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| Vermont Tech |
| **Nutrient Management Update** |
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| I have written/reviewed this Nutrient Management Component for technical adequacy and it meets the requirements of the NRCS Field Office Technical Guide (FOTG) standard Nutrient Management (590)  **Sosten Lungu, Ph.D**  **TSP #: 10-6602**  **Date: 11/12/2014** |

**Description of the Existing Setting**

Vermont Technical College and Osha farms consist of 457 acres of cropland, some of it is pasture for heifers and dry cows in the summer. The cropland production system produces alfalfa, white clover, red clover, corn silage, sorghum-sudangrass silage, orchard grass, tall fescue, perennial ryegrass, timothy and festololium. Winter rye is planted as a cover crop in corn silage fields and harvested for silage annually at the Osha farm.

Note that we expect our anaerobic digester to be operating at full capacity in 2015. Next year’s cNMP update will include fields from other neighboring farms and acreage will rise.

**Waste Generation and Storage**

The college’s new effluent pond (2013 is approximately 3,007,185 gallons. We also have access to the old college manure pit (471,273 gallons), the Osha manure pit (561,000 gallons) and the digester’s one-week effluent storage tank (115,000 gallons). All milk house and barn wash water and separated solids bedding is currently collected with manure from lactating cows and transported to the anaerobic digester using manure trucks. If transportation is down for a short period, the combined manure, bedding and wash water are temporarily stored in the manure pits at the college farm and the Osha farm. Design of the manure pits and barnyards at both farms excludes runoff from manure pits and the effluent pond. Dry cows and heifers are pastured for six months of the year. Dry manure collected during their six months of confinement, and from the calf barn at the college is collected and trucked to the digester. A small amount of dry manure contaminated with long-stemmed hay and compost produced from mortality piles is spread on hay fields. Digestate produced by the anaerobic digester is separated, using a screw press auger, creating liquid effluent and separated solids (Table 1). The separated solids are used as bedding~~s~~ for lactating cows, dry cows, heifers, calves and birthing cows at the college and Osha farms. As of November 2014, all solids were being used as bedding; no excess solids were being produced. Liquid effluent is spread to the cropland and pasture fields. NRCS figures can be used to calculate approximate annual production of 1,733,261 gallons of liquid  effluent (Table 3) and about 244,000 gallons of separated solids.

In our 2015 update of this combined NMP, we will use data gathered in transportation of: 1) our combined liquid manure, bedding and wash water to the digester; 2) solid dairy manure to the digester; and 3) separated solids from the digester to the barns.

**Animal Mortality Facility**

All dead cows, calves, aborted fetuses, placental membranes are composted. The dead animals are placed in the composting area within 6 hours of carcass discovery. The dead animal is placed over 24 inches of wood chips, and then covered with an additional 12 inches of sawdust and feed refusals. The site is check every six months to see if the carcass is fully degraded. The composted material is used in hay fields. The composting area is a well-drained soil and it is more than 1000 ft from hydrologically sensitive areas.

The nutrients from mortality composting and dry manures are accounted for in long-term manure application (see line 2 of Table 2).

**Nutrient Management Capacity**

The crop nutrient removal values were calculated using the Crop Nutrient Tool (USDA-NRCS) to estimate removal of nutrients at various levels. The estimates were then used to calculate the nutrient balances for the two farms. The 457 acres agronomic nutrient requirement at the two farms is 60,799 lbs of N, 9,412 lbs P2O5 and 60,339 lbs of K2O (Table 2). The two farms generated 30,846 lbs of N, 8,623 lbs P2O5 and 30,086 lbs of K2O in 2014 (Table 2). ***To meet phosphorus needs of the crops, VTC and Osha farms need about 781 lbs P2O5 annually.***

Changes for 2015

Approximately 1,166,739 million gallons of organic residuals will be imported in 2015. The imported organic residuals will pass through the anaerobic digester combined with animal waste (combined liquid manure, bedding and wash water and solid manure) from VTC and Osha farms. Liquid effluent produced by anaerobic digestion of the combined animal waste and organic residuals will be sampled to determine the nutrient load to be spread. To accommodate the additional nutrients brought in with the organic residuals, Vermont Tech has partnered with neighboring farms, and will be spreading digester effluent on a total of 729 acres comprised of the 457 acres of the college and Osha farms and an additional 272 acres of fields from Ayers Brook Goat Dairy, Silloway Farm and the Parmelee Farm. These fields are mapped and described in Tom Eaton’s 2014 CNMP, submitted to VAAFM. For the combined 729 acres, the crop nutrients needs are 112,922 lbs of N and 72, 693 lbs of P per year. Using the current effluent test (Table 1), liquid digester effluent is projected to have 44,776 lbs of N, 24,360 lbs of P2O5 and, 147,028 lbs of K2O.

Therefore, we estimate that Vermont Tech has adequate waste storage and cropping land to import an additional 1,166,739 gallons of waste. Another nutrient management plan will be submitted in 2015 after testing liquid digester effluent stored over the winter and fresh effluent produced in the spring.

**Table 1: Current Effluent Analysis**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Units** | **TKN** | **NH4-N** | **Organic N** | **P2O5** | **K2O** | **Cu** | **% Solids** |
|  | Lbs/1000 Gal |  |  |  |  |  |  |  |
| Effluent |  | 16.70 | 9.20 | 7.50 | 4.20 | 15.80 | 0.03 | 2.20 |

**Analysis on 06/12/2014**

**Total Waste Produced 1,733,261 Gallons/Year**

**Table 2: Nutrient Balance for the 457 acres of the Vermont Tech and Osha farms\***

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| --- | --- | --- | --- |
| **Credits** | **N** | **P2O5** | **K2O** |
|  | **Lbs** | | |
| Nitrogen credits from previous legume crop | 4,400 | 0 | 0 |
| Residual from long-term manure application | 2,019 | 0 | 0 |
| Composted material | 500.0 | 175 | 400 |
| Fertilizer – Starter (corn silage) | 2,700 | 1,350 | 2,700 |
| Fertilizer – Side dressing (corn silage) | 6,960 | 0 | 0 |
| Manure/Effluent | 14,767 | 7,273 | 27,386 |
| **Total Nutrients** | **31,356\*\*** | **8,798** | **30,486** |
| **Total Crop Nutrient Removal** | **66,370** | **9,579** | **60,796** |
| **Deficit** | **35,014** | **781** | **30,310** |

\*This is a summary of field-by-field analysis.

\*\*Using 60% of nutrient value as recommended by the nutrient availability reference below.

**Table 3: Software and Data Sources Used to Create this Plan**

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| Animal waste | USDA NRSC Field Office, Berlin, VT |
| Crop Nutrient Removal | USDA-NRCS |
| Nutrient availability | Nutrient Recommendations for Field Crops in Vermont, UVM Extension, 2004 |
| Crop fertilizer recommendation | Nutrient Recommendations for Field Crops in Vermont, UVM Extension, 2004 |
| Effluent Analysis | University of Maine |
| Practice Standard | VT NRCS Nutrient Management Standard (590)  <http://www.vt.nrcs.usda.gov/technical/Conservation_Practices/Index.html> |
| Mineralization estimates in compost | Eghball and Power (1999b) and Eghball (2000). |