Douglas Regehr Nutrient Management Plan
2017

Prepared for:
Douglas Regehr,
5042 Schubert Road,
Armstrong BC

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1. Introduction
This is a Nutrient Management Plan (NMP) for Douglas Regehr (D Regehr), 5042 Schubert Road, Spallumcheen BC (Figure 1) for the 2017 cropping year. It contains information on all nitrogen sources on the farm, and nitrogen requirements for crops in 2017 based on estimated crop uptake and residual soil nitrate levels. It has been written as part of the requirements of Regehr’s Ministry of Environment Information Order (March 2014) and is a retrospective look at 2017 nutrient management on the farm. This plan covers the period September 1 2016 to August 31 2017 because in 2016-2017 crops were planted in fall and fertilized prior to planting.

The Douglas Regehr property consists of 19.3 hectares (47.6 acres) of arable land as well as the farmstead. The farm operated a feedlot on-site from 1980 to 1997. The feedlot was depopulated in 1997. From 2002 to 2007 the feedlot was rented by H.S. Jansen who housed 1000 replacement heifers in it year-round. The farm has not had any animals on-site since 2007 when Jansen moved his replacement heifers elsewhere. The farm has been managed organically since 2012; since that time there has been no synthetic fertilizer used on the farm and all nutrients used by crops have been provided in broiler or liquid dairy manure. The land base farmed now includes the area of the old feedlot; prior to 2015 this area was not farmed.

This plan considers the agronomic balance of nitrogen only. The residual levels of phosphorus and potassium in the soil plus the amount applied in manure in fall 2016 will meet crop needs for these nutrients for 2017. The arable land base contains phosphorus in excess of agronomic levels however the fields are not linked to surface water so there is little risk of movement of soil phosphorus to surface water. See section 14 for a more thorough discussion of soil phosphorus levels and management.

All calculated values used in this plan are derived from the BC Ministry of Agriculture’s Nutrient Management Planner calculator Excel spreadsheet.

2. Livestock on site 2017
D Regehr has no livestock on site. There have been no livestock on site since 2007 when the feedlot on site was depopulated.

Table 1 below shows the farm’s fields, acreages cropped and crops grown between 2014 and 2017. The current crop cycle at D Regehr’s begins in fall with application of manure and planting of cereal crop or canola, and finishes in late summer the following year with harvest of that crop.

In 2017, D Regehr cropped 47.6 acres (19.3 hectares) of land. All land was planted to canola which was harvested in late summer 2017. The fields are listed with areas and 2017 cropping information in Table 1 below. Fields are identified on Figure 2. Site Map.

Note that the ‘Horse pasture’ is included with the ‘Home field’ for soil testing and calculation of nutrient requirements.
Table 1. Cropping Report – 2014-2017

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Area</th>
<th>2014 Crop</th>
<th>2015 Crop</th>
<th>2016 Crop</th>
<th>2017 Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 Home Field</td>
<td>15.5</td>
<td>wheat</td>
<td>wheat</td>
<td>spelt</td>
<td>canola</td>
</tr>
<tr>
<td>102 Old Feedlot</td>
<td>3.1</td>
<td>not cropped</td>
<td>wheat</td>
<td>spelt</td>
<td>canola</td>
</tr>
<tr>
<td>Horse pasture</td>
<td>0.65</td>
<td>pasture</td>
<td>pasture</td>
<td>spelt</td>
<td>canola</td>
</tr>
<tr>
<td>Total</td>
<td>19.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Results of BC Ministry of Agriculture 2016 Post-harvest Soil Nitrate Study

Table 2 contains the results of the Ministry of Agriculture fall 2016 post-harvest nitrate soil testing at D Regehr for the fields that were farmed in 2017 (lab data attached). Both fields farmed by D Regehr in 2016 were included in the fall 2016 study. The fields had an agronomic rating of high to very high soil residual nitrate-N based on the BC Ministry of Agriculture (AGRI) scale that was used to assess residual soil nitrate-N levels in the Hullcar area in fall 2016. Residual soil nitrate-N was measured to 90 cm in the soil.

Note: D Regehr’s fields had been manured in late summer 2016 before post-harvest nitrate sampling was done. This is because the crop cycle at D Regehr farm begins in fall with planting of crops. A small amount of manure is applied before seeding to provide nutrients for the crop. This resulted in significant nitrate-N present in the 0-30 cm zone in 101 Home Field. Field 102 Old Feedlot was not manured in 2016; the residual nitrate-N measured in fall 2016 is apparently due to release of residual N from soil organic matter.

Residual soil nitrate-N levels to 60 cm have been used to calculate manure application rates for 2017.

Residual soil ammonium-N data has not been included in residual soil nitrogen levels. There is currently no Ministry of Agriculture interpretation for residual soil ammonium-N.

Bulk density conversions: Residual soil nitrate-N was converted from mg/kg to kg/ha assuming a soil bulk density of 1470 kg/m³ to reflect the sandy texture of the soils in and around the D Regehr property.
Table 2. 2016 Post-harvest Soil Nitrate-N Data

<table>
<thead>
<tr>
<th>Field ID</th>
<th>2016 Crops</th>
<th>Sampling Depth</th>
<th>October 2016 Nitrate-N (NO₃-N)</th>
<th>Average NO₃-N in 0-90 cm Depth</th>
<th>Ammonium-N (NH₄-N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>cm</td>
<td>mg/kg</td>
<td>mg/kg</td>
<td>mg/kg</td>
</tr>
<tr>
<td>101 Home field (includes horse pasture)</td>
<td>Spelt/canola</td>
<td>0-15</td>
<td>30</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15-30</td>
<td>16</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-60</td>
<td>5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60-90</td>
<td>2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Total residual N (kg/ha)</td>
<td></td>
<td></td>
<td>131</td>
<td>High</td>
<td>NA</td>
</tr>
<tr>
<td>102 Old Feedlot</td>
<td>Spelt/canola</td>
<td>0-15</td>
<td>35</td>
<td>21.3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15-30</td>
<td>35</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-60</td>
<td>14</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60-90</td>
<td>15</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Total residual N (kg/ha)</td>
<td></td>
<td></td>
<td>282</td>
<td>Very high</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Ministry of Agriculture (AGRI) Agronomic Rating: 0-49 kg/ha low, 50-99 kg/ha medium, 100-199 kg/ha high, 200+ kg/ha very high. Note: Residual nitrate-N in soil was calculated at a soil BD of 1470 kg/m³.

5. Nitrogen applied to D Regehr fields from all sources in 2017

5.1 Manure application

During the 2017 cropping year no manure was applied to D Regehr’s fields. A small application of manure was made in late summer 2016 to provide nutrients for establishment of the canola planted in fall 2016. This was captured in the fall 2016 post-harvest soil nitrate testing and is included in nutrient accounting as the ‘residual nitrate-N’.

Post-harvest nitrate soil testing will be done in late summer 2017 once the canola crop is harvested. Based on the amount of residual nitrogen present in the soil, manure will be applied to meet the requirements of the spelt crop to be planted in fall 2017.

5.2 Other sources of nitrogen on farm

**Fertilizer nitrogen:** No synthetic or mineral nitrogen fertilizer was used by D Regehr in 2017 as the farm is managed organically.

**Irrigation water:** The farm irrigates with one well that is assumed to have the same nitrate concentration as the D Regehr irrigation well, an average nitrate-N concentration of 15.6 mg/L of nitrate (June 2017 sample). Based on approximately 5” (12.7 cm) of irrigation applied to the farm’s fields per growing season, approximately 20 lb/A of nitrate is supplied in the irrigation water. This amount of nitrogen has been accounted for as fertilizer N when calculating crop nitrogen requirements.
for 2017. It is recommended that irrigation water is tested once annually mid-season for nitrates for accuracy.

6. Cropping and nitrogen requirements of crops – 2016 and 2017

The canola crop grown in 2017 is estimated to require approximately 40 lb/acre of nitrogen. 2017 cropping information is found in columns B, C and D of Table 3. Crop, estimated dry yield and protein content of crop as well as 2017 nitrogen application rates have been provided by D Regehr and corroborated by reference sources. Because the amount of residual nitrogen present in fall 2016 and the amount of nitrogen expected to be released from organic matter in 2017 exceeds expected crop uptake of nitrogen, the crop is estimated to require no additional nitrogen in 2017.

Explanation of crop nitrogen requirements for 2017: Table 3, Column H contains the nitrogen application rate recommendations for 2017. This number is the estimated crop nitrogen uptake (column E) less the amount of residual nitrate in the 0 to 60 cm depth of the soil (column F, from fall 2016 PHNT results) and less the amount of nitrogen that is estimated to be released from soil organic matter in 2017 for each field (column G).

Column E contains the estimated crop nitrogen uptake values by field for 2017. These values are the product of crop dry yield by crop protein corrected for %N in protein (16% of protein is nitrogen).

Column F contains the residual soil nitrate from fall 2016 soil test results to 60 cm depth.

Column G contains the nitrogen fertility factors by field which are an estimate of the amount of nitrogen which will be released from soil organic matter over the 2017 growing season. Both fields were given a nitrogen fertility factor of 45 lb/A. Field 101 Home field has been manured regularly at or below agronomic rates. Field 102 Old feedlot has never been manured or fertilized (since the area was decommissioned as a feedlot) but the organic layer from the feedlot is still releasing a significant amount of nitrogen.

Table 3. Crop nitrogen requirement calculations -2017

![Worksheet 1. Calculate the Crop Nitrogen Application Recommendations](image-url)
7. Planned applications of manure in 2017

Canola (planted in fall 2016): no manure application planned during 2017. The soil contained sufficient residual nitrogen in fall 2016 to meet 2017 crop requirements.

8. Agronomic balance calculations – Crop requirements vs. available nutrients

Table 4 shows the nitrogen balance for each field for 2017 (3rd from last column) for the period September 2016 to August 2017. The table shows that, based on the assumptions used in the calculator, the available farm-specific data and the planned manure application rates, both fields had more nitrogen than crop requirements in 2017.

Note: No manure was applied in 2017. Therefore there are no manure types listed in the NMP calculator.

Note: the 20 lb/A in the fertilizer column of Table 4 (column J) represents the estimated contribution of nitrates from irrigation water.

Table 4. Agronomic balance calculations for 2017 cropping year

9. Timing of manure applications

Because crops are planted in the fall, a small application of manure is made in late summer to meet crop requirements for starting the crop based on residual soil nitrate-N levels when the previous crop is removed. For the past two years a small late summer manure application has been sufficient to meet crop requirements.

10. Method of manure application

Solid manure will be applied by solid manure spreader. Liquid manure will be applied by vacuum tanker.

11. Tracking of manure applications

All manure applications made to D. Regehr’s land base are tracked and recorded. All manure used at the farm is purchased and brought on to the farm by the load; total volumes used are tracked by the load.

12. Setbacks

D Regehr maintains the following setbacks when applying manure:
- 30 m (100 ft) from all domestic wells, surface water and residences
- 3.5 m (10 ft) from industrial wells (including irrigation wells), roads and other buildings

13. **Other fertilizers -2017**
No synthetic or mineral fertilizer is ever used at D Regehr’s fields as the farm is managed organically.

14. **Soil phosphorus status**
Both fields farmed by D Regehr had soil available phosphorus levels in the excess range in fall 2016 (Table 5). Phosphorus from agricultural fields can move into surface water where there is hydraulic conductivity between fields and surface water such as where fields are located next to surface water or where ditches or tile drainage connects to surface water. The amount of phosphorus that can potentially move into surface water increases as soil residual phosphorus levels increase.

Deep Creek runs adjacent to Field 102 Old Feedlot in a north-south direction. Along the boundary with Deep Creek there is a >150 m treed buffer between the field and Deep Creek which is expected to effectively slow down runoff and allow runoff water to move into the soil which will capture phosphorus. The risk of movement of phosphorus from Field 102 Old Feedlot into Deep Creek is minimal.

Steele Springs is located >50 m south of the southern boundary of the D. Regehr property. There is a >100 m buffer between D. Regehr’s arable land and Steele Springs which will effectively slow down runoff and allow runoff water to move into the soil which will capture phosphorus in runoff. The risk of movement of phosphorus from D. Regehr’s arable land to Steele Springs is minimal.

**Table 5. Soil phosphorus status – fall 2016**

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Crop Information</th>
<th>Crop Phosphorus (P) Applicator Calculations</th>
<th>Crop Phosphorus Application Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(name or number)</td>
<td>Crop type to be fertilized</td>
<td>Crop dry yield</td>
<td>Crop available phosphorus factor</td>
</tr>
<tr>
<td></td>
<td>(estimated)</td>
<td>(tons/ac)</td>
<td>(lb P/ton)</td>
</tr>
<tr>
<td>101 Home Field</td>
<td>canola</td>
<td>0.6</td>
<td>15.0</td>
</tr>
<tr>
<td>102 Old Feedlot</td>
<td>canola</td>
<td>0.6</td>
<td>15.0</td>
</tr>
</tbody>
</table>

15. **Irrigation rate**
D Regehr’s fields are situated on soils with a texture of sand, sandy loam or loamy sand. These soils are rapidly permeable and have low moisture and nutrient holding capacity. Nitrate leaching can occur easily from these soils if irrigation water moves down below the crop rooting depth. For this reason, D Regehr irrigates according to soil moisture requirements to ensure that no excess irrigation water is applied.
16. **Manure storage capacity**

D Regehr has no manure storage on site. Manure is not stockpiled on site. It is applied as soon as it is hauled to the farm.

17. **Soil Monitoring - Post-harvest soil nitrate testing fall 2017**

After crop harvest in fall 2017, soil sampling will be done in each field to 90 cm to assess the residual nitrate-N levels in the farm’s two fields. This information should be used in determination of manure application requirements for 2018.

18. **Groundwater Monitoring - 2017**

D Regehr’s domestic well is tested approximately 3 times per year (spring, summer and fall) by Steele Springs Water District (Brian Upper). In 2017, the well was tested in February and June and will be tested again in September (Table 6). Nitrate levels of 14.8 and 15.5 mg/L were measured in February and June respectively. Original lab data are found in separate pdf files.

The nitrate levels in D Regehr’s well track those of Steele Springs which is located to the south west. Nitrate levels exceed the Canadian Drinking water standard of 10 mg/L and have done since June 2015. There is no indication that nitrate levels are higher from the D Regehr well than from Steele Springs at this point which suggests that the impacts to aquifer 103 (which supplies Steele Springs) originate to the northwest.

**Table 6. Results of 2017 Monitoring of D Regehr Well**

<table>
<thead>
<tr>
<th>Sampling date</th>
<th>Groundwater nitrate level (mg/L)</th>
<th>Laboratory</th>
<th>Sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2 2017</td>
<td>14.8</td>
<td>Caro Analytical</td>
<td>Brian Upper, SSWD</td>
</tr>
<tr>
<td>June 22 2017</td>
<td>15.5</td>
<td>Caro Analytical</td>
<td>Brian Upper, SSWD</td>
</tr>
</tbody>
</table>

19. **Surface water monitoring**

There are no surface water sources on the D. Regehr property. There are no streams or seasonal runoff channels on the property. The nearest surface water is Steele Springs which is located > 50 m south of the south property line, and Deep Creek which is located approximately 200 metres to the east of the eastern edge of the property with a 150 m treed buffer between arable land and the creek. Therefore no surface water monitoring is being conducted as part of this Nutrient Management Plan.
October 24, 2017
Figure 1. D. Regehr property at 5042 Schubert Road in relation to Knob Hill Road and Hullcar Road
Figure 2. Site map showing boundaries of Douglas Regehr property, fields and wells

Well ID:
1 – Irrigation well
2 – Domestic well
3 – Golder 2016 permanent monitoring well
4 – Golder temporary well (borehole) (filled in)
Figure 3. Soil test report – PHINT Home field October 2016

<table>
<thead>
<tr>
<th>Field</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home field</td>
<td>2016</td>
</tr>
</tbody>
</table>

Post-harvest soil test – Home field – October 2016
Post-harvest soil test – Old feedlot – October 2016