Ken Regehr Farm June 2018 Action Plan Summary

June 26, 2018

Introduction

On June 8, 2016, Ken Regehr Holdings Ltd. of 4516 Hullcar Road, Armstrong BC was served with a Pollution Prevention Order (PPO) under the Environmental Management Act (File: 108432). The PPO referenced the lands identified by PID 011-227-486 other than the portion occupied by Purple Springs Nursery Inc., 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 PPO 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 June 30, 2017 and 2018 summarizing items completed from the Action Plan.

This report is the June 30, 2018 Summary and includes results of monitoring conducted from June 15 2017 to June 15, 2018, and upgrades and management changes arising out of the Action Plan completed between July 1, 2017 and June 26, 2018. This report follows the format of the K. Regehr Action Plan, and Action Item numbering in this report reflects that of the Action Plan.

1. Groundwater monitoring results

Action required: Monitor Project wells 7, 8, 13 and 17 three times per year in 2017 and 2018. Samples are to be analyzed for nitrate-N, nitrite-N, ammonia-N, TKN, total nitrogen and chloride. Project well 13 to be sampled twice at the beginning of the season, at pump startup and after 1 hour of pumping. This is not required for the other wells or for the rest of the season.

Ken Regehr irrigation wells were sampled on June 29, 2017, September 25, 2017 and April 11, 2018. Samples were collected by farm staff and/or consultants following BC Field Sampling Guidelines. 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 and chloride parameters tested. Original lab data is attached as a separate pdf file with chain of custody and QC data included. Project well 17 was missed from the sampling schedule in June 2017.

No exceedances were noted in the period of this summary, July 1 2017 to June 30 2018.

The wells will be tested again in summer and fall of 2018.

Table 1. 2017/8 Nitrogen data for Ken Regehr Irrigation Wells (all data as mg/L)

Parameter	June 29 2017	September 25 2017	April 11 2018	BC drinking water quality guideline
Project Well 7				
Nitrate (as N)	2.18	0.061	1.82	10
Nitrite (as N)	0.013	0.023	0.108	1
Ammonia, total (as N)	0.127	0.103	0.070	No guideline
Total Kjeldahl N	0.194	0.143	<0.500	No guideline
Total N	2.38	0.227	1.93	No guideline
Chloride	22.5	1.37	32.8	No guideline
Project Well 8				
Nitrate (as N)	2.02	0.817	<0.010	10
Nitrite (as N)	0.013	0.025	<0.010	1
Ammonia, total (as N)	0.121	0.112	0.155	No guideline
Total Kjeldahl N	0.244	0.163	0.343	No guideline
Total N	2.27	1.00	0.343	No guideline
Chloride	21.9	16.4	28.6	No guideline
Project Well 13 (at pump startup)				
Nitrate (as N)	1.96	0.665	<0.010	10
Nitrite (as N)	0.014	0.017	<0.010	1
Ammonia, total (as N)	0.128	0.144	0.023	No guideline
Total Kjeldahl N	0.160	0.321	0.093	No guideline
Total N	2.14	1.00	0.093	No guideline
Chloride	21.8	16	23.2	No guideline
Project Well 13 (after 1 hour of pumping)				
Nitrate (as N)	-	-	<0.010	10
Nitrite (as N)	-	-	<0.010	1
Ammonia, total (as N)	-	-	0.029	No guideline
Total Kjeldahl N	-	-	0.412	No guideline
Total N	-	-	0.412	No guideline
Chloride	-	-	23.1	No guideline
Project Well 17				
Nitrate (as N)	na	0.716	<0.010	10
Nitrite (as N)	na	0.018	<0.010	1
Ammonia, total (as N)	na	0.243	0.183	No guideline
Total Kjeldahl N	na	0.259	0.298	No guideline
Total N	na	0.993	0.298	No guideline
Chloride	na	15.6	24.0	No guideline

2. Water sample from constructed wetland (lagoon)

Action required: Test the constructed wetland (lagoon) 3 times per year during 2017 and 2018 for the same list of parameters as per groundwater testing (nitrate-N, nitrite-N, ammonia-N, TKN, total nitrogen and chloride) and compare results to Project well 13 quality data from the same time period. Samples should be collected from the downstream end of the wetland at least 1 metre from shore. Each sample should consist of at least five sub-samples collected from around the wetland.

Table 2 below contains the results of the wetland water sample and the sample from project well 13 from April 2018. Sampling was done according to BC Field Sampling Guideline specifications. Sample was placed in a cooler on ice and delivered to Caro Analytical in Kelowna BC for analysis the same day. Samples were analyzed for the same suite of nitrogen parameters as groundwater samples. Lab data is attached as a separate pdf file with chain of custody and QC data attached.

Nitrate-N and nitrite-N were below the lab's detection limit in the Project well 13 sample, and were well below the BC drinking water quality guideline for both parameters in the lagoon sample. Levels of ammonia and total nitrogen were very low in the Project well 13 sample, and were higher in the lagoon sample. This suggests that the lagoon is having little or no impact on the water quality in Project well 13.

The lagoon was sampled once in 2017, in spring, and so far has been sampled once in 2018. The Action Plan states that the lagoon must be sampled 3 times per year, in spring summer and fall. This is not possible because the lagoon has been pumped empty and the liquid used as irrigation water. The lagoon will not have water in it again until spring 2019 during spring runoff unless there is very heavy rain in fall 2018. Because of this, the lagoon will not be sampled again until April 2019.

Table 2. Spring 2018 Lagoon Water Sample and Project Well 13 Nitrogen Data (all data as mg/L)

Parameter	Wetland lagoon	Project well 13	BC drinking water quality guideline
Nitrate (as N)	0.041	<0.010	10
Nitrite (as N)	<0.010	<0.010	1
Ammonia, total (as N)	116	0.023	No guideline
Total Kjeldahl N	211	0.093	No guideline
Total N	211	0.093	No guideline
Chloride	152	23.2	No guideline

3. Annual maintenance of constructed wetland (lagoon)

Action required: Conduct annual maintenance on the constructed wetland including removal of excess sediment to maintain wetland capacity, and conduct maintenance of berms as required.

Annual maintenance on the constructed wetland was completed in fall 2017 when water levels were low and will be done again in fall 2018. This will include removal of excessive sediment and berm maintenance.

4. Re-planting of areas of wetland (lagoon) with native plants

Action required: Re-plant areas of the constructed wetland with native aquatic macrophytes.

Re-planting of areas of the wetland with native plants occurred in fall 2017 when water levels in the wetland were low.

5. Install staff gauge on constructed wetland (lagoon) and record water levels

Action required: Install a staff gauge on the wetland/pond system by June 1, 2017, and conduct regular water level recording during snow-free months for 2017 and 2018.

The staff gauge was installed on May 31, 2017 and has been operational since then. The first water level was recorded at the beginning of June 2017 at 0.4 m above the established base level. During the June through October period in 2017, lagoon level remained at or below 0.0 m; values are not shown. The level began to rise in November 2017. Table 3 contains the water readings from November 1 2017 to June 19 2018. In April, May and June, lagoon liquid was irrigated onto some of the farm's crop land until the lagoon level was at 0. It will remain at 0 (unless there is heavy fall rain) until runoff begins in spring 2019.

Table 3. Water level in lagoon from staff gauge

Date	Reading on staff gauge (m above baseline level)
2017	
November 1	0
November 14	0.05
November 21	0.085
November 27	0.09
December 30	Frozen
2018	
February 28	0.596
March 6	0.73
March 13	0.875
March 25	0.85
April 6	0.72 (lagoon liquid pumped out for irrigation water)
April 13	0.67 (lagoon liquid pumped out for irrigation water)
April 16	0.67
April 27	0.59 (lagoon liquid pumped out for irrigation water)
April 30	0.59
May 11	0.59
May 19	0.46 (lagoon liquid pumped out for irrigation water)
May 24	0.33 (lagoon liquid pumped out for irrigation water)
June 2	0.1 (lagoon liquid pumped out for irrigation water)
June 8	0 (lagoon liquid pumped out for irrigation water)
June 15	0
June 19	0

6. Permeability study on feedlot

Action required: Conduct a permeability study on the base of the feedlot. The study was to establish permeability by collecting 7 soil samples for bulk density and texture analysis, and calculation of hydraulic conductivity using bulk density and texture data.

The report was completed in summer 2017 and was accepted by the Ministry of Environment.

7. 2017 Farm Book

Action required: Have a Farm Book or Nutrient Management Plan prepared for 2018 based on soil sampling results by a qualified person (defined as a CCA or QP in the Action Plan). The Plan was to be designed for a zero agronomic nitrogen balance on each field. It was to consider the results of the fall 2017 post-harvest soil nitrate study in developing 2018 manure application rates.

The 2018 Farm Book for all fields farmed by Ken Regehr Farm was written in spring 2018 by Doug Macfarlane, CCA, of Emerald Bay Ag Services, Vernon BC. It was developed for a zero nitrogen balance on each field and incorporates the results of the fall 2017 post-harvest soil testing conducted by the Ministry of Agriculture (AGRI). Manure application records and irrigation records are being kept by farm staff as required in the Action Plan.

8. Post-harvest soil testing of all fields over Hullcar aquifer 103

Action required: Collect post-harvest soil samples from all fields farmed by Ken Regehr in 2018 that are located over aquifer 103.

Post-harvest soil testing of all fields farmed by Ken Regehr Farm was done in September and October 2017 within two weeks of the final harvest on each field. Samples were collected at 0-15, 15-30, 30-60 and 60-90 cm depths and analyzed for nitrate-N as well as other soil nutrients and quality parameters.

Ken Regehr will participate in post-harvest soil testing in fall 2018 if the program is continued.

9. Participation in AGRI benchmark soil study

Action required: Participate in the AGRI benchmark soil study in 2018 if it is repeated.

Ken Regehr Farm participated in the AGRI benchmark soil study in fall 2017 and will participate in fall 2018 if the study is continued.

10. Manure application rate reduction in Field 210

Action required: None. Field 210 was leased by Ken Regehr Farm in 2016. Ken Regehr Farm opted not to renew the lease on this field in 2017 and did not farm this field in 2017 or 2018.

11. Apply manure based on Farm Book recommendations

Action required: Manure applications in 2018 must be made based on the field and crop-specific recommendations contained in the 2018 Farm Book.

The farm retains Doug Macfarlane, CCA, of Emerald Bay Ag Services to provide nutrient management planning for the farm. He prescribes application rates of feedlot manure for each field based on crop to

be grown, nutrient content of the feedlot manure and the results of fall soil nitrate testing. He prepared a Farm Book for the operation in spring 2018 that prescribed manure application rates for each field.

Table 3 shows the fields that were amended with feedlot manure up to June 25, 2018, the rate prescribed by the CCA, the application date and the actual application rates. The application rate of manure was lower than the prescribed rate on all but one field, and was the same as the prescribed rate in one field. Three fields received no manure in spring 2018. There is no concern with the manure application rates for spring 2018.

Table 4. 2018 prescribed and actual manure application rates to June 25, 2018

Field ID	Field name	2017 Crop	Prescribed manure app'n rate	Actual manure app'n rate	Date of manure application
			Tons/acre	Tons/acre	
101	Home	Corn silage	20	15	April
102	West	Corn silage	18	15	April
103	Far west	Alfalfa	0	0	-
104	West hill	Alfalfa	0	0	-
105	Bottom feedlot	Alf/grass – new seeding	20	15	April
201	Top back	Corn silage	30-35	23.75	April
202	Small field	Cereal silage	30-35	26.4	April
203	Road	Corn silage	30	24.5	April
205	Reserve	Corn silage	25	25	Spring
206	Len's	Corn silage	28	17	Spring
207	Reserve top	Corn silage	20	17	Spring
208	Dorothy's	Alfalfa	0	0	-
209	Swann's	Corn silage	35	23.5	April

12. Test manure from feedlot in spring prior to manure application

Action required: Feedlot manure must be analyzed in spring 2018 prior to manure application, and results used in calculating manure application rates for 2018.

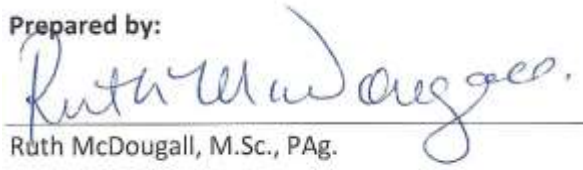
Manure from the feedlot was tested in spring 2018. The manure was tested for total and available nitrogen (ammonium-N and nitrate-N). Results of the manure test were used in calculating manure application rates on fields for 2018. The lab data is appended in a separate file.

13. Avoid use of inorganic nitrogen fertilizer unless insufficient manure available

Action required: Use of inorganic fertilizer to be avoided in 2017 and 2018 unless insufficient manure was available to meet crop needs or manure could not be applied to a field. If fertilizer N is used, it must be done based on a field sampling program and the recommendation of a qualified person.

No inorganic nitrogen fertilizer was used in spring 2018 and none is planned to be used on any of Ken Regehr's fields in 2018.

Prepared by:



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