Preliminary Technical Assessment — Environmental Considerations of the Proposed Wonder Valley AI Data Center

Prepared for: Legal counsel to the Sturgeon Lake Cree Nation

Re: Proposed Wonder Valley AI Data Center Park, Greenview Industrial Gateway, Municipal District of Greenview, Alberta (O'Leary Ventures / O'Leary Digital)

Author: Robert Davies, PhD

Date: June 2026

What this is

This is a preliminary, good-faith technical assessment, written to help identify which environmental questions most warrant scrutiny and independent expert study. It is **not** a comprehensive environmental review, a formal expert report, or a legal opinion.

Confidence is highest on the physics of energy and heat — the magnitude of the facility's thermal output and what becomes of it — because those follow from conservation laws and straightforward engineering arithmetic. On the consequences that flow from that output — acoustic propagation, effects on wildlife and traditional land use, hydrology, air quality, and the adequacy of regulatory process — I'm not expert, so flagging those as matters requiring other specialists. Where published science already speaks to a question, I cite it. My aim is to mark the issues and point to the analyses a credible assessment should contain, not to render final conclusions.

Every quantitative figure below should be treated as a first-order estimate intended to convey scale, to be confirmed against the developer's own filings.

The scale of what's proposed

The proposal is not a "data center" in any familiar sense. As recently described, the project would draw approximately **9 gigawatts (GW) of power**, occupy a landholding of roughly **65 square kilometers**, and is licensed for about **6 million cubic meters of water per year**. Power would come from on-site, behind-the-meter natural-gas generation. At realistic generating efficiency, supplying 9 GW of electricity means burning fuel — and therefore rejecting heat — at a continuous rate on the order of **16 to 18 GW**, day and night, year-round. Essentially the entire fuel burn ends up as heat released at the site, because the electricity is consumed on site and degrades, in full, to heat.

For perspective, this single facility's power demand has been described as comparable to roughly two-thirds of what Alberta's entire electrical grid uses at midday, and its carbon emissions would make it, by reported assessments, the largest single-source emitter in the country — enough to offset the gains Alberta achieved by phasing out coal. (Estimate)

These are not data centers in any familiar sense of the term. From here on, I'll refer to these energy-and-heat behemoths — massive compute fused with massive power generation — as ***Gigascale AI Smelters*****, smelting data and material strip-mined from people and planet.**

Cumulative effects on an already-industrialized landscape

A central point. The site sits in the Gold Creek area of the Greenview Industrial Gateway, atop the Montney Formation — an active oil-and-gas landscape where companies are already extracting, with well and access networks dense through the surrounding forest. This matters because the relevant ecological (and, I'm assuming, legal) question isn't the new project in isolation; it is the **cumulative** burden. The data center won't be introducing a single novel disturbance into intact boreal forest. Rather, it will be layering an enormous new thermal, acoustic, air-emissions, and water demand on top of an environment already fragmented by resource extraction — across territory in which the Cree Nation exercises treaty and harvesting rights. In short: from a systems perspective, cumulative-effects are a primary issue.

Where the heat goes

It appears that this is, in effect, a dry-air cooled facility. The six million cubic meters per year of water is a few percent at best of what would be needed for the entire 18 GW thermal load. (I calculate ~300 million m^3/yr for power plant and data center together.) This is important for two reasons. First, yes, the water consumption will be much less, but the heat is leaving the facility now as sensible heat to the air (meaning it will raise air temperature) rather than latent heat (water vapor, which doesn't raise air temperature as much): the facility must directly warm vast volumes of air and release them to the environment. Second, this means the design will require extremely large arrays of industrial fans, to facilitate air cooling. This consumes considerable energy, and produces considerable noise.

So the proposed water use is a significant **resource and rights** issue in its own right (see below). But it does almost nothing to relieve the heat, which is overwhelmingly an air problem. Both deserve attention; they are largely distinct.

The cooling infrastructure: a fan array without real precedent

Shedding 15+ GW to the air continuously requires moving an extraordinary volume of air through banks of fans. To convey the scale, I scaled from a real facility — the Wyodak Power Plant near Gillette, Wyoming, long noted as having the largest air-cooled condenser in the United

States. Wyodak is a ~330 MW plant whose air-cooled condenser runs on the order of ~69 large fans to shed roughly 500 MW of heat.

Wonder Valley's air-cooled load is about thirty times larger. Scaling by heat duty — and cross-checked by an independent calculation of the airflow required — yields an estimate on the order of **two thousand large fans at minimum, and plausibly many thousands** of smaller ones, since data-center heat is lower-grade than power-plant steam and is typically rejected through more numerous units. The associated cooler structures would occupy roughly **0.3 to 0.6 km²**, (perhaps a couple of hundred acres) and the fans alone would draw on the order of **400 to 500 MW of electricity continuously** — a mid-sized power station's output devoted solely to turning fans. In plain terms: the equivalent of the largest air-cooled condenser in the United States, multiplied many times over, running without pause in boreal forest. I'd flag this as the basis for the acoustic concerns that follow. The developer's actual cooling design and fan specifications would be needed to refine these figures.

Noise

Noise is an under-appreciated concern. Continuous operation of a fan array of this magnitude implies a chronic, broadband (and low-frequency) noise source completely unnatural to this landscape. Determining exact sound levels at distance would require formal propagation modeling. This analysis should be required of the developer. But the existing science on this exact industry and biome is directly relevant and important:

- Studies in Alberta's boreal forest comparing wildlife near noise-generating energy facilities to nearly identical but quiet sites have found that **total songbird density was roughly 1.5 times higher at the quiet sites** (Bayne, Habib & Boutin 2008).
- A companion study found that chronic compressor-station noise reduced **ovenbird pairing success from 92% at quiet well pads to 77% at noisy sites**, with a markedly younger, lower-quality male population — attributed to noise masking the songs by which males attract mates (Habib, Bayne & Boutin 2007). The compressor stations in question produce roughly 75–90 dB(A).

The proposed facility is not one compressor station. Acoustically it is the equivalent of thousands of fans — orders of magnitude beyond the single sources these studies examined — operating continuously. A rough propagation estimate places its broadband output well above the natural night-time boreal background (on the order of 20–30 dB(A)) across a radius of many kilometers, with low-frequency content carrying farthest and winter temperature inversions extending that reach further. Again, the precise contours require modeling. But the conclusion that chronic industrial noise would blanket a large area of the Nation's territory isn't in serious doubt, in my opinion. H**uman evidence is abundant, well-documented.** Data-center noise complaints have become a genuine movement, and the acoustic signature reported is exactly what is predicted from first principles.[1] Because the noise spans multiple frequency ranges, especially the low end, it's hard to capture on a decibel meter — which makes noise regulations, not written with

[1] https://www.eesi.org/articles/view/communities-are-raising-noise-pollution-concernsabout-data-centers

these kinds of facilities in mind, nearly useless. Low-frequency noise travels farther, penetrates buildings more easily, resists conventional insulation, and is most noticeable at night when background sound drops and the cooling systems keep running at full capacity.

One further point. The published record notes that effective noise-reduction technology exists but has historically been deemed unnecessary at such facilities **because of the lack of impact on human residences**. For territory that is inhabited, travelled, and harvested by the Nation — and in which the affected wildlife are themselves integral to treaty and harvesting rights — that rationale does not obviously hold. So… flagging the acoustic question. A proper acoustic propagation study is warranted.

Thermal effects on the local environment

Because the heat exits from concentrated cooler arrays rather than being spread across the whole landholding, those zones would be intense local heat sources, generating persistent rising plumes of warm air. Most of that heat lofts and disperses; the near-surface effects are local to the cooler zones and their immediate surroundings.

The cold-climate context introduces a specific concern absent in temperate or desert settings: in deep cold, the combination of waste heat and added water vapor (from combustion and from the evaporative cooling fraction) can generate persistent **ice fog or freezing fog** — reducing visibility, depositing rime ice on vegetation and infrastructure, and altering local snow cover and melt. These effects are ecologically and practically relevant in a boreal winter and intersect with wildlife winter range. The heat source is real and large. Determining the magnitude and reach of these effects would require site-specific atmospheric modeling, which, as near as I can tell, hasn't been done. **And I'll emphasize, this is no small thing. As proposed, this facility will be one of the largest single-site heat sources on the planet.**

Water

Independent of the heat question, the consumptive use of approximately 6 million m^3/yr is a substantial demand in a region that has experienced declared agricultural drought. That said, I'm not a hydrologist. But one question I haven't seen addressed is water quality. One can expect pollution of multiple types to find its way into the water system from such a massive industrial project, both through construction and operation. Of particular interest, given the heat load, is water temperature. Again, specific designs of the facility and cooling systems would be needed to do an authentic analysis.

Air emissions

A continuous gas-combustion source of this size is, by any measure, a major emitter — of oxides of nitrogen, fine particulate matter, carbon monoxide, and carbon dioxide — layered onto an airshed already hosting extraction and processing activity. The reported characterization of the project as the country's largest single-source emitter warrants independent verification, and a

formal air-quality dispersion analysis (and greenhouse-gas accounting), cumulative with existing sources, is the appropriate tool. This lies outside my expertise but is clearly relevant.

Carbon emissions

Accounting for both combustion emissions and methane leakage, the life cycle carbon emissions here would be something like 50 megatons / year of CO2 equivalent, or 7% of Canada's total emissions.

Any carbon-capture claim warrants scrutiny on two grounds. First, real-world capture rates on gas combustion are partial and unproven at anything approaching this scale — "captured" rarely means most of the carbon. Second, the *fate* of the captured CO_2 matters: in oil-and-gas regions it is frequently used for enhanced recovery — injected to extract additional hydrocarbons whose later combustion can offset or exceed any storage benefit. Whether this project proposes permanent geological storage or enhanced recovery should be established before any capture claim is credited against its emissions.

What a credible assessment would require

The recurring theme is that the project's significant effects have not (as far as I can see) been characterized by the independent, whole-system analyses that a development of this magnitude would normally demand. I'd expect a credible assessment to include, at minimum:

- An **acoustic propagation study** using the actual fan specifications and layout, terrain, ground cover, and winter meteorology, mapping sound contours (including low-frequency content) against traditional-use areas and key wildlife habitat.
- A **site-specific atmospheric (mesoscale) thermal model** characterizing plume behavior, near-surface warming, ice-fog potential, and reach under the local cold-climate conditions.
- An **air-quality dispersion analysis** for combustion emissions, with greenhouse-gas accounting, cumulative with existing extraction sources.
- A **basin water balance** addressing the consumptive demand against drought conditions and ecological flows.
- A **cumulative wildlife and traditional-land-use assessment** integrating noise, light, habitat fragmentation, and thermal effects on top of the existing extraction footprint.

The absence such assessment is significant: it means the project's effects on the Nation's territory remain uncharacterized, and that any assurance of their being acceptable or mitigable rests on an absence of analysis rather than on analysis.

Summary of the issues

1. The facility is industrial infrastructure of a scale with little precedent — roughly 9 GW of power and 16–18 GW of continuous heat — not a "data center" in any ordinary sense. It is, to repeat, a ***Gigascale AI Smelter,*** **fusing massive compute and a massive, fossil-fueled powerplant to smelt data and material strip-mined from people and planet.**
2. Despite the water-cooling emphasis, this effectively appears to be an air-cooled facility: 15+ GW must be shed to the air, requiring a continuously running fan array of thousands of units. It's a critical issue that is deeply under-appreciated.
3. That fan array implies chronic, novel noise across a landscape whose wildlife are demonstrably sensitive to exactly this kind of disturbance, and which is the Nation's harvesting territory.
4. Local thermal effects, including cold-climate ice fog, are real but more localized; the heavier concerns are noise, water, emissions, and cumulative effects. Still, this needs real modeling.
5. Each of these belongs on top of an already-industrialized extraction landscape — making cumulative effects, and the adequacy of assessment and consultation, the throughline.

Once again: a fully independent, whole systems analysis is what's needed here. Everything is connected: feedback loops in complex systems like this mean effects of one kind generate other effects of other kinds.

This assessment is a preliminary, good-faith technical opinion based on the project as publicly described. It is not a comprehensive environmental review, a formal expert report, or legal advice..

References

- Bayne, E. M., Habib, L., & Boutin, S. (2008). Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. *Conservation Biology*, 22(5), 1186–1193. https://doi.org/10.1111/j.1523-1739.2008.00973.x
- Habib, L., Bayne, E. M., & Boutin, S. (2007). Chronic industrial noise affects pairing success and age structure of ovenbirds *Seiurus aurocapilla*. *Journal of Applied Ecology*, 44(1), 176–184. https://doi.org/10.1111/j.1365-2664.2006.01234.x

Anchor for the cooling-scale estimate: the Wyodak Power Plant (Gillette, Wyoming; ~330 MW; among the largest air-cooled condensers in the United States), scaled by heat-rejection duty and cross-checked by a first-principles airflow calculation. Project figures (≈9 GW, ≈65 km², ≈6 million m³/yr) are drawn from recent public reporting and should be confirmed against the developer's regulatory filings.

NOTE: In preparing this document I used a general-purpose AI assistant as a research aid and editor, drawing on a substantial body of prior discussion we have developed on this and related topics. All factual references have been independently checked and cross-checked where possible.

About the Author: *Dr. Robert Davies is a physicist and complex systems scientist, whose work focuses on global change and civilizational futures. A university professor for 25 years, Dr. Davies has worked in atmospheric physics, quantum optics and information, and spacecraft-environment interactions.*