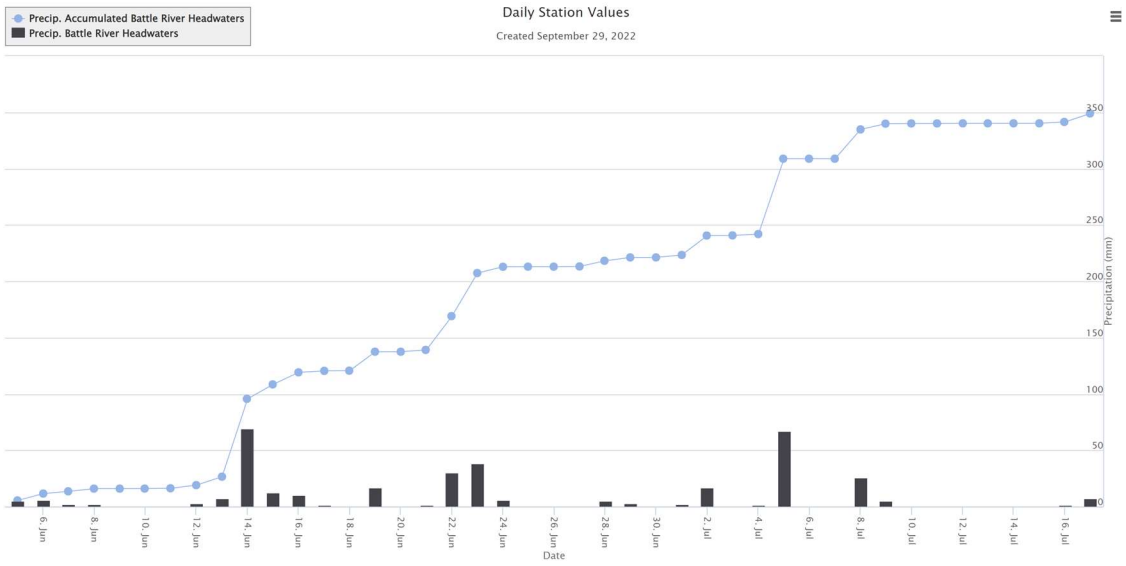


Figure 4 – Precipitation and Accumulated Precipitation for Rainfall Events, 30-day June-July 2022

A runoff and storage assessment was completed for these actual rainfall events with varying starting CB volume conditions – empty, one-third full, and two-thirds full – at the onset of rain. A summary of the CB storage performance can be seen in *Figure 5*. This shows that at starting from empty, the CB will be at overflow capacity (10,336 m^3) approximate two weeks from the onset of rain and sooner if any runoff volume was currently being stored.

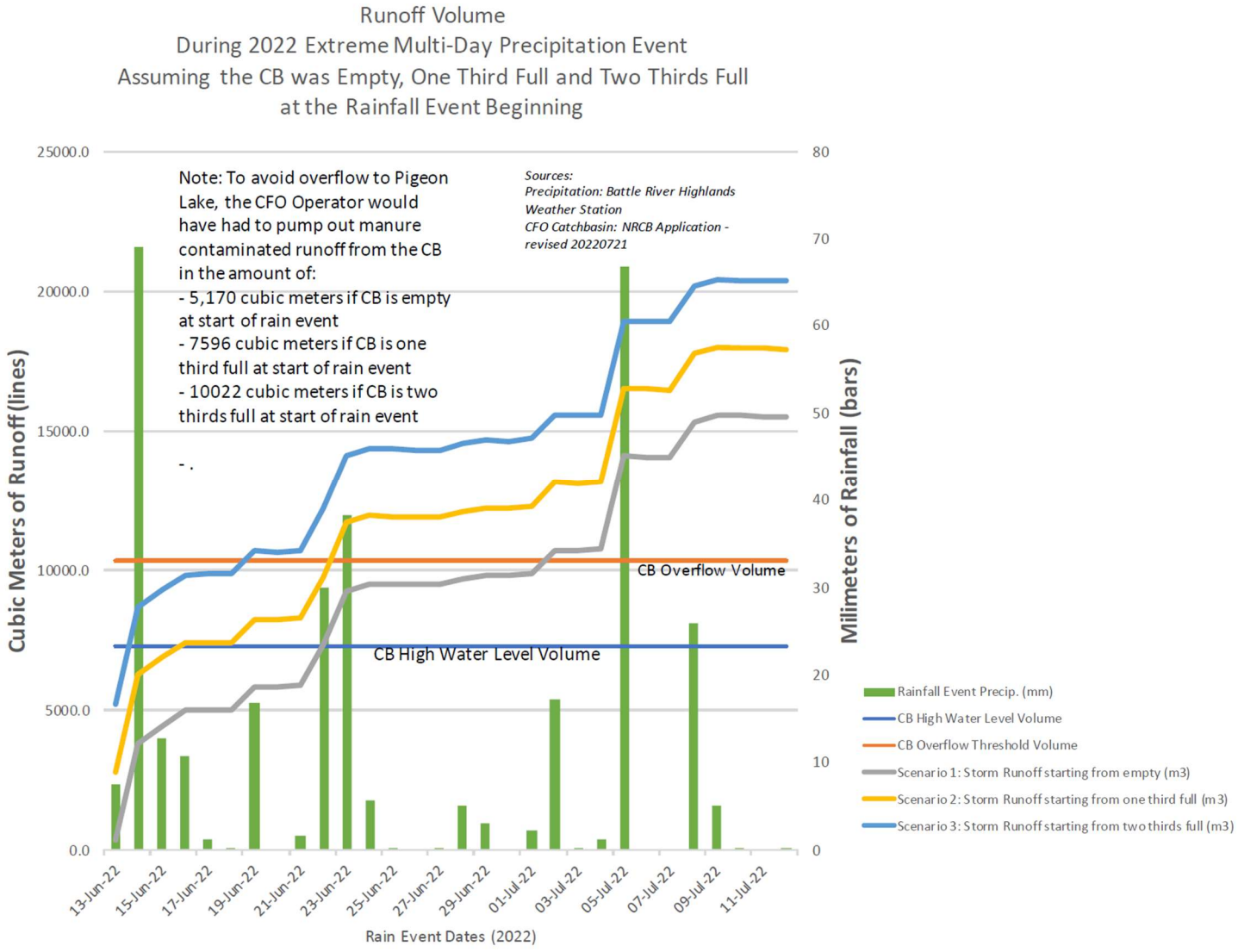


Figure 5 – Multi-Day Catch Basin Storage Volume Assessment

3.3. Release of Runoff and Potential Risks

Based on the review of the current CB calculations and design approach, the capacity of the facility could be exceeded due to successive rainfall events should the facility not be regularly emptied. However, there is no formal emergency spillway or specific location for the overflows to be released. This can result in downstream flooding and potential failure of the embankment being used. Furthermore, it is our understanding the effluent may contain contaminants that could be harmful to the downstream receiving environment. This should be considered

as part of an overall risk assessment and management plan when developing the design criteria for the design of the CB facility. Lastly, if the volume will be reduced via pumping and disposal at another location, during rainfall events, the location of disposal and the pumping plan should be described in any permit or approval documentation.

4. Considerations and Recommendations

The following design considerations and recommendations are provided to align the current CB design to industry standards for stormwater storage facilities:

- The design of the stormwater storage CB facility should consider long-term rainfall data and patterns as opposed to a single rainfall event amount. This is particularly important as there is no indication of how and when the CB would be emptied.
- The use of computer simulation modeling could aid in design optimization when considering pond emptying frequency
- An emergency overflow should be provided in the event the capacity of the facility is exceeded. If the intent of the design is to no allow for any release or provide an emergency overflow in order to completely protect downstream areas, then the pond should be sized for a much larger return period (e.g. 100-year or 1-500yr return period
- A stormwater storage facility design report should be provided documenting the analysis methodology, discussion on potential risks and mitigation, and operation and maintenance plans

5. Closure

We trust that this report provides the information required at this time. Should you have any questions, please contact either of the undersigned.

Yours truly,

McElhanney Ltd.

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PERMIT TO PRACTICE
McELHANNEY LTD.
RM SIGNATURE:
RM APEGA ID #: 62960
DATE: 29 Sept 2022
PERMIT NUMBER: P006383
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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