

Jansen Farms EIA Action Plan Summary – 2017 Final

December 18, 2017

Introduction

On May 12, 2016, H.S. Jansen and Sons Farm Ltd of 5063 Knob Hill Road, RR4, Armstrong BC was served with a Pollution Abatement Order (PAO) under the Environmental Management Act (File: AMS#350091). The PAO referenced the lands identified by PID 011-769-092, as well as other lands associated with the operation, and identified the specific substance of concern as nitrate from agricultural waste. As part of the PAO requirements, the operation was required to have an Environmental Impact Assessment (EIA) completed, to develop an Action Plan based on the results of the EIA and to submit a formal written summary on November 30, 2017 summarizing items completed from the Action Plan.

This report is the November 30, 2017 Annual Summary and includes results of monitoring conducted during 2017 and upgrades and management changes arising out of the Action Plan which were completed as of November 2017. This report follows the format of the H.S. Jansen and Sons Farms Ltd Action Plan (July 2017), and Action Item numbering in this report reflects that of the Action Plan. The next Annual Summary will be prepared for November 30, 2018 and will include 2018 monitoring data and information on upgrades completed in 2018.

A. General Items from May 2016 Pollution Abatement Order

1. **Ensure adequate and safe manure storage facilities. Maintain and keep in good working order the side slopes and pond edges of effluent storage structures**
 - Effluent storage structures were visually monitored monthly. No maintenance was required in 2017. See section 2.3.
2. **Drainage management measures required to ensure manure does not leave property or enter groundwater**
 - Manure application setbacks of 30 m minimum from Deep Creek will prevent movement of manure into surface water. Application rates of manure and irrigation rates are designed to ensure that crop requirements are not exceeded and thus that residual nitrate levels are low, and that nitrate does not leave the crop root zone during the growing season.
3. **Remedial measures required to ensure manure does not leave property boundaries, enter surface water or impact wells**
 - Manure setbacks from surface water, wells and property boundaries are designed to ensure that manure does not migrate off site when applied.
4. **Soil, surface and groundwater monitoring to demonstrate effectiveness of implemented strategies**
 - Soil testing for nitrates was done in all fields in fall 2017 as part of the AGRI PHNT study.
 - All irrigation and domestic wells were tested for nitrate once in 2017.

- Monitoring wells were tested twice in 2017 and will be tested 3 times in 2018.
- See sections 3.4, 3.6, 4.1 and 4.4 for more detail on 2017 soil and water monitoring.

5. **Maps**

- Detailed maps showing all fields and wells on the HS Jansen property are found in the 2017 EIA. Detailed maps showing all fields and wells on the property are also found in the 2017 Nutrient Management Plan.
- Maps showing the wells sampled to the south of Field 103A and 103B are found at the back of this document.

6. **2017 Nutrient Management Plan (NMP)**

- The 2017 NMP was submitted to the Ministry of Environment on May 24, 2017. It was reviewed by ENV and AGRI, and a final edited version was submitted on June 16, 2017.

B. Items arising from the 2017 Environmental Impact Assessment

1. Manure management and storage

1.1 Construct a new screen and silo system for solids

- The new screen and silo system for solids is partially installed and will be completed by spring 2018.

1.2 Create a separate recycled grit storage or re-use area off the slab

- This has not been done as it is not necessary to the safe and effective functioning of the manure management system. The existing system contains grit and captures any leachate from it.

1.3 Cover compost facility

- This has not been done. It is not necessary because any leachate from the compost facility is collected on a concrete surface and transferred to the lagoon. Covered compost facilities are not required under the current AWCR provided that leachate is collected and managed appropriately.

2. Manure supply infrastructure

2.1 Install pipeline breach monitoring device with shutoff. Contingency plan in case of a spill.

- The manure pipeline system has a sensor which is connected to cell phones of farm staff. It will notify of a pressure drop during pumping.
- The contingency plan is being developed.

2.2 Ensure all mainline installations are approved by a Certified Irrigation Designer

- There were no mainline installations in 2017.

2.3 Manure and stormwater management system inspected monthly. Summarize in annual summary report.

- Manure and stormwater management system were inspected monthly by Dale Jansen by

walking the perimeter of the lagoons and visually inspecting the liquid-solid separation unit and concrete storage area. No issues were noted and therefore no actions were required.

3. Nutrient management and crop selection

3.1 Continue to use qualified person to prepare annual nutrient management plan (NMP) for the operation. NMP must be designed to meet an agronomic balance of zero for each field, must account for all nitrogen sources on Jansen farm and must incorporate recommendations from 2016 AGRI PHNT study.

- 2017 Nutrient Management Plan was prepared by Ruth McDougall, M.Sc, PAg with input from Doug Macfarlane, CCA who is the nutrient management planner for the operation. The plan was designed for an agronomic balance of zero on each field farmed by HS Jansen over the Hullcar aquifer. R. McDougall approved all proposed nutrient applications for 2017.
- The NMP included all sources of nitrogen on the farm and from off-farm which included manure and nitrate from groundwater.
- Results from fall 2016 AGRI PHNT study were included in the 2017 NMP and used to develop application rates for individual fields.

3.2 Ensure operational nutrient applications are made in consultation with crop advisor.

- Operational nutrient applications were made in consultation with Doug Macfarlane, CCA who is the farm's nutrient management advisor. He consulted with the QP as required.

3.3 Include nitrate additions in irrigation water when calculating nitrogen application rates

- Nitrate levels in irrigation water were used to estimate the addition of nitrate in irrigation water. This amount was accounted for when calculating manure application rates on all fields. This information is found in the 2017 NMP.

3.4 Conduct annual post-harvest soil testing on all fields over Hullcar aquifer to 900 mm.

- Post-harvest soil testing was done in fall 2017 in all of Jansen's fields. Samples were collected within 2 weeks of final crop harvest. Samples were collected to 900 mm depth in 4 depth increments, 0-15 cm, 15-30 cm, 30-60 cm and 60-90 cm. Soil data will be used to calculate manure application rates for 2018.

3.5 Reduce nitrogen application rate in manure in 2017 on fields that had residual nitrate in fall 2016 in the medium to high category

- Corn fields were all but one in the high agronomic range in fall 2016. All of those fields had a lower nitrogen application rate in 2017 than they had in 2016.
- Alfalfa/grass fields had slightly higher or similar application rates of nitrogen in manure in 2017. There were two reasons for this: 1. The nitrogen uptake rate of a stand of alfalfa/grass in full production is in the range of 400 to 450 lb/A/yr. 2. The manure application rate in 2017 provided approximately 1/3 of this or 88 to 110 lb/A. The manure application rates in 2016 had provided only 20 to 90 lb/A of nitrogen. These application rates were approved by AGRI when they approved the NMP in spring 2017.

3.6 Participate fully in BC AGRI benchmark study if continued in 2017

- HS Jansen and sons participated in the fall 2017 AGRI benchmark study. Two of Jansen's fields have been included in the fall 2017-spring 2018 benchmark study. They were sampled three times in fall 2017 and will be sampled twice more in spring 2018 for nitrate-N to 90 cm.

3.7 Apply nutrients based on the field and crop specific recommendations from NMP.

- With one exception, nitrogen application in manure in 2017 was in line with recommendations in the 2017 NMP. Eleven of 12 fields received an application rate of nitrogen in manure that was at or below the rate recommended in the NMP. One field (109 Sylvia) received more nitrogen than recommended in the NMP. The difference in the amount of available nitrogen provided in manure was minor: The field received 29 lb/A of available N while 18 lb/A was recommended in the NMP. The crop of silage corn on the field had a nitrogen requirement of 192 lb/A.

3.8 Maintain records of all nutrients applied to lands in 2017

- Records were kept of all manure applications by field and volume in 2017. This information is available on request.

3.9 Install additional flow meters on the liquid manure distribution system to confirm application rates

- Installation of additional flow meters on the liquid manure distribution system did not occur in 2017 because funding was not available from the Ardcorp Hullcar fund. These have been requested from the Ardcorp Hullcar fund and will be purchased and installed in 2018 if funded by this fund.

3.10 Test liquid manure for nutrient content at least 3 times during growing season and use current manure data to calculate application rates

- Liquid manure from the large storage lagoon was tested 3 times in 2017, in March, May and August. Nitrogen information for the manure was used when calculating manure application rates.

3.11 Continue to export separated solids off the Hullcar aquifer fields unless there is insufficient liquid manure to meet crop N requirements.

- All separated solids (solids separated out of the manure stream by the liquid-solid separation system) were hauled to the operation's Lavington fields in 2017.

3.12 No inorganic N fertilizer used on fields over Hullcar aquifer unless insufficient manure is available to meet crop N needs or manure cannot be applied to a field.

- No inorganic nitrogen fertilizer was used at HS Jansen and Sons in 2017.

3.13 Irrigate fields based on data from soil moisture monitors

- Irrigation rates on all fields were based on data from soil moisture monitors. Sufficient irrigation water was applied to wet the soil to at least the 1' depth but not below the 2'

depth to ensure that crop roots could access all applied water and that irrigation water did not penetrate below crop rooting depth.

3.14 Install soil moisture monitors on more fields over aquifer 103.

- Installation of additional soil moisture monitors was conditional on Ardcorp funding. That funding was not distributed in 2017. Monitors have been requested as part of the Ardcorp Hullcar funding and will be installed if funding is approved for these items.

4. Groundwater

4.1 Sample monitoring wells 1S, 1D, 3 and 5 for total N, TKN, nitrate-N and ammonia-N 3x per year for 2 years (approx. March, July and November). Include results in annual summary report

- Monitoring wells were sampled once or twice in 2017, during October, November and December. Sampling was done by Jennifer Kjaerbeck of Mountainview Electric, Enderby BC using standard sampling protocols. Samples were placed in a cooler with ice packs and delivered to Caro Analytical in Kelowna BC for analysis the same day. Samples were analyzed for a suite of nitrogen parameters. Table 1 contains the results for the nitrogen parameters tested. Original lab data is attached as separate pdf files with QC data included.

- Water from monitoring wells 5 and 1S exceeded the Canadian Drinking water guideline of 10 mg/L nitrate; MW5 and 1S were measured at 14.6 and 17.7 mg/L respectively in fall 2017. Water from monitoring well 3 was below the guideline.

- The spring and summer samples were missed in 2017. Wells will be sampled in 2018 in spring, summer and fall, and data will be included in the November 30 2018 annual summary report.

4.2 Continue to record soil moisture monitoring data

- Soil moisture monitoring data is recorded automatically and stored on site.

4.3 Complete a study to further assess the flux of nitrate-N through the unsaturated zone using lysimeters

- Installation of lysimeters was conditional on Ardcorp funding. Funding was not distributed in 2017. Lysimeters have been requested and will be purchased and installed in 2018 if funding is granted for them.

4.4 Sample domestic wells to the south of the field of concern for nitrogen parameters to help delineate the southern extent of the nitrate plume.

- Nitrate and nitrite data from all wells used by HS Jansen and sons that are located to the south of fields 103A and 103B are found in Table 2 and well locations are identified on Map 1 and Map 2 (this includes domestic and irrigation wells). All wells had nitrate and nitrite levels below the drinking water guidelines when sampled in September 2017.

4.5 Report the results of MW 1S and 1D to neighbours

- Neighbours are aware of the nitrate levels in these wells. Nitrate data from these wells is

available on the Hullcar Aquifer Information website in the HS Jansen EIA.

C. Action items for 2018:

1. Ensure MW 1S, 1D, 3 and 5 are tested 3 times during the growing season, in spring, summer and fall to better understand variations in nitrate levels throughout the year.
2. Consider reducing nitrogen application rate in manure on fields that have a medium agronomic rating based on fall 2017 PHNT results.
3. Reduce nitrogen application rate in manure on fields that have a high or very high agronomic rating based on fall 2017 PHNT results.

Prepared by:

Ruth McDougall, M.Sc., PAg

December 18, 2017

Table 1. 2017 Nitrogen data for HS Jansen and Sons monitoring wells (all data as mg/L)

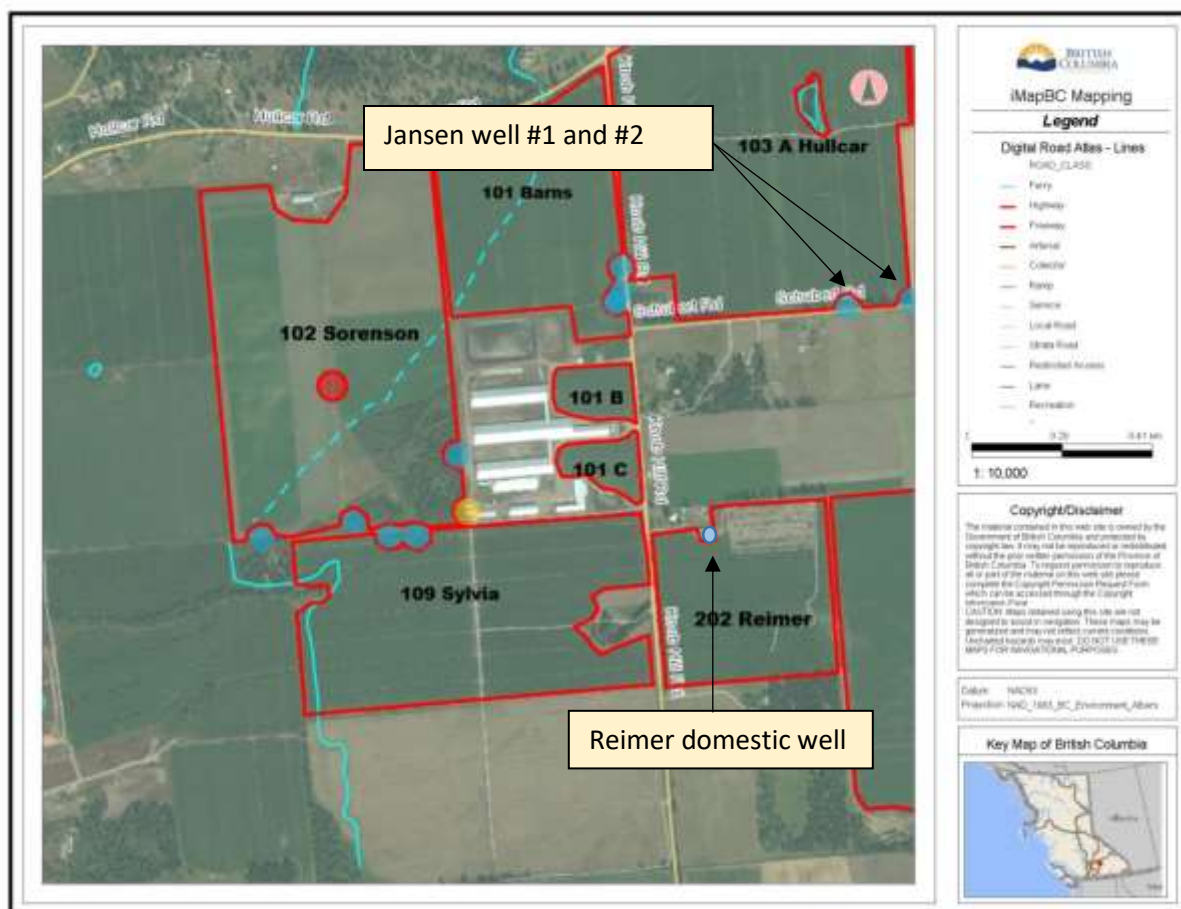
Parameter	October 16	November 20	BC drinking water quality guideline
Monitoring well 03			
Nitrate (as N)	1.95	1.66	10
Nitrite (as N)	<0.010	<0.010	1
Ammonia, total (as N)	0.078	0.108	No guideline
Total Kjeldahl N	0.683	0.717	No guideline
Total N	2.64	2.38	No guideline
Monitoring well 05			
Nitrate (as N)	14.6	Not sampled	10
Nitrite (as N)	<0.010	Not sampled	1
Ammonia, total (as N)	0.096	Not sampled	No guideline
Total Kjeldahl N	0.517	Not sampled	No guideline
Total N	15.1	Not sampled	No guideline
Monitoring well 1S (tested December 6, 2017)			
Nitrate (as N)	Not sampled	17.7	10
Nitrite (as N)	Not sampled	<0.010	1
Ammonia, total (as N)	Not sampled	0.061	No guideline
Total Kjeldahl N	Not sampled	0.943	No guideline
Total N	Not sampled	18.6	No guideline
Monitoring well 1D (tested December 6, 2017)			
Nitrate (as N)	Not sampled	5.62	10
Nitrite (as N)	Not sampled	<0.010	1
Ammonia, total (as N)	Not sampled	<0.020	No guideline
Total Kjeldahl N	Not sampled	0.418	No guideline
Total N	Not sampled	6.03	No guideline

Table 2. Nitrate and nitrite levels in wells south of Field 103A and 103B (all data as mg/L)

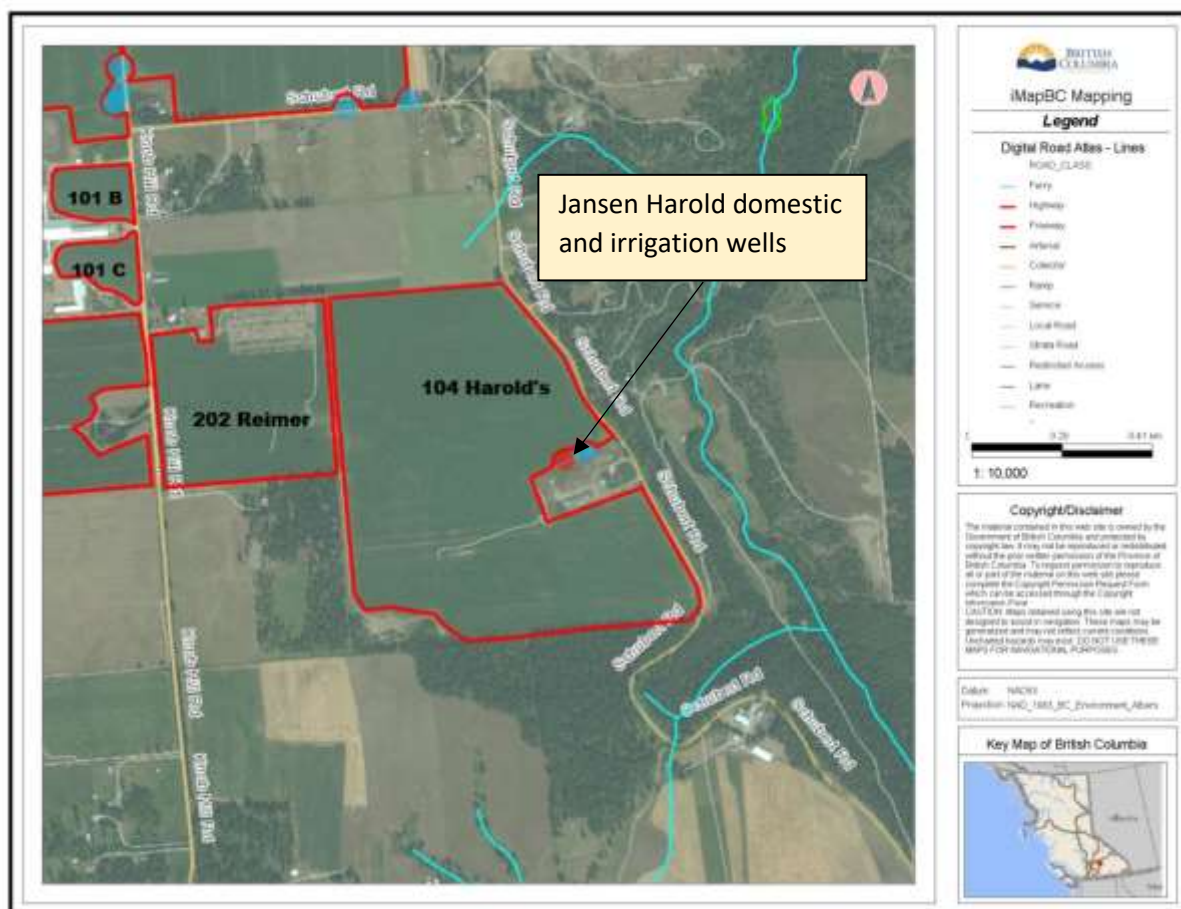
Parameter	Jansen well #1 WP25853 (SE corner of Field 103A)	Jansen well #2 WP25852 (S edge of Field 103A)	Reimer domestic well No WP # (Field 202)	Jansen Harold irrigation well WP25867 (Field 104)	Jansen Harold domestic well WP25868 (Field 104)	BC drinking water quality guideline
Nitrate (as N)	9.78	6.15	<0.025	3.34	1.4	10
Nitrite (as N)	0.0839	0.0807	<0.0050	0.0239	<0.0050	1

**Well locations are marked on Maps 1 and 2. Wells were tested in October 2017.*

Map 1. HS Jansen wells #1, #2 and Reimer domestic (map from HS Jansen 2017 NMP and courtesy of BC AGRI)



Map 2. HS Jansen Harold irrigation and domestic wells (map from HS Jansen 2017 NMP and courtesy of BC AGRI)



Legend	
	Field borders*
	Domestic well
	Livestock watering well
	Irrigation Well
*nutrient application areas including 30m setbacks to wells and surface water	

CERTIFICATE OF ANALYSIS

REPORTED TO Mountain View Electric Ltd.
PO Box 467- 1009 Belvedere Street
ENDERBY, BC V0E 1V0

ATTENTION Mountain View Electric Ltd.

PO NUMBER 17-4827

PROJECT HS Jansen & Sons

PROJECT INFO 17-4827

WORK ORDER 7111608

RECEIVED / TEMP 2017-11-20 14:56 / 8°C

REPORTED 2017-11-27 11:08

COC NUMBER B64292

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

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Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at kmckeown@caro.ca

Authorized By:

Kristin McKeown
Account Manager



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#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7

TEST RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7111608
2017-11-27 11:08

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW4D (7111608-01) Matrix: Water Sampled: 2017-11-20 08:30						F2

Anions

Chloride	15.8	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	0.015	MAC = 10	0.010	mg/L	2017-11-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-11-22	
Phosphate (as P)	< 0.010	N/A	0.010	mg/L	2017-11-22	

General Parameters

Ammonia, Total (as N)	0.090	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	0.654	N/A	0.050	mg/L	2017-11-22	
pH	7.15	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	2.08	N/A	0.0020	mg/L	2017-11-25	

Calculated Parameters

Nitrate+Nitrite (as N)	0.0154	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.669	N/A	0.0500	mg/L	N/A	

Total Metals

Potassium, total	4.24	N/A	0.10	mg/L	2017-11-24	
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Microbiological Parameters

Coliforms, Total (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
Coliforms, Fecal (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
E. coli (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	

MW4S (7111608-02) | Matrix: Water | Sampled: 2017-11-20 08:40

F2

Anions

Chloride	9.83	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	0.079	MAC = 10	0.010	mg/L	2017-11-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-11-22	
Phosphate (as P)	0.014	N/A	0.010	mg/L	2017-11-22	

General Parameters

Ammonia, Total (as N)	0.050	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	0.604	N/A	0.050	mg/L	2017-11-22	
pH	7.27	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	0.500	N/A	0.0020	mg/L	2017-11-25	

Calculated Parameters

Nitrate+Nitrite (as N)	0.0787	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.683	N/A	0.0500	mg/L	N/A	

Total Metals

Potassium, total	8.58	N/A	0.10	mg/L	2017-11-24	
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Microbiological Parameters

TEST RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7111608
2017-11-27 11:08

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW4S (7111608-02) Matrix: Water Sampled: 2017-11-20 08:40, Continued						F2

Microbiological Parameters, Continued

Coliforms, Total (MPN)	23	N/A	3.0	MPN/100 mL	2017-11-21	
Coliforms, Fecal (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
E. coli (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	

MW3 (7111608-03) | Matrix: Water | Sampled: 2017-11-20 08:55

Anions

Chloride	7.12	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	1.66	MAC = 10	0.010	mg/L	2017-11-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-11-22	
Phosphate (as P)	0.010	N/A	0.010	mg/L	2017-11-22	

General Parameters

Ammonia, Total (as N)	0.108	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	0.717	N/A	0.050	mg/L	2017-11-22	
pH	7.30	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	1.06	N/A	0.0020	mg/L	2017-11-25	

Calculated Parameters

Nitrate+Nitrite (as N)	1.66	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	2.38	N/A	0.0500	mg/L	N/A	

Total Metals

Potassium, total	6.88	N/A	0.10	mg/L	2017-11-24	
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Microbiological Parameters

Coliforms, Total (MPN)	3.6	N/A	3.0	MPN/100 mL	2017-11-21	
Coliforms, Fecal (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
E. coli (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	

Skelton MW (7111608-04) | Matrix: Water | Sampled: 2017-11-20 09:15

Anions

Chloride	15.6	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	0.095	MAC = 10	0.010	mg/L	2017-11-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-11-22	
Phosphate (as P)	< 0.010	N/A	0.010	mg/L	2017-11-22	

General Parameters

Ammonia, Total (as N)	0.058	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	0.216	N/A	0.050	mg/L	2017-11-22	
pH	7.33	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	0.0682	N/A	0.0020	mg/L	2017-11-25	

TEST RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7111608
2017-11-27 11:08

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Skelton MW (7111608-04) Matrix: Water Sampled: 2017-11-20 09:15, Continued						F2

Calculated Parameters

Nitrate+Nitrite (as N)	0.0953	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	0.311	N/A	0.0500	mg/L	N/A	

Total Metals

Potassium, total	7.88	N/A	0.10	mg/L	2017-11-24	
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Microbiological Parameters

Coliforms, Total (MPN)	3.6	N/A	3.0	MPN/100 mL	2017-11-21	
Coliforms, Fecal (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
E. coli (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	

47309 (7111608-05) | Matrix: Water | Sampled: 2017-11-20 12:20

F2

Anions

Chloride	32.9	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	8.59	MAC = 10	0.010	mg/L	2017-11-22	
Nitrite (as N)	0.150	MAC = 1	0.010	mg/L	2017-11-22	
Phosphate (as P)	0.020	N/A	0.010	mg/L	2017-11-22	

General Parameters

Ammonia, Total (as N)	1.21	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	1.85	N/A	0.050	mg/L	2017-11-22	
pH	7.82	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	0.146	N/A	0.0020	mg/L	2017-11-25	

Calculated Parameters

Nitrate+Nitrite (as N)	8.74	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	10.6	N/A	0.0500	mg/L	N/A	

Total Metals

Potassium, total	7.36	N/A	0.10	mg/L	2017-11-24	
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Microbiological Parameters

Coliforms, Total	≥ 110	MAC = 0	1	CFU/100 mL	2017-11-21	
Background Colonies	> 200	N/A	200	CFU/100 mL	2017-11-21	
Coliforms, Fecal	< 1	N/A	1	CFU/100 mL	2017-11-21	
E. coli	< 1	MAC = 0	1	CFU/100 mL	2017-11-21	

Back Up Dairy MW (7111608-06) | Matrix: Water | Sampled: 2017-11-20 12:35

F2

Anions

Chloride	22.9	AO ≤ 250	0.10	mg/L	2017-11-22	
Nitrate (as N)	11.6	MAC = 10	0.010	mg/L	2017-11-24	
Nitrite (as N)	0.060	MAC = 1	0.010	mg/L	2017-11-22	

TEST RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7111608
2017-11-27 11:08

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Back Up Dairy MW (7111608-06) Matrix: Water Sampled: 2017-11-20 12:35, Continued						F2
Anions, Continued						
Phosphate (as P)	< 0.010	N/A	0.010	mg/L	2017-11-22	
General Parameters						
Ammonia, Total (as N)	0.081	None Required	0.020	mg/L	2017-11-22	
Nitrogen, Total Kjeldahl	0.463	N/A	0.050	mg/L	2017-11-22	
pH	7.63	7.0-10.5	0.10	pH units	2017-11-23	HT2
Phosphorus, Total (as P)	0.308	N/A	0.0020	mg/L	2017-11-25	
Calculated Parameters						
Nitrate+Nitrite (as N)	11.6	N/A	0.100	mg/L	N/A	
Nitrogen, Total	12.1	N/A	0.100	mg/L	N/A	
Total Metals						
Potassium, total	8.62	N/A	0.10	mg/L	2017-11-24	
Microbiological Parameters						
Coliforms, Total (MPN)	3.6	N/A	3.0	MPN/100 mL	2017-11-21	
Coliforms, Fecal (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	
E. coli (MPN)	< 3.0	N/A	3.0	MPN/100 mL	2017-11-21	

Sample Qualifiers:

F2 The sample was not field-preserved with HNO₃ and was therefore preserved in the laboratory and held for at least 16 hours prior to analysis for total metals.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7111608
2017-11-27 11:08

Analysis Description	Method Ref.	Technique	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2011)	Automated Colorimetry (Phenate)	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Coliforms, Fecal in Water	SM 9221 E (2006)	Most Probable Number / Multiple-Tube Fermentation	Kelowna
Coliforms, Total in Water	SM 9221 B (2006)	Most Probable Number / Multiple-Tube Fermentation	Kelowna
E. coli in Water	SM 9221 (2006)	Most Probable Number / Multiple-Tube Fermentation	Kelowna
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2011)	Block Digestion and Flow Injection Analysis	Kelowna
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2011)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
>	Greater than the specified Result
>=	Greater than or equal to the specified Result
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
MPN/100 mL	Most Probable Number per 100 millilitres
pH units	pH < 7 = acidic, pH > 7 = basic
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

[Guidelines for Canadian Drinking Water Quality \(Health Canada, Feb 2017\)](#)

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing. The quality control (QC) data is available upon request

CERTIFICATE OF ANALYSIS

REPORTED TO Mountain View Electric Ltd.
PO Box 467- 1009 Belvedere Street
ENDERBY, BC V0E 1V0

ATTENTION Mountain View Electric Ltd.

PO NUMBER 17-4827

PROJECT HS Jansen & Sons

PROJECT INFO 17-4827

WORK ORDER 7120456

RECEIVED / TEMP REPORTED 2017-12-06 12:11 / 7°C
2017-12-13 15:14

COC NUMBER No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at kmckeown@caro.ca

Authorized By:

Kristin McKeown
Account Manager

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#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7

TEST RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7120456
2017-12-13 15:14

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
HS Jansen MW 1S (7120456-01) Matrix: Water Sampled: 2017-12-06 10:15						
Anions						
Nitrate (as N)	17.7	MAC = 10	0.010	mg/L	2017-12-07	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-12-07	
General Parameters						
Ammonia, Total (as N)	0.061	None Required	0.020	mg/L	2017-12-08	
Nitrogen, Total Kjeldahl	0.943	N/A	0.050	mg/L	2017-12-11	
Calculated Parameters						
Nitrate+Nitrite (as N)	17.7	N/A	0.0500	mg/L	N/A	
Nitrogen, Total	18.6	N/A	0.0500	mg/L	N/A	

HS Jansen MW 1D (7120456-02) | Matrix: Water | Sampled: 2017-12-05

Anions						
Nitrate (as N)	5.62	MAC = 10	0.010	mg/L	2017-12-07	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2017-12-07	
General Parameters						
Ammonia, Total (as N)	< 0.020	None Required	0.020	mg/L	2017-12-08	
Nitrogen, Total Kjeldahl	0.418	N/A	0.050	mg/L	2017-12-11	
Calculated Parameters						
Nitrate+Nitrite (as N)	5.62	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	6.03	N/A	0.0500	mg/L	N/A	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO PROJECT Mountain View Electric Ltd.
HS Jansen & Sons

WORK ORDER REPORTED 7120456
2017-12-13 15:14

Analysis Description	Method Ref.	Technique	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2011)	Automated Colorimetry (Phenate)	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2011)	Block Digestion and Flow Injection Analysis	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

[Guidelines for Canadian Drinking Water Quality \(Health Canada, Feb 2017\)](#)

General Comments:

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APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO PROJECT Mountain View Electric Ltd.
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WORK ORDER REPORTED 7120456
2017-12-13 15:14

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B7L0422									
Blank (B7L0422-BLK1)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Blank (B7L0422-BLK2)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Blank (B7L0422-BLK3)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Blank (B7L0422-BLK4)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
LCS (B7L0422-BS1)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	4.13	0.010 mg/L	4.00		103	93-108			
Nitrite (as N)	2.06	0.010 mg/L	2.00		103	85-114			
LCS (B7L0422-BS2)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	4.05	0.010 mg/L	4.00		101	93-108			
Nitrite (as N)	2.18	0.010 mg/L	2.00		109	85-114			
LCS (B7L0422-BS3)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	3.97	0.010 mg/L	4.00		99	93-108			
Nitrite (as N)	2.09	0.010 mg/L	2.00		104	85-114			
LCS (B7L0422-BS4)			Prepared: 2017-12-07, Analyzed: 2017-12-07						
Nitrate (as N)	3.86	0.010 mg/L	4.00		96	93-108			
Nitrite (as N)	1.90	0.010 mg/L	2.00		95	85-114			
Duplicate (B7L0422-DUP3)			Source: 7120456-01		Prepared: 2017-12-07, Analyzed: 2017-12-12				
Nitrate (as N)	18.6	0.010 mg/L		17.7			5	10	
Nitrite (as N)	< 0.010	0.010 mg/L		< 0.010				6	
Duplicate (B7L0422-DUP4)			Source: 7120456-02		Prepared: 2017-12-07, Analyzed: 2017-12-07				
Nitrate (as N)	5.66	0.010 mg/L		5.62			< 1	10	

APPENDIX 2: QUALITY CONTROL RESULTS

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2017-12-13 15:14

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B7L0422, Continued									
Duplicate (B7L0422-DUP4), Continued		Source: 7120456-02		Prepared: 2017-12-07, Analyzed: 2017-12-07					
Nitrite (as N)	< 0.010	0.010 mg/L		< 0.010			6		
Matrix Spike (B7L0422-MS3)		Source: 7120456-01		Prepared: 2017-12-07, Analyzed: 2017-12-07					
Nitrite (as N)	2.16	0.010 mg/L	2.00	< 0.010	108	80-120			
Matrix Spike (B7L0422-MS4)		Source: 7120456-02		Prepared: 2017-12-07, Analyzed: 2017-12-07					
Nitrate (as N)	9.42	0.010 mg/L	4.00	5.62	95	75-125			
Nitrite (as N)	2.04	0.010 mg/L	2.00	< 0.010	102	80-120			

General Parameters, Batch B7L0391

Blank (B7L0391-BLK1)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
Blank (B7L0391-BLK2)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
Blank (B7L0391-BLK3)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
LCS (B7L0391-BS1)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	1.05	0.020 mg/L	1.00		105	90-115			
LCS (B7L0391-BS2)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	1.06	0.020 mg/L	1.00		106	90-115			
LCS (B7L0391-BS3)			Prepared: 2017-12-08, Analyzed: 2017-12-08						
Ammonia, Total (as N)	1.07	0.020 mg/L	1.00		107	90-115			

General Parameters, Batch B7L0592

Blank (B7L0592-BLK1)			Prepared: 2017-12-08, Analyzed: 2017-12-11						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
Blank (B7L0592-BLK2)			Prepared: 2017-12-08, Analyzed: 2017-12-11						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
LCS (B7L0592-BS1)			Prepared: 2017-12-08, Analyzed: 2017-12-11						
Nitrogen, Total Kjeldahl	1.07	0.050 mg/L	1.00		107	84-121			
LCS (B7L0592-BS2)			Prepared: 2017-12-08, Analyzed: 2017-12-11						
Nitrogen, Total Kjeldahl	1.08	0.050 mg/L	1.00		108	84-121			