BURNS MAENDEL
CONSULTING ENGINEERS LTD.

903 Rosser Avenue
Brandon, MB R7A 0L3
Tel: 204.728.7364
Fax: 204.728.4418
www.bmce.ca

April 15, 2024

Environmental Approvals Branch
Manitoba Environment and Climate Change
Box 35 – 14 Fultz Boulevard
Winnipeg, MB R3Y 0L6

Attention: **Housseini Coulibaly - EAB**

Reference: 7317434 Manitoba Ltd. - Crystal Spring Colony Wastewater Lagoon – File No. 6193.00

Subject: Technical Advisory Committee Response

Mr. Coulibaly,

On December 20th, 2023 BMCE received questions and comments relating to the Crystal Spring Colony proposed wastewater treatment lagoon Environmental Act Proposal (EAP) from the Technical Advisory Committee (TAC), the Rural Municipality of Armstrong, and the Rural Municipality of Gimli. BMCE received further comments from the general public on February 22nd, 2024.

BMCE has provided responses and clarification, where applicable, to applicable questions and comments in the attached letter.

I trust that the attached meets your requirements, however should you require additional information please do not hesitate to contact the undersigned at 204-728-7364.

Yours truly,
BURNS MAENDEL CONSULTING ENGINEERS LTD.

[redacted]

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
[redacted]

Ashley Haigh, P. Eng
Civil Engineer

Commentary from Department of Fisheries and Oceans:

Q1: *We request that you visit our website at http://www.dfompo.gc.ca/pnwppe/reviews-revues/request-review-demande-d-examen-001-eng.html to determine if DFO needs to review your project. If your project is not in one of the listed exempted waterbody types nor does it fall within the standards and codes of practice, we recommend that you submit a Request for Review to DFO before proceeding further.*

A1: Refer to BMCE EAP Section 4.5. As per the Fisheries Act – Wastewater Systems Effluent Regulations SOR/2012-139 – Part 1 Effluent Containing Deleterious Substances:

Authorization to deposit

- ***6 (1)*** *For the purpose of paragraph 36(4)(b) of the Act, the owner or operator of a wastewater system may*
  — during a given calendar year, quarter or month, determined in accordance with subsection (2) — deposit or permit the deposit of effluent that contains any of the deleterious substances prescribed in
  section 5 via the system's final discharge point in any water or place referred to in subsection 36(3) of the Act if the effluent is not acutely lethal as determined in accordance with section 15 and if — during the
- *previous calendar year, previous quarter or previous month, determined in accordance with subsection (2) — the effluent met the following conditions:*
  (a) *the average carbonaceous biochemical oxygen demand due to the quantity of CBOD matter in the effluent did not exceed 25 mg/L;*
  (b) *the average concentration of suspended solids in the effluent did not exceed 25 mg/L;*
  (c) *the average concentration of total residual chlorine in the effluent did not exceed 0.02 mg/L, if chlorine, or one of its compounds, was used in the treatment of wastewater; and*
  (d) *the maximum concentration of un-ionized ammonia in the effluent was less than 1.25 mg/L, expressed as nitrogen (N), at 15°C ± 1°C.*

A domestic wastewater lagoon is permitted to discharge to fish bearing water bodies, so long as the above effluent conditions are met. Should a license be issued for the lagoon, it is standard practice that the testing and effluent requirements as stated above are included as a condition of the license by Manitoba Environment and Climate Change (MECC). BMCE has confirmed that a Request for Review does not need to be submitted to DFO.

Questions from the Environmental Compliance and Enforcement Branch:

Q2: *Is the blood from the animals being directed toward the lagoon? If so, what steps is the facility taking to minimize odour?*

A2: Blood does not enter the wastewater collection system or the lagoon. During the slaughter process, blood is allowed to coagulate and, once in semi-solid form, will be mixed with offal byproducts and composted or sent to a rendering facility.

Q3: Why is the water from the weeping tile being directed toward the lagoon?

A3: The proponent requested BMCE include weeping tile discharge to the lagoon as they prefer this over individual sump systems in each house. Flow from the weeping tile has been included within the 15% Inflow and Infiltration (I&I) used to hydraulically size the proposed lagoon.

Questions and Commentary from the Rural Municipality of Armstrong:

Q4: *The proposed lagoon location is in close proximity to the only two (2) residences in the immediate area.*

A4: BMCE proposed the lagoon at this location due to the lower capability of this land to be farmed and the proximity to the proposed discharge path.

MECC's *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons, 2022* Section 2.a) requires a minimum setback from the outer toe of the lagoon berm to the nearest individual residence of 300 metres. BMCE has provided a minimum setback of 532 metres (177% the minimum requirement).

Q5: *The proposed lagoon location is prone to flooding events.*

A5: Refer to BMCE EAP Appendix E for the Hydrologic and Hydraulic Assessment completed. The recommended 1:100-year flood level is 247.80 metres. The proposed lagoon berm height has been designed to 248.50 metres, 0.7m above the 1:100-year flood level and is also 0.58m above the lowest point in either Road 106N or Road 15E, in the vicinity of the lagoon (247.92 metres).

In a typical year, the lagoon will only be discharged between June 15 to November 1 during the dry season. If flooded conditions are present, the lagoon will not be discharged and MECC will be contacted for emergency discharge direction. The lagoon has also been designed with 1.0m of freeboard to allow for additional storage under emergency conditions.

Q6: *No information has been given as to how the provincial infrastructure in the area will be improved to accommodate the proposed lagoon and surface water runoff from the colony. Moreover, this area is always one ice jam away from causing flooding not only on the lagoon site but throughout the Malonton area.*

A6: This EAP and technical review response is intended to remain within the scope of the wastewater lagoon alone, however, BMCE applied for and obtained approval to construct water control works (License No. 2023-WCW-0172) in accordance with The Water Rights Act for the surface water runoff from the proposed colony site and lagoon. The proposed works include the appropriate drain crossings, removal of one approach, and detention storage.

BMCE also applied for and obtained a Provincial Water Infrastructure Permit (File 31E.05) to complete works in accordance with The Water Resources Act for the surface water runoff from the proposed colony site and lagoon.

In addition, the discharge from the lagoon will be released using a trickle discharge. See A5 regarding flooded conditions. Ice jam flooding is not a concern since the lagoon will only be discharged between June 15 to November 1 during the dry season.

Q7: *The proposed lagoon is in close proximity to a waterway used by fish for spawning.*

A7: Refer to A1 and BMCE EAP Section 4.5.

Q8: *No other waste treatment options have been presented by the provincial authority.*

A8: A domestic wastewater treatment lagoon is the preferred treatment technology for a population of this size in a rural setting. As long as regulations and guidelines are met/exceeded, an alternative treatment method is typically not considered. Wastewater treatment lagoons offer the following advantages over other treatment systems:

- Ease of operation for small communities,
- Require less energy to operate than aerated lagoons or treatment plants, and
- Tolerant to wastewater load fluctuations.

Q9: *Proper consultation was not undertaken with the affected Municipalities to allow other solutions and issues to be presented and discussed.*

A9: A requirement of the MECC EAP approval process includes publicly posting the EAP for a period of 30 days (or longer) to allow for public and technical review and commentary, as is presently being conducted. BMCE will be responding to all questions and commentary with regards to the proposed lagoon. Domestic wastewater treatment lagoons which adhere to regulations and guidelines are commonly approved without special public consultations.

In addition, the Fisher Armstrong Planning District, via the Rural Municipality of Armstrong office, issued a Development Permit No. #2021-A-29 on October 14, 2021, for the development of the new colony site, including the location of a wastewater treatment lagoon.

BMCE also met with the Rural Municipality of Armstrong during the design and approvals process for the new colony site:

- During a meeting on July 24, 2023, to discuss drainage for the site, a resolution was passed stating:

  WHEREAS Crystal Spring Colony, within section 28-18-3E, is seeking RM consent to drainage works as submitted by a summary provided on July 13, 2023.
  AND WHEREAS RM Council has met with the engineer on July 24, 2023, and has discussed and reviewed the application.
  THEREFORE BE IT RESOLVED that Council approve the proposed drainage design as presented by the project engineer with the requirement for the following assurances to address drainage concerns:
  1. *That the referenced retention pond be of such a size to accommodate heavy run-off from all anticipated and future roof and potential asphalt surfaces*
  2. *That affected provincial drains are in sufficient condition and capacity to accommodate additional run-off*

3. *That the culvert and crossing along 15E (approximately 600 metres north of 106N) be upgraded (or removed) to accommodate heavy water flow without creating a choke-point.*

- a meeting on September 22, 2023, to discuss drainage, access road location, and the lagoon placement, with Colony members present. At this meeting, the RM inquired about the location of the proposed lagoon, BMCE explained the rational. The RM appeared satisfied with the discussion; the lagoon, and its placement, was not mentioned further until BMCE received these comments.

Following the September 22, 2023, meeting, the Rural Municipality of Armstrong requested BMCE contact Ms. Kim Kmet from the Environmental Compliance and Enforcement Brandon of MECC. Ms. Kmet had been receiving calls regarding concerns over the new development. BMCE contacted Ms. Kmet and explained the existing approvals and licensing processes in place for the new development. Ms. Kmet was satisfied all regulatory requirements were being followed.

Questions and Commentary from the Rural Municipality of Gimli:

Q10: *The location of the proposed lagoon appears to be in an area that is at a high risk of flooding. This is particularly so given the greater risk of extreme climate events arising as a consequence of climate change. While Burns Maendel has proposed certain options to improve drainage, these options appear to be contrary to the Willow Creek Integrated Watershed Management Plan. More importantly, these options require the involvement of third parties to implement them. The proponent is not in a position to implement these options on their own.*

A10: Refer to A5 regarding flooding in the area of the proposed lagoon. There are no significant drainage improvement options proposed for the wastewater lagoon aside from maintaining the proposed drainage path on proponent owned land (BMCE EAP Section 2.9). Refer to A6 for further site drainage information, third party involvement is not required. BMCE has reviewed the *Willow Creek Integrated Watershed Management Plan Draft* as it relates to the proposed lagoon. The *Willow Creek Integrated Watershed Management Plan Draft* acknowledges that properly designed and operated lagoons are a viable option for adequately treating wastewater.

Q11: *The proposed lagoon design contemplates the effluent ultimately being discharged into Willow Creek. The effluent will be discharged between the months of June and November. As we understand it, Willow Creek is a Class A drain with a number of indicator species of fish. Those include both Pike and Walleye. Members of the local community in Gimli have raised concerns about the impact that effluent discharge may have on fish spawning in Willow Creek, as well as on the viability of the fish in the creek as a whole. Those concerns relate to both the impact that the effluent will have as a consequence of its water quality and to the impact that the mere act of discharging the effluent will have on the fish in Willow Creek. Commercial and recreational fishing is a significant aspect of Gimli's local community and economy. Gimli has an obligation to ensure that adequate steps have been taken to investigate any development that may detrimentally impact upon either commercial or recreational fishing.*

A11: BMCE has the upmost concern for the safety and wellbeing of the public and surrounding ecosystems regarding the proposed lagoon. BMCE has considered the potential impacts to fish spawning (refer to A1 and BMCE EAP Section 4.5) and completed a review of the *Fish Community and Fish Habitat Inventory of Streams and Constructed Drains Throughout Agricultural Areas of Manitoba 2002-2006.* Site X-04-157 (location at which the proposed lagoon effluent would enter Willow Creek) is listed as a catch site for Central Mudminnow and Northern Pike, both of which spawn in the early spring (usually April) and will not be affected by potential lagoon discharge. Discharge would not occur until June 16th at the earliest and therefore poses no risk to spawning in Willow Creek.

Q12: *The proposal concedes that there are two threatened birds that exist in the area of the development: the barn swallow (Hirundo Rustica) and the bobolink (Dolichonyx Oryzivorus). It should be evident that the proposed construction and operation of the lagoon in the vicinity of these threatened species could impact upon their population.*

A12: Refer to BMCE EAP Section 4.7. The Manitoba Conservation Data Centre has provided recommendations for construction practices in areas with sensitive species and BMCE has

made these recommendations a requirement of lagoon construction. This is a common practice for earthworks construction projects in Manitoba.

Questions and Commentary from Dillon Consulting:

Q13: *Can the proponent particularize how it has determined that the proposed development will not adversely impact upon potential or established Aboriginal and/or Treaty rights, having not consulted with any Indigenous communities in the area, including the First Nation community that resides a mere 40 km away from the proposed development?*

A13: The duty to consult First Nations is a constitutional duty imposed on the Crown flowing from section 35 of the Canadian Charter of Rights and Freedoms.[1]

The Colony is committed to mitigating any potentially adverse impacts its operation may have to all its neighbours – First Nations are no different. For the reasons set out in this response and the technical submissions of BMCE, the Colony submits that any potentially adverse effects associated with the proposed operation can be mitigated through appropriate practices, measures and safeguards.

The technical merits of the proposed operation notwithstanding, the Colony states it has no legal duty to consult First Nations in submitting the within application. It is a third-party, not exercising any government function, and is in no way acting an agent or delegate of the Crown. This point of law is confirmed by the Supreme Court of Canada in *Haida Nation v. British Columbia (Minister of Forests),* 2004 SCC 73 ("*Haida*").[2]

The duty to consult First Nations rests with the Province in enacting the legislation that delegates procedural powers to municipalities – in this case *The Municipal Act* and *The Planning Act.* That is the stage at which the duty to consult is owed to First Nations and must be exercised by the Province on behalf of the Crown.

The Court in *Neskonlith* adopted the words of the Supreme Court of Canada in *Rio Tinto Alcan Inc. v. Carrier Sekani Tribal Council* 2010 SCC 43, stating "[i]f a tribunal structure set up by the legislature is incapable of dealing with a decision's potential adverse impacts on Aboriginal interests, then the Aboriginal peoples affected must seek appropriate remedies in the courts."[3]

Finally, members of any nearby First Nations are welcome to review the technical submissions of BMCE to make submissions and submit evidence in the same manner as all members of the public, including with respect to any potential impacts they believe the Colony's proposal may have on the exercise of their Treaty Rights.

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[1] Part 1 of the *Constitution Act*, 1982, being Schedule B to the *Canada Act 1982* (UK), 1982, c 11.
[2] TAB 8 – *Haida*, paragraph 53.
[3] TAB 9 – *Neskonlith*, paragraph 69.

Q14: *Can the proponent particularize how it has obtained, reviewed, and considered the feedback, concerns, and comments of adjacent and/or affected property owners and municipalities, including the aforementioned Indigenous communities?*

A14: Refer to A13. A requirement of the MECC EAP approval process includes publicly posting the EAP for a period of 30 days (or longer) to allow for public and technical review and commentary, as is presently being conducted. BMCE will be responding to questions and commentary with regards to the proposed lagoon.

Q15: *Can the proponent provide an opinion on the likely degree of impact that the proposed development and supporting drainage improvements would have on the local and downstream drainage network?*

A15: Refer to A6. Based on the BMCE EAP Appendix E - Hydrologic and Hydraulic Assessment Table 2, the mean daily discharge of Willow Creek at Rd 15E was calculated to range from 4.4 - 31.6 m^3/s, depending on design storm frequency. A two-week trickle discharge period for the proposed lagoon results in 0.018 m^3/s additional flow. This represents an increase in flow through Willow Creek at Rd 15E by 0.4%, or less. The proposed lagoon will negligently impact downstream residents along Willow Creek; the lagoon will not be discharged during peak runoff periods.

Q16: *Can the proponent demonstrate any commitment from the relevant municipal bodies in relation to the level of operation and maintenance required in order to implement the proponent's proposed drainage changes?*

A16: No additional levels of operation and maintenance are required by municipal bodies regarding the drainage or discharge from the proposed lagoon. Refer to A6.

Q17: *Can the proponent confirm that the proposed drainage amendments are permissible under the current draft Willow Creek Integrated Watershed Management Plan and advise what steps they took to investigate this issue?*

A17: Refer to A6. There are no drainage amendments relating to the proposed lagoon.

Q18: *Can the proponent provide commentary on whether the project location would be 'habitually inundated' without the above drainage improvements which are reliant upon third party participation?*

A18: Refer to A5, A6, and A16.

Q19: *Can the proponent confirm if they are (or are not) in alignment with Section 2. (c) of the Design Objectives for Wastewater Treatment Lagoons (MCC, 2022)? Further to the above question: can the proponent provide rationale as to why they are (or why they are not) in alignment with Section 2. (c) of the Design Objectives for Wastewater Treatment Lagoons?*

A19: Section 2. c) of the Design Objectives for Wastewater Treatment Lagoons states:

***Surface Runoff**: Location of lagoons in areas receiving significant amounts of runoff water is discouraged unless adequate provisions are made to divert storm water around the cells and otherwise protect embankments of the lagoon. Areas which are habitually inundated shall be avoided.*

Figure 05 from the BMCE EAP Appendix E - Hydrologic and Hydraulic Assessment shows that the water surface profile in the South Malonton Drain could exceed the existing north and west prairie elevations alongside the drain, in the event of a 1 in 10-year storm, or greater. The water surface elevations for a 1 in 10-100 year storms are expected to be much lower than the proposed lagoon embankments, refer to A5.

Q20: *Any changes to drainage in that affect water elevations would trigger an Environmental Impact Assessment under the Canadian Environmental Assessment Act. Can the proponent confirm whether there would be any the impact on Dennis Lake if the above amendments to drainage are made and advise as to what steps they took to investigate this issue?*

A20: Refer to A6. This EAP and technical review response is intended to remain within the scope of the wastewater lagoon alone, there are no drainage alterations and subsequent water elevation changes caused as a result of the proposed lagoon. All proposed drainage works have been licensed by the authorities having jurisdiction. Dennis Lake is located approximately 15km west and 19 metres higher than the proposed lagoon. There are no impacts to Dennis Lake caused by the proposed lagoon.

Q21: *Downstream flooding from the project site along Willow Creek has been documented. Can the proponent comment on the impact on downstream residents along Willow Creek during peak runoff periods if the above amendments to drainage are made?*

A21: There are no drainage alterations and subsequent water elevation changes caused as a result of the proposed lagoon. The lagoon will be trickle discharged during low-flow, dry, conditions. While not relevant to the lagoon EAP, a drainage license has been obtained from MECC and MTI.

Q22: *Can the proponent provide a quantitative analysis in relation to contaminant loading and treatment for the parameters beyond (i.e., nutrient loading) in order to demonstrate that no significant negative effect on water quality is likely to occur based on the current design?*

A22: A quantitative analysis of contaminant loading is not required for compliant lagoon effluent discharge. The proposed lagoon design meets all requirements as outlined in MECC's *Design Objectives for Wastewater Treatment Lagoons, 2022*. Refer to BMCE EAP Section 2.6. Wastewater will be tested prior to discharge to confirm the following effluent quality requirements (1. i)) are met:

***Effluent Quality Requirements**: All wastewater treatment lagoons must meet the following requirements:*

- *i. Five-day carbonaceous biochemical oxygen demand (CBOD5) – not to exceed 25 milligrams per litre;*
- *ii. Total suspended solids (TSS) – not to exceed 25 milligrams per litre unless caused by algae;*
- *iii. Fecal coliform content or Escherichia coli (E. Coli) content as indicted by the MPN index - not to exceed 200 per 100 millilitres;*
- *iv. Un-ionized ammonia content expressed as nitrogen (N), at 15°C ±1°C – not to exceed 1.25 milligrams per litre for intermittently discharging facilities; and*
- *v. Total phosphorus – not to exceed one milligram per litre; or a demonstrated nutrient reduction strategy for facilities discharging less than 820 kg/year of total phosphorus (a population equivalent of under 2000 people.) For facilities proposing a nutrient reduction strategy, strategies will be evaluated on a site specific basis, and strategies which do not offer a reasonable likelihood of attaining*

a total phosphorus content of one milligram per litre at a significant downstream waterway will not be approved.

Q23: *We note that there is one long-term water quality monitoring station within the Willow Creek watershed located on Willow Creek at PTH 8. This site has been monitored quarterly since 2005 by the East Interlake Conservation District and was added to the provincial long-term water quality network in 2010. Has the proponent compared their potential chemical loading to baseline data in Willow Creek?*

A23: The proposed lagoon design meets all requirements as outlined in MECC's *Design Objectives for Wastewater Treatment Lagoons, 2022*. A comparison to water quality monitoring stations is not required as part of the approval process for domestic wastewater treatment lagoons which conform to the current regulations and guidelines.

Q24: *Can the proponent provide evidence to identify whether the proposed drainage works and loss of surface water retention will or will not aggravate the migration of contaminants?*

A24: There are no drainage works relating to the proposed lagoon, all drainage works have been licensed.

Q25: *Can the proponent provide their proposed monitoring plans that demonstrate compliance prior to, and at the point of mixing with Willow Creek?*

A25: Monitoring is only required at the discharge location for a domestic wastewater lagoon, refer to A22. No monitoring plans at the point of mixing with Willow Creek are proposed at this time.

Q26: *Can the proponent describe how they will minimize negative impacts downstream and to the environment through discharge to Willow Creek?*

A26: There are no negative impacts anticipated as a result of the proposed lagoon construction and operation, refer to BMCE EAP Section 4.

Q27: *As noted above, Total Suspended Solids (TSS) are a concern for the region. How will the proponent mitigate TSS effluent quality in the adjacent drainage ditch, and at the point of mixing with Willow Creek?*

A27: The proposed lagoon design meets all requirements as outlined in MECC's *Design Objectives for Wastewater Treatment Lagoons, 2022*. The *Willow Creek Integrated Watershed Management Plan Draft* states the mean value of TSS measured in Willow Creek between 2008 and 2010 is 31 mg/L. Current regulations stipulate a lagoon must not be discharged until it meets a TSS value of less than 25 mg/L (less than the average value of Willow Creek).

Q28: *As the Willow Creek Integrated Watershed Management Plan has included stated goals with measurable reduction in nutrients, bacteria, and TSS for Willow Creek, can the proponent provide alternative treatment plans that would meet these stated goals, as opposed to using Willow Creek for 'natural filtering of any contamination'?*

A28: Refer to A22. No effluent will be discharged from the lagoon until it meets MECC license requirements; alternative treatment plans are not required. "Additional natural filtering of any contamination" occurs within the discharge path and Willow Creek prior to the final discharge location of Lake Winnipeg.

Q29: *Can the proponent outline their strategies for record keeping, and identify potential areas for project risk/mitigation (e.g., can the proponent identify options for nutrient abatement, address access issues, and outline emergency discharge procedures)?*

A29: Refer to BMCE EAP Section 5.2 for record keeping requirements. Refer to BMCE EAP Section 4 for possible effects and planned mitigation measures. Refer to A22 for effluent quality testing and BMCE EAP Section 2.6 for proposed nutrient abatement (trickle discharge). There are no access or egress issues with the proposed lagoon. Should a license be issued for the lagoon, it is standard practice to outline the procedure for an emergency discharge as a condition of the license by MECC, typically to the effect of:

The licensee shall, if reporting is required pursuant to clause XX of this licence in two consecutive years:
a) Engage the services of a qualified consultant, acceptable to the director, to undertake an investigation of the development and related infrastructure, to determine the ability or inability of the existing system to meet the hydraulic loading capacity of the community. The investigation shall include but not be necessarily limited to:
i) diagnosis of the cause(s) of the recent exceedances of maximum operating depth;
ii) sources of infiltration into the wastewater system including the municipal infrastructure;
iii) current hydraulic loading of the system;
iv) lack of storage capacity due to sludge build-up within existing cells;
v) the organic loading on the primary cell in terms of the five day biochemical oxygen demand; and
vi) operating procedures;
b) Provide to the director, within four months of the notification given pursuant to clause XX an engineering report describing in detail the results and observations concluded by virtue of the investigation; and
c) Provide to the director, within four months of the report provided pursuant to sub-clause b) of this section, a remedial action plan in the form of a detailed engineering report describing recommended modifications, repairs, or upgrading works to overcome excessive hydraulic loading of the system.

Q30: *Can the proponent outline their approach to sludge management, including whether sludge removal will be required, and where the sludge will be deposited if removal is required?*

A30: If the proposed lagoon is decommissioned or if sludge needs to be removed from the lagoon (approximately every 20-30 years), MECC requires a Biosolids Application EAP be submitted for review, at that time. Typically, solids are land applied. Extensive nutrient testing is completed to ensure the land which solids are applied to does not receive excess nutrients.

Q31: *Can the proponent provide information on how they will implement and measure sediment and erosion control during and after construction until the site is stabilized to ensure no sediment enters the Willow Creek and ultimately Lake Winnipeg?*

A31: Should a license be issued for the lagoon, it is standard practice to outline the procedure for construction erosion control as a condition of the license by MECC, typically to the effect of:

The Licencee shall:

a) *Conduct all ditch related work activities during no flow or dry conditions and not during the April 1 to June 15 fish spawning and incubation period;*
b) *Not construct the wastewater treatment lagoon or wastewater collection system during periods of heavy rain;*
c) *Place and/or isolate all dredged and construction material where it will not erode into any watercourse;*
d) *Implement effective long-term sediment and erosion control measures to prevent soil-laden runoff, and/or silt from entering any watercourse during construction and until vegetation is established;*
e) *Routinely inspect all erosion and sediment control structures and immediately complete any necessary maintenance or repair;*
f) *Revegetate soil exposed during the construction of the Development with native or introduced grasses or legumes. Native species shall be used to revegetate areas where native species existed prior to construction; and*
g) *Use rock that is free of silt and clay for riprap.*

Q32: *Given the fact that the proponent intends to discharge effluent into fish-bearing waters, the Fisheries Act applies, and effluent discharge criteria will need to meet the federal standards protective of freshwater aquatic receptors, above and beyond the MCC requirements. Can the proponent indicate what measures are in place to ensure that the effluent discharge criteria meets or surpasses the federal standards protective of freshwater aquatic receptors?*
A32: The Fisheries Act standards for effluent and MECC standards for effluent align. Refer to A1 and A22.

Q33: *Can the proponent advise whether they investigated if the effluent discharge to drain/creek would impact groundwater over years of release and if so, what conclusions they drew?*

A33: Effluent discharge is required to meet or exceed provincial requirements, therefore an investigation into the contamination of groundwater is not required.

Q34: *Can the proponent comment on why there are no up gradient and down gradient monitoring wells? Typically, these can be used to determine whether there is any impairment to the groundwater sources so that remedial action may be taken quickly.*

A34: Up gradient and down gradient monitoring wells are not required to be installed, nor is groundwater monitoring a common requirement for a lagoon with a properly designed liner system. In instances where ground water has been observed near the ground surface and the risk of contamination is increased, monitoring wells may be considered. As per the Geotechnical Investigation completed in the location of the proposed lagoon, 4 of the

5 test holes did not observe groundwater within depths of 5.9 to 7.5 meters below surface grade. 1 of the 5 test holes observed ground water at a depth of 5.6 meters below surface grade.

Q35: *Can the proponent append the groundwater study report prepared by Friesen Drillers to the EAP for review?*

A35: Please see the attached report in Appendix A of this letter. This report was completed for the purpose of determining suitable groundwater for the development of the site, not for the purpose of lagoon design.

Q36: *We note that the Willow Creek Integrated Watershed Management Plan recommends conducting environmental risk assessments for all wastewater lagoons or sewage treatment plants to establish site-specific effluent discharge objectives. Given the sensitivity of the ecosystem and fish habitat that the wastewater lagoon is discharging directly into, can the proponent advise whether an environment risk assessment was performed and if so, produce the relevant report. If not, can the proponent confirm that such an assessment will be conducted?*

A36: In accordance with Table 2: Implementation Plan for the Willow Creek IWMP, Priority 3: Surface Water Quality on page 52 of the *Willow Creek Integrated Watershed Management Plan Draft,* the EAP submission process is considered the environmental risk assessment for the proposed wastewater lagoon and satisfies this condition. A regulated wastewater lagoon adhering to current standards for discharge can safely discharge to a Type A habitat; refer to A1 and A11.

Q37: *Can the proponent provide commentary on how effluent discharge would or would not impact fish and/or fish habitat in Willow Creek, including potential changes to spawning potential?*

A37: Refer to A1 and A11. No impact to fish, fish habitat, or spawning potential is anticipated.

Q38: *Section 3.7.3 of the EAP describes habitat for two species of threatened bird (the barn swallow, Hirundo rustica; the bobolink, Dolichonyx oryzivorus) that is in the immediate vicinity of the current proposed project location (specifically, the 'cultivated fields'). Has a species at risk study been conducted at the site to confirm that there are no nests, burrows, or dens in the project site?*

A38: Refer to A12. The Manitoba Conservation Data Centre has provided recommendations for construction practices in areas with sensitive species and BMCE has made these recommendations a requirement of lagoon construction.

Q39: *Other wastewater lagoons in the Province with abattoir wastewater have aerated secondary cells to assist with treatment, and/or discharge to land (as prescribed by their Licenses). Can the proponent comment on why these approaches are not being proposed here?*

A39: BMCE has appropriately designed the size of the lagoon to treat the hydraulic and organic loading from the proposed abattoir (blood is being collected and does not enter

the wastewater system; refer to A2). In addition, BMCE has previously designed and obtained licenses for wastewater lagoons, with similar abattoir loading, without the use of an aerated secondary cell.

Q40: *Considering this is a facility that is being designed for one (1) annual discharge event, can the proponent confirm that the Primary cell will not experience overloading during the period (approximately 40 days) when the secondary cell is isolated in preparation for the discharge event?*

A40: Thank you for bringing this to our attention. The statement in BMCE EAP Section 2.8: *"However, based on the loading calculations, we do not anticipate a second discharge will be necessary in a typical operating year."* was made in error and should be removed. Two discharges are expected to obtain a maximum 230-day retention time once the new colony site is fully built-out (20+ years). In addition, the primary cell has not been adequately sized to accommodate hydraulic flow during the discharge period. BMCE will submit a Notice of Alternation to MECC to increase the primary cell capacity to account for the additional volume.

Q41: *Construction details are missing from the EAP, e.g., groundwater dewatering system during liner installation, monitoring well installation surrounding the facility, preparation of the liner surface, reference to liner installation report submittals to Manitoba Environment and Climate Change (MEC), etc.*

A41: The above-mentioned construction details are commonly stipulated as conditions in the license issued by MECC. Pending the issuance of a license and any stipulations provided by MECC, conforming Construction Drawings and Specifications will be issued. In addition, groundwater dewatering during liner installation is not required at the proposed depth of installation for the lagoon based on the geotechnical investigation. Refer to A34 regarding groundwater monitoring wells.

Q42: *Operational details are missing from the EAP, i.e., discharge procedure, record keeping and inspection routines, groundwater and surface water monitoring plans, biosolids management.*

A42: Refer to BMCE EAP Section 2.8 for discharge procedures. Refer to BMCE EAP Section 5.1 for inspection and monitoring requirements. Groundwater and surface water monitoring are not a common requirement of wastewater lagoon operation (refer to A34) and a biosolids management plan does not need to be included until such time that it is required (refer to A30).

Q43: *Can the proponent confirm that it has applied for and received the relevant development permits associated with the construction of the lagoon and associated outbuildings.*

A43: Confirmed. The Fisher Armstrong Planning District, via the Rural Municipality of Armstrong office, issued a Development Permit No. #2021-A-29 on October 14, 2021, for the development of the new colony site. This EAP is for the lagoon licensing process only, building permits are to be applied for as required.

Questions and Commentary from the Public:

Q44: [The proposed lagoon will cause a] decrease in adjacent or neighbouring property values due to lagoon being so close.

A44: The Rural Municipality of Armstrong and the Fisher Armstrong Planning District designates the colony lands as within the "AG - Agricultural General Zoning District" in accordance with the Rural Municipality of Armstrong - Zoning District Map 1B. In Part II of the RM of Armstrong Zoning Districts bylaw, Section 12.2 Item 22) a Public Utility is a 'Permitted Use' within AG zoned land. Part I of the RM of Armstrong Zoning Districts bylaw, Section 7.6 Item 5) defines a Public Utility as: *"…any system, works, plant, pipeline, equipment, service or system of sewage collection or disposal declared to be a public utility … Typical uses include …* ***sewage lagoons*** *…"* Therefore, the Rural Municipality of Armstrong bylaws permits the use of sewage lagoons on Agricultural General zoned lands within the RM. The region's objectives include *"[recognizing] that within the Agriculture Areas of the Planning District a variety of legitimate rural uses associated with agricultural, natural resources activities as well as residential, commercial, industrial and recreational uses that cannot be suitably located in a settlement center must be accommodated in a manner which not only supports and enhances the continued viability of the Planning District but also minimizes the potential for land use conflicts."* The colony's proposed lagoon falls well within the approved land use for this area.

Q45: [The proposed lagoon] creates a deterrent for people who would otherwise want to live in this neighbourhood.

A45: Within a 1km radius of the proposed lagoon site, 53% of the land is Colony owned. Of the remaining 47% non-Colony owned land, more than 47% is covered densely by trees. This leaves approximately 22% of the available land surrounding the proposed lagoon site exposed to or within sightline of the proposed lagoon. This land is also zoned "AG - Agricultural General Zoning District" by the Fisher Armstrong Planning District. Further residential development of the available land around the lagoon is unlikely.

Q46: Would it be feasible to move the proposed lagoon location to the northwest corner of the property? If not possible, will the trees and bushes on the south side of the lagoon be maintained? These trees and bushes would shield the lagoon from viewing from adjacent properties, especially from across the road.

A46: Moving the proposed lagoon to the northwest corner of the property would shorten the discharge path to Willow Creek and decrease the nutrient uptake by plants. The northwest corner of the property is also approximately 1.0m lower in elevation than the proposed lagoon location and more susceptible to flood events. Due to these reasons, BMCE recommends the lagoon be constructed in its currently proposed location. The trees and bushes on the south side of the lagoon will remain, and the Colony will be planting additional trees.

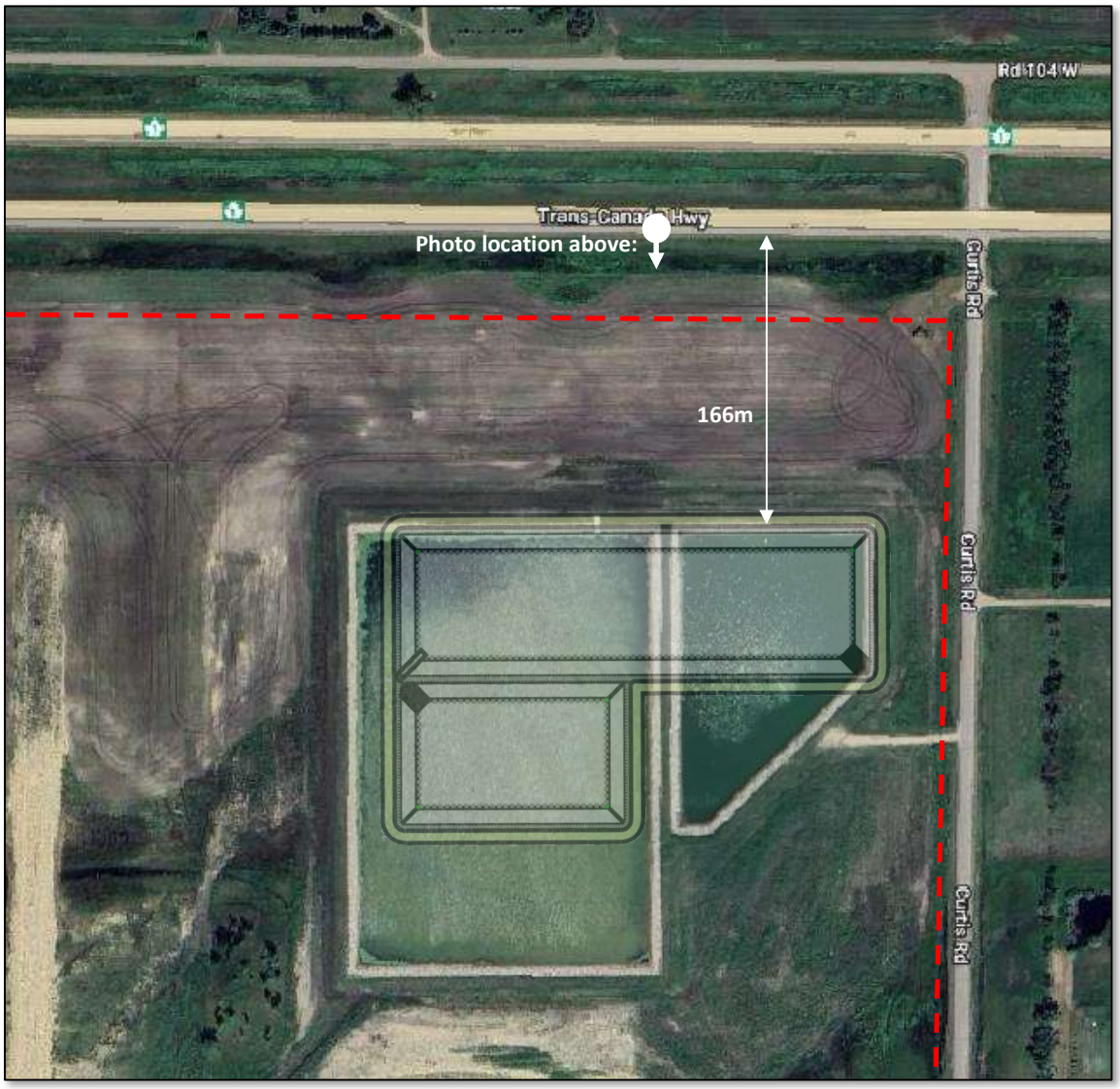
Q47: Could additional plantings be done? Regardless of location, adding more tree lines/fencing, odour/eyesore buffer would need to be incorporated in the plans.

A47: Properly designed lagoons are typically visually discreet, see below photos of the Meadowbrook lagoon located along Highway #1, west of Brandon, MB. The Meadowbrook lagoon is located approximately 166m from the edge of the highway. The proposed lagoon is located 133m from Road 15E and 227m from Road 106N.

An overlay of the proposed lagoon has been shown over the Meadowbrook lagoon for size comparison.

There is only one residence within sightline of the lagoon that is not as densely surrounded by trees, however, treed areas still exist between it and the proposal lagoon. This residence is 608 meters away from the proposed lagoon, more than double the minimum recommended setback distance.

Regardless, the Colony will be planting additional trees around the proposed lagoon. Additional plantings will be incorporated into the revised Drawings submitted with the Notice of Alteration (refer to A40).



Q48: Due to frequent winds from north and northwest, noxious gases would be blown right towards adjacent residences.

A48: If a lagoon is properly designed and well operated, odour problems are usually just a temporary occurrence during seasonal turnover, notably in the spring. Turnover lasts an average of 2 weeks. Based on historical data obtained from the Gimli Climate Station #5031042 between 2017 and 2024, 14% of the recorded direction-of-gusts were to the south or southeast during potential turnover seasons for the lagoon (April-May and September-October). There is a 1 in 7 chance of the prevailing wind direction directing odour to the closest residences to the proposed lagoon, based on the average length of the turnover period, the nearest residents may experience mild odour for 2-3 days in each the spring and fall.

Q49: What is the expected useful life of the liner? What happens if the liner fails?

A49: BMCE has specified a 60 mil textured HDPE liner, as required by MECC's *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons, 2022.* This type of liner is specifically designed to minimize the effect of human development on the environment, especially for waste containment. The expected lifetime of the specified material, properly installed and protected, is for the life of the lagoon facility.

If the liner fails, the PVC collection pipes installed beneath the lagoon would collect leaked wastewater in the sump collection points. Collection sumps will be inspected on a regular basis. A leak in the lagoon liner will be evident and diagnosed in a timely fashion, if required.

Q50: The land is not currently used as cultivated agricultural land; it is bush and wild meadow. There could be nesting grounds in the area.

A50: Reference to the proposed lagoon location in BMCE EAP Section 3.7.3. is intended to speak to the project location as a whole (28-18-03 E). BMCE EAP Sections 3.1 and 4.4 reference that the lagoon is located on land *"presently utilized as grasslands…with isolated areas of deciduous forest."* and *"lands that consist of cultivated fields with intermittent deciduous forest,"* respectively. Refer to A12 for nesting grounds mitigation measures.

Q51: What is the history of land ownership: was this area previously Crown land, municipal, or provincial land?

A51: The land was purchased privately by the Colony in 2020. Land ownership prior to this was not investigated.

Q52: Drainage options proposed by the proponent appear to be contrary to the Willow Creek Integrated Watershed Management Plan.

A52: Refer to A10.

Q53: Proposed drainage options require third-party involvement for implementation: proponent is not in a position to independently implement these options.

A53: Refer to A10.

Q54: [The] development area consists of numerous permanent and semi-permanent wetlands: drainage of Class 4 and 5 wetlands is prohibited under The Water Rights Act.

A54: As part of the Water Control Works License (No. 2023-WCW-0172) application, the Colony and the Manitoba Water Stewardship Division worked together to properly diagnose the various Class I, II, and III wetlands that exist within the project site in June 2023. No Class IV and V wetlands were identified. Any altered wetlands as part of this project will be compensated for under The Water Rights Act and Water Rights Regulation, upon receipt of the lagoon license.

Q55: Given flood protection measures such as dykes that were mentioned around the proposed development, was the construction of a ditch on the east side of Road 15E considered in order to protect neighbouring properties from flooding?

A55: There are no dykes being proposed or installed as a result of the development or the wastewater lagoon. All structures are being constructed above the recommended flood protection levels. BMCE applied for and obtained approval to construct water control works (License No. 2023-WCW-0172) in accordance with The Water Rights Act a Provincial Water Infrastructure Permit (File 31E.05) to complete works in accordance with The Water Resources Act for the surface water runoff from the proposed colony site and lagoon. The proposed works include the appropriate drain crossings, removal of one approach, and detention storage to minimize impacts to neighbouring properties.

Q56: How will the lagoon discharge during a wet fall when water may be surrounding it?

A56: If the conditions are such that the lagoon cannot be reasonably discharged, MECC will be contacted to determine any emergency discharge procedures. Upon review by MECC, the lagoon may be discharged, or else wastewater may be pumped out and hauled to an appropriate wastewater treatment facility.

Q57: Local community members in Gimli raised concerns about the impact of effluent discharge on fish spawning in Willow Creek, as well as fish viability in the creek.

A57: Refer to A1, A11, and A37.

Q58: [The local community has] concerns about the impact that the effluent will have due to its water quality and impact that the mere discharging of effluent will have on fish in Willow Creek.

A58: Refer to A1, A11, and A37.

Q59: What will be the impact on those using nearby waterways for recreational purposes such as kayaking on Willow Creek, or for livelihood and sustenance such as fishing?

A59: Regarding impacts to fishing, refer to A1, A11, and A37. No impact anticipated.

Regarding impacts to recreation, the *Manitoba Water Quality Standards, Objective, and Guidelines*, 2011 states the following parameter limits for recreational use surface waters:

Parameter	Maximum Limit for Recreational Surface Water	Maximum Lagoon Discharge Limit
Fecal Coliforms	200 per 100 mL	200 per 100 mL
Microcystin LR	20 µg/L	Testing not required. Visually observed on lagoon surface as blue algae, indicates high BOD loading.
pH	5.0-9.0	Testing not required. Typically between 6.0-9.0; varies with season.

Therefore, wastewater lagoon discharge parameters align with the recommended limits for recreational water use. No impact anticipated.

Q60: Could [the] proponent provide an estimate of the volume of effluent discharged on an annual basis?

A60: At full capacity, the lagoon has been designed to discharge a maximum volume of 17,048m^3 in the spring and 10,006m^3 in the fall, totaling 27,054m^3 annually. In reality, a colony builds out slowly over time. It could be more than 20 years before these volumes are realized.

Q61: What plans have been made to mitigate negative impacts in case of failure or accidental discharge from the lagoon?

A61: Refer to A49 for failure detection and A56 for emergency discharge procedures.

Q62: Will effluent discharge data (i.e., water quality testing data be accessible to the public? Will compliance results be made public?

A62: Discharge testing results must be submitted to and approved by MECC prior to every discharge.

Q63: Is public notification to downstream residents before discharge feasible?

A63: Approval to discharge must be received from MECC prior to every discharge; individual contact will not be provided.

Q64: The proponent has failed to demonstrate that no significant negative effect on water quality is likely to occur.

A64: Refer to A22.

Q65: [The three-phase hydro line installed to service the new development] cause significant damage to a neighbouring property.

A65: The Colony was not responsible for the installation of power lines outside of their own property. All power lines installed outside of the Colony property were done so by Manitoba Hydro. If power lines were installed within the right-of-way and caused damage, it is the Rural Municipality of Armstong's responsibility to discuss remedial measures with Manitoba Hydro.

Q66: Will groundwater be the only (or main) water source for the colony? Provide an estimate of groundwater use (m^3/day). Will this water consumption affect nearby wells?

A66: It is anticipated that groundwater will be the main water source for the Colony. Water use in excess of 25m^3/day requires a Water Use License from MECC. Applications for water use will be reviewed by the Water Use Licensing Section to determine the availability of unallocated water for the development.

Q67: What is the anticipated impact to groundwater quantity and quality (i.e., risk of aquifer contamination, drawdown, or depletion)?

A67: Refer to A66. A properly designed lagoon liner will not allow infiltration of untreated wastewater. There is negligible risk of impact to groundwater quality from the proposed lagoon.

Q68: The geotechnical report states that groundwater observations were short-term and not necessarily reflective of genuine groundwater conditions on the project site; have long-term monitoring plans been made?

A68: No, however, the Desktop Hydrogeological Review completed by Friesen Drillers states *"[Groundwater fluctuations] up to about 10ft. (3m) were apparent from the [nearest hydrograph stations]. Overall, the hydrograph indicates relatively stable aquifer levels, with no evidence of long term, progressive drawdown apparent in the chart."* and *"The new colony site is located within the thicker till sequence and static water levels are anticipated to be well below grade."*

Q69: Can the proponent append the groundwater study report prepared by Friesen Drillers to the EAP for review?

A69: Refer to A35.

Q70: [Does the proponent have approval obtained under the Fisheries Act] for the deposition of a deleterious substance into the drain leading to Willow Creek?

A70: Refer to A1.

Q71: Golden-winged Warbler and Red-headed Woodpecker are two SARA species in the project area – were impacts considered?

A71: BMCE contacted the Manitoba Conservation Data Centre to request a search of the rare species database for the project area. The review considered the primary location, as well as a 2-kilometer radius buffer from the footprint boundary. During this review, only the Barn swallow and Bobolink were identified, refer to A12. The Manitoba Conservation Data Centre has provided recommendations for construction practices in areas with sensitive species and BMCE has made these recommendations a requirement of lagoon construction.

Q72: What is the anticipated impact of the construction and operation of the lagoon on the Barn swallow (Hirundo rustica) and bobolink (Dolichonyx oryzivorus) populations, two threatened species?

A72: Refer to A12.

Q73: How will the smell from the abattoir and lagoon be mitigated?

A73: Refer to A48. See BMCE EAP Section 4.9: *"As outlined in Section 4.1, odour will only be a problem for short periods of time during the spring and fall. Nuisance odours can cause several minor health effects such as headaches, eye irritation, and respiratory problems. However, due to the proposed tree line and distance of separation from the nearest residences, no adverse effects on nearby residents are anticipated."*

Q74: How will "excessive odour" be determined and by whom? What will the possible/probable mitigation measures be?

A74: Excessive lagoon odour is commonly caused by lagoon overloading. Excessive odour will be determined in conjunction with the season, to distinguish between unusual or temporary seasonal turnover odour. Odour can be diagnosed by the lagoon operator or reported by the public to MECC.

If the lagoon odour is determined to be caused by overloading, mitigation measures such as desludging and installing aeration can be implemented. However, the proposed lagoon has been conservatively designed to accommodate and treat all of the Colony's future wastewater production. Excessive smell is not anticipated.

Q75: How will the addition of abattoir wastewater to human waste affect the efficiency of the lagoon and frequency of discharges?

A75: The addition of the abattoir wastewater has been accounted for in the design of the proposed lagoon and treatment requirements, no impact to the lagoon efficiency or currently proposed discharge frequency are anticipated.

Q76: No qualification was provided regarding the proposed trickle discharge. Can the proponent specify the related flow rate?

A76: Standard practice is to complete trickle discharge over a 2-4 week period. For a lagoon of this size, BMCE has designed a discharge period of 2 weeks. The average flow rate from the lagoon at maximum capacity will be approximately 14 L/s. For comparison, the average daily flow entering Willow Creek from the South Malonton Drain along Road 15E from a 1:2 year storm event is 1500 L/s.

Q77: Under summer drought conditions (e.g., 2021), Willow Creek may have virtually no flow; effluent dilution as suggested in the proposal would have an adverse impact: provide a discussion on the effluent dilution and associated effect, if any, on Willow Creek and Lake Winnipeg.

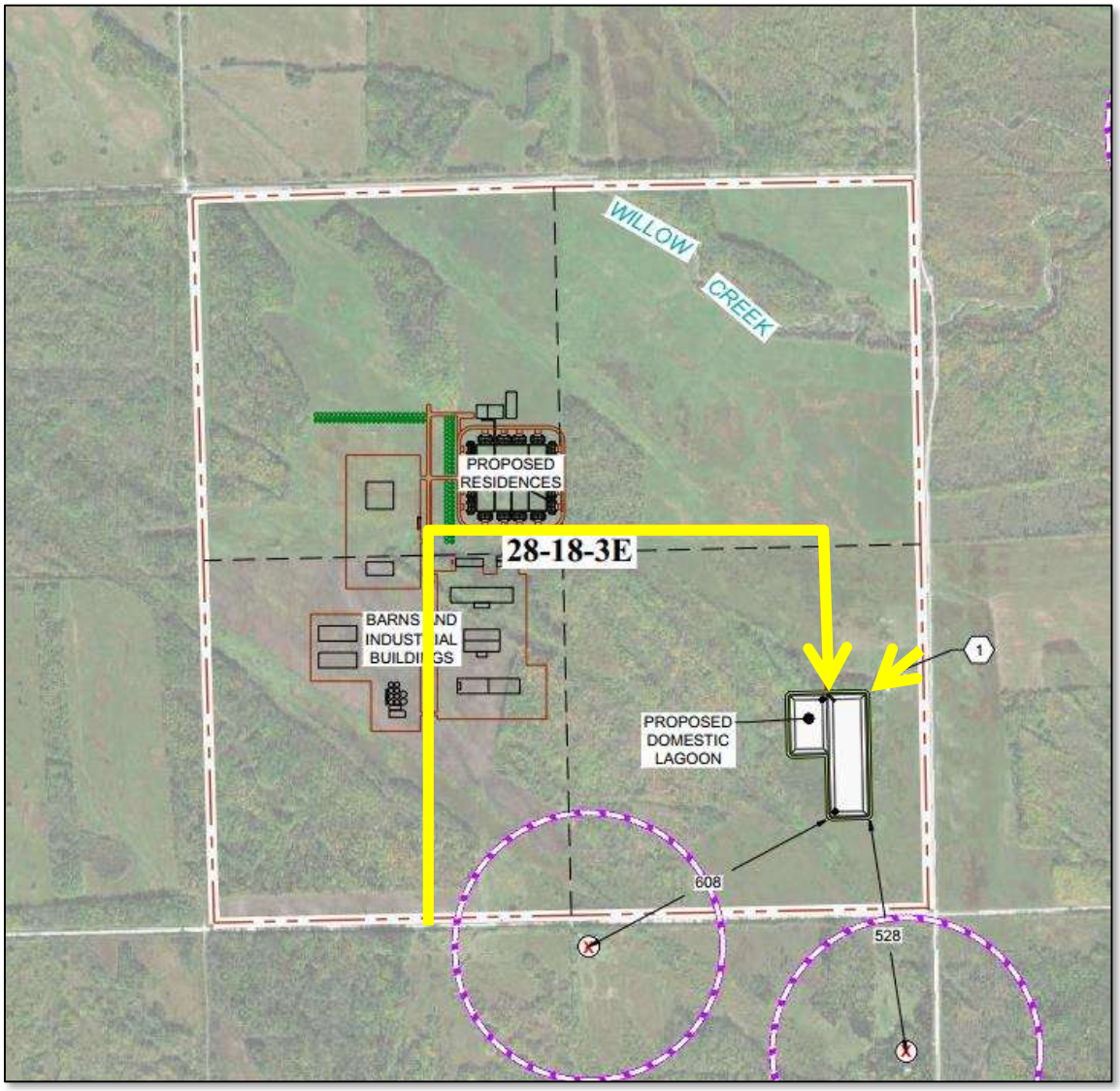
A77: Drought conditions are optimal conditions for lagoon discharge. This will allow for increased uptake of nutrients and polishing of effluent by vegetation, especially in the 1.1 km ditch prior to discharging to Willow Creek. No adverse effects are expected due to discharging during drought conditions on either Willow Creek or Lake Winnipeg.

Q78: What are [the construction impacts] for the lagoon, including greenhouse gas (GHG) emissions? What are the proposed mitigation measures?

A78: Refer to BMCE EAP Section 4.0 for Possible Effects & Planned Mitigation of Proposed Development details. Regarding GHG, *"During construction, emissions from construction equipment will be present. These emissions will be addressed and minimized by emphasizing the use of construction equipment in good operative condition and minimizing equipment idle time."*

Q79: It is shown there will be a service road on the north side of the lagoon: can the equipment access the site from the north to minimize the effects (pollutants, noise, and dust) on neighbours and minimize damage to drainage ditch?

A79: Construction equipment is expected to access the site via the proposed road off Husavic Road (106N) and the service road north of the lagoon, or via the existing property access off Road 15E, shown in yellow below:



Hauling to the site will be minimal as this is an HDPE lined lagoon and therefore does not require imported material to construct the berms. Most equipment will be mobilized to site and remain on site until the project is completed. Construction will take place only between the hours of 7:00am-11:00pm, in accordance with the Rural Municipality of Armstrong By-Law No. 7/2022. No damage to any drainage ditches are anticipated.

Q80: [Is there a] plan to mitigate GHG emissions from this project?

A80: Refer to A78.

Q81: The report indicates that the lagoon will emit noxious gases in the summer and spring whereas previously, this was reported to occur during spring and fall.

A81: Thank you for bringing this to our attention. The statement in BMCE EAP Section 4.9: *"As outlined in Section 4.1, odour will only be a problem for short periods of time during the spring and summer."* was made in error and should be corrected to *"As outlined in Section 4.1, odour will only be a problem for short periods of time during the spring and fall."*

Q82: How will hazardous wastewater (containing hydrocarbons such as in oil and gas) from the truck wash be prevented from polluting nearby Willow Creek and Lake Winnipeg?

A82: The truck wash wastewater is estimated to contribute 3.6% of the maximum daily loading to the lagoon. As per the National Plumbing Code of Canada, 2020, where the discharge from a fixture may contain oil, gasoline, sand, grit or similar materials, an interceptor designed for the purpose of trapping such discharges shall be installed. There will be an insignificant amount of hydrocarbons which may enter the lagoon. No pollution to Willow Creek or Lake Winnipeg is anticipated.

Q83: Will the quality of the collected water be monitored to verify there is no leak in the HDPE liner?

A83: BMCE assumes this question refers to the water collected by the PVC piping beneath the proposed lagoon liner. The quality of the ground water collected in the sump system will not be regularly tested. However, if persistent and excessive ground water is present, it will be tested to verify if a leak is the cause.

Q84: Will lagoon effluent be monitored for the presence of hazardous chemicals (e.g., petroleum products, heavy metals, oil, and grease)?

A84: No, refer to A82 regarding petroleum products, oil, and grease. Heavy metals predominantly settle out of wastewater and collect over time in the sludge layer of the lagoon. If the sludge is to be land applied as biosolids, a heavy metal analysis is completed at that time.

Q85: Will the effluent be monitored for bacteria, viruses, and other potential pathogens?

A85: The proposed lagoon will be required to monitor fecal coliform and E. coli bacteria prior to discharge in accordance with MECC's *Design Objectives for Wastewater Treatment Lagoons, 2022*. These types of bacteria are widely used as indicator organisms to determine the effectiveness of the disinfection process. Wastewater lagoons are typically better at removing fecal coliform bacteria and other pathogens than conventional mechanical plants, because long retention times, exposure to sunlight, dissolved oxygen, and settling are keys to pathogen removal.

Q86: Is there a golf course as part of this project?

A86: Thank you for bringing this to our attention. There is no golf course as part of this project. The bullet point in BMCE EAP Section 5.2: *"A statement whether the effluent was used for golf course irrigation purposes, volumes, dates, and time of irrigation applications,"* was included in error and should be removed.

Appendix A – Hydrogeological Review – Friesen Drillers

Friesen DRILLERS

March 2, 2021

Mr. Daniel Burns, P.Eng.
Senior Engineer
Burns Maendel Consulting Engineers Ltd.
1331 Princess Avenue
Brandon, MB R7A 0R4

Dear Daniel,

Subject **Desktop Hydrogeological Review**
Project No. 2021-011 - Crystal Spring Colony Site Development
28-18-03EPM - Rural Municipality of Armstrong, Manitoba

Friesen Drillers is pleased to provide this report to detail the results of our desktop hydrogeological study for a proposed groundwater supply at the above noted site. This study included a desktop review of available hydrogeological information to define the expected groundwater conditions for the area. It should be noted that no field work component was undertaken as part of this study.

Project Background and Scope of Work

It is our understanding that the Crystal Spring Colony plans to establish a new groundwater supply for a new colony development. As part of this proposed development, a preliminary hydrogeological review was requested to determine groundwater availability for the colony purposes. The preliminary estimate of colony water usage is less than 120 U.S.G.P.M. (~7.5 L/s) (BMCE, 2021).

Friesen Drillers was retained by Burn Maendel Consulting Engineers (BMCE) to complete a desktop hydrogeological appraisal for the colony site. This appraisal would be based on published works and hydrogeological information available for the region. A small report would be generated to detail the results. The report would be sealed by a professional hydrogeologist/hydrogeological engineer. The report would include the following components:

- Review local well logs, surficial geology, and background historical reports to describe the general aquifer conditions for the area. Well logs would also be reviewed to determine typical aquifer completion zones, well depths, and well construction types.
- Review of provincial hydrograph data to assess regional groundwater level fluctuations. This is an important consideration in the well drilling methodology, as some locations in the Interlake have artesian conditions with flow rates of more than 2,000 U.S.G.P.M.
- Review expected annual usage allocations and determine any regulatory requirements that may be necessary for the site.
- Provide recommendations for new groundwater supply at the proposed location. This will include an appropriate methodology and required well construction, along with the permitting requirements and technical analyses.

Site Setting

The new colony site is located four miles west of Highway 8, along Husavik Road (106 N), approximately 6 miles southwest of the Gimli townsite. It is understood that the new colony site is planned for section 28-18-3E. In general, the area surrounding the new colony site is sparsely populated and is used primarily for agricultural purposes. The site location is shown on the following page as Figure 1.

The site lies at an elevation of approximately 240 m geodetic. The land surface slopes to the east towards Lake Winnipeg, which has a surface elevation of approximately 216 m geodetic. Beyond the regional easterly slope of the prairie landscape, the land surface is generally of low topographic relief.

The Willow Creek flows easterly through the northeast quarter of the property, providing overland drainage to Lake Winnipeg.

Site Setting (Cont'd)

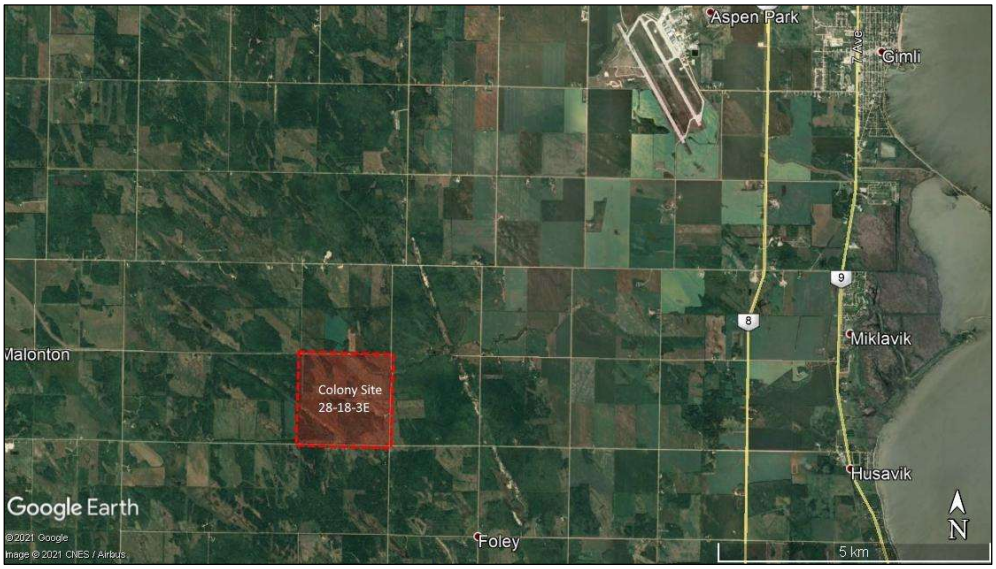


Figure 1 – Location of the new colony site; Crystal Spring Colony. (Source – Google Earth, 2021)

Regional Geology

Bedrock in the Gimli area composes the eastern fringes of the Western Canadian Sedimentary Basin (WCSB). The WCSB is a very large geologic feature that extends throughout the central Canadian plains and underlies about 1.4 million km^2 (Alberta Geological Survey, 2009). Formations of the WCSB dip towards the west at a rate of about 5-10 feet for every mile (Betcher, 1986). A geological cross-section is shown on the following page as Figure 2.

The WCSB rests upon Precambrian granitic bedrock. Above the Precambrian surface, the Ordovician Winnipeg Formation sandstone comprises fine-grained silica sand with layers of shale (Betcher et al., 1995). The thickness of the sandstone is commonly up to 60-80 ft., except along the basin edge, where it thins considerably. The sandstone cementation is variable which has a direct control on the overall permeability of the formation. For example, within the area known as the Carman Sands, the sandstone is poorly cemented, while areas outside of the Carman Sands, such as in the Interlake area, the sandstone can be relatively well cemented (McCabe, 1978).

The sandstone is overlain by the Ordovician Red River Formation, which includes alternating limestone and dolostone layers with minor shale (Render, 1970). The total thickness of the RRF increases from a few tens of feet at the edge of the basin to more than several hundred feet in the western parts. The RRF was extensively weathered by karstic glacial processes, which resulted in a highly fractured upper surface that commonly has significantly increased zones of permeability (Render, 1970). From Figure 2, the RRF composes the main subcrop under the new colony site, with a depth to bedrock in the range of about 100 to 130 ft. below grade.

The surficial geology of the region, shown on the following page as Figure 3, is composed predominantly of silt-rich glacial till surrounded by extensive deposits of clay (Matile and Keller, 2012). In some locations, the till contains localized lenses of sand and gravel. The overburden sediments in the region were deposited as a result of glacial activity and, as a result, display a relatively complex distribution. The total thickness of overburden deposits at the proposed colony site was mapped to be about 100-130 ft. (30-40 m) (Figure 3).

Based on regional geologic mapping, stratigraphy underlying the new colony site includes the following:

- Glacial silt-rich till with minor clay from surface to 100-130 ft. below grade.
- Brown carbonate bedrock (Red River Formation) from about 130 to about 375 ft. below grade.
- Winnipeg Formation shale and sandstone from about 375 to about 475 ft. below grade
- Precambrian granitic bedrock below about 475 ft. below grade.

Regional Geology (Cont'd)

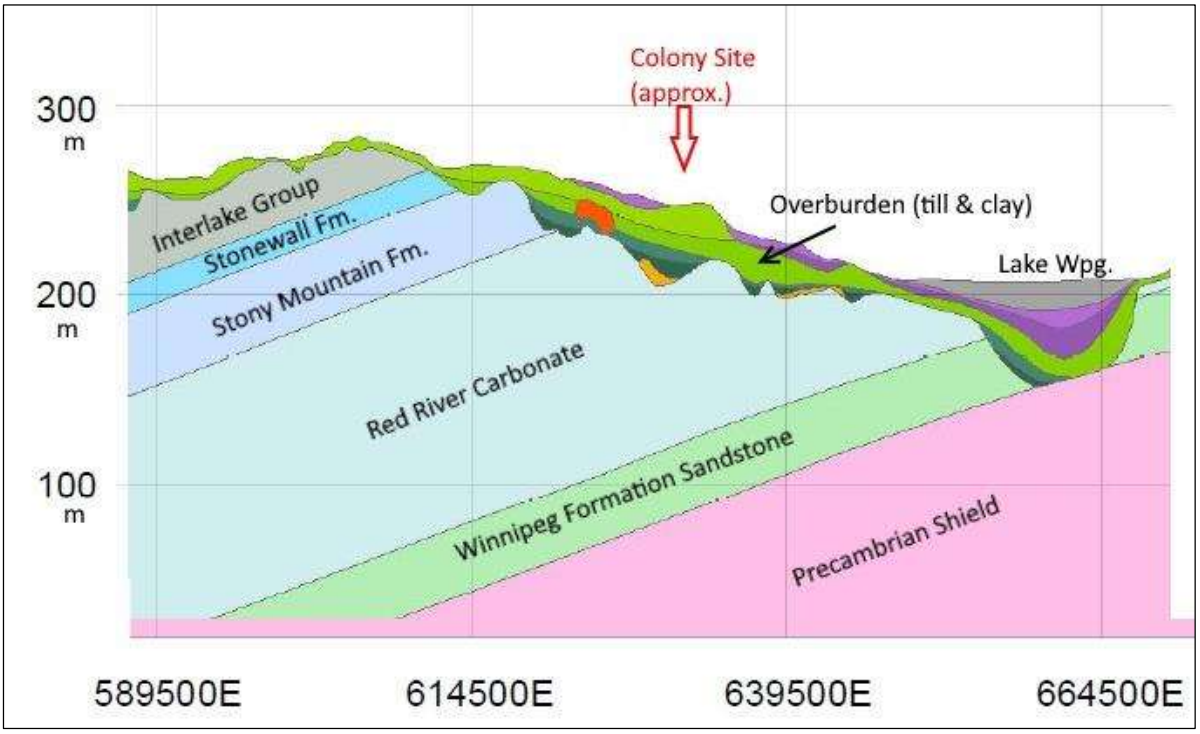


Figure 2 – Geological cross-section; Crystal Spring Colony. (Source – Matile and Keller, 2012)

Figure 3 – Surficial geology (plan view); contours indicate depth to bedrock (m). (Source – Manitoba Mineral Resources, 2013)

Regional Hydrogeology

Aquifers in the Interlake region can be found in all of the major geologic units. Localized aquifers can occur in the overburden deposits, while major regional aquifers occur within the Ordovician bedrock, including the Red River Formation carbonate, and the Winnipeg Formation sandstone (Betcher et al., 1995). The Precambrian granitic bedrock is typically not suitable for water supply development in the Interlake region (Betcher et al., 1995).

Aquifers in the overburden are typically present in the form of scattered lenses of sand and gravel. These aquifers are commonly limited in thickness and geographical extent and, as a result, are also limited with respect to development potential as compared to the more consistent and extensive bedrock aquifers. The potential flow rates and overall sustainability of these aquifer types are often limited in the Interlake region and would require site specific testing to confirm (Betcher et al., 1995).

The Carbonate Aquifer System forms the most geologically extensive and widely developed groundwater source in Manitoba, especially in the southeast and Interlake regions of the Province (Betcher et al., 1995). The main porosity within the carbonate aquifer occurs from secondary joints, fractures, and karstic features that are most common in the upper zones of the bedrock. Due to this geologic condition, aquifer transmissivity can vary significantly over short distances, resulting in substantial variations in well yield and static water levels (Render, 1970). The variability makes it necessary to conduct test work to identify suitable well locations in the carbonate aquifer.

A groundwater mound has been identified within the central Interlake region (Betcher et al, 1995). Areas of the central Interlake that have a relatively thin cover of lacustrine and glacial drift provide a source of groundwater recharge for the carbonate aquifer. Groundwater then flows radially outwards from the centre of the mound towards Lake Winnipeg and Lake Manitoba. It has been suggested that slow discharge from the aquifer into Lake Winnipeg and Manitoba is occurring, although this has not been confirmed (Betcher et al., 1995).

The carbonate aquifer transitions conformably into the Winnipeg Formation shale and sandstone. A layer of shale immediately underlies the carbonate in most locations; the shale transitions with depth into sandstone dominated layers. The shale commonly forms a hydraulic barrier separating the upper carbonate from the lower sandstone aquifer.

The equivalent freshwater head in the Winnipeg Formation Aquifer is noted to be about 220 to 225 m, which is on average 10-12 feet above the static water level in the overlying carbonate aquifer (Betcher et al., 1995). This indicates an upward vertical gradient between the two units. Test holes indicate the transmissivity of the sandstone is very low on average, with calculated values less than 1,000 U.S.G.P.D./ft. on average (Betcher, 1986). It appears that the sandstone is very well cemented with poor yields on average.

Hydrograph Review

The Manitoba Groundwater Management Section maintains a network of hydrograph monitoring stations throughout the province, including a large number of monitoring stations in the carbonate aquifer and a lesser number of stations in the sandstone aquifer and overburden sand and gravel aquifers. These stations provide a record of groundwater levels and basic geochemistry (MCC, 2014).

The closest provincial station to the new colony site is G05SB001, located at the Gimli townsite (20-19-4E). This station is completed into the bedrock carbonate aquifer. A second hydrograph station, G05SB002, also completed into the carbonate, is located near Fraserwood (4-20-02E). A copy of the G05SB001 hydrograph chart is shown as Figure 4.

It is apparent from the hydrograph plot that groundwater levels in the carbonate aquifer respond to changes in climatic conditions. It is common for years with below average precipitation, such as the late 1980s, to correspond with lower groundwater levels. Conversely, years with above average precipitation correspond with above average groundwater levels. Water level fluctuations up to about 10 ft. (3 m) were apparent from the chart in Figure 4. Overall, the hydrograph indicates relatively stable aquifer levels, with no evidence of long term, progressive drawdown apparent in the chart.

The hydrograph from G05SB002 is shown as Figure 5. Although the period of observation is shorter, the station recorded groundwater fluctuations that were similar to G05SB001. A notable difference was in the reported static water levels between the two sites. At Gimli, static water levels were commonly between about 5 ft. above grade and 5 ft. below grade. At Fraserwood, the static water levels were commonly 98-110 ft. below grade. This significant variation in static water levels is attributed largely to topographical variability, with some lesser influences from variable aquifer transmissivity. In general, areas located on the elevated till landscapes have deeper static levels, while areas on the lower clay landscapes have higher static levels. The new colony site is located within the thicker till sequence and static water levels are anticipated to be well below grade. However, site specific testing would be required to confirm this condition.

Hydrograph Review (Cont'd)

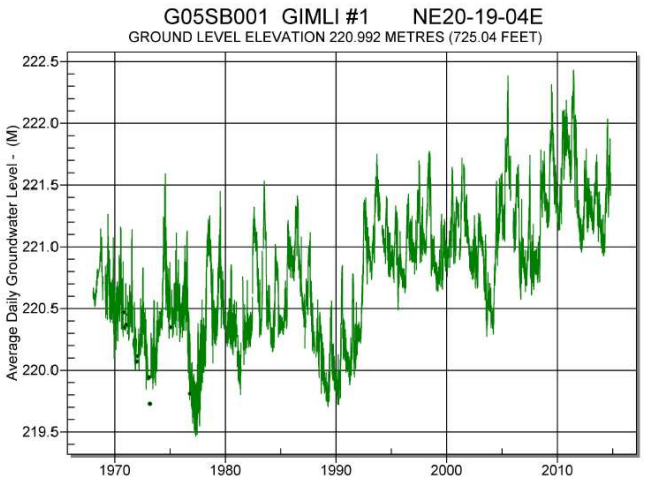


Figure 4 – Hydrograph G05SB001. (Source – MCC, 2014)

Figure 5 – Hydrograph G05SB002. (Source – MCC, 2014)

Groundwater Geochemistry

Geochemistry results available from the provincial hydrograph stations were reviewed (MCC, 2014). Geochemistry highlights from the two closest provincial stations is shown in Table 1. The total dissolved solids (TDS) content reported for the carbonate aquifer was 400-500 mg/L, with low chloride (less than 5 mg/L) and moderate to high iron (0.4 - 2.4 mg/L) concentrations. The mineralogy of the carbonate aquifer commonly produces very hard groundwater. Overall, groundwater quality in the carbonate aquifer appears to be fresh and generally of good quality in the area. Site specific testing would be required to confirm local conditions.

Within the Gimli area, the Winnipeg Formation sandstone aquifer is thought to be saline (Betcher et al., 1995). A Manitoba Water Resources Branch test well located about 4 miles west of Ponemah, Manitoba, reported TDS contents of about 12,000 mg/L.

Table 1
Regional Groundwater Geochemistry

Sample ID	Aquifer Type	Electrical Conductivity (uS/cm)	TDS (mg/L)	Chloride (mg/L)	Iron (mg/L)
G05SB001	Carbonate	826	489	2.59	0.43
G05SB002	Carbonate	720	396	4.7	2.4

Table 1 – Geochemistry from provincial stations in the carbonate aquifer. (Data source – MCC, 2014)

Well Log Review

A review of the hydrogeological information specific to the area around the new colony site involved the use of air photos and the provincial water well database (GWDRILL, 2018). The database contained a record for 14 wells in the area. The well construction dates range from pre-1964 to 2016, with most wells completed before 1990. Total well depths ranged from 134 to 407 ft., with an average of 225 ft. below grade. All of the wells were completed into the bedrock carbonate aquifer.

The hydraulic data was incomplete in the reported well logs. Static water levels were reported between 43 and 90 ft. below grade, with an average of 78 ft. below grade. Pumping test rates ranged from 7.0 U.S.G.P.M. to 30 U.S.G.P.M. (GWDRILL, 2018). Specific capacity values could not be calculated due to incomplete data.

Typical well construction in the Carbonate Aquifer involves drilling through the overburden sediments until competent bedrock is encountered. Well casing is then set into a socket in the bedrock with open hole completion until suitable fractures are encountered. In some places in the Interlake, especially in the Gimli area, artesian heads are present, which requires the casing to be cemented in place to prevent leakage from the outside of the well casing.

Regulatory Setting

The Province of Manitoba has the responsibility to distribute water under the Water Rights Act. This act requires that anyone using more than 25,000 L/day must obtain a license under the Act. Water rights licensing is based on a first in time, first in right procedure. For groundwater systems, a Groundwater Exploration Permit (GEP) is required prior to starting the project. In order to provide approval for the GEP, Manitoba Conservation and Climate – Drainage and Water Use Licensing Section (MCC–DWULS) reviews the available aquifer allocation (if available), to determine if the project would be viable.

A hydrogeological assessment and final report are then prepared for the site by a consulting hydrogeological engineer or hydrogeologist. Upon completion of the testing, MCC-DWULS reviews the proponent's proposal to determine if third party impacts may result. If these impacts are present, mitigation factors such as groundwater interference plans, well repairs, replacements, and pump inspections may be required. These programs are usually undertaken by the proponent of the project.

If the application is deemed acceptable and third party impacts are managed or addressed, MCC-DWULS will issue a license for the diversion of groundwater. The proponent then has a conditional right to the water supply for a specified duration. The right is also protected from other groundwater use in the area.

The Environment Act is another set of regulations that are applicable to larger water supply systems. The threshold to require an Environment Act Licence for irrigation supply is 200 dam^3/year (162 acre-ft./year). The Environment Act licensing is typically a more extensive process and usually involves a public review component.

None of the aquifers around the Crystal Spring site are currently under management and annual allocation limits have not been established by the Province. As a result, the total annual groundwater allocation should be based on the actual water use requirements for the site and will be limited by the performance of the supply well(s), local aquifer conditions, and potential for third party inference impacts.

A review of annual water supply requirements would be required to determine if the total water demand for the site would be more than 200 dam^3/year, as this would trigger the Environment Act licensing process.

Conclusions and Recommendations

The following conclusions are provided based on the results of the desktop review:

- The new Crystal Spring Colony site lies within the Western Canadian Sedimentary Basin. The site is underlain by sedimentary rocks including the bedrock carbonate aquifer. The overburden is composed predominantly of silt rich till and clay.

- Local domestic water supplies are almost exclusively developed from the bedrock Carbonate Aquifer.

- The depth of the local Carbonate Aquifer was reported to vary between about 100-130 ft. (30 to 40 m) below grade. The average total well depth was around 225 ft.

- The provincial hydrograph network reports a very large range for regional groundwater levels in the Carbonate Aquifer, from 100 ft. below grade to 5 ft. above grade. Local well logs indicated static water levels around the colony site to be commonly lower than 50 ft. below grade (GWDRILL, 2018). Site specific testing will be required to confirm local conditions.

- Specific capacity from the carbonate aquifer could not be calculated due to incomplete data. However, testing rates up to 30 U.S.G.P.M. were reported. The carbonate aquifer in the Gimli area generally has good capacity. However, test drilling is necessary to identify suitable well locations.

- Based on a required flow rate less than 120 U.S.G.P.M., it is estimated that one or two supply wells will be required to meet the demands and provide appropriate redundancy capacity. This will also depend on the observed yield of the test wells.

- Groundwater quality in the carbonate aquifer was reported to be generally good, with TDS content around 500 mg/L. Site specific testing would be required to confirm local conditions. The deeper sandstone aquifer contains poor groundwater quality, with saline conditions (TDS >10,000 mg/L) common in the region.

Conclusions and Recommendations (Cont'd)

- The use of groundwater at the planned flow rates (less than 120 U.S.G.P.M.) will likely require a Water Rights Licence. If total annual water use from the site exceeds 200 dam^3/year, an Environment Act Licence will also be required.

Based on the above conclusions, the carbonate aquifer would be the preferred options for development of a new groundwater supply to meet the demands of the new colony site. This is based on the reported well yields, groundwater quality data, and overall sustainability of the carbonate aquifer.

The following actions are recommended for a new groundwater supply developed from the carbonate aquifer for the Crystal Spring site.

- Confirm if the total annual groundwater use will exceed 200 dam^3/year to determine if environment licensing will be required.
- A field testing program should be undertaken to assess local aquifer conditions at the site. The test work should be supervised by a qualified hydrogeologist/ hydrogeological engineer and should include the following:
    - Obtain a Groundwater Exploration Permit from MCC-DWULS.
    - Conduct test drilling with mud/air rotary. Test wells should be constructed with 5 inch diameter PVC casing. It is assumed that at least two test holes would be required to identify suitable well locations. Well drillers should be prepared for flowing conditions.
    - Conduct a short term pumping test on each 5 inch test well to assess aquifer capacity. A longer term pumping test may be required based on the preliminary results. This should be designed and supervised by a hydrogeologist/ hydrogeological engineer.
    - Collect groundwater samples from the test wells to assess local groundwater geochemistry. The samples should be sent to an accredited laboratory for the required analyses.
    - The results of the test work and technical analysis should be presented in a final report that is signed by a professional engineer/geoscientist. The report should provide recommendations for further water supply development options.

We thank you for the opportunity to work on this project. Should you require anything further, please contact us at 204-326-2485.

Sincerely

Friesen Drillers Limited

[redacted]

Justin Neufeld, B.Sc.(G.Sc.), P.Geo.
Groundwater Geologist

[redacted]

APEGM
Certificate of Authorization
Friesen Drillers Limited
[redacted] Date: March 2, 2021

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Limitations

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