From: [redacted]
To: Oksana Newmen; Dominic Kazmierczak
Cc: [redacted]
Subject: [EXTERNAL] - Re: Update on Burnco Aggregate Submission
Date: March 9, 2021 11:14:31 AM

Hi Oksana,

After discussing with several parties, Rocky View and the latest hearings have set precedences on several areas that we believe Administration is responsible to include:

- water security: Lehigh and Mtn Ash agreed on water monitoring of neighbour wells, the latest up to 1.5 miles.
Darryl's well is only 40 feet deep and in the gravels.
Our dry holes immediately across from the pit showed water formation in the gravels.
Without water security, we have nothing.
Hydrogeological studies are complex for all the areas. The applicant reports are not validated by third party experts.
The opposition hydrogeological experts showed significant evidence.
Alberta Environment process doesn't involve or circulate to adjacent landowners who water security is critical!

- performance measures and standards: Lehigh discussed. Mtn Ash agreed to monitoring and reporting

- size of pit: the approved Mtn Ash pit was a portion of 320 acres or about 150-160 acres in size. McKyler said she might have approved a smaller Lehigh pit?
As our largest neighbour and experienced business said phases of 10 years for the Burnco pit.
Current pit was approved 2011 for 10 year pit of six phases.
Market conditions and transportation and other factors show the pit is still processing the first phase and has large piles of gravel stored waiting.
Councillor 9 has changed 3 times in 10 years. Only one councillor was on RV Council 2011 when the pit of 10 years was approved.

- since covid the tourists, traffic and area have seen significant increases.
The Bow River Valley is a significant corridor and provides water security to millions downstream!

There are more points that we and our neighbours will be submitting once we know the applicant timelines and get the revised reports.
The applicant has over 4.5 months to review and revise. We expect to be given reasonable time frames of 60-90 days too.

Appreciate this topic is extremely important to our family for now and future generations!

Ann McKendrick McNabb
[redacted]

On Mar 8, 2021, at 11:52 AM, ONewmen@rockyview.ca wrote:

Hi Ann,

Sorry, I've not forgotten you! And Happy International Women's Day to you as well ☺

I'll send an update by the end of today.

Warm regards,
~Oksana

From: Ann McNabb [redacted]
Sent: March 8, 2021 11:35 AM
To: Oksana Newmen <ONewmen@rockyview.ca>
Cc: Will McNabb P.E. [redacted]>; Kari-Ann McNabb [redacted]
Subject: [EXTERNAL] - Re: Update on Burnco Aggregate Submission

Do not open links or attachments unless sender and content are known.

Hello Oksana,

Happy International Women's day! Hope you have a special day.

Just wondering if you have any answers?

Please confirm that you have received my requests? I do not know if you are working or if I should send my requests to Dominique?

Appreciate,

Ann

> On Mar 1, 2021, at 13:40 PM, Ann McNabb [redacted] wrote:
>
> Hello Oksana,
>
> Hope all is going well.
>
> I submitted a video to the Feb 16, 2021 MDP hearing and

recommended some motions.

I am wondering if you have received an update for the Cochrane West pit from Burnco?

Will the parties who submitted and adjacent landowners be circulated and given adequate time of 8-12 weeks to comment?

Is there an anticipated time that there will be a public hearing? or any date established?

Are you involved with the Mt Ash March 2, 2021 hearing?

I have yet to hear from Alberta Environment appeal.
There is growing evidence from all the Lehigh Hanson and Mtn Ash hearings technical experts that there is significant potential for impact on the water aquifer.
That is what we stated in 2009-2011 hearing for the West Cochrane now Burnco pit.

Appreciate your feedback.

Ann

Ann McKendrick McNabb
President McKendrick Ranches Ltd.
[redacted]

From: PAA_Development
To: Oksana Newmen
Subject: FW: [EXTERNAL] - Public comment, Burnco West Cochrane gravel pit.
Date: June 14, 2021 9:12:28 AM

Hi Oksana,

Some feedback regarding your upcomoing burnco gravel pit file west of Cochrane.

Best regards,

EVAN NEILSEN
Development Assistant | Planning Services

ROCKY VIEW COUNTY
262075 Rocky View Point | Rocky View County | AB | T4A 0X2
Phone: 403-520-7285
ENeilsen@rockyview.ca | www.rockyview.ca

-----Original Message-----
From: Christine Harrison <CHarrison@rockyview.ca>
Sent: June 14, 2021 9:02 AM
To: PAA_Development <Development@rockyview.ca>
Cc: Brenda Shute <BShute@rockyview.ca>
Subject: FW: [EXTERNAL] - Public comment, Burnco West Cochrane gravel pit.

Hello,

We have received this email in our general mailbox for your department, please respond to this inquiry.

We respectfully request you confirm contact when this inquiry is completed.

Thank you.

CHRISTINE HARRISON
Call Centre Representative | | Customer Care and Support

ROCKY VIEW COUNTY
262075 Rocky View Point | AB | T4A 0X2
Phone: 403-230-1401
charrison@rockyview.ca | www.rockyview.ca

-----Original Message-----
From: Andrew Woolley [redacted]
Sent: June 13, 2021 10:27 PM
To: Questions <questions@rockyview.ca>
Subject: [EXTERNAL] - Public comment, Burnco West Cochrane gravel pit.

Do not open links or attachments unless sender and content are known.

(Can you please pass this on ready for the hearing?)

“Yes, but not until after the Highway 1A and 22x new junction has been completed. It is already horribly difficult to manage to cross at various times of the day and the truck traffic will make it much, much worse.”

Thank you.

Andrew Woolley
Ghost Lake

June 2, 2021

Via Email

Rocky View County
262075 Rocky View Point
Rocky View County, Alberta T4A0X2

Attention: Oksana Newman, Planner

Re: Burnco West Cochrane Proposed Bylaw C-8073-2020 Application PL20200066 to amend Rocky View Land Use Bylaw (the "Proposed Bylaw Amendment")

McKendrick Ranches Ltd. (MRL), McNabb Developments Limited (MDL), and Ann McKendrick McNabb, are opposed to the Proposed Bylaw Amendment, which was presented to Rocky View (RV) Council and received first reading September 1, 2020.

Our first and primary concern is the size of the proposed pit. If approved, this Land Use and subsequent mine expansion would create 452 hectares (1,117 acres) of contiguous lands zoned as NRI for a gravel mining and aggregate processing expansion. The proposed land use would rezone approximately 6.5 km of lands south of the highway 1A along the Bow River.

Rezoning an area this large for resource extraction without a Rocky View gravel strategy is risky and unwise. Rocky View has not developed a gravel strategy and policies to allow a mix of land uses in a developing a community for the next 120 years. Policies need to be established to allow growth, planning, operating, reclamation, and environmental standards to protect surrounding residents from the harmful health, water, and numerous concerns. Currently the County approves land use assuming the extensive regulatory approvals which don't engage the community. Approving decades (or potentially a century +) of gravel with current policies and practices is not be in the best interests of future Councils and future generations of Rocky View residents. At a recent Council meeting, it was stated Rocky View has 50 or more years of gravel supply, so taking the time now to get this right is imperative.

Burnco has advised their current operations are 125,000 tonnes per year. At this rate, the current zoned 151 ac pit allows for 20 years of supply. At this time we feel there is no need to expand. The proposed total expanded pit is estimated to be 15 million tonnes would take 120 years of gravel extraction at the current yearly sales. Burnco's proposed MSDP states that they plan to increase the production to 500,000 tonnes per year over the next few years but these numbers are purely speculative. If these rates were ever to be achieved, Burnco proposes the pit will result in 30-35 years of aggregate extraction, which based on past performance we feel are not achievable.

Our concern is that if Rocky View approves between 30-120 years of gravel production, spanning 6.5 km along a critical county and tourist highway corridor, the County and the Community will lose the ability to apply good planning principals, will sterilize the entire area, and impact the highest and best use of this area along the beautiful Bow River west of Cochrane. This is directly contrary to Rocky View new Municipal Development Plan (MDP).

Recommend that Council grant Aggregate Land Use for an area that can be mined and reclaimed in a ten-year period or for an additional 160acres. This would allow Burnco to continue development and minimize impact to adjacent property owners, allow review of the environmental impact and critical Bow River water aquifer, and understand the performance monitoring Burnco has identified in the MSDP and proposed Direct Control monitoring measures. The Land Use timeframe should be defined for a specific period so that the County, adjacent properties, and the community can plan for future land use and development growth with the County's and Bow River Community's best interest in mind.

Recommend Rocky View table the bylaw until third party reviews of water quality are conducted and presented to Rocky View given concerns of water aquifer needs to adjacent owners, First Nations, and downstream water intakes by Cochrane and Calgary. A scientific study done by Jon Fennel (attached) shows the current 151 ac Burnco pit, has water samples with concentrations of these constituents: aluminum, chromium, arsenic, lead, cadmium, cobalt, copper, iron, and zinc were found to be in excess of guidelines for the protection and freshwater aquatic life in Alberta's surface waters (Alberta Environment 2018). Some were also in excess of Health Canada's 2020 Guidelines for Canadian Drinking Water Quality, those being: aluminum, arsenic, lead, iron, mercury and manganese. Further reviews should ensure biophysical impact and environmental sensitive setbacks of Grand Valley Creek are adequate before consideration of rezoning.

Recommend Rocky View table the bylaw until the MSDP is updated to not impact neighbouring properties. We ask that Burnco revise their MSDP to not impact neighbouring properties when it comes to impacts such as dust. Currently Burnco shows dust impacts extending onto neighbouring properties, we feel that is unfair and unnecessary and needs to be remedied before rezoning is considered as the MSDP forms part of the bylaw being contemplated by Council.

In summary, we are opposed to a gravel development of 1117 ac and 6.5 km along the Bow River 1A corridor which contain some of the most picturesque views in all of Rocky View County. We urge Rocky View Council to limit Burnco to the amount of land that can be developed and reclaimed in a ten-year time frame.

We also urge Council to table this bylaw until third party reviews are completed to validate the potential impact of the current and any future expansion of the Burnco pit on the drinking water quality for adjacent properties, Cochrane, Calgary, downstream users, and the aquatic life of this ecosystem.

Sincerely,

Ann McKendrick McNabb, President McKendrick Ranches Ltd.
William McNabb, President McNabb Developments
Kari-Ann McNabb, Vice President McNabb Developments

Summary of a scientific experiment by Dr. Fennell, M.Sc., Ph.D., P.Geol. Hydrogeologist & Geochemist, see attached report and data for the complete results.

An experiment was conducted on a sample of sand and gravel obtained from Burnco's current West Cochrane Pit. This pit is part of a large development currently under review by Rocky View County. The area extends for 6 or more kilometers along the Bow River approximately 7km west on Highway 1A from the Highway 1A/22 intersection. The purpose of this experiment was to assess what type of changes to water quality might occur after flowing deionized water these sediments. The purpose was to mimic the infiltration of snowmelt and/or rainfall through a thin (1.25m) column of soil (see Figure 1).

Figure 1. Experimental setup, execution, and sample turbidity noted.

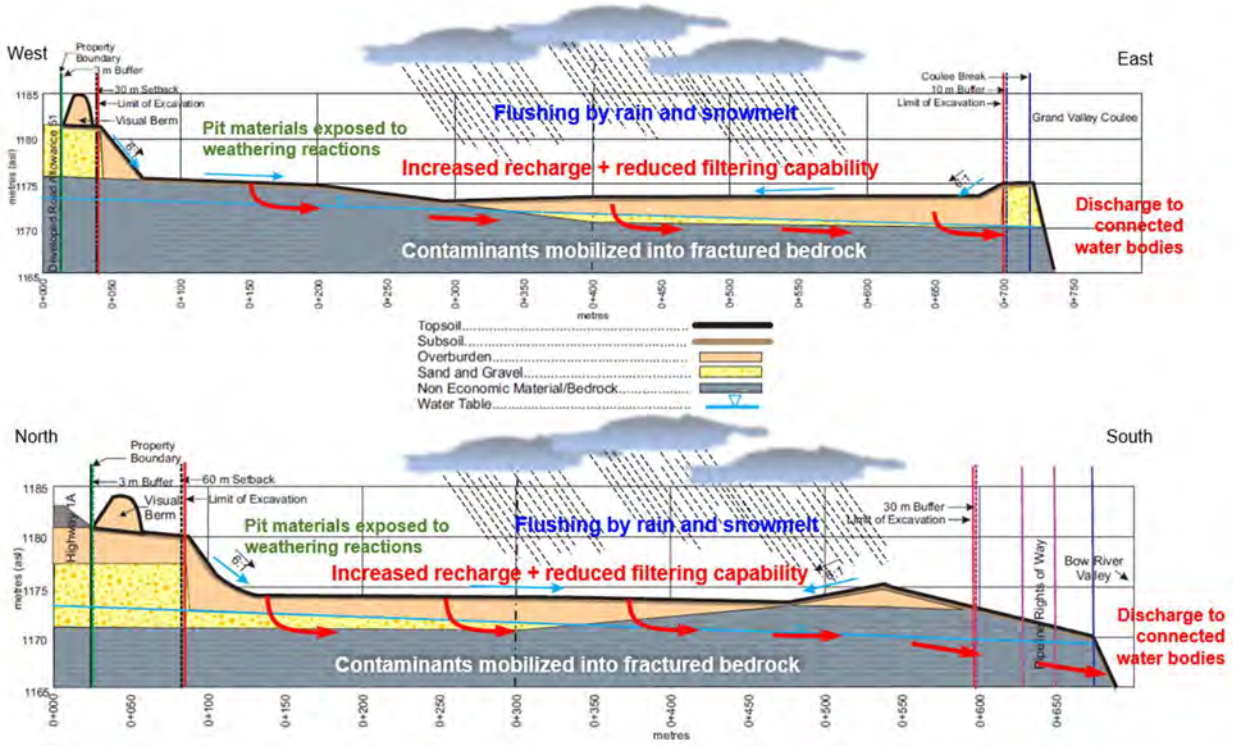
Test results showed a significant increase in turbidity (0 to >4000 NTU), pH (5 to 9.1), and the chemical quality of the effluent water. The most notable changes were related to metals and trace elements, many exceeding published guidelines to protect humans and aquatic receptors (see the following table).

Parameter	Soil flush #1	Soil flush #2	AB Tier 1	AB FWAL	CDWQ
Turbidity (NTU)	>4000	1600	--	2	1
Aluminum (mg/L	6.1	4.0	0.05		<0.1 OG
Arsenic (mg/L	0.019	0.009	0.005	0.005	0.010 ALARA
Cadmium (µg/L)	0.53	0.44	0.34*		--
Chromium (mg/L)	0.013	0.020	0.001+ 0.0049++	0.001+ 0.0089++	0.05 MAC
Cobalt (mg/L)	0.0095	0.0071	0.0015*		--
Copper (mg/L)	0.0150	0.0097	0.0070	0.0390	2 AO
Iron (mg/L)	17	12	0.3		≤0.3 AO
Lead (mg/L)	0.010	0.0073	0.007*		0.005 ALARA
Manganese (mg/L)	0.81	0.74	0.05	--	0.12 MAC
Mercury-total (mg/L)	Not	0.030	0.000005		0.001 MAC
Zinc (mg/l)	0.120	0.073	0.030		5.0 AO

Notes:

1. Values indicated for protection of freshwater aquatic life relate to long-term exposure.
2. * Assumes a groundwater hardness of 250 mg/L (as $CaCO_3$).
3. + = hexavalent; ++ = trivalent.
3. MAC = maximum acceptable value; ALARA = as low as reasonably achievable; AO = aesthetic value; OG = operational guidance value.

The proposed development of the West Cochrane Pit by Burnco will significantly, and permanently, alter the natural landscape of this picturesque area and forever change the conditions by eliminating the filtering capacity of the soils to contaminants mobilized or introduced during pit operation and following site reclamation. And given the estimate groundwater flow rates, based on available site information (from around 150 to more than 500 m/yr) the threat of impact to nearby receptors is notable.



Exposing sand, gravel, and bedrock to weathering and flushing has the potential to increase risk to the local environment from mobilized or introduced contaminants. Not only will fish-bearing streams like the Bow be put at risk, but also the drinking water supplied of downstream communities. If this is not properly assessed we are placing these receptors at risk. Unfortunately, we are left with more questions than answers. And for such a highly intrusive, visually unappealing, and extremely disruptive project wouldn't you want to know?

The concern with the current application before Rocky View County is that it does nothing to assess the impacts that may occur around a VERY LARGE gravel pit development, despite the opportunity to clarify these outstanding questions and concerns.

Why is it always have to be left up to the public to seek the truth about such gravel developments?

Why can't proponents do a more thorough job of assessing the risks?

June 5, 2021

Attention: To whom it may concern

Re: West Cochrane Pit soil column flushing experiment

The following is a summary of the experiment conducted on a sample of sand and gravel obtained from Burnco's currently operating West Cochrane Pit, located approximately 7 km west on Highway 1A from the Highway 1A/22 intersection. The purpose of this test was to assess the possible physical and chemical changes that may occur to water (i.e. precipitation) flowing through these sediments and entering the local groundwater.

Methodology

A sample of sand and gravel was procured from the Burnco West Cochrane Pit for testing. Once delivered, a subset of that sand and gravel was placed in a newly purchased, and cleaned, plastic 20L pail for delivery to the point of testing. On 08 May 2021 a representative aliquot of the sand and gravel, comprising a mixture of clay, silt, sand and cobbles, was loaded into a pre-cleaned 1.5 m x 51 mm ID PVC pipe to mimic a vertical soil column beneath the Burnco pit area. A pre-cleaned plastic container was used to load the sample into the PVC pipe to avoid the use of any metallic equipment. Prior to loading the sample, the base of the PVC pipe was covered with clean fibreglass mesh to retain the soil sample the pipe. Once in place, settling of the sediment was achieved by tapping the outside of the pipe with a small hammer to compact the material towards natural in-situ conditions.

Laboratory-grade deionized water was obtained from the contacted laboratory (Bureau Veritas, BV) to react with the soil column. Prior to adding the deionized water to the soil, the length of the sediment column was measured indicating a 1.25 m vertical thickness. When ready the soil column was slowly

hydrated with the deionized water to mimic infiltration of precipitation. Once the water began draining from the base of the PVC pipe, unfiltered samples were collected into sample bottles provided by BV (i.e. HDPE and glass, where required).

An initial set of samples (Soil flush #1) was collected on 08 May 2021 at 11:30AM. Once obtained and properly labelled the samples were placed in a refrigerator. The soil column was then allowed to drain over-night and a second set of samples (Soil flush #2) was collected the following day, 09 May 2021 at 10:45AM, using the same deionized water flow-through procedure.

Figure 1. Experimental setup, execution, and sample turbidity noted.

Upon completion of testing, both sample sets were placed in an ice-filled cooler to maintain their integrity while in transit to BV in northeast Calgary AB. Stand chain-of-custody (CoC) protocols were followed to track the shipping and handling process. Delivery was made within 48 hours for the first set of samples, and 24 hrs for the second set. A copy of the completed CoC is provided in Appendix 1. During the testing procedure, photographs were taken to document the process. Visual turbidity of the samples was noted at the time, as indicated in the photographs provided in Figure 1.

Analytical program

A relatively comprehensive analytical program was executed to assess changes to the deionized water quality following its transit through the soil column. Analysis was completed for the following:

- pH, alkalinity, and hardness,
- major ions (calcium, magnesium. sodium, potassium, bicarbonate + carbonate, sulphate, and chloride),
- nitrate and nitrite,
- metals and trace elements (including mercury), and
- turbidity.

All samples were received in good order, as documented by BV on the CoC. Sample temperatures were logged in at less than the require 10°C threshold and were received within the required time limit for sensitive parameters including turbidity and nitrate+ nitrite. The high quality of the deionized water was confirmed by BV (Appendix 1). A Certificate of Analysis for the two tests was provided (Appendix 2).

Results

As noted in Appendix 1, the deionized water used for the testing was devoid of any particulate or dissolved constituents, much like natural precipitation. Measurement with a hand-held TDS meter confirmed a "zero" mineralization. The pH and temperature were also measured at the time of testing with a combination

hand-held meter and returned values of 5 to 6 and 13°C to 14°C, respectively, on both days.

After confirming the starting conditions of the deionized water, the water was slowly flowed through the sediment column. Samples collected from the base were very different in appearance compared to the water that was added at the top. Of particular note was the colour and turbidity as noted in the lower right image of Figure 1. The occurrence of such turbidity is surprising considering the assumption often made that fine particles will be strained or filtered out as the water flows through the subsurface. However, this was obviously not the case. Measured values for Soil flush #1 and Soil flush #2 were >4000 NTU and 1600 NTU, respectively (Appendix 2).

In addition to turbidity, the chemical quality of the deionized water was also notably changed after reacting with the soil mixture. For example, the total dissolved solids (TDS) content increased from a pre-test value of 0 mg/L to 47 mg/L for Soil flush #1 and to a value of 39 mg/L for Soil flush #2. The laboratory pH also increased significantly to 9.1 for both tests. This represents a change from mildly acidic to alkaline conditions following a rather short reaction time and is indicative rapid reactions occurring as the water flowed through the soil mixture (e.g. ion exchange).

Prior to conducting further data evaluation a check on the correctness of analysis was performed. This included a review of the anion-cation charge balance to confirmed acceptability. The values obtained for both samples (-1.1% and 1.9%, respectively) were within the recommended standard of ±2%[1]. An additional test was performed where the ratio of reported TDS versus calculated TDS was compared. The range of acceptability is between 1.0 to 1.2[1], and the values obtained for the two soil flush tests were 1.01 and 1.00, respectively. Based on these confirmations the results from both tests were considered acceptable for further evaluation.

Other changes that occurred to the deionized water were less visual and more chemical in nature, with some of the constituents returning values in excess of

[1] *Standard Methods for the Examination of Water and Wastewater*

published water quality criteria. The criteria used for comparison is this study included:

- Alberta Tier 1 Soil and Groundwater Remediation Guidelines – for agricultural land (Alberta Government 2019)
- Environmental Quality Guidelines for Alberta Surface Waters – for the protection of freshwater aquatic life - FWAL (Alberta Government 2018)
- Guidelines for Canadian Drinking Water Quality - CDWQ (Health Canada 2020)

The following table summarizes a number of parameters in the soil flush effluent that exhibited values in excess of the above-noted criteria:

Parameter	Soil flush #1	Soil flush #2	AB Tier 1	AB FWAL	CDWQ
Turbidity (NTU)	>4000	1600	--	2	1
Aluminum (mg/L	6.1	4.0	0.05		<0.1 OG
Arsenic (mg/L	0.019	0.009	0.005	0.005	0.010 ALARA
Cadmium (µg/L)	0.53	0.44	0.34*		--
Chromium (mg/L)	0.013	0.020	0.001^{+} 0.0049^{++}	0.001^{+} 0.0089^{++}	0.05 MAC
Cobalt (mg/L)	0.0095	0.0071	0.0015*		--
Copper (mg/L)	0.0150	0.0097	0.0070	0.0390	2 AO
Iron (mg/L)	17	12	0.3		≤0.3 AO
Lead (mg/L)	0.010	0.0073	0.007*		0.005 ALARA
Manganese (mg/L)	0.81	0.74	0.05	--	0.12 MAC
Mercury-total (mg/L)	Not	0.030	0.000005		0.001 MAC
Zinc (mg/l)	0.120	0.073	0.030		5.0 AO

Notes:

1. Values indicated for protection of freshwater aquatic life relate to long-term exposure.
2. * Assumes a groundwater hardness of 250 mg/L (as $CaCO_3$).
3. $^{+}$ = hexavalent; $^{++}$ = trivalent.
3. MAC = maximum acceptable value; ALARA = as low as reasonably achievable; AO = aesthetic value; OG = operational guidance value.

Measured values for the other constituents analyzed are provided in Appendix 2. However, those listed in the preceding table represent the most notable in terms of risk to human and ecological receptors.

Discussion

The proposed development of the West Cochrane Pit by Burnco will significantly, and permanently, alter the natural landscape of this picturesque area. Although Burnco indicates that the anticipated change to the local groundwater and surface water will be negligible, that claim has not actually been substantiated. Baseline groundwater quality was established by Burnco back in 2018, but no follow-up water quality monitoring has been conducted since. This includes in and around the currently operating pit area, which was commissioned following the 2018 program.

In light of the results generated by this experiment, concern exists that particulate matter and dissolved constituents will be mobilized from disturbed areas into the local groundwater and any receiving water bodies. Given the range of hydraulic conductivity values measured for the sand and gravel at the site (pdf page 773-75 of the Burnco's MSDP: 4.8 to 25.6 m/d), a calculated lateral hydraulic gradient of 0.028 from the Matrix's supporting report, and an assumed effective porosity of 30%, the flow of groundwater beneath the site could range anywhere from around 150 m/yr to more than 600 m/yr (depending on local conditions). Therefore the transit time for a substance release to a receptors would be relatively short at less than a year to perhaps a year or so.

Stripping of the overlying topsoil and removal of a substantial amount (if not all) of the sand and gravel beneath will inevitably reduce the filtering capacity of the subsurface and allow contaminants that occur during the mining process (natural or other) to move more quickly down to the water table. This is shown in conceptual manner in Figure 2 on the following page, and is reinforced by a statements made by Matrix Solutions in an excerpt from Burnco's 2020 Master Site Development Plan (MSDP pdf page 682 of 1882):

The removal of the silty clay (where present) at site, will remove a natural barrier to potential contamination of the groundwater from surface spills. Any contaminant spilled at surface during or after operations would preferentially flow either vertically through the porous gravel and bedrock to the water table or along preferentially pathways (secondary permeability/fractures) in the bedrock. From below the water table it would follow groundwater flow direction (south to southeast), likely ending up in the Grande Valley Creek, Beaupré Creek, and the Bow River. Any contamination could potentially flow into the underlying bedrock, posing a risk to any residential well users in the area.

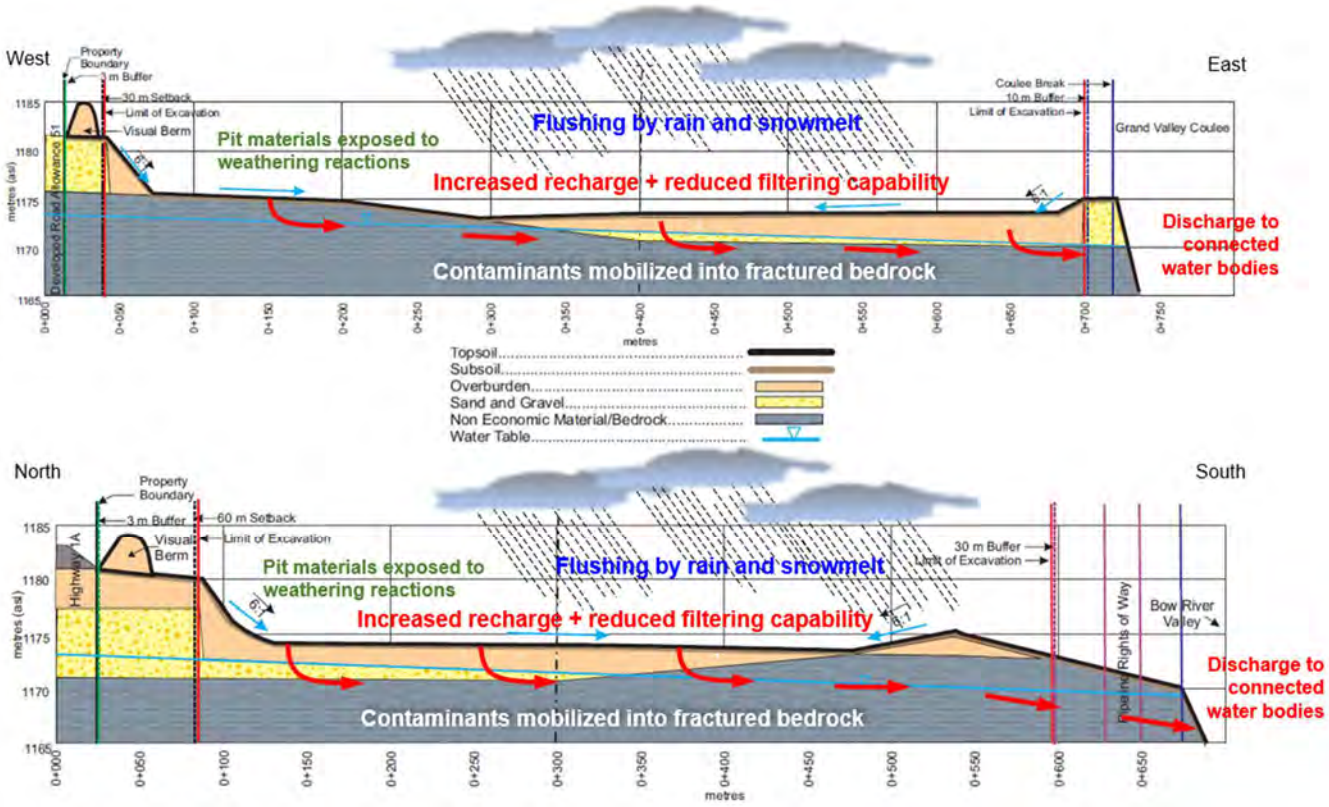


Figure 2. Conceptual diagram showing change to site conditions from pit development and associated risk to aquatic receptors.

Recharging precipitation (snow melt or rai) entering the subsurface will enhance the ability to move particulate and dissolved matter into the groundwater. By removing the filtering capacity of sediment this will only exacerbate the condition. It is clear from this experiment that turbidity can be produced from flushing water thought a 1.25 m soil column, not to mention notable changes to the chemical quality of the effluent.

The findings of this study suggest that the action of mining gravel from a very large development area will ultimately expose the remaining sand and gravel, as

well as the underlying bedrock aquifers, to weathering reactions and enhanced flushing by annual snow melt and rainfall events.

As such, any contaminants (solid or dissolved) mobilized and flushed from these exposed sediments will increase the risk of impact to the local environment. Proximity to receptors will be a major factor, not to mention how the mobilized contaminants move through the subsurface. However, this aspect has not been assessed by Burnco, and the fact that the groundwater flow velocity has not been assessed makes any statements about risk very difficult, if not impossible. The receptors at greatest risk include:

- local springs and water wells,
- Grand Valley Creek,
- Beaupre Creek, and
- the Bow River.

With the exception of the Bow River, most of the local surface water features in the study area are not believed to be fish-bearing. However, they do likely have environments that will sustain aquatic habitat that supports downstream aquatic systems. From a federal *Fisheries Act* perspective this is pertinent. The potential introduction of harmful constituents into aquatic systems is an obvious threat, and the waters from the site eventually drain into the fish-bearing Bow River. The Bow River is also used as a source of drinking water by the Town of Cochrane, as well as Calgary, so some assessment of the potential discharge of harmful substances into the river should have been conducted. However, it was not.

The turbidity guideline for protection of aquatic life in Alberta requires that the maximum long-term average for "clear" water systems, like the West Cochrane Pit area, be kept within 8 NTU above background values for any short-term exposure (e.g. up to 24 hours). Over the longer-term the increase should be no more than 2 NTU above background levels (Alberta Government 2018).

The way in which Burnco mines the sand and gravel deposit will dictate the end result regarding risk to the local groundwater and connected systems. It is unclear whether the plan is to mine down to the bedrock surface or whether a thin veneer

of sand and gravel deposit will be left in place. All of this granular material rests in contact with fractured bedrock as noted in Burnco's MSDP, submitted in June 2020. Based on the findings of this study, mobilization of turbidity from any residual sand and gravel left above the bedrock is a risk. Once in bedrock it will have a reduced chance of being attenuated, as fracture flow is very different than flow though the porous media. Again, this aspect was not assessed.

If Burnco decides to operate a wet pit instead, and mine below the water table without dewatering, this will likely occur via bailing operations. The effect of this extraction method will be to create very turbid water due to the churning action of the equipment. Again, the migration of mobilized particulate matter through the sediments is likely. Mobilization of turbidity in local groundwater has been documented before, with measurable effects being noted as far as 1.8 km downgradient. The following quote is taken from a report authored by Mead (1995):

> *"This DEQ [Department of Environmental Quality] study found a turbidity plume that extended more than a mile to the north (downgradient) of the gravel operation. The average turbidity of the water being discharged from the washing operation into the pond at the site was 2,737 nephelometric turbidity units (NTUs). Nearly all wells sampled within the first 6,000 feet of the turbidity plume were measured at 5 NTU or more. Many wells within the first 3,000 feet of the plume had turbidity levels of 10 NTU or more. Nearly all wells outside the plume had turbidities of 2 NTU or less."*

Additionally, the release of harmful metals and trace elements is of concern. This is not only associated with the type of metal or trace element mobilized, but also the form it is in when present in the water. Given the anticipated groundwater conditions beneath the Burnco development area (i.e. well oxygenated and at a pH of 7 to 8, as noted on pdf page 699 in Burnco's MSDP) the speciation of chromium, for example, would favour the more mobile chromate ion (i.e. CrO_4^{2-}).

When present as chromate, and at the groundwater conditions described previously, it will be present in the hexavalent form. This is shown in the Eh-pH diagram provided in Figure 3. Hexavalent chromium is a highly toxic species, and can influence aquatic life at values as low as 0.001 mg/L. The other metals and

trace elements noted in the summary table on page 5 will have their own unique toxicity and mobility characteristics.

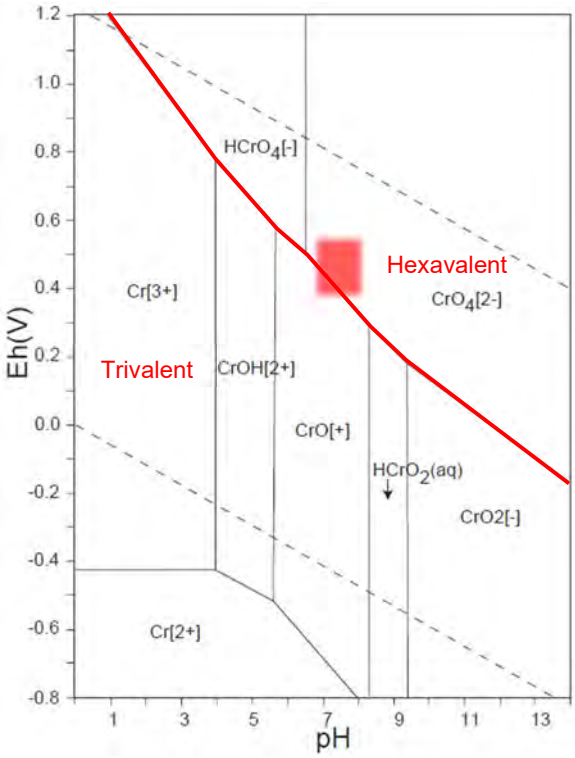


Figure 3. Eh-pH diagrams for chromium (left) and selenium (right)[2].
Note: red shaded area represents conditions expected in well-oxygenated groundwater system.

Unfortunately, none of the required information to assess this aspect has been provided. In fact, there is no monitoring data available for any of the wells around the working gravel pit to determine what constituents may have been mobilized so far. The only location assessed for metals and trace elements back in 2018 was a monitoring well located upgradient of the operating pit and adjacent to Highway 1A, that being MW18-02(B2).

The concern with the Burnco's current application to Rocky View County is that it does nothing to assess the impacts to groundwater and connected surface water environments that could occur around a working gravel pit. Although there are monitoring wells established around the current open pit, no up-to-date information is available to assess what has occurred since commissioning of that pit. Of equal

[2] *Geological Survey of Japan*

importance is the lack of assessment done to determine what the full impact of the West Cochrane Pit will look like once development is complete and reclamation has occurred.

Given the results of this soil column test there should be cause for concern. The pit mining activities will be located very close to aquatic receptors and therefore pose a threat to their existence and future viability. At the very least Burnco should be required to conduct a proper risk assessment and account for the potential mobilization, transport, and fate of contaminants like the ones documented in this experiment. It would also be informative for Burnco to assess conditions around their existing West Cochrane Pit via the series of dedicated monitoring wells installed there. This should include a proper assessment of water quality and geochemical conditions to better understand the risks involved if mining is to be extended across the larger proposed development area. Unfortunately, none of this work has been completed or provided for decision makers to rely on. This begs the questions:

"To what degree will Burnco's proposed development impact the groundwater quality across the larger area?"

and

"How will this impact downgradient receptors like Grand Valley Creek, Beaupre Creek, and ultimately the Bow River?"

Closure

This report has been prepared to summarize results of a soil column flushing experiment designed to mimic infiltration of snowmelt and rainwater through sand and gravel deposits beneath the West Cochrane Pit area. The content is meant to inform decision makers so that unintended consequences to the environment and downstream communities can be avoided. If there are any questions regarding the methodology or interpretation of findings provided herein, the reader should contact the undersigned for clarification.

Respectfully submitted by:

Jon Fennell, M.Sc., Ph.D., P.Geol.
Hydrogeologist & Geochemist

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APPENDIX 1

Deionized water quality (from Bureau Veritas):

QA/QC Batch	QC Type	Parameter	Date Analyzed	Value	UNITS
A221986	Method Blank	Turbidity	2021/05/12	<0.10	NTU
		Total Mercury (Hg)	2021/05/12	<0.0019	ug/L
		Total Barium (Ba)	2021/05/16	<0.010	mg/L
		Total Boron (B)	2021/05/16	<0.020	mg/L
		Total Calcium (Ca)	2021/05/16	<0.30	mg/L
		Total Iron (Fe)	2021/05/16	<0.060	mg/L
		Total Lithium (Li)	2021/05/16	<0.020	mg/L
		Total Magnesium (Mg)	2021/05/16	<0.20	mg/L
		Total Manganese (Mn)	2021/05/16	<0.0040	mg/L
		Total Phosphorus (P)	2021/05/16	<0.10	mg/L
		Total Potassium (K)	2021/05/16	<0.30	mg/L
		Total Silicon (Si)	2021/05/16	<0.10	mg/L
		Total Sodium (Na)	2021/05/16	<0.50	mg/L
		Total Strontium (Sr)	2021/05/16	<0.020	mg/L
		Total Sulphur (S)	2021/05/16	<0.20	mg/L
		Total Aluminum (Al)	2021/05/14	<0.0030	mg/L
		Total Antimony (Sb)	2021/05/14	<0.00060	mg/L
		Total Arsenic (As)	2021/05/14	<0.00020	mg/L
		Total Beryllium (Be)	2021/05/14	<0.0010	mg/L
		Total Chromium (Cr)	2021/05/14	<0.0010	mg/L
		Total Cobalt (Co)	2021/05/14	<0.00030	mg/L
		Total Copper (Cu)	2021/05/14	<0.00020	mg/L
		Total Lead (Pb)	2021/05/14	<0.00020	mg/L
		Total Molybdenum (Mo)	2021/05/14	<0.00020	mg/L
		Total Nickel (Ni)	2021/05/14	<0.00050	mg/L
		Total Selenium (Se)	2021/05/14	<0.00020	mg/L
		Total Silver (Ag)	2021/05/14	<0.00010	mg/L
		Total Thallium (Tl)	2021/05/14	<0.00020	mg/L
		Total Tin (Sn)	2021/05/14	<0.0010	mg/L
		Total Titanium (Ti)	2021/05/14	<0.0010	mg/L
		Total Uranium (U)	2021/05/14	<0.00010	mg/L
		Total Vanadium (V)	2021/05/14	<0.0010	mg/L
		Total Zinc (Zn)	2021/05/14	<0.0030	mg/L
		Dissolved Sodium (Na)	2021/05/13		%
		Dissolved Calcium (Ca)	2021/05/13	<0.30	mg/L
		Dissolved Iron (Fe)	2021/05/13	<0.060	mg/L
		Dissolved Magnesium (Mg)	2021/05/13	<0.20	mg/L
		Dissolved Manganese (Mn)	2021/05/13	<0.0040	mg/L
		Dissolved Potassium (K)	2021/05/13	<0.30	mg/L
		Dissolved Sodium (Na)	2021/05/13	<0.50	mg/L
		Dissolved Calcium (Ca)	2021/05/13	<0.30	mg/L
		Dissolved Iron (Fe)	2021/05/13	<0.060	mg/L
		Dissolved Magnesium (Mg)	2021/05/13	<0.20	mg/L
		Dissolved Manganese (Mn)	2021/05/13	<0.0040	mg/L
		Dissolved Potassium (K)	2021/05/13	<0.30	mg/L
		Dissolved Sodium (Na)	2021/05/13	<0.50	mg/L
		Dissolved Nitrite (N)	2021/05/12	<0.010	mg/L
		Alkalinity (PP as CaCO3)	2021/05/14	<1.0	mg/L
		Conductivity	2021/05/14	<2.0	uS/cm
		Dissolved Chloride (Cl)	2021/05/14	<1.0	mg/L

APPENDIX 2

(see attached PDF)

Your C.O.C. #: 635648-01-01

Attention: John Fennell

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.
4000 19th Street NE
Calgary, AB
CANADA T2E 6P8

Report Date: 2021/05/31
Report #: R3026392
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C130760
Received: 2021/05/10, 08:10

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2021/05/14	AB SOP-00005	SM 23 2320 B m
Cadmium - low level CCME (Total)	2	N/A	2021/05/14		Auto Calc
Chloride/Sulphate by Auto Colourimetry	2	N/A	2021/05/15	AB SOP-00020	SM23-4500-Cl/SO4-E m
Conductivity @25C	2	N/A	2021/05/14	AB SOP-00005	SM 23 2510 B m
Hardness	1	N/A	2021/05/14		Auto Calc
Hardness	1	N/A	2021/05/16		Auto Calc
Mercury (Total) by CV	1	2021/05/12	2021/05/12	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP-Dissolved-Lab Filtered (1)	2	N/A	2021/05/13	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Total	2	2021/05/12	2021/05/16	AB SOP-00014 / AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Total	2	2021/05/12	2021/05/13	AB SOP-00014 / AB SOP-00043	EPA 6020b R2 m
Ion Balance	1	N/A	2021/05/15		Auto Calc
Ion Balance	1	N/A	2021/05/16		Auto Calc
Sum of cations, anions	1	N/A	2021/05/14		Auto Calc
Sum of cations, anions	1	N/A	2021/05/16		Auto Calc
Nitrate and Nitrite	2	N/A	2021/05/14		Auto Calc
NO2 - NO2 + NO3 (N) in Water	2	N/A	2021/05/12	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	2	2021/05/11	2021/05/14		Auto Calc
pH @25°C (2)	2	N/A	2021/05/14	AB SOP-00005	SM 23 4500-H+B m
Total Dissolved Solids (Calculated)	1	N/A	2021/05/15		Auto Calc
Total Dissolved Solids (Calculated)	1	N/A	2021/05/16		Auto Calc
Turbidity	2	N/A	2021/05/12	CAL SOP-00081	SM 23 2130 B m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your C.O.C. #: 635648-01-01

Attention: John Fennell

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.
4000 19th Street NE
Calgary, AB
CANADA T2E 6P8

Report Date: 2021/05/31
Report #: R3026392
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C130760
Received: 2021/05/10, 08:10

Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.
(2) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

Encryption Key

AUTHORIZED REPORT
RAPPORT AUTORISÉ

Bureau Veritas
31 May 2021 15:09:14

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Customer Solutions, Western Canada Customer Experience Team
Email: customersolutionswest@bureauveritas.com
Phone# (403) 291-3077

==========

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

ROUTINE WATER -LAB FILTERED (WATER)

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Calculated Parameters				
Anion Sum	meq/L	0.93	0.81	N/A
Cation Sum	meq/L	0.91	0.78	N/A
Hardness (CaCO3)	mg/L	39	35	0.50
Ion Balance (% Difference)	%	NC	NC	N/A
Dissolved Nitrate (N)	mg/L	0.10	0.058	0.010
Dissolved Nitrate (NO3)	mg/L	0.45	0.26	0.044
Dissolved Nitrite (NO2)	mg/L	<0.033	<0.033	0.033
Calculated Total Dissolved Solids	mg/L	47	39	10
Misc. Inorganics				
Conductivity	uS/cm	89	76	2.0
pH	pH	9.15	9.11	N/A
Anions				
Alkalinity (PP as CaCO3)	mg/L	3.5	3.8	1.0
Alkalinity (Total as CaCO3)	mg/L	34	33	1.0
Bicarbonate (HCO3)	mg/L	32	31	1.0
Carbonate (CO3)	mg/L	4.2	4.6	1.0
Hydroxide (OH)	mg/L	<1.0	<1.0	1.0
Dissolved Chloride (Cl)	mg/L	2.8	1.7	1.0
Dissolved Sulphate (SO4)	mg/L	8.4	4.7	1.0
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010
Dissolved Nitrate plus Nitrite (N)	mg/L	0.10	0.058	0.010
Lab Filtered Elements				
Dissolved Calcium (Ca)	mg/L	4.8	4.5	0.30
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060
Dissolved Magnesium (Mg)	mg/L	6.6	5.6	0.20
Dissolved Manganese (Mn)	mg/L	<0.0040	<0.0040	0.0040
Dissolved Potassium (K)	mg/L	1.4	1.2	0.30
Dissolved Sodium (Na)	mg/L	2.1	1.4	0.50

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

REGULATED METALS (CCME/AT1) - TOTAL

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Elements				
Total Cadmium (Cd)	ug/L	0.53	0.44	0.020
Total Aluminum (Al)	mg/L	6.1	4.0	0.0030
Total Antimony (Sb)	mg/L	0.00076	<0.00060	0.00060
Total Arsenic (As)	mg/L	0.019	0.0094	0.00020
Total Barium (Ba)	mg/L	0.35	0.24	0.010
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010
Total Boron (B)	mg/L	<0.020	<0.020	0.020
Total Calcium (Ca)	mg/L	180	210	0.30
Total Chromium (Cr)	mg/L	0.013	0.020	0.0010
Total Cobalt (Co)	mg/L	0.0095	0.0071	0.00030
Total Copper (Cu)	mg/L	0.015	0.0097	0.00020
Total Iron (Fe)	mg/L	17	12	0.060
Total Lead (Pb)	mg/L	0.010	0.0073	0.00020
Total Lithium (Li)	mg/L	0.021	<0.020	0.020
Total Magnesium (Mg)	mg/L	39	45	0.20
Total Manganese (Mn)	mg/L	0.81	0.74	0.0040
Total Molybdenum (Mo)	mg/L	0.0020	0.0025	0.00020
Total Nickel (Ni)	mg/L	0.024	0.016	0.00050
Total Phosphorus (P)	mg/L	0.73	0.63	0.10
Total Potassium (K)	mg/L	3.5	2.5	0.30
Total Selenium (Se)	mg/L	0.00037	0.00022	0.00020
Total Silicon (Si)	mg/L	12	8.1	0.10
Total Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010
Total Sodium (Na)	mg/L	2.2	1.4	0.50
Total Strontium (Sr)	mg/L	0.21	0.21	0.020
Total Sulphur (S)	mg/L	2.0	1.4	0.20
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020
Total Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010
Total Titanium (Ti)	mg/L	0.045	0.032	0.0010
Total Uranium (U)	mg/L	0.0014	0.0012	0.00010
Total Vanadium (V)	mg/L	0.021	0.015	0.0010
Total Zinc (Zn)	mg/L	0.12	0.073	0.0030
RDL = Reportable Detection Limit				

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Physical Properties				
Turbidity	NTU	>4000 (1)	1600	0.10

RDL = Reportable Detection Limit
(1) Sample contained sediment

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		ZT5149	
Sampling Date		2021/05/09 10:45	
COC Number		635648-01-01	
	UNITS	SOIL FLUSH #2	RDL
Elements			
Total Mercury (Hg)	ug/L	0.0030	0.0019
RDL = Reportable Detection Limit			

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.7°C
Package 2	7.3°C

Version #3: Report reissued only with sample Soil Flush #1 & #2 as per client request. 20210531

Version #2: Report reissued due to typo error with email address. 20210519

Sample ZT5148 [SOIL FLUSH #1] : Turbidity completed within 48h after laboratory receipt to a maximum of five days from sampling. Data are satisfactory for compliance purposes. NO2 - NO2 + NO3 (N) in Water completed within 48h after laboratory receipt to a maximum of five days from sampling. Data are satisfactory for compliance purposes.

Results relate only to the items tested.

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

BV Labs Job #: C130760
Report Date: 2021/05/31

QUALITY ASSURANCE REPORT

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A221986	Turbidity	2021/05/12			102	80 - 120	<0.10	NTU	0.83	20
A223437	Total Mercury (Hg)	2021/05/12	93	80 - 120	97	80 - 120	<0.0019	ug/L	NC	20
A223560	Total Barium (Ba)	2021/05/16	96	80 - 120	106	80 - 120	<0.010	mg/L	5.4	20
A223560	Total Boron (B)	2021/05/16	103	80 - 120	107	80 - 120	<0.020	mg/L	2.2	20
A223560	Total Calcium (Ca)	2021/05/16	NC	80 - 120	108	80 - 120	<0.30	mg/L	3.3	20
A223560	Total Iron (Fe)	2021/05/16	118	80 - 120	107	80 - 120	<0.060	mg/L	3.4	20
A223560	Total Lithium (Li)	2021/05/16	108	80 - 120	112	80 - 120	<0.020	mg/L	4.7	20
A223560	Total Magnesium (Mg)	2021/05/16	NC	80 - 120	113	80 - 120	<0.20	mg/L	0.90	20
A223560	Total Manganese (Mn)	2021/05/16	109	80 - 120	105	80 - 120	<0.0040	mg/L	2.5	20
A223560	Total Phosphorus (P)	2021/05/16	104	80 - 120	104	80 - 120	<0.10	mg/L	NC	20
A223560	Total Potassium (K)	2021/05/16	NC	80 - 120	110	80 - 120	<0.30	mg/L	2.4	20
A223560	Total Silicon (Si)	2021/05/16	113	80 - 120	113	80 - 120	<0.10	mg/L	5.4	20
A223560	Total Sodium (Na)	2021/05/16	NC	80 - 120	107	80 - 120	<0.50	mg/L	1.4	20
A223560	Total Strontium (Sr)	2021/05/16	94	80 - 120	106	80 - 120	<0.020	mg/L	3.1	20
A223560	Total Sulphur (S)	2021/05/16	NC	80 - 120	109	80 - 120	<0.20	mg/L	0.77	20
A223574	Total Aluminum (Al)	2021/05/13	112	80 - 120	116	80 - 120	<0.0030	mg/L	6.4	20
A223574	Total Antimony (Sb)	2021/05/13	113	80 - 120	116	80 - 120	<0.00060	mg/L	1.3	20
A223574	Total Arsenic (As)	2021/05/13	103	80 - 120	102	80 - 120	<0.00020	mg/L	0.17	20
A223574	Total Beryllium (Be)	2021/05/13	114	80 - 120	108	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Chromium (Cr)	2021/05/13	104	80 - 120	105	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Cobalt (Co)	2021/05/13	101	80 - 120	104	80 - 120	<0.00030	mg/L	3.2	20
A223574	Total Copper (Cu)	2021/05/13	97	80 - 120	104	80 - 120	<0.00020	mg/L	14	20
A223574	Total Lead (Pb)	2021/05/13	100	80 - 120	106	80 - 120	<0.00020	mg/L	NC	20
A223574	Total Molybdenum (Mo)	2021/05/13	117	80 - 120	110	80 - 120	<0.00020	mg/L	5.2	20
A223574	Total Nickel (Ni)	2021/05/13	98	80 - 120	105	80 - 120	<0.00050	mg/L	11	20
A223574	Total Selenium (Se)	2021/05/13	113	80 - 120	115	80 - 120	<0.00020	mg/L	0.93	20
A223574	Total Silver (Ag)	2021/05/13	102	80 - 120	105	80 - 120	<0.00010	mg/L	NC	20
A223574	Total Thallium (Tl)	2021/05/13	108	80 - 120	113	80 - 120	<0.00020	mg/L	NC	20
A223574	Total Tin (Sn)	2021/05/13	109	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Titanium (Ti)	2021/05/13	110	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Uranium (U)	2021/05/13	103	80 - 120	105	80 - 120	<0.00010	mg/L	2.6	20
A223574	Total Vanadium (V)	2021/05/13	107	80 - 120	105	80 - 120	<0.0010	mg/L	5.9	20
A223574	Total Zinc (Zn)	2021/05/13	100	80 - 120	106	80 - 120	<0.0030	mg/L	NC	20

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BV Labs Job #: C130760
Report Date: 2021/05/31

QUALITY ASSURANCE REPORT(CONT'D)

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A223796	Dissolved Calcium (Ca)	2021/05/16	NC	80 - 120	99	80 - 120	<0.30	mg/L	1.1	20
A223796	Dissolved Iron (Fe)	2021/05/16	111	80 - 120	104	80 - 120	<0.060	mg/L	NC	20
A223796	Dissolved Magnesium (Mg)	2021/05/16	NC	80 - 120	102	80 - 120	<0.20	mg/L	1.9	20
A223796	Dissolved Manganese (Mn)	2021/05/16	108	80 - 120	102	80 - 120	<0.0040	mg/L	3.3	20
A223796	Dissolved Potassium (K)	2021/05/16	104	80 - 120	104	80 - 120	<0.30	mg/L	1.3	20
A223796	Dissolved Sodium (Na)	2021/05/16	NC	80 - 120	96	80 - 120	<0.50	mg/L	1.4	20
A223798	Dissolved Calcium (Ca)	2021/05/14	NC	80 - 120	101	80 - 120	<0.30	mg/L	1.8	20
A223798	Dissolved Iron (Fe)	2021/05/14	110	80 - 120	105	80 - 120	<0.060	mg/L	NC	20
A223798	Dissolved Magnesium (Mg)	2021/05/14	NC	80 - 120	103	80 - 120	<0.20	mg/L	2.8	20
A223798	Dissolved Manganese (Mn)	2021/05/14	109	80 - 120	103	80 - 120	<0.0040	mg/L	1.1	20
A223798	Dissolved Potassium (K)	2021/05/14	104	80 - 120	105	80 - 120	<0.30	mg/L	2.7	20
A223798	Dissolved Sodium (Na)	2021/05/14	NC	80 - 120	99	80 - 120	<0.50	mg/L	2.3	20
A223899	Dissolved Nitrate plus Nitrite (N)	2021/05/12	122 (1)	80 - 120	99	80 - 120	<0.010	mg/L	1.1	20
A223899	Dissolved Nitrite (N)	2021/05/12	100	80 - 120	104	80 - 120	<0.010	mg/L	NC	20
A225434	Alkalinity (PP as CaCO3)	2021/05/14					<1.0	mg/L	NC	20
A225434	Alkalinity (Total as CaCO3)	2021/05/14			98	80 - 120	<1.0	mg/L	1.5	20
A225434	Bicarbonate (HCO3)	2021/05/14					<1.0	mg/L	2.0	20
A225434	Carbonate (CO3)	2021/05/14					<1.0	mg/L	NC	20
A225434	Hydroxide (OH)	2021/05/14					<1.0	mg/L	NC	20
A225437	pH	2021/05/14			100	97 - 103			0.16	N/A
A225438	Conductivity	2021/05/14			101	90 - 110	<2.0	uS/cm	0.65	10
A226330	Dissolved Chloride (Cl)	2021/05/15	99	80 - 120	105	80 - 120	<1.0	mg/L	NC	20
A226330	Dissolved Sulphate (SO4)	2021/05/15	105	80 - 120	106	80 - 120	<1.0	mg/L	NC	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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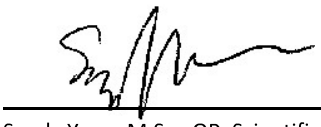
BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Sandy Yuan, M.Sc., QP, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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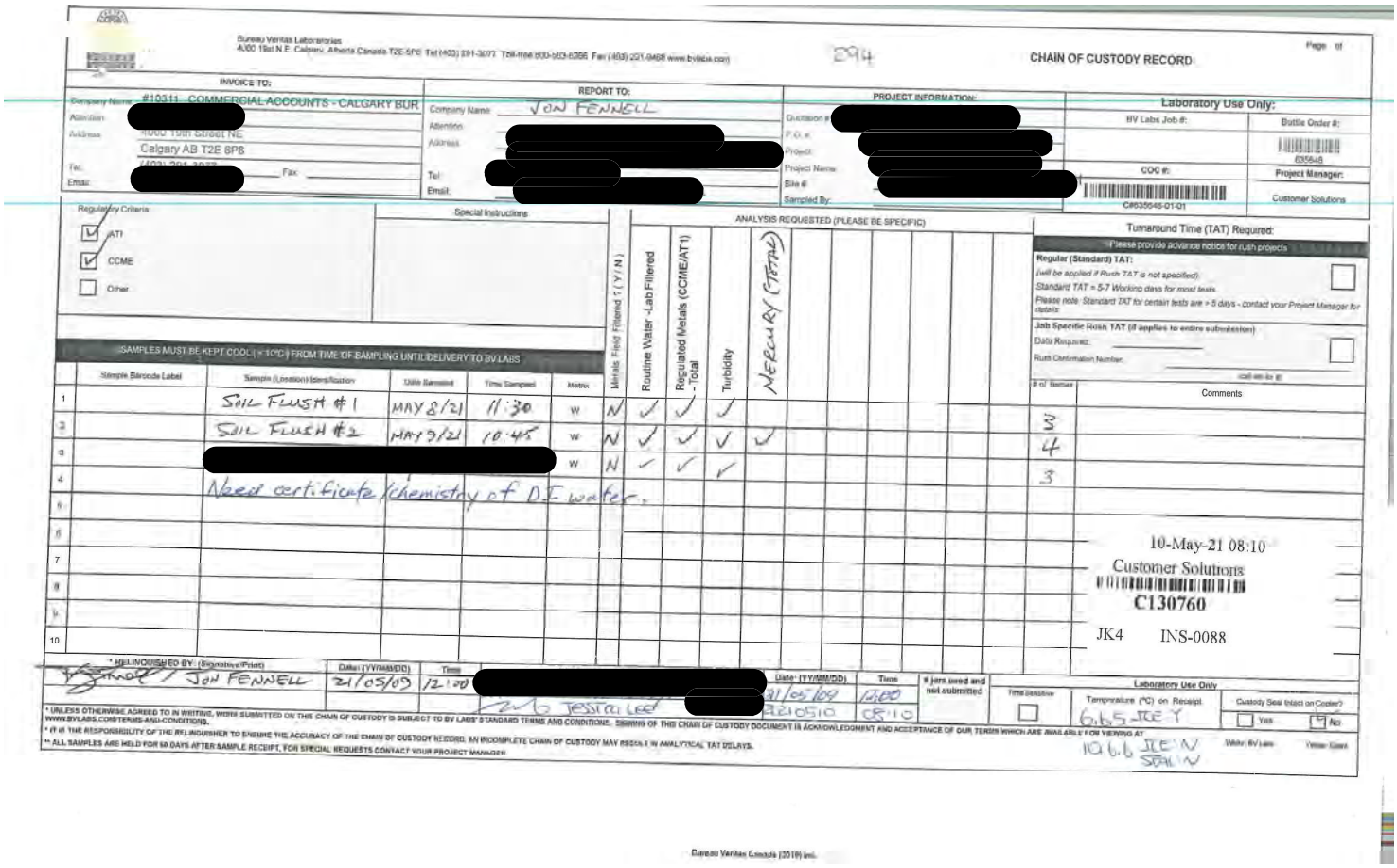


Bureau Veritas Laboratories
4000 19st N.E. Calgary, Alberta Canada T2E 6P8 Tel (403) 291-3077 Toll-free 800-563-6266 Fax (403) 291-9468 www.bvlabs.com

E94

CHAIN OF CUSTODY RECORD

Page 1 of

INVOICE TO:
Company Name: #10311 - COMMERCIAL ACCOUNTS - CALGARY BUR
Attention: [redacted]
Address: 4000 19th Street NE
Calgary AB T2E 6P8
Tel: [redacted] Fax:
Email: [redacted]

REPORT TO:
Company Name: JON FENNELL
Attention: [redacted]
Address: [redacted]
Tel: [redacted]
Email: [redacted]

PROJECT INFORMATION:
Quotation #: [redacted]
P.O. #:
Project:
Project Name:
Site #:
Sampled By:

Laboratory Use Only:
BV Labs Job #:
Bottle Order #: 635648
COC #: C#635648-01-01
Project Manager:
Customer Solutions

Regulatory Criteria:
☑ AT
☑ CCME
☐ Other

Special Instructions

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y / N)	Routine Water -Lab Filtered	Regulated Metals (CCME/AT1) -Total	Turbidity	MERCURY (TOTAL)	# of Bottles	Comments
1		SOIL FLUSH #1	MAY 8/21	11:30	W	N	✓	✓	✓		2	
2		SOIL FLUSH #2	MAY 9/21	10:45	W	N	✓	✓	✓	✓	4	
3	[redacted]				W	N	✓	✓	✓		3	
4		Need certificate/chemistry of DI water.										
5												
6												
7												
8												
9												
10												

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT:
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required:
Rush Confirmation Number:
(call lab for #)

10-May-21 08:10
Customer Solutions
C130760
JK4 INS-0088

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	Received by: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Time Sensitive	Laboratory Use Only: Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
JON FENNELL	21/05/09	12:00	[redacted] TESSA LEE	21/05/10	08:10		☐	6.6 JCE Y SOM N	☐ Yes ☑ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.
** ALL SAMPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT. FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER.

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Johnson Kwan
32 Horseshoe Crescent
Cochrane, AB
June 13, 2021

Rocky View County Council
Letter of Concern – Burnco West Cochrane Gravel Pit Expansion (Bylaw 8073-2020)

Dear Rocky View County Council :

Thank you for your time in reviewing our letter submission. Our family is located ± 1.6 km from the proposed gravel pit development, at the eastern border of Rocky View County.

We have three major concerns about this application and included our recommendations for each of the concern for Council's consideration.

1) **Scale and Direction of Expansion:** The proposed gravel pit is over 1,116 acres in size, which is far greater than all of the gravel pits in the area combined (Hillstone: 163 acres; Lafarge Hughes: 160 acres; Summit: 323 acres). We question the necessity and the scale of such excessive expansion given that there are multiple gravel pit operations already approved in this area.

   In addition to the scale of the proposed development, we are also concerned about the direction of the proposed gravel pit expansion. Heavy industrial development of this scale is incompatible with residential development and should be locate away from existing residences to minimize their adverse impact.

   Instead of encroaching the existing residences to the east, the proposed expansion would be more appropriate towards the west where the existing Wildcat Hills gas plant is located.

   Recommendation: We respectfully recommend Council to amend the MSDP and the associated land use redesignation application to reduce the scope of the expansion by excluding the proposed gravel pit operation east of Grande Valley Creek towards the existing residential areas (See Figure 1 – Phasing Plan from the proposed MSDP – Areas E22-24, F25-27, G28-31, and H30).

   The remaining expansion areas toward the west is still significant in size (± 600 acres including Areas A1-6, B8-11, C12-15, and D16-21), and would allow the operation to continue for years to come.

Figure 1 - Phasing Plan from proposed MSDP

2) **Traffic Impact:** According to the MSDP, the proposed expansion represents an increase of four times the volumes currently being shipped from the site as it ramps up to full production. The haul route will remain unchanged from Range Road 51 to Highway 1A.

Given that Highway 1A is the only haul route towards the targeted market (Calgary and Cochrane area), it is surprising that the Traffic Impact Assessment (TIA) submitted for this application did not investigate any offsite impacts along Highway 1A and the associated intersections (e.g., Horse Creek Road, Heritage Gate, and Highway 22 intersections).

Based on our firsthand experience, traffic often back up from the Highway 1A & 22 intersection to Heritage Gate during rush hours (± 1.3 km) and sometimes all the way to Horse Creek Road during the weekends (± 2 km).

Recommendation: We respectfully recommend Council to amend the MSDP (Section 3.9) to include a policy that requires an updated Traffic Impact Assessment at future development permit stage. The updated TIA shall be prepared to the County and Alberta Transportation's satisfaction and should examine the offsite impact along Highway 1A and the associated intersections for each phase of the expansion. The applicant/developer shall be responsible for any necessary upgrades, intersection improvements, and/or cost contribution for the improvements as identified by the TIA.

Figure 2 - Context Map (Highway 1A and associated intersections)

3) **Inadequate Landscaping and Screening:** As noted in the first section, heavy industrial development of this scale is incompatible with residential development. For this reason, we recommend Council to exclude the proposed expansion east of Grande Valley Creek, towards the existing residential areas.

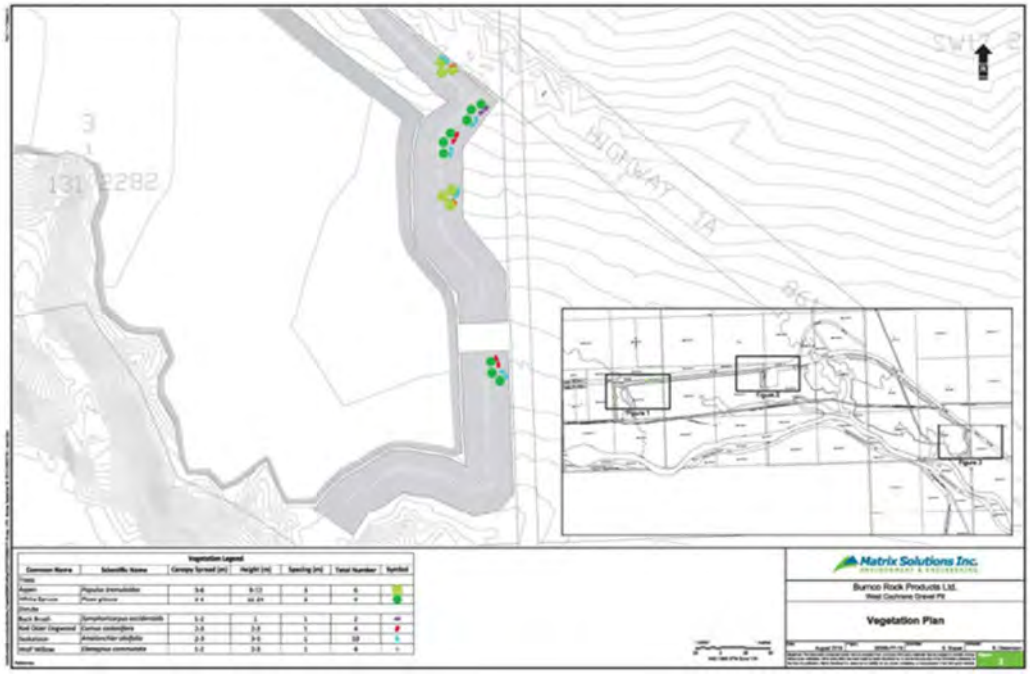
   If the application is able to proceed to its full extent, we recommend Council to require additional landscaping and site screening along the eastern portion of the site to mitigate the proposed gravel pit operation's adverse impacts (i.e., dust, noise, and visual impacts).

   Given the magnitude of the proposed expansion, the limited landscaping proposed by the applicant is inadequate to serve as a shelter belt to protect the existing residences (See Figure 3 – Proposed Landscaping & Site Screening).

   Recommendation: We respectfully recommend Council to amend the MSDP (Section 3.14 and Figure 39) to include the requirement for a treed shelter belt with additional landscaping and site screening along the eastern portion of the site.

   Sample policy wording as follows: 'the applicant/developer shall provide a treed shelter belt with additional landscaping and site screening along the eastern portion of the site and submit an updated Landscaping and Site Screening Plan at the development permit stage to the County's satisfaction.'

Figure 3 - Proposed Landscaping & Site Screening



Lastly, we would like to express our disappointment in the level of engagement conducted by the applicant given the magnitude of this application. There were only two open houses held for this proposal in the last three years – one in April 2018 before the majority of the residents moved into the area, and another in March 2020 when the COVID-19 pandemic first started. We did not receive any notification from the applicant in the last three years.

To conclude, we respectfully request Council to consider the three amendments suggested in this letter submission. The proposed amendments would enable a more responsible approach to resource development in proximity to the existing residential areas.

We sincerely thank you for taking the time to review our letter submission and taking our recommendations into consideration.

Sincerely,

Johnson Kwan

From: Joan Owen
To: Oksana Newmen
Subject: [EXTERNAL] - Application #PL20200066 - Burnco Rock Products Ltd.
Date: September 22, 2020 6:23:40 PM

Greetings,

Thank you for your Notice of Application referenced in application #PL202000066 and dated September 10, 2020.

Big Hill Creek Ranches Ltd. is an adjacent land owner, owning the property described as 25 acres +/- SW17-26-4-W5 in Rockyview County. As Highway 1A divides Section 17, we are in the position of having a small portion of land adjacent to the proposed S-NAT development by Burnco Rock Products Ltd.

It is our understanding that Burnco Rock Products Ltd. intends to build a 7 metre high berm that will run along the east boundary of the project and that this berm would be along/adjacent to the west boundary of our property described as 25 acres +/- SW17-26-4-W5. To the best of our understanding, we believe that this structure is required by various regulatory bodies for the development of an aggregate extraction site.

One question we have is: What would be the implications and subsequent results of having the berm begin south of our property at Section 7/8, thus excluding our property from the discussion? Is this a viable consideration? See page 6 of the Land Use Redesignation Application Master Site Development Plan.

It is our belief that good fences make good neighbours. To this end, we would ask that both the County of Rockyview, in its consideration of the application, and that Burnco Rock Products Ltd., in their development of berm, consider the impact of this structure on our property. We would request that Burnco Rock Products Ltd. be asked, by Rockyview County, to give due consideration to the effects of this berm on the use and enjoyment of our property, now and with any implications for future resale value. We would also ask that Burnco Rock Products Ltd. be held to account by Rockyview County to ensure that this berm, should it be built, is constructed in a thoughtful, intentional, purposeful, and neighbourly manner to maintain neighbourly relations between Big Hill Creek Ranches Ltd. and Burnco Rock Products Ltd., The David H. McDougall Ranch Ltd. and Tricycle Lane Ranches Ltd.

Thank you for the opportunity to provide input on this proposal by Burnco Rock Products Ltd. I can be contacted by return email or at 403.877.6441 should you have any questions or require further clarification of anything contained herein.

We look forward to hearing from you regarding the answer to our question.

Warm regards,
--
Joan Owen
Big Hill Creek Ranches Ltd.

APPLICATION PL20200066

Burnco Land Use Redesignation Application
West Cochrane Gravel Pit

ADJACENT LANDOWNER COMMENTS

Bertrand Levesque and Julie Simard

This letter states Bertrand Levesque and Julie Simard's opposition to Application PL20200066

September 30th 2020

This letter states Bertrand Levesque and Julie Simard's opposition to the Application PL20200066. Regardless of all mitigations plans proposed by Burnco, the financial impact to property value remains unaddressed.

We, as adjacent landowners, have great concerns regarding the Land Use Redesignation application to expand the extraction area of the West Cochrane gravel pit at NW 13-26-05 W5M.

Our property is a small 17 acres parcel immediately adjacent to the NW corner of the proposed expanded project; we are located on the north side of Highway 1A, uphill from the project area.
The area around our property is farm land, acreages, all in a beautiful landscape, with the Rockies as a back drop. The land surrounding the project - including the land under the project scope – is used for grazing cows and horses, as cultivated land or for country residences.

We are aware of the mitigation plans presented by Burnco regarding the following issues:

- Visual Impact
- Noise
- Air Quality
- Traffic increase
- Ground Water impact
- Wildlife corridor

The Burnco Plan is incomplete and offer poor re-assurances in the event of negative impacts to our water well, our health or the enjoyment of our property. There are no mechanism in place to ensure accountability, responsibility or enforcement.
For example, if our water well was impacted, we would have to bear the cost and weight of proving beyond a reasonable doubt that the impact is resulting from the gravel operation. This can be difficult.
The same could be said if we developed lungs issues from the dust.
Ultimately, the Burnco proposed mitigations will do nothing to change the fact that no one wishes to live next to an active gravel pit.

But our main area of concern is that Burnco does not address the impact of their operation on the market value of neighboring properties. The issue is not even acknowledged.
Why should we, as adjacent landowners, have to suffer significant financial losses in order for Burnco to expand and prosper? We firmly believe that Burnco should be made fully responsible and have full mitigation/resolution plans for each impact, including and most importantly, the financial impact to neighboring property values.

This financial impact is real and has been reported by numerous studies, both in Canada and USA. This is a topic that is continuously raised when applications are made to introduce or expand gravel operations close to residential areas.[1] [2] [3] [4]
When a new industrial operation is established, its immediate neighbors will see their property values drop. There is a strong relationship between the distance to the operation and the loss in value of a

[1] https://www.lanecounty.org/UserFiles/Servers/Server_3585797/File/Government/BCC/2016/2016_AGENDAS/101116agenda/PublicHearing/testimony%20BCC%20hearing_Part7.pdf
[2] http://www.killthealbionquarry.org/HOME-VALUES-PLUMMET-FROM-QUARRIES.html
[3] https://www.rockyviewgravelwatch.com/
[4] http://www.countynewsonline.ca/wp-content/uploads/2017/02/Bearspaw-Gravel-Quarries-Letter-to-MD.pdf

property: the smaller the distance, the greater the loss. The closest properties stand to lose as much as 25 to 39% of their value once a gravel project starts. [5] [6]

[7]

This impact can be observed as soon as the project is known publicly, and will be more severe as the project becomes tangible and expand. This impact might be reverted if the land is properly reclaimed, but this is beyond our lifespan and cannot be used to justify approval to this project.

Who would want to spend top dollars to buy a nice house located 100 yards away from a noisy, ugly, busy 7/24 industrial gravel pit? Would you?

This project would undeniably make our property extremely hard to sell and leave us with a huge financial loss in the event of a sale.

We are therefore in opposition to application PL20200066.

Sincerely,
Bertrand Levesque & Julie Simard

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[5] Hite, D. 2006.Summary Analysis: Impact of operation gravel pit on house values, Delaware County, Ohio. Dept. Agricultural Economics and Rural Sociology, Auburn University, May.
[6] http://www.lansink.ca/downloads/Lansink's%20Case%20Study%20Pit%20or%20Quarry%20Jan%202014.pdf
[7] Hite, D. 2006.Summary Analysis: Impact of operation gravel pit on house values, Delaware County, Ohio. Dept. Agricultural Economics and Rural Sociology, Auburn University, May. Graph borrowed from http://www.countynewsonline.ca/wp-content/uploads/2017/02/Bearspaw-Gravel-Quarries-Letter-to-MD.pdf

Response to Application Number PL20200066

Burnco Land Use Redesignation Application

West Cochrane Gravel Pit

McKendrick Ranches Ltd. (MRL) and McNabb Lands

Abstract

The report states MRL and McNabb's opposition to Application Number PL20200066.

September 30, 2020

Application Number: PL20200066 MRL and McNabb Comments

Table of Contents

1 Executive Summary

BURNCO Rock Products Ltd. (BURNCO) currently operates a gravel pit at NW 13-26-05 W5M located northwest of the Town of Cochrane, Alberta. BURNCO has applied for a Land Use amendment Application Number PL20200066 (the Burnco Application) the purpose of which is to increase the permitted area of aggregate resource extraction to further the expansion of the gravel mining and processing and to secure the long-term future of the existing mine. McKendrick Ranches Ltd. ("MRL") provides the following positions regarding the BURNCO application as currently proposed.

If approved, this Land Use and subsequent mine expansion would create 452 hectares (1,117 acres) of contiguous lands zoned as NRI for a gravel mining and aggregate processing expansion. BURNCO's intention is to secure long-term investment in the mine and then amend the existing Development Permit (DP # PRDP20175123) and Provincial Code of Practice Registration (Registration # 254757-00-00) for NW 13-26-05 W5M to include all the lands subject to this Land Use Amendment. This would create a gravel pit development which BURNCO plans to operate for the long term and will have lasting impacts upon neighbors, the Town of Cochrane, Rocky View County and MRL. **Appendix A** illustrates the MRL and McNabb lands impacted.

Responsible Planning of a mine facility and employment base of such a scale should predicate the development of an Area Structure Plan firstly to fully consider the long-term nature of planning and development opportunities and constraints of the mine on its neighbour's future planning. It is important that the County undertake a comprehensive planning exercise for Highway 1A prior to approving a Land Use that has such a major impact on neighbouring lands. Moreover, any adverse impacts that may be experienced on neighbouring properties due to the nature and scale of the mine should be mitigated within the boundaries of the applicant's lands and not impose those restrictions on its neighbours. This could include moving the berm and active face of the mine further away from the neighbouring properties and moving the crushing and washing operations to a location which would not impact the neighbouring properties.

Staging of Aggregate Mining and Processing Facilities is a common best practice in AB. Land Use for the application area as proposed is premature without operational performance assessment targets being set by Rocky View County and Alberta Environment from which assurances to Rocky View, Cochrane and neighbors will be met prior to subsequent Land Use approvals and further operational permit expansions. Without those guarantees to the community the Land Use application as proposed is premature.

Scale of Mine is largely unprecedented in Rocky View County. Burnco's Indus pit is approximately the same size; however, there is no record of an MSDP for this pit on Rocky View County's website. This should constitute requirements for higher levels of Land Use approval assessment, community consultation, neighboring owners Land Use policy and planning considerations to mitigate impacts.

A comprehensively prepared and approved gravel strategy adopted by Rocky View County is also a must and, like other Counties in Alberta, is a best practice to avoid ad hoc mining approvals and subsequent appeals.

McKendrick Ranches respects the right of an owner such as the Applicant to pursue highest and best uses for their property; however, given the scale and long term nature of the Application, it must be conducted with forethought and on good Land Use planning practices with a responsibility not to negatively impact neighbors and the community from pursuing the enjoyment and economic advancement of their interests as well.

2 Responsible Planning

2.1 Win-Win-Win

BURNCO's sustained mining and processing ability is a win for Burnco. Rocky View County wins by additional revenues generated form the mine to further advance towards Rocky View County's goal of 35% nonresidential taxes base. Making an effort to properly plan the Hwy 1A Corridor area and engaging residents in that planning exercise allows both Rocky View County and the residents to not lose on additional opportunities available within this corridor and also to thoroughly evaluate the benefits of development planning on their lands as well as to mitigate mining impacts. An Area Structure Plan developed along the Highway 1A corridor will allow for Rocky View County, the applicant and the residents to understand the full potential of this area and to determine strategies that will allow for the development of resource extraction in concert with the development potential of this locale.

In February 2019, McNabb presented a strategy for the development of Section 8 which is located between the Town of Cochrane and the proposed gravel pit to the Rocky View County Governance and Priorities Committee (GPC). GPC supported recognition of commercial and residential growth pressure in this area for consideration of upcoming updates to the County Plan as shown in **Appendix B.**

McNabb has also discussed this plan with the Town of Cochrane.

2.2 Planning Required Prior to Approval of Application

- **Prepare Hwy 1A ASP:** Planning of corridor can take place in a fully considered format versus spot zoning of 1,200 acres of mining and processing operations.
- **Regional Significance**: Plan should be circulated to CMRB.
- **Restrictions on Adjacent Landowner Uses**: Rezoning the entire area as NRI restricts neighbouring development for decades and potentially for the next century or longer due to setback requirements from extraction mines. Any restrictions on development within the MRL lands such as additional setbacks due to adverse effects from the extraction operation should be accommodated within the property of the applicant and not within the MRL property.

In particular, the Burnco Report indicates that exceedances of Alberta Ambient Air Quality Objectives will occur for fine particulate matter and for total suspended particles for a distance of 100 metres outside the boundaries of the site. It is requested that Land Use not be granted on those lands that will affect the adjacent landowners until such time as Burnco can demonstrate that its operations will not have any adverse effect on neighbouring lands and that no additional setbacks will be required on the MRL property as a result of the Burnco operations.

2.3 Contradiction of RVC Land Use Framework

The Application contradicts RVC's Land Use Framework:

1. ***Land Use Framework Strategy, which encourages conservation, land stewardship, healthy ecosystems, and the efficient use of land.***
   Zoning for long term use of 1,200 acres of gravel mining operations plus requiring setbacks from future uses is not efficient use of land and contributes to sprawling development patterns.

2. ***Provide for a safe, secure, and reliable drinking water supply*.**
   Protection of neighbouring groundwater sources is important. Operational practices for de-watering is known to affect adjacent landowner wells.

3. ***Retain rural landscapes, dark skies, open vistas, and agriculture lands.***
   The 1,200 acres of gravel mine operations does not support any of these policies.

4. ***Development shall be planned, designed, and constructed to protect alluvial aquifers.***
   Dewatering operations required to support the mine do not protect Alluvial Aquifers. MRL has many springs and wells that are difficult to monitor and protect.

5. ***Avoid Development of Wetlands and Riparian Areas***
   Protection of Bow River watershed and aquifer, for which the Land Use is adjacent, may place downstream communities' water at risk. The Land Use change and economic viability is dependent on dewatering a complex aquifer. The complexity of the local hydrology and the impact of aggregate mining, contamination and use of water for washing gravel over the lifespan of the mine requires performance measures be met prior to future Land Use expansion.

2.4 Proposed MDP Amendment - Aggregate Extraction Section 2.6.1

The proposed MDP wording is:

2.6.1 Aggregate Extraction

a) Minimize the adverse impact of aggregate resource extraction on existing residents, adjacent Land Uses, and the environment.

The impact of the Burnco application should be minimized by requiring that all adverse impacts from the Burnco operation, including dust and noise should be retained within the boundaries of the Burnco lands.

b) Encourage collaboration between the County, the aggregate extraction industry, and impacted residents and landowners to develop mutually agreeable solutions that mitigate impacts of extraction activities.

At present, the collaboration between Burnco and MRL has not yet been apparent. Impacts of the extraction activities clearly impact MRL from a noise, dust and visual perspective. MRL should be allowed to pursue its objectives without undue interference from a neighbor. MRL concerns about de-watering and mining in the aquifer for the benefit of Burnco have been ignored.

c) Discourage residential development that may be impacted by future aggregate extraction when proposed outside of an adopted area structure plan.

The adoption of an Area Structure Plan in this area would serve to maximize the development potential in this corridor and determine the Land Uses that would be complementary to each other. Moreover, the adoption of an Area Structure Plan would provide some certainty as to the phasing of both the aggregate extraction and the adjacent development. This is one of the purposes of an ASP.

d) Where aggregate activities are located in proximity to an adjacent municipality, the County should co-operate with that jurisdiction to ensure co-ordination of major haul routes and mitigation of impacts on adjacent Land Uses

Major haul routes may become problematic without the construction of upgrades on Highway 1A and the intersection of Highway 22 and Highway 1A.

e) Consider co-locating other complimentary industrial uses adjacent to aggregate extraction sites

An Area Structure Plan would provide some direction as to which complementary uses could be located in proximity to the aggregate extraction site and determine the phasing of same.

Request:

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- **That the Burnco Application be circulated to CMRB.**
- **That all additional setback requirements due to noise, dust or other nuisances be accommodated within the Burnco property.**
- **Burnco be required to engage adjacent landowners directly impacted by dewatering.**

3 Staging of Aggregate Mine and Processing Facilities

3.1 Approval Based on Ten Year Timeframes

The current NRI Land Use for 151.21 acres was started in 2009 and **Appendix C** shows the original McDougall application. In 2012 a Development Permit was granted for phased development. See **Appendix D** for pictures of Burnco's existing sites in the area. Burnco continues to work on the first 20-30 acres phase with no mining below the aquifer water level. However, with dewatering practices there will be more aggregate available within the water aquifer which would slow the horizontal expansion need of the mine

Given this timing 20 acres has been in mining operations over about a 10-year period. This questions the need to obtain zoning of a mine requiring 1,200 acres at this time. It is premature to zone that much land for a future mine. Alternatively, a Land Use strategy to conduct mining in stages ensures that performance criteria is met and does not preclude other growth along the 1A corridor or Cochrane.

The initial Land Use should be considered on the east side of the Burnco property. This is the land that is closest to Section 8 near Cochrane. By approving a smaller Land Use footprint, the Applicant will be incentivized to work only the gravel deposits in that location, thereby removing the resource prior to the time when MRL is ready to develop, thus eliminating conflict,

The decisions made today for such a scale of mining operations maybe detrimental for the 1A Corridor area and the Bow River Watershed.

Request:

- **That Council grant Land Use for ten-year time frames for mining needs. The initial Land Use should be granted for the lands that are in closest proximity to Section 8 near Cochrane. Future mining needs would be accommodated through subsequent Land Use applications once the applicant demonstrates adherence to appropriate performance standards and reclamation requirements.**

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Rocky View County needs to have assurance that the Land Use approval of aggregate extraction will be followed up with performance measures once mining is taking place. This could be conducted by Council providing direction to administration to enable periodic review of the measures and required amendments to align with cumulative impact assessments evaluated at the time of Land Use approval. The performance measurements should be brought before Council on a regular basis, available to the public upon request and circulated to adjacent land owners. Should the applicant not meet the performance criteria, then the permit should be cancelled

Precedence and examples have been developed. Refer to Ponoka County Development Permit D-19-53 revised November 26, 2019.

3.3 Original Pit to New Proposal Comparison

Table 1 compares the 2009 proposed McDougall pit and the 2020 Burnco Cochrane West pit. The comparison shows a significant change in scope, practice, and impact. This illustrates how cumulative impacts must be assessed and monitored as operations change?

1. **Water:** Protect the aquifers and Bow River watershed for neighbors use and downstream communities. Water licensing requirements of Burnco.

2. **Environment and Tourism:** Bow River Valley natural scenery.

3. **Gravel Extraction Volume:** Council should consider business need case study by the applicant to support need for current and future proposed Land Use and mine extraction growth. The applicant (operating since 2016) and previous operator (since the original application in 2009) have been working on the 160-acre pit for the past 11+ years and is only partly completed, which at this pace would give the lifespan of this additional rezoning a project life of potentially 100 years.

Application Number: PL20200066 MRL and McNabb Comments

Table 1: Burnco West Cochrane Gravel Pit since 2009 Proposal

	McDougall Pit Proposal	2020 Burnco Pit MSDP
Land Use	Dutchik 2009-01 first draft approve 2011 17ac first phase Dutchik to operate pit	Burnco MSDP 2020-06-01
Land Use	10 years volume sold to-date?	30-35 years 400% increase 500,000 T/yr 28 tandem trucks per hour
Approved	2011 Public Hearing Reeve and Council approve except Area Councilor Paul McLean opposed	2020 fall Public Hearing?
Size	151.21 ac	New 994.4 ac plus 151.21 Total 1,145.61 ac plus, SE13 Bow R water site Maybe 1200 acres?
Mine	stay 1m above water	dewater McDougall pit dewater east and west pits
Phase	2011: one phase 17ac mine reclaim to start next phase	Phase 1 and 2 are permanent Several phases open East and West sites in parallel?
Develop Permit	July 12. 2012 Fig 1	
Appeal Board	Max Area 12 ha. Phase 1: 7ha Phase 2: 4.9ha SDAB change from Council approval	
Develop Permit	2012-DP-15078 Burnco now operator	
Process	crush, market gravel	crush, wash, market gravel Water pipeline from Bow River Access road to Bow River Potential for cement? Cochrane pit Potential for asphalt? Potential for other commercial?
Berm	few 100metres Not permanent	7-8 miles? Permanent
SADB	PRDBP20175123	
Appeal Board	Burnco appeal levy, hours	
After Mine	2009 proposed Agriculture Potential development?	Historically Burnco redevelops Greystone, others Not returned to agriculture Best invest value
Zoning Changes		potentially change zoning anytime based on economics with approval

Request:

- **That the applicant be requested to prepare a business case to support the aggregate extraction application which provides support for the 1200-acre extraction operation and the projected operating timeline of 30 – 35 years.**

3.4 Water Issues and Environment

The Land Use change proposed by Burnco takes the existing pit that was proposed to last 10 years (see **Appendix C**) and expands the area to include another 994.4 acres. This is the prime watershed area for all downstream communities' water supply: Cochrane, Calgary, Carseland and more. The new proposal 2020-06 shows a Master Site Development Plan that mines below the ground water. Currently the development permit is for mining a metre above the ground water. This requires Alberta Environment and Parks (AEP) approval and needs extensive consultation with adjacent landowners, downstream users and the Calgary Region. In particular MRL is concerned with the following:

- Water issue dispute resolution needs to be established to ensure the process does not drag out for quite some time
- Third Party water monitoring of adjacent MRL and McNabb wells and springs paid for by Burnco including a predefined frequency.

MRL was just notified Burnco applied to AEP to mine in the water aquifer for the current pit (McDougall 2011) during COVID-19. Burnco advised they put a public notice advertisement in Cochrane Times July 1, 2020 with a seven-day appeal period see **Appendix E.** Cochrane Times is circulated to Cochrane residences and no longer to MRL's rural Rocky View County mailbox.

Request:

- **That this application be held in abeyance by Council until such time as AEP has completed its review of the project.**
- **That the County determine a dispute resolution mechanism.**
- **That third-party water monitoring be established and paid for by the Applicant.**

3.5 Transportation

Transportation in the area is very challenging especially during peak times. Burnco proposes 400% increase to 500,000 T/yr and 28 tandem trucks per hour. At present, Alberta Transportation and the Town of Cochrane have indicated that development potential within the Town is limited due to capacity constraints imposed by the intersection of Highway 22 and Highway 1A. As this is likely a major haul route for Burnco, the capacity of this intersection should be examined to determine whether there is enough capacity to support the Burnco application. The timeline for the upgrade of this intersection should also be determined so that it aligns with the Applicant's proposal.

An upgrade of Highway 1A should also be requested to allow for the extra capacity required on the section of roadway adjacent to the applicant's proposal.

Request:

- **That Alberta Transportation be consulted regarding expansion of 1A highway and the upgrade of the intersection of Highway 22 and Highway 1A.**

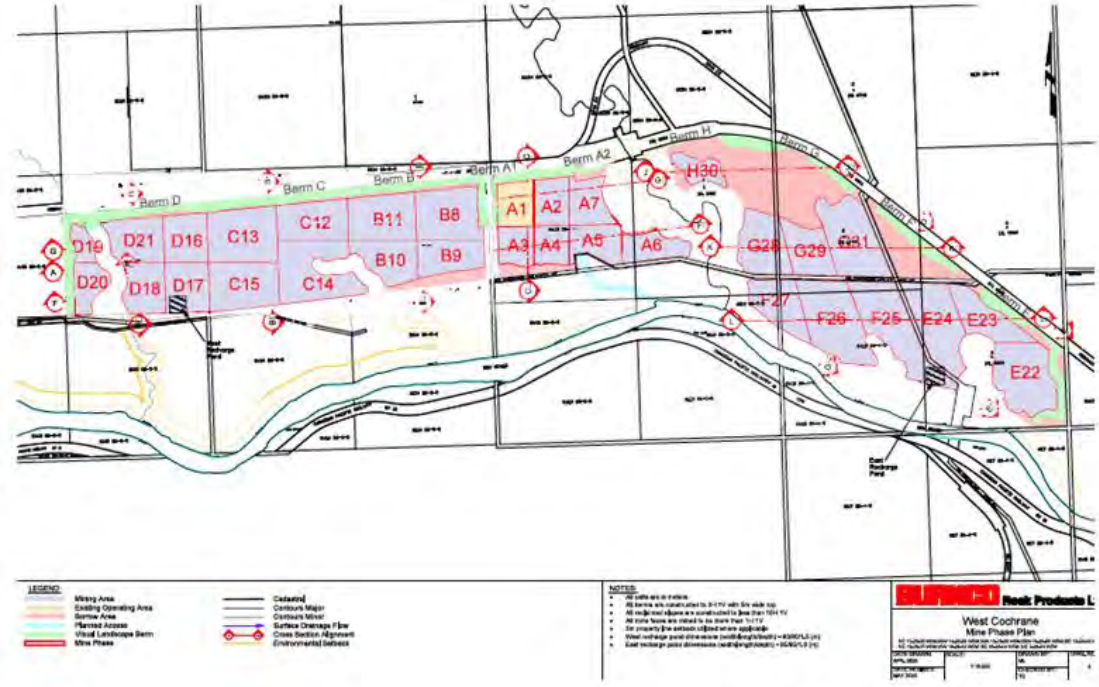
3.6 Larger Permanent Berm Buffer

A larger buffer between the gravel pit and Section 8 allows both parties to achieve their objectives with no conflicts. The current proposed berms require additional setback on MRL's Section 8 lands to provide a buffer for future development and from Highway 1A for future expansion. Increasing the buffer between the applicant's operation and the MRL property allows the Applicant to retain all potential harmful effects within its property. Additionally, it is anticipated that Highway 1A will likely need to be widened. The location of the berm on Burnco's property should be located to accommodate any potential widening required on the south side of the highway. In the long term it is anticipated that a berm will also be required on the north side, similar to Highway 8. The figures and pictures attached indicate the location and visual effect of the installation of berms along Highway 1A and adjacent to Section 8

Request:

- **Increase the setback to Permanent Berms from Section 8 and from Highway 1A.**

Figure 1: West Cochrane Mine Phase Plan from Burnco's Application Number PL20200066



3.6.1 Existing Berm

3.6.2 Gravel Piled Higher than Berms and Views Blocked

The following image illustrates that the gravel is piled higher than the berms and blocks views unless a multi-story building is built.

4 Scale of Mine

Gravel pits are being approved on an ad-hoc basis at various scales of operations in Rocky View County. A comprehensive gravel strategy with periodic reviews within Rocky View would provide clarity regarding the responsible planning of a larger areas of gravel aggregates and certainty for both the mining operators and the community impacted by the cumulative effects.

Below is a link to an example that could be referenced for another municipality that have done studies in order to provide information on where gravel developments are best suited as opposed to ad hoc development:

https://mdpeace.com/wp-content/uploads/2014/04/Gravel-Pit-Study.pdf

Request:

- **Complete a Comprehensive Gravel Strategy prior to Land Use approval.**

5 Conclusion

The application is in contradiction to RVC's planning documents and approving the Land Use change is a conflict with RVC's own planning documents.

Decisions today made by Rocky View Council today will impact trends, growth, environment, wildlife, water, resources, health, and economic factors for the foreseeable future.

What are the needs twenty years from now? Does Rocky View need more gravel pits now, ten years or twenty years? What infrastructure is needed for health and technology and are those compatible with gravel pits?

MRL recognizes the importance of business assessment for Rocky View taxes and the County success. MRL understands Burnco desire to profit, provide jobs and be a good corporate citizen by claims to monitor and perform; however, this should not be at the expense of MRL.

In summary MRL and McNabb have made the following requests:

- **That Rocky View County prepare an Area Structure Plan along the Highway 1A Corridor prior to considering the Burnco Application.**

- **That the Burnco Application be circulated to CMRB.**

- **That all additional setback requirements due to noise, dust or other nuisances within the Burnco property.**

- **Burnco be required to engage adjacent landowners directly impacted by dewatering.**

- **That Council grant Land Use for ten-year time frames for mining needs. The initial Land Use should be granted for the lands that are in closest proximity to Section 8 near Cochrane. Future mining needs would be accommodated through subsequent Land Use applications once the applicant demonstrates adherence to appropriate performance standards and reclamation requirements.**

- **That the applicant be requested to prepare a business case to support the aggregate extraction application which provides support for the 1200-acre extraction operation and the projected operating timeline of 30 – 35 years.**

- **That this application be held in abeyance by Council until such time as AEP has completed its review of the project.**

- **That the County determine a dispute resolution mechanism.**

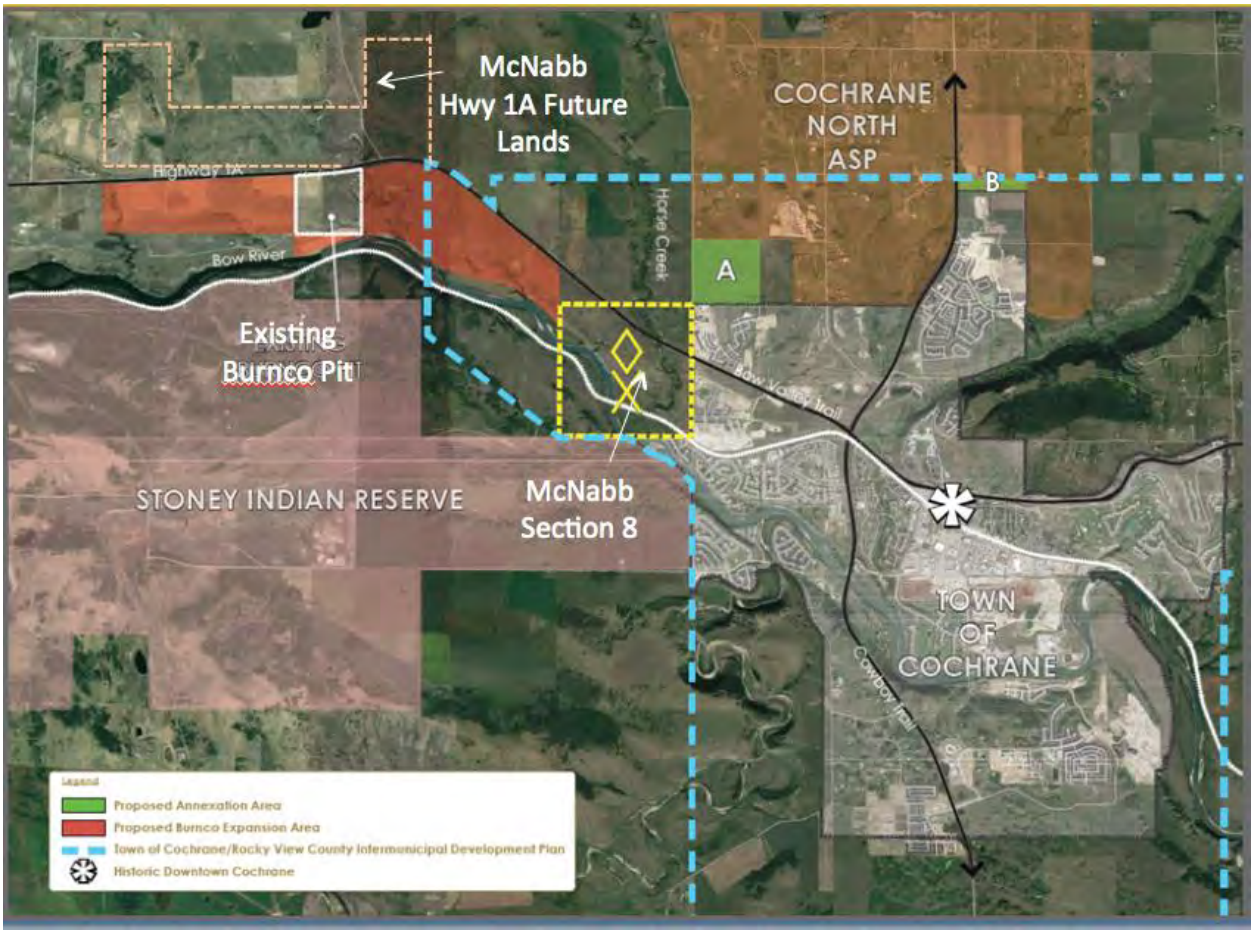
- **That third-party water monitoring be established and paid for by the Applicant.**

- **That Alberta Transportation be consulted regarding expansion of 1A highway and the upgrade of the intersection of Highway 22 and Highway 1A.**

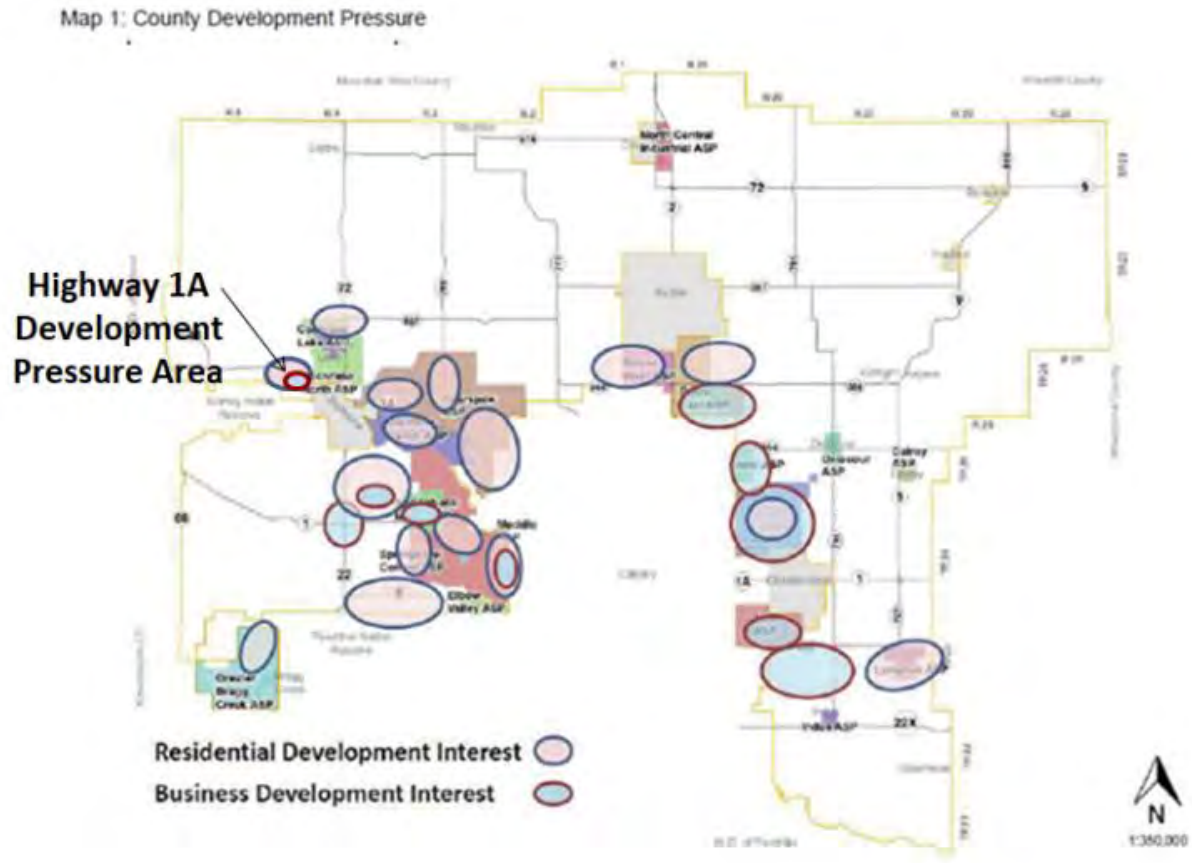
- **Increase the setback to Permanent Berms from Section 8 near Cochrane and from Highway 1A.**

- **Complete a Comprehensive Gravel Strategy prior to Land Use approval.**

Appendix A – Land Ownership Map



Appendix B – County Development Pressure Map



County Plan Growth & Servicing Strategy

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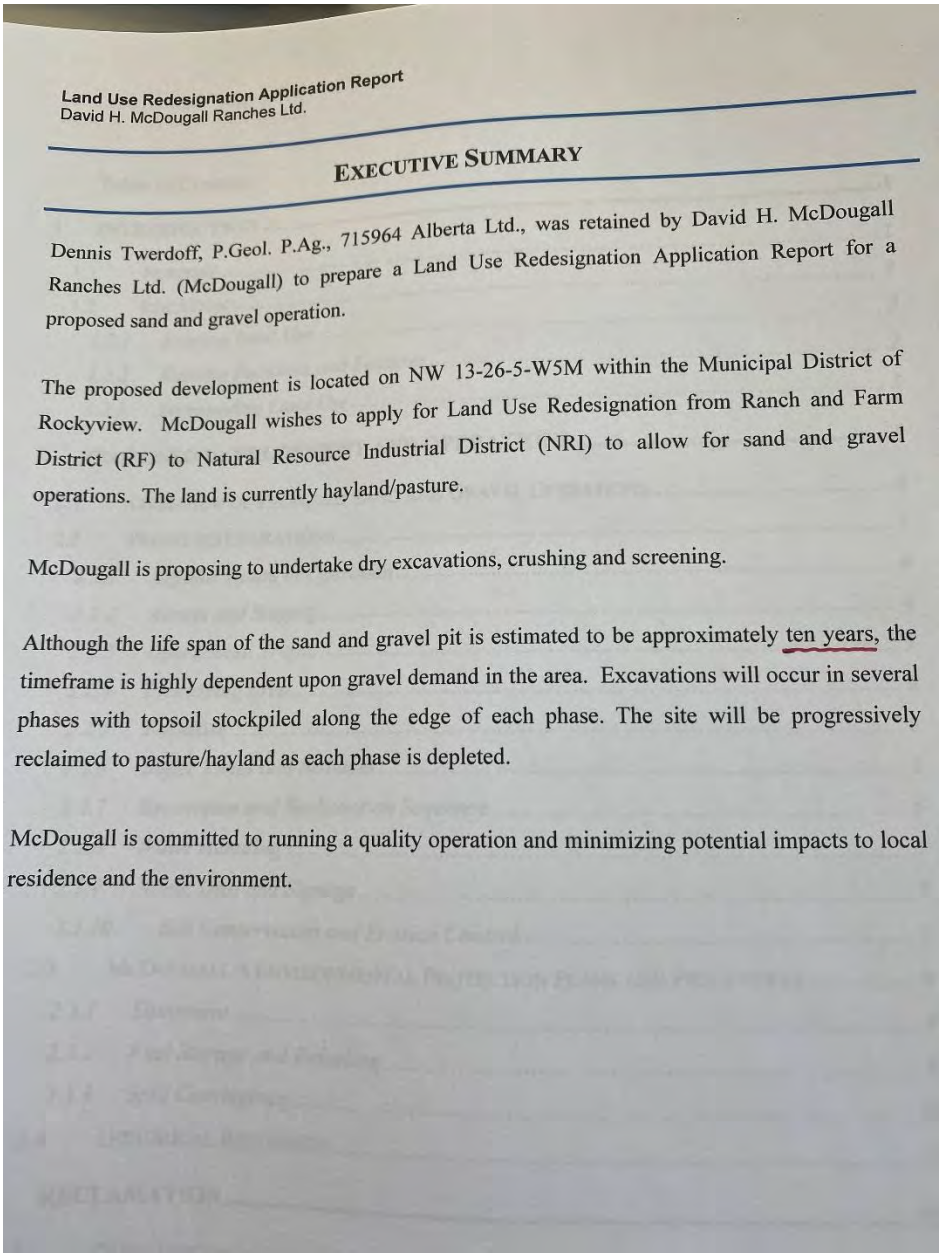
Appendix C – Original McDougall Land Use Application



Land Use Redesignation Application Report
David H. McDougall Ranches Ltd.

EXECUTIVE SUMMARY

Dennis Twerdoff, P.Geol. P.Ag., 715964 Alberta Ltd., was retained by David H. McDougall Ranches Ltd. (McDougall) to prepare a Land Use Redesignation Application Report for a proposed sand and gravel operation.

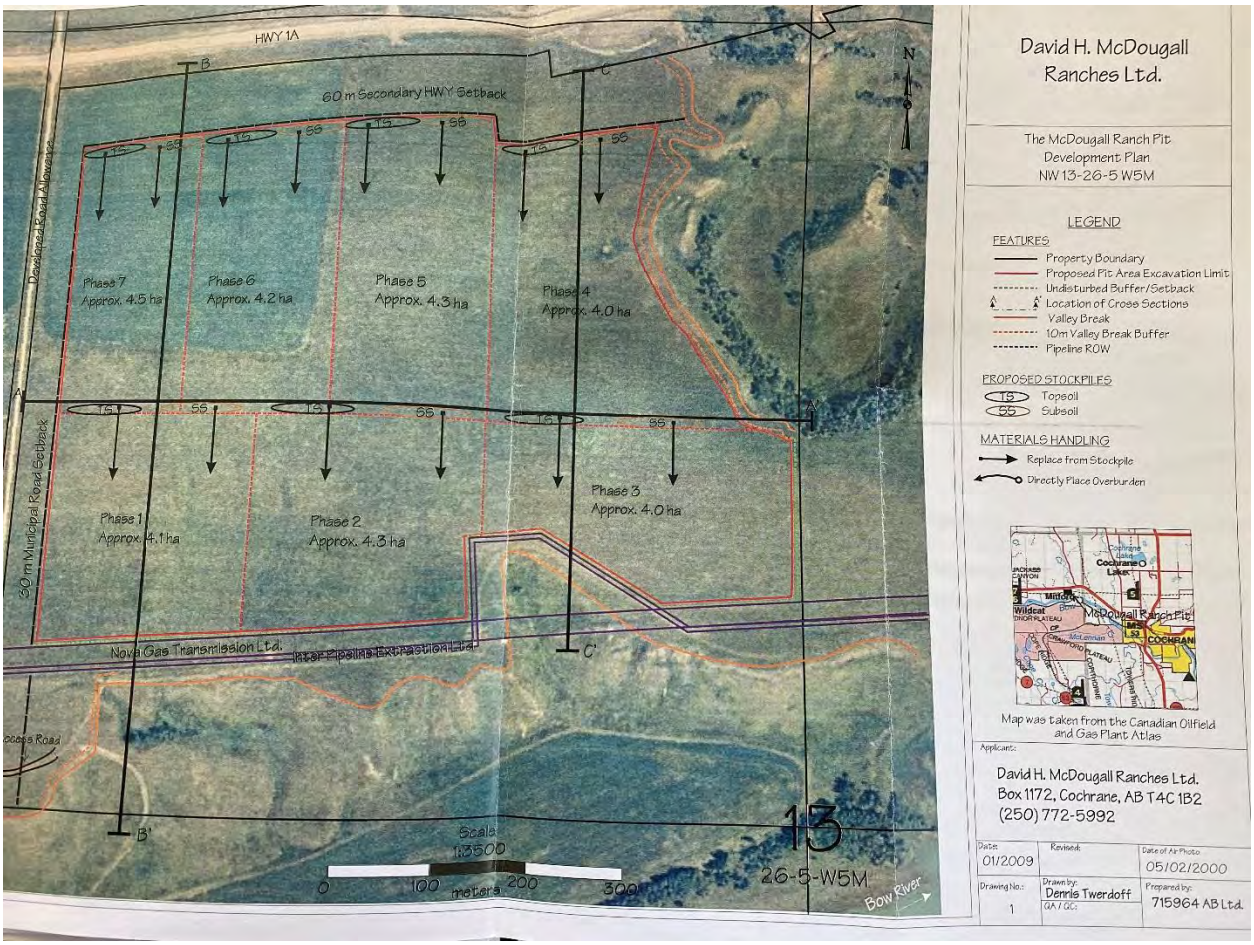
The proposed development is located on NW 13-26-5-W5M within the Municipal District of Rockyview. McDougall wishes to apply for Land Use Redesignation from Ranch and Farm District (RF) to Natural Resource Industrial District (NRI) to allow for sand and gravel operations. The land is currently hayland/pasture.

McDougall is proposing to undertake dry excavations, crushing and screening.

Although the life span of the sand and gravel pit is estimated to be approximately ten years, the timeframe is highly dependent upon gravel demand in the area. Excavations will occur in several phases with topsoil stockpiled along the edge of each phase. The site will be progressively reclaimed to pasture/hayland as each phase is depleted.

McDougall is committed to running a quality operation and minimizing potential impacts to local residence and the environment.

Application Number: PL20200066 MRL and McNabb Comments



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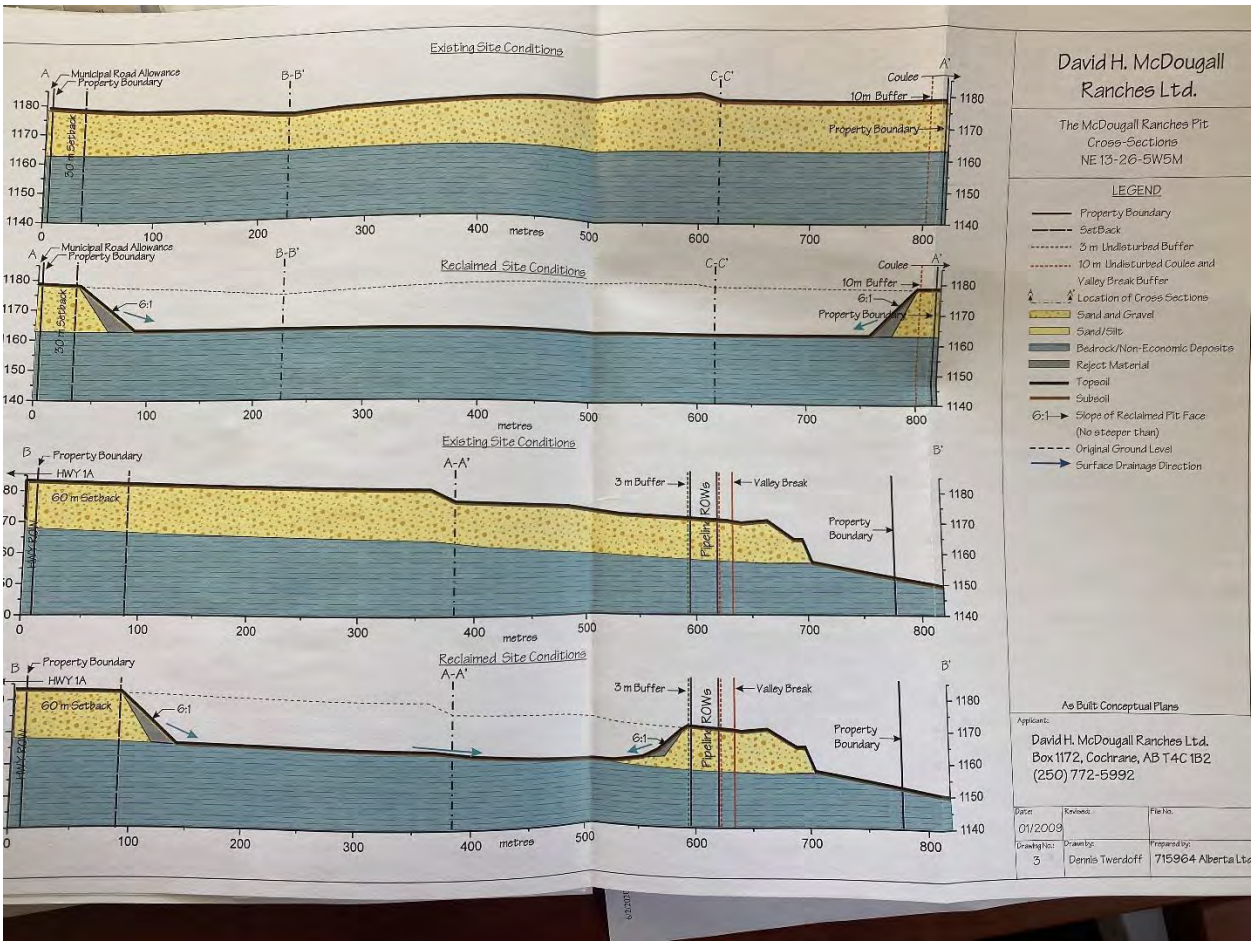

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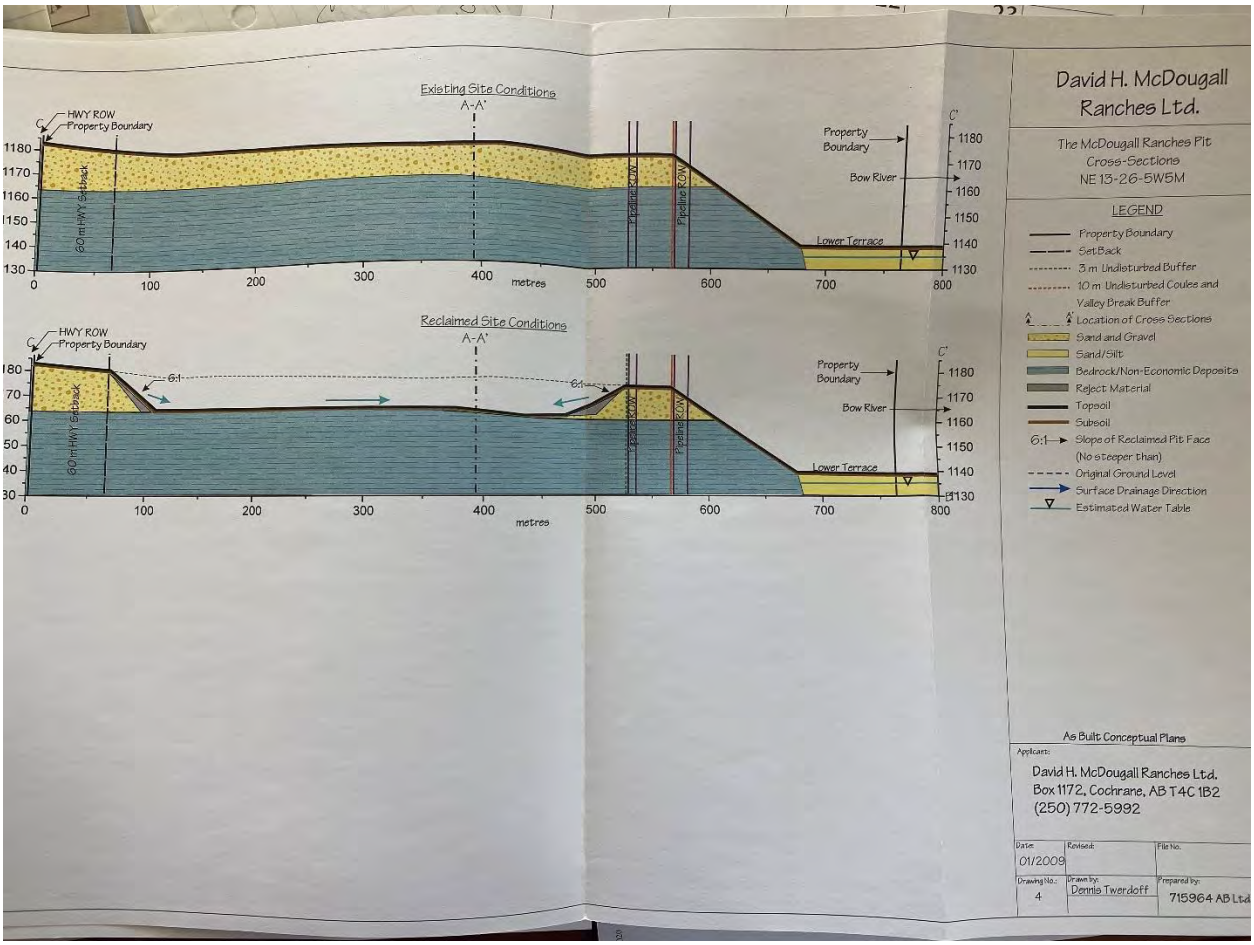

Appendix D – Pictures of Existing Burnco Operations

Gravel View

Night Operation is 24 hours/day Impacting Dark Skies, Neighbours, and Wildlife

Restored Greystone Site

Additional View of Restored Greystone Site

Additional Gravel View

Appendix E - Cochrane Times July 1, 2020 Public Notice Burnco Rock Products Water Act Notice of Decision

Part 9 of the Water Act provides the right to appeal this decision. Any person who is directly affected by this decision may submit a notice of appeal, within seven (7) days of the providing of this notice, to: Chair Environmental Appeals Board

Public Notices

PUBLIC NOTICE

BURNCO Rock Products Ltd.

WATER ACT

NOTICE OF DECISION

Notice is given that **BURNCO Rock Products Ltd.** has been issued an approval under the provisions of the *Water Act*, on June 8, 2020, to extract aggregate from below the water table of an existing sand and gravel site located at NW 13-026-05-W5M.

Further information may be obtained from:

Regulatory Assurance Division
Southern Region
2nd Floor, 2938 11 Street NE
Calgary, Alberta T2E 7L7
Telephone: 403-297-7605
Fax: 403-297-2749

Please quote file number: **00430788**

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Chair
Environmental Appeals Board
3rd Floor, Peace Trust Tower
10011 109 Street
Edmonton, Alberta T5J 3S8
Telephone: 780-427-6207
Fax: 780-427-4693
www.eab.gov.ab.ca/index.htm

For contact purposes, please include your name, phone number, address, land location, and a statement respecting how this decision will directly affect you or your water supply.

8. Opposition - Storms Cornish September 2020

Burnco Land Use Redesignation Application

West Cochrane Gravel Pit

Reginald Storms and Kathleen Cornish

The report states Storms and Cornish's opposition to Application Number PL20200066.

September 30, 2020

Application Number: PL20200066 Storms/Cornish Comments

BURNCO Rock Products Ltd. (BURNCO) currently operates a gravel pit at NW 13-26-05 W5M located northwest of the Town of Cochrane, Alberta. BURNCO has applied for a Land Use amendment Application Number PL20200066 (the Burnco Application) the purpose of which is to increase the permitted area of aggregate resource extraction to further the expansion of the gravel mining and processing and to secure the long-term future of the existing mine. Reginald Storms and Kathleen Cornish (Storms/Cornish), owners of neighbouring property located at NW 15 26 R5 W5M, Municipal address 262144 Range Rd 53, provide the following positions regarding the BURNCO application as currently proposed.

If approved, this Land Use and subsequent mine expansion would create 452 hectares (1,117 acres) of contiguous lands zoned as NRI for a gravel mining and aggregate processing expansion. BURNCO's intention is to secure long-term investment in the mine and then amend the existing Development Permit (DP # PRDP20175123) and Provincial Code of Practice Registration (Registration # 254757-00-00) for NW 13-26-05 W5M to include all the lands subject to this Land Use Amendment. This would create a gravel pit development which BURNCO plans to operate for the long term and will have lasting impacts upon neighbors, the Town of Cochrane, Rocky View County and Storms/Cornish.

Responsible Planning of a mine facility and employment base of such a scale should predicate the development of an Area Structure Plan firstly to fully consider the long-term nature of planning and development opportunities and constraints of the mine on its neighbour's future planning. It is important that the County undertake a comprehensive planning exercise for Highway 1A prior to approving a Land Use that has such a major impact on neighbouring lands. Moreover, any adverse impacts that may be experienced on neighbouring properties due to the nature and scale of the mine should be mitigated within the boundaries of the applicant's lands and not impose those restrictions on its neighbours. This could include moving the berm and active face of the mine further away from the neighbouring properties and moving the crushing and washing operations to a location which would not impact the neighbouring properties.

Staging of Aggregate Mining and Processing Facilities is a common best practice in AB. Land Use for the application area as proposed is premature without operational performance assessment targets being set by Rocky View County and Alberta Environment from which assurances to Rocky View, Cochrane and neighbors will be met prior to subsequent Land Use approvals and further operational permit expansions. Without those guarantees to the community the Land Use application as proposed is premature.

Scale of Mine is largely unprecedented in Rocky View County. Burnco's Indus pit is approximately the same size; however, there is no record of an MSDP for this pit on Rocky View County's website. This should constitute requirements for higher levels of Land Use approval assessment, community consultation, neighboring owners Land Use policy and planning considerations to mitigate impacts.

A comprehensively prepared and approved gravel strategy adopted by Rocky View County is also a must and, like other Counties in Alberta, is a best practice to avoid ad hoc mining approvals and subsequent appeals.

Storms/Cornish respect the right of an owner such as the Applicant to pursue highest and best uses for their property; however, given the scale and long term nature of the Application, it must be conducted with forethought and on good Land Use planning practices with a responsibility not to negatively impact neighbors and the community from pursuing the enjoyment and economic advancement of their interests as well.

BURNCO's sustained mining and processing ability is a win for Burnco. We assume that Rocky View County benefits financially from the project, and it would be useful to see what the financial benefits are compared with the costs that will be incurred by having such a large development with its environmental issues. Making an effort to properly plan the Hwy 1A Corridor area and engaging residents in that planning exercise allows both Rocky View County and the residents to not lose on additional opportunities available within this corridor and also to thoroughly evaluate the benefits of development planning on their lands as well as to mitigate mining impacts. An Area Structure Plan developed along the Highway 1A corridor will allow for Rocky View County, the applicant and the residents to understand the full potential of this area and to determine strategies that will allow for the development of resource extraction in concert with the development potential of this locale.

Planning Required Prior to Approval of Application

- **Prepare Hwy 1A ASP:** Planning of corridor can take place in a fully considered format versus spot zoning of 1,200 acres of mining and processing operations.
- **Regional Significance**: Plan should be circulated to CMRB.
- **Restrictions on Adjacent Landowner Uses**: Rezoning the entire area as NRI restricts potential use and enjoyment of neighbouring properties as well as affecting property values for agriculturally zoned properties for decades and potentially for the next century or longer.
  In particular, the Burnco Report indicates that exceedances of Alberta Ambient Air Quality Objectives will occur for fine particulate matter and for total suspended particles for a distance of 100 metres outside the boundaries of the site. It is requested that Land Use not be granted on those lands that will affect the adjacent landowners until such time as Burnco can demonstrate that its operations will not have any adverse effect on neighbouring lands and that no additional setbacks will be required on the Storms/Cornish property as a result of the Burnco operations.

Contradiction of RVC Land Use Framework

The Application contradicts RVC's Land Use Framework:

1. ***Land Use Framework Strategy, which encourages conservation, land stewardship, healthy ecosystems, and the efficient use of land.***
   Zoning for long term use of 1,200 acres of gravel mining operations plus requiring setbacks from future uses is not efficient use of land and contributes to sprawling development patterns.

2. ***Provide for a safe, secure, and reliable drinking water supply*.**
   Protection of neighbouring groundwater sources is important. Operational practices for de-watering is known to affect adjacent landowner wells.

3. ***Retain rural landscapes, dark skies, open vistas, and agriculture lands.***
   The 1,200 acres of gravel mine operations does not support any of these policies.

4. ***Development shall be planned, designed, and constructed to protect alluvial aquifers.***
   Dewatering operations required to support the mine do not protect Alluvial Aquifers.

5. ***Avoid Development of Wetlands and Riparian Areas***
   Protection of Bow River watershed and aquifer, for which the Land Use is adjacent, may place downstream communities' water at risk. The Land Use change and economic viability is dependent on dewatering a complex aquifer. The complexity of the local hydrology and the impact of aggregate mining, contamination and use of water for washing gravel over the lifespan of the mine requires performance measures be met prior to future Land Use expansion.

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b) Encourage collaboration between the County, the aggregate extraction industry, and impacted residents and landowners to develop mutually agreeable solutions that mitigate impacts of extraction activities.

At present, the collaboration between Burnco and at least one neighbouring landowner has not yet been apparent. Impacts of the extraction activities clearly impact this neighbouring landowner from a noise, dust and visual perspective. All neighbouring landowners should be allowed to pursue their objectives without undue interference from a neighbor. Concerns of neighbouring landowners about de-watering and mining in the aquifer for the benefit of Burnco have been ignored.

c) Discourage residential development that may be impacted by future aggregate extraction when proposed outside of an adopted area structure plan.

The adoption of an Area Structure Plan in this area would serve to maximize the development potential in this corridor and determine the Land Uses that would be complementary to each other. Moreover, the adoption of an Area Structure Plan would provide some certainty as to the phasing of both the aggregate extraction and the adjacent development. This is one of the purposes of an ASP.

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Application Number: PL20200066 Storms/Cornish Comments

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Size	151.21 ac	New 994.4 ac plus 151.21 Total 1,145.61 ac plus, SE13 Bow R water site Maybe 1200 acres?
Mine	stay 1m above water	dewater McDougall pit dewater east and west pits
Phase	2011: one phase 17ac mine reclaim to start next phase	Phase 1 and 2 are permanent Several phases open East and West sites in parallel?
Develop Permit	July 12. 2012 Fig 1	
Appeal Board	Max Area 12 ha. Phase 1: 7ha Phase 2: 4.9ha SDAB change from Council approval	
Develop Permit	2012-DP-15078 Burnco now operator	
Process	crush, market gravel	crush, wash, market gravel Water pipeline from Bow River Access road to Bow River Potential for cement? Cochrane pit Potential for asphalt? Potential for other commercial?
Berm	few 100metres Not permanent	7-8 miles? Permanent
SADB	PRDBP20175123	
Appeal Board	Burnco appeal levy, hours	
After Mine	2009 proposed Agriculture Potential development?	Historically Burnco redevelops Greystone, others Not returned to agriculture Best invest value

Zoning Changes		potentially change zoning anytime based on economics with approval

Request:

- **That the applicant be requested to prepare a business case to support the aggregate extraction application which provides support for the 1200-acre extraction operation and the projected operating timeline of 30 – 35 years.**

Water Issues and Environment

The Land Use change proposed by Burnco takes the existing pit that was proposed to last 10 years and expands the area to include another 994.4 acres. This is the prime watershed area for all downstream communities' water supply: Cochrane, Calgary, Carseland and more. The new proposal 2020-06 shows a Master Site Development Plan that mines below the ground water. Currently the development permit is for mining a metre above the ground water. This requires Alberta Environment and Parks (AEP) approval and needs extensive consultation with adjacent landowners, downstream users and the Calgary Region. In particular MRL is concerned with the following:

- Water issue dispute resolution needs to be established to ensure the process does not drag out for quite some time
- Third Party water monitoring of adjacent Storms/Cornish wells paid for by Burnco including a predefined frequency.

Storms/Cornish were just notified Burnco applied to AEP to mine in the water aquifer for the current pit (McDougall 2011) during COVID-19. Burnco advised they put a public notice advertisement in Cochrane Times July 1, 2020 with a seven-day appeal period see **Appendix E.** Cochrane Times is circulated to Cochrane residences and not to Storms/Cornish's rural Rocky View County mailbox.

Request:

- **That this application be held in abeyance by Council until such time as AEP has completed its review of the project.**
- **That the County determine a dispute resolution mechanism.**
- **That third-party water monitoring be established and paid for by the Applicant.**

Transportation

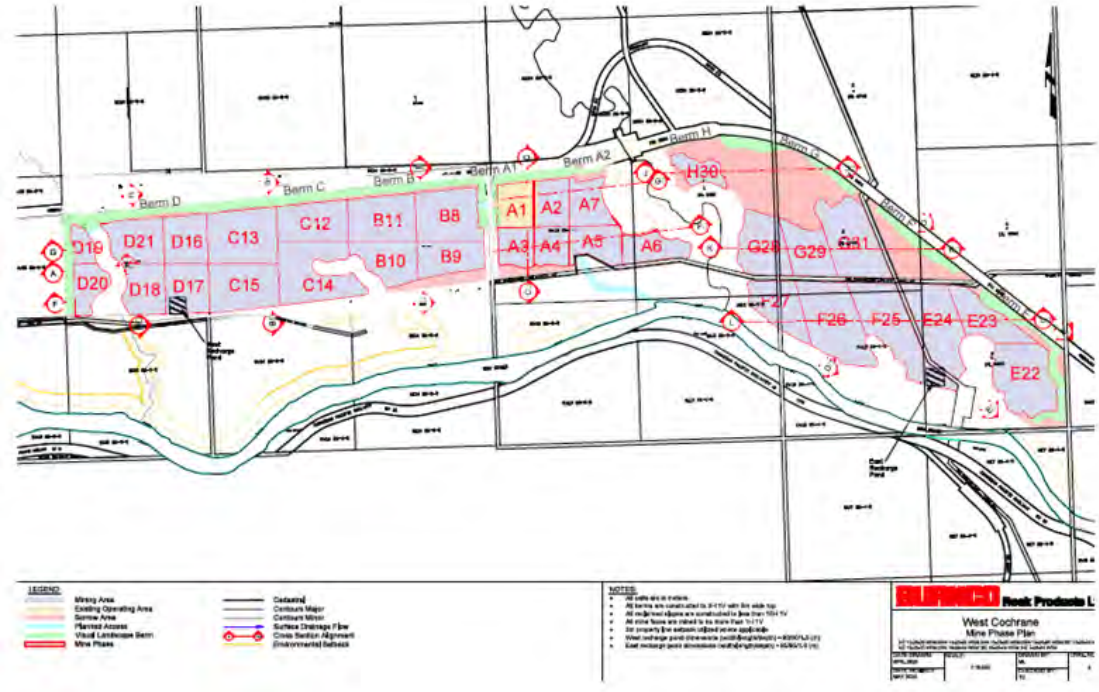
Transportation in the area is very challenging especially during peak times. Burnco proposes 400% increase to 500,000 T/yr and 28 tandem trucks per hour. At present, Alberta Transportation and the Town of Cochrane have indicated that development potential within the Town is limited due to capacity constraints imposed by the intersection of Highway 22 and Highway 1A. As this is likely a major haul route for Burnco, the capacity of this intersection should be examined to determine whether there is enough capacity to support the Burnco application. The timeline for the upgrade of this intersection should also be determined so that it aligns with the Applicant's proposal.

An upgrade of Highway 1A should also be requested to allow for the extra capacity required on the section of roadway adjacent to the applicant's proposal.

Request:

- **That Alberta Transportation be consulted regarding expansion of 1A highway and the upgrade of the intersection of Highway 22 and Highway 1A.**

Figure 1: West Cochrane Mine Phase Plan from Burnco's Application Number PL20200066



Scale of Mine

Gravel pits are being approved on an ad-hoc basis at various scales of operations in Rocky View County. A comprehensive gravel strategy with periodic reviews within Rocky View would provide clarity regarding the responsible planning of a larger areas of gravel aggregates and certainty for both the mining operators and the community impacted by the cumulative effects.

Below is a link to an example that could be referenced for another municipality that have done studies in order to provide information on where gravel developments are best suited as opposed to ad hoc development:

https://mdpeace.com/wp-content/uploads/2014/04/Gravel-Pit-Study.pdf

Request:

- **Complete a Comprehensive Gravel Strategy prior to Land Use approval.**

Conclusion

The application is in contradiction to RVC's planning documents and approving the Land Use change is a conflict with RVC's own planning documents.

Decisions today made by Rocky View Council today will impact trends, growth, environment, wildlife, water, resources, health, and economic factors for the foreseeable future.

What are the needs twenty years from now? Does Rocky View need more gravel pits now, ten years or twenty years? What infrastructure is needed for health and technology and are those compatible with gravel pits?

Storms/Cornish recognize the importance of business assessment for Rocky View taxes and the County success. Storms/Cornish understand Burnco desire to profit, provide jobs and be a good corporate citizen by claims to monitor and perform; however, this should not be at the expense of Storms/Cornish.

In summary Storms/Cornish have made the following requests:

- **That Rocky View County prepare an Area Structure Plan along the Highway 1A Corridor prior to considering the Burnco Application.**

- **That the Burnco Application be circulated to CMRB.**

- **That all additional setback requirements due to noise, dust or other nuisances within the Burnco property.**

- **Burnco be required to engage adjacent landowners impacted by dewatering.**

- **That Council grant Land Use for ten-year time frames for mining needs. The initial Land Use should be granted for the lands that are in closest proximity to Section 8 near Cochrane. Future mining needs would be accommodated through subsequent Land Use applications once the applicant demonstrates adherence to appropriate performance standards and reclamation requirements.**

- **That the applicant be requested to prepare a business case to support the aggregate extraction application which provides support for the 1200-acre extraction operation and the projected operating timeline of 30 – 35 years.**

- **That this application be held in abeyance by Council until such time as AEP has completed its review of the project.**

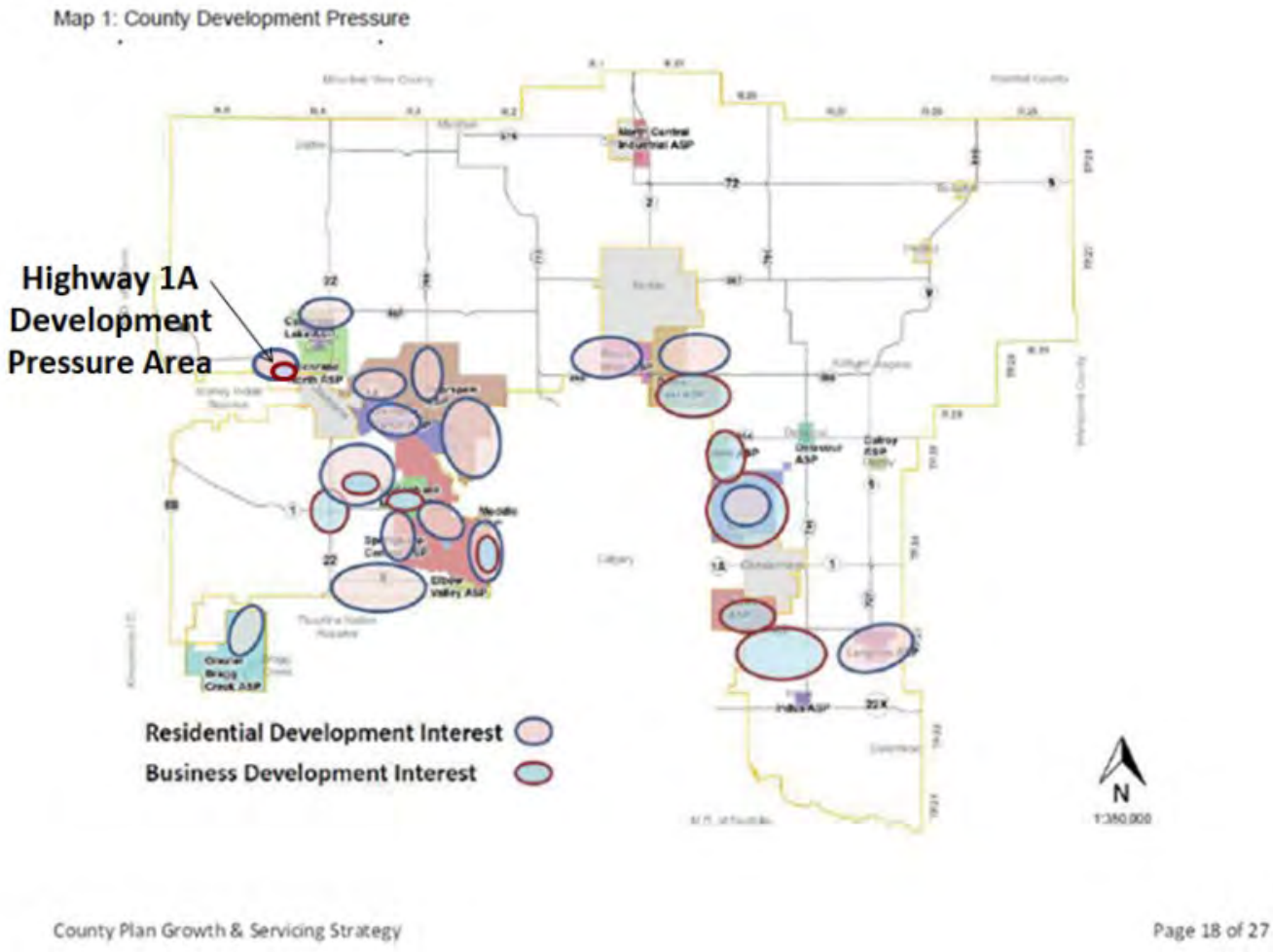
- **That the County determine a dispute resolution mechanism.**

- **That third-party water monitoring be established and paid for by the Applicant.**

- **That Alberta Transportation be consulted regarding expansion of 1A highway and the upgrade of the intersection of Highway 22 and Highway 1A.**

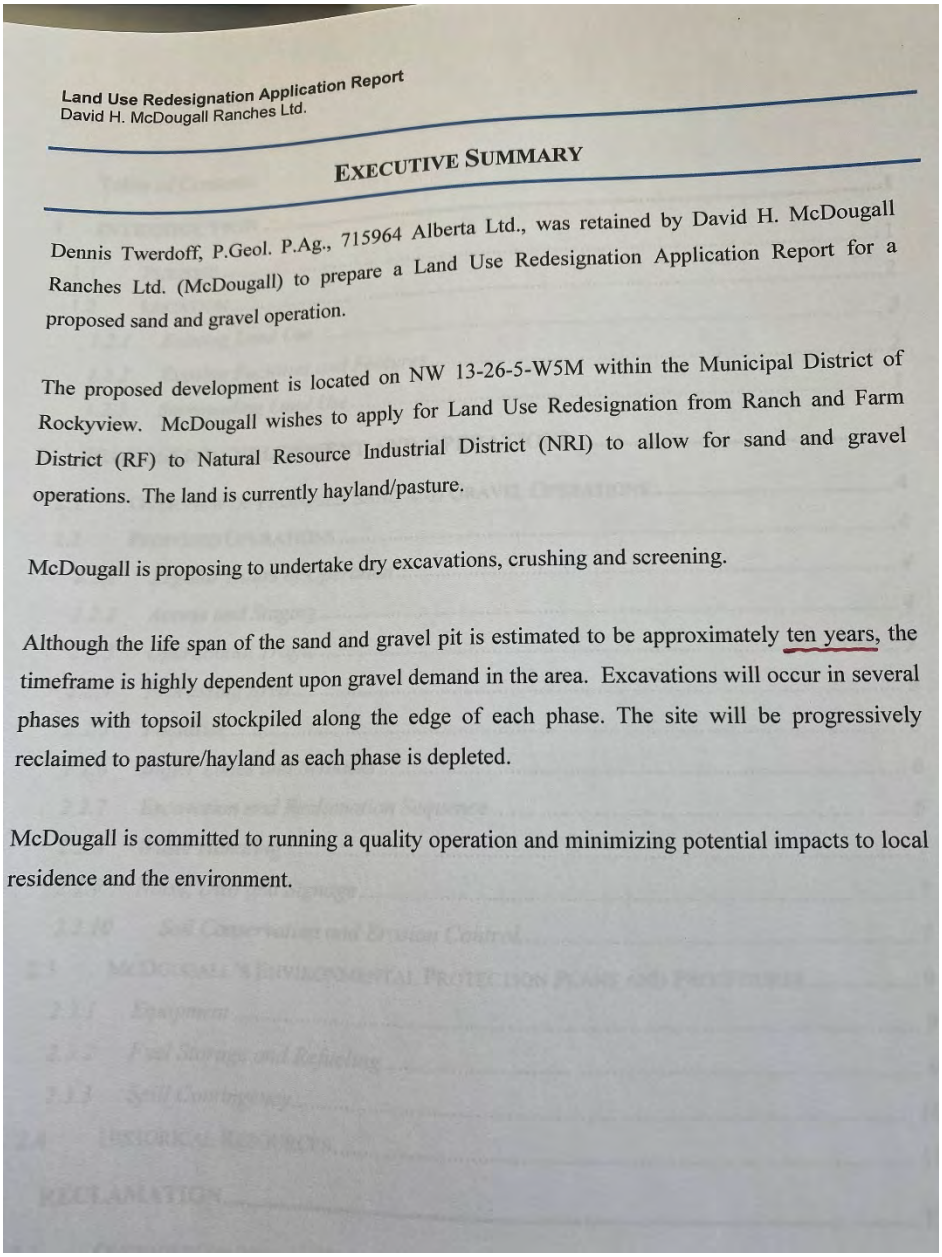
- **Complete a Comprehensive Gravel Strategy prior to Land Use approval.**

Appendix A – County Development Pressure Map



Application Number: PL20200066 Storms/Cornish Comments

Appendix B – Original McDougall Land Use Application



Land Use Redesignation Application Report
David H. McDougall Ranches Ltd.

EXECUTIVE SUMMARY

Dennis Twerdoff, P.Geol. P.Ag., 715964 Alberta Ltd., was retained by David H. McDougall Ranches Ltd. (McDougall) to prepare a Land Use Redesignation Application Report for a proposed sand and gravel operation.

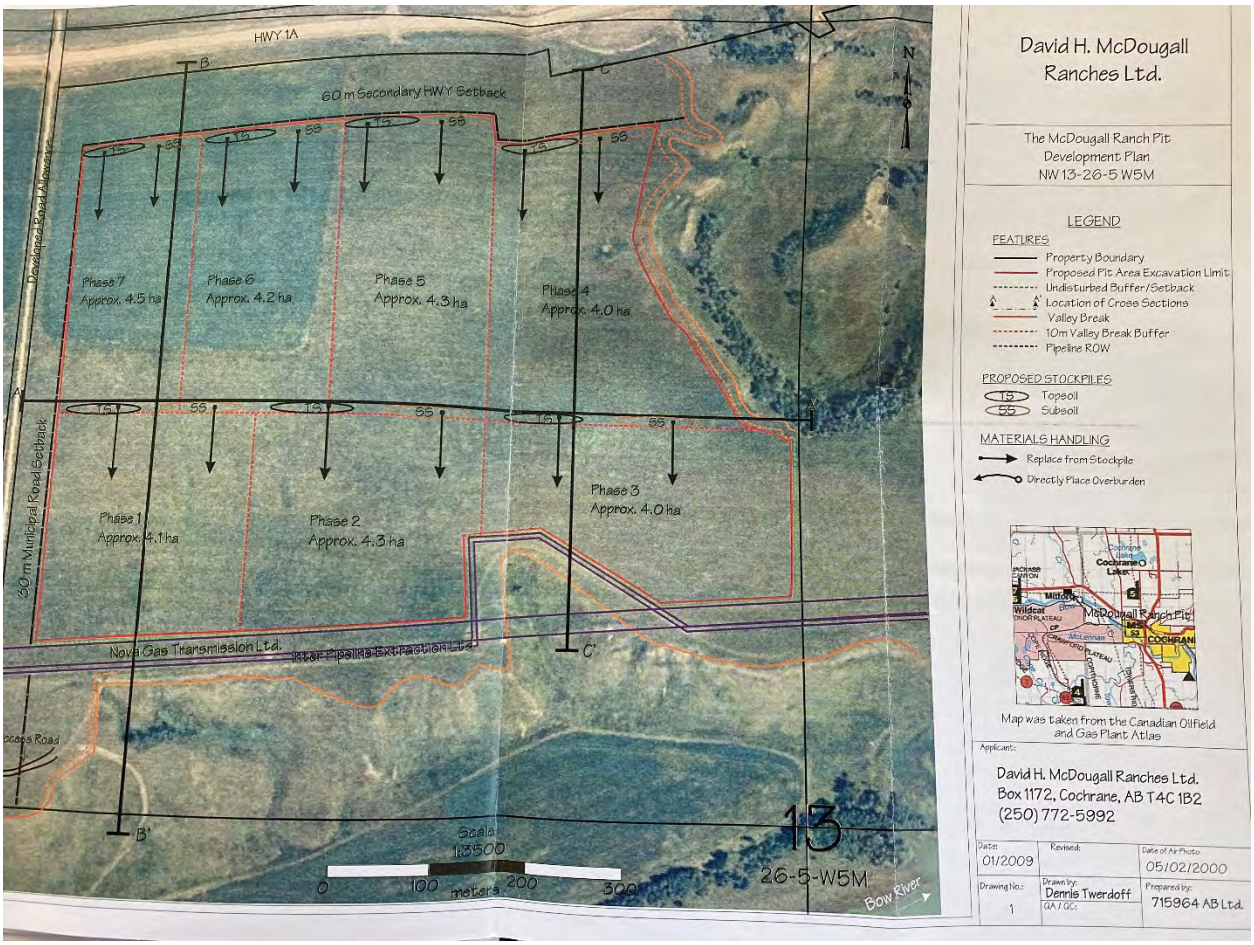
The proposed development is located on NW 13-26-5-W5M within the Municipal District of Rockyview. McDougall wishes to apply for Land Use Redesignation from Ranch and Farm District (RF) to Natural Resource Industrial District (NRI) to allow for sand and gravel operations. The land is currently hayland/pasture.

McDougall is proposing to undertake dry excavations, crushing and screening.

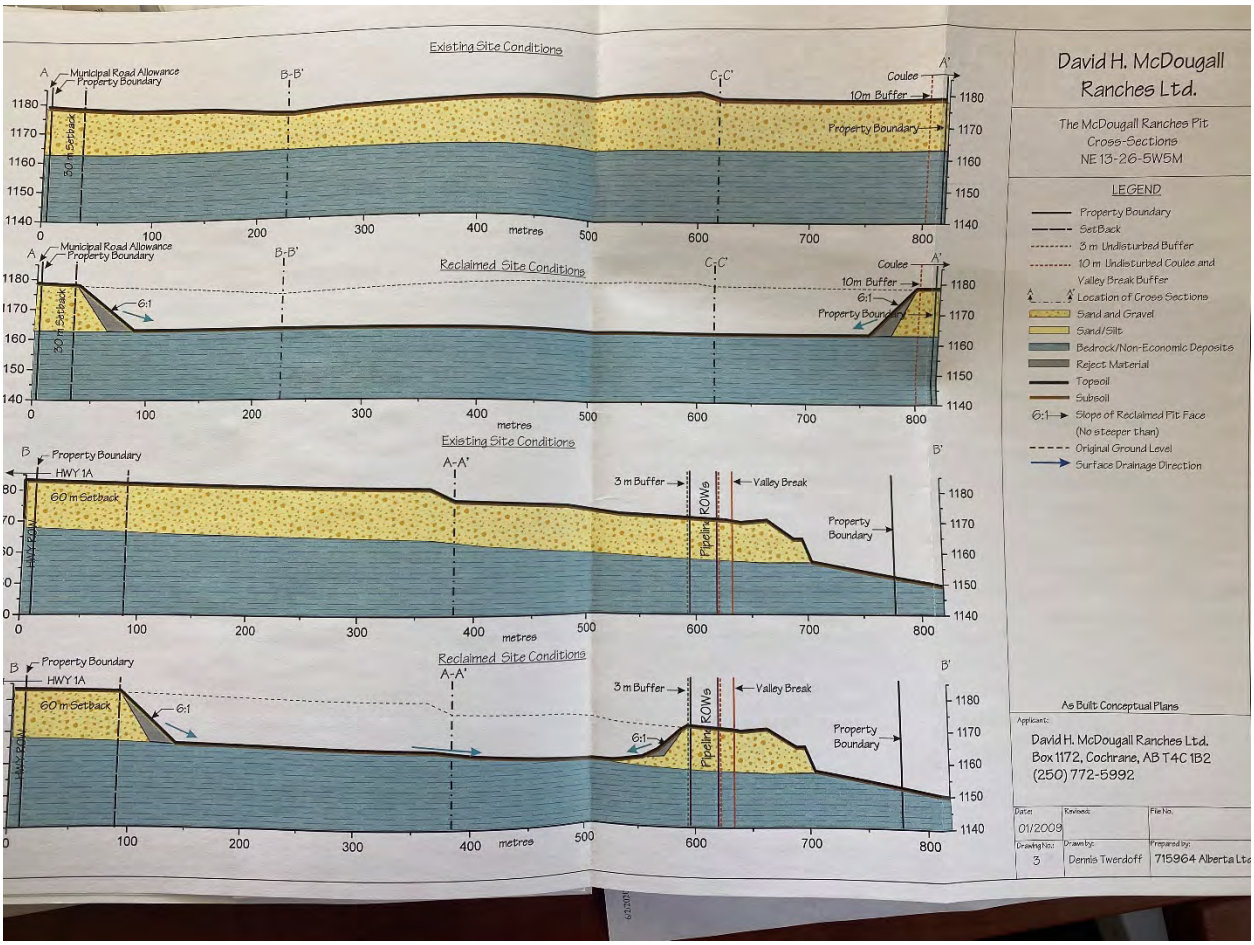
Although the life span of the sand and gravel pit is estimated to be approximately ten years, the timeframe is highly dependent upon gravel demand in the area. Excavations will occur in several phases with topsoil stockpiled along the edge of each phase. The site will be progressively reclaimed to pasture/hayland as each phase is depleted.

McDougall is committed to running a quality operation and minimizing potential impacts to local residence and the environment.

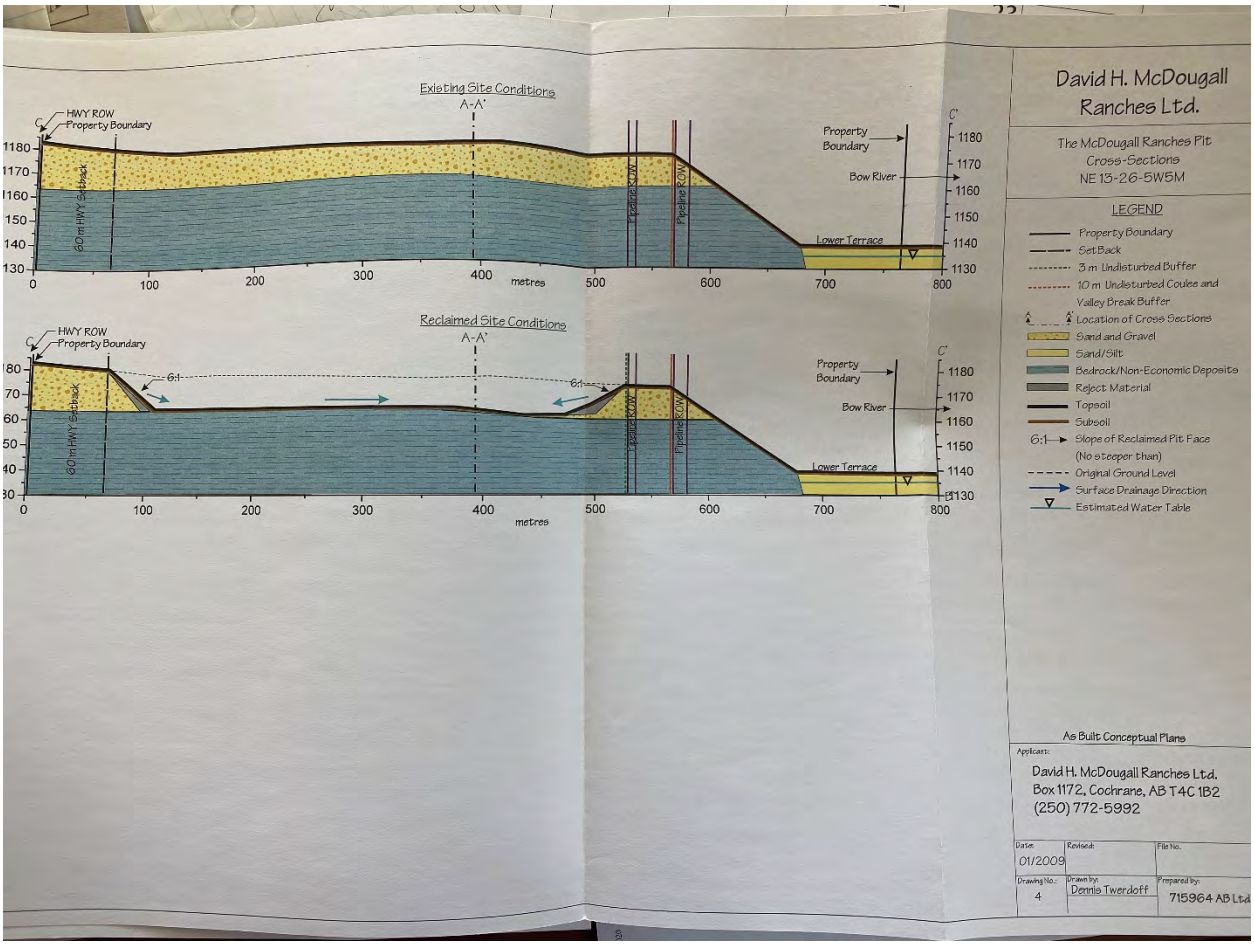
Application Number: PL20200066 Storms/Cornish Comments



Application Number: PL20200066 Storms/Cornish Comments



Application Number: PL20200066 Storms/Cornish Comments



Appendix C – Pictures of Existing Burnco Operations

Gravel View

Night Operation is 24 hours/day Impacting Dark Skies, Neighbours, and Wildlife

Application Number: PL20200066 Storms/Cornish Comments

Restored Greystone Site

Additional View of Restored Greystone Site

Additional Gravel View

Application Number: PL20200066 Storms/Cornish Comments

Appendix D - Cochrane Times July 1, 2020 Public Notice Burnco Rock Products Water Act Notice of Decision

Part 9 of the Water Act provides the right to appeal this decision. Any person who is directly affected by this decision may submit a notice of appeal, within seven (7) days of the providing of this notice, to: Chair Environmental Appeals Board

Public Notices

PUBLIC NOTICE

BURNCO Rock Products Ltd.

WATER ACT

NOTICE OF DECISION

Notice is given that **BURNCO Rock Products Ltd.** has been issued an approval under the provisions of the *Water Act*, on June 8, 2020, to extract aggregate from below the water table of an existing sand and gravel site located at NW 13-026-05-W5M.

Further information may be obtained from:

Regulatory Assurance Division
Southern Region
2nd Floor, 2938 11 Street NE
Calgary, Alberta T2E 7L7
Telephone: 403-297-7605
Fax: 403-297-2749

Please quote file number: **00430788**

Part 9 of the *Water Act* provides the right to appeal this decision. Any person who is directly affected by this decision may submit a notice of appeal, within seven (7) days of the providing of this notice, to:

Chair
Environmental Appeals Board
3rd Floor, Peace Trust Tower
10011 109 Street
Edmonton, Alberta T5J 3S8
Telephone: 780-427-6207
Fax: 780-427-4693
www.eab.gov.ab.ca/index.htm

For contact purposes, please include your name, phone number, address, land location, and a statement respecting how this decision will directly affect you or your water supply.

From: Natalie Robertson
To: Oksana Newmen
Cc: Christine Harrison
Subject: FW: [EXTERNAL] - Burnco Development West of Cochrane
Date: October 1, 2020 2:22:36 PM

Hi Oksana,

I believe this is your file… they made the deadline!

Regards,

NATALIE ROBERTSON, MEDES
Development Assistant| | Planning and Development

ROCKY VIEW COUNTY
262075 Rocky View Point | AB | T4A 0X2
Phone: 403-520-6333
nrobertson@rockyview.ca | www.rockyview.ca

From: Diane Young [redacted]
Sent: September 30, 2020 8:26 PM
To: Questions <questions@rockyview.ca>
Subject: [EXTERNAL] - Burnco Development West of Cochrane

We would like to have some points looked at in regards to the Burnco Development West of Cochrane and understand the deadline is October 1st.

Wendell and Diane Young
Division 9
NE Section 16 26 west of 5th

We live in the same area where all the proposed development will occur. Our biggest concern is the water issue; Burnco should look after all the neighbors by measuring the water pre start of any work, during the work and continue to work with the neighborhood once they start the production of the pits. Water is life here in the county and we want to make sure that our livelihoods in our homes, farms and ranches continue to be of the same quality pre- development.

Water that flows from the Bow /Grand Valley Creek should not be touched. The Ghost Dam with all of its changing levels is not something that should be relied on for water.

The second thing we would like addressed is the berms. Currently the first pad that has been built has the berm too close to the highway. If there is any need to widen the highways, it would automatically go to the farm/ranch lands. When I see where highway 22X has placed their berms far from the main highway, why cannot this be done on Highway 40?

Sincerely,

Wendell and Diane Young
[redacted]

Sent from Mail for Windows 10

From:	Glenn Makwich
To:	Oksana Newmen
Cc:	Shawn Belecki; John Simpson; Luke Simpson; Christie Simpson; Jeff Beaton
Subject:	Re: [EXTERNAL] - Burnco West Cochrane Development
Date:	September 30, 2020 1:12:15 PM
Attachments:	2020_09_30 LTR RVC Objection - Burnco West Cochrane Pit 02 SIGNED.pdf FW Burnco West Cochrane Development Comment Sheet Letter.msg Letter to Burnco - West Cochrane Pit Rev. 1.pdf

Oksana, on behalf of Simpson Ranching Ltd. please see attached their letter of objection to proposed bylaw C-8073-2020 to amend Rocky View County Land Use Bylaw.
Also find attached our letter dated April 30, 2020 addressed to Burnco with our concerns following their open house of March 9, 2020 and their emailed response from May 8, 2020 to our concerns.
Please review the attached and keep us apprised of any further developments, especially scheduled public hearing.

Glenn Makwich
Senior Project Manager

Please note that I am away/unavailable on Fridays and may not return emails until the following week.

IDEA Group Inc.
4034-4th Street SE
Calgary, AB T2G 2W3
ph. 403.274.4556
cell. 403-835-2133
fax. 403.206.7295
email. g.makwich@ideagroupinc.ca
web.www.ideagroupinc.com

From: Oksana Newmen <ONewmen@rockyview.ca>
Date: Thursday, September 17, 2020 at 11:26 AM
To: Glenn Makwich <g.makwich@ideagroupinc.ca>
Subject: RE: [EXTERNAL] - Burnco West Cochrane Development

Hi Glenn,

No discussion of potential public hearing dates. And I believe the request for comments is October 1st, but if you need more time, just let me know. We appreciate having feedback within a reasonable amount of time so things aren't trickling in over a long period of time, but we are of course sensitive to people's need for time to review.

Warm regards,
~Oksana

From: Glenn Makwich <g.makwich@ideagroupinc.ca>
Sent: September 17, 2020 10:55 AM
To: Oksana Newmen <ONewmen@rockyview.ca>
Cc: Shawn Belecki <Shawn.Belecki@cana.ca>; Jeff Beaton <j.beaton@ideagroupinc.ca>

Subject: Re: [EXTERNAL] - Burnco West Cochrane Development

Oksana, we see a unanimous decision on the September 1 council meeting first reading.
A couple of quick questions if I may. Any idea yet of when public hearing will be held? Secondly, is there a deadline to submit a letter of objection?

Glenn Makwich
Senior Project Manager

Please note that I am away/unavailable on Fridays and may not return emails until the following week.

IDEA Group Inc.
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fax. 403.206.7295
email. g.makwich@ideagroupinc.ca
web.www.ideagroupinc.com

From: Oksana Newmen <ONewmen@rockyview.ca>
Date: Friday, July 24, 2020 at 8:25 AM
To: Glenn Makwich <g.makwich@ideagroupinc.ca>
Subject: RE: [EXTERNAL] - Burnco West Cochrane Development

Glenn,

That's correct. I'm guessing you/your client spotted the McNair pit first reading item on July 28th – different site, different project entirely. Also much smaller at 26 acres.

Warm regards,
~Oksana

From: Glenn Makwich <g.makwich@ideagroupinc.ca>
Sent: Thursday, July 23, 2020 5:23 PM
To: Oksana Newmen <ONewmen@rockyview.ca>
Subject: [EXTERNAL] - Burnco West Cochrane Development

Oksana, our client wanted us to confirm that the land use redesignation for the above subject site is not on the July 28th council agenda.
I couldn't find it on the agenda but he also wanted me to confirm with you. Can you help?

Glenn Makwich
Senior Project Manager

Please note that I am away/unavailable on Fridays and may not return emails until the following week.

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ph. 403.274.4556
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fax. 403.206.7295
email. g.makwich@ideagroupinc.ca
web.www.ideagroupinc.com

SIMPSON RANCHING LIMITED
#100, 5720 4th Street S.E., Calgary, Alberta T2H 1K7

PHONES
RANCH (403) 932-2897
OFFICE (403) 255-5521
FAX (403) 255-0944
www.simpsonranching.ca

September 30, 2020

VIA EMAIL

Rocky View County
262075 Rocky View Point
Rocky View County, Alberta T4A 0X2

Attention: Oksana Newmen (Planner)

Re: Burnco West Cochrane Development Proposed Bylaw C-8073-2020 to amend Rocky View County Land Use Bylaw (the "Proposed Bylaw Amendment")

Simpson Ranching Limited ("SRL"), is hereby writing to object to the Proposed Bylaw Amendment which was presented to Rocky View Council and received first reading on September 1, 2020.

SRL's concerns respecting the Proposed Bylaw Amendment, as set forth more fully below, were formulated after reviewing the detailed response we received from Burnco respecting questions submitted by SRL after attending Burnco's open house on March 9, 2020 (the "Burnco Response"), and our review of Burnco's presentation boards from that open house. Copies of SRL's initial inquiries of Burnco and the Burnco Response have been enclosed with this letter of objection.

SRL's first and primary concern with the Proposed Bylaw Amendment relates to the amount of land impacted by this proposed change. In the Burnco Response, Burnco informed SRL that current yearly sales from the current operations of this West Cochrane site range from 100,000 to 150,000 tonnes and that if the Proposed Bylaw Amendment is passed, the total estimated reserves available would amount to 15 million tonnes. These numbers suggest that the Proposed Bylaw Amendment would allow for 120 to 150 years of gravel extraction at the current yearly sales volume. The Burnco Response also indicates that Burnco hopes to increase extraction over a 10-year period to 500,000 tonnes per year. If achieved, this would result in a site capacity range of between 30 to 35 years.

As stated, SRL is concerned that greenlighting between 30-150 years of gravel production today, will result in a scenario where the County loses all ability to apply prudent planning principals that address future county needs in a critical county highway corridor, and we would urge the County to avoid.

This and, there is no guarantee that any current development or production will result from an approved amendment.

After the Burnco open house, SRL inquired about the reclamation timeline for current and future pits, what commitments were in place respecting reclamation, and what certainty County landowners would have respecting open land based on the next stages of operation and development of Burnco's operation. With a timeframe for completion between 30 and 150 years, SRL remains unclear how these requirements will be managed and staged, or how there would be any prudent municipal control or approvals over future activities if the application is approved.

A secondary concern related to magnitude of the proposed amendment is that because several decades of gravel reserves will be preserved and protected by the Proposed Bylaw Amendment, the amendment will likely result in grandfathering and potentially avoidance of future requirements respecting environmental protections, surface reclamation, and resource development requirement and regulations respecting operations. Accordingly, SRL objects to a re-designation of this magnitude. Burnco's primary response to this concern is that they desire long term supply security for their concrete and asphalt plants for long term business certainty. As stated previously, long term remains undefined and a reasonable time frame should be provided based on current performance, taking into account this site together with the complete complement of Burnco gravel reserves in the County.

Burnco should provide a plan to phase development and ensure minimal impact to the surrounding landowners, the environment, and define extraction completion in a manner suitable for future land use and development growth within Rocky View County. On page 5 of the presentation boards it appears that the mining, and more importantly the borrow areas, indicated on the site map are tight to the top of the Grande Valley Creek escarpment. It is important to define and protect these boundaries at land use stage and adhere to them during the mining and borrow operations of the pit. A setback from the top of escarpment is required to minimize the erosion impact to Grande Valley Creek.

On page 17 of the presentation boards, the Biophysical Impact, it states that a 30m buffer from a water course is recommended for a Riparian Zone. When the map and legend are referenced, it appears as though the Riparian Zone is defined incorrectly, in fact Grande Valley Creek seems to be protected on one side at the North end of the map, but not the other.

The reclamation timeline of the current and future pits and how that relates to the amount of open land based on the next stages of operation and completion is critical to understand – with a timeframe for completion between 30 and 150 years, we do not understand how this will be managed, or how there would be any prudent municipal control or approvals over future activities if the application is approved.

We do not feel that a gravel development application of this size is the best use of this land along a highway corridor, along the Bow River, with mountain views, and access to major urban centers, at this time or in the future. We urge Rocky View County to limit Burnco and their application to the amount of land feasibly developed and reclaimed in a ten-year period prior to approval by council.

Sincerely,
Simpson Ranching Limited

So - J. Luke Simpson

Enclosures (2): SRL's Initial Inquiries of Burnco
The Burnco Response

4034 4 Street SE
Calgary, AB T2G2W3
(t)403.274.4556
(f)403.206.7295
www.ideagroupinc.com

30 April 2020 IDEA File: 20000

IDEA GROUP INC.
4034-4th Street SE
Calgary AB
T2G 2W3

Attention: Travis Coates - via email

RE: BURNCO West Cochrane Development

On behalf of Simpson Ranching Limited we are writing to comment on your project as requested at your open house of March 9, 2020.

Our concerns and comments listed below were formulated by responses to our questions at the open house as well as review of your presentation boards that were forwarded to us.

We would appreciate a response to our questions and concerns.

Our first concern would be the amount of land that BURNCO is trying to get Land Use on. For us to clearly understand this we need to know the production of each of your operating pits and the timeline of estimated pit depletion. You say that this proposed West Cochrane development should ramp up to 500,000 tonnes per year within the next 10 years. That compares with Indus from 2016. What is the West Cochrane current pit production and what is the estimated gravel reserve in this first phase? As well, we would like to know the forecast on your depletion of these anticipated reserves for the entire application area.

It appears as though this application is protecting Burnco against future changes in zoning regulations, environmental protections or surface resource development. Why is it necessary to rezone so much land now?

How does Burnco plan to phase development to least impact surrounding landowners, the environment and to complete extraction in a pattern that is suitable to a future land use and development growth.

Another concern would be the reclamation timeline of this current pit and how that relates to the amount of open land based on the next stages of operation. We are sure that there has been a considerable amount of research and input into the proper way to stage this project.

How does a gravel development application of this size provide for the highest and best use of this land (along a highway corridor, along the Bow river, with mountain views and access to major urban centers) now and in the future?

On page 5 it appears that the mining and more importantly the borrow areas indicated on your site map are quite tight to the top of the escarpment of the Grande Valley Creek. We believe that it is quite important to define and protect these boundaries at land use stage and stick to them during your mining and borrow operations. There must be a setback from the top of escarpment to minimize the erosion impact to this creek valley.

On page 17, the Biophysical Impact, it states that a 30-meter buffer from a water course is the recommendation for a Riparian Zone. When we look at the map and if we are interpreting the

legend properly it doesn't appear to be drawn correctly. The creek itself seems to be protected on one side and not the other.

Further to the above, we did not see any reference to a wildlife corridor study, yet we did see some significant sized culverts in the area, can you please clarify?

We would urge Burnco to limit their application to the amount of land feasibly developed in a ten-year period prior to submission to the county.

Sincerely,

IDEA Group Inc.

Glenn Makwich
Tel. 403.274.4556
Fax 403.206.7295

CTJ/ctj

CC: Jeff Beaton, IDEA
Shawn Belecki, CANA Group of Companies
John Simpson, Simpson Ranching
Luke Simpson, Simpson Ranching
Christie Simpson, Simpson Ranching

From:	Travis Coates
To:	Glenn Makwich
Cc:	John Simpson; Shawn Belecki; Luke Simpson; Christie Simpson; Jeff Beaton; Thomas Tyler; Ulrich Scheidegger
Subject:	FW: Burnco West Cochrane Development Comment Sheet & Letter
Date:	May 8, 2020 10:50:19 AM
Attachments:	Comment Sheet.pdf Letter to Burnco - West Cochrane Pit Rev. 1.pdf

Glen,

Thanks again for the correspondence. I have included this letter in our open house feedback and it will help assist us as we put the final touches on our Land Use Submission. As mentioned in my previous email, I would be more than happy to have a call with your group to provide further opportunity for discussion.

Please see below. I have provided responses to your questions in red.

We would appreciate a response to our questions and concerns.

Our first concern would be the amount of land that BURNCO is trying to get Land Use on. For us to clearly understand this we need to know the production of each of your operating pits and the timeline of estimated pit depletion. You say that this proposed West Cochrane development should ramp up to 500,000 tonnes per year within the next 10 years. That compares with Indus from 2016. What is the West Cochrane current pit production and what is the estimated gravel reserve in this first phase? As well, we would like to know the forecast on your depletion of these anticipated reserves for the entire application area. Current sales from our existing West Cochrane site are in the range of 100,000 to 150,000 tonnes per year. As stated on the slides, the total estimated reserve of this project is 15 million tonnes. Based on the anticipated extraction rate of 500,000 tonnes plus ramp up time, the project would have a life span of around 30-35 years. BURNCO has a number for gravel production sites around Calgary and supply from this site would form part of that network.

It appears as though this application is protecting Burnco against future changes in zoning regulations, environmental protections or surface resource development. Why is it necessary to rezone so much land now? BURNCO operates a number of asphalt and concrete plants. Having secure supply of aggregate for those plants is critical. The reason to rezone all portions of the project at current time is to provide some assurance that this site can be relied upon in future to supply aggregate to those facilities. Gravel pits are subject to continuous permit renewals at the municipal and provincial levels so the inclusion of areas is not an attempt to avoid future regulation changes, but rather, driven by a need for long term business certainty.

How does Burnco plan to phase development to least impact surrounding landowners, the environment and to complete extraction in a pattern that is suitable to a future land use and development growth. The open house included phasing details of the project. I would draw your attention to the plan for phased construction of the screening berm. This will allow the screening berm to mitigate visual impacts of the project as it proceeds. Feedback form the first open house has also led us to plan phasing on the eastern portion of the project (those lands east of Grande Valley Creek) so that operations progress from east to west. This will mean that operations at the site are moving away from the town of

Cochrane over time.

Another concern would be the reclamation timeline of this current pit and how that relates to the amount of open land based on the next stages of operation. We are sure that there has been a considerable amount of research and input into the proper way to stage this project. Not all lands will be open and disturbed at one time. The Permitted land base is there to ensure access to gravel, it is not needed as operational space at one time. Reclamation will be progressive.

How does a gravel development application of this size provide for the highest and best use of this land (along a highway corridor, along the Bow river, with mountain views and access to major urban centers) now and in the future? Gravel pits are an interim land use. As stated above, the life of this project is expected to be in the range of 30-35 years. After that, the lands will be ready for the future. Some areas before that time as operations progress. We think this fits well for the area given its close proximity to urban centers as you noted (but which are still no less than 1 mile away from the east extent of our project boundary). Though we remain unsure what exactly the future will bring as definition of highest and best use often depends who you are talking to.

On page 5 it appears that the mining and more importantly the borrow areas indicated on your site map are quite tight to the top of the escarpment of the Grande Valley Creek. We believe that it is quite important to define and protect these boundaries at land use stage and stick to them during your mining and borrow operations. There must be a setback from the top of escarpment to minimize the erosion impact to this creek valley. Planning has been very careful in relation to this point. Natural drainage flows down the escarpment at present. Mining activities must restore this drainage and ensure ponding is not being created. A couple of key sections of the escarpment must be excavated to facilitate this. The concern about sediment is appreciated and BURNCO has very detailed and thorough planning related to erosion and sediment control for these areas.

On page 17, the Biophysical Impact, it states that a 30-meter buffer from a water course is the recommendation for a Riparian Zone. When we look at the map and if we are interpreting the legend properly it doesn't appear to be drawn correctly. The creek itself seems to be protected on one side and not the other. A 30m buffer is being maintained form all riparian areas. Further a 60m setback is being maintained from the Bow River and Grande Valley Creek. These setbacks were mapped, and sometimes overlap. The most stringent setback was utilized in all cases. Please note that many riparian areas do not have bed or banks (ie active river channel to map) they just hold water periodically at some point throughout the year. As a result, setbacks are generally based of centerline. Other streams have bed and banks to go off, and setbacks in those cases are based of those.
Happy to follow up on this if I am misunderstanding the question.

Further to the above, we did not see any reference to a wildlife corridor study, yet we did see some significant sized culverts in the area, can you please clarify? Impacts to wildlife was reviewed as part of our Biophysical Impact Assessment. As stated above, not all areas of the site will be active at one time. That will greatly assist in maintaining wildlife mobility across the lands. Setbacks form riparian areas will also help to achieve this goal. I am a little unsure with regard to the culvert reference. BURNCO has proposed a number of culverts within its screening berm. These will be located and sized in a similar fashion to those under highway 1A and are there to ensure stormwater flows can continue as most storm water in the area is moving from north to south and toward the Bow River. They are not there to serve a wildlife function specifically. Our screening berms have 3:1 sloping and would be easily navigated by all wildlife.

We would urge Burnco to limit their application to the amount of land feasibly developed in a ten- year period prior to submission to the county. Thank you for this comment

however that approach just would not provide BRUNCO with meaningful business certainty.

Working remotely in adherence with COVID-19 social distancing measures.
Contact me via email or phone @ (403) 640-9217.

Thank you and take care,

Travis Coates, P. Eng
Land and Resource Manager Alberta and Saskatchewan
Phone: (403) 640-9217
Email: travis.coates@burnco.com
Excellence · Integrity · Passion

From: Glenn Makwich <g.makwich@ideagroupinc.ca>
Sent: Wednesday, May 6, 2020 11:02 AM
To: Travis Coates <Travis.Coates@burnco.com>
Cc: John Simpson <simpsonj@cana.ca>; Shawn Belecki <Shawn.Belecki@cana.ca>; Luke Simpson <Luke.Simpson@cana.ca>; Christie Simpson <Christie.Simpson@atco.com>; Jeff Beaton <j.beaton@ideagroupinc.ca>
Subject: Burnco West Cochrane Development Comment Sheet & Letter

[External Email]

Travis, please see attached.

Glenn Makwich
Senior Project Manager

Please note that I am away/unavailable on Fridays and may not return emails until the following week.

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web.www.ideagroupinc.com

Caitlyn T. Anderson

From: Alex Reed [redacted]
Sent: June 18, 2021 4:13 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Opposition to the Burnco West Cochrane Gravel Pit Bylaw C-8073-2020

I wish to voice, and have recorded as a matter of record, my opposition to the Burnco West Cochrane Gravel Pit Bylaw C-8073-2020.

Aside from the fact that I don't believe that this gravel is needed, my concerns are about the traffic and air quality, but my major concern is about what will become of the water quality for the Town of Cochrane. 30,000+ residents of the Town of Cochrane depend of that water and the Town's intake value is just downstream from this monster gravel pit.

I plead with the Rockyview County Council to not approve this Bylaw.

Respectfully,

Alex Reed
Town of Cochrane Resident
137 Gleneagles View
[redacted]

June 23, 2021

Via Email

Rocky View County
262075 Rocky View Point
Rocky View County, Alberta T4A0X2

Attention: Oksana Newman, Planner

Re: Oppose Burnco West Cochrane Proposed Bylaw C-8073-2020 Application PL20200066 to amend Rocky View Land Use Bylaw (the "Proposed Bylaw Amendment")

Burnco Land Use and proposed MSDP Policies Lack specific visible performance measures for adjacent landowners and the Community

McKendrick Ranches Ltd and Ann McKendrick McNabb, are opposed to the Proposed Bylaw Amendment, which was presented to Rocky View (RV) Council and received first reading September 1, 2020.

Land use for additional Aggregate use should be conditional on proving that the Bow River water quality will not be impacted by the current or future pits.

Our first and primary concern is the size of the proposed pit. If approved, this Land Use and subsequent mine expansion would create 452 hectares (1,117 acres) of contiguous lands zoned as NRI for a gravel mining and aggregate processing expansion. The proposed land use would rezone approximately 6.5 km of lands south of the highway 1A along the Bow River.

Rocky View has not developed a gravel strategy, performance measures and policies to allow a mix of land uses in a developing community for the next 120 years. Given current markets, the proposed pit could last **120 years with no visible measures to ensure the community is not impacted**.

Are aggregate company consultant reports reviewed by unbiased experts? Is the air quality and dusts measured to ensure no impact on neighbours and animals health regardless of residences or distances? Are visible tests required yearly or frequently to ensure the drinking water of a few million people are reviewed by qualified experts and the data available to the public? The answers to many of these questions: NO, there is no proactive performance measures available to the public to ensure practices are safe and the pits are timely reclaimed to environmental or current standards.

Rocky View County (RVC) and Council have jurisdiction over the public decision and the land use planning. RVC Bylaws State: "practice sound land use planning in order to protect agriculture operations, native habitat, environmentally sensitive areas and retain rural landscapes, dark skies, open vistas and agriculture lands." In the Natural resource policy **basically RVC give all the authority to Alberta Environment and Parks (AEP) or other regulatory groups.** AEP will only consider the application if the County is willing to allow the

land use in the environmentally sensitive Bow River Valley corridor. The **AEP process does not require adjacent property owner notification, engagement and provide for performance monitoring visible to the adjacent property owners.** AEP are not elected**.**

Once Land Use is approved by RVC, Alberta Environment and Parks cannot change the zoning even if that means the Bow River Valley water is destroyed. (Discussed in AE Appeal of a Burnco northern gravel operation). AEP has not required third party testing to ensure aggregate mining doesn't impact the water aquifer and drinking water standards. Any monitoring or measurements are not provided to the adjacent property owners impacted by the decisions and are not public. We have to go through a lengthy and challenging Appeal process and perhaps Public Hearing. All after the fact. After the problems are experienced and real. Impacted Bow River water aquifers are not easily reclaimed. The selenium problems caused by Coal Mining have created huge issues not easily or maybe never resolved. "For years the BC failed to address selenium pollution in the Elk Valley. Now no one knows how to stop it." By Carol Linnitt Dec 4, 2018.

The process needs changing. Rocky View is recommending Land Use change with a Direct Control District. Then the Direct Control needs to allow for performance measures reported regularly to the community impacted. See the attached example Ponoka Aggregate Appendix A. This was provided by a Red Deer lawyer who worked with our hydrogeologist Water Line Resources and other consultants on developing performance measures to support the Community and responsible Aggregate development.

To ensure the Policies stated by Burnco, summarized in Burnco's Appendix 2: MSDP Policy Summary are effective then the Direct Control Bylaws or other practices need to be specific and allow for mutual discussion and collaboration. Land Use changes need to set the process to ensure the Direct Control is written to provide visible and measurable guidance.

Policy not discussed
RV Direct Control **Recommend that Council grant Aggregate Land Use for an area that can be mined and reclaimed in a ten-year period only after proof the Bow River drinking water will not be impacted.** see the Ponoka Appendix A established 10-year time frames to address the concerns of the Community.

RV Direct Control should establish setbacks on the Burnco proposed lands, so the Aggregate resource does not impact the Land Use and residential developments on neighbours' property or the community. RV Municipal Develop Plan does not address planning for the 15 km west of Cochrane. Approving decades (or potentially a century +) of gravel with current policies and practices is not in the best interests of future Councils and future generations of Rocky View residents.

RV Direct Control need Policies to allow growth, planning, operating, reclamation, and environmental standards to protect surrounding residents from the harmful health, water, and numerous concerns.

Policy 1: Burnco will secure from AEP …
RV Direct Control (DC) Bylaws will engage the community directly impacted in the Registration from AEP under the code of Practice for Pits. DC will ensure water, air, noise and other quality measures are agreed and mitigation agreed in advance versus the current Appeal and complaint process after the negative impact to the health and quality of life occur.

Policy 3, 8, 9: Burnco operating Hours allow for 24-hour crushing.
The Direct Control will propose better positioning of crushing operations and reduce the negative impact on residences and animals. Note 2012-12 Development Appeal Board changed the RV Administration recommended and property owners preferred crush hours to suite the Applicant (24 hours/day).

Policy 6,9: Noise measures
DC will require peaks and not averages and be visible and reported regularly to the community impacted. Rural standards will be applied.

Policy 7: Dust control measures need to be reported to the community.
Rocky View Land Use and Direct Control (DC) policies should require setbacks to prevent dust impacting the neighbours and health. Burnco reports show our property is impacted 100m. and maybe more given different wind conditions, see Appendix B. Regardless of residence, we and our animals use the space and do not want cancer or other health risks that normally are not present. Only when Aggregate Land Use is approved do the health risks occur. We are not compensated for this contamination and our property reclaimed. Rocky View Land approval should not allow this practice to occur.

Policy 10, 11,12,13: Burnco will monitor water levels in the network of 18 monitoring wells…follow direction from AEP. Water act approvals for dewatering, bailing, or other activities in the ground water.
RV Direct Control District should require neighbour water monitoring see Appendix C as proposed by other Aggregate operators and agreed by Burnco provided we agreed to Land Use for 1117 ac. We have expressed concerns about the water aquifer in the first RV hearing 2009-2011, to Burnco and have an Appeal to AEP concerning the probable impact on the water aquifer. 2011 RV approved the current McDougall now Burnco 151 ac pit with mining to one metre above the water aquifer. Burnco got approval from AEP June 2020 to mine in the water aquifer without our involvement or any monitoring of our wells or prevention. Our Appeal has not been addressed after six months. No-one restores the potential water we lost.

Rocky View **Direct Control should require quarterly third-party reviews of water quality of the existing pit and all areas disturbed for concerns of drinking water standards** for impact to the Bow River and a few million residences. **Land use for additional Aggregate use should be conditional on proving that the Bow River water quality will not be impacted.**

Policy 14, 15,16,17: Transportation and safety
RV Direct Control should provide for community and adjacent property owner input plus proper setbacks. Alberta Transportation advised that there should be no permanent berms within 30 m of the property lines. The current pit has 3m high berms to the property line. During the construction our access to SW24-26-5W5 was being removed and later replaced by Burnco as we were not consulted.

Policy 18,19,20: Storm water, drainage, reclamation, water quality issues
RV Direct Control needs to establish policies to ensure water quality and neighbours are protected.

Policy 21,23: Setbacks
RV Direct Control should ensure the 3-metre-high berms do not adversely impact wildlife, future road widening and community planning. The Trans Canada trail system is planning a trail along the 1A similar to the one from Canmore to Banff. The views will be significantly altered by 3 m high berms for 6.5 km along the proposed Burnco pit.

Policy 24, 25, 26, 27, 28,29, 30: Reclamation…
Direct Control will establish guidelines to allow land use and reclamation occurs in ten-year time frames to ensure that the surrounding community is not directly impacted with a lack of Municipal Plan for the area. A large aggregate area of 6.5 km long and 1117ac establishes a direction of commercial – industrial and spot zoning without planning for the highest and best use.

Appendix A: see attached policies from Ponoka County

Development Permit D-19-53 – Revised November 26, 2019

Attached as separate document

Appendix B: from Burnco MSDP

Figure 25: Maximum Predicted 24-hr $PM_{2.5}$ Concentration

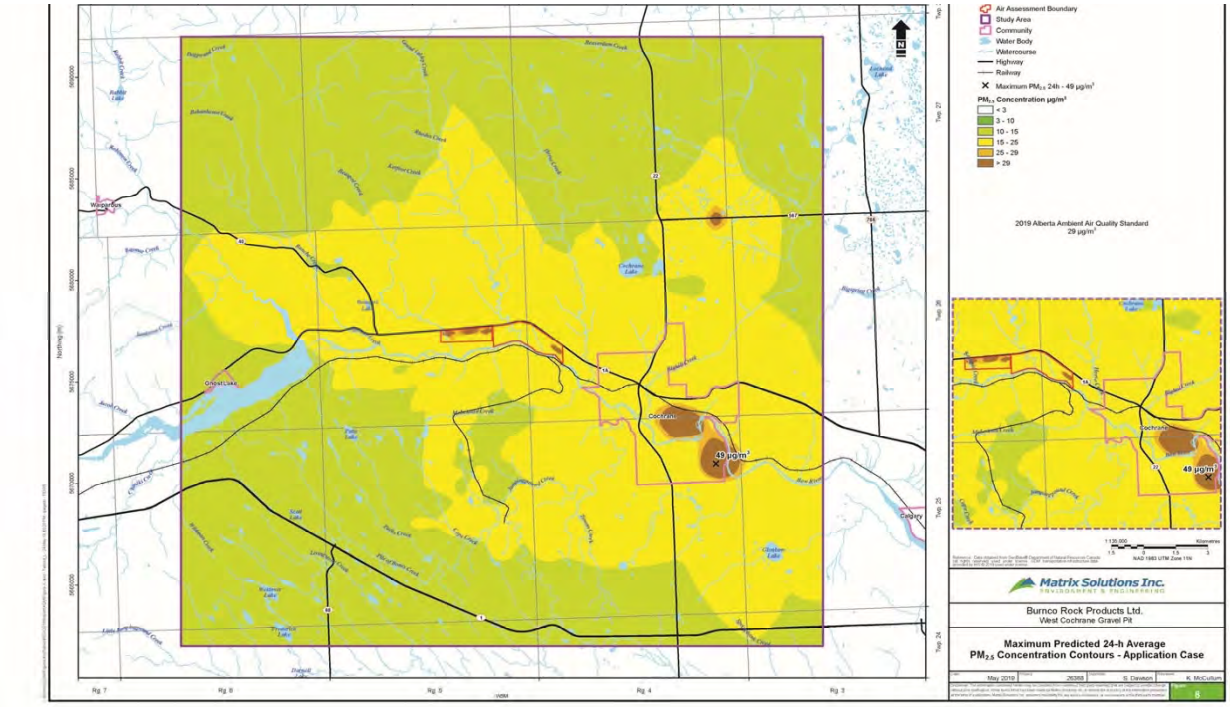
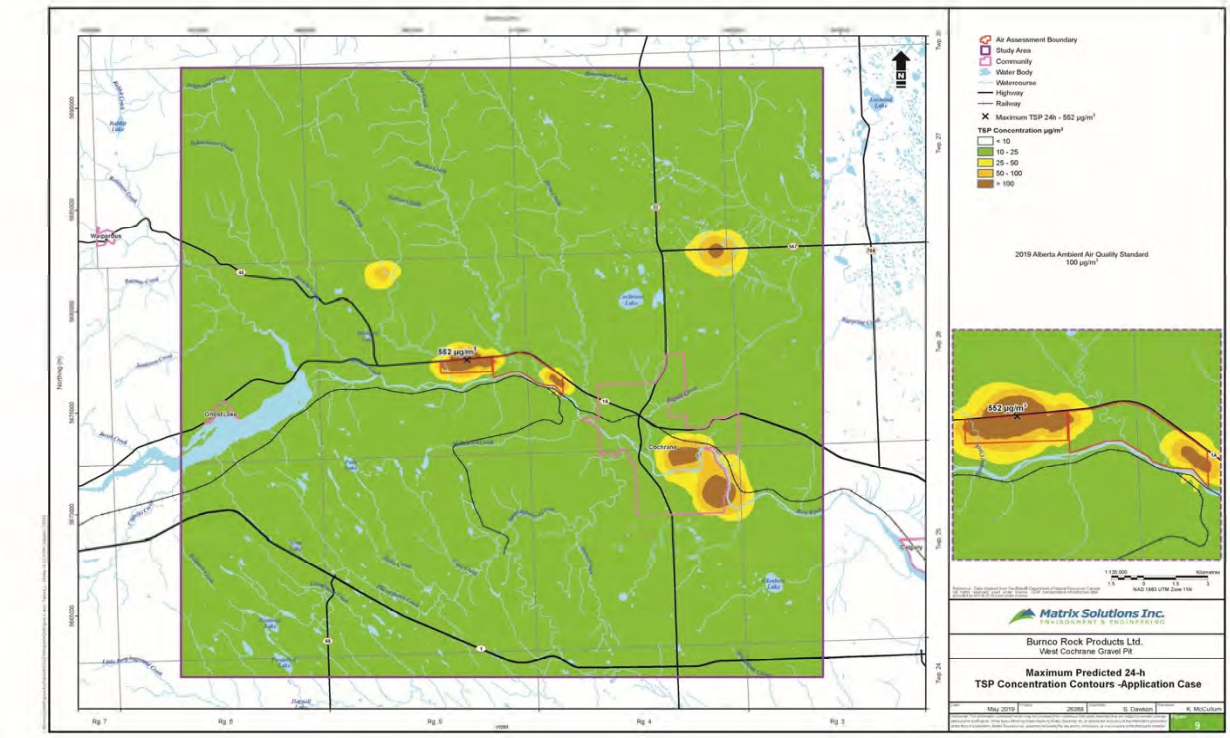


Figure 26: Maximum Predicted 24-hr TSP Concentration



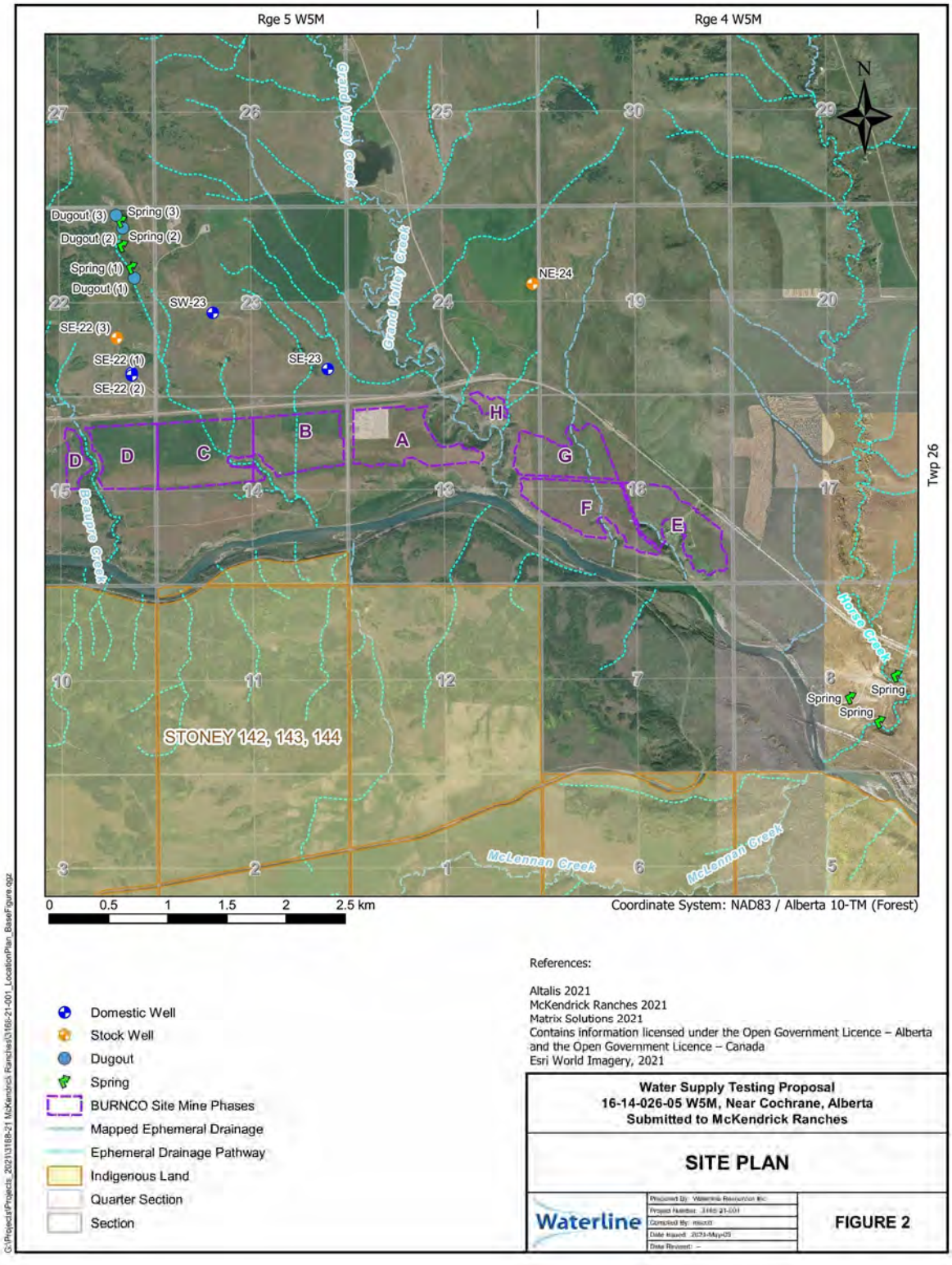
Appendix C: Draft of Water Monitoring

Baseline Water Monitoring.
BURNCO will retain a third-party consultant to complete the following activities to establish baseline groundwater information. Such baseline water monitoring shall be completed for a period of two (2) years which will include the following:

(i) Testing will be completed on each of the following wells as shown in Figure 2 below
Well in SE22 (1), SE22 (2), SE23, SE22 (3), SW23, Spring (1) in NE22.

(iv) A drive-point piezometer will be installed at Spring (1) in NE22.
(v) A two-hour pumping test will be completed at all water wells and a slug test will be completed at the spring to characterize groundwater flow rates in relation to aquifer drawdown. These pumping tests will be completed once at the start of the baseline testing program.
(vi) Automatic water level recorders will be installed at each water well and the spring to determine the baseline water levels and seasonal fluctuations. Water levels will be collected for a period of two years and downloaded biannually.
(vii) Groundwater samples will be collected to characterize the water quality, including hydrocarbons, dissolved metals, general chemistry parameters and turbidity. Samples will be collected bi-annually for a period of two years (4 samples per location).
(viii) During operation of the West Cochrane Gravel Pit, BURNCO will complete baseline water monitoring at an additional 4 locations if requested by McKendrick Ranches. Such baseline monitoring shall be completed on wells installed by McKendrick Ranches or at spring locations as desired by McKendrick Ranches and done in accordance with the above protocol.
(c) Ongoing Water Monitoring
During operation of the West Cochrane Gravel Pit, BURNCO will retain a thirdparty consultant to collect ongoing groundwater information in addition the data collected as part of the baseline water monitoring:
(i) Automatic water level recorders will be maintained at four (4) water well and/or spring locations to monitor water levels and seasonal fluctuations. Data will be collected annually.
(ii) Groundwater samples will be collected at four (4) water well and/or spring locations to characterize the water quality, including hydrocarbons,
(iii) Ongoing water monitoring will be completed in locations as requested by McKendrick Ranches as part of the annual data collection.
dissolved metals, general chemistry parameters and turbidity. Such sampling will be completed once every three (3) years;

Appendix C: Draft of Water Monitoring cont'd Figure 2 Water testing map



Appendix C: Draft of Water Monitoring cont'd

3. Complaint Protocol

For as long as the West Cochrane Gravel Pit is in operation, and in the event McKendrick Ranches believes that there has been surface water or groundwater interference as a result of the gravel pit, McKendrick Ranches may submit a written complaint to BURNCO setting out in sufficient detail the suspected surface water or groundwater interference and, if known, the suspected cause. In the event BURNCO receives a complaint BURNCO agrees as follows:

(a) To investigate, as soon as practicable, the written complaint alleging the Gravel Pit operation has caused the reported surface water or groundwater interference.

(d) If the Complaint is related to disruption of water to a residence such that the residence is without potable water, then BURNCO will provide an alternative source of water for use in residential needs within 48 hours of receiving the Complaint. BURNCO shall continue to supply this alternative water until resolution of the compliant has been completed.

(e) Within a commercially reasonable timeframe of receiving the Complaint, to provide McKendrick Ranches with a written report containing the following:

(i) description of the complaint;

(ii) detailed complaint investigation notes;

(iii) conclusion as to whether surface water or groundwater interference has occurred, and whether such interference has occurred as a result of the Gravel Pit operation; and

(iv) if interference has occurred as a result of the Gravel Pit operation, recommendations for remediation and/or mitigation of the impact(s), which may include among other recommendations:

a. lowering the intake of the pump to compensate for a drop-in water level;

b. re-drilling the water well to an increased depth so as to allow the pump to be installed at a lower depth;

c. drilling a new well; or

d. providing an alternate water supply.

(f) In the event a complaint report concludes that surface water or groundwater interference has occurred as a result of the Gravel Pit operation, BURNCO shall be responsible to remediate and/or mitigate such interference at BURNCO's sole cost and expense. Such recommendations for remediation and/or mitigation shall be discussed and agreed between the Parties acting reasonably.

4

(g) It is mutually acknowledged that at any time during this process, McKendrick Ranches shall be at liberty to file a complaint with Alberta Environment and BURNCO agrees to abide by any corrective actions ordered resulting therefrom.

Ponoka County

DEVELOPMENT PERMIT D-19-53 – REVISED November 26, 2019

A Permit has been approved and is hereby issued to: **VCD AGGREGATES LTD. (the "Applicant")**
#2 – 53050 RR 220
ARDROSSAN, AB
T8E 2C7

FOR **Development & Operation of a SAND & GRAVEL PIT (Liddle-McKelvie Pit)**

As Described on Application No. D-19-53

LEGAL: **NW 36-43-25-W4**
NW 1-44-25-W4
SW 1-44-25-W4
SE 11-44-25-W4

CONDITIONS OF APPROVAL:

CONDITION #1	The Applicant must remit to Ponoka County a Community Aggregate Levy in the amount of $0.25 per tonne of sand/gravel hauled from the pit in accordance with Ponoka County By-Law 24-06-CAPL (according to the terms, and in the amount as amended or repealed and replaced from time to time).

CONDITION #2	The Applicant shall comply with the approved application, reports, (including the Golder Air Quality Report, the Golder Noise Impact Report and the Golder Operations Plan) and plans submitted to Ponoka County and the Ponoka County SDAB (unless altered by these conditions); non-compliance with the reports, plans, and conditions shall be considered a contravention of the development permit. If there is a breach of any requirement of the development permit the County may barricade all or any access between the Site and County controlled roads or pursue any other available enforcement options.

CONDITION #3	Hours of operation shall be: • Earthworks: 7:00 a.m. to 7:00 p.m.; Monday-Friday; • Processing/Crushing: 7:00 a.m. to 7:00 p.m.; Monday-Friday; • Sales/Hauling: 7:00 am to 5:00 p.m.; Monday-Saturday except as altered pursuant to Road Use Agreement (see below) No operations (earthworks, processing/crushing, sales, hauling) shall be undertaken on Sundays or Statutory Holidays (including but not limited to, New Year's Day, Alberta Family Day, Good Friday, Easter Monday, Victoria Day, Canada Day, Heritage Day, Labour Day, Thanksgiving Day, Remembrance Day, Christmas Day and Boxing Day), unless prior approval has been obtained from Ponoka County.

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DEVELOPMENT PERMIT D-19-53 – REVISED November 26, 2019

CONDITION #4	The extraction of sand and gravel that is the subject of this development permit is to be commenced within thirty-six (36) months of the effective date of all regulatory approvals. Prior to this thirty-six (36) months, the Applicant is entitled to commence preparatory work such as the construction of the berms and/or walls.

CONDITION #5	The Applicant shall inform the Ponoka County Development Officer of the date when sand and gravel extraction from the Site commences. This permit shall expire 7 years from the date that sand and gravel extraction from the Site commences. At the expiration of the 7-year period the development permit shall be subject to an extension of a period of 3 years, subject to the Development Authority determining that there has been reasonable compliance with the requirements (including conditions of this development permit). If the permit is not renewed following the authorized extraction of sand and gravel (either within the 7-year period or the extension of a maximum of 3 years), the Applicant is granted no more than 3 years to complete reclamation of all disturbed areas (not only within the pit, but on all areas within the Site). All extraction activity, excluding reclamation work, must cease upon the expiration of the development permit, unless a new development permit has been applied for and approved by Ponoka County. Final reclamation work of grading and seeding must be completed to the point of a reclamation certificate within the greater of 3 years of all authorized extraction activities ceasing on the Site, or 3 years from the expiry of this or the extended development permit. No extraction or development shall commence within Phase Two of the Site, as described in Section 2.1 Active Mining of the Golder Operations Plan submitted to the Ponoka County SDAB as Exhibit 21, until the Development Authority is satisfied that it has been provided with modelling information indicating that the Applicant can meet, for Phase Two: a) The Air Quality Standard; and b) The Noise Standard.

CONDITION #6	Any application to extend extraction of sand and gravel beyond the approved 7-year period (whether for the 3-year extension of the development permit, or any renewal of the development permit beyond the term of the development permit) is subject to review by the Development Authority, who shall be notified in writing of any request for an extension. Such requests shall be accompanied by the appropriate development permit application fee, if required. It is expected that any request for an extension or renewal shall be made no less than six (6) months prior to the expiry date of this development permit or any renewed development permit. At the option of Ponoka County, the Applicant (at the Applicant's expense) will also be required to provide an audit by a third party expert providing a review as set out in Ponoka County's direction; it

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DEVELOPMENT PERMIT D-19-53 – REVISED November 26, 2019

	would be anticipated that the audit would review compliance with the requirements of this permit, and impact on neighboring roads, lands and occupants. Beyond the first 3-year development permit extension period, any renewal may be on different terms/conditions than referenced in this permit.

CONDITION #7	At the option of Ponoka County, the Applicant shall provide (prior to commencing excavation at the Site) a letter of credit or other acceptable security to Ponoka County's Development Officer to ensure compliance with any Road Use Agreement or Development Agreement required by Ponoka County. The security taken under the Development Agreement shall be returned to the Applicant once the terms of the Development Agreement have been fulfilled.

CONDITION #8	The following shall be provided prior to any construction at the Site (unless Ponoka County agrees to defer the timing to a later date): a) Development permit fees; b) Entry into a Development Agreement (and any additional work/requirements as set out in the Development Agreement, including the provision of financial security); c) Entry into a Road Use Agreement (and any additional work/requirements as set out in the Road Use Agreement, including the provision of financial security); d) Installation of perimeter fencing and all site security to prohibit all unauthorized access to the site; e) Placement of signage; f) Emergency Response Plan; g) Fire Prevention and Protection Plan; and h) Baseline Groundwater Study.

CONDITION #9	The Applicant shall during the currency of this development permit: a) Ensure compliance with all current and updated conditions/requirements of federal, provincial and municipal legislation (including regulations of Alberta Environmental Protection, Land Reclamation Division and the guidelines set under the Environmental Protection and Enhancement Act), including a provincial Roadside Development Permit; b) Ensure compliance with all current and updated conditions/requirements of any easement, covenant, building scheme, or development agreement affecting the Site; c) Obtain and comply with all necessary approvals from Alberta Transportation and Canadian Pacific Railway; and d) Authorize other regulatory authorities to share information with Ponoka County.

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CONDITION #10	The Applicant must provide all required federal and provincial approvals to Ponoka County within sixty (60) days of approval. The Applicant shall notify Ponoka County within sixty (60) days if the Applicant applies for a change and/or if any change to any provincial approval related to the operations is approved by the Province.

Mine Site and Related Operations:

CONDITION #11	Mining shall commence in the areas closest to the residences within the SW 12-44-25-W4. The area of active mining shall not exceed 20 acres at any given time with progressive reclamation as the project moves from one area to another. The area of active mining excludes the stockpile and truck loading area, and the processing and conveyor area. The maximum area where initial reclamation respecting mining is being performed shall not exceed 20 acres at any given time (where overburden is being placed from a new area of active mining). The area where medium or long term reclamation is being performed shall not exceed 60 acres at any given time (where overburden was placed in a prior calendar year). The Applicant shall provide related information (including a survey report by a licensed surveyor or other qualified professional acceptable to Ponoka County) in regards to areas of active mining and all reclamation to Ponoka County at the request of Ponoka Country.

CONDITION #12	This development permit includes the following maximum for accessory buildings, namely scales, a scale house, two (2) trailers, and two small buildings for lubricant and fuel storage. Any additional accessory buildings required for the Site shall require a separate development permit from Ponoka County.

CONDITION #13	Operations on Site shall not rely on generators, unless in an emergency situation where there is a failure of the connection from a utility service provider.

CONDITION #14	No asphalt plants shall be permitted on the Site without first obtaining a development permit from Ponoka County.

CONDITION #15	No portable structures, scales, equipment or parked vehicles etc. shall be located within the greater of the following setbacks (unless authorized by the Development Authority): a) 40 meters of the right of way of the nearest constructed road/highway/railway line or within 10 meters of the quarter lines unless otherwise relaxed; and

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	b) The setbacks shown on Figures 2 and 3 and described in Section 2.2 Structures and Setbacks of the Golder Operations Plan submitted to the Ponoka County SDAB as Exhibit 21. Any noise attenuation berm and/or wall may be located within the noted setbacks if authorized by the Development Authority.
CONDITION #16	The Site must be secured by perimeter fencing (6 foot chain link or temporary steel construction fence) along the following 3 areas: a) The active mining area; b) The processing area on the west side of the Site; and c) The stockpile/sale area on the northwest of the Site. The Applicant shall ensure that the lands are securely gated and locked when not in use by the Applicant.
CONDITION #17	The Applicant shall provide (and obtain approval of) a copy of the Emergency Response Plan for the Site prior to commencing extraction activity. The Emergency Response Plan shall be subject to the approval of the Regional Fire Chief.
CONDITION #18	The Applicant shall provide (and obtain approval of) a Fire Prevention and Protection Plan prior to commencing any extraction activity. The Fire Prevention and Protection Plan shall be subject to the approval of the Regional Fire Chief.
CONDITION #19	The Applicant shall ensure that there is appropriate lighting to the satisfaction of Ponoka County's Development Officer so as to provide security/safety. Lighting standards and fixtures shall be located and arranged so that no light is directed at residences on adjacent lands and so that it does not interfere with the effectiveness of any traffic control device.
CONDITION #20	The Applicant shall keep the area subject to the development permit in a clean and tidy condition, free from rubbish and non-aggregate debris. The Applicant shall remove all garbage, waste and recyclables from the lands and dispose of such materials in an approved disposal facility. The Applicant shall keep the lands in a clean and orderly manner, at the Applicant's own expense, including but not limited to, ensuring appropriate waste receptacles are located on the lands, that no garbage or waste is imported onto the lands, and that any trees that may be required to be removed from the excavation site are properly piled.
CONDITION #21	The Applicant shall supply, at the Applicant's own expense, portable commercially serviced toilets to be used on the lands during the entire term of the permit.

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CONDITION #22	Aggregate shall be moved across the Battle River by a covered conveyor bridge with no footprint within the river channel.

CONDITION #23	Aggregate shall be transported under Highway 2A through a tunnel by a covered conveyor to a loading site on the west side of Highway 2A.

CONDITION #24	A conveyor system shall be used to move aggregate within the pit. The system will have covered dropping points, with spray bars at those dropping points.

Storage/Hydrocarbons:

CONDITION #25	1. No highly explosive materials used for blasting will be used or stored on the Site. 2. No activity shall be allowed that would interfere or compromise the quality of any broadcast or communication system including, but not limited to, radio, television, internet, phone, and any wireless local area network in the area. 3. There shall be no offensive odour, heat, or glare noticeable at or beyond the boundary for the Site.

CONDITION #26	Only CSA-approved double walled fuel containment vaults shall be allowed on-site at any time.

CONDITION #27	Secondary containment, not less than 100% of the largest container, shall be provided to all areas where lubricating oil is stored on-site.

CONDITION #28	Vehicles will be properly maintained to reduce the potential for hydraulic fluids/fuel leaks or spills. Only biodegradable hydraulic fluids shall be used for vehicles or infrastructure within the pit, unless such fluids are not supported by manufacturer specifications.

CONDITION #29	The Applicant shall ensure that there is suitable disposal methods for liquid wastes generated on the site and that there shall be no hazardous liquids stored on the site (i.e. waste oils, glycol containers etc.). Waste oil shall be removed from the site as it is extracted and taken to an appropriate disposal facility.

CONDITION #30	Any permanent refueling area shall ensure that the fuel is stored in a container that is surrounded by an impermeable secondary containment that is capable of containing the full volume of fuel that is stored in the tank (e.g.: a dyke lined with an

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	impermeable geomembrane or plastic containment tray). There shall be no servicing of vehicles in the pit, unless absolutely necessary.

CONDITION #31	Refuelling shall occur only in the following areas, namely a permanent refuelling area in: a) The active mining area (Phase I or Phase II as the case may be); b) The processing area on the west side of the Site; and c) The stockpile/sale site on the northwest of the Site.

Reclamation:

CONDITION #32	Unless these standards are modified by a provincial regulatory authority, the Applicant shall ensure that reclamation of the Site occurs as follows: a) All aspects of the extraction and reclamation operation take place in full compliance with any requirements or recommendations contained within any professional's report submitted as part of this development permit or provincial approvals. b) If operations under the development permit are abandoned prior to the expiration of the development permit, the Applicant shall complete the reclamation of the Site within three (3) years of the abandonment of the operations on the Site. For the purposes of this condition, the operation of the use shall be deemed to be abandoned if the Applicant fails to haul aggregate from the Site for a period of more than one (1) year. c) Progressive reclamation techniques will be implemented as the mine sequence progresses. i. The Applicant will salvage all topsoil and replace evenly with an average depth of 0.15m. ii. If subsoil is encountered, it will be salvaged and replaced evenly throughout the Site. iii. Once reclamation is complete, there will be four water body areas; • These water bodies will have side slopes of 5:1 both 1m above and 1m below the full water supply. The water bodies will collect the majority of the surface runoff within the pit boundaries • Phase 1 will drain into Water Body #1 and #2 • Phase 2 will drain into Water Body #3 and #4

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Development Agreement:

CONDITION #33	The Applicant shall enter into (prior to performing any site excavation) and comply with a development agreement pursuant to Section 650 of the *Municipal Government Act* with Ponoka County, if such agreement is deemed necessary by Ponoka County the agreement shall contain terms satisfactory to Ponoka County. Without limiting the generality of the foregoing, the development agreement may include: a) requirements relating to accesses to and from the Site; and b) paving or other upgrading to municipal roads (including Range Road 251 from the Junction of Highway #2A to the Menaik Road (Township Road 442)).

Road Use Agreement:

CONDITION #34	The Applicant shall enter into and comply with a Road Use Agreement with Ponoka County on terms satisfactory to Ponoka County if such agreement is deemed necessary by Ponoka County during the currency of the development permit. Note that Ponoka County may require the terms of the agreement to be amended from time to time. If Ponoka County does not require a Road Use Agreement initially it may require one at a later point during the currency of the development permit. These terms may include (without limiting the generality of the foregoing) the following requirements at the option of Ponoka County: a) All loads leaving the pit loading area must be tarped; b) All gravel trucks used in the operation of the pit are registered with the Alberta Sand & Gravel Association; c) Dust control measures and road maintenance; d) Financial security requirements; e) Hours of operation for hauling; f) Haul routes; g) Maximum truck numbers and volume; h) The haul route may be amended from time to time, when in the opinion of Ponoka County circumstances warrant the haul route to be amended; i) Restrictions on hauling in relation to school buses (for example, No gravel trucks shall enter or exit the Site when a school bus is within 300.0 m (984.25 ft.) of the access to the Site); j) The Applicant shall, prior to undertaking any work on County roads, obtain the consent of Ponoka County to do such work. This shall include but shall not be limited to the installation of signage on County road right-of-way's; k) The Applicant shall provide regular gravel truck counts to Ponoka County for every vehicle once every quarter, in a manner suitable to Ponoka County,

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	during the operation of the pit; l) The Applicant shall ensure that all trucks used in connection with the development are clearly marked as per the applicable federal, provincial, or municipal requirements; m) Noise mitigation measures; n) Prohibitions or restrictions respecting accessing the Site; o) Prohibitions respecting parking on any municipal road. In this regard, an on-site parking area shall be provided to accommodate all vehicles waiting to load materials (for example prohibitions respecting no trucks allowed to stage on RR 251 or any municipal road. Including that there must be no access into the loading area until 6:30 a.m. and no trucks shall leave the Site prior to 7:00 a.m.); p) The placement and location of any required signage. This may include emergency contact numbers to warn of possible Site or operational hazards and dangers such as but not limited to: prohibiting the use of engine retarder brakes; advising of the gravel haul in progress; advising of trucks turning; warning of open pit excavation).

Visual Mitigation:

CONDITION #35	The Applicant shall provide 4 berms and/or walls to address visual and noise mitigation as further described in these conditions.

Noise Mitigation:

CONDITION #36	The Applicant shall ensure that all operations at the Site, from the date that excavation of sand and gravel commences until completion of reclamation, meet or exceed the requirements of the following (the "Noise Standard") namely compliance with AER Directive 38, with measurements being at the Site boundary, subject to the following interpretations and modifications: a) Measurement shall be at the boundary of the Site, not the individual residential receptors that are beyond the Site. For clarity, the residence represented by Receptor R05 as referred to throughout the Noise Report need not meet the requirements of the Noise Standard; b) the Noise Standard applies to the operations within the Site and does not apply to noise emanating from the haul route; c) baseline testing may include mitigative measures such as berms and/or walls; d) the modelling for the Noise Standard may include the noise emanating from the existing feedlot within the site.

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	The Applicant shall install noise mitigative measures similar to the four (4) noise attenuation berms referenced in the Noise Report on p. 10 and in Figure 1. That said, the final design of these features shall be designed in accordance with the Noise Standard, and the final design is subject to the approval of the Development Authority. They may be designed to be a berm and/or wall. Each of these features (i.e. the berm and/or wall) shall be constructed prior to extraction of sand and gravel in the vicinity of the area where they are serving as noise attenuation. The Applicant shall be subject to submitting periodic reports to Ponoka County detailing compliance with the Noise Standard, as provided for in Condition 46.

CONDITION #37	The Applicant shall undertake additional noise mitigation measures satisfactory to the Development Officer, in order to ensure that noise does not unduly impact occupants of residences in the vicinity of the Site, including: a) avoiding unnecessary revving of engines and switch off equipment when not required; b) ensuring plant and vehicles are properly maintained, and regularly checking silencers and bearings to ensure noise is minimized; c) using rubber linings where possible in chutes and dumpers to reduce impact of noise; d) prohibiting the use of engine retarder brakes (both on the Site and when hauling off-site); e) enclosing pumps and crushers with sound absorbing blanket systems; f) positioning crushers behind stockpiles or in low lying areas (e.g. pit bottom) to provide acoustic screening; g) installing and maintaining muffler systems on engine-driven equipment (e.g., trucks, dozers, shovels); h) restricting pit operations to the daytime period (e.g., between 7:00 a.m. and 7:00 p.m.); i) processing/crushing infrastructure shall only be located in the processing/crushing area along the western boundary of the Site, and out of view from the public; and j) other measures as required to ensure compliance with AER Directive 038 at the perimeter of the Site.

Air Quality:

CONDITION #38	The Applicant shall ensure that all operations at the Site, meet or exceed the requirements of the following (the "Air Quality Standard") at the boundary of the Site, namely compliance with the Alberta Ambient Air Quality Objectives ("AAAQO")

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for three different compounds: total suspended particulate matter ("TSP"), fine particulate matter less than 2.5 microns aerodynamic diameter ("$PM_{2.5}$") and nitrogen dioxide ("NO_2") (i.e. the concentrations shall be at or below the thresholds referenced in the following table, subject to the following interpretations and modifications:

a) Level - The acceptable concentration of these compounds at ground level is as set-out in the AAAQO and is provided in Table 1 below:

Compound	Averaging Period	Accepted AAAQO Concentration [$\mu g/m^3$]
TSP	24-hour	100
	Annual	60
$PM_{2.5}$	24-hour	29
NO_2	1-hour	300
	Annual	45

$\mu g/m^3$ = micrograms per cubic metre
Table 1: Alberta Ambient Air Quality Objectives Thresholds

b) Standard - The levels shall meet the AAAQO thresholds (not some other standard);
c) Period - The averaging period shall be as set out in the above table;
d) Location - The modelling and measurement shall be measured at the boundary of the Site, not at the location of individual residences that are the receptors. For clarity, any residence within the boundary of the Site need not meet the requirements of the Air Quality Standard.

The Applicant shall ensure that continuous ground level monitoring of $PM_{2.5}$ take place at the perimeter of the Site to ensure concentration levels are at or below the AAAQO threshold. Passive, but ongoing ground level NO_2 monitoring (for a 30 day period) is also required at the perimeter of the Site to ensure concentration levels are at or below the AAAQO thresholds. Should a complaint be tabled, at the discretion of the Development Officer, a monitoring system for TSP may be required.

The Applicant shall also ensure that all extraction activities be carried out so as to mitigate the negative impacts to air quality to the satisfaction of the Development Officer. These measures shall include the following:
a) routine road watering (season appropriate) of dry roads within the Site;
b) wet pit excavation (season appropriate);

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	c) installation of spray bars at crushers and conveyor transfer points where dust generation is anticipated (season appropriate); d) shrouding where spray bars are insufficient; and e) installation of a texas gate with integrated spray bars (season appropriate) at the truck exit to Range Road 251. Results from the air quality monitoring program will be submitted to Ponoka County to make available for public access as indicated below.

Complaints:

CONDITION #39	If Ponoka County receives complaints relating to air quality or noise, Ponoka County through its Development Officer may request the Applicant to provide a third party study of Ponoka County's choice (at the Applicant's expense) on operations and additional mitigative measures that could be taken to improve air quality or reduce noise levels; Ponoka County may during the currency of the development permit impose additional recommended requirements for these mitigative measures which shall be complied with by the Applicant within the timeframe imposed by the County.

CONDITION #40	If an affected party has a complaint relating to the Applicant's operations under this Development Permit, the affected party shall submit a written (or email) complaint concurrently to: The Applicant: VCD Aggregates and The County's Development Officer At the following addresses: VCD Aggregates Ltd. #2 – 53050 RR 220 ARDROSSAN, Alberta T8E 2C7 Ponoka County Development Officer 4205 Hwy #2A PONOKA, Alberta T4J 1V9

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Surface Water:

CONDITION #41	The Applicant shall ensure that the development does not cause any adverse draining impact on adjacent property or flooding of nearby ditches in excess of their capabilities.

CONDITION #42	Any required *Water Act* approvals must be obtained prior to any excavation or soil disturbance on the site.

CONDITION #43	Alberta's *Water Act* requires that an approval and/or license be obtained before undertaking a construction activity in a waterbody or before diverting and using water (surface water and groundwater). It is the Applicant's responsibility to contact Alberta Environment to ensure that the development complies. Call (403)340-7052.

CONDITION #44	All portions of the Site that will not be excavated shall be landscaped in a manner that all surface run off is contained onsite, unless *Water Act* approval has been granted stating otherwise. Portions of the site that will be excavated shall be landscaped in accordance with a reclamation plan. The reclamation plan shall detail how surface run-off will be managed.

Ground Water:

CONDITION #45	The Applicant shall be required to take reasonable steps, as determined by Ponoka County to ensure that the development does not cause any adverse groundwater impacts on adjacent existing water users, aquifers, or the natural environment. The Applicant shall provide a baseline study (to the satisfaction of Ponoka County's Development Officer) of all wells within 1,600m of the perimeter of the Site including water quantity and quality.

Access and Information:

CONDITION #46	The Applicant shall according to the frequency set out as follows supply a report to Ponoka County for review indicating: a) Compliance with the Noise Standard; b) Compliance with the Air Quality Standard; and

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	c) Compliance with the other requirements of this development permit including the progress of pit operations and a drawing showing current pit boundaries, stockpile locations, reclaimed areas and overall Site development status. During the first two years following the extraction of sand and gravel, the Applicant shall provide the Report on a quarterly basis (or more frequently on the County's request). After the first two years following the extraction of sand and gravel, the Applicant shall provide the Report on an annual basis (or more frequently on the County's request).

CONDITION #47	The Site including processing, reclamation or other areas involving related activities may be subject to inspection at any time deemed necessary by Ponoka County.

CONDITION #48	The Applicant shall provide Ponoka County (and its agents) with access to the lands and all records necessary and beneficial to satisfy Ponoka County that the Applicant has complied with this development permit, the terms and requirements of the Road Use Agreement, and the requirements of the Development Agreement, including without limiting the generality of the foregoing: a) All information that verifies the details in the aggregate shipped tonnage roll for the lands; and b) Tonnage of aggregate stockpiled on the lands or elsewhere; and tonnage of aggregate removed from the lands.

Other:

CONDITION #49	The Applicant shall ensure that weed and invasive species control measures are in place for the life of the pit, which shall be at the Applicant's sole expense. The Applicant shall work with Ponoka County's Manager of Agricultural Services and the land owners of the Site to develop and implement an active weed control program for the development.

CONDITION #50	The Applicant shall ensure that the lands are seeded, and vegetation maintained, where possible, or planted, at the Applicant's sole expense, as required by Ponoka County. The Applicant may work with Ponoka County's Manager of Agricultural Services and the land owners of the Site to develop and implement a seeding and vegetation program for the development.

CONDITION #51	It is the Applicant's responsibility to locate all underground utilities and rights-of-way prior to construction or excavation. Contact ALBERTA ONE-CALL at 1-800-242-3447 or online at http://www.alberta1call.com.

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This Permit is issued in compliance with the requirements of Ponoka County Land Use By-Law 07-08-LU. It is the permittees' responsibility to examine the Title in order to ascertain if a RESTRICTIVE COVENANT exists that would further restrict the type of construction or land use.

The Permittee is hereby authorized to proceed with the specified development providing that there is complete adherence to all of the above noted conditions. ~~Should an appeal be made against this decision to the Court of Appeal, this Permit shall be rendered NULL and VOID~~. **REMOVED**

Date of Issuance of Permit: ***November 18, 2019***

Signature of Chairman,
Subdivision & Development Appeal Board: _____
Paul McLauchlin

NOTES:

1. The issuance of a Permit in accordance with the Notice of Decision is subject to the condition that it does not become effective until 14 days after the date the order, decision or permit is issued.

2. This Permit is issued in accordance with the Notice of Decision and is valid for a period as set out in the conditions. If at the expiry of this period, the development has not been commenced or carried out with reasonable diligence, this Permit shall be NULL and VOID.

3. Any affected person may appeal this decision within 30 days of the issuance of the Permit, to the Court of Appeal on a question of law or jurisdiction, in accordance with Section 688 of *the Municipal Government Act*.

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Caitlyn T. Anderson

From: [redacted]
Sent: June 23, 2021 11:50 AM
To: Legislative Services Shared
Cc: [redacted]
Subject: [EXTERNAL] - BYLAW C-8073-2020: Letter of OPPOSITION (application PL20200066)

Do not open links or attachments unless sender and content are known.

To Legislative Services,

We, Bertrand Levesque and Julie Simard, owners of 17 acres property located at NW 15 TWP26 RGE 5 W of 5, OPPOSE the proposed BYLAW C-8073-2020 (application PL20200066) to facilitate aggregate extraction.

We are located on the north side of Highway 1A, uphill from the project area. We are X06 in the Burnco Proposed BYLAW documents.
The area around our property is farm land, acreages, all in a beautiful landscape, with the Rockies as a back drop.
We have worked very hard to be in a position to purchase our property and it represents our largest asset.
We enjoy our acreage surrounded by horses and country life.

We have reviewed the documents provided by Burnco and are left with deep concerns.
Our reasons to **OPPOSE BYLAW C-8073-2020** (application PL20200066) are numerous:

1- Very negative visual Impact: as we are overlooking the existing pit on Highway 1A, we already have first row seats to watch it progress towards the west until it ultimately reaches us (60m between the edge of our property and the edge of the Project). Our house and acreage being at higher elevation than the proposed project already allows us to see the present exploitation work with existing berms already in place (tops of piles are visible). We can be guaranteed of an even better view as it continues it's expansion through the years even with the 7m berm in place. Berms and trees are suppose to help but they would need to be in place to have a chance to work. The berms around the existing exploitation still have no trees and trees need time to gain significant height and width necessary to create a barrier for dust, noise and limit the visual impact.

2- Increase noise with trucking, crushing, machinery etc. Burnco has a crushing plant planned 350m from our property. According to the proposed plan, no full time monitoring until work is within 200m of an occupied residence… So pretty much no full time monitoring at all since we are the closest residence. Trucking is meant to increase to 28 tandem trucks per hour 6 days/week representing a much increased traffic for our road.

3- Deteriorating Air quality as we are immediately north west of the present and future exploitation areas along the Hwy 1A. We were shocked to see that the Air Quality model produced for the Burnco proposal shows PM2.5 levels above 25 for our location and 552 just across the road. These particles directly impact health of humans and animals. Of course the model is run with all berms in place. This will only be true at the final stage of the operations since Burnco plans to build the berms as they move west. This leaves us completely open to the operations as soon as they start Phase B. To add to this, Burnco presented no plans for full time air quality monitoring as long as the exploitation work is not within 200m of an occupied residence. This implies that as long as they are not actively working within D19 (across from us) there will be no monitoring although we will have been living in increased dust from the gravel pit for over 10-15 years! This is unacceptable!

4- Impacts on water all around us: impacts on our water well, the potential risk of increased flooding of the Beaupre Creek which passes through our property upstream from the proposed Burnco crossing and we can not forget the

impacts on the water of the Bow River with increased concentrations of constituents already seen from the present 151 ac West Burnco Pit. The proposed exploitation expansion of another 966.4 acres can only lead to much more pronounced increase of these constituents in the Bow River which will affect all downstream residents and municipalities of Cochrane and Calgary and beyond.

5- Impacts on wildlife… we are blessed with a varied and healthy wildlife around us particularly along the Beaupre Creek. Gravel exploitation from both the east and west bank will be very detrimental to all. Just last week I witnessed a Great Blue Heron by the creek just east of our house! Over the past 7 years we have lived here, we observed coyotes, bears, cougars, elks, deers, fox, owls, herons, eagles, osprey and so many other varieties of birds. The required setback from the creek will not change the fact that the Beaupre Creek will be a small island of vegetation surrounded by a large gravel operation running 24/7. It will not protect any current and future wildlife which inhabits this area.

6- **Negative Impact on adjacent/nearby Property Value**. This is of extreme concern to us since Burnco does not address the impact of their operation on the market value of neighboring properties. The issue is not even acknowledged.

> Obviously, we are not the first property owners having to deal with such situation and many studies were done on this topic here in Canada and in the USA. Whenever a gravel pit, a mine or other industrial operation moves into a neighborhood, neighboring properties suffer a loss in resale value. This can be observed many kms away from the operation. The loss of value is noticeable as soon as the project is publicly known, well ahead of the arrival of the machinery and is measurable only if the properties are sold. In extreme situations, the impact on the property can be so severe that the property becomes un-sellable but unrecorded loss (no sell price data).
>
> Furthermore, there is a direct relationship between the Property Value Decrease and its distance to the operation. In other words, the closer the property is to the pit, the greater the negative impact to its value. Our Property is located **60m** from the North West corner of the planned project area. Reported Property Value Decrease in such close proximity to operations range from **30 to 40%**. How are we supposed to absorb a $300,000-$400,000 loss?
>
> Why should we, as adjacent landowners, have to suffer significant financial losses in order for Burnco to expand and prosper? We firmly believe that Burnco should be made fully responsible and have full mitigation/resolution plans for each impact, including and most importantly, the financial impact to neighboring property values

At the West Cochrane location, Burnco has the “benefit” of having very few neighbors to deal with, essentially only a handful of people opposing their plan and who can easily be dismissed. We may represent a smaller deterrent for Burnco but we stand to be 100% affected by them, financially as well as having to live with the direct impacts on our environment for the rest of our lives (we are already too old to see the end of the operations). Yet, we find ourselves having very little recourse to protect us.

If you took a few minutes to truly put yourself in our shoes (or in our house), you would be filled with disbelief, helplessness, anger and panic as this Burnco train coming full speed ahead with apparently no one to slow them down. The life long savings you put into your property are now being seriously threatened and you are easily dismissed by the company responsible. You are being told not to worry, trees will be planted… and you will see no change in your property value!
These are lies! Any realtor looking after their buyers interest will recommend to avoid buying a property next to a gravel pit whether existant or proposed. This is a no brainer and no one will argue on that.
We are facing our biggest single financial loss, having to reconsider retirement plans because of Burnco’s imposition around us. It is time for companies to be held fully accountable for the impacts of their business.

In summary, we find the proposed mitigation plans to be insufficient and also late in their execution to truly mitigate the impacts on water, noise, air, wildlife and view. We also fail to see why such a large area should be considered for land use redesignation at once. Small
And above all, that no efforts are made to alleviate the imposed financial burden this will cause us.

We fully OPPOSE BYLAW C-8073-2020

Regards,

Bertrand Levesque and Julie Simard

Fish & Habitat Concerns from Burnco's Proposed West Cochrane Gravel Mine

David W. Mayhood

FWR
Freshwater Research Limited

Technical Note No. 2021/06-1

June 2021

Cover photo: Grand Valley Creek as seen from the top of the culvert at Highway 1A, looking downstream, 18 June 2021, showing the fractured bedrock beneath overburden to be mined at the subject pit.

Fish & Habitat Concerns from Burnco's Proposed West Cochrane Gravel Mine

David W. Mayhood

Prepared on behalf of

Ann McNabb
Cochrane, AB

for

Rocky View County Council
Rocky View, Alberta

FWR Technical Note No. 2021/06-1
June 2021

FWR
Freshwater Research Limited

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Summary

Burnco Rock Products Ltd. proposes to mine for aggregate across 4.52 km^2 of land extending in two blocks for a total distance of approximately 6-7 km along, and south of, Highway 1A to the Bow River west of Cochrane, Alberta. The principal watercourses to be affected are the Bow River mainstem; its tributaries Beaupre Creek and Grand Valley Creek; and local springs. There are several springs draining groundwater from the proposed mine site to the tributary watercourses and the Bow River. Data on the aquatic habitats and fish populations in the affected watercourses are sparse to non-existent, but it is known that the Bow River above Calgary holds 19 species of fish, of which 9 are sportfish. Many species of fish favour habitats influenced by groundwater discharges into streams for temperature regulation, spawning, egg incubation, juvenile rearing, overwintering, and refuge from other adverse conditions.

Here I comment on the implications for fish and their habitats of a soil flushing experiment conducted by professional hydrogeologist and geochemist Dr. Jon Fennell on a representative sample of the soil to be disturbed by the mining operation. I make additional comments on some other aspects of the proposed mine as they occurred to me in reviewing the available documentation.

Dr. Fennell's experiment is a reasonable attempt to evaluate, at a preliminary level, the likely consequences to groundwater quality of natural precipitation draining through the disturbed above-bedrock deposits in the area to be mined. Dr. Fennell reported one physical characteristic and several chemical constituents in the soil flush effluent that exceeded, and sometimes far exceeded, various regulatory criteria, and so are of concern if they were to reach open-water aquatic habitats and springs via the groundwater system.

It is important to understand that these concerns are not significantly reduced by the dilution power of the receiving watercourses if fish or other organisms are using those sites preferentially, as several species are likely to do. Dilution is not even a viable solution to contaminant releases under prevailing regulations.

Some of the potential problems posed by the elevated parameters are as follows. Several contaminants can bioaccumulate, so may amplify through food webs throughout the aquatic domain and even into terrestrial systems.

Turbidity from the experiment effluent water exceeded maximum criteria for the protection of fish and wildlife by 800 to more than 2000 times. Turbidity in this case would have been due to **total suspended solids** almost entirely, and the turbidity levels measured were likely comparable to 1100 to 2800 mg/L of total suspended solids, as a rough estimate. In the field, we should expect these high levels to be persistent over weeks and months, possibly longer. Suspended solids that high and persistent are capable of causing up to 100% mortality of trout eggs and larvae. Adult and juvenile trout would be expected to avoid locations so affected, which leads to the question whether there is suitable alternative habitat for them nearby. Burnco's document provides no data to address this issue, a serious deficiency.

Total Arsenic in effluent water exceeded guidelines for aquatic life by 1.8 to 3.8 times.

Total Cadmium in effluent water exceeded guidelines for aquatic life by 1.3 to 1.6 times.

Total Chromium in effluent water exceeded guidelines for aquatic life by 13 to 20 times, if all in the hexavalent form, or 1.5 to 2.2 times, if all in the trivalent form.

Total Cobalt in effluent water exceeded guidelines for aquatic life by 4.7 to 6.3 times.

Total Lead in effluent water equaled or slightly exceeded guidelines for aquatic life.

Total Zinc in effluent water exceeded guidelines for aquatic life by 2.4 to 4 times.

Synergistic effects, in which the toxicity of these and other individual constituents affect the toxicity of each other, are possible, even likely, and need to be assessed to fully understand the risk posed by this proposed development.

Fish move around among the habitats critical for completing their life history. They use different kinds of habitat at different times and life stages. To understand how any disturbance, such as this gravel mine, might affect fish populations, it is essential to understand if, how and when local populations use the emergent groundwater habitat that might be affected by the gravel pit disturbance. Burnco has made no attempt to do this.

Gravel extraction sites are surface mines. Large mines disturb large areas, so roughly speaking, they inevitably impact the local environment more or less in proportion to their size. This proposed aggregate mine is quite large and close to sensitive aquatic receptors, so it needs to be evaluated accordingly.

Burnco's two-paragraph fish and aquatic habitat survey was performed with minimal effort and attention to the risks in question and was not designed for, or capable of, identifying the aquatic biological communities at groundwater discharge sites, or their uses by fishes. Dr. Fennell's simple experiment shows that serious contamination problems from Burnco's gravel mine are possible and could affect any Bow River fish populations that rely upon groundwater discharge habitats in the vicinity of the proposed development. These issues need to be properly evaluated in a thorough environmental assessment of Burnco's desired gravel extraction activities.

Contents

Introduction

Burnco Rock Products Ltd. proposes to mine for aggregate across 4.52 km^2 of land extending in two blocks for a total distance of approximately 6-7 km along, and south of, Highway 1A to the Bow River west of Cochrane, Alberta (Burnco 2020). Hydrogeologist and geochemist Dr. Jon Fennell conducted an experimental test to assess the possible physical and chemical changes that may occur to precipitation flowing through these sediments after being disturbed, and entering the local groundwater, as will occur as a result of mining (Fennell (2021). In a 15 June email I was asked by Ann McNabb of Cochrane to comment on the findings and their implications for fishes and their habitats, if any, and more generally on any other possible effects of the proposed gravel mine that I noticed in Burnco's documentation. I agreed to do so in a very limited way due to the short notice, on 16 June.

Here I comment on the potential effects on local fishes and their habitats of Dr. Fennell's findings, based on a reading of his report (Fennell 2021), Burnco's master site development plan (Burnco 2020, as revised May 2021), my understanding of the effects of groundwater contamination, the biology of Alberta's fishes, and my reading of relevant scientific literature. I understand that Burnco has produced a voluminous supporting document of some 1800 pages in hard copy, which I could not find on the Rocky View County website, and which was not available to me on short notice.

I am an aquatic ecologist with an M.Sc. and 54 years of experience working on the ecology of the inland waters of western Canada, with emphasis on the fishes, other aquatic organisms, and their habitats of the Eastern Slopes of the Rocky Mountains in Alberta. My curriculum vitae is attached hereto.

Study Area

The site in question lies within the land description described in Burnco (2020:1), and is mapped in various ways throughout that document. The Bow River mainstem borders the site on the south, and two named tributaries, Beaupre and Grand Valley creeks (cover photo), are incised into the site in the west and centre-east, respectively. Several smaller unnamed watercourses cross or drain the property along its length, emptying primarily into the Bow River, with some emptying into Beaupre and Grand Valley creeks.

I searched Alberta Environment and Parks' online database (Alberta FWMIS, FWIMT) for recent fish inventories, but found none in either named creek within the study area as of 17 June 2021. I could find no recent site-specific fish occurrences within the study area reach of the Bow River in the same database on the same date. Burnco (2020:12) did not report finding any fish in the named creeks or three other unnamed watercourses from a survey they conducted 8 November 2018. They noted that there were no impediments or barriers to fish migration to their confluences with the Bow River. The two most easterly watercourses they visited did not provide fish habitat. Burnco (2020) did not provide any information as to fish or fish habitat in the Bow River.

The most current summarized information available on the fishes occupying the Bow River above Calgary was extracted from Henderson and Peter (1969) by Culp et al. (1992). I believe it reasonably represents the Bow River fauna in the vicinity of the Burnco proposed gravel mine site (Table 1). Of the 19 species listed, nine are considered sportfish species. Several of the remainder are often abundant and therefore must play a large role in the ecology of the river. One, bull trout, is threatened under Canada's *Species at Risk Act*, but is believed to be functionally extirpated in the river below this point (Bighill Springs reach), and at very high risk of extirpation-likely unrecoverable above it in the Ghost Reservoir reach (DFO 2020).

Table 1. Species of fish known to occur in the Bow River above Calgary. Extracted from Henderson and Peter (1969) by Culp *et al.* (1992).

Species name	Common name
Oncorhynchus clarkii	cutthroat trout
Oncorhynchus mykiss	rainbow trout
Salvelinus fontinalis	brook trout
Salvelinus confluentus	bull trout
Salvelinus namaycush	lake trout
Salmo trutta	brown trout
Prosopium williamsoni	mountain whitefish
Esox lucius	northern pike
Lota lota	burbot
Catostomus catostomus	longnose sucker
Catostomus platyrhynchus	mountain sucker
Catostomus commersonii	white sucker
Culaea inconstans	brook stickleback
Couesius plumbeus	lake chub
Rhinichthys cataractae	longnose dace
Cottus ricei	spoonhead sculpin
Percopsis omiscomaycus	trout-perch
Semotilus margarita	pearl dace
Pimephales promelas	fathead minnow

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Contaminants in Disturbed Soil Water Effluent

In a laboratory experiment, Fennell (2021) assessed the possible physical and chemical changes that may occur to water (i.e. precipitation) flowing through the sediments in Burnco's proposed mining area and entering the local groundwater. In measurements of numerous parameters, he found one physical characteristic and several chemical constituents in the soil flush effluent that exceeded, and sometimes far exceeded, various regulatory criteria, and so are of concern if they were to reach open-water aquatic habitats and springs via the groundwater system.

Turbidity from the experimental effluent water exceeded maximum criteria for the protection of fish and wildlife (Government of Alberta 2018) by 800 to more than 2000 times. Turbidity in this case would have been due to total suspended solids almost entirely, and the turbidity levels measured were likely comparable to 1100 to 2800 mg/L of total suspended solids, as a rough estimate (D. Mayhood, unpublished data). In the field, we should expect these high levels to persist over weeks and months, possibly longer. Suspended solids that high and persistent are capable of causing up to 100% mortality of trout eggs and larvae (Newcombe and Jensen 1996). Adult and juvenile trout would be expected to avoid locations so affected, which leads to the question whether there is suitable alternative habitat for them nearby. Burnco's document provides no data to address this issue.

Several metals and a metalloid exceeded guidelines for protection of aquatic life (Government of Alberta 2018). Here are a few examples.

Total Arsenic in effluent water exceeded guidelines for aquatic life by 1.8 to 3.8 times.

Total Cadmium in effluent water exceeded guidelines for aquatic life by 1.3 to 1.6 times.

Total Chromium in effluent water exceeded guidelines for aquatic life by 13 to 20 times, if all in the hexavalent form, or 1.5 to 2.2 times, if all in the trivalent form.

Total Cobalt in effluent water exceeded guidelines for aquatic life by 4.7 to 6.3 times.

Total Lead in effluent water equaled or slightly exceeded guidelines for aquatic life.

Total Zinc in effluent water exceeded guidelines for aquatic life by 2.4 to 4 times.

All of these elements are toxic to fish, and all bioaccumulate (Chu and Chow 2002, Sevcikova *et al* 2011). For those that survive, the fish may be turned into toxic time bombs that, if consumed by predators, will spread the toxin further into aquatic and terrestrial food webs at even higher concentrations. Synergistic effects, in which the toxicity of these and other individual constituents affect the toxicity of each other, are possible, even likely (Bae *et al*. 2001), and need to be assessed to fully understand the risk posed by this proposed development.

Fishes and Habitat Use

Many species of fish favour habitats influenced by springs and groundwater discharges into streams for temperature regulation, spawning, egg incubation, juvenile rearing, overwintering, and refuge from other adverse conditions (Cunjak and Power 1986, Power *et al*. 1999, Hitt *et al*. 2017). They will often migrate long distances to take advantage of groundwater. Springs can even be important in establishing genetic differentiation within populations, as shown by rainbow trout in Fall River, California, where certain groups favour specific springs and are evolving different genetic characteristics (Ali *et al*. 2016).

Some of the species of fish occupying the Bow River in the reach affected by Burnco's proposed mine (Table 1) are likely to be essentially sedentary, travelling very little throughout their lifetime. Examples of this group likely include stickleback (Jiang *et al*. 2015) and sculpins (Veillard 2016), that probably remain within a few tens of metres or less of one location. Other small fishes, such as lake chub, are known to move up to 3 km to spawn (Brown *et al*. 1970). Some of the larger species, however, are well-known to travel long distances throughout their lifetimes in riverine habitats, such as white and longnose suckers, and mountain whitefish.

These differences in mobility mean that impacts to use of instream groundwater discharge and springs will affect species differently. Migratory fishes that use such sites near the proposed Burnco mine site, if they become contaminated with elements from the pit, could carry them upstream as far as the Ghost Dam or as far downstream as Bearspaw Dam, spreading the contamination over a large area as they die or enter the food web of predators. On the other hand, they may be less likely to become contaminated if they use the Burnco groundwater discharge sites for only relatively brief periods. In contrast, the less mobile species are at particular risk of contamination if they occupy groundwater discharge sites carrying pollutants from Burnco's pit, and could build up higher concentrations as a result. Finally, all fishes might be displaced from these discharge sites.

Given the great importance of springs and instream groundwater discharge sites to fish, Burnco (2020) should have surveyed springs and groundwater sites, and should have considered the effects from any disruptions to them caused by the proposed aggregate mining operation. At present, it is just not possible to make even an informed guess as to the effects of the proposed mine site on fishes in the Bow River and its tributaries. We simply don't know what fish species use the groundwater discharge sites, if they use them at all, or anything at all about the importance of these sites for fish and how and when they use them.

Conclusion

Fish move around among the habitats critical for completing their life history (Schlosser 1991). They use different kinds of habitat at different times and life stages. To understand how any disturbance, such as this gravel mine, might affect fish populations, it is essential to understand if, how and when local populations use the emergent groundwater and spring

habitat that might be affected by the gravel pit disturbance. Burnco has made no attempt to do this.

Gravel extraction sites are surface mines. Surface mines disturb large areas, so roughly speaking, they inevitably impact the local environment more or less in proportion to their size. This proposed aggregate mine is quite large and close to sensitive aquatic receptors, so it needs to be evaluated accordingly.

Burnco's two-paragraph fish and aquatic habitat survey was performed with minimal effort and attention to the risks in question and was not designed for, or capable of, identifying the aquatic biological communities at groundwater discharge sites, or their uses by fishes. Dr. Fennell's simple experiment shows that serious contamination problems from Burnco's gravel mine are possible and could affect any Bow River fish populations that rely upon instream groundwater discharge habitats or springs in the vicinity of the proposed development. These issues need to be properly evaluated in a thorough environmental assessment of Burnco's desired gravel extraction activities.

Acknowledgements

Jon Fennell provided helpful comments and corrections on an earlier summary of this technical note.

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Henderson, N. E., and R. E. Peter. 1969. Distribution of fishes of southern Alberta. Journal of the Fisheries Research Board of Canada 26:325-338.

Hitt, N. P., E. L. Snook, and D. L. Massie. 2017. Brook trout use of thermal refugia and foraging habitat influenced by brown trout. Canadian Journal of Fisheries and Aquatic Sciences 74:406-418. doi:10.1139/cjfas-2016-0255

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Power, G., R. S. Brown, and J. G. Imhof. 1999. Groundwater and fish—insights from northern North America. Hydrological Processes 13:401-422.

Schlosser, I. J. 1991. Stream fish ecology: a landscape perspective. BioScience 41:704-712. doi:10.2307/1311765

Sevcikova, M., H. Modra, A. Slaninova, and Z. Svobodova. 2011. Metals as a cause of oxidative stress in fish: a review. Veterinarni Medicina 56:537-546.

Veillard, M. F. 2016. Investigating fine-scale movement patterns and comparative swimming performance of the newly identified and threatened Rocky Mountain sculpin (*Cottus* sp.) across its Canadian distribution. MSc thesis, Department of Renewable Resources, University of Alberta, Edmonton, AB. xv+81 p. https://bit.ly/3ivU5Te

Online

Alberta Fish and Wildlife Management Information System (FWMIS). https://www.alberta.ca/access-fwmis-data.aspx Access 17 June 2021.

Appendix: DW Mayhood Curriculum Vitae

FWR
Freshwater Research Limited

1213 - 20th Street NW, Calgary, Alberta, Canada T2N 2K5 +1.403.283.8865

David W. Mayhood

Aquatic Ecologist

dmayhood@fwresearch.ca
https://www.fwresearch.ca

Education

M.Sc. Limnology 1978, University of Calgary

B.Sc. Honours Zoology 1969, University of Calgary

Graduate research projects: Production of trout and their food supplies in Alberta mountain lakes (thesis research); population dynamics of the zooplankton organism *Leptodiaptomus sicilis* in four mountain lakes

Continuing Professional Development, Specialized Courses

Wildland Hydrology Silva Forest Foundation, Slocan Park, British Columbia 1994

Professional Experience

since 1981: Principal & President, FWR Freshwater Research Limited, Calgary

1979-1981: Senior Biologist, Aquatic Environments Limited, Calgary

1974-1978: Contract Biologist, Canadian Wildlife Service/Parks Canada (Banff National Park), Calgary, and graduate work, University of Calgary

1970-1973: Fisheries Technician & Project Biologist, Canadian Wildlife Service/Parks Canada, Calgary

1967-1969: Summer Research Assistant, Fisheries Research Board of Canada (Experimental Lakes Area, NW Ontario); Canadian Wildlife Service/Parks Canada, Calgary

Professional Memberships & Affiliations

American Association for the Advancement of Science, American Fisheries Society, Ecological Society of America, International Society of Limnology, Society for Freshwater Science, Society for Conservation Biology, Society of Canadian Limnologists, Canadian Society of Zoologists

FWR
Freshwater Research Limited

Honours

Wilderness Defender Award, Alberta Wilderness Association, 23 November 2018.

https://albertawilderness.ca/about-us/alberta-wilderness-defenders-awards/

https://albertawilderness.ca/wp-content/uploads/2018/10/20180900_archive_awa_wla-1.pdf

Areas of Special Interest

- Ecology and conservation biology of western Canadian fishes, with emphasis on mountain trout
- Ecology and natural history of mountain lakes, streams and their watersheds
- Zoogeography and ecology of fishes, zooplankton and benthic invertebrates in lakes and streams of western Canada
- Aquatic biomonitoring and impacts of pipelines, oil & gas wells, roads, railways, strip mines, extraction plants, dams and agriculture on freshwater ecosystems

Representative Projects

Current Project: Alberta Wilderness Association, funded by Bow River Basin Council

Independent researcher: Sediment loading to selected streams in the McLean Creek ATV area. With University of Calgary Environmental Science student Logan Boyer, identifying the principal sources of total suspended sediment (TSS) to Elbow River tributaries Silvester, McLean, Quirk, and Connop creeks; assessing the relative importance of each to sediment loading and fish habitat in those creeks; quantifying the TSS loading to the Elbow River from the creeks, and to the total TSS load in the Elbow River.

Alberta Sustainable Resource Development, Fisheries & Oceans Canada

Consulting Biologist: contributed 2 reviews as background references to the provincial recovery plan for threatened westslope cutthroat trout; coauthored background paper and recovery potential assessment for federal recovery program; developed reference parameters for headwater stream stocks of native cutthroat trout; contributed a conceptual framework and guidelines for westslope cutthroat trout recovery in Alberta

Watershed analysis 1996-present — various clients

Consulting Biologist: Analyzed ecosystem risks in 105 small watersheds in southwestern Alberta; recommended changes in land use and management to correct identified problems.

Yellowstone to Yukon Conservation Initiative

Consulting Biologist: Compiled information and prepared a technical report on the distribution and conservation status of the fishes of the Y2Y biogeographic region.

Canadian Parks Service, Banff & Jasper National Parks

Consulting Biologist: in-depth review and analysis of the regulatory and conceptual background for fish conservation and management in Canadian national parks; survey of fish conservation and management in North American parks and reserves; analysis of the origin, history and status of native fish stocks of JNP and BNP; draft of a fish management plan for JNP based on these studies.

Canadian Wildlife Service/Parks Canada

Project Biologist: eight years of research and management work on aquatic ecology and fisheries in the national parks of western Canada

- 3-year biophysical survey of lakes, streams and fish populations in the Lake Louise area of Banff National Park, Alberta, including habitat morphometry and hydrology, water chemistry, planktonic primary productivity (radiocarbon studies), zooplankton, benthic invertebrates, macrophytes, fish, estimates of fish food organism production, estimates of potential trout production based on the food supply; developed a fisheries management plan based on the estimates.
- 2-year biophysical survey of lakes and streams in southern Prince Albert National Park, Saskatchewan
- fishery management activities in the prairie national parks over a five-year period as a fisheries technician and biologist, including trapping, spawn-taking, marking, field hatchery operations, fry planting, population monitoring and analysis, creel census operation and analysis, and program evaluation

Clients: Denison Mines Ltd., Petro-Canada

Biologist & Project Biologist: baseline studies of Rocky Mountain streams in British Columbia's North-East Coal Block as a basis for assessing the potential impact of coal strip mining on fish and their habitats

Client: Canadian Hunter Exploration Limited

Project Biologist: baseline study of stream habitats and fish populations; assessment of potential impacts of gas pipeline construction on fish populations and fish habitat in the foothills region near Grande Prairie, Alberta; monitoring of stream crossings during installation.

***Clients:** Alberta Wilderness Association, Diamond Hitch Outfitters, Beaver Mines Area Landowners Group, Rocky Mountain Ecosystem Coalition, other NGOs*

Expert witness: testimony on fishes and their habitats in the Rocky Mountain and Plains ecoregions at 10 public hearings on feedlot, pipeline, well licence, coal mine and dam applications before federal and provincial regulatory boards.

Ongoing Self-directed Studies

Studies of sediment delivery from roads and off-highway vehicle trails, chemistry of mountain waters, mountain stream temperatures, trout growth in mountain lakes, native cutthroat trout, mountain spring fauna

Specialized Analytical Services

- expert identification and sample analysis services on fish, benthic invertebrates and zooplankton organisms from throughout northwestern North America — numerous contracts with Environment Canada, Alberta Environment, Alberta Forestry, Lands and Wildlife, and several environmental consulting companies.
- computerized statistical analysis of salary data, analysis of student distribution data for the University of Calgary Faculty Association

Teaching

University of Calgary

Environmental Sciences Program

Supervised Students

- Logan Boyer: Environmental Science 505; **Road and off-highway vehicle trail total surface erosion and sediment delivery into McLean Creek assessed using the WEPP:Road model**. Research Project in Environmental Science, Environmental Sciences Program, University of Calgary, Calgary, AB. 2017 Fall Term
- Caitlin Gifford: Environmental Science 504; **Natural individual markings for studying fall movements, habitat use and population size in threatened westslope cutthroat trout,** *Oncorhynchus clarkii lewisi*. ENSC 504 Research Project in Environmental Science (unpublished), Environmental Sciences Program, University of Calgary, Calgary, AB. iii+20 p. 2010/2011 Fall/Winter Term. Parts of this work were published by Gifford & Mayhood (2014).
- Heidi Erdle: Environmental Science 504; **Effects of ATV use, cattle grazing, logging and petroleum development on westslope cutthroat trout** (*Oncorhynchus clarkii lewisi*) **habitat in an Alberta foothills stream**. ENSC 504 Research Project

in Environmental Science (unpublished), Environmental Sciences Program, University of Calgary, Calgary, AB. iii+35 p. 2010/2011 Fall/Winter Term

Environmental Science 401 - Environmental Science Field Course

- August & September 2018: assisted students on stream ecology field course

Environmental Science 401 - Environmental Science Field Course

- September 2017: advised students on stream ecology and trout habitat

Environmental Science 401 - Environmental Science Field Course

- September 2015: advised students on stream ecology and trout habitat

Environmental Science 502 - Special Problems in Environmental Management, Guest lectures

- November 2011: *Green Science in a brown world: Interpretation hazard in value-based science*
- February 2011: *Bullshit in environmental science* An application of Harry Frankfurt's 2005 philosophical analysis to the field (Frankfurt, H. 2005. On bullshit. Princeton University Press, Princeton, NJ. 67 p.)
- January 2010: *Atmospheric, aquatic and terrestrial waste disposal: Issues for inland fish populations*
- November 2007: *Fish population loss, habitat damage and watershed degradation in southwestern Alberta, 1885 - 2007*
- December 2006: *Degradation of fish populations and their habitats in southwestern Alberta, 1885 - 2006*

Department of Biology

Biology 200 - Introductory Biology

1969: Teaching Assistant

Mount Royal College, Calgary

Department of Chemical, Biological and Environmental Sciences

Biology 1219 - Limnology

September to December 1989: As a sabbatical replacement instructor, developed, prepared and taught a credit lecture and field/laboratory course (6 hours weekly) required for the college's 2-year diploma in Environmental Technology/Water Pollution Studies.

various dates, 1988-96: guest lectures, lab and field instruction in aquatic ecology

Southern Alberta Institute of Technology, Calgary

Guest lectures on watershed ecology to Environmental Technology students

- December 2008, November 2009: *Some effects of human development on watersheds: Problems and solutions*

Related Volunteer Activities

- Timberwolf Wilderness Society founding director, 2012 - present; President 2018-2019; Director 2019-2021
- Rocky Mountain Ecosystem Coalition founding director and treasurer, 1993 - 1999
- Alberta Wilderness Association Director 1991-92, 1978-79
- Organizer, Wild Rivers Forum, Alberta Wilderness Association Provincial Conference 1978
- Alternate Member, Public Advisory Committee of the Environment Council of Alberta 1978-79
- donated professional services (e.g., technical studies and advice, written and oral technical submissions to regulatory bodies, popular-style articles on fish conservation, computer consulting), various public interest groups including Timberwolf Wilderness Society, Friends of Mount Backus, Yellowstone to Yukon Conservation Initiative, Bragg Creek Environmental Coalition, Canadian Parks and Wilderness Society, Rocky Mountain Ecosystem Coalition, Alberta Wilderness Association, Speak Up for Wildlife Foundation, Trout Unlimited Canada and American Wildlands

Publications and Reports

Technical Publications (Peer-reviewed)

Fluker, S. C., and D. W. Mayhood. 2020. Environmental stewardship of public lands? The decline of westslope cutthroat trout along the eastern slopes of the Rocky Mountains in Alberta. Public Land & Resources Law Review 42:39-79. https://scholarship.law.umt.edu/plrlr/ Temprarily also available online at: https://www.researchgate.net/publication/342978970_Environmental_Stewardship_of_Public_Lands_The_Decline_of_Westslope_Cutthroat_Trout_along_the_Eastern_Slopes_of_the_Rocky_Mountains_in_Alberta

Mayhood, D.W., M. D. Sawyer and W. Haskins. 2004. Historical risk analysis of watershed disturbance in the southern east slopes region of Alberta, Canada, 1910-1996. Pages 23-29 *in* G.J. Scrimgeour, G. Eisler, B. McCulloch, U. Silins and M. Monita, editors. Forest-Land Fish Conference – Ecosystem Stewardship through Collaboration. Proceedings of the Forest-Land-Fish Conference II, 26-28 April 2004, Edmonton, Alberta. x+212 p. http://www.fwresearch.ca/Library.html

Sawyer, M. D. and D. W. Mayhood. 1998. Cumulative effects analysis of land-use in the Carbondale River catchment: implications for fish management. pp. 429-444 *in* M. K. Brewin and D. M. A. Monita, technical coordinators. Proceedings of the Forest-Fish Conference: land management practices affecting aquatic ecosystems, Calgary, AB, May 1-4, 1996. Canadian Forest Service, Northern Forest Centre Information Report NOR-X-356, xiii+533 p. http://www.fwresearch.ca/Library.html

Mayhood, D. W. 1998. Is the greater ecosystem concept relevant for conserving the integrity of aquatic ecosystems in the Canadian Rocky Mountains? pp. 772-780. *in* Munro, N. W. P., and J. H. M. Willison, editors. Linking protected areas with working landscapes — conserving biodiversity. Science and Management of Protected Areas Association, Wolfville, NS. xvii + 1018 p. http://www.fwresearch.ca/Library.html

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Herzig, A., R. S. Anderson and D. W. Mayhood. 1980. Production and population dynamics of *Leptodiaptomus sicilis* in a mountain lake in Alberta, Canada. Holarctic Ecology (now Ecography) 3:50-63. doi: 10.1111/j.1600-0587.1980.tb00708.x

Technical Publications (not peer-reviewed)

Mayhood, D. W. 2020. The proposed Grassy Mountain Coal Mine: Effects on trout populations & their critical habitats. Report prepared on behalf of Timberwolf Wilderness Society for submission to Joint Impact Assessment Panel for the Grassy Mountain Mine. Canadian Impact Assessment Agency & Alberta Energy Regulator, FWR Technical Report No. 2020/09-1, Ottawa, ON & Calgary, AB. iv+31 p. https://ln2.sync.com/dl/9359ad130/svnyzuir-shumidvf-rcbr2dgf-9jerxvne

Mayhood, D. W. 2014. Guerrilla ecology: Toward an effective strategy for monitoring Alberta's trout streams in a hostile climate. pp. 316-322. in R. F. Carline, and C. LoSapio, editors. Wild Trout IX: Sustaining wild trout in a changing world. Wild Trout Symposium, Bozeman, MT. 392 p. http://www.wildtroutsymposium.com/proceedings-11.pdf

Gifford, C. M., and D. W. Mayhood. 2014. Natural marks for identifying individual fish in small populations of at-risk westslope cutthroat trout. pp. 275-281. *in* R. F. Carline, and C. LoSapio, editors. Wild Trout IX: Sustaining wild trout in a changing world. Wild Trout Symposium, Bozeman, MT. 392 p. http://www.wildtroutsymposium.com/proceedings-11.pdf

Cleator, H., J. Earle, L. Fitch, S. Humphries, M. Koops, K. Martin, D. Mayhood, S. Petry, C. Pacas, J. Stelfox, and D. Wig. 2009. Information relevant to a recovery potential assessment of pure native westslope cutthroat trout, Alberta population. Canadian Science Advisory Secretariat Research Document 2009/036. iv+24 p. Available from: http://www.dfo-mpo.gc.ca/csas/

Mayhood, D. W. 2007. Fishes of the Yellowstone to Yukon region. Technical Report No. 3, Yellowstone to Yukon Conservation Initiative, Canmore, AB. vi+39 p. Available from: http://www.y2y.net

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Caitlyn T. Anderson

From: [redacted]
Sent: June 22, 2021 7:23 AM
To: Legislative Services Shared
Subject: [EXTERNAL] - Bylaw C-8073-2020: Burnco West Cochrane Pit application
Attachments: Soil column experiment_JFennell_June 18_2021 Rev 1.pdf; Appendix 2_C130760V3R-R2021-05-31_15-07-08_R006-redacted.pdf; 2021-06-05 Exec Summary of scientific experiment by Dr. Jon Fennell.pdf

Respected Council Members;

My name is Dr. Jon Fennell. I am a professional hydrogeologist and geochemist registered with APEGA, and have been practicing for over 30 years (both locally and internationally). I was recently asked by a group of local landowners located near the proposed West Cochrane Pit to review Burnco's application. Specifically, I was asked to review the groundwater aspects of this proposed development and the risks to local water resources. Based on work done by Matrix in support of Burnco's application it is clear that Grand Valley Creek, Beaupre Creek, and the Bow River will be receiving entities to any contaminants released during and after this massive development. Although baseline work has been done to understand the groundwater quality pre-development, **nothing** has been done to assess the risk that stripping of the topsoil and removal of a large amount of gravel will pose to local water bodies and/or water wells.

The assumption that has consistently been made by many is that gravel extraction will not affect local groundwater quality to any degree. To test the validity of that assumption I was asked to perform an scientific experiment to mimic what might occur after a large thickness of the gravel deposit is removed from the area and a thin veneer is left above the fractured bedrock. I have attached a report I prepared for the group summarizing the results of that experiment, as well as the Certificate of Analysis from the contracted lab (Bureau Veritas), and an Executive Summary. I request that your read these documents – at least the short 1-page Executive Summary prepared by the group.

To summarize through, after flowing laboratory-grade, filtered and purified deionized water through a 1.2m soil column (to mimic snowmelt and rainfall infiltrating through a thin veneer of remaining gravel) the results were not consistent with assumption that minimal change will occur. In fact the water contained:

- high levels of turbidity (over 500 times higher than expected background) and
- concentrations of harmful trace elements like arsenic, chromium, and lead (among other things) well in excess of Alberta's guidelines to protect freshwater aquatic life as well as drinking water.

This compromised water would be flowing into fractured bedrock with limited ability to filter out these contaminant before they reached a receptor like Grand Valley Creek, or the Bow River. The concern here, as it is with all gravel pits, is that this aspect has never really been studied before, yet the results are striking and should give cause for concern.

Considering the scale of this development and the proximity to local creeks and the Bow River (that support critical habitat for fish species and provide drinking water for downstream communities) a proper risk assessment should have been conducted by the applicant. Unfortunately, this was **not** done. And this now places the RVC council members in a disadvantaged position. Having to make a land use decision like this, that will permanently alter the landscape along a picturesque highway and place the environment at risk with less than all the facts is, frankly, unacceptable. And given the results of the soil column experiment, which is **direct evidence** that mobilization of harmful contaminants **is possible**, a more in-depth and proper risk review should be required before any further development is considered.

Although all of this may run counter to what Burnco or others who support then feel is necessary (or may be required to do under the currently “limited” guidelines or directives for this activity), what they are asking of the council members is to approve something with less than all the facts. As a resident and tax payer in Rocky View County my request to you is that you consider the possible consequences of this proposed development before you make a final decision. More work is needed to cover off the potential risk associated with this massive land disturbance and ensure that an everyone, and everything, that will be impacted are properly protected. This might mean a different type of development – maybe smaller, maybe phased with performance criteria before further development is approved. It might mean no development if the risk is too high. Whatever the course, what is certainly required is a due diligence to ensure that long-lasting, unintended consequences do not occur as a result of this and other similar developments.

If you have any questions you may contact me at your convenience.

Respectfully,

June 18, 2021

Attention: To whom it may concern

Re: West Cochrane Pit soil column flushing experiment

The following is a summary of the experiment conducted on a sample of sand and gravel obtained from Burnco's currently operating West Cochrane Pit, located approximately 7 km west on Highway 1A from the Highway 1A/22 intersection. The purpose of this test was to assess the possible physical and chemical changes that may occur to water (i.e. precipitation) flowing through these sediments, both during and after development, and entering the local groundwater.

Methodology

A sample of sand and gravel was procured from the Burnco West Cochrane Pit for testing. Once delivered, a subset of that sand and gravel was placed in a newly purchased, and cleaned, plastic 20L pail for delivery to the point of testing. On 08 May 2021 a representative aliquot of the sand and gravel, comprising a mixture of clay, silt, sand and cobbles, was loaded into a pre-cleaned 1.5 m x 51 mm ID PVC pipe to mimic a vertical soil column beneath the Burnco pit area. A pre-cleaned plastic container was used to load the sample into the PVC pipe to avoid the use of any metallic equipment. Prior to loading the sample, the base of the PVC pipe was covered with clean fibreglass mesh to retain the soil sample the pipe. Once in place, settling of the sediment was achieved by tapping the outside of the pipe with a small hammer to compact the material towards natural in-situ conditions.

Laboratory-grade deionized water was obtained from the contacted laboratory (Bureau Veritas, BV) to react with the soil mixture in the column. Prior to adding the deionized water, the length of the sediment column was measured

indicating a 1.25 m vertical thickness. When ready the soil column was slowly hydrated with the deionized water to mimic infiltration of precipitation. Once the water began draining from the base of the PVC pipe, unfiltered samples were collected into bottles provided by BV (i.e. HDPE and glass, where required).

An initial set of samples (Soil flush #1) was collected on 08 May 2021 at 11:30AM. Once obtained and properly labelled the samples were placed in a refrigerator. The soil column was then allowed to drain over-night and a second set of samples (Soil flush #2) was collected the following day, 09 May 2021 at 10:45AM, using the same deionized water flow-through procedure.

Figure 1. Experimental setup, execution, and sample turbidity noted.

Upon completion of testing, both sample sets were placed in an ice-filled cooler to maintain their integrity while in transit to BV in northeast Calgary AB. Stand chain-of-custody (CoC) protocols were followed to track the shipping and handling process. Delivery was made within 48 hours for the first set of samples, and 24 hrs for the second set. A copy of the completed CoC is provided in Appendix 1. During the testing procedure, photographs were taken to document the process. Visual turbidity of the samples was noted at the time, as indicated in the photographs provided in Figure 1.

Analytical program

A relatively comprehensive analytical program was executed to assess changes to the deionized water quality following its transit through the soil column. Analysis was completed for the following:

- pH, alkalinity, and hardness,
- major ions (calcium, magnesium. sodium, potassium, bicarbonate + carbonate, sulphate, and chloride),
- nitrate and nitrite,
- metals and trace elements (including mercury), and
- turbidity.

All samples were received in good order, as documented by BV on the CoC. Sample temperatures were logged in at less than the require 10°C threshold and were received within the required time limit for sensitive parameters including turbidity and nitrate+ nitrite. The high quality of the deionized water was confirmed by BV (Appendix 1). A Certificate of Analysis for the two tests was also provided (Appendix 2).

Results

As noted in Appendix 1, the deionized water used for the testing was devoid of any particulate or dissolved constituents, much like natural precipitation. Measurement with a hand-held TDS meter confirmed a "zero" mineralization. The pH and temperature were also measured at the time of testing with a combination

hand-held meter and returned values of 5 to 6 and 13°C to 14°C, respectively, on both days.

After confirming the starting conditions of the deionized water, the water was slowly flowed through the sediment column. Samples collected from the base were very different in appearance compared to the water that was added at the top. Of particular note was the colour and turbidity as indicated in the lower right image of Figure 1. The occurrence of such turbidity is surprising considering the assumption often made that fine particles will be strained or filtered out as the water flows through the subsurface. However, this was obviously not the case. Measured values for Soil flush #1 and Soil flush #2 were >4000 NTU and 1600 NTU, respectively (Appendix 2).

In addition to turbidity, the chemical quality of the deionized water was also notably changed after reacting with the soil mixture. For example, the total dissolved solids (TDS) content increased from a pre-test value of 0 mg/L to 47 mg/L for Soil flush #1 and to a value of 39 mg/L for Soil flush #2. The laboratory pH also increased significantly to 9.1 for both tests. This represents a change from mildly acidic to alkaline conditions following a rather short reaction time, and is indicative rapid reactions occurring as the water flowed through the soil mixture (e.g. ion exchange).

Prior to conducting further data evaluation a check on the correctness of analysis was performed. This included a review of the anion-cation charge balance to confirmed acceptability. The values obtained for both samples (-1.1% and 1.9%, respectively) were within the recommended standard of ±2%[1]. An additional test was performed where the ratio of reported TDS versus calculated TDS was assessed. The range of acceptability is between 1.0 to 1.2[1], and the values obtained for the two soil flush tests were 1.01 and 1.00, respectively. Based on these confirmations the results from both tests were considered acceptable for further evaluation.

Other changes that occurred to the deionized water were less visual and more chemical in nature, with some of the constituents returning values in excess of

[1] *Standard Methods for the Examination of Water and Wastewater*

published water quality criteria. The criteria used for comparison in this study included:

- Alberta Tier 1 Soil and Groundwater Remediation Guidelines – for agricultural land (Alberta Government 2019)
- Environmental Quality Guidelines for Alberta Surface Waters – for the protection of freshwater aquatic life - FWAL (Alberta Government 2018)
- Guidelines for Canadian Drinking Water Quality - CDWQ (Health Canada 2020)

The following table summarizes a number of parameters in the soil flush effluent that exhibited values in excess of the above-noted criteria:

Parameter	Soil flush #1	Soil flush #2	AB Tier 1	AB FWAL	CDWQ
Turbidity (NTU)	>4000	1600	--	2	1
Aluminum (mg/L)	6.1	4.0	0.05		<0.1 OG
Arsenic (mg/L)	0.019	0.009	0.005	0.005	0.010 ALARA
Cadmium (µg/L)	0.53	0.44	0.34*		--
Chromium (mg/L)	0.013	0.020	0.001^{+} 0.0049^{++}	0.001^{+} 0.0089^{++}	0.05 MAC
Cobalt (mg/L)	0.0095	0.0071	0.0015*		--
Copper (mg/L)	0.0150	0.0097	0.0070	0.0390	2 AO
Iron (mg/L)	17	12	0.3		≤0.3 AO
Lead (mg/L)	0.010	0.0073	0.007*		0.005 ALARA
Manganese (mg/L)	0.81	0.74	0.05	--	0.12 MAC
Zinc (mg/l)	0.120	0.073	0.030		5.0 AO

Notes:

1. Values indicated for protection of freshwater aquatic life relate to long-term exposure.
2. Metals and trace elements are reported as "Total". Guidelines for aluminum and iron relate to the "Dissolved" forms.
2. * Assumes a groundwater hardness of 250 mg/L (as $CaCO_3$).
3. $^{+}$ = hexavalent; $^{++}$ = trivalent.
4. MAC = maximum acceptable value; ALARA = as low as reasonably achievable; AO = aesthetic value; OG = operational guidance value.

Measured values for the other constituents analyzed are provided in Appendix 2. However, those listed in the preceding table represent the most notable in terms of risk to human and ecological receptors.

Discussion

The proposed development of the West Cochrane Pit by Burnco will significantly, and permanently, alter the natural landscape of this picturesque area. Although Burnco indicates that the anticipated change to the local groundwater and surface water will be negligible, that claim has not actually been substantiated. Baseline groundwater quality was established by Burnco back in 2018, but no follow-up water quality monitoring has been communicated since. This includes in and around the currently operating pit area, which was commissioned following the 2018 program.

In light of the results generated by this experiment, concern exists that particulate matter and dissolved constituents will be mobilized from disturbed areas into the local groundwater and any receiving water bodies. Given the range of hydraulic conductivity values measured for the sand and gravel at the site (pdf page 773-75 of the Burnco's MSDP: 4.8 to 25.6 m/d), a calculated lateral hydraulic gradient of 0.028 from the Matrix's supporting report, and an assumed effective porosity of 30%, the flow of groundwater beneath the site could range anywhere from around 150 m/yr to more than 600 m/yr (depending on local conditions). Therefore the transit time for a substance released to reach a receptors would be relatively short at less than a year to perhaps a year or so.

Stripping of the overlying topsoil and removal of a substantial amount of the sand and gravel beneath will inevitably reduce the filtering capacity of the subsurface and allow contaminants that occur during the mining process (natural or other) to move more quickly down to the water table. This is shown in conceptual manner in Figure 2 on the following page, and is reinforced by a statement made by Matrix Solutions in an excerpt from Burnco's 2020 Master Site Development Plan (MSDP pdf page 682 of 1882):

The removal of the silty clay (where present) at site, will remove a natural barrier to potential contamination of the groundwater from surface spills. Any contaminant spilled at surface during or after operations would preferentially flow either vertically through the porous gravel and bedrock to the water table or along preferentially pathways (secondary permeability/fractures) in the bedrock. From below the water table it would follow groundwater flow direction (south to southeast), likely ending up in the Grande Valley Creek, Beaupré Creek, and the Bow River. Any contamination could potentially flow into the underlying bedrock, posing a risk to any residential well users in the area.

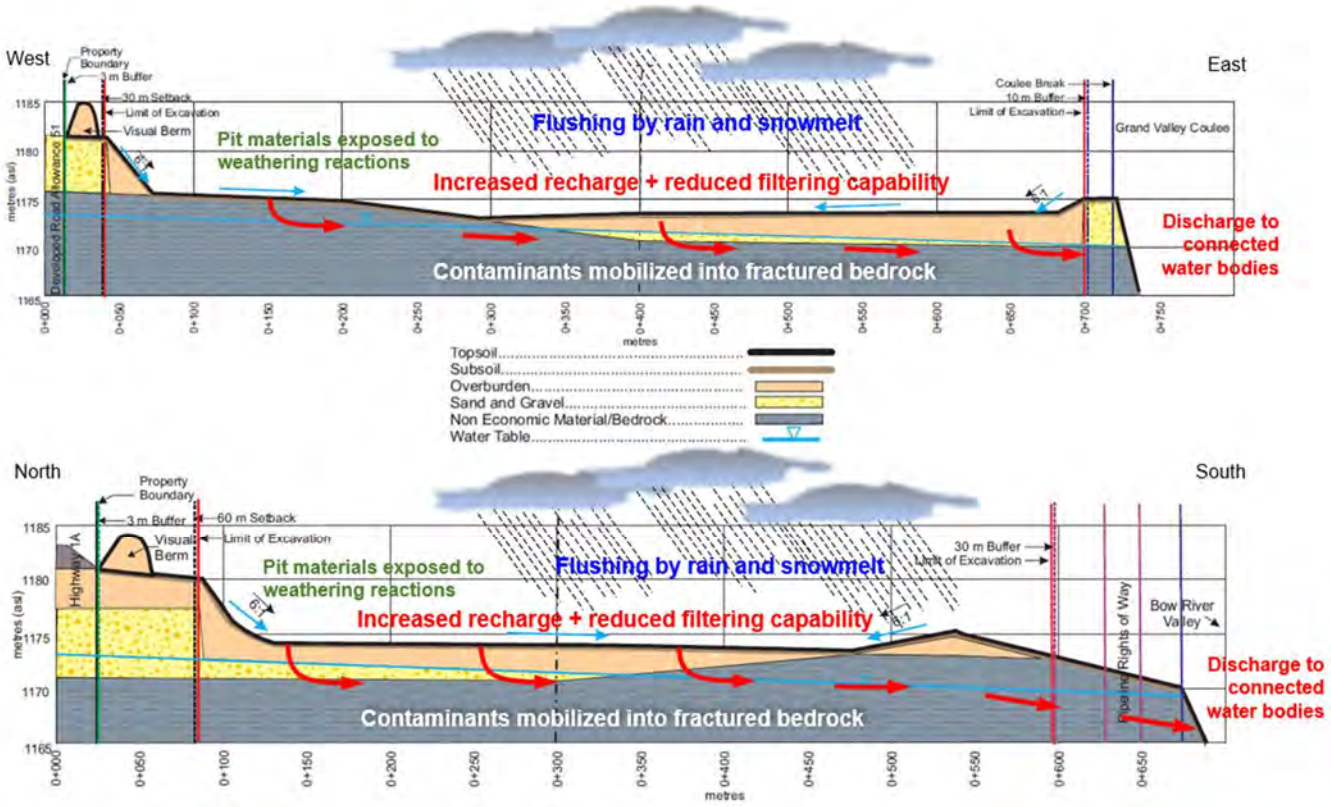


Figure 2. Conceptual diagram showing change to site conditions from pit development and associated risk to aquatic receptors.

Recharging precipitation (snow melt or rain) entering the subsurface will enhance the ability to move particulate and dissolved matter into the groundwater. By removing the filtering capacity of sediment this will only exacerbate the situation. It is clear from this experiment that turbidity can be mobilized by flushing water thought a 1.25 m soil column, not to mention notable changes to the chemical quality of the effluent.

The findings of this study suggest that the action of mining gravel from a very large development area will ultimately expose the remaining sand and gravel, as

well as the underlying bedrock aquifers, to weathering reactions and enhanced flushing by annual snow melt and rainfall events.

As such, any contaminants (solid or dissolved) mobilized and flushed from these exposed sediments will increase the risk of impact to the local environment. Proximity to receptors will be a major factor, not to mention how the mobilized contaminants move through the subsurface. However, this aspect has not been assessed by Burnco, making any statements about risk very difficult, if not impossible. The receptors at greatest risk include:

- local springs and water wells,
- Grand Valley Creek,
- Beaupre Creek, and
- the Bow River.

With the exception of the Bow River, most of the local surface water features in the study area are not believed to be fish-bearing. However, they do likely have environments that will sustain aquatic habitat that supports downstream aquatic systems. From a federal *Fisheries Act* perspective this is pertinent. The potential introduction of harmful constituents into aquatic systems is an obvious threat, and the waters from the site eventually drain into the fish-bearing Bow River. The Bow River is also used as a source of drinking water by the Town of Cochrane, as well as Calgary, so some assessment of the potential discharge of harmful substances into the river should have been conducted. However, it was not.

The turbidity guideline for protection of aquatic life in Alberta requires that the maximum long-term average for "clear" water systems, like the West Cochrane Pit area, be kept within 8 NTU above background values for any short-term exposure (e.g. up to 24 hours). Over the longer-term the increase should be no more than 2 NTU above background levels (Alberta Government 2018).

The way in which Burnco mines the sand and gravel deposit will also dictate the end result regarding risk to the local groundwater and connected systems. It is understood that a thin veneer of sand and gravel deposit will be left in place. All of this granular material rests in contact with fractured bedrock as noted in Burnco's

MSDP, submitted in June 2020. Based on the findings of this study, mobilization of turbidity from any residual sand and gravel left above the bedrock is a risk. Once in the fractured bedrock it will have a reduced chance of being attenuated, as fracture flow is very different than flow though porous media. Again, this aspect was not assessed.

If Burnco decides to operate a wet pit instead, and mine below the water table without dewatering, this will likely occur via bailing operations. The effect of this extraction method will be to create very turbid water due to the churning action of the excavation equipment. Again, the migration of mobilized particulate matter through the sediments is likely. Mobilization of turbidity in local groundwater has been documented before, with measurable effects being noted as far as 1.8 km downgradient. The following quote is taken from a report authored by Mead (1995):

> *"This DEQ [Department of Environmental Quality] study found a turbidity plume that extended more than a mile to the north (downgradient) of the gravel operation. The average turbidity of the water being discharged from the washing operation into the pond at the site was 2,737 nephelometric turbidity units (NTUs). Nearly all wells sampled within the first 6,000 feet of the turbidity plume were measured at 5 NTU or more. Many wells within the first 3,000 feet of the plume had turbidity levels of 10 NTU or more. Nearly all wells outside the plume had turbidities of 2 NTU or less."*

Additionally, the release of harmful metals and trace elements is a concern. This is not only associated with the type of metal or trace element mobilized, like arsenic or lead, but also the form it takes when present in the water. Given the anticipated groundwater conditions beneath the Burnco development area (i.e. well oxygenated and at a pH of 7 to 8, as noted on pdf page 699 in Burnco's MSDP) the speciation of chromium, for example, would favour the more mobile chromate ion (i.e. CrO_4^{2-}).

When present as chromate, and at the groundwater conditions described previously, it will be present in the hexavalent form (the more toxic form). This is shown in the Eh-pH diagram provided in Figure 3. Hexavalent chromium is a highly toxic species, and can influence aquatic life at values as low as 0.001 mg/L. The

other metals and trace elements noted in the summary table on page 5 will have their own unique toxicity and mobility characteristics.

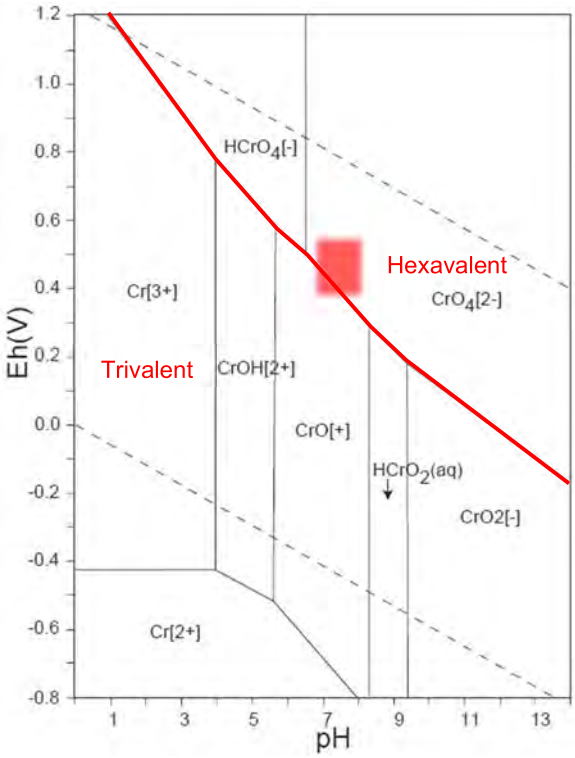


Figure 3. Eh-pH diagrams for chromium[2]. *Note: red shaded area represents conditions expected in well-oxygenated groundwater system.*

Unfortunately, none of the required information to assess this aspect has been provided. In fact, there is no monitoring data available for any of the wells around the working gravel pit to determine what constituents may have been mobilized so far. The only location assessed for metals and trace elements back in 2018 was a monitoring well located upgradient of the operating pit and adjacent to Highway 1A, that being MW18-02(B2).

The concern with the Burnco's current application to Rocky View County is that it does nothing to assess the impacts to groundwater and connected surface water environments that could occur around a working gravel pit. Although there are monitoring wells established around the current open pit, no up-to-date information is available to assess what has occurred since commissioning of that pit. Of equal importance is the lack of assessment done to determine what the full impact of the

[2] *Geological Survey of Japan*

West Cochrane Pit will look like once development is complete and reclamation has occurred.

Given the results of this soil column test there should be cause for concern. The pit mining activities will be located very close to aquatic receptors and therefore pose a threat to their existence and future viability. At the very least Burnco should be required to conduct a proper risk assessment and account for the potential mobilization, transport, and fate of contaminants like the ones documented in this experiment. It would also be informative for Burnco to assess conditions around their existing West Cochrane Pit via the series of dedicated monitoring wells installed there. This should include a proper assessment of water quality and geochemical conditions to better understand the risks involved if mining is to be extended across the larger proposed development area. Unfortunately, none of this work has been completed or provided for decision makers to rely on. This begs the questions:

"To what degree will Burnco's proposed development impact the groundwater quality across the larger area?"

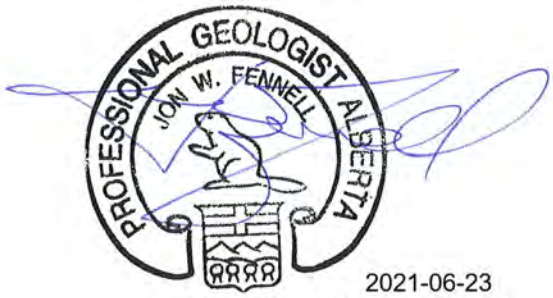
and

"How will this impact downgradient receptors like Grand Valley Creek, Beaupre Creek, and ultimately the Bow River?"

Closure

This report has been prepared to summarize results of a soil column flushing experiment designed to mimic infiltration of snowmelt and rainwater through sand and gravel deposits beneath the West Cochrane Pit area. The content is meant to inform decision makers so that unintended consequences to the environment and downstream communities can be avoided. If there are any questions regarding the methodology or interpretation of findings provided herein, the reader should contact the undersigned for clarification.

Respectfully submitted by:



Jon Fennell, M.Sc., Ph.D., P.Geol.
Hydrogeologist & Geochemist

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APPENDIX 1

Deionized water quality (from Bureau Veritas):

QA/QC Batch	QC Type	Parameter	Date Analyzed	Value	UNITS
A221986	Method Blank	Turbidity	2021/05/12	<0.10	NTU
		Total Mercury (Hg)	2021/05/12	<0.0019	ug/L
		Total Barium (Ba)	2021/05/16	<0.010	mg/L
		Total Boron (B)	2021/05/16	<0.020	mg/L
		Total Calcium (Ca)	2021/05/16	<0.30	mg/L
		Total Iron (Fe)	2021/05/16	<0.060	mg/L
		Total Lithium (Li)	2021/05/16	<0.020	mg/L
		Total Magnesium (Mg)	2021/05/16	<0.20	mg/L
		Total Manganese (Mn)	2021/05/16	<0.0040	mg/L
		Total Phosphorus (P)	2021/05/16	<0.10	mg/L
		Total Potassium (K)	2021/05/16	<0.30	mg/L
		Total Silicon (Si)	2021/05/16	<0.10	mg/L
		Total Sodium (Na)	2021/05/16	<0.50	mg/L
		Total Strontium (Sr)	2021/05/16	<0.020	mg/L
		Total Sulphur (S)	2021/05/16	<0.20	mg/L
		Total Aluminum (Al)	2021/05/14	<0.0030	mg/L
		Total Antimony (Sb)	2021/05/14	<0.00060	mg/L
		Total Arsenic (As)	2021/05/14	<0.00020	mg/L
		Total Beryllium (Be)	2021/05/14	<0.0010	mg/L
		Total Chromium (Cr)	2021/05/14	<0.0010	mg/L
		Total Cobalt (Co)	2021/05/14	<0.00030	mg/L
		Total Copper (Cu)	2021/05/14	<0.00020	mg/L
		Total Lead (Pb)	2021/05/14	<0.00020	mg/L
		Total Molybdenum (Mo)	2021/05/14	<0.00020	mg/L
		Total Nickel (Ni)	2021/05/14	<0.00050	mg/L
		Total Selenium (Se)	2021/05/14	<0.00020	mg/L
		Total Silver (Ag)	2021/05/14	<0.00010	mg/L
		Total Thallium (Tl)	2021/05/14	<0.00020	mg/L
		Total Tin (Sn)	2021/05/14	<0.0010	mg/L
		Total Titanium (Ti)	2021/05/14	<0.0010	mg/L
		Total Uranium (U)	2021/05/14	<0.00010	mg/L
		Total Vanadium (V)	2021/05/14	<0.0010	mg/L
		Total Zinc (Zn)	2021/05/14	<0.0030	mg/L
		Dissolved Sodium (Na)	2021/05/13		%
		Dissolved Calcium (Ca)	2021/05/13	<0.30	mg/L
		Dissolved Iron (Fe)	2021/05/13	<0.060	mg/L
		Dissolved Magnesium (Mg)	2021/05/13	<0.20	mg/L
		Dissolved Manganese (Mn)	2021/05/13	<0.0040	mg/L
		Dissolved Potassium (K)	2021/05/13	<0.30	mg/L
		Dissolved Sodium (Na)	2021/05/13	<0.50	mg/L
		Dissolved Calcium (Ca)	2021/05/13	<0.30	mg/L
		Dissolved Iron (Fe)	2021/05/13	<0.060	mg/L
		Dissolved Magnesium (Mg)	2021/05/13	<0.20	mg/L
		Dissolved Manganese (Mn)	2021/05/13	<0.0040	mg/L
		Dissolved Potassium (K)	2021/05/13	<0.30	mg/L
		Dissolved Sodium (Na)	2021/05/13	<0.50	mg/L
		Dissolved Nitrite (N)	2021/05/12	<0.010	mg/L
		Alkalinity (PP as CaCO3)	2021/05/14	<1.0	mg/L
		Conductivity	2021/05/14	<2.0	uS/cm
		Dissolved Chloride (Cl)	2021/05/14	<1.0	mg/L

APPENDIX 2

(see attached PDF)

Your C.O.C. #: 635648-01-01

Attention: John Fennell

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.
4000 19th Street NE
Calgary, AB
CANADA T2E 6P8

Report Date: 2021/05/31
Report #: R3026392
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C130760
Received: 2021/05/10, 08:10

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	2	N/A	2021/05/14	AB SOP-00005	SM 23 2320 B m
Cadmium - low level CCME (Total)	2	N/A	2021/05/14		Auto Calc
Chloride/Sulphate by Auto Colourimetry	2	N/A	2021/05/15	AB SOP-00020	SM23-4500-Cl/SO4-E m
Conductivity @25C	2	N/A	2021/05/14	AB SOP-00005	SM 23 2510 B m
Hardness	1	N/A	2021/05/14		Auto Calc
Hardness	1	N/A	2021/05/16		Auto Calc
Mercury (Total) by CV	1	2021/05/12	2021/05/12	AB SOP-00084	BCMOE BCLM Oct2013 m
Elements by ICP-Dissolved-Lab Filtered (1)	2	N/A	2021/05/13	AB SOP-00042	EPA 6010d R5 m
Elements by ICP - Total	2	2021/05/12	2021/05/16	AB SOP-00014 / AB SOP-00042	EPA 6010d R5 m
Elements by ICPMS - Total	2	2021/05/12	2021/05/13	AB SOP-00014 / AB SOP-00043	EPA 6020b R2 m
Ion Balance	1	N/A	2021/05/15		Auto Calc
Ion Balance	1	N/A	2021/05/16		Auto Calc
Sum of cations, anions	1	N/A	2021/05/14		Auto Calc
Sum of cations, anions	1	N/A	2021/05/16		Auto Calc
Nitrate and Nitrite	2	N/A	2021/05/14		Auto Calc
NO2 - NO2 + NO3 (N) in Water	2	N/A	2021/05/12	AB SOP-00091	SM 23 4500 NO3m
Nitrate (as N)	2	2021/05/11	2021/05/14		Auto Calc
pH @25°C (2)	2	N/A	2021/05/14	AB SOP-00005	SM 23 4500-H+B m
Total Dissolved Solids (Calculated)	1	N/A	2021/05/15		Auto Calc
Total Dissolved Solids (Calculated)	1	N/A	2021/05/16		Auto Calc
Turbidity	2	N/A	2021/05/12	CAL SOP-00081	SM 23 2130 B m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your C.O.C. #: 635648-01-01

Attention: John Fennell

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.
4000 19th Street NE
Calgary, AB
CANADA T2E 6P8

Report Date: 2021/05/31
Report #: R3026392
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C130760
Received: 2021/05/10, 08:10

Uncertainty has not been accounted for when stating conformity to the referenced standard.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.
(2) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.

Encryption Key

Bureau Veritas
31 May 2021 15:09:14

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Customer Solutions, Western Canada Customer Experience Team
Email: customersolutionswest@bureauveritas.com
Phone# (403) 291-3077

==========

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

ROUTINE WATER -LAB FILTERED (WATER)

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Calculated Parameters				
Anion Sum	meq/L	0.93	0.81	N/A
Cation Sum	meq/L	0.91	0.78	N/A
Hardness (CaCO3)	mg/L	39	35	0.50
Ion Balance (% Difference)	%	NC	NC	N/A
Dissolved Nitrate (N)	mg/L	0.10	0.058	0.010
Dissolved Nitrate (NO3)	mg/L	0.45	0.26	0.044
Dissolved Nitrite (NO2)	mg/L	<0.033	<0.033	0.033
Calculated Total Dissolved Solids	mg/L	47	39	10
Misc. Inorganics				
Conductivity	uS/cm	89	76	2.0
pH	pH	9.15	9.11	N/A
Anions				
Alkalinity (PP as CaCO3)	mg/L	3.5	3.8	1.0
Alkalinity (Total as CaCO3)	mg/L	34	33	1.0
Bicarbonate (HCO3)	mg/L	32	31	1.0
Carbonate (CO3)	mg/L	4.2	4.6	1.0
Hydroxide (OH)	mg/L	<1.0	<1.0	1.0
Dissolved Chloride (Cl)	mg/L	2.8	1.7	1.0
Dissolved Sulphate (SO4)	mg/L	8.4	4.7	1.0
Nutrients				
Dissolved Nitrite (N)	mg/L	<0.010	<0.010	0.010
Dissolved Nitrate plus Nitrite (N)	mg/L	0.10	0.058	0.010
Lab Filtered Elements				
Dissolved Calcium (Ca)	mg/L	4.8	4.5	0.30
Dissolved Iron (Fe)	mg/L	<0.060	<0.060	0.060
Dissolved Magnesium (Mg)	mg/L	6.6	5.6	0.20
Dissolved Manganese (Mn)	mg/L	<0.0040	<0.0040	0.0040
Dissolved Potassium (K)	mg/L	1.4	1.2	0.30
Dissolved Sodium (Na)	mg/L	2.1	1.4	0.50

RDL = Reportable Detection Limit
N/A = Not Applicable

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

REGULATED METALS (CCME/AT1) - TOTAL

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Elements				
Total Cadmium (Cd)	ug/L	0.53	0.44	0.020
Total Aluminum (Al)	mg/L	6.1	4.0	0.0030
Total Antimony (Sb)	mg/L	0.00076	<0.00060	0.00060
Total Arsenic (As)	mg/L	0.019	0.0094	0.00020
Total Barium (Ba)	mg/L	0.35	0.24	0.010
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010
Total Boron (B)	mg/L	<0.020	<0.020	0.020
Total Calcium (Ca)	mg/L	180	210	0.30
Total Chromium (Cr)	mg/L	0.013	0.020	0.0010
Total Cobalt (Co)	mg/L	0.0095	0.0071	0.00030
Total Copper (Cu)	mg/L	0.015	0.0097	0.00020
Total Iron (Fe)	mg/L	17	12	0.060
Total Lead (Pb)	mg/L	0.010	0.0073	0.00020
Total Lithium (Li)	mg/L	0.021	<0.020	0.020
Total Magnesium (Mg)	mg/L	39	45	0.20
Total Manganese (Mn)	mg/L	0.81	0.74	0.0040
Total Molybdenum (Mo)	mg/L	0.0020	0.0025	0.00020
Total Nickel (Ni)	mg/L	0.024	0.016	0.00050
Total Phosphorus (P)	mg/L	0.73	0.63	0.10
Total Potassium (K)	mg/L	3.5	2.5	0.30
Total Selenium (Se)	mg/L	0.00037	0.00022	0.00020
Total Silicon (Si)	mg/L	12	8.1	0.10
Total Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010
Total Sodium (Na)	mg/L	2.2	1.4	0.50
Total Strontium (Sr)	mg/L	0.21	0.21	0.020
Total Sulphur (S)	mg/L	2.0	1.4	0.20
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020
Total Tin (Sn)	mg/L	<0.0010	<0.0010	0.0010
Total Titanium (Ti)	mg/L	0.045	0.032	0.0010
Total Uranium (U)	mg/L	0.0014	0.0012	0.00010
Total Vanadium (V)	mg/L	0.021	0.015	0.0010
Total Zinc (Zn)	mg/L	0.12	0.073	0.0030
RDL = Reportable Detection Limit				

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		ZT5148	ZT5149	
Sampling Date		2021/05/08 11:30	2021/05/09 10:45	
COC Number		635648-01-01	635648-01-01	
	UNITS	SOIL FLUSH #1	SOIL FLUSH #2	RDL
Physical Properties				
Turbidity	NTU	>4000 (1)	1600	0.10

RDL = Reportable Detection Limit
(1) Sample contained sediment

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

MERCURY BY COLD VAPOR (WATER)

BV Labs ID		ZT5149	
Sampling Date		2021/05/09 10:45	
COC Number		635648-01-01	
	UNITS	SOIL FLUSH #2	RDL
Elements			
Total Mercury (Hg)	ug/L	0.0030	0.0019
RDL = Reportable Detection Limit			

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.7°C
Package 2	7.3°C

Version #3: Report reissued only with sample Soil Flush #1 & #2 as per client request. 20210531

Version #2: Report reissued due to typo error with email address. 20210519

Sample ZT5148 [SOIL FLUSH #1] : Turbidity completed within 48h after laboratory receipt to a maximum of five days from sampling. Data are satisfactory for compliance purposes. NO2 - NO2 + NO3 (N) in Water completed within 48h after laboratory receipt to a maximum of five days from sampling. Data are satisfactory for compliance purposes.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A221986	Turbidity	2021/05/12			102	80 - 120	<0.10	NTU	0.83	20
A223437	Total Mercury (Hg)	2021/05/12	93	80 - 120	97	80 - 120	<0.0019	ug/L	NC	20
A223560	Total Barium (Ba)	2021/05/16	96	80 - 120	106	80 - 120	<0.010	mg/L	5.4	20
A223560	Total Boron (B)	2021/05/16	103	80 - 120	107	80 - 120	<0.020	mg/L	2.2	20
A223560	Total Calcium (Ca)	2021/05/16	NC	80 - 120	108	80 - 120	<0.30	mg/L	3.3	20
A223560	Total Iron (Fe)	2021/05/16	118	80 - 120	107	80 - 120	<0.060	mg/L	3.4	20
A223560	Total Lithium (Li)	2021/05/16	108	80 - 120	112	80 - 120	<0.020	mg/L	4.7	20
A223560	Total Magnesium (Mg)	2021/05/16	NC	80 - 120	113	80 - 120	<0.20	mg/L	0.90	20
A223560	Total Manganese (Mn)	2021/05/16	109	80 - 120	105	80 - 120	<0.0040	mg/L	2.5	20
A223560	Total Phosphorus (P)	2021/05/16	104	80 - 120	104	80 - 120	<0.10	mg/L	NC	20
A223560	Total Potassium (K)	2021/05/16	NC	80 - 120	110	80 - 120	<0.30	mg/L	2.4	20
A223560	Total Silicon (Si)	2021/05/16	113	80 - 120	113	80 - 120	<0.10	mg/L	5.4	20
A223560	Total Sodium (Na)	2021/05/16	NC	80 - 120	107	80 - 120	<0.50	mg/L	1.4	20
A223560	Total Strontium (Sr)	2021/05/16	94	80 - 120	106	80 - 120	<0.020	mg/L	3.1	20
A223560	Total Sulphur (S)	2021/05/16	NC	80 - 120	109	80 - 120	<0.20	mg/L	0.77	20
A223574	Total Aluminum (Al)	2021/05/13	112	80 - 120	116	80 - 120	<0.0030	mg/L	6.4	20
A223574	Total Antimony (Sb)	2021/05/13	113	80 - 120	116	80 - 120	<0.00060	mg/L	1.3	20
A223574	Total Arsenic (As)	2021/05/13	103	80 - 120	102	80 - 120	<0.00020	mg/L	0.17	20
A223574	Total Beryllium (Be)	2021/05/13	114	80 - 120	108	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Chromium (Cr)	2021/05/13	104	80 - 120	105	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Cobalt (Co)	2021/05/13	101	80 - 120	104	80 - 120	<0.00030	mg/L	3.2	20
A223574	Total Copper (Cu)	2021/05/13	97	80 - 120	104	80 - 120	<0.00020	mg/L	14	20
A223574	Total Lead (Pb)	2021/05/13	100	80 - 120	106	80 - 120	<0.00020	mg/L	NC	20
A223574	Total Molybdenum (Mo)	2021/05/13	117	80 - 120	110	80 - 120	<0.00020	mg/L	5.2	20
A223574	Total Nickel (Ni)	2021/05/13	98	80 - 120	105	80 - 120	<0.00050	mg/L	11	20
A223574	Total Selenium (Se)	2021/05/13	113	80 - 120	115	80 - 120	<0.00020	mg/L	0.93	20
A223574	Total Silver (Ag)	2021/05/13	102	80 - 120	105	80 - 120	<0.00010	mg/L	NC	20
A223574	Total Thallium (Tl)	2021/05/13	108	80 - 120	113	80 - 120	<0.00020	mg/L	NC	20
A223574	Total Tin (Sn)	2021/05/13	109	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Titanium (Ti)	2021/05/13	110	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20
A223574	Total Uranium (U)	2021/05/13	103	80 - 120	105	80 - 120	<0.00010	mg/L	2.6	20
A223574	Total Vanadium (V)	2021/05/13	107	80 - 120	105	80 - 120	<0.0010	mg/L	5.9	20
A223574	Total Zinc (Zn)	2021/05/13	100	80 - 120	106	80 - 120	<0.0030	mg/L	NC	20

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A223796	Dissolved Calcium (Ca)	2021/05/16	NC	80 - 120	99	80 - 120	<0.30	mg/L	1.1	20
A223796	Dissolved Iron (Fe)	2021/05/16	111	80 - 120	104	80 - 120	<0.060	mg/L	NC	20
A223796	Dissolved Magnesium (Mg)	2021/05/16	NC	80 - 120	102	80 - 120	<0.20	mg/L	1.9	20
A223796	Dissolved Manganese (Mn)	2021/05/16	108	80 - 120	102	80 - 120	<0.0040	mg/L	3.3	20
A223796	Dissolved Potassium (K)	2021/05/16	104	80 - 120	104	80 - 120	<0.30	mg/L	1.3	20
A223796	Dissolved Sodium (Na)	2021/05/16	NC	80 - 120	96	80 - 120	<0.50	mg/L	1.4	20
A223798	Dissolved Calcium (Ca)	2021/05/14	NC	80 - 120	101	80 - 120	<0.30	mg/L	1.8	20
A223798	Dissolved Iron (Fe)	2021/05/14	110	80 - 120	105	80 - 120	<0.060	mg/L	NC	20
A223798	Dissolved Magnesium (Mg)	2021/05/14	NC	80 - 120	103	80 - 120	<0.20	mg/L	2.8	20
A223798	Dissolved Manganese (Mn)	2021/05/14	109	80 - 120	103	80 - 120	<0.0040	mg/L	1.1	20
A223798	Dissolved Potassium (K)	2021/05/14	104	80 - 120	105	80 - 120	<0.30	mg/L	2.7	20
A223798	Dissolved Sodium (Na)	2021/05/14	NC	80 - 120	99	80 - 120	<0.50	mg/L	2.3	20
A223899	Dissolved Nitrate plus Nitrite (N)	2021/05/12	122 (1)	80 - 120	99	80 - 120	<0.010	mg/L	1.1	20
A223899	Dissolved Nitrite (N)	2021/05/12	100	80 - 120	104	80 - 120	<0.010	mg/L	NC	20
A225434	Alkalinity (PP as CaCO3)	2021/05/14					<1.0	mg/L	NC	20
A225434	Alkalinity (Total as CaCO3)	2021/05/14			98	80 - 120	<1.0	mg/L	1.5	20
A225434	Bicarbonate (HCO3)	2021/05/14					<1.0	mg/L	2.0	20
A225434	Carbonate (CO3)	2021/05/14					<1.0	mg/L	NC	20
A225434	Hydroxide (OH)	2021/05/14					<1.0	mg/L	NC	20
A225437	pH	2021/05/14			100	97 - 103			0.16	N/A
A225438	Conductivity	2021/05/14			101	90 - 110	<2.0	uS/cm	0.65	10
A226330	Dissolved Chloride (Cl)	2021/05/15	99	80 - 120	105	80 - 120	<1.0	mg/L	NC	20
A226330	Dissolved Sulphate (SO4)	2021/05/15	105	80 - 120	106	80 - 120	<1.0	mg/L	NC	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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BV Labs Job #: C130760
Report Date: 2021/05/31

COMMERCIAL ACCOUNTS - CALGARY BUREAU VERITAS CANADA (2019) INC.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Sandy Yuan, M.Sc., QP, Scientific Specialist

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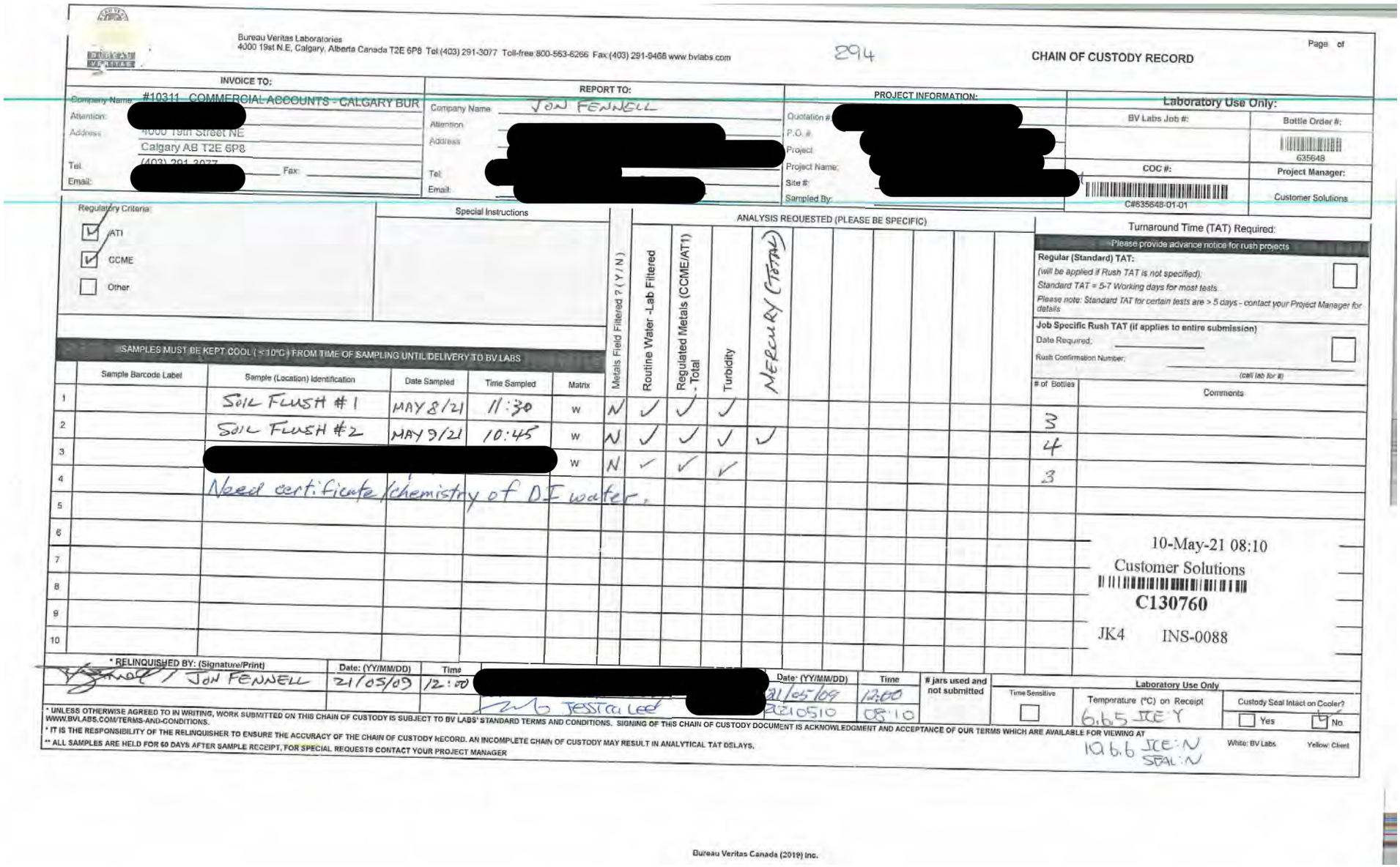

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CHAIN OF CUSTODY RECORD

Page of

INVOICE TO:
Company Name: #10311 COMMERCIAL ACCOUNTS - CALGARY BUR
Attention: [redacted]
Address: 4000 19th Street NE, Calgary AB T2E 6P8
Tel: (403) 291-3077 Fax:
Email: [redacted]

REPORT TO:
Company Name: JON FENNELL
Attention:
Address: [redacted]
Tel:
Email:

PROJECT INFORMATION:
Quotation #: [redacted]
P.O. #:
Project:
Project Name:
Site #:
Sampled By:

Laboratory Use Only:
BV Labs Job #:
Bottle Order #: 635648
COC #: C#635648:01-01
Project Manager: Customer Solutions

Regulatory Criteria: ☑ ATI ☑ CCME ☐ Other

Special Instructions

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y / N)	Routine Water -Lab Filtered	Regulated Metals (CCME/AT1) - Total	Turbidity	MERCURY (TOTAL)	# of Bottles	Comments
1		SOIL FLUSH #1	MAY 8/21	11:30	W	N	✓	✓	✓		3	
2		SOIL FLUSH #2	MAY 9/21	10:45	W	N	✓	✓	✓	✓	4	
3	[redacted]				W	N	✓	✓	✓		3	
4		Need certificate/chemistry of DI water.										
5												
6												
7												
8												
9												
10												

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT: ☐
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details
Job Specific Rush TAT (if applies to entire submission)
Date Required:
Rush Confirmation Number: (call lab for #) ☐

10-May-21 08:10
Customer Solutions
C130760
JK4 INS-0088

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time
JON FENNELL	21/05/09	12:00	[redacted] TESSA LEE	21/05/09 210510	12:00 08:10

jars used and not submitted

Laboratory Use Only
Time Sensitive ☐
Temperature (°C) on Receipt: 6.6.5 ICE Y / 10.6.6 ICE: N SEAL: N
Custody Seal Intact on Cooler? ☐ Yes ☑ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.
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White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Curriculum Vitae

Jon Fennell. M.Sc., Ph.D., P.Geol.

PROFESSIONAL PROFILE

Dr. Jon Fennell has been a practicing consultant in the natural resource sector for over 30 years offering support in the environmental sciences and resource management. His experience includes contaminated sites assessment, development of local and regional-scale groundwater systems, mine dewatering strategies, water supply and disposal, groundwater-surface water interaction assessment, implementation of monitoring and management systems, climate analysis and adaptation strategies, and environmental forensics including applications of:

i) remote sensing
ii) downhole, earth-based and airborne geophysical methods
iii) geochemical assessment & modelling
iv) stable and radiogenic isotopes to support source water tracing, chemical fingerprinting, and age-dating

The bulk of Jon's experience is associated with various oil & gas and mineral resource development projects in Canada and abroad. Over the last 13 years Jon has worked closely the Alberta Government through various initiatives to support the Water for Life Strategy, Land Use Framework, and Cumulative Effects Management System in the province. A primary area of focus is on developing strategies to ensure water security and communicating the importance of water knowledge as it applies to sustainable development activities.

PROJECT EXPERIENCE

International support

United Nations – Joint Caribbean Climate Change Partnership

Technical lead for the development of UNFCCC-sanctioned National Adaptation Plans for the countries of Belize and Guyana, with the goal of addressing multi-sector impacts from future climate change. Responsibilities included review of existing policies and studies supporting climate change adaptation, assessment of current adaptation plans for major economic, social, and environmental sectors, Incorporation of IPCC model results under various RCP scenarios, delivery of facilitated in-country workshops for various ministries, provision of recommendations to address gaps identified in current plans, liaison with government officials and UNDP organizers, completion of risk assessment and options analysis to identify high-value actions, preparation of capacity-building plan and 10-yr strategic plan, and risk and vulnerability assessment (including spatial aspects under various climate change scenarios – SRES and RCP).

Mexican Soda and Water Company – Monterrey Mexico

Lead for a groundwater evaluation project to supplement beverage making operations a large manufacturing plant in the city of Monterrey. Responsibilities included review of background geological, hydrogeological and geochemical information across a large study area centered on the Monterrey Metropolitan Area; assessment of structural fabric of study area including presence of major folds, faults, and other features (e.g. karst), amalgamation of background data with result from Quantum

Geoelectrophysics reconnaissance program to identify prospective drilling targets, completion of a 4C report (compare, contrast, correlate, confirm) and selection of prime drilling target for testing and evaluation.

Dept. of Environment & Resource Management – Coal Seam Gas Development, Queensland Australia

Lead for a hydrogeochemical assessment and water fingerprinting exercise in Great Artesian Basin aquifers of the Surat and Bowen basins to support Coal Seam Gas development and cumulative effects analysis. Responsibilities included a comprehensive data and information inventory to facilitate source water fingerprinting and collation of large public-domain data sets to provide a first-of-its-kind database of water quality information, review of major ions, metals and trace elements, stable and radiogenic isotopes and dissolved gases to identify recharge phenomenon, cross-formational flow characteristics and distinct water types, and statistical analysis to assess data groupings and spatial trends.

Additionally, lead for an aquifer vulnerability assessment to assess groundwater and groundwater-dependent ecosystem risks from Coal Seam Gas development in southeast Queensland. Responsibilities included development of a multi-criteria weighting and ranking system linked with GIS to display areas of highest risk to drawdown including areas users and groundwater dependent ecosystems, and facilitation of industry and government workshops to present and vet results.

Origin Energy – Coal Seam Gas Development, Queensland Australia

Groundwater lead for a large-scale coal seam gas project (up to 10,000 wells) located in the headwaters of the Murray-Darling Basin and recharge area for the Great Artesian Basin. Responsibilities included, development of a regional-scale groundwater monitoring system using vulnerability and risk mapping, design of a hydrogeological model covering a 173 000 km^2 area (using FEFLOW) to assess cumulative effects from coal seam gas development, completion of supporting Technical Report (including risk mapping, injection feasibility, model development) and Environmental Impact Statement chapter, and liaison with the Queensland Department of Environment and Natural Resources to address needs for the required Environmental Impact Assessment.

Texas Petroleum Company – Hydrocarbon Development, Columbia South America

Completion of an onsite environmental assessment of oilfield operations in support of the transfer of the Teca Nare, Cocorná, Velásques Oil Fields and the Velásquez-Galan Pipeline. Responsibilities included phase 1 site assessment of field operations, verification of site conditions at all well sites including soil and vegetation conditions prior to property transfer, assessment of baseline surface water and groundwater chemical conditions, as wells as environmental quality assessment to determine contamination from oilfield operations, and provision of summary report including recommendations.

Texas Petroleum Company – Hydrocarbon Development, Ecuador South America

Completion of a baseline groundwater and surface water study in a remote and environmentally sensitive area of the Amazon basin (headwaters area) to support a helicopter-assisted drilling program for oil and gas exploration. Responsibilities included field reconnaissance to establish the suitability of proposed drilling targets, assessment of the suitability of local surface water and groundwater sources for drilling fluid provision (quality and quantity), review of baseline soil quality, site hydrogeology, and geochemical conditions, and development of recommendations for pit construction and site preparation.

Canadian International Development Agency – Municipal works, Ecuador South America

Completion of a baseline soil and groundwater study (physical and chemical) around the City of Catamayo to determine the feasibility of siting an engineered wastewater impoundment for the treatment of municipal sewage treatment (project funded by CIDA). Responsibilities included general site reconnaissance, collection of soil and groundwater samples for baseline geochemical quality assessment, review of hydrogeological conditions and processes relating to baseline conditions, and submission of recommendations on the suitability of the proposed location and possible approaches to rectify existing limitations.

Government of Yemen – National water supply, Yemen

Hydrogeological and geochemical support for a regional-scale study of water supply potential in the country. Responsibilities included hydrogeological and hydrogeochemical facies mapping, geochemical assessment and flow path evolution modelling, groundwater flow field assessment and modelling, sustainable yield evaluation, and groundwater age dating.

Blackbird Mine – Acid Rock Drainage assessment, Idaho USA

Completion of a hydrogeological baseline study and associated stable isotope investigation ($\delta^{34}S$, $\delta^{18}O$, and $\delta^{2}H$) to determine the source of acid mine drainage near active underground workings. Responsibilities included review of existing geochemical data and related mineral equilibria conditions (i.e. baseline and impacted), and assessment of geochemical reactions leading to ARD conditions, including biogeochemical aspects.

Government support

Alberta Environment, Oil Sands Science and Monitoring Division

Preparation of oil sands tailings pond seepage review report. Responsibilities included review of background information pertaining to oil sands produced water (OSPW) seepage research and natural bedrock groundwater discharge studies, review of industry-submitted EPEA compliance reports to assess current “state of affairs” regarding monitoring and OSPW detections, assessment of seepage management systems, review of geological pathways for OSPW migration, and development of seepage risk profiles for all active tailings ponds.

Alberta Environment and Parks (AEP)

Provision of external expert review for the Implementation Directive for the Surface Water Body Aggregate Policy (SWBAP). Responsibilities included review of relevant Government of Alberta documents relating to aggregate mining in or near surface water bodies and/or floodplain environments, use of information from relevant policies in other jurisdictions as well as studies and research (aquatic, terrestrial, river morphology, climate risk) regarding impacts of aggregate mining in floodplain areas, identification of gaps regarding goals and objectives of the approval and management process, ,review of

risk assessment approach to approving aggregate mines near surface water bodies, and provision of recommendations for monitoring, evaluating and reporting, and interaction with AEP project team members and presentation of results.

Also, participation on expert hydrogeology panel to development a template for groundwater management frameworks (GMFs) in Alberta. Responsibilities included assessment of background on Alberta groundwater resources and documents highlighting existing GMFs inside and outside of Canada, review of sustainability goals and challenges with groundwater management (quantity and quality), review of prevailing concepts to groundwater management (i.e. surface water capture, risk and vulnerability assessment), identification of data needs and required infrastructure to support cumulative effects management, identification of proposed indicators using DPSIR approach, and participation in external panel and internal AEP team of hydrogeological experts to define aspects of a standardized GMF template.

Alberta Environmental Monitoring Evaluation and Reporting Agency (AEMERA)

Assessment of Alberta's groundwater observation well network, including redundancy and gap analysis. Responsibilities included groundwater risk mapping, development of a numerical scoring scheme to prioritize monitoring wells, statistical and spatial analysis of provincial water chemistries using information from the Alberta water well information database, and development of monitoring strategy including analytes and frequency to address key development activities (e.g. hydraulic fracturing, waste disposal, large-scale groundwater extractions).

Alberta Environment (AENV)

Various projects include:

- Assistance with scoping, conceptual design and development of approach to Groundwater Management framework template
- Expert review for Implementation Directive for the Surface Water Body Aggregate Policy
- Review and comment on Groundwater Monitoring Directive (2012 draft)
- Technical assistance with development of a guidance framework to respond to the implications of thermal mobilization of constituents at in-situ bitumen recovery projects including facilitation of team workshops to communicate the physical and chemical aspects of thermal mobilization and the risks posed by in-situ operations, development of a risk-based, phased, approach to assessing thermal mobilization to address source-pathway-receptor aspects, development of a draft guidance document and interaction with the AEP communications team, and support for industry and CAPP consultation meetings to review the draft guidance document.
- Completion of vulnerability and risk mapping for the Lower Athabasca Regional Planning area and development of groundwater management framework for the mineable and thermal in situ areas.
- Completion of an inventory of existing quality and quantity issues, water supply conditions and related environmental policy.
- Participation in technical and policy-related work sessions involving various stakeholder representatives.
- Assessment of potential cumulative effects from thermal in-situ bitumen recovery operations and related activities (i.e. water withdrawal for steam generation; fluid waste injection)
- Facilitation of technical and policy-related work sessions to engage stakeholders (operators, AENV and ERCB) directly affected by changes to provincial water management.

Alberta Environment and Sustainable Resource Development (ESRD)

Various projects include:

- Development of a multi-attribute point-scoring system and ArcGIS tool to assist with optimal siting of provincial monitoring wells to address concerns regarding hydraulic fracturing (HF). Responsibilities included identification of key risks to groundwater resource from HF activities, conceptualization and construction of a subsurface risk assessment, and identification of surface access opportunities in an ArcGIS platform to identify prime locations for monitoring in active and future development areas.
- Northern Athabasca Oil Sands Region groundwater monitoring program. Responsibilities included development of sampling methodology, data evaluation process and program logistics, communication to technical team comprising oil sands operators, ERCB and AEP representatives, development of an on-line visualization tool, and client liaison.
- Review of LARP management plan, supporting Groundwater Management Frameworks and supporting guidance documents re: Thermal Mobilization of Trace Elements during In Situ Developments and Groundwater Monitoring Directive.
- Preparation of summary document for Scientific Advisory Committee of the Oil sands GW working group, and Alberta Environment.

Alberta Land Use Secretariat (LUS)

Assistance with development of land planning scenarios in NE Alberta to guide future development in the Lower Athabasca Regional Plan area pursuant to the goals of the Alberta Land-use Framework. Responsibilities included presentations to the Land Use Secretariat, Regional Planning Team and Regional Advisory Council, development and assessment of modelled results from a cumulative effects simulator, completion of groundwater modelling over a 93 000 km^2 area (using MODFLOW), and development of an approach to deal with groundwater resources in the LARP area.

Alberta Utilities Commission (AUC)

Provision of expert review support for a wind power application in the Provost AB area. Responsibilities included review of project concept and environmental implications, assessment of completeness regarding baseline hydrogeological assessment, assessment of impact analysis and proposed mitigation, identification of gaps and provision supplemental information requests.

BC Ministry of Energy, Mines and Petroleum Resources

Provision of expert review support for hydraulic fracturing review process. Responsibilities included preparation of background information pertaining to water quality risks and source-pathway-receptor aspects of hydraulic fracturing operations, provision of recommendation regarding geochemical fingerprinting (ion ratios, isotopes, NORMs), risk assessment and mapping techniques, and monitoring, and appearance at in-camera session to discuss water quality aspects with academic panel members including recommendations.

Agency support

Alberta Innovates (AI)

Provision of hydrogeological support services for the following University of Alberta research studies:

- Resolving human versus Industrial Influences on the water quality of the Lower Athabasca River (data synthesis; geophysical and geochemical assessment; isotope geochemistry source water fingerprinting, GW-SW interaction – identification and flux)
- Review of Arsenic in Alberta's groundwater (collation of multiple open source and private data bases, GIS platform design; correlation/cluster/factor analysis to determine source/cause/reasons(s), both physical and geochemical, for elevated concentrations, development of a risk mapping tool to identify existing and potential future high-risk areas and aquifer intervals)
- Predicting Alberta's Water Future (complete estimates of groundwater recharge to Alberta's 2200 sub-basins; determining groundwater use projection by major sector to 2050; assessing baseflow contributions and groundwater stress area based analytic model outputs; project changes to provincial water supplies based on population growth, energy extraction, food production, land use, and climate variability/change; coordinate results with climate change model outputs and SWAT model outputs to generate preliminary Water Risk map for the province.

Alberta Water Research Institute (AWRI)

Preparation of a report assessing Alberta's inventory of water and its associated dynamics (natural and human-induced). Responsibilities included the development of a partnership model including participants from Universities and Institutes in Beijing, Switzerland, Edmonton, Calgary and Lethbridge, completion of a complete inventory of surface water, groundwater and fossil water (glaciers and deep groundwater) to identify current and future risks to water supplies in the province, and assessment of climate variability and change implications to provincial groundwater water resources

Canada's Oil Sands Innovation Alliance (COSIA)

Completion of a tailing pond seepage risk assessment and preparation of a peer-review journal manuscript to place suspected oil sands impacts into perspective. Responsibilities included review of individual tailings ponds established at the various operating oil sands mines in the Athabasca Oil Sands region, application of source-pathway-receptor model in relation to calculated groundwater flow velocities, stand-off distances from receptors, and natural attenuation properties to assess risk associated with each structure, and preparation of manuscript to place into context natural discharge of low-quality groundwater from bedrock formation versus oil sands seepage.

Other projects include:

- Completion of regional geochemical assessments in NE Alberta (35,000 km^2 area) supporting the Regional Water Management Initiative. Responsibilities included, collation of regional geological, hydrogeological, and geochemical data using public domain and industry information, assessment and interpretation of hydrogeological setting and of conceptual models, assessment of traditional and isotope geochemistry to determine source water chemistry to define flow path phenomena areas of aquifer interactions, statistical analysis of data to determine groupings and associations (PCA analysis), and documentation and presentation of results at various public venues.
- Completion of a water disposal assessment in NE Alberta (153,000 km^2 area) supporting the Regional Water Management Initiative. Responsibilities included collation of regional geological, hydrogeological, and water production data using public domain and industry information, development of a multi-criteria analysis approach to assessing Injection Potential and Theoretical Injection Rates based on a system of weighted and ranked physical and chemical attributes, and development of an ArcGIS platform to identify high-value disposal formations in relation to existing and planned in situ developments and pipelines

- Completion of oil sands industry study assessing the risks and benefits of landfills, salt caverns and disposal wells in liquid waste management. Responsibilities included participation in industry workshops. assessment of liquid waste management options, documentation and presentation of the results to industry members.

Cumulative Environmental Management Association (CEMA)

Assessment of baseline hydrological and hydrogeological conditions and development of a regional-scale groundwater quality monitoring network (18 000 km^2 study area) located in the Athabasca Oil Sands Region of northeast Alberta. Responsibilities included refinement of conceptual hydrogeological model, groundwater-surface water interaction assessment, assessment of quality conditions and trends (including statistical analysis), knowledge and data gap analysis, pathway identification and vulnerability assessment for sensitive receptors, field reconnaissance and well selection, isotope interpretation ($\delta^{18}O$, $\delta^{2}H$, $\delta^{13}C$, Carbon-14), groundwater hydrograph analysis, report preparation and presentation, and liaison with government and industry representatives.

Other projects include:

- Preparation of a groundwater monitoring and management plan in support of the State of the Muskeg River Watershed report. Responsibilities included assessment of baseline groundwater quantity and quality conditions in the study area, identification of development stresses and potential short and long-term impacts, identification of proposed physical, chemical and state indicators for monitoring, and interaction in multidisciplinary team.
- Overview of historical, current, and planned groundwater initiatives in the Regional Municipality of Wood Buffalo. Responsibilities included interviews with relevant industry, government, academia, aboriginal, and non-governmental organization groups, identifying and accessing relevant studies, reports, and investigations relating to groundwater and groundwater-surface water interaction, and development of a useable database with relevant descriptors of content and results.

Lakeland Industry and Community Association (LICA)

Assessment of the current health of two large watersheds (covering over 8500 km^2) in response to changing climatic conditions, changing land use practices, and increased pressure on water resources (surface water and groundwater) by agricultural and industrial users. Responsibilities included the assessment of historical Landsat imagery, review of stream and groundwater hydrograph data, assessment of effects of climate phenomena on basin hydrology, development of a hydrogeological framework from over 11,500 water well records, and review of temporal quality data from lakes and water wells.

Petroleum Technology Alliance of Canada (PTAC)

Completion of studies and industry workshops assessing environmental net benefit of saline water use versus non-saline water use in unconventional oil and gas development and the role of collaboration in unconventional oil and gas development.

Municipal and Watershed Stewardship Groups

Butte Action Committee

Preparation for, and participation in, AEP-led Surface Water Body Aggregate Policy 2017 stakeholder review workshops. Responsibilities included consultation with stakeholder group, provision of support for Leduc workshop, review of AEP materials in advance of Airdrie workshop (AEP policies, guides, codes, risk assessment framework), review of other Canadian and International policies and guides to

aggregate mining near water bodies, review of impact studies related to aggregate mine development near surface water bodies (erosion, pit capture, infrastructure risk, fisheries and riparian area impacts), assessment of climate change implications for streamflow timing and magnitude, as well as intensity, duration, and frequency of storms and related runoff, on 1:100 levels, and documentation of questions to AEP for clarification and response to AEP questions re: climate change implications.

Red Deer River Watershed Alliance (RDRWA)

Assistance with development of an Integrated Watershed Management Plan to address future development in the basin. Responsibilities included assessment of aquifer types and groundwater inventory, water use patterns, effects of land use and climate variability/change on basin storage, assessment of water quality conditions, risk and vulnerability analysis, development of beneficial management practices, and development of a conceptual monitoring system to achieve plan goals and objectives.

South McDougall Flats Protection Society, Sundre AB

Review of proposed re-zoning for aggregate mine development in historic floodplain of Little Red Deer River in Sundre, AB. Responsibilities included review of proposed gravel pit re-zoning area, air photo assessment and delineation of paleo-floodplain. preparation and presentation of workshop materials at public forums re: pros and cons of gravel mining (including policy framework review), and support for Town Council hearing.

Town of Okotoks, AB

Assistance with review of development applications and support for ensuring water security through conjunctive use strategies. Responsibilities included expert review of development applications assessing cumulative drawdown effects and provision of recommendations to manage effects, engagement with Town official on development of a sustainable water management strategy, and provision of support for AENV and Environmental Appeal Board process.

Also, completion of a pre-feasibility study to assess aquifer storage and recovery (ASR) and managed aquifer recharge (MAR) as a solution to water supply challenges. Responsibilities included review of regulatory setting and constraints for ASR and MAR (Canada and international jurisdictions), review of ASR and MAR projects world-wide, assessment of local geological and hydrogeological conditions and identification of potential areas to facilitate ASR and MAR success, modelling to determine optimal placement of MAR system to enhance baseflow conditions, groundwater-surface water interaction assessment, and preparation and presentation of pre-feasibility summary to Town Council and Mayor.

Town of High River, AB

Lead for the development of a Water Sustainability Plan predicated on risk identification and alternative storage and management options for a large alluvial aquifer system. Responsibilities included concept and program design, execution of vulnerability mapping approach to assess risk to High River from groundwater impacts (e.g. underground storage tanks), development of conceptual hydrogeological framework, review of groundwater–surface water interaction and climate variability effects, assistance with groundwater model development, and liaison with town officials, MD Foothills official and other project stakeholders.

Tsuut'ina First Nation

Completion of flood analysis for the Redwood Meadow development on the Elbow River floodplain. Responsibilities included review of river hydrology, flood frequency, and related changes in river

morphology, assistance with hydrological modelling to address groundwater flooding potential to existing and panned development areas, calculation of damage estimates associated with 5-, 20-,100-, 200- and 500-year return periods, and liaison with First Nations representatives, Government of AB, and Canadian Environmental Assessment Agency.

Industry support

Alberta Energy Company (AEC)

Preparation of an Environmental Operations Manual for all aspects of petroleum exploration and development in Alberta. Contents of the manual included environmental procedures for seismic cutline provision and reclamation, siting and construction of drilling leases and processing facilities, siting and construction of pipeline right of ways, spill response and cleanup, and site reclamation.

Amoco Canada

Various projects include:

- Numerous gas plant and batter investigations, including the completion of geophysical surveys (EM38, EM31, and EM61), and the design, installation, testing and sampling of groundwater monitoring networks.
- Completion of environmental site assessments and landfill delineation programs for gas plant divestitures. Responsibilities included installation, testing and sampling of groundwater monitoring wells, completion of soil sampling programs, and assessment of the results to determine the liability cost associated with property transfer.
- Completion of a stable isotope study using $\delta^{34}S$, $\delta^{18}O$, $\delta^{2}H$, $\delta^{13}C$ to determine the source of anomalous groundwater sulphate concentrations (natural vs. anthropogenic), and review of fresh groundwater usage for steam injection. Responsibilities included assessment of historical monitoring well and lake level readings to evaluate local effects resulting from groundwater withdrawal.
- Sounding Lake area monitoring program to determine effects from nearby drilling activity. Responsibilities included interviews with well-owners, assessment of the water delivery system, short-term aquifer testing, sample collection using ultra-clean sampling methods, evaluation of the data, and communication of results to client and owner.

Apache Canada

Completion of watershed analysis and intake siting in support of a Water Act Application on Smoky Lake. Responsibilities included assessment of Smoke Lake watershed and water supply potential, water supply modelling to determine availability and reliability of lake water, review of historical flow data and determination of suitable IFN at outlet (i.e. Q80), review of terrestrial, fisheries and water quality data to support water diversion strategy, development of proposed monitoring and response plan, and liaison with AEP and AER representatives.

Bellatrix Exploration Ltd.

Completion of a Water Sourcing study for Rocky Mountain asset. Responsibilities included review of existing and potential water sourcing options, development MCA and of GIS tool to assess and map high-value water opportunities, and completion of a corporate water security plan.

BP Canada

Resident well sampling program to determine effects from nearby drilling programs and existing gas wells. Responsibilities included well-owner interviews, assessment of the well conditions and water delivery system, sample collection using ultra-clean sampling methods, and communication of results.

Canadian Occidental

Completion of a stable isotope studies to determine the source of sulphate impact from two large sour gas processing facilities (Balzac and Okotoks). Responsibilities included drilling, installation, and testing of monitoring wells, development of a conceptual site model , review of site-wide geochemistry (soil and groundwater), and application of $\delta^{34}S$, $\delta^{18}O$, $\delta^{2}H$, and $\delta^{13}C$ isotopes to resolve natural versus anthropogenic influences.

Devon Canada

Various projects include:

- Development of a thermal mobilization risk model to support development efforts in the Jackfish and Pike oil sands developments. Responsibilities included review and evaluation of existing geochemical data including metals and trace elements, development of conceptual site model using existing geological picks for various identified formations, design of Spatial MCA approach to map risk of thermal mobilization from artificial ground heating, and preparation of summary document and presentation at various public venues.
- Completion of detailed studies to define baseline hydrogeological and hydrological conditions in support of a CBM project in the Crowsnest Region of the eastern Rocky Mountains. Responsibilities included, completion of detailed field reconnaissance program, establishment of a spring and water well monitoring network, investigation of surface water/groundwater interactions, development of a conceptual hydrogeological framework in a mountainous area using geological and geochemical data, groundwater age dating of regional confined aquifers using radioactive isotopes (i.e. Tritium and Chlorine-36), and public and regulatory liaison.
- Hydrogeological support for D51 disposal application. Responsibilities included refinement of conceptual model and identification of hydrodynamic conditions supporting disposal water entrapment by stagnation zone using geochemical and isotope evidence.

Enerplus

Completion of a Water Security Plan for the Western Canadian assets. Responsibilities included review of asset operations and water management process, assessment of basin water risk conditions and current mitigations in place, source water and disposal opportunity assessment, and development of multi-criteria assessment (MCA) process to rank water risk profile of each asset and provide recommendations for mitigation.

Graymont Western US Inc.

Preliminary development of a mine dewatering and water management strategy for a large limestone quarry located in the eastern from ranges of the Rocky Mountains. Responsibilities included assessment of baseline hydrogeological and hydrogeochemical conditions in a mountain environment, source water fingerprinting and groundwater age-dating, fracture and lineament analysis using structural geology and geophysical analysis (GPR, borehole tele-viewer), groundwater-surface water interaction assessment (i.e., Bow River), conceptualization of dewatering strategy utilizing oriented and horizontal well technology, and issues identification and risk analysis.

Hammerhead Resources

Completion of watershed analysis, flood assessment and intake siting in support of a Water Act Application on the Smoky River. Responsibilities included assessment of Smoky River watershed and water supply potential, review of historical flow data and assessment of Q80 and Q95, flood assessment to determine 1:10 and 1:25 year event levels, review of fisheries and bank stability assessment in support of intake siting, development of proposed monitoring and response plan, and liaison with AEP and AER representatives.

Husky Oil Operations Ltd.

Completion of a water security plan for the Ansell asset, west-central Alberta. Responsibilities included review of project water profile and future requirements for hydraulic fracturing, facilitation of risk review workshop, and review of water source opportunities and development of MCA opportunity ranking process.

Also, completion of a Water Security Plan for a 200,000 barrel per day thermal in situ oil sands operation. Responsibilities included, review of water supply and disposal needs for the duration of the planned project, risk and opportunity analysis using multi-criteria analysis to ensure viability of supply and disposal strategies, and identification of strategies to ensure project viability and project sustainability.

Imperial Oil

Various projects include:

- Completion of field and bench-scale tests to determine facilitated mobility of metals, trace elements, and dissolved organics resulting from artificial ground heating around thermal in situ wells. Responsibilities included drilling, installation, testing, and sampling (soil and water) from 22 deep (up to 90 m) monitoring wells at a newly established thermal in situ pad to determine baseline geochemistry and groundwater flow directions, tracer experiment to determine groundwater flow velocities in a deep (>80 m) confined aquifer, collection of sediment samples (under anoxic conditions) for bench-scale heating experiments to determine metals mobility and related kinetics, review of stable isotopes in groundwater and dissolved gases to determine effects of heating from in-situ thermal wells on local geochemical conditions (inorganic and organic constituents), reaction path modelling to determine processes influencing changes metals concentrations and biological activity resulting from subsurface heating, determination of activation energies for metals release, and the role of biogeochemical reactions in facilitating metals release, transport and fate modelling to determine the long-term risk of thermal mobilization of metals (and other related constituents) to the surrounding environment, and documentation of result and liaison with client and regulatory agencies.
- Design and implementation of dewatering program for large process water ponds. Responsibilities included review of site geological conditions, installation of dewatering wells, acquisition and interpretation of aquifer test data, design of dewatering system using appropriate theoretical calculations and analytical modelling solution, and development of dewatering plan and associated performance monitoring
- Completion of a regional groundwater investigation and development of a regional-scale ground water monitoring network (per EPO 95-07 requirements) in a multi-layer inter-till aquifer system in east-central Alberta. Responsibilities included assessment and interpretation of Quaternary stratigraphy, interpretation of seismic line data and geophysical borehole log analysis, regional groundwater flow mapping, geochemical facies mapping, assessment of regional arsenic concentrations, trends, and potential connection to thermal in situ development activities,

groundwater age-dating and stable isotope analysis ($\delta^{18}O$, $\delta^{2}H$, $\delta^{34}S$, $\delta^{11}B$ and $\delta^{13}C$: dissolved constituents and gases), preparation of investigation report to address EPO questions (i.e. source and cause of groundwater quality issues), and liaison with regulators during investigation and EPO closure process.

- Completion of an environmental liability assessment to determine the cost of decommissioning, abandoning and restoring the area currently occupied by the Norman Wells field. Responsibilities included completion of a Phase 1 audit of production facilities and supporting infrastructure (i.e. wellheads, pipelines, satellites, batteries and former refinery), design and implementation of a late Fall field program to sample a statistically sufficient number of locations to generate realistic liability costing for field shutdown and closure, generation of a summary report, and assistance with design of liability costing model and summary reporting.
- Completion of numerous isotope studies using to determine groundwater flow rates in regional confined aquifers and the source of anomalous groundwater quality conditions and dissolved gas concentrations near a large heavy oil recovery operation using assessment of $\delta^{18}O$, $\delta^{2}H$, $\delta^{34}S$, $\delta^{11}B$ and $\delta^{13}C$ and Tritium and Carbon-14 for groundwater age-dating.
- Tritium age dating of groundwater in Norman Wells, NWT to determine vertical groundwater flow characteristics in discontinuous permafrost environment
- Development and implementation of a site characterization program at a former refinery and battery (circa 1930s) located approximately 160 km south of the Arctic Circle. Responsibilities included the design and installation of a monitoring network in discontinuous permafrost, and assistance in development of assessment programs to generate Tier II criteria in support of a human health and ecological risk assessment.
- Support for re-licensing of supply wells for oilfield injection using Alberta Environment "Water Conservation and Allocation Guideline for Oilfield Injection" and "Groundwater Evaluation Guideline." Responsibilities included, completion of field-verified surveys, review of site geological conditions, acquisition and interpretation of aquifer test data, assessment of groundwater/surface water interaction, and determination of long-term sustainable yield using analytical solutions
- Hydrogeological lead for a large oil sands mine EIA (Kearl Oil Sands Mine Project). Responsibilities include evaluation and interpretation of water well information and chemical data, defining Quaternary stratigraphy, temporal water level assessment to determine potential impact to regional groundwater quality and quantity arising from mine development and dewatering, and support at Joint Panel hearing.
- Cold Lake area monitoring program (Arsenic Investigation – 30 private residents). Responsibilities included interviews with well-owners, assessment of the water delivery system, sample collection using ultra-clean sampling methods, review of the data, and communication of results to client, well owner and Alberta Environment
- Completion of an environmental liability assessment and costing exercise in support of the sale of the Judy Creek field to PenGrowth Corp. to statistically sample a sufficient number of facilities to generate realistic liability cost for property transfer. Responsibilities included completion of Phase 1 audits of production facilities and supporting infrastructure (i.e. wellheads, pipelines, satellites, and batteries), design and implementation of winter field program to sample facilities to generate realistic liability cost for property transfer
- Conceptual model design for dewatering scheme in support of mine development. Responsibilities included assessment of geological conditions, boundary assessment, parameter selection and optimization, and assessment of model results

- Completion of a groundwater modelling study to determine the sustainable yield of a major deep freshwater aquifer in the Cold Lake area. Responsibilities included the provision of hydrogeological support for model conceptualization and design, input parameter selection, and evaluation and communication of results
- Development and implementation of a regional groundwater quality monitoring network covering an area of 1,200 km^2. Responsibilities included, regular interaction with environmental regulatory agencies and the local landowners, installation, testing and sampling of deep (up to 230 m) monitoring wells to assess potential impact to confined aquifers due to production well casing failures, design, implementation and interpretation of aquifer tests in support of groundwater remediation programs, and development of cost effective approaches towards restoring water quality conditions in deep aquifers influenced by heavy hydrocarbons and associated production fluids.
- Preparation of an AB environment approved Incident Response Plan to deal with groundwater quality issues identified during routine monitoring activities at a large heavy oil recovery scheme. Responsibilities included design of a cost-effective sampling schedule including rationalization of a 200 well monitoring network to provide a meaningful network of approx. 100 wells, and development of statistical limits for response and mitigation actions.

Japan Canada Oil Sands (JACOS)

Execution of hydrogeological section of an expansion EIA for the Hangingstone Thermal In Situ Oil Sands project. Responsibilities included development of baseline hydrogeology, EIA sections, and SIR responses, liaison with project team and governing agencies, and stakeholder consultation with First Nations and 3PC.

Also, completion of a water supply project in support of a heavy oil recovery scheme using Alberta Environment "Water Conservation and Allocation Guideline for Oilfield Injection" and "Groundwater Evaluation Guideline." Responsibilities included assessment of geophysical logs and EM survey results, design and implementation of field programs, step rate test and constant rate test data acquisition and analysis, well screen selection and well design, well efficiency assessment, and use of pertinent analytical equations to predict effect of long-term pumping.

Mobil Oil Canada

Completion of a stable isotope study to determine the source of sulphate impact from a large sour gas processing facility. Responsibilities included, drilling and installation of monitoring wells, development of a conceptual site model , review of site-wide geochemistry (soil and groundwater), and application of $\delta^{34}S$, $\delta^{18}O$, $\delta^{2}H$, and $\delta^{13}C$ isotopes to resolve natural versus anthropogenic influences.

Nexen ULC

Development of a water strategy to service the Aurora LNG project/Dilly Creek asset. Responsibilities included assessment of development trajectory with respect to water use, identification of feasible water supply source to accommodate up to 6.5 million m^3 per year of water, conceptualization of water storage strategy to reduce pressure on local water sources and minimize physical footprint of development, development of a water conveyance strategy utilizing existing rights of way, including Class 5 cost estimation, and liaison with Fort Nelson first Nations to facilitate development of baseline hydrology monitoring program and facilitation of a Section 10 water licence (following successful EAB appeal of previous licence).

Also, the design and completion of bench-scale testing to determine the mobilization of metals and trace elements under applied heating. Responsibilities included conceptual design of experimental process in

collaboration with AGAT lab representatives, assessment of frozen core samples and selection of appropriate intervals for physical (grain size, mineralogy via XRD) and chemical testing (total metals, leachable metals), assessment of results from sequential batch heating experiments extending from 5-100°C for metals species released to solution, geochemical modelling of kinetic experiment results to determine activation energies of metals release, completion of attenuation experiments to determine potential for mobilized metals to re-associated with sediments under cooled conditions, and preparation of suitable documentation to present to the client and AER.

Pembina Pipeline Corporation

Provision of expert legal support to review source and cause of industrial chemical contamination at an operating gas plant. Responsibilities included review of existing site investigations, procedures, and documentation, assessment of efficacy of investigations and protocols (field and laboratory), development of conceptual model to explain presence and movement of sulfolane in bedrock deposits, and review of risk assessment findings and provision of recommendations to close data and information gaps.

Petro-Canada

Various projects include:

- Completion of detailed regional and local baseline studies, and cumulative impact assessment, to establish regional and local hydrogeological and geochemical characteristics in support of a 30,000 bbl/d heavy oil recovery expansion (MacKay River Project). Responsibilities included defining Quaternary stratigraphy, temporal water level assessment to determine potential impact to regional groundwater quality and quantity arising from bitumen recovery operations, development of a numerical groundwater model to assess long-term effects of water withdrawal and waste disposal to support project activities, and completion of climate change assessment formed part of the assessment for project design.
- Conceptualization and design of field program to assess water supply and water disposal for two major heavy oil projects (>30,000 bbl/d). Responsibilities included selection of drilling locations based on geophysical reconnaissance, implementation of field programs, step rate test and constant rate test data acquisition and analysis, well efficiency assessment, well screen selection and well design, and use of pertinent analytical equations.
- Review of fresh groundwater use for a water flood project. Responsibilities included interpretation of historical monitoring well data to determine the effects of the groundwater withdrawal from the local aquifer.
- Assessment of long-term effects of industrial water supply wells used for a water flood scheme. Responsibilities included a review groundwater chemistry and well hydraulic data to determination sustainable production rates.
- Completion of an environmental operations audit and subsequent industrial landfill delineation to determine the source area of possible groundwater contamination. Responsibilities included completion of a comprehensive intrusive landfill delineation and soil sampling program to determine the extent and volume of landfill contamination.
- Completion of an industrial landfill delineation project to determine possible sources of groundwater contamination. Responsibilities included completion of a magnetometer survey, follow-up excavation and soil sampling near a decommissioned landfill to determine the presence, extent and volume of residual landfill material.

Procor

Review of operational history of a salt cavern storage facility including an assessment of groundwater quality near the large brine storage ponds and the potential for impact to the Regina Aquifer.

Shell Canada

Various projects include:

- Completion of watershed analysis and intake siting in support of a Water Act Application on Iosegun Lake. Responsibilities included assessment of Iosegun Lake watershed and water supply potential, water supply modelling to determine availability and reliability of supply, review of historical flow data and determination of suitable IFN at outlet (i.e. Q80), review of terrestrial, fisheries and water quality data to support water diversion strategy, development of proposed monitoring and response plan, and liaison with AEP and AER representatives.
- Hydrogeological support for Jackpine Mine Expansion EIA
- Development of Groundwater Management Plan and annual monitoring support at Shell's Muskeg River Mine. Responsibilities included review of site-wide groundwater monitoring network for applicability to EPEA Approval requirements (including gap analysis, routine monitoring and reporting per EPEA requirements, selection of indicator suites to facilitate routine monitoring, evaluation, and reporting, identification of locations with water quality concerns, development of approach to statically assessing and responding to data excursions and trends, and preparation of the GMP for consideration and acceptance by AEP.
- Support for Carmon Creek EIA and assessment of brackish water supply potential in support of heavy oil operations in the Peace River area. Responsibilities included assessment of baseline hydrogeological conditions and potential impacts from project development, preparation of climate change assessment for project development, support for SIR submissions and EIA team interactions, feasibility assessment of potential for deep formations to produce sustained supplies and conceptual well-field development, and liaison with regulatory agencies
- Development of a regional-scale ground water monitoring network in a multi-layer aquifer system in the Peace River region of Alberta. Responsibilities included assessment of Quaternary stratigraphy, interpretation of seismic line data, geophysical borehole log analysis, and geochemical facies mapping and solution chemistry analysis.
- Assistance with the development and construction of an induced infiltration groundwater supply system for the Shell Caroline Gas Plant industrial water supply project. Responsibilities included drilling and installation of large diameter water production wells, borehole geophysical logging and interpretation. sand quantification testing and analyses to determine sediment production volumes prior to pipeline construction, and liaison with client and local landowners.

Suncor Energy

Various projects include:

- Lead subsurface specialist for a multi-criteria decision analysis and life-cycle value analysis in support of a regional brine management strategy in the Athabasca Oil Sands area. Responsibilities included development of a holistic weighting and ranking approach to address triple-bottom-line assessment of treatment and disposal options for liquid and solid waste streams originating from oil sands mining and in situ assets located across a 30 000 km^2 area, facilitation of, and participation in, workshops to assess viable options for treatment and disposal including Class 4 costing, and

development of a constraints mapping approach (vulnerability, risks and opportunities) using ArcGIS to assist in management and disposal options for liquid and solids waste streams.

- Development of an Athabasca River reconnaissance program to identify and sample natural groundwater-surface water interaction zones discharging waters from the Cretaceous and Devonian formations. Responsibilities included planning/execution and interpretation of a marine-based geophysical program using EM31 imaging and bathymetric readings, development of pore water sampling program including geochemical assessment of waters and source fingerprinting (major ion, trace element, dissolved organics, and stable and radiogenic isotopes), interpretation of results and presentation at various venues (government, industry.
- D51 disposal monitoring at the Firebag Thermal In Situ Project
- Thermal mobilization assessments (Firebag, Lewis, Meadow Creek)
- Development of brine water management strategy including options analysis and Class 4 costing
- Preparation of an oil sands mining closure strategy outlining goals, objectives, tasks, timelines, and consulting and research agencies to execute in support of Life of Mine Closure and Reclamation process
- Assistance with Fort Hills Operational Plan regarding preservation of McClelland Lake and wetland complex; review of physical hydrogeology and geochemical setting; assessment of numerical model design and output; review of cut-of wall design and mitigation system; review of adaptive management processes
- Review of Devonian – McMurray interactions at the North Steepbank mine expansion and assistance with investigation program design (including geochemical assessment)
- Completion of geophysical and porewater surveys on the Athabasca and Steepbank Rivers to determine contributions of natural discharge versus industry inputs
- Review of existing water supply for Steepbank and Millennium mine operations and development of contingency supply options. Responsibilities included review of past water resource evaluations, development of geophysical investigation program and interpretation of results, assessment of contingency water supply (groundwater and operations water), client consultation and liaison with Alberta Environment, and implementation of horizontal well technology to provide a secure supply of water for continued operations
- Groundwater age-dating and source area identification in support of active tailings pond seepage investigations. Responsibilities included conceptual site model design, review of traditional geochemistry to determine end-point water types, and application of Tritium, $\delta^{18}O$, $\delta^{2}H$, $\delta^{34}S$, $\delta^{11}B$ to resolve geochemical setting and potential areas of seepage
- Preparation of an AB Environment approved Groundwater Management Plan at a large oil sands mining operation. Activities included, the design of a cost-effective sampling schedule including rationalization of over 300 wells to establish a meaningful monitoring network of 150 wells, development of statistically established trigger values for response and mitigation, and lliaison with Government of Alberta during review and approval.

Syncrude Canada

Participation on expert hydrogeology panel to review Devonian investigation program for Aurora mine and assess mitigation strategies to control high risk areas (Les Gray - UBC, Carl Mendoza, - UofA, Ken Baxter - Golder, Jon Fennell - WP). Responsibilities included review of existing baseline data for active mining site, identification of high-risk areas to consider for future investigation and monitoring, participation in group workshop settings to communicate findings and accumulate input for

recommendations refinement, and participation in internal panel meetings to discuss concepts and develop final recommendations.

Teck Resources Limited

Evaluation of stream response to groundwater interception in support of fisheries habitat offsetting at Line Creek Mine, BC. Responsibilities included baseline reconnaissance of Line Creek alluvial system and GW-SW water interactions with Line Creek, assessment of area springs, shallow groundwater, and creeks to determine geochemical quality and flow conditions (using drive point well technology and data logger systems), completion of ground penetrating radar survey to map thickness and morphology of alluvial deposits, water quality fingerprinting using major ion, trace elements (in particular selenium) and stable isotopes to determine interaction of groundwater environment with Line Creek, and assessment of selenium mobilization conditions related to active mine workings and development of a conceptual (passive) mitigation strategy to offset impacts to fisheries habitat.

Total E&P

Support for Joslyn North Mine EIA submission and development of a mine dewatering strategy for. Responsibilities included development of baseline hydrogeology, EIA sections and SIR responses , liaison with project team and governing agencies, joint Panel hearing support.

Also, selection and phasing of depressurization wells and associated monitoring wells, review of deep well injection potential, including geochemical compatibilities of waters, development of a performance monitoring system, selection of pipeline route, and preparation of a design-based memorandum with related costs (Class 3) of implementation and long-term operation.

Various Gas Plants, Batteries and Refineries (Alberta, British Columbia, Saskatchewan)

Completion of piezometer network design at numerous operating facilities to assess the potential impact to local groundwater quality resulting from industrial activities and extent of contaminant migration from known source areas (Imperial Oil, Shell, Mobil, Canadian Occidental); and, provision of hydrogeological services in support of a gas plant decommissioning (ongoing). Responsibilities include, well installation, testing and sampling, involvement in a site-specific risk assessment (ecological and human health), development of sampling protocols, and assessment of cost-effective remediation techniques to address various contaminant situations in both soil and groundwater.

Various Oil and Gas Facilities (Alberta, Saskatchewan)

Completion of environmental operations audits and development of waste management plans for numerous operating oil and gas facilities (Amoco, Petro-Canada, Shell). Responsibilities included review of historical operations files (spill reports, waste handling procedures, EUB and AENV records), completion of site inspections and interviews, and historical air photo analysis and interpretation.

EDUCATION

Ph.D. (Geochemistry) – University of Calgary, 2008

M.Sc. (Physical Hydrogeology and Isotope Geochemistry) – University of Calgary, 1994

B.Sc. (Geology: hard rock, sedimentology, mineralogy, structural, geochemical) – University of Saskatchewan, Saskatoon, 1985

REGISTRATIONS & AFFILIATIONS

APEGA (P.Geol. – Alberta)

EGBC (P.Geo. – British Columbia)

APEGS (P.Geo. P.Eng. – Saskatchewan)

NAPEG (P.Geol. – Northwest Territories and Nunavut)

National Ground Water Association (NGWA)

International Association of Hydrogeologists

Canadian Water Resources Association (CWRA)

Sustainable Energy Development Program (Univ. of Calgary) – External Advisory Board – 2017 to present

Bow River Basin Council (Calgary), Board of Directors (2008-2013), Chair of Monitoring and Modelling committee (2008 to 2012), Member of Legislation and Policy Committee (2006-2011), Member of Integrated Watershed Management Group (2007 to 2010)

SPECIFIC TECHNICAL EXPERTISE

- ICP-MS, GC-MS, Ion chromatography (LC-MS, HPLC, IC)
- SEM, XRD (bulk and clays), XRF, EDS and Synchrotron Light (XANES, and EXAFS)
- Isotope ratio mass spectrometry (IRMS)
- Solid-phase extraction, Alumina fraction, and sequential soil extraction
- Toxicity identification evaluation for metals and organics
- Selection of appropriate inorganic or organic analytical techniques based on Standard Methods for Water and Wastewater
- Statistical analysis (e.g. population testing, trend analysis, control charting, PCA, HCA, spatial analysis)
- Multi-criteria decision analysis (MCDA)
- Vulnerability and risk mapping
- Risk assessment (human and ecological)
- Climate tele-connections assessment, climate model analysis and impact identification, development of adaptation strategies

PUBLICATIONS

Fennell J. and Aciszewski T (2019). Current knowledge of seepage from oil sands tailings ponds and its environmental influence in northeastern Alberta. Science of the Total Environment, 686, p. 968-985.

Birks S.J., **Fennell J.W.**, Gibson J.J., Yi. Y., Moncur M.C., and Brewster M. 2019. Using regional datasets of isotope geochemistry to resolve complex groundwater flow and formation connectivity in northeastern Alberta, Canada. Applied Geochemistry, 101 (2019), p. 140-159.

Hatala R., **Fennell J.,** and Gurba G. 2018. Advances in the realm of Hydrogeophysics: The emerging role of Quantum Geoelectrophysics in Aquifer Exploration. Can. Soc. of Expl. Geoph., RECORDER October Focus - Hydrogeophysics: the Past, Present, and Future. Vo. 43, No. 6, p. 32-36.

Birks S.J., Moncur M.C., Gibson J.J., Yi Y., **Fennell J.**, and Taylor E.B. 2018. Origin and hydrogeological setting of saline groundwater discharges to the Athabasca River: Characterization of the hyporheic zone. Applied Geochem., 98, p. 172-190.

Fennell J., 2018. Predictions, perceptions and the precautionary principle: responding to climate change in a realm of uncertainty. Canadian Water Resources Association, Water News, Fall/Winter 2018. Vo. 37, No. 2, p. 6-9.

Fennell J., 2018. Water, Peace, and Global Security: Canada's Place in the World We Want (Sandford and Smakhtin, eds.), Groundwater and Canada's Future – Moving data and information to knowledge and security. Prepared for the United Nations University, Institute for Environment, Water and Health, 17 pp.

Fennell J. 2018. Poison Well: Chasing arsenic in Alberta's groundwater. Water Canada, January/February 2018, p. 20-21.

Fennell J. 2017. Let's make a deal: Canada's vital role in the Columbia River Treaty. Water Canada, September/October 2017. p. 42-43.
Faramarzi M., K. Abbaspour, V. Adamowicz, W. Lu, **J. Fennell**, A. Zehnder and G. Goss 2017. Uncertainty based assessment of dynamic freshwater scarcity in semi-arid watershed of Alberta, Canada. *Journal of Hydrology: Regional Studies*, 9, p. 48-68.

Fennell J. 2015. Disposal in the unconventional oil and gas sector: Challenges and solutions. American Assoc. of Petroleum Geologists, *Environmental Geosciences*, Vol. 22, No. 04, December 2015, p. 127-138.

Fennell J. and O. Keilbasinki 2014. Water, food, and our climate: Is California a harbinger of things to come? *WaterCanada*, July/August 2015, p. 24-25.

Fennell J. and O. Keilbasinki 2014. Water without Borders: What is Canada's role in water security? *WaterCanada*, November/December 2014, p. 50-51.

Gibson J.J., **J. Fennell**, S.J. Birks, Y. Yi, M. Moncur, B. Hansen and S. Jasechko 2013. Evidence of discharging saline formation water to the Athabasca River in the northern Athabasca oil sands region. *Canadian Journal of Earth Sciences*, 50, p. 1244 - 1257.

M.S. Ross, A.S. Santos Pereira, **J. Fennell**, M. Davies, J. Johnson, L. Sliva, and J.W. Martin 2012. Quantitative and Qualitative Analysis of Naphthenic Acids in Natural Waters Surrounding the Canadian Oil Sands Industry. *Environmental Science and Technology*, 46, p. 12796 – 12805.

Fennell J. 2011. Total Water Management – a new and necessary paradigm. Environmental Science and Engineering Magazine, May/June edition.

Fennell J., Klebek M. and Forrest F. 2011. An approach to managing cumulative effects to groundwater resources in the Alberta Oil Sands. World Heavy Oil Congress proceedings, March 2011.

Fennell J. 2010. Protecting water supplies in CSG development. *Water Engineering Australia*, Vo. 4, No. 6, September 2010.

Fennell J. 2008. Effects of Aquifer Heating on Groundwater Chemistry with a Review of Arsenic and its Mobility. Ph.D. thesis, Department of Geoscience, University of Calgary.

Fennell J. Zawadzki A. and Cadman C. 2006. Influence of natural vs. anthropogenic stresses on water resource sustainability: a case study. *Water Science and Technology*. Volume 53, No. 10, p 21-27.

William L.B., M.E. Wieser, **J. Fennell**, I. Hutcheon, and R.L. Hervig 2001. Application of boron isotopes to the understanding of fluid-rock interactions in a hydrothermally stimulated oil reservoir in the Alberta Basin, Canada. *Geofluids*, Vol. 1, p. 229-240.

Kellett R., **J. Fennell**, A. Glatiotis, W. MacLeod, and C. Watson 1999. An Integrated Approach to Site Investigations in Permafrost Regions: Geophysics, Soils, Groundwater, and Geographical Information Systems. ARCSACC Conference, Edmonton '99.

Gilson E.W., R. Kellett, **J. Fennell**, P. Bauman, and C. Sikstrom 1998. High Resolution Reflection Seismic and Resistivity Imaging of Deep Regional Aquifers for Stratigraphic Mapping. CSEG Conference.

Fennell J. and Bentley L. 1997. Distribution of Sulphate and Organic Carbon in a Prairie Till Setting: Natural versus Industrial Sources. *Water Resources Research*, Vol. 34, No. 7, p. 1781-1794.

Fennell J. and Sevigny J. 1997. Effects of Acid Conditions on Element Distribution Beneath a Sulphur Base Pad (Acid Mobilization Study). Publication submitted to the Canadian Association of Petroleum Producers (CAPP).

Fennell J. 1994. Source and Distribution of Sulphate and Associated Organics at a Sour Gas Plant in Southern Alberta. M.Sc. thesis, Department of Geology and Geophysics, University of Calgary.
Hayes B., J. Christopher, L. Rosenthal, G. Los, B. McKercher, D. Minken, Y. Tremblay, and

J. Fennell 1994. *Atlas of the Western Canadian Sedimentary Basin – Chapter 19: Cretaceous Manville Group*. Canadian Society of Petroleum Geologists and Alberta Research Council, ISBN 0-920230-53-9.

PRESENTATIONS & LECTURES

Bow River Basin Council – Technical Series, May 2021, online: Flooding, climate change and the need for a precautionary approach.

Bow River Basin Council – Legislation and Policy Group seminar, April 2021, online: Gravel mining – the physics, chemistry, and risks you need to know.

COSIA Oil Sands Innovation Summit, June 2019 Calgary AB: Fact or fiction – the truth regarding tailings pond seepage in Canada's oil sands (response to a Free Trade Agreement challenge),

CWRA Alberta Branch conference, April 2019 Red Deer: Flooding, climate change, and the need for a precautionary approach.

University of Calgary, Sustainable Energy Development Program. February 2019, Decision support processes and tools in sustainable energy development projects.

Mine Water Solutions, June 2018. Total Water Management: Canada's contribution to sustainable mine development.

Canadian Water Resources Association, April 2018, Red Deer, AB. Arsenic and Alberta's Groundwater: the where and why.

Southern Alberta Institute of Technology (water Initiative), February 2018, Calgary AB. Risky business: understanding Alberta water security

Canadian Society of Unconventional Resources (CSUR), January 2018, Calgary AB. Managing through nature's extremes: ensuring water security for successful UCOG operations.

SEAWA, Nov 2017, Medicine Hat AB. Hydrology of riparian areas: the need for protection and preservation.

CWRA National Conference, June 2017, Lethbridge AB. Climate change, the Columbia River Treaty, and considerations for a successful re-negotiation.

Thermal mobilizations and the regulatory response, May 2017, Calgary AB. CHOA forum.

National Ground Water Association, March 2017, Denver CO. Advances in the realm of hydrogeophysics: the role of Quantum Geoelectrophysics in groundwater exploration

Haskayne School of Business IRIS series, Feb 2017. Following the molecules: the importance of water to Canada's future.

BRBC-CEAC, Feb 2017, Cochrane AB, GW-SW interaction and the implication for development in riparian lands.

Watertech, April 2017, Banff AB. Arsenic in Alberta's Groundwater: the where and why; Isotopes and Geochemistry:

National Ground Water Association, Hydrogeophysics for deep groundwater exploration, March 2017, Denver CO. Advances in the realm of Hydrogeophysics: the role of Quantum Geoelectrophysics in Groundwater Exploration

Haskayne School of Business CPC IRIS seminar series, February 2017, Calgary AB. Following the molecules: the importance of water in Canada's future.

Bow River Basin Council/Cochrane Environmental Action Committee Collaborating for Healthy Riparian Lands Engagement Workshop, February 2017, Cochrane AB. Groundwater-Surface water interaction and the implications of human development in riparian lands.

Watertech, April 2016, Banff AB. Predicting Alberta's Groundwater Future & An Integrated Approach to Resolving Complex Hydrogeological Settings.

Canadian Water Resources Association (CWRA), April 2016, Edmonton AB. Natural discharge and its role in Athabasca River water quality.

Canada's Oil Sands Innovation Alliance (COSIA) Water Forum, March 2016, Calgary AB. Natural discharge and its role in Athabasca River water quality.

Canadian Association of Petroleum Geologists (CSPG), March 2016, Calgary AB. Climate, water availability, and the success of Western Canada's Energy Development & Natural discharge and its role in Athabasca River water quality.

Underground Injection Control (GWPC), February 2016, Denver CO. Disposal in the unconventional oil and gas sector: challenges and solutions.

AGAT Environmental Series, Jan/Feb 2016. Calgary and Edmonton, AB. Climate, water availability and the success of Western Canada's energy industry.

International Water Conference, November 2015, Orlando FL. Disposal in the unconventional oil and gas sector: challenges and solutions.

Chemistry Industry Association of Canada, October 2015, Edmonton AB. Water Sustainability: and its importance to successful industry.

EnviroAnalysis, July 2015, Banff AB. Thermal mobilization and Arsenic: implication for the oil sands.

WaterTech, April 2015, Kananaskis AB. Smart Monitoring to address challenges of Unconventional Gas development and an approach to mapping risk related to thermal mobilization of constituents.

Canadian Water Resources Association, April 2015, Red Deer AB. Water, Energy and Canada's Future (keynote address)

Underground Injection Council, February 2015, Austin TX. Monitoring to address challenges of Unconventional Gas development (invited speaker)

National Ground Water Association, Groundwater monitoring for Shale Gas developments workshop, November 2014, Pittsburgh PA. Smart monitoring to address the challenges of Unconventional Gas Development (invited speaker)

Canadian Water Resources Association, June 2014, Hamilton ON. Water disposal in the Oil Sands: challenges and solutions and What is Water Security and Why is it Important.

Water Management in Mining, May 2014, Vancouver BC. Total Water Management: a necessary paradigm for sustainable mining.

CSPG GeoConvention May 2014, Calgary AB. Water disposal in the Oil Sands: challenges and solutions; Placing the risk of thermal mobilization into perspective; What is Water Security and Why is it Important?

WaterTech, April 2014, Banff AB. Water disposal in the Oil Sands: challenges and solutions and Placing the risk of thermal mobilization into perspective.

Canada's Oil Sand Innovation Alliance (COSIA), March 2014, Edmonton AB. Water disposal in the Oil Sands: challenges and solutions and Placing the risk of thermal mobilization into perspective.

International Assoc. of Hydrogeologists, GeoMontreal 2013, October 2013, Montreal QC. The role of subsurface heating in trace element mobility.

Oil Sands Heavy Oil Technology 2013, July 2013, Calgary AB. The role of subsurface heating in trace element mobility.

Watertech, April 2013, Banff AB. The role of subsurface heating in trace element mobility.

International Assoc. of Hydrogeologists World Congress 2012, September 2012, Niagara ON. Session Chair for Hydrogeological Issues in the Oil Sands and presenter: i) Oil Sands overview – economic and environmental setting; ii) Framing groundwater vulnerability in the oil sands: an approach to identify and discern; and iii) Climate: a driving force affecting water security in the oil sands

Water in Mining 2012, June 2012, Santiago Chile. Total Water Management: a necessary paradigm for sustainability.

BCWWA 2012 Annual Conference, April 2012, Penticton BC. The role of inventory, dynamics, and risk analysis in water management: a case study.

WaterTech, April 2012, Banff AB. Plenary Session. Bringing context to the oil sands debate: understanding the role of nature and its environmental effects.

BCWWA Hydraulic Fracturing Workshop, Fort St. John BC, March 2012. Keynote address: Striking a Balance – water resource management versus economic development (keynote address).

CONRAD 2012, March 2011, Edmonton AB. Bringing context to the oil sands debate: understanding the role of nature and its environmental effects.

Alberta Irrigation Projects Assoc., November 2011, Lethbridge AB. Managing what we have: a review of Alberta's water sources, volumes and trends (invited speaker).

Alberta Innovates Technology Talks, November 2011, Calgary AB. Dynamics of Alberta's Water Supply: a review of supplies, trends and risks.

Red Deer River Watershed Alliance Annual General Meeting, October 2011, Red Deer AB. Water in the Red Deer: volumes, patterns, trends and threats.

Land and Water Summit, October 2011, Calgary AB. Total Water Management: a necessary paradigm for water security.

CEMA Groundwater Working Group, June 2011, Fort McMurray AB. Groundwater in the oil sands: facts, concepts and management processes.

CWRA Alberta / Alberta Low Impact Development Annual Conference, April 2011, Red Deer AB. A Review of Alberta's Water Supply and trends.

WaterTech, April 2011, Banff AB. Managing what we have: a review of Alberta's water supply.

World Heavy Oil Congress 2011, March 2011, Edmonton, AB. An approach to managing cumulative effects to groundwater resources in the Alberta Oil Sands.

Engineers Australia, August 2010, Brisbane Qld. CSG development in Australia: an approach to assessing cumulative effects on groundwater (invited speaker).

Joint IAH/AIG meeting, July 2010, Melbourne Vic. Assessing the effects of coal seam gas development on water resources of the Great Artesian Basin (invited speaker).

18th Queensland Water Symposium, June 2010, Brisbane Qld. A cumulative effects approach to assessing effects from coal seam gas development on groundwater resources (invited speaker).

WaterTech, April 2010, Lake Louise AB. Regional Groundwater Monitoring Network Implementation: Northern Athabasca Oil Sands Region.

University of Calgary, December 2009, Calgary AB. What's happening to our water? A review of issues and dynamics.

CSPG Gussow Conference, October 2009, Canmore AB. Water sustainability in the Alberta Oil Sands: managing what we have (invited speaker).

Bow River Basin Council, Legislation and Policy Committee Groundwater Licensing Workshop, March 2009, Calgary AB. Groundwater: the hidden resource

BlueWater Sustainability Initiative, January 2009, Sarnia ON. Planning approaches and forensic tools for large-scale regional monitoring initiatives.

CWRA Technical luncheon session, October 2008, Calgary, AB. Water sustainability in a growing Alberta.

Bow River Basin Council, September 2008, Calgary AB. Basin Monitoring and Management Approaches.

IAH/CGS GeoEdmonton08, Edmonton AB. Coordinator and Chair of Groundwater Development Session.

North American Lake Management Society (NALMS) 2008, Lake Louise AB, Coordinator and Chair of Climate Change Effects to Lakes, Reservoirs and Watersheds section.

EcoNomics™ Luncheon, May 2008, Calgary AB. Water Sustainability in the Hydrocarbon Industry.

WaterTech, April 2008, Lake Louise AB. Effects of climate and land cover changes on basin water balances.

CWRA Annual Conference, April 2008, Calgary AB. Role of climate change and land cover on water supply sustainability.

Bow River Basin Council, March 2007, Calgary AB. Forest Hydrology and the effects of Climate Change.

ALMS/CWRA, October 2006, Lethbridge AB. Reservoir Maintenance Workshop. Climate tele-connections and their effects on basin water supplies

Bow River Basin Council, June 2006, Calgary AB. Groundwater sustainability: the invisible resource (Climate change and basin sustainability)

Engineering Institute of Canada, May 2006, Ottawa ON. CCC2006 Land use and climate change effects at the basin scale.

International Water Association, Watershed and River Basin Management Specialists Group Conference, Calgary, AB, 2005. Basin Water Management Strategies.

Burgess Shale Geoscience Foundation, August 2004 and 2005, Field BC. Water in a Changing Climate: understanding and adapting.

C-CAIRNS, October 2005, Victoria BC, Climate and Fisheries Impacts, Uncertainty and Responses of Ecosystems and Communities, Effects of Climate and the PDO on Hydrology of a Major Alberta Watershed.

North American Lake Management Society, November 2004, Victoria BC. Climate Change and Effects on Water Resources.

Canadian Institute Conference, June 2004, Calgary AB. Water Management Strategies for the Oil and Gas Industry: The challenge and approach

Canadian Society of Petroleum Geologists, Gussow Conference, March 2004, Canmore AB. Understanding the Effects of Natural and Anthropogenic Forcings on Basin Water Resources.

Alberta Environment and EUB, April 2003, Elk Point AB. Climate and Land Use Change Effects on Basin Water Resources in the Lakeland Region - East-central Alberta.

Joint CGS/IAH Conference, June 2001, Calgary AB. A Multidisciplinary Approach to Resolving Complex Hydrogeologic Systems.

Aquatic Toxicity Workshop, October 1996, Calgary AB. Use of site characterization and contaminant situation ranking to focus a risk assessment evaluation at a decommissioned sour gas plant and associated landfill.

Joint GAC/MAC Conference, April 1995, Waterloo ON. Use of geochemical modelling and stable isotopes to determine the source of groundwater quality impacts near a sour gas processing facility.

Joint GAC/MAC Conference, Edmonton AB, 1994. Assessment of depression-focused recharge as a mechanism for variable groundwater and soil chemistry.

GasRep Conference, Calgary AB, 1994. Use of stable isotopes to determine the source of water quality impacts near a sour gas processing facility.

Caitlyn T. Anderson

From: L. McCullough [redacted]
Sent: June 23, 2021 2:53 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - RE: Burnco West Cochrane Gravel Pit Bylaw C-8073-2020

I'M STRONGLY OPPOSED TO POLLUTING BOW RIVER AND OUR DRINKING WATER.

As a new resident of Cochrane, I am learning more about how developing nearby gravel pits are being priortorized before people's health.

WE CANNOT LIVE WITHOUT CLEAN WATER. There is a real move now to protect Alberta's water ie. the halt of Grassi Mountain to foreign fuel interests and more to come. The writing is on the wall. It is time Rocky View County get in touch with what is paramount to human and animal health and a *fundamental human right: access to clean water*.

CONCERN FOR CLEAN WATER SHOULD BE THE GUIDING PRINCIPLE for any and all economic activity anywhere. Expansion of gravel pits in the area is NOT IN THE PUBLIC'S BEST INTEREST. It may benefit a few (jobs) but it will harm many (water-drinkers, animals, the environment.)

ALSO, I AM CONCERNED ABOUT PROTECTING BIG HILL SPRINGS PARK. If there must be expansion of a nearby gravel pit, it should be given a 5 km berth as recommended by environmental experts. Long-term impacts must be considered and decisions not be made piece-meal. It is not easy but it is necessary.

Thank you for taking this matter under serious consideration.

Signed,

A concerned citizen in Cochrane, AB.

Michelle Mitton

From: Aaron Hamilton [redacted]
Sent: June 14, 2021 10:04 AM
To: Public Hearings Shared
Subject: [EXTERNAL] - Bylaw C-8073-2020

Follow Up Flag: Follow up
Flag Status: Flagged

Name: Mrs Aaron Hamilton
Address: 175 Jumping Pound Terrace, Cochrane, AB T4C 0K5

Dear Council Members:

I am writing to oppose Bill C-8073-2020

Please do NOT proceed with another gravel pit!

Highway 1A is a beautiful highway used by families on their way to the mountains and Ghost Lake with recreation vehicles, boats, Trailers etc. Adding heavy equipment, extra traffic, dust, stone chips just makes for dangerous driving conditions for families.

The very close proximity of the gravel pit to the town of Cochrane is ridiculous! Strong westerly winds blow over Cochrane daily. The toxins and heavy medals stirred up by in the air and water by yet another gravel pit in the area is so unnecessary, not to mention the additional noise.

Please, please do NOT move this redundant gravel pit forward!

Aaron Hamilton

Caitlyn T. Anderson

From: Rick Hayton [redacted]
Sent: June 22, 2021 3:26 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Comments to Burnco West Cochrane Gravel Pit Bylaw C-8073-2020

Please find my comments below on the proposed Burnco West Cochrane Gravel Pit Bylaw C-8073-2020.

As a Cochrane resident, I am strongly opposed to the development of the Burnco West Cochrane Gravel Pit.

The potential for toxic ground water runoff into the Bow River from this site is not acceptable. Burnco's proposed setbacks from the Bow River will not prevent eventual leaching from the site into the river. Since Cochrane's water supply is obtained immediately downstream of this site, I do not believe development of this site as a large gravel operation is in the best interests of the Cochrane community.

The increase in activity (noise and dust) and truck traffic from this proposed gravel operation should not be allowed to develop on the edges of a growing metropolitan community. It is not in the best interests of Cochrane. It is bad enough that gravel operations are within the Town of Cochrane on the south side of the river. The dust and noise from this existing gravel operation are excessive and dangerous to health on windy days with dust blowing long distances from the actual operation of screening and stockpiling. Putting a large gravel operation up wind of Cochrane is just plain stupid and extremely bad regional planning.

Sincerely,
Rick Hayton,
Cochrane, Alberta

Michelle Mitton

From: Robert Hamilton [redacted]
Sent: June 14, 2021 8:35 AM
To: Public Hearings Shared
Subject: [EXTERNAL] - Re: Bylaw C-8073-2020

Name: Robert Hamilton
Address: 175 Jumping Pound Terrace, Cochrane, AB T4C 0K5

Dear Council Members:

I am writing in **opposition to the proposed rezoning**.

I was shocked when you approved a gravel pit on the edge of Big Hills Springs provincial park. How could you even consider something like that? Now you are considering a much larger gravel pit on the edge of our town on the way to the Ghost Lake reservoir? How many of these gravel pits do we need in our one small county?

The dust and noise associated with a large gravel mining operation on the edge of our town will impact the quality of life for all residents of Cochrane but especially those with chronic breathing conditions. Coming so soon on the heels of a respiratory pandemic it's astonishing you would want to diminish air quality in any way.

In addition, any run-off from the gravel mining activity will impact water quality in the adjacent waterways. When combined with run-off from proposed coal mines the environmental impact will be significant for all Albertans.

The people of Rockey View County treasure fresh air, clean water and natural beauty. You were elected to protect our way of life and our environment. A gravel pit promotes none of those values. If you continue to approve gravel pits you will be failing in your duty.

For these reasons **I strongly oppose the proposed rezoning and I urge you to do the same.**

Robert Hamilton
175 Jumping Pound TC
Cochrane AB T4C 0K5
[redacted]

Burnco West Cochrane Gravel Pit
Redesignation & Master Site Development Plan
RVC Bylaw C-8073-2020
Submission prepared by: Rocky View Gravel Watch
June 18, 2021

Rocky View Gravel Watch is opposed to Burnco's application to expand its existing gravel operations west of Cochrane south of Highway 1A from 151 acres to a total of 1,117 acres.

The primary reasons for our opposition to this application are:

- Serious concerns regarding the pit's impact on water quality in the local aquifers, the Bow River, and creeks that flow through the property. Recently performed tests have provided disturbing results that must be addressed.
- No justification has been provided to support the need to add such massive acreage to their existing gravel pit.
- No explanation has been provided to support their assertion that production from the site will increase four-fold once the pit is expanded.
- Serious impacts on significant wildlife corridors.
- Permanent disfiguring of a major tourism attraction in Rocky View – the scenic views along Highway 1A between Cochrane and the Rockies.
- Inadequate reclamation plans.

Unlike earlier gravel pit applications that have been considered by Rocky View Council this term, the Burnco application has not provided any of its technical studies for review by the public. This makes an assessment of its application significantly more difficult, especially given that its MSDP is also much more vague on many critical issues relative to MSDPs provided with other gravel pit redesignation applications.

In itself, this shortcoming should be sufficient to require the tabling of this application until Burnco releases its technical studies and the public have had a meaningful opportunity to review them. Of all the gravel applications considered by this Council, Burnco is requesting that significantly more land to be redesignated than any of its competitors have done. As a result, it is only fair and appropriate to hold Burnco to at least the same standard of information sharing as has been provided in other gravel applications.

Water Quality Concerns

Burnco is proposing to excavate gravel both above and below the water table. Its MSDP is extremely vague about specifics. This in itself should be completely unacceptable. It is not clear how Council can approve an

application when such substantive information is not clearly evident in the applicant's submission.

In a separate submission, Dr. Jon Fennell is presenting the results of a soil column flushing experiment conducted with gravel from the existing Burnco West Cochrane gravel pit. The results from that experiment are disturbing in that they found levels of metals and trace elements above levels that are safe for freshwater aquatic life and for human drinking water. Many of these are toxins that accumulate in the body, rather than being flushed out over time.

The test Dr. Fennell performed mimics the effect of precipitation flowing through what is left after most of the gravel has been extracted from a site. This is the situation that will be present during excavation and quite possibly after reclamation.

Burnco has acknowledged that the bedrock in that area is fractured. As a result, whatever leaches through during and after gravel extraction will end up in the aquifer. This means that any contaminants will end up affecting drinking water for everyone who relies on groundwater wells and on water from the Bow River.

Burnco's technical studies supporting its application do not consider this issue. They have reported on pre-excavation groundwater quality. However, they have done no work to determine the impact their gravel extraction activities might have on that water quality. This is an unacceptable shortcoming.

Simply assuming there will not be a problem is not adequate. Burnco must be required to demonstrate that its proposed gravel extraction activities will not damage water quality before they can proceed.

No Demonstrated Need for Pit Expansion

Burnco currently operates a 151-acre pit at its West Cochrane location. Since it opened in 2016, it has produced 125,000 tonnes of gravel per year. This leaves their existing pit with 14 − 15 years remaining reserves, at their current production rate.

Burnco also has over 3,200 acres of operating gravel pits elsewhere in Rocky View. Although they assert that some of these pits are "nearing depletion", they have provided no information on expected remaining reserves at any of their other four pits in Rocky View. Nor have they provided any information on possibilities for expanding any of those pits as an alternative to expanding its West Cochrane operations.

At Burnco's current production rate, the additional reserves at the West Cochrane location would increase the pit's lifespan to well over 100+ years. It is completely irresponsible to consider redesignating land to gravel production that may not be used for such purposes within the next century. This is particularly true given the current lack of any comprehensive policy approach to managing gravel resources within the County. Once such policy is in place, this may be an appropriate location to identify for future gravel extraction. However, until such a policy is in place, permanently redesignating almost 1,000 acres lacks any justification.

Given the water quality concerns raised above, Burnco's explanation for the need for this expansion is particularly worrisome. Burnco indicates that they are looking to this site to replace gravel washing operations they have undertaken at other locations to continue to provide itself with a vertically integrated source of supply for its asphalt and concrete operations in Calgary.

For starters, it is not Rocky View's responsibility to assist Burnco in maintaining its vertical integration. From Rocky View's perspective, the question is whether this is the highest and best use for this land, not whether Burnco can maintain its profitability more easily if this land is redesignated as it desires.

Even more importantly, gravel washing activities this close to the Bow River and on top of fractured bedrock will significantly increase the risks of contamination for critical water sources. Burnco does not appear to have provided any technical studies documenting the potential impacts from gravel washing at this location. Until they have demonstrated that this activity will not increase risks of water quality degradation, their application must not be approved.

No Explanation for Assumed Four-fold Increase in Production Volumes

Burnco's MSDP assumes that once the additional 966 acres are redesignated, their production rate at the West Cochrane site will suddenly increase from 125,000 tonnes/year to 500,000 tonnes/year. There is no justification provided for this assertion. As a result, it appears to be, at best, an extremely optimistic hope.

The gravel market is highly competitive. According to Burnco's MSDP, its existing West Cochrane pit could be producing 500,000 tonnes/year but has not been doing so. It is difficult to imagine that if they could have sold an additional 375,000 tonnes/year, they would not have been doing so already.

Without any explanation for why they will be able to quadruple their production rate, there is no demonstrated need for such a massive expansion.

Even if there were an explanation, the proposed expansion would extend the pit's expected life to at least 30 years. It would be far more responsible to redesignate the land as it is needed within a 5 – 10-year timeframe, not a 30 – 100-year timeframe. How can any current council determine the highest and best use for land so far into the future?

Significant Impacts on Wildlife Habitat and Corridors

Burnco's own MSDP identifies many species at risk that traditionally live in or near its proposed gravel pit expansion. This is not surprising given that the site stretches 6.5 kilometres along the Bow River.

The proposed mitigation measures are totally inadequate to protect the affected wildlife. The wording of Burnco's mitigation measures is full of "should" statements rather than concrete obligations. This makes them meaningless and unenforceable.

As an example, the location includes nesting sites for a number of migratory bird species. Burnco's mitigation measures state that if they find active nesting sites, "site-specific measures **should be** developed" (emphasis added) – that commits them to nothing.

It is also highly disturbing that Burnco's own description of its mitigation measures for riparian areas and wetlands states "if setbacks are adhered to" the mitigation measures should result in no residual impacts on the affected riparian areas and wetlands. This suggests that there is a real possibility that the setbacks will not be adhered to and that, if they are not, there will be permanent damage to these environmentally sensitive areas. Disturbingly, other mitigation measures include commitments to develop plans for activities that occur within setback areas. No explanation is provided for these apparently contradictory mitigation measures.

Permanently disfiguring scenic tourist route

The drive through Rocky View County along Highway 1A to the Rockies is an extremely popular tourist route. Many people intentionally choose the slower, more scenic route along Highway 1A rather than the Trans-Canada Highway west from Calgary.

The proposed gravel expansion will permanently disfigure this major tourist attraction. Constructing 6.5 kilometres of berms along the south side of Highway 1A to obscure the presence of heavy industrial open pit mining will

transform a drive with breath-taking scenery to a drive during which one endures a heavy industrial corridor. Few tourists seek out heavy industrial "sites" as part of their vacation plans.

This disfigurement of the scenic corridor would be bad enough if Burnco was removing the berms once the gravel pit is finally reclaimed. However, they are proposing to leave the berms in place forever. As well as the serious negative impact this will have on one of the province's premier tourist routes, it also raises questions about the adequacy of their reclamation plans.

Inadequate and/or ineffective reclamation plans

Gravel pit operations typically use berms as a convenient location to store topsoil, subsoil, and overburden so that it will be readily available for use during reclamation at the end of the pit's life. However, Burnco is proposing the retain the screening berms adjacent to Highway 1A permanently. Given this, how is Burnco going to fulfill its reclamation obligations?

Burnco's MSDP asserts that the screening berms will be "constructed with an overburden core". However, for these berms to be landscaped as described, they will need to have topsoil and subsoil as well – without those components, vegetation will not grow or survive.

Despite this basic plant science reality, the MSDP asserts that all topsoil and subsoil will be salvaged and used in reclamation. These statements in its MSDP simply do not fit together. They cannot both have used overburden and soil from the site to construct permanent berms and also use all soil in their reclamation activities.

Burnco is also proposing to maintain far greater disturbed areas as active gravel pit operations than has been proposed by other gravel applications in the County. They are proposing to have 70 acres on the west side of the pit and 51 acres on the east side of the pit as disturbed areas at any one time for a total of 121 acres. In contrast, other gravel operations have proposed active disturbed areas of only 40 acres at any one time. What justification is there for Burnco to be held to a lower standard for its reclamation obligations than its competitors? This is particularly critical given the environmentally sensitive nature of its location and the serious water quality concerns that have been raised.

Conclusion

There is no justification for approving this application as submitted. Burnco's existing pit has 15 years remaining reserves at its current production rate. Until Burnco returns with a credible explanation for how it

will maintain a quadrupling of its rate of production over the next thirty years, there is no need to redesignate any additional land to meet its production needs in the immediate future. Even if Burnco can realize these optimistic production levels, there is no need to redesignate enough land to provide 30 years of production. It would be far more responsible to redesignate land on an as-needed basis.

Before any further redesignation of land is appropriate at this location, Burnco also must demonstrate that the water quality concerns raised by Dr. Jon Fennell's study are false. Until they can do that, it is irresponsible to approve additional gravel pit operations in this location.

Burnco also needs to address the serious shortcomings in its mitigation measures that should be protecting the highly sensitive environment in which they propose to operate. The inconsistencies in their reclamation plans also must be resolved before any application is approved.

Caitlyn T. Anderson

From: William McNabb [redacted]
Sent: June 23, 2021 1:30 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Bylaw C-8073-2020

Name: William McNabb
Address:31 Silver Ridge Rise Nw, Calgary AB T3B 4P6 - Have an option to develop W5M-4-26-8
Bylaw: C-8073-2020

To Rocky View Counsel

Concerning Bylaw C-8073-2020

A lot of things about this application scares me. The first is that this pit could be in the community for 120 years or more if approved as is. The approval needs to be for what can be used in ten years at current rates or max 160 additional acres connected to the current location.
The second is the dewatering of the pit. The pit was not supposed to be dewatered. But over ten years there has been efforts to change this scope through the operating agreement every 5 years that has no elected official on the board. This allows the operator to increase the scope of the operations without the public input that is required. This is ridiculous for planning and holding the surrounding land owner's captive to a temporary land usage that will outlast all living today.
The third is the environmental aspect of the pit. Burnco has chosen to put the plants for their operations on the east and west fence line of the pit. This will spread the contaminants onto the surrounding land owners. They have the land to put the operations where the dust and noise will mostly be on Burnco's land. Yet they have chosen to hurt the surrounding land owners by letting them be the buffers for Burnco's light, noise and dust contamination. This is unacceptable, especially when they have the land to do otherwise.
The fourth is the Health of the surrounding community. Burnco can limit exposure by putting the operations as far away from the city of Cochrane and neighbors as possible. They have chosen to put it as close as possible to the east and west boundaries. Exposure to dust is the cause of ailments that have long term effects. Reducing the exposure is a critical part of having the highest tax benefit with the lowest associated health costs that will occur with the pit. To do otherwise is fiscally and morally wrong.

It comes down to the "why" of this pit. Clearly more gravel is not needed at present, as the current pit still has 20 years of life. I would request that this not be approved until the current pit is used and then max 160 arces. A gravel policy needs to be in place to provide guidance for the residents of Rocky View. Why would people want to live out in Rocky View country when they are under constant threat of a gravel development next to them for 100+ years. With no way to protect their investment, their surrounding environment and their health.

Environment is critical. The current protocols allow for data gaps that are crucial for determining the real effect. If the current pit is approved, we want to see real time data from around the property monitored by a third party and complaints filed when they are putting contaminants on the surrounding properties.

Water is critical. If dewatering is taking place a monitor needs to be put in place on the wells within 1 mile of the Burnco pit. This is to allow us data to fight if we lose our water due to the pit and thus lose the agricultural base that has been the lifeblood for 150 years.

Thanks you,
William GM McNabb PE P.Eng

June __, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently work as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

[Individual's Name] APVINDER GILL
[Individual's Address] 164 WILLOWMERE WAY CHESTERMERE AB T1X0E2

June 22, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently work as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

Beinder Brar
152 Willowmere Way
Chesteremere, AB, T1X 0E2

June 16, 2021

Rocky View County

262075 Rocky View Point

Rocky View County, AB

T4A 0X2

Attention: Legislative Services

(legislativeservices@rockyview.ca)

Re: Burnco's West Cochrane Pit (By-Law C-8073-2020)

As the owner of NW and SW 31-26-3 W5M, Mountain Ash Limited Partnership supports the Master Site Development Plan and redesignation from Ranch and Farm District to Natural Resource Industrial District of Burnco's West Cochrane Pit.

Responsible aggregate resource extraction should be encouraged in this area to avoid sterilization of a valuable natural resource and ensure competitive aggregate pricing of aggregate requirements for the benefit of Rocky View County and local business.

Sincerely,

Mountain Ash Limited Partnership

Bruce Waterman

June 23, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I am the current tenant of BURNCO's Carseland property, located in Wheatland County. Prior to BURNCO's development on this property, they leased the adjacent property from my family for a number of years. Throughout my experience with BURNCO, they have been courteous and professional in their dealings with me and have been very willing to remedy concerns that may arise. During the operation of their sites, they develop and follow excellent mitigation factors that significantly reduce the impacts of their operations. BURNCO strives to be a courteous neighbour in the community and I look forward to working with them in the future.

I believe that BURNCO will continue to follow these practices with their West Cochrane Gravel Pit and because of this I can support this application.

Sincerely,

Clarence Byma
225047 Highway 817, Wheatland County, Alberta, T1P 0S4
[redacted]

Volker Stevin Contracting Ltd.

June 22, 2021

Legislative Services,
Rocky View County,
262075 Rocky View Point,
Rocky View County, AB,
T4A 0X2

Sent via email to legislativeservices@rockyview.ca

Re: Proposed Amendments to Land Use Bylaw C-8000-2020

Volker Stevin Contracting is in support of the Proposed Amendments to Land Use Bylaw C-8000-2020. We work with Burnco on a regular basis and find that they are the standard that all gravel crushing operations should be held to. We have Burnco crush material in our pits yearly and we are also a partner in the Stoney Trail Aggregate Reserve (STAR) with them along with Lafarge.

After reviewing the Master Site Development Plan for the West Cochrane Gravel Pit it is clear that Burnco is committed to continue to be a great community partner to Rocky View County and an example for other gravel producers in Alberta.

Sincerely,

Corey Stasiuk
GM Asphalt Plants
Volker Stevin Contracting
7175 12 St SE
Calgary, AB, T2H 2S6

June 22, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I am the current tenant of BURNCO's Aldersyde property, located in Foothills County. Throughout my experience with BURNCO they have been courteous and professional in their dealings with me and have been very willing to remedy concerns that may arise. During operation of their sites, they develop and follow excellent mitigation factors that significantly reduce the impacts of their operations. BURNCO strives to be a courteous neighbour in the community and I look forward to working with them in the future.

I believe that BURNCO will continue to follow these practices with their West Cochrane Gravel Pit and because of this I can support this application.

Sincerely,

Darren Hansma

[redacted]

[redacted]

[redacted]

Hello, my name is David Dutchik.

I'm the owner of lands associated with those areas of the project west of Grand Valley Creek. And as the owner of these lands, I would like to express my support for the proposed gravel pit.

I've known BURNCO since 2011 when they started to get involved in the proposed gravel pit I had on NW13. Since then, they completed the permits for that site. They upgraded the intersection on the 1A. They built a large berm to hide the operation. They've done fencing and signs....They brought that concept into reality. They pay attention to things... to noise, dust and truck traffic. Their site is neat and orderly. BURNCO has always been courteous and professional.

In my opinion, they've done a good job with the existing site and I think they will do a good job with what they are proposing. They have expertise and they have been around long enough to give me confidence.

Change is constant and our Cochrane community is a prime example. The community continues to grow with developments and upgrades and this does not happen without the resources.

Finally, I've just finished building my dream house a half mile away from this project and I wouldn't have done that if I didn't think BURNCO would do a good job. Most importantly, my ranch has been in the family over 100 years and my son plans to make it longer. In no way would I jeopardize his future in agriculture.

Please support this project.

Thank you

David Dutchik

David Dutchik

Caitlyn T. Anderson

From: Erik Bakke [redacted]
Sent: June 15, 2021 5:25 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Burnco / Bylaw C-8073-2020

Do not open links or attachments unless sender and content are known.

To whom it may concern regarding Burnco proposed gravel pit west of Cochrane:

First, I've been a neighbour of Burnco for the past 6 years. Arguably, I am Burnco's closest residential neighbour, although 2 others likely tie for this (map and location can be viewed at your option, 15 Artists View Gate, Calgary, AB online).

I've provided commentary below in support of Burnco's development plans, categorized by "neighbour" and "operations".

First, Burnco is a good neighbour. How can an industrial neighbour be a good neighbour? They, and their employees, act like people who care about neighbourly relations and behave and follow through as such.
Examples:
in 2017/18, ATCO refurbished their gas lines in our neighbourhood. They used the corner by our house as a "lay down area" for equipment. This turned it into a reasonably large gravel parking lot, which upon completion, and further prodding, they didn't do a great job remediating. The neighbourly concern was partly aesthetic, but also neighbourhood quality - it wasn't long until this gravel pad screamed "late night parking area" to all kids and others who want to park their cars and do… things… in their cars at night, including littering after the refuse of drinking, smoking, sex, etc.. The residential neighbours got together to plan to remediate it ourselves. We thought it was a long shot to reach out to Burnco, but they were helpful right away (they had experienced equipment theft from people using that same corner to access their lands). We had planned to chip in to get an appropriate amount of topsoil, more than the dusting ATCO did, some seed, and plans to take turns watering it until the seed took. Burnco provided both a loader to bring over a bucket of soil right away, plus a truck to deliver some in a few days time. One could easily expect a large industrial neighbour to just ignore inquiry, or say that's not something they can do. But their actions are neighbourly - just as easy as I could go to the garden shed to grab a spade to help a neighbour, their "garden shed" has larger implements that they are willing to dedicate a few minutes time with to help. That was their offer, not even our ask.

Secondly, their land is posted no trespassing. I respect this. At one point in 2019 our neighbour's (now gone, sadly) dog was in the habit of jailbreaking himself from their yard, then luring one of my dogs out for adventures. He was an Australian Shepard mix, and was both clever and felt he had a broader responsibility to patrol the neighbourhood. This caused me to one day walk over to Burnco through the no trespassing signs to find their security staff to ask if they've seen the adventuring dogs. I walked up to the station of a fellow, whom did ask me what I was doing there as his first question. I explained that I was a neighbour looking for two dogs on the lam, gave my address and phone number, etc. I could have just as easily been brushed off with comments like "our policy doesn't make exception for searching for dogs", "not my problem", etc. but even the security guard said "I think I can help", and "We'll keep an eye out". Think! How many times are you frustrated in life interacting with corporations or other bureaucracies where think is no part of the interaction - where it's defined by rules and procedure - when empowering an employee to think solves problems better while leading to better outcomes, even if they are "just" the security guard. This also stuck with me as a good neighbour concept, it's not just when you contact senior management, but their front line people as well. Good management and attitude have a way of trickling down.

It is clear these types of things are not their ongoing obligation, however my experience is simply that as a neighbour, one is greeted with dialogue and thoughtfulness rather than the typical corporate procedures and stonewalling, and it has been appreciated.

Secondly, on the subject of Operations, the 6 years I've been next to them, here are some day to day experiences:
- I've never experienced dust
- I've not heard cement or gravel trucks coming or going.
- occasionally, and only if I'm outside and the wind is right, I hear what I have dubbed the "Fred Flintstone whistle" which I think is a shift change or such later in the afternoon, although I don't know for sure. It has never dawned on me whatsoever that this is even close to what a person would call a nuisance or be disturbed by.

Literally that's it.

I don't know if the standard of operation is the same or different from the gravel pit I live next to vs the one being proposed, but that can be ascertained by those in charge of the application. If it's the same, I attest as a neighbour that any future residential neighbours are extremely unlikely to be disappointed by having Burnco as a neighbour.

Submission by
Erik Bakke
15 Artists View Gate,
Calgary AB T3Z 3N4

June 21, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I am the current tenant of BURNCO's Black Diamond property, located in Foothills County and have leased the same lands from them for 8 years. Throughout my experience with BURNCO they have been courteous and professional in their dealings with me and have been very willing to remedy concerns that may arise. During operation of their sites, they develop and follow excellent mitigation factors that significantly reduce the impacts of their operations. BURNCO strives to be a courteous neighbour in the community and I look forward to continue working with them in the future.

I believe that BURNCO will continue to follow these practices with their West Cochrane Gravel Pit and because of this I can support this application.

Sincerely,

Frank Thomson

[redacted]

RVC Public Hearing, BURNCO, July 6/21

Bylaw C – 8073-2020

File PL 20200066, et al

This letter is for All of Council, in support of the BURNCO APPLICATION, W of Cochrane.

I have lived next to BURNCO's Springbank pit for the past 42 years. They are stellar neighbours in that they use full dust control, and sound control. In addition, they clean along the eastern portion of Old Banff Coach Road of dropped gravel, which is their most used truck route.

In this new location, under application, I am impressed that:

they are working with the Stoney Nakoda Nation to identify archaeological sites such as tipi rings,

their disturbance is all outside the wetlands as per their Biophysical Site Assessment report,

they propose to spend $1.5M to upgrade the current entry site, both for safety and in cooperation with Alberta Transportation,

and in cooperation with the Town of Cochrane they propose one of their first sites to be at the east end to finish that off earliest.

I take all these points from their submission and from exchanges with BURNCO; in order to point out that this level of thoroughness is typical of my experience with how BURNCO operates.

Respectfully,

Gloria Wilkinson

Springbank

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently work as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

1831626 Alberta Ltd

GURPREET SAINI

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C – 8073 2020

I am writing this letter in support of BURNCO Rock Product's Land Use Application – Bylaw C - 8073-2020.

I currently work as a truck driver in the aggregate industry, and I transport aggregate to and from BURNCO'S sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

Harinderpal Kang

45 Martha's Haven Green NE
Calgary, AB T3J3X6v

GRAY'S LIMITED
62 Slater Road
Strathmore, AB T1P 1J3
Telephone: 403-934-3590 Fax: 403-934-3076
Email: info@graysltd.com

June 17, 2021

Rocky View County
262075 Rocky View Point
Rocky View County, AB T4A 0X2

RE: Burnco West Cochrane Hearing
2021608 Council Meeting Public Hearing July 6, 2021

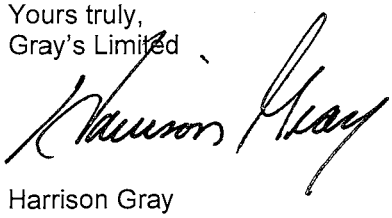
Rocky View Council:

I understand that Burnco Rock Products is proposing to develop a gravel operation at a West Cochrane site.

Gray's Limited of Strathmore Alberta in the County of Wheatland has been in business for over seventy-four years. During this period, Burnco has processed various gravel materials for us.

I can confirm that Burnco is responsible, and dependable, and provides a quality product in a safe, and environmentally friendly manner. I wholeheartedly endorse this company.

Yours truly,
Gray's Limited



Harrison Gray

HG/jw

Y:\HGRAY\HG-Rockyview County Letter.docx

Caitlyn T. Anderson

From: jagdev deol [redacted]
Sent: June 19, 2021 1:04 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Letter of Support - BYLAW C- 8073-2020

I am writing this letter in support of BURNCO Product's Land USE Amendment Applicaiton - Byl 8073-2020

I am currently employed as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's sites in the Rockyview County. These aggregates sites are allowing me to make a living in the community and are a very essential part of continued sustainable development.

BURNCO's past and current projects have shown that, when projects are developed responsibly, they do create a beneficial relationship with the community and the residents that reside there.

It is because of BURNCO ' s responsibly developed projects and record in Rocky View County I support BURNCO and its application for the expansion of the West Cochrane Gravel Pit.

Sincerely

Jagdev Deol
O/A Samaira Deol Trucking Ltd
301 Windermere Drive
Chestermere AB T1X1S3

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently work as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

Jasmal Saini (JHK transport Ltd.)

149 Williamson Way - Chestermere

21 June /2021

June 21, 2021

Rocky View County
Legislative Services
262075 Rocky View Point
Rocky View County, AB T4A 0X2

Re: Letter of Support – Bylaw C-8073-2020

This letter is being provided in support of Land Use Amendment Application – Bylaw C-8073-2020.

Aggregates are a key resource in sustaining our way of life. They are used to construct our homes, they are needed for roads, schools and in hospitals. Aggregate production also supports a wide variety of local jobs. These jobs include truck drivers, equipment operators, consultants and engineers. These jobs provide value to our communities and helps to sustain our municipalities and our province.

Responsible aggregate development should be encouraged and supported. We believe that BURNCO Rock Products Ltd. has shown a long history of successful projects that have been operated in a thoughtful and responsible manner. We have no doubt that they will bring the same expertise and stewardship shown at these other locations to this project.

Please accept this letter of support for the West Cochrane Gravel Pit.

Sincerely,

Jennifer Weslowski
Land Manager, SAB & WCAN Cement

Lafarge Canada Inc.
2213 – 50th Avenue S.E., Calgary, Alberta T2B 0R5
Phone: (403) 351-9022 Fax: (403) 278-6147

Caitlyn T. Anderson

From: Jim Burns <jim.burns@burnswest.com>
Sent: June 21, 2021 11:57 AM
To: Legislative Services Shared
Subject: [EXTERNAL] - Bylaw C-8073-2020

TO LEGISLATIVE SERVICES
RE: BYLAW C-8073-2020

from
BURNSWEST Corporation,
Suite 106,
155 Glendeer Circle S.E.
Calgary, AB
T2H 2S8

TO WHOM IT MAY CONCERN –

I have read through BURNCO's submission for their West Cochrane Pit, and was totally overwhelmed at the extensive detail their staff and consultants have provided in answer to all the pertinent questions which have been asked by the County, as well as some which haven't been asked. Believe me when I say that their follow through in meeting their obligations and satisfying the concerns of the County and the Public goes well beyond expectation in my opinion. I may be prejudiced, but BURNCO's track record is the best in the business.

I was an instrumental part in working with Rocky View Councillors on BURNCO's gravel pit application for the Burma Road Pit, and at that time thought we had gone above and beyond in answering any concerns which could arise from opening that or any other pit. The details in this current application go beyond what was supplied at Burma Road. You will find in checking the County's records on that pit since it opened, that they have lived up to all they said they would do in operating that site, and more. That is also true for their other sites located in Rocky View County and elsewhere.

BURNCO is requesting that the site be operated for 30 to 35 years. To some neighbours and maybe some councillors this may appear to be excessive, but it is not when you consider that during this period dust, noise, and visual perceptions will be controlled and minimal. Again, take a look at the Burma Road Pit for their exemplary performance.

Yours truly,
James Burns,
Past President, BURNCO,
and
President,
BURNSWEST Corporation.

June 22, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I have been approached by Burnco to submit a letter in support of their Master Site Development Plan (MSDP) for the West Cochrane Gravel Pit. I accept this request with respect and would like to share some of my experiences with living beside an active gravel pit for the consideration of the decision makers prior to their approval of this MSDP.

I have lived on the east side of Burnco's Springbank Operations for sixteen years, in the community of Cougar Ridge in Calgary. Cougar Ridge is immediately adjacent to the West Calgary Ring Road, and Burnco mined the gravel to the future road grade depth within the transportation utility corridor (TUC) beside Cougar Ridge as an extension of their ongoing Springbank operations. My house overlooks the ring road and gravel pit operations. This pit was already in operation prior to the development of Cougar Ridge as a residential development.

I am also the President of the Cougar Ridge Residents Association[1] (CRRA), and that is how I came to interact with Burnco about their gravel pit operations. Our association was approached by a concerned citizen about the ongoing impacts that the gravel pit was having on his residence, and he initiated an extensive plan to increase the mitigation measures that were in place to reduce these negative impacts (primarily of dust and noise). The CRRA eventually agreed to assist with his push for increased mitigation measures. As this land was owned by Alberta Transportation and those lands were reserved for the ring road, this became quite a lengthy process. To summarize the results, without getting into the details of the process, the CRRA was ultimately successful in obtaining permission from Alberta Transportation to plant a 1 km long shelterbelt in the 10m immediately bordering Cougar Ridge. This shelterbelt was and is the responsibility of the CRRA. It was planted by a group of over 100 community volunteers. When we approached Burnco about this, they not only provided a significant portion of the costs toward trees but many of their staff gave up a weekend and brought their families to help us plant. I remain grateful for that. I would like to note that throughout this process we learned that Burnco had previously planted trees along the top of the screening berm prior to the residential development but was asked to remove them by the authorities, as they didn't want any trees to interfere with the future uses within the Transportation and Utility Corridor.

[1] The opinions expressed in this letter are the opinions of the author and are not a representation of the opinions of the Cougar Ridge Residents Association.

I have read through the MSDP and it looks to be very thorough with most, if not all, of the concerns that would arise being identified and addressed. The positive measures of the MSDP that stand out to me the most based on my experience as a neighbour to a gravel pit are the commitment to mitigation measures including screening berms and planting and Burnco's commitment to progressive reclamation. There is also a commitment to periodically reassess aspects of the plan as time goes on and conditions may change, and to implement further measures as needed.

Gravel pits mine a non-renewable resource and permanently alter the landscape over a multi-year process with a significant environmental and social impact. They also provide necessary resources for development and ongoing employment. There are both costs and benefits. With proper management, the benefits can outweigh the costs. As I am not an expert in gravel pits or their impact on the environment, I will defer to the scientists and experts any concerns about the natural creeks, mining below the water table, proximity to the Bow River, the impact on vegetation and wildlife, and Burnco's safety record and operational management.

For myself, when I moved into Cougar Ridge at the edge of town, much of the area was still a greenspace. The area that is now the vast site of ring road and utility construction was once a well-managed gravel pit whose operations were performed in a manner that intentionally minimized its impact on its neighbours and was staged to leave the native vegetation in place until it became necessary to remove it. I can say that the current state of the Ring Road construction and its apparent minimal concern and mitigation of nuisances on its neighbours and the environment is a stark contrast to how Burnco runs its operations. Burnco's plan for progressive reclamation of vegetation and original habitat for the wildlife is extremely important. Within the TUC footprint the land use has been forever changed and Burnco was not responsible for performing any of that reclamation as the area is becoming a highway. The loss of that vegetation and witnessing the impact it is having on the displaced local wildlife is having a greater negative impact on the neighbouring residents than ever expected. This is why the need for proper reclamation and ongoing management of the landscape is critically important.

To summarize my letter, I will quote the MSDP under item 4.0 Cumulative effects. "The impacts related to this development have been mitigated as much as reasonably possible, that the site will not have an undue impact, and that the West Cochrane Gravel Pit be operated in a socially and environmentally responsible manner." As long as Burnco operates the West Cochrane Gravel Pit with the same stewardship and respectful approach that I have experienced at their Springbank site, and I believe they will based on the relationship that I have developed with Burnco, please accept this letter in support of this MSDP.

Kelly G. Smith

98 Cougarstone Court SW, Calgary AB T3H 5R4

June 18th, 2021

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently work as a truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

Kuljit Dhanda
305 Windermere Drive
Chestermere AB

Caitlyn T. Anderson

From: Larry de Castro [redacted]
Sent: June 23, 2021 3:00 PM
To: Legislative Services Shared
Subject: [EXTERNAL] - Burnco Rock Products

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

I am writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

I currently have worked with Burnco since 1998 as a self employed truck driver in the aggregate industry and I transport aggregate to and from BURNCO's numerous sites in Rocky View County. I am also a resident of RVC near Chestermere. These aggregate sites allow for me to make a living in the community and are an essential part of continued sustainable development. BURNCO has shown through their current and past projects, that when projects are developed responsibly, they can create a beneficial relationship with the community and the residents that reside there.

It's due to BURNCO's track record in Rocky View County that I can support BURNCO and its application for expansion of the West Cochrane Gravel Pit.

Sincerely,

Larry de Castro

DeCastro Trucking Ltd

--
Larry de Castro
DeCastro Trucking Ltd
[redacted]

Lehigh Hanson
HEIDELBERGCEMENT Group

Lehigh Hanson Materials Limited
222, 885 – 42 Ave SE
Calgary, AB T2G 1Y8
Phone 403-531-3000
Fax 403-531-3001
www.lehighhansoncanada.com

June 22, 2021

Attention: Rocky View County Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Via email: legislativeservices@rockyview.ca

Subject: Letter of Support – Bylaw C-8073-2020

To whom it may concern,

I am writing regarding BURNCO Rock Products Ltd.'s proposed West Cochrane Gravel Pit. As a landowner of Rocky View County, please accept this letter of support for the land use amendment application Bylaw C-8073-2020.

Aggregates are a critical component of supporting long-term growth and development in the region. They are a scarce, non-renewable resource which, if not extracted prior to the development of an alternative use, will be potentially lost forever.

Responsible aggregate development should be encouraged and supported. BURNCO Rock Products Ltd. has a history of responsible operation in the region. We believe they will continue to be good stewards of the industry with this latest project.

Sincerely,

Mike Smith
VP & GM, Materials SAB, SK & MB

Lehigh Hanson Materials Limited
Phone: 403-214-4141

June 22, 2021

Legislative Services
Rocky View County
262075 Rocky View Point
Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter Of Support – Bylaw C-8073-2020

McNair Sand and Gravel's support of Land Use Amendment Application – Bylaw C-8073-2020.

The owners and management of McNair Sand and Gravel believe responsible aggregate development should be encouraged and supported. We believe that BURNCO Rock Products Ltd. has shown a long history of successful projects that have been operated in a thoughtful and responsible manner. We have no doubt that they will bring the same expertise and stewardship shown at these other locations to this project.

Please accept this letter of support for the West Cochrane Gravel Pit.

Miles McNair

Caitlyn T. Anderson

From: Muray Poffenroth [redacted]
Sent: June 19, 2021 9:00 AM
To: Legislative Services Shared
Subject: [EXTERNAL] - Burnco west Cochrane project

I would like to provide a letter of support for this project as our property and our sons property are very close to Burnco Irricana gravel pit and have had no issues with noise or dust we have livestock right next to the pit as well we find Burnco to be considerate and very good neighbours sincerely Murray Poffenroth

June 23, 2021

Legislative Services

Rocky View County

262075 Rocky View Point

Rocky View County, AB, T4A 0X2

Attention: Rocky View County Legislative Services

Subject: Letter of Support – Bylaw C-8073-2020

We are writing this letter in support of BURNCO Rock Product's Land Use Amendment Application – Bylaw C-8073-2020.

We were the previous owners of the subject lands that are located to the east of the Grand Valley Creek. Our experience with the West Cochrane Gravel Pit, has shown us that BURNCO takes their operations and relationship with the community very seriously. They've shown that through careful planning and development, these operations can have little to no impact on the surrounding neighbours and communities that they operate in. BURNCO has significant experience in Rocky View County and have shown that they are a part of the community.

We believe that BURNCO will continue to follow these practices with their West Cochrane Gravel Pit and because of this we can support this application.

Sincerely,

Russell & Patricia Wiechnik
[redacted]