Sept.8, 2021

Via email

The Honourable Jonathan Wilkinson
Minister of Environment and Climate Change
House of Commons
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Dear Minster Wilkinson and Ms. Pullishy:

Re: Request to Designate the Vivian Sand Extraction Project Based on Missing and Misleading Information in the Vivian Sand Extraction EAP and the Hydrogeology and Geochemistry Assessment Report prepared by AECOM Canada Ltd.

On the behalf of What the Frack Manitoba I am requesting that the Vivian Sands Extraction Project be designated on the basis of missing and misleading new information in the CanWhite Sands Extraction Environment Act Proposal (EAP) and the Hydrogeology and Geochemistry Assessment Report (HGR) prepared by AECOM Canada Ltd. The missing and misleading new information pertains to significant effects from the project that would be within federal jurisdiction.

On November 16, 2020, Barbara Pullishy, Director, Prairie and Northern Region of the Impact Assessment Agency of Canada (IAAC) wrote a letter to F. Somji, President and CEO of CanWhite Sands Corporation (CWS) informing him that even though the Vivian Sand Processing and Extraction Project had not been designated that:

"*The Agency appreciates the information that you provided in response to our request of August 28, 2020. Recognizing that CanWhite Sands is still undertaking studies and planning related to the Extraction Project, many responses were insufficient for the Agency to determine the potential for effects within federal jurisdiction, as relate to that Project.*

The Agency requires that CanWhite Sands provide any information related to the Vivian Sand Extraction Project and its potential effects, including the results of any ongoing studies, to the Agency as it becomes available. The Agency will advise the federal Minister of Environment and Climate Change should new information arise to suggest the Project may lead to significant effects within federal jurisdiction. The Agency will further review new information with a view to determining if it warrants the Minister to re-consider designating the Project.

The Agency also requests that CanWhite Sands provides its Environment Act Licence application for the Vivian Sand Extraction Project to the Agency, upon submission to Manitoba Conservation and Climate."

This letter was obtained through an access to information request number A-2020-00050 submitted March 11, 2021. A similar letter was written to Don Sullivan of What the Frack Manitoba by David McGovern, President of the IAAC on Dec.16, 2020.

The EAP and HGR have been completed for the Vivian Sand Extraction Project now undergoing licensing review. The reports can be found in the Manitoba Public Registry 6119.00 - Silica Sand Extraction Project - CanWhite Sands Corp.

We prepared a list of questions supported by references for the CWS Virtual Open House of Aug. 24, 2021. The submitted questions document a series of inadequacies and misleading or incorrect information in the EAP and HGR. The questions were submitted Friday Aug. 20, 2021 before the virtual open house. CWS did not specifically address any of the submitted questions in the virtual open house. Attached with this letter is the questions document submitted to the CWS Virtual Open House. In the chat box during the open house I submitted five written questions that were "*dismissed by the host*." The chat box was configured such that participants could not see written questions of others.

Some oral statements were made by the CWS participants in the virtual open house that seemed to be a partial rebuttal to some of the questions submitted in advance, however no specific advance questions were read out and completely addressed. There is no indication that any proper thorough response will ever be forthcoming. The questions may be posted on public registry along with other public comments. The posting is likely to occur after the Oct. 7, 2021 deadline for public submissions and after responses from the provincial Technical Advisory Committee (TAC) are received. The TAC would not be able to review and respond to the public comments. For the Vivian Sand Processing Project and other projects, the TAC has responded in a siloed fashion, addressing issues only pertaining to their particular narrow jurisdiction. With these procedures the public comments will receive no independent qualified technical expert review and response other than from AECOM personnel who are hired to represent the interest of CWS.

It is essential that the IAAC give a proper independent technical review and response to the issues raised by the public and What the Frack Manitoba and their own experts. We request the IAAC open a new public registry for the Vivian Sand Extraction Project, accept public input and make a formal decision as to designation with written reasons.

We understand that the IAAC can make a narrow decision based only on issues under federal jurisdiction. However the IAAC Act under section 9(1) provides leeway for designation on broader grounds based on public interest, health and safety and protection of the environment that could overlap provincial jurisdiction.[1] We are urging the IAAC to take a broad view of protection of the valuable aquifers in southeast Manitoba and the health and safety of all the residents who rely on this water source. We think that under the present provincial process legitimate issues are being ignored and suppressed. We emphasize that designation of the Vivian Sand Extraction Project would necessarily require designation of the Vivian Sand Processing facility Project and Railway Yard Project as required by the Impact Assessment Act relating to cumulative and incidental interacting effects of these projects.[1] We remind the IAAC that a response has not yet been received to an official request from What the Frack Manitoba sent on May 19, 2021 to designate the CWS Vivian Sand Railway Yard Project. We request that the IAAC send this letter and the attached question document to relevant federal departments for technical review and input. One combined project encompassing the Vivian Sand Extraction, Processing and Railway Yard Projects should be considered for designation. The list of questions and references prepared on behalf of What the Frack Manitoba for the CWS Virtual Open House of Aug. 24, 2021 are attached.

The main issues raised by the questions for the CWS Virtual Open House that would lead to project effects within federal jurisdiction are itemized below.

1. Re-injection into the aquifers of excess water from sand extraction

The UV sterilization system specified in the EAP will not be effective in eliminating harmful microbes due to manganese and iron and fine particulate in the water that will scatter UV light. Re-injection to the sandstone of excess aerated water extracted with the sand will carry harmful microbes and oxygen into the aquifer. The oxygen in the re-injected water will react with sulphide in pyrite in the shale aquitard and deeper layers of shale within the sandstone, with marcasite (a form of pyrite) in the sand, with pyritic oolite layers in the sandstone and with pyritic concretions in the sandstone to form acid. The acid formed by oxidation of sulphide will mobilize heavy metals such as arsenic that the HGR report documented in the shale. The geochemistry results of the HGR that reported low or no sulphide in the shale and sand were corrupted because the sand samples and core logs were subject to air and moisture for a long period. These issues are all described with references in the attached questions document.

Particularly egregious was the collection of sand samples from stockpiles from well Bru 95-3. Well Bru 95-3 was completed on June 28, 2019 according to drilling records obtained from MB Groundwater. The sand stockpiled outside was exposed to air and moisture until the time of sampling in November of 2021. Any marcasite in the sand as was reported for Winnipeg formation sand from Wanipigow would have long been leached out.[2]

It is essential that sand and core sampling be redone with many more samples over the entire Bru area. The sand must be protected from air during extraction. Air lift extraction of the sand cannot be used. Sonic drilling methods such as were used at Wanipigow may be required.[2] Sand and core samples must immediately be sealed in air tight containers and sent for analysis. The sampling and sealing of the samples must be done by an independent agency or company that has expertise in this area.

At the CWS Virtual Open House I had the opportunity to ask one question at the end of the meeting. I asked about the sand sampled from Bru 95-3 that would have been corrupted due to weathering in the outdoor sand stockpile from which the sand sample was taken. The response was that the sand in the Vivian area was from the Carman sands that are different from the sand at Wanipigow and would have no marcasite. The name given to the sands is irrelevant. To determine the amount of sulphide in the sand a valid sample must be taken that has been protected from oxidation. Figure 4 of the attached question document provides evidence that the Carman sands are south of the Vivian extraction area.

Selenium was reported in the geochemistry results of the HGR in the carbonate, shale and sandstone despite the exposure of the samples to air that would oxidize and mobilize the selenium. Shake flask tests and other geochemistry results in the HGR have documented potentially toxic levels of selenium in the carbonate aquifer, shale aquitard and the sandstone aquifer. The concentration of selenium (Se) and arsenic (As) for Bru 1221-1 in the shale was particularly high at 1.64 mg/L Se and 0.0306 mg/L As. The selenium concentration of 0.002 mg/L in the sandstone aquifer for Bru 121-1 was attributed in the HGR report to shale fragments in the sandstone. The reported selenium and arsenic would be expected to be underestimated due to oxidation of the samples that occurred.

ALS lab results for solid core samples for Bru 121-1 give high values for heavy metals with arsenic at 30.4 ppm, barium, 30 ppm, boron,70 ppm, and selenium 13.1 ppm. The solid core sample results for Bru 95-8 also had elevated heavy metal content with 24.2 ppm arsenic, 30 ppm barium, and 58 ppm chromium. The XRD results from Table 1 Appendix A Part 6 in the HGR showed pyrite at 1.3 weight

percent in the shale aquitard for well Bru 95-8 near Vivian and 0.6 weight percent for well Bru 121-1 even though much of the pyrite would have oxidized from exposure of the samples to air.

Reference 9 gives methods to prevent oxidation of pyrite in core samples in the attached questions document. A further reference by Basu et al. (2000) describes methods to prevent oxidation of shale samples including air tight containers and refrigeration at 4 degrees.[3] A reference, König et al (2000) documents the oxidation pyrite in core samples that are exposed to air during storage reporting, "*Massive Fe(II) to Fe(III) oxidation, which involved between 24% and 45% of the initial Fe(II), occurred within only 6 months of refrigerated storage."*[4] These references establish that oxidation of pyrite in samples can occur rapidly and that the geochemical results conducted in the HGR would underestimate sulphide concentrations.

Ryan Mills, senior hydrogeologist who helped prepare the HGR admitted at the CWS Virtual Open House the core log samples were exposed to air but stated that the samples were prepared according to standard industry practice. He stated that pyrite oxidation was sufficiently slow, that very little would have oxidized before analysis. To keep core logs exposed to air in core boxes is standard practice for preserving a record of the extent of an ore body but is not acceptable for geochemical analysis. Two of the three core log samples Bru 121-1 and Bru 146 were held in storage in Steinbach for over a year where they would have been exposed to air. Bru 121-1 well was completed in Feb. 19, 2019 when the core logs would have been retrieved. The core log from the site near Vivian, Bru 95-8, extracted on Nov.11, 2020 and analyzed Jan.5, 2021, was not in an air tight container nor maintained at 4C. The samples were sent in low density polyethylene (LDPE) bags that allow air ingress. (reference 11 of the attached questions document)

The shale aquitard is reported in the HGR to be likely compromised by extraction activities. The shale aquitard is liable to crumble into the sandstone.

The well log from Bru 95-7 reports shale layers interbedded with sandstone below the pure sand layer at depth below surface between 72.24 to 74.68 meters. This shale could be extracted with the sand. Figure 1 shows a picture taken in the spring of 2020 of extracted sand piles south of Vivian show shale fragments interspersed in the sand. These pictures provide incontrovertible evidence of shale fragments within extracted sand.

Figure 1. Photo of shale fragments extracted with the sand near Vivian Manitoba, spring 2020. The photo was taken by a local concerned citizen (name withheld for privacy reasons)

Shale extracted with the sand would oxidize sulphide in the extraction processing tanks to form acid and mobilize heavy metals. Selenium in the shale would oxidize to a soluble form and be released as well. Most of the contaminated water from the processing tanks would be re-injected into the sandstone aquifer. Some of the contaminated water would be directed into the slurry lines. Oxidation of the selenium and pyrite in the small shale fragments carried in the sand would further contaminate the slurry line water. The oxidation of the pyrite and selenium in shale fragments would occur from aerated re-injected water in the sandstone aquifer. The sand grains in the sandstone aquifer may contain marcasite since the geochemical tests for the sand was corrupted due to exposure of the sand samples to air. The oxidation of marcasite would form more acid and mobilize heavy metals and selenium.

A paper by Schrieber and Riciputi (2005) identifies concretions formed in the Winnipeg sandstone as containing pyrite and marcasite.[5] The HGR describes screening out of concretions from the sandstone after extraction of the sand. Oolite nodules described as pyritic by Watson have been observed in extracted sand piles at Vivian.[6] The concretions and oolite nodules have not been analyzed for the presence of sulphide, selenium and other heavy metals. These concretions and ooilite nodules in the sandstone aquifer would be another source of contamination when exposed to aerated re-injected water.

The HGR reports mixing of the carbonate and sandstone water will occur due to degradation of the shale aquitard caused by the extraction activities. Mixing of aquifer water is prohibited by the regulations of the Manitoba Groundwater and Well Water Act.[10] The aerated re-injected water would enter the carbonate aquifer where selenium has been detected at levels that produced toxic concentrations in shale flask tests documented in the HGR. The aerated re-injected water would oxidize and mobilize selenium in the carbonate aquifer. Contaminated water from the sandstone could enter the carbonate aquifer from the mixing.

Groundwater moves relatively quickly in the carbonate aquifer eventually discharging into the Red River, a major fish bearing water body. The contaminants including selenium introduced and formed in the aquifer by the re-injected aerated water will eventually discharge into the Red River. Selenium is toxic to

aquatic organisms above two parts per billion.[8] All the water wells along the flow path would be contaminated.

Rebuttal remarks in the CWS Virtual Open House by CWS personnel that the sandstone and carbonate aquifers already have oxygen are not credible. A paper by Phipps et al. (2008) reported, over a large area of the Winnipeg formation in eastern Manitoba including the Vivian area, that no dissolved oxygen (D.O.) was detected in the carbonate and sandstone aquifers for most samples.[11] In particular Phipps's paper reported:

Carbonate aquifer:
"*Measured pH ranges from 7.0 to 8.1, with a median value of 7.5. Redox and D.O. were measured in 17 sites. The D.O. ranges from 0.03 (oxygen is absent) to 1.14 mgL-1. Only one sample has greater than 1 mgL-1,* ***whereas the remaining samples are almost completely depleted of oxygen,*** *containing less than 0.20 mgL-1. Eh ranges from -223 to 244 mV*."

Sandstone aquifer:
"*pH varies from 7.2 to 8.2 (median = 7.6). Only one sample, located near the erosional margin, had D.O. concentration > 1 mgL-1 and three other samples had low concentrations >0.1 mgL-1,* ***however, the remainder had concentrations of 0.06 and lower (effectively 0 mgL-1 D.O.)****).(n=18) The Eh ranges from -30 to +181 mV.* "

Dissolved oxygen levels are reported in table 4.7 of the HGR for several Bru 95 wells in the carbonate, shale and sandstone ranging from 0.2 to 7 mg/L. These results are generally high compared to the results from Phipps et al.(2008). The results from Phipps et al. (2008) were over a much broader region and should be considered to be more representative of the generally very low dissolved oxygen concentrations that would be found throughout the Bru area.

The HGR states; "*the Winnipeg Shale is extensively weathered to clay and shows a strong blue color in the bottom half of its thickness at some locations suggesting limited access to oxygen*." The blue shale colour confirms lack of oxygen can occur in the shale aquitard layer.

Inconsistent sealing results were reported for the core logs in the HGR. For instance Bru 95-7 core log reports,

"*surface seal completed to a depth of 7.62. m (25ft) BGS using 0.51 m (20") diameter tri-cone bit and bentonite–cement grout*"

Bru- 95-8 core log reports,

"*bentonite-cement grout was injected down the tremmie pipe and was used to backfill the hole from 0 to 55.09 m BGS*"

The grout for Bru-95-8 grout would have penetrated past the shale aquitard which terminates at 52 m BGS whereas the surface seal for Bru 95-7 would not have penetrated to the shale aquitard. It is possible that some dissolved oxygen was introduced into the Bru 95 wells during drilling and testing procedures.

Sand has been extracted in the Vivian area such from well Bru 95-3 using air lift methods that may have introduced oxygen into the aquifers accounting for the higher results of dissolved oxygen reported in the HGR for Bru wells near Vivian.

2. Slurry Line Leakage

A spill from the CWS slurry lines that would carry selenium, arsenic, other toxic heavy metals, and harmful microbes could drain into fish bearing water bodies such as the Brokenhead River and Cook's Creek. The slurry line would be expected to carry the extremely toxic acrylamide monomer from the clarifier tank.[7] The contaminants will be ever increasing in the slurry lines as water is recycled and fresh extracted sand and flocculent is added to the slurry line and recycled water loop.[7]

The federal guideline limit for selenium in water for aquatic organisms is very small, two micrograms per litre.[8] Mitigation measures for potential selenium and other contaminant leakage into the environment have not been adequately addressed. A precedent has been set with the Grassy Mountain Coal Project[9] where the project was denied by a joint IAAC and provincial review in part because of potential selenium release to the environment.

The potential for spill from the slurry lines affecting fish is acknowledged in the Extraction EAP which states;

"*Accidental releases, depending on the type and quantity of substances released, have the potential to affect air, surface water, groundwater and soils, with* ***consequential effects*** *on vegetation****, aquatic resources*** *and possibly human health and safety*"

In the CWS Virtual Open House mitigation of spill risk was mentioned by CWS personnel who stated that pressure transducers will be installed in the lines that would automatically shut down the slurry lines in the event of a leak. No such automated system is documented in the EAP. No plans or engineering drawings have been provided for such a system. Even if an automated shut down system were installed, pressure transducers would not detect small continuous leaks that may over time release more contaminated water to the environment than a single large slurry line break. The slurry lines are subject to erosion by the sand particles and many other sources of potential leakage as documented in the attached questions (reference 20 in questions).

The EAP never assessed the potential for ongoing small leaks from the slurry lines when they would be emptied into vacuum trucks and moved every five to seven days. Considering there would be about 455 wells drilled per year at full production each requiring slurry line movement, the potential for spillage during emptying and movement is significant.

3. Sinkholes and Subsidence

Cover collapsed sinkholes would occur in the approximately 65 well clusters drilled per year as documented in the question 1 of the document submitted for the CWS Virtual Open House. CWS personnel claimed that literature reports specifying a stable thickness of the limestone larger than 37.8 meters does not apply in the Bru area where the limestone is very strong. The Stantec reports referred to in the HGR specifying a minimum thickness for the limestone of 15 meter thickness have not been produced. The Stantec limit is therefore unverified.

The core log for Bru 95-8 in the HGR report gives the limestone from 32.3 to 35.3 meter depth below surface to be weathered and incompetent. Thus there are 3 meters of incompetent limestone documented. This is followed by 1.6 meters of competent limestone to a depth of 36.9 meters. Next are 1.5 meters of limestone with small vugs which are small cavities. Limestone with vugs would not be competent. Next is a clay rich layer of 1.5 meters to a depth of 39.9 meters, followed by a 1.5 meters limestone with

horizontal fractures to a depth of 41.4 meters. The clay layer and the limestone layer with horizontal fractures would not be competent. A final limestone layer 4.6 meters thick to 46 meters depth is reported with no comment as to integrity. In the column of limestone for Bru 95-8 there are at most only 6.2 meters of competent limestone out of the13.7 meters. Other Bru core logs in the HGR report competent limestone but this could be due to less detailed core logging for these holes most of which were not completed to the same depth as Bru 95-8. The Bru 95-8 core log is hard evidence supplied by CWS itself that the limestone in the Bru area is not altogether competent or strong.

Note as well that the full depth of the limestone for well Bru 95-8 at 13.7 meters is les than the Stantec limit of 15 meters. Figure 1 of the questions document shows that none of 37 drill reports give limestone thickness in the Bru are over 37.8 meters. In the eastern area where extraction will begin, most limestone thicknesses are less than the unverified Stantec limit of 15 meters.

The so called "sand pillars" between clusters will likely slump and move into the large cavities created by the sand extraction. The forty-two CWS drill reports obtained from Manitoba Groundwater documented many instances of sand collapsing into drill holes demonstrating the sand pillars are not stable. The well log for Bru 95-8 in the HGR report states that the sandstone is fine grained, well sorted, poorly cemented and of low strength and that the borehole would not stay open without drill mud. The core logs for Bru 95-6, 95-7, and 96-1, all state the sand is poorly cemented with low strength. These drill reports and core logs demonstrate the sand pillars would be prone to slumping. The airlift method of extraction would not be viable for strongly cemented sand pillars. Wherever sand extraction occurs with the airlift method, sand must be unconsolidated and therefore prone to slumping into the extraction cavities.

According to a recording and a transcript made by local volunteers for the CWS Virtual Open House, Brent Bullen, Chief Operating Officer of CWS stated in response to a question about the cavities;

"*We are seeing indication that the sand will actually move and rest back in. It's a unique sand it has many properties so would actually stand up.*"

This statement indicates that CWS acknowledges the sand pillars will slump into the cavities in the sandstone. However the statement by B. Bullen is nonsensical. How can sand rest back in and stand up at the same time?

Sand slumping will enlarge the cavities under the well clusters creating an ever more unstable situation. Figure 2 illustrates the geometry of the well clusters and a unit cell within the clusters. The unit cell in figure 2 is 114 meters wide by 98.7 meters high with a central cavity of 54 meters in diameter. The extraction ratio in the sand layer for the unit cell shown is 0.203 (~20%). The unit cell and the 20% extraction ratio in the sand layer repeats as the clusters expand. The extraction ratio quoted in the EAP for the processing plant of 5% would include the layers of limestone and glacial till above the sand layer thus giving a much smaller extraction ratio.

At the CWS Virtual Open House Brent Bullen stated;

"*We look at global sustainability we actually will take on average 1% of the resource in the global space that's in the Winnipeg formation."*

The global ratio in the entire global space of the Winnipeg formation is not relevant to subsidence for the room and pillar configuration in the excavated area of the well clusters. To determine subsidence the extraction ratio within the sand layer is required only in the area of the extraction well clusters. The thicknesses of the limestone and till layers are relevant to determine the stability of the limestone and the

total unsupported weight of overburden above the cavities but not to determine the extraction ratio relevant to sand slumping. In fact the thicker the layers above the extracted layer, the more unsupported weight that would contribute to subsidence and formation of sinkholes even though, if included in the extraction ratio, thicker layers of limestone and till would decrease the extraction ratio.

As the sand slumps into the cavities the unsupported cavity area will increase as the extraction proceeds. Eventual collapse of the limestone and till and subsequent subsidence is inevitable over the entire area of the well clusters.

The sand layer from the well log for Bru 95-7 documented in the HGR to be 20 meters is representative of the initial area where extraction is planned. The maximum sand extraction depth according to the HGR is 25 meters. Thus the average depth of the general subsidence would be 4 to 5 meters based on an extraction ratio of 0.2 (20%) in the sand layer. A huge ever growing depression from subsidence would result that would fill with surface water. The depth of the depression is likely to vary from a few meters to up to 20 meters depending on the degree of slumping and sinkhole formation. Individual sinkholes could form for a well cluster to a depth of 20 meters (the total depth of the sand layer). The general subsidence area covered by all well clusters could be punctuated with these deeper sinkholes.

The carbonate and sandstone aquifers would be exposed to contamination from agricultural chemicals animal fecal matter, septic tank seepage and surface run off into the subsided depression and sinkholes. This contamination would migrate in the carbonate aquifer exposed by subsidence. The contamination would eventually discharge to the Red River contaminating all the wells along the flow path. There may be hydrogeological connections between the aquifers and Cook's Creek and the Brokenhead River causing discharge of contaminants into these fish bearing waters. The large and ever growing area of subsidence and sinkholes would disrupt the local surface run off patterns and may create permanent swamps that could drain into the Brokenhead River and Cook's Creek carrying contaminants into fish bearing water bodies.

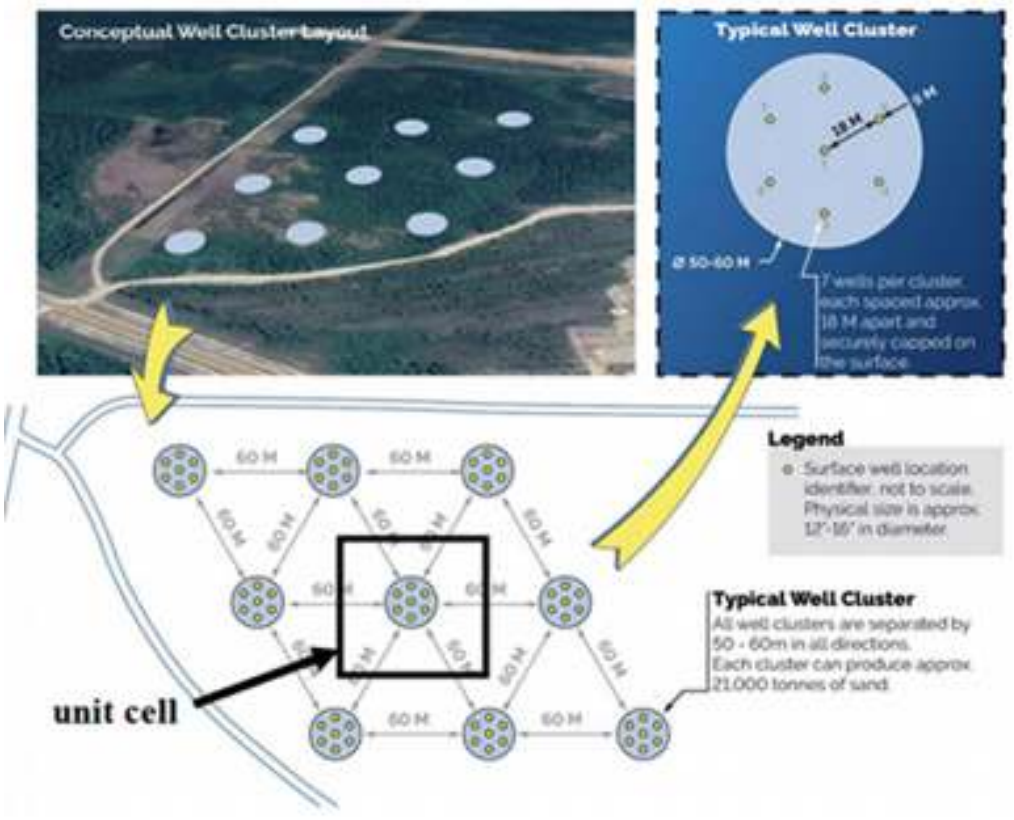

Figure 2-3: Conceptual Extraction Well and Well Cluster Layout

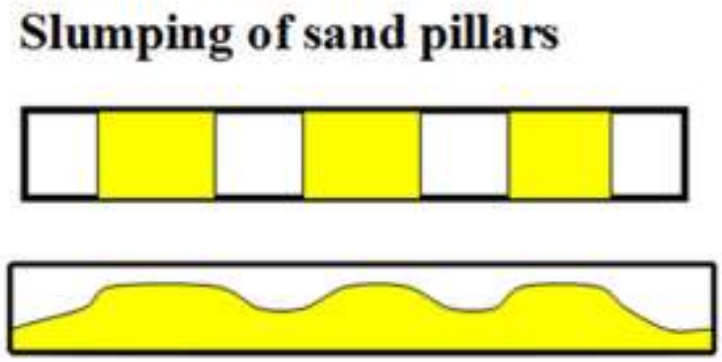

Figure 2. Slumping of sand pillars leading to subsidence between well clusters. Figure 2-3 from the CWS EAP was modified for this figure.

4. Waste Disposal

According to the HDR oversized particles, mainly sand concretions, will be screened out at the extraction site and sent for disposal at a licensed facility. The facility is not named nor is the volume of screened waste material quantified. The paper by Schrieber and Riciputi (2005) identifies concretions formed in the Winnipeg sandstone as containing pyrite and marcasite.[5] Figure 3, a photograph of extracted sand south of Vivian taken by a nearby concerned citizen in the spring of 2020, shows that the concretions can be large and significant in volume. Pyritic oolite nodules[6] have also been observed in the extracted sand piles at Vivian. These oolite nodules could be screened out and add to the pyritic waste at the extraction site. Such concretions and oolite nodules were not analyzed for sulphide and heavy metal content nor subject to acid base accounting. These concretions and oolite nodules would likely be acid generating and

would require specialized disposal and storage on site. It is essential that the concretions and oolite be independently sampled to prevent air exposure and analyzed.

Figure 3. Concretions potentially containing sulphide in pyrite and marcasite in sand piles extracted near Vivian Manitoba in the spring of 2020.

In addition, drill cuttings will require disposal. The HGR identifies the shale drill cuttings as potentially acid generating (PAG). Some of the larger shale fragments could be screened out and require specialized disposal for PAG waste. The volume of such screened out shale fragments has not been considered.

5. Unrealistic Groundwater Model Simulations

The groundwater model simulations using the finite-element code FEFLOW v.7.3 were unrealistic. Only 0 and 50 percent re-injection of water was modelled. CWS has explicitly stated that no discharge of water to the environment will occur from the extraction operations. Thus virtually all the water extracted with the sand will be re-injected. The EAP states that only 10 US gallons per minute (gmp) per well cluster will be directed into the slurry line recycle water loop. The remainder of water in the sand will be re-injected. The maximum rate of water plus sand extracted per well cluster is given in the HGR as 540 gpm. The amount of water extracted with the sand will vary according to the HGR from about 30% initially to 80% by the end of the 5 to 7 days of extraction. The water sent to the recycled loop would be used to replenish the water lost to wet the sand stockpiles at the processing plant.

The model did not examine the actual intended operating conditions of near 100% re-injection of water. Modelling of the fate and quantity of re-injected aerated water is essential. It is recognized in the HGR that the shale aquitard would likely be compromised leading to mixing of aquifer waters. The amount of water that would enter the carbonate aquifer during re-injection at operational rates should have been modelled. Contaminated water can move much more quickly though the fractures in limestone than through the sand matrix of the sandstone aquifer. The contamination could include harmful microbes, acid, and heavy metals including arsenic and selenium. It is essential to determine movement of the re-injected water through the carbonate to determine the contamination potential of the aquifer.

The fate and amount of the aerated re-injected water in the sandstone should also have been determined.

The amount of heavy metals released to the aquifers is likely to be oxygen limited. It is essential to know how much oxygen would be introduced to the aquifers and the movement of the oxygen through the aquifers. Not only dissolved oxygen could be re-injected but gaseous oxygen in air bubbles entrained in the water during the airlift process. Gaseous air could also enter the aquifers directly from the air injection tube in the extraction wells. CWS has stated in the Sept. 11 letter of F. Somji to the IAAC that the air injection tube is shorter that the sand recovery tube so that the air will not directly enter the aquifer. However, especially during initial priming of the system and during operation, some leakage of gaseous air to the aquifer could occur. It is essential to quantify the volume, rate and fate of all sources of oxygen introduced into the aquifer by the extraction process. This has not been done in the groundwater modelling.

6. The Winnipeg Aqueduct

As shown in figure 4 in the questions document attached, the Winnipeg aqueduct traverses the entire CWS project area. The slurry lines and return recycled water loops will eventually have to cross the aqueduct likely multiple times. The aqueduct is known to have cracks that allow infiltration of surface water (reference 25 in the attached question document). Slurry line spills near the aqueduct could contaminate Winnipeg's drinking water supply with harmful microbes, arsenic, selenium, other heavy metals and the highly toxic acrylamide monomer. A major break of the slurry line would leak at a rate of up to 24 cubic meters per minute as documented in the CWS processing plant EAP. The aqueduct could be submerged with a volume of about an Olympic sized swimming pool in two hours. A gradual undetected leak could infiltrate the aqueduct undetected for a long time.

CWS is applying for a licence up to 2025. The excavations are not planned to reach the aqueduct by 2025. Project alterations after 2025 such as crossing of the Winnipeg aqueduct could be approved by an alteration request under the Environment Act with no consultation with the City of Winnipeg or the federal government. The Winnipeg aqueduct transverses a provincial boundary and Shoal Lake is part of Lake of the Woods, an international water body. Therefore the aqueduct should fall under federal jurisdiction. The IAAC should consider the crossing and potential contamination of the Winnipeg aqueduct in the decision about designation.

7. Section 35 Consultations

The large land disturbance from clearing slurry lines and well cluster drill pads will cause long term damage to the traditional lands of First Nations and Métis in the area. The land subsidence and sinkholes would have a devastating impact on traditional lands and wildlife and likely the fish bearing water bodies of Cook's Creek, the Brokenhead River, and the Red River. The entire extraction project is on treaty one lands. Crown land where the indigenous people has harvesting rights will be adversely affected by the extraction project. There has been no Section 35 consultation undertaken by the provincial crown and as specified in the sections 155 (b) and (i) and other provisions of the Impact Assessment Act and by the Constitution of Canada. The extraction EAP states

"*The Project is not expected to adversely impact the exercise of Indigenous or Treaty rights*"

No consultation is planned. The IAAC should ensure that province carry out the consultations. The IAAC should consider this egregious lack of indigenous consultation in the decision to designate. Without IAAC intervention no indigenous consultation will occur.

8. Greenhouse Gas Emissions

The greenhouse gas (GHG) emissions summarized in Table 6-3 of the Extraction EAP were not combined with the GHG from the processing facility and the projected GHG from all users of a new gas line to be constructed to serve the CWS processing plant. The GHG emissions from the pant and extraction project might not extend beyond the 2050 target for zero net emissions according to the project 24 year stated lifetime. However the project start date could be delayed or production could continue beyond 2050 through submission of project alterations as described in the executive summary of the extraction EAP. The natural new natural gas line planned for the CWS processing plant would continue operation beyond 2050. There are no plans to meet 2050 GHG reduction targets that would be required by the new Canadian Net-Zero Emissions Accountability Act (Bill C-12). Bill C-12 is federal legislation that comes under IAAC jurisdiction. The IAAC must consider in its decision to designate, the cumulative GHG project emissions including from all users along the proposed new natural gas line for the CWS project. The mitigation measure of geothermal electrical heating for the CWS processing plant sand dryer may be required to conform to the new federal legislation.

9. Conclusion and Recommendations

We recommend the IAAC send this letter and the attached questions document to relevant federal departments for technical review and input. The IAAC should open a public registry on the Vivian Sands Extraction Project. Based on the evidence submitted here, review by federal technical experts and public concerns expressed on a new public registry the IAAC we request the IAAC designate the Vivian Sands Processing Project, the Vivian Sands Extraction Project and the CWS Railway Yard project integrated as one Vivian Sands Project. We think that the evidence given here and provided elsewhere will require such designation.

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Sincerely on behalf of What the Frack Manitoba,
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