Resource Assessment and

Watershed Plan for Agriculture in the Rock River Watershed,

Franklin County, Vermont

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Vermont

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Background and Purpose of Plan

These watershed plans were developed by NRCS in Vermont to address the need for more effective practice implementation of conservation plans on agricultural lands in the Lake Champlain Basin. Past conservation practice implementation efforts have been broad in scope and have not resulted in any significant improvements in water quality. In response to the pending new phosphorus TMDL for Lake Champlain and due to the availability of increased NRCS funding for the next five years, NRCS in Vermont has decided to use a more strategic and focused process for conservation practice implementation. Under this new process NRCS will collaborate with the Vermont Department of Environmental Conservation (VTDEC) to contribute information to the agricultural sections of Tactical Basin Plans (TBP's). These agricultural watershed plans will provide a comprehensive inventory of land use and resource conditions in each of the targeted watersheds. This information will then be used by local NRCS staff and partners working in each watershed to identify and target specific farms and fields for further resource assessment and for the development of practice alternatives.

Local Watershed Teams will be initially established by NRCS in each watershed, but eventually they will be directed by an appropriate local partner to bring all agricultural partners together to work in a coordinated and strategic effort. The Local Watershed Teams will determine the length of the project for each watershed and what amount of phosphorus reduction they would like to achieve during that time period. These Teams will also identify objectives to meet their goals and a detailed action plan supporting these objectives. The timeline and amount of practice implementation may be determined to some extent by the amount of funds likely to be available and the staff available to implement the Local Watershed Team Action Plan.

These watershed plans will also include the results of an analysis to establish phosphorus reduction goals (in lbs/yr) for each of the targeted watersheds using existing EPA tools such as the EPA HUC-12 Tool for the Lake Champlain Basin. The percent reduction in phosphorus load identified by EPA for the larger HUC-8 watershed will be used to calculate the required phosphorus load reduction for each HUC-12 watershed. Currently, EPA has proposed phosphorus reduction goals for our four targeted watersheds that range from 35 to 83 percent, although at this time the TMDL is not finalized and these reduction goals could still change.

Based on the required reduction for each of the targeted watersheds, an example conservation practice scenario will be developed. This scenario will include a suite of individual practices, and systems of practices, that when implemented will reduce phosphorus loading from the agricultural lands by the required amount for each of the targeted watersheds. The new EPA Scenario Tool will be used to develop this example suite of practices that meet the TMDL goal for agriculture in each of the watersheds. The Local Watershed Teams will modify this list of selected practices and the amount applied based on their more detailed assessment of the watershed and their locally developed goals. The amount of estimated phosphorus reduction from implemented practices will be tracked on an annual basis. It is important to note that the phosphorus reduction amounts achieved by these specific practices are an estimate based on some fairly general modeling assumptions. These modeled loading reductions can be helpful in establishing goals for a watershed and for the tracking of progress. However, these numbers are not necessarily accurate in a way that they could be used for regulatory purposes.

Resource Inventories

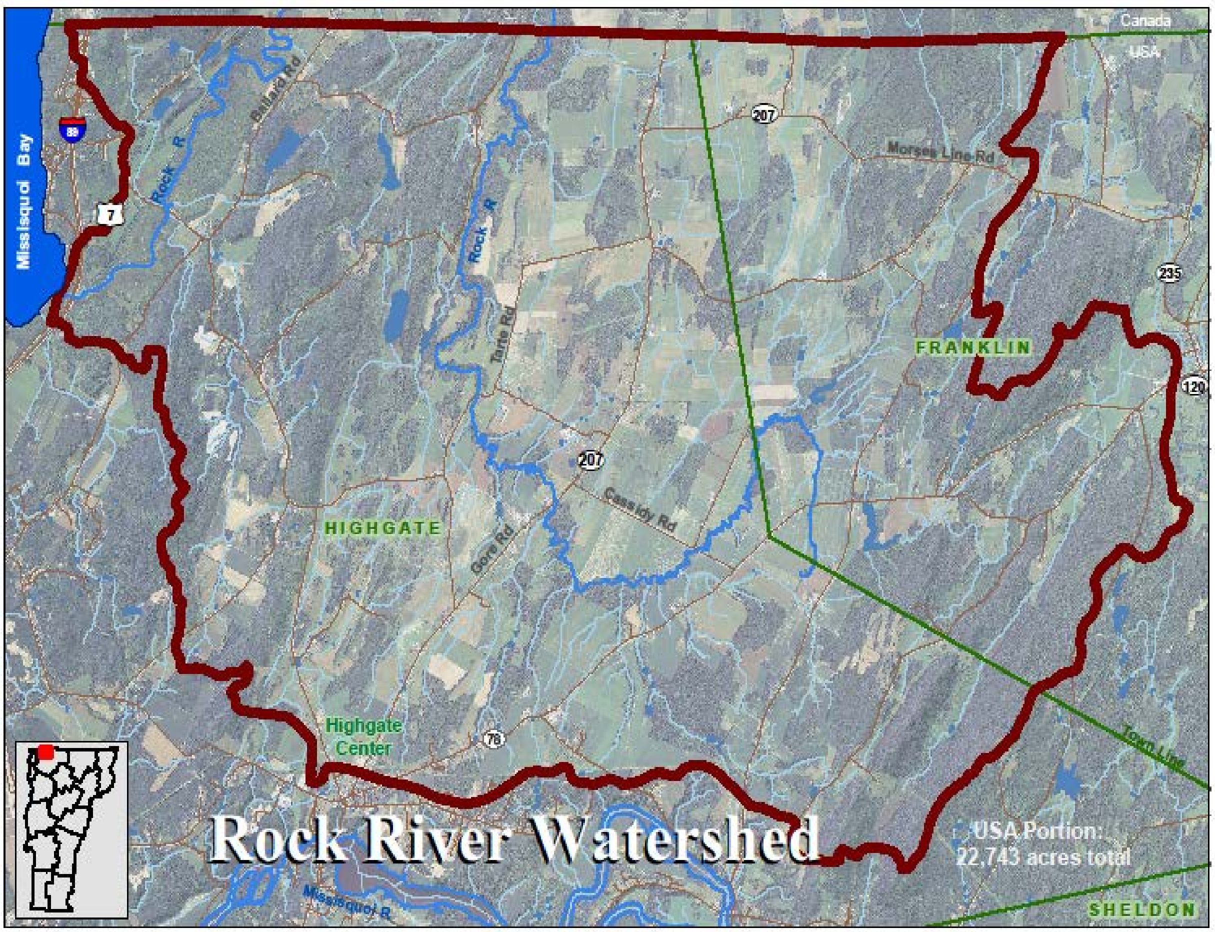
A variety of watershed land and farm assessments were undertaken in order to provide resource condition information on a watershed scale to the Local Watershed Teams and to NRCS staff and partners. These various data layers can be used individually or in combination with each other to help the Local Watershed Teams and conservation planners to target areas for further on the ground assessment and then if appropriate, conservation practice implementation. Due to the large extent of information that could be potentially developed, and the short time frame in which the data is needed, we have prioritized the development of the data layers to some extent based on feedback from local NRCS employees.

For each data layer a short narrative will describe the data set, briefly how it was generated, show a watershed wide map of the data, a more detailed example map, and some tabular or graphical summary data when appropriate. Suggestions will also be provided how this data layer might be used in conjunction with other data layers. All applicable NRCS offices will be provided GIS based electronic files of each data layer for them to use in their more detailed assessments.

Watershed Overview

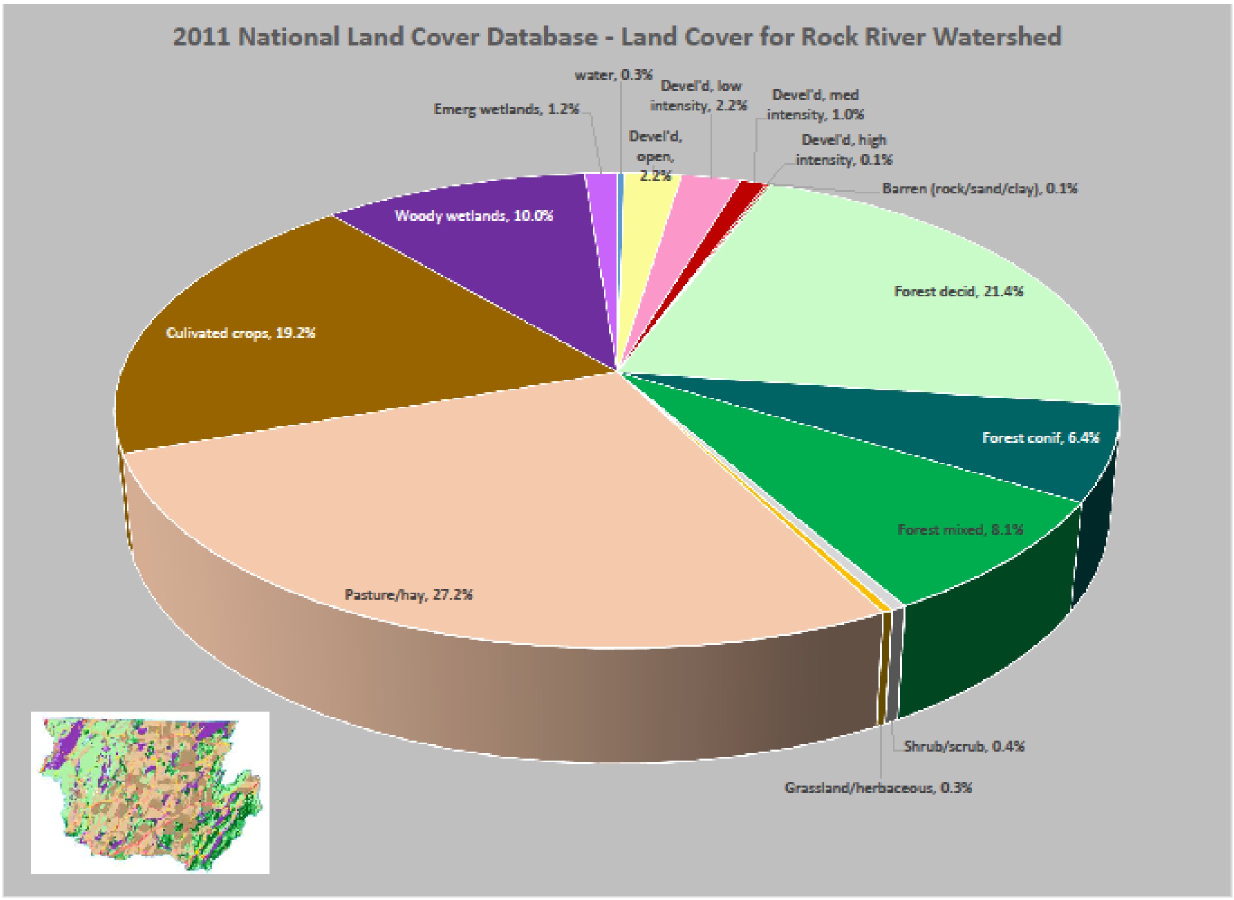
The Rock River watershed is located in northwestern Franklin County Vermont (Figure 1). The Rock River drains through Canada, entering Missisquoi Bay a few miles south of the international border. The total watershed area on the U.S. side of the border is 22,743 acres. Missisquoi Bay is subject to frequent and sometimes severe blue-green algae blooms during the summer months.

Figure 1 – Map of the Rock River Watershed



The Rock River Watershed is very rural with a significant amount of land in agriculture. Data from the National Cropland Database (NCD 2011, Figure 2) estimates that 19% of the watershed is in annual cropland and 27% is in pasture or hayland, for a total of 46% in agriculture. Approximately 36% of the watershed is in forest. Only about 5.5% of the watershed is in a developed use.

Figure 2 – Land Cover in the Rock River Watershed (NCD 2011)



Farmsteads

The Farmstead Map shows the location of each active farmstead within the Rock River Watershed (Figure 3). The identification of farmsteads was conducted by visual interpretation of the 2014 NAIP imagery with some corrections from local field office staff. Farmstead boundaries were based on the visual identification of structures and heavily disturbed ground surface. As can be seen in Figure 3, there were a total of 48 active farmsteads identified in the Rock River Watershed in 2014. Three of the farmsteads were MFO's, no LFO's were identified in the watershed. These maps can be used to ensure that all farmsteads in the watershed are reviewed on the ground for potential waste management issues and to help identify farmsteads with potential resource concerns such as improperly constructed and/or maintained heavy use areas.

Figure 3 – Farmstead Locations in the Rock River Watershed

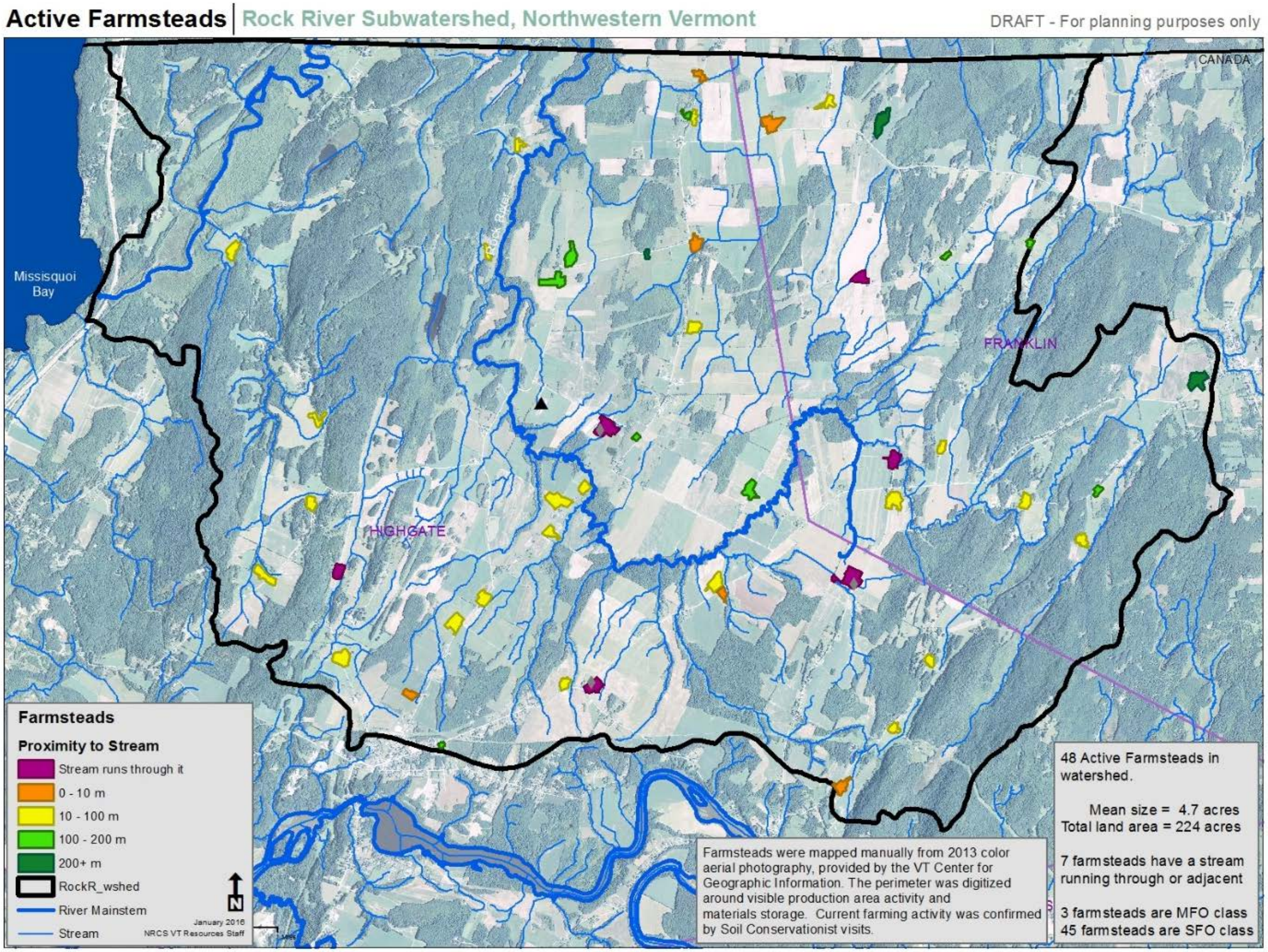
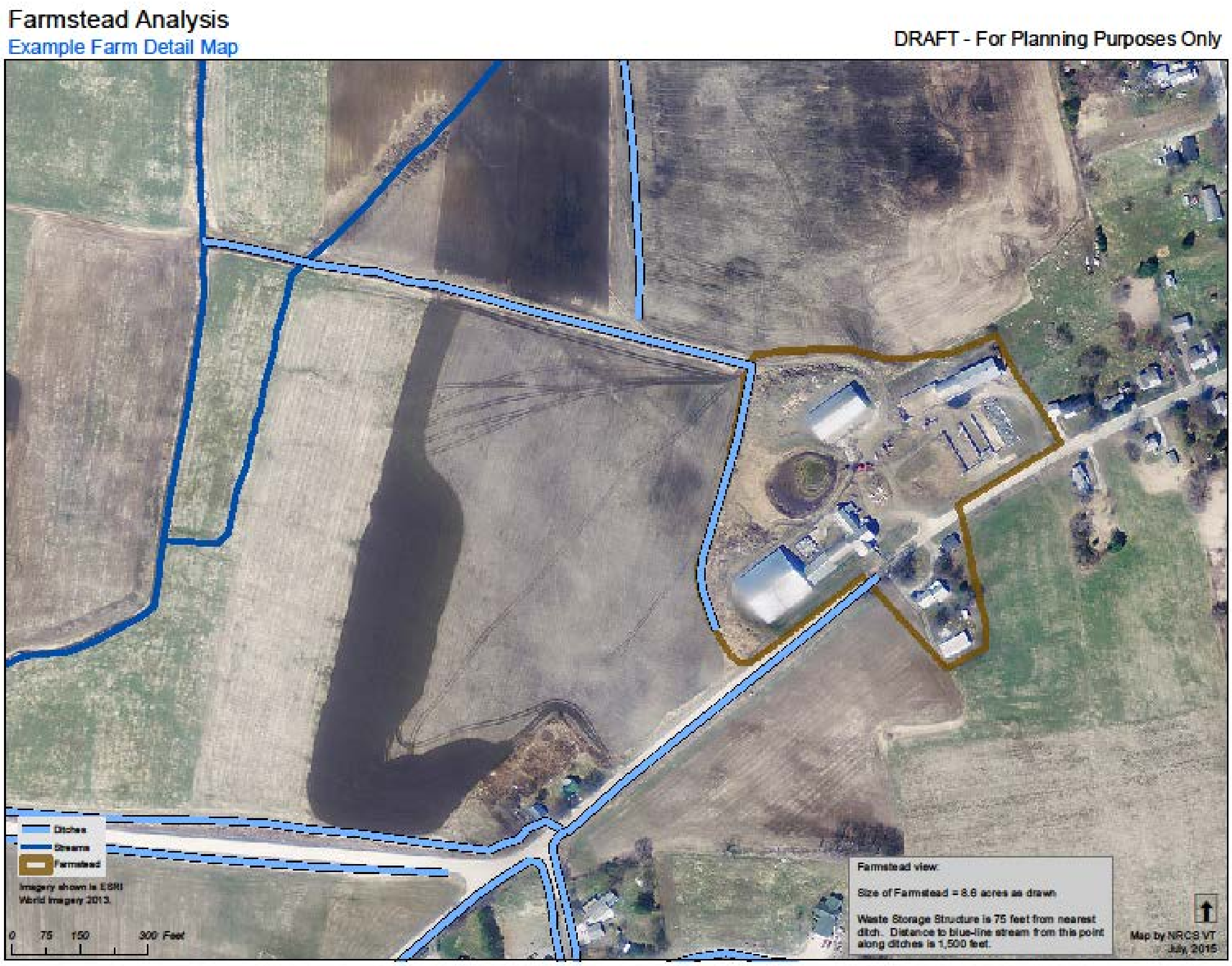


Figure 4 shows an example Farmstead Map for a location that has several barns, a manure storage facility and some heavy use areas, but shows no visible resource concerns. The close proximity of the manure pit to a surface ditch might warrant an onsite visual assessment of any potential resource concerns.

Figure 4 – Example Farm Scale Farmstead Map

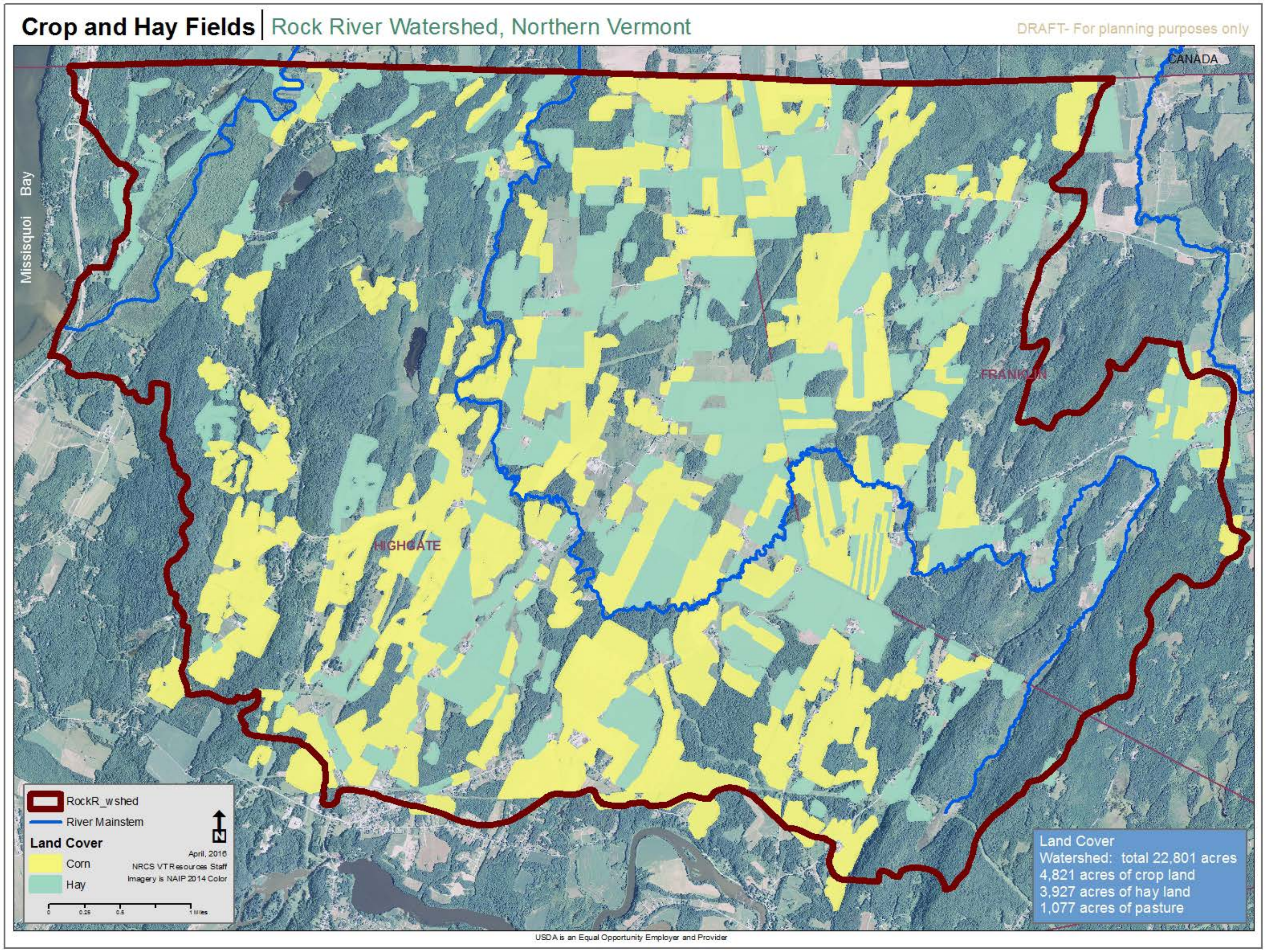


<u>Annual Cropland and Hayland</u>

One of the basic pieces of information needed for agricultural watershed planning is the extent and types of land cover in the watershed. Annual cropland and hayland were visually identified in the Rock River Watershed using 2014 NAIP imagery. As such the land cover is a "snapshot in time" since many crop and hay fields are rotated between annual crops such as corn and hay. An additional analysis identified fields in continuous annual crops.

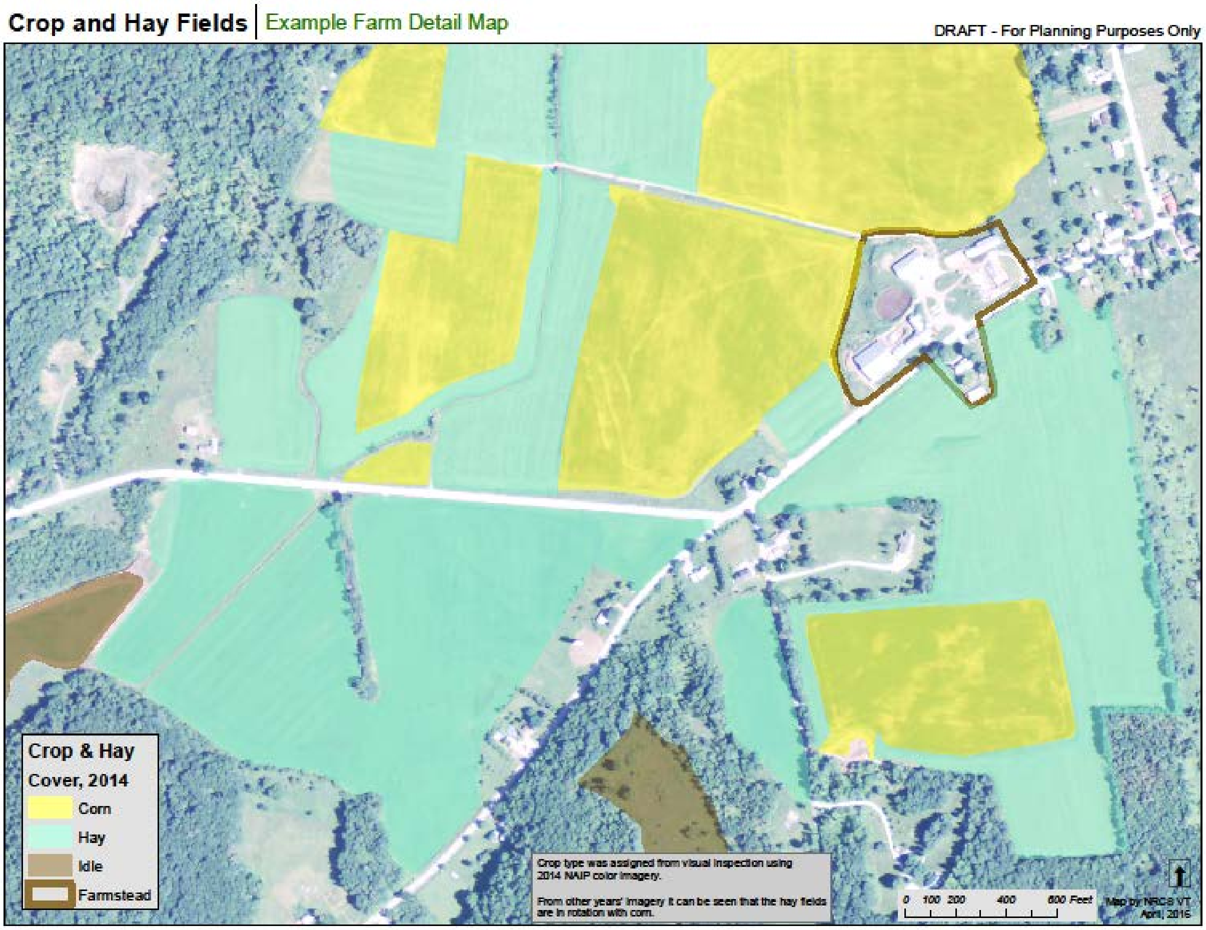
Figure 5 shows the location and extent of annual cropland and hayland in the Rock River Watershed. This information was digitized using the 2014 National Agriculture Imagery Program (NAIP), and as such may differ slightly from the NCD data presented in Figure 2. According to the NAIP photography there was a total of 4,740 ac of annual cropland, 3,954 ac. of hayland and 1,077 ac. of pasture in the Rock River Watershed in 2014. This comprises a total of 42% of the 22,743 ac. watershed.

Figure 5 – Location and Extent of Annual Cropland and Hayland in the Rock River Watershed



Field scale maps can be produced by conservation planners working in the watershed. Figure 6 is an example of field scale map for annual cropland and hayland. The Annual Cropland and Hayland Maps can be used alone or overlain with other several data layers such as the Erosion and Runoff Risk Potential Maps to evaluate specific fields for erosion and runoff risk. It is important to remember that these Annual Cropland and Hayland Maps represent land cover in 2014 and many of these fields may be in a corn/hay rotation.

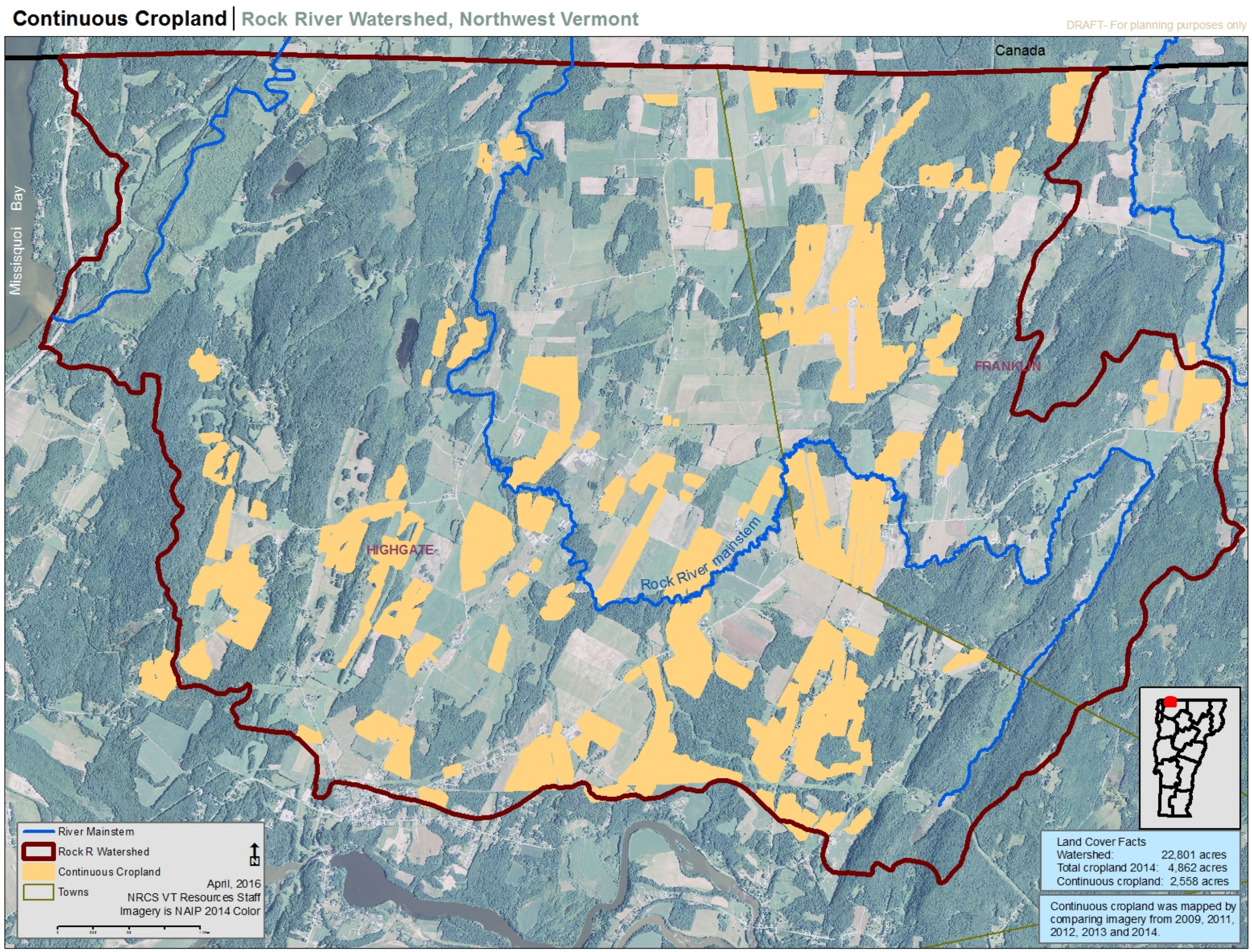
Figure 6 – Example Field Scale Map of Annual Cropland and Hayland



An additional analysis was performed to identify farm fields continuously planted to annual crops such as silage corn (Figure 7). These fields were visually identified using five years of aerial imagery (2009, 2011, 2013, and 2014). There is an estimated 2,558 acres of continuous cropland identified in the Rock River Watershed (53% of total cropland). The remaining cropland is in rotation, mostly with hay.

Fields in continuous annual crops are likely to exhibit a number of resource concerns. These fields may have higher erosion rates, depleted organic, and higher nutrient application rates, among other concerns. For these reasons these fields should be prioritized for more detailed onsite evaluations. Any fields identified as continuous cropland and have a high Erosion and Runoff Risk Potential should be considered as especially vulnerable to significant resource concerns.

Figure 7 – Map of Fields in Continuous Annual Crops



Cropland and Steep Slope Adjacency

The streams and rivers in the Rock River watershed are fairly deeply incised compared to the streams in some other watersheds. The Rock River Watershed also has extensive deposits of silt textured materials that can be highly erosive. The result of this combination of steep slopes and erosive soils leads to the development of gullies in these areas. These gullies often first form in the woods or on non-ag land adjacent to fields and then with time head cut into the crop fields.

This GIS analysis highlights areas of steep slopes over 8% grade that are adjacent to fields. It is important to identify the location of potential gullies as they can be direct conduits of nutrients and sediment into receiving waters. With the advent of widespread availability of highly detailed LiDAR elevation data, it becomes much easier to locate these potential erosion areas. A flow accumulation model was used to identify steep areas within 30 meters of a flow pathway that are adjacent to crop and hay fields. The analysis used 1 meter LiDAR data. The results of the analysis for the Rock River Watershed are shown in Figure 8.

Individual field scale maps such as the one shown in Figure 9 can be developed to target in-field resource assessments. As part of the field assessment these areas should be visually checked to identify any areas with significant gully erosion. The maps in Figures 8 and 9 also show (in tan) those streams and rivers that are listed as Impaired by the State of Vermont (VDEC 303d List).

Figure 8 – Cropland Adjacent to Steep Slopes in the Rock River Watershed

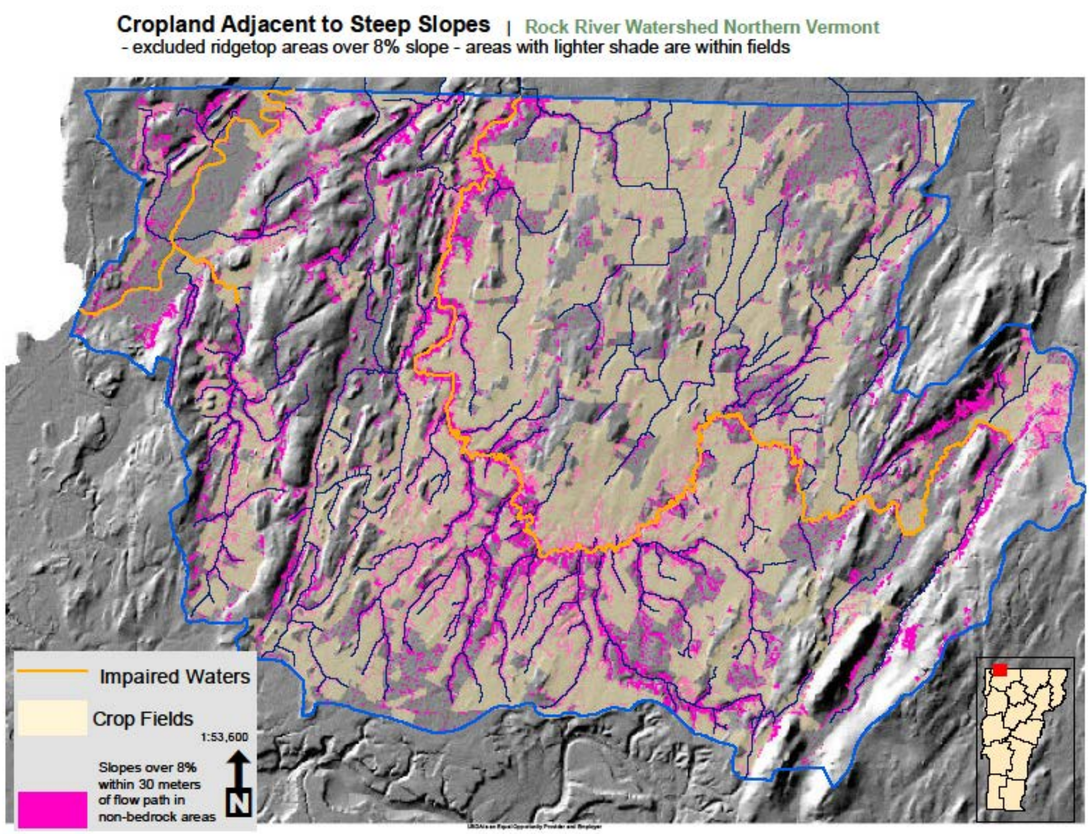
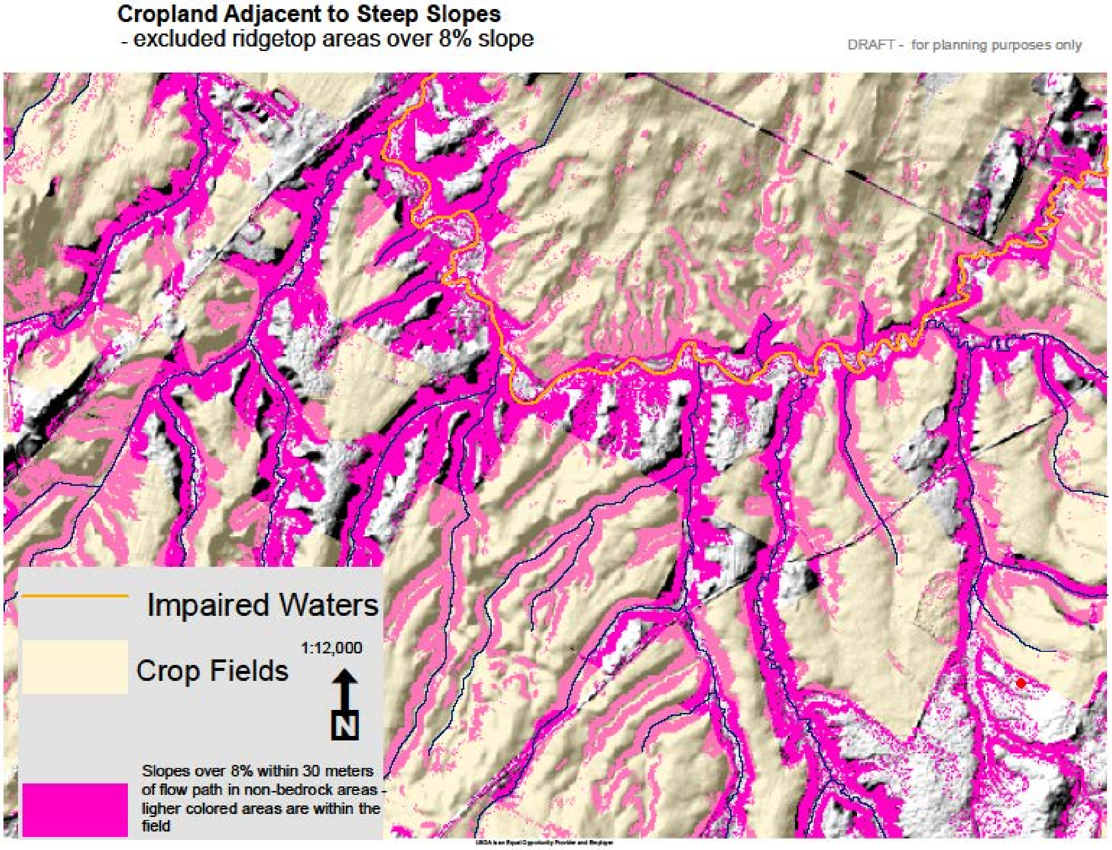


Figure 9 - Field Scale Map of Areas with Steep Slopes Adjacent to Cropland



Wetland Restoration Potential

The Restorable Wetland data layer was developed by a variety of government agencies and private consultants in 2007. The main data input layers were: hydric soils, land-use / land-cover data from 2002 showing open land, percent slope (slopes under 5%), and National Wetland Inventory data showing disturbed wetlands. Once appropriate restoration sites had been delineated using GIS analysis, these areas were then run through a prioritization model that ranked the sites based their potential to retain phosphorus. Four prioritization categories for restoration were chosen: highest, high, moderate, and low. For further details on how the data layer was developed refer to the “Lake Champlain Wetland Restoration Plan” report.

Since this data is now 9 years old, land use changes have occurred over this time period. The data was edited to remove sites that contained house sites. The e911 “esites” data for 2015 was used to remove those areas that now show homes within the restorable wetlands. Additionally, State Land that was also excluded from the data layer, since it is not eligible for NRCS restoration programs. The extent and location of potentially restorable wetland areas are shown in Figure 10. These areas are located on private land and may have historic drainage and other modifications. These areas would only be available for restoration under a voluntary restoration program such as the Agricultural Conservation Easement Program for wetlands. Using field scale maps such as in Figure 11, it will be necessary for an on-site investigation to insure that they are eligible and capable of being restored to natural wetland conditions.

Figure 10 - Watershed Scale Map of Potentially Restorable Wetlands

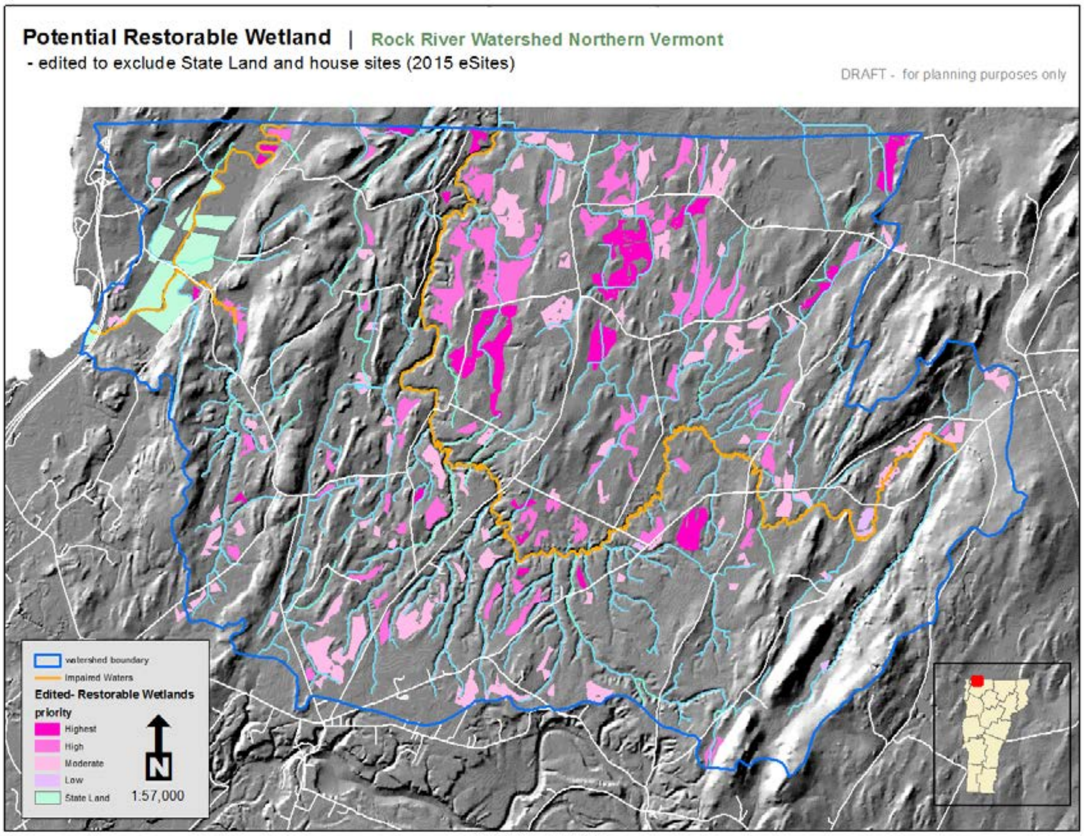
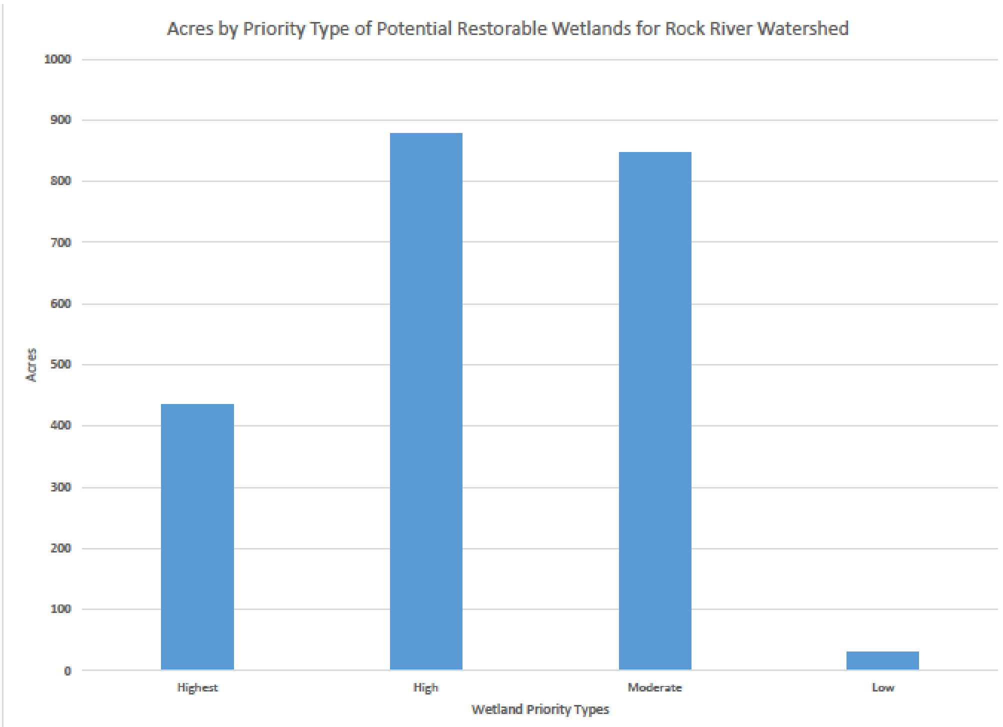


Figure 11 - Example Field Scale map of Potentially Restorable Wetlands

The map in Figure 10 identifies over 2,100 aces of potentially restorable wetland in the Rock River Watershed. As can be seen in Figure 12 over half of this area (1,310 acres) is categorized as having high or very high restoration potential. The site specific restoration data as shown in Figure 11 could be overlain with crop and hayland data or other information such as tract information to further assess its viability for restoration.

Figure 12 - Summary of Potentially Restorable Wetland Classes



<u>Erosion and Runoff Risk Potential</u>

A GIS model was constructed to estimate the risk of erosion and runoff from farm fields based on four factors. The factors included are the K value, hydrologic soil group, slope (based on Digital Elevation Model (DEM) data), and flooding potential of the soil map unit. This analysis does not take into account field management and existing conservation practices. The categories in the Erosion and Runoff Potential Maps are meant to represent the relative risk of sheet and rill erosion and runoff occurring from specific fields or portions of fields. As can be seen in Figure 13 a moderate portion of the fields in the Rock River Watershed have been identified having a high or very high risk for erosion and runoff. Figure 14 provides an example of the type of field level maps that can be produced from this data. It is important to note that in many situations it is only a portion of a field that is identified as having high or very high risk.

Figure 13 – Erosion and Runoff Risk Potential in the Rock River Watershed

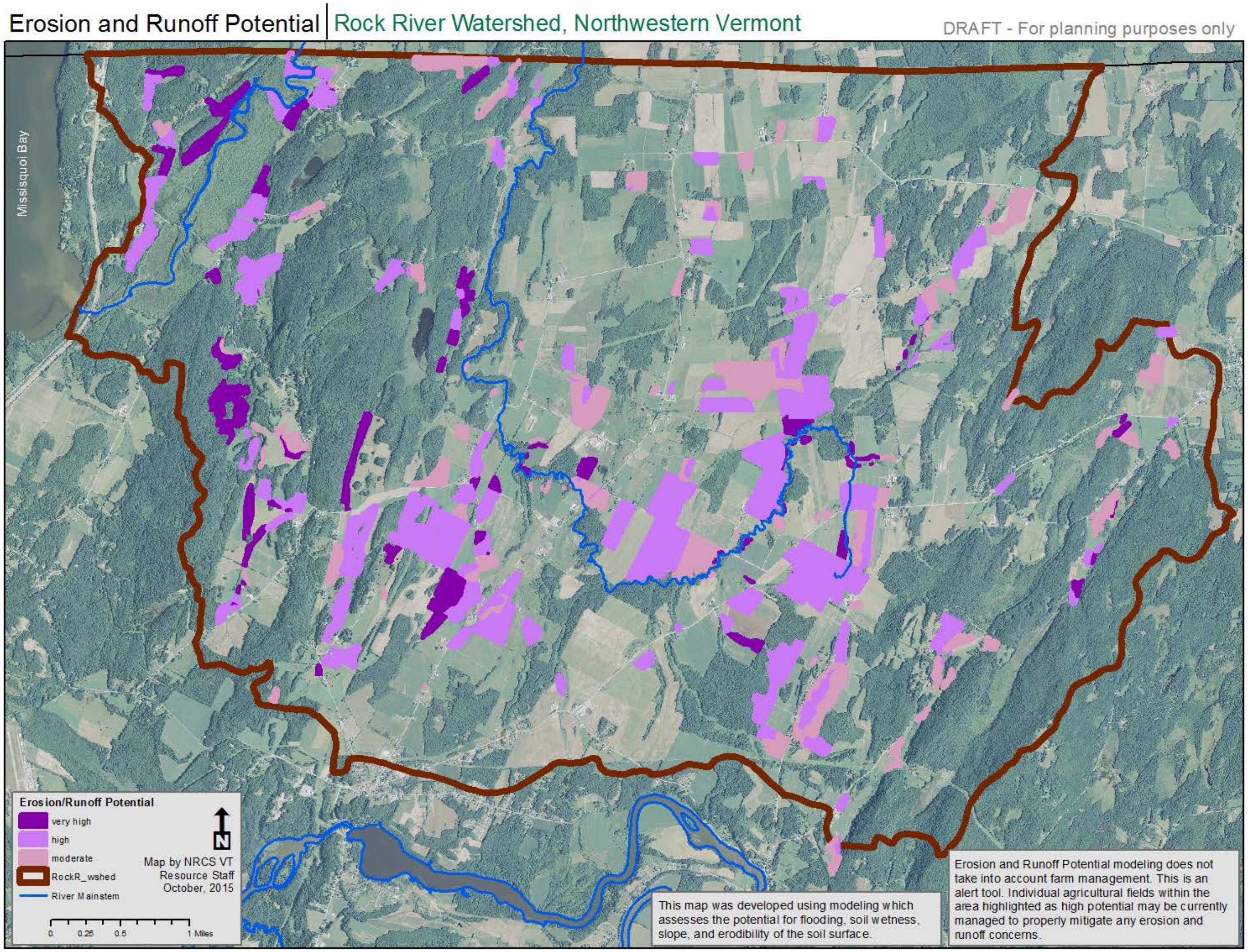
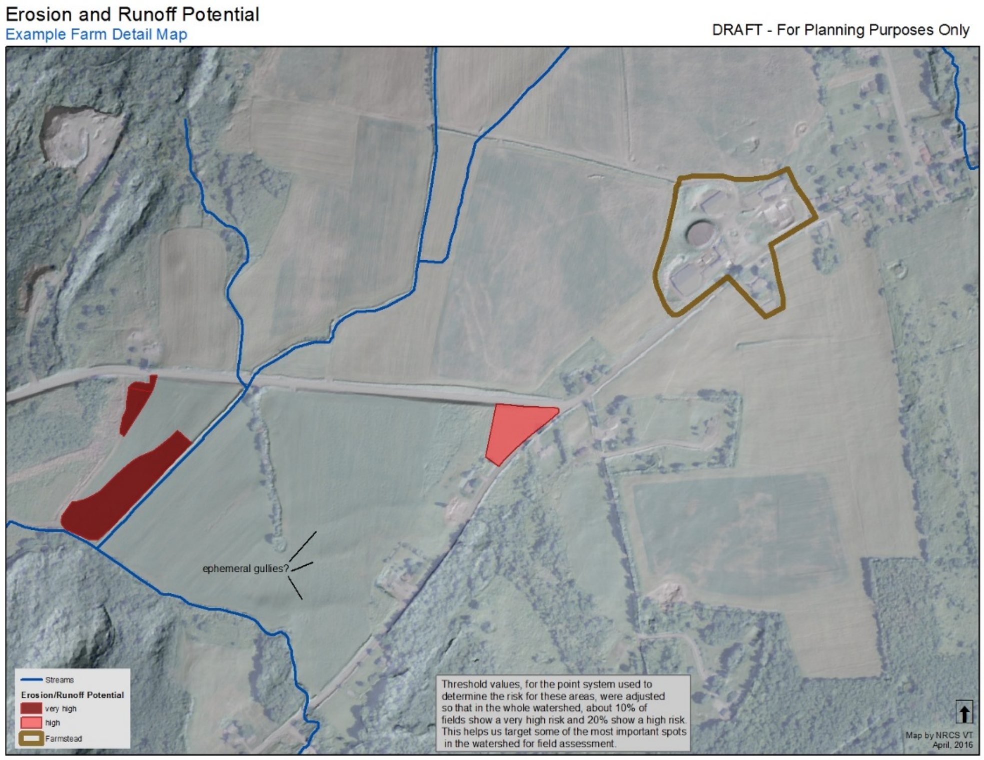


Figure 14 - Example Field Scale Erosion and Runoff Risk Potential Map



Farm Ditches

Field ditches are common on agricultural land throughout the Lake Champlain Basin in Vermont. These waterways have the potential to readily transport both sediment and nutrients to streams and rivers. Under the new Required Agricultural Practices recently passed by the State Legislature all ditches will likely be required to have a 10 ft. wide vegetated buffer adjacent to them. As such it will become important to know the location of these ditches to ensure that the farmer has opportunities to install buffers on these ditches. Figure 15 shows the location of ditches and other drainage features in the Rock River. These drainage features were identified through visual interpretation of orthophotos and LiDAR data and as such **do not represent a completely accurate and complete depiction of drainage features in the watershed. These maps should be used for planning purposes only.** There were a total of 72 miles of field and roadside ditches identified in the Rock River Watershed. Field scale maps can also be developed as shown in Figure 16 where the ditch locations are overlain with crop field and farmstead location data.

Figure 15 - Map of Field Drainage Features in the Rock River Watershed

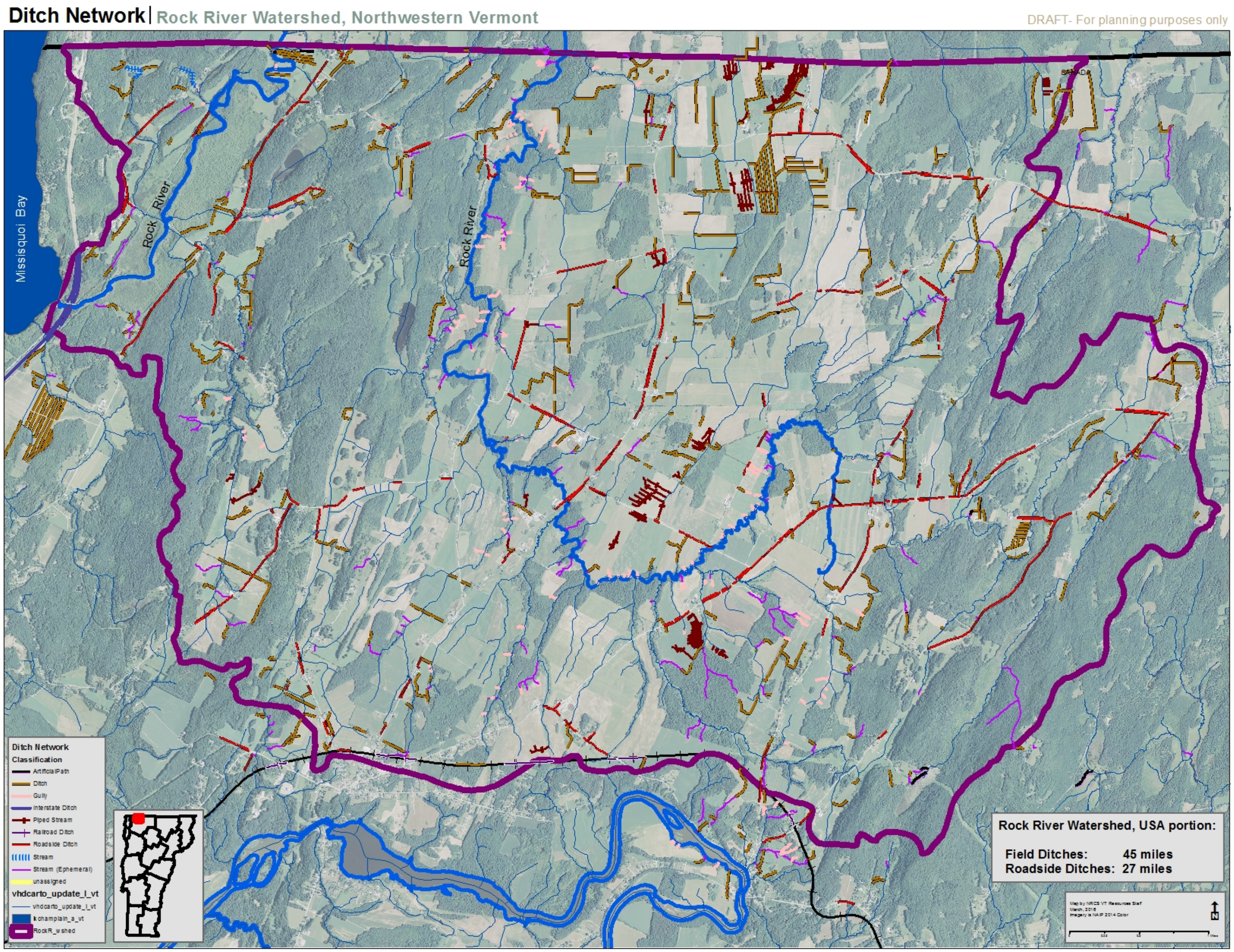
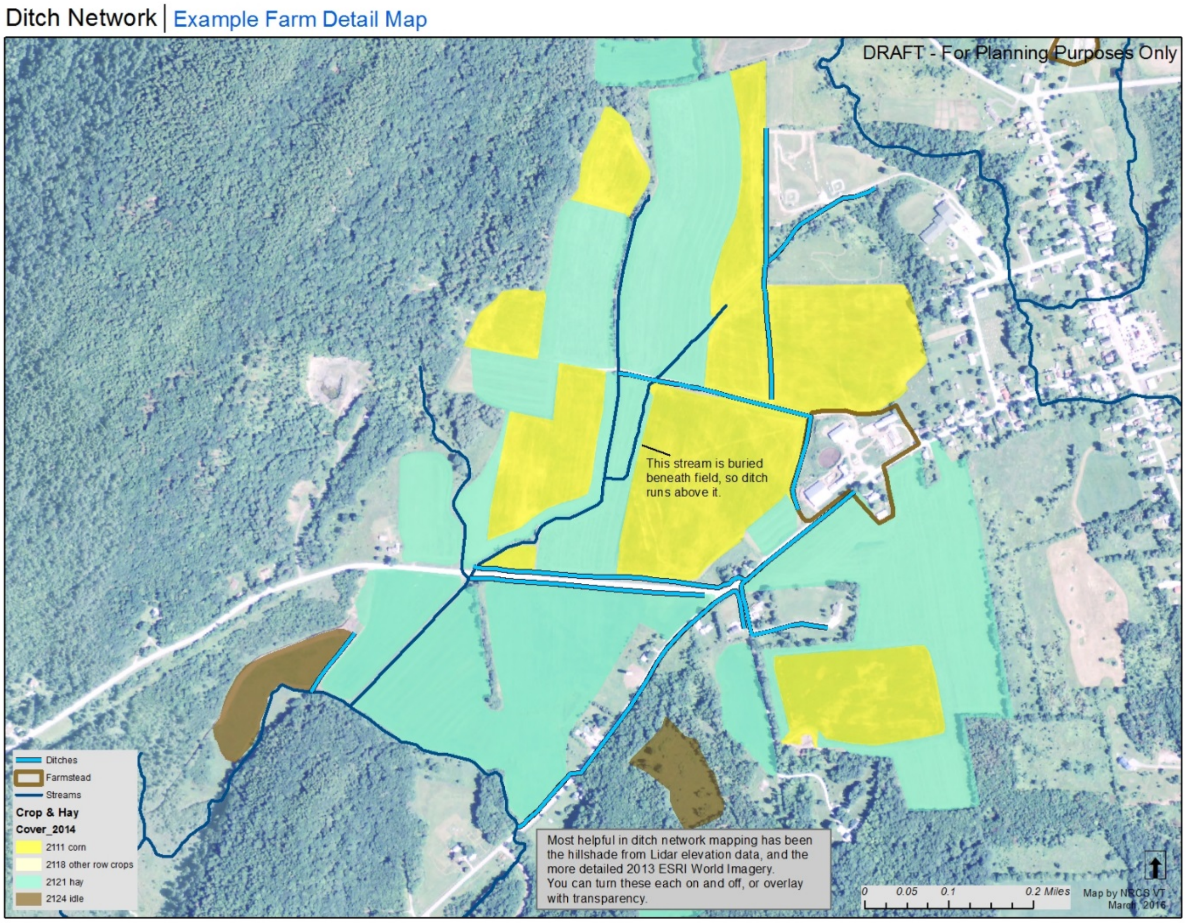


Figure 16 - Example Field Scale Ditch Map

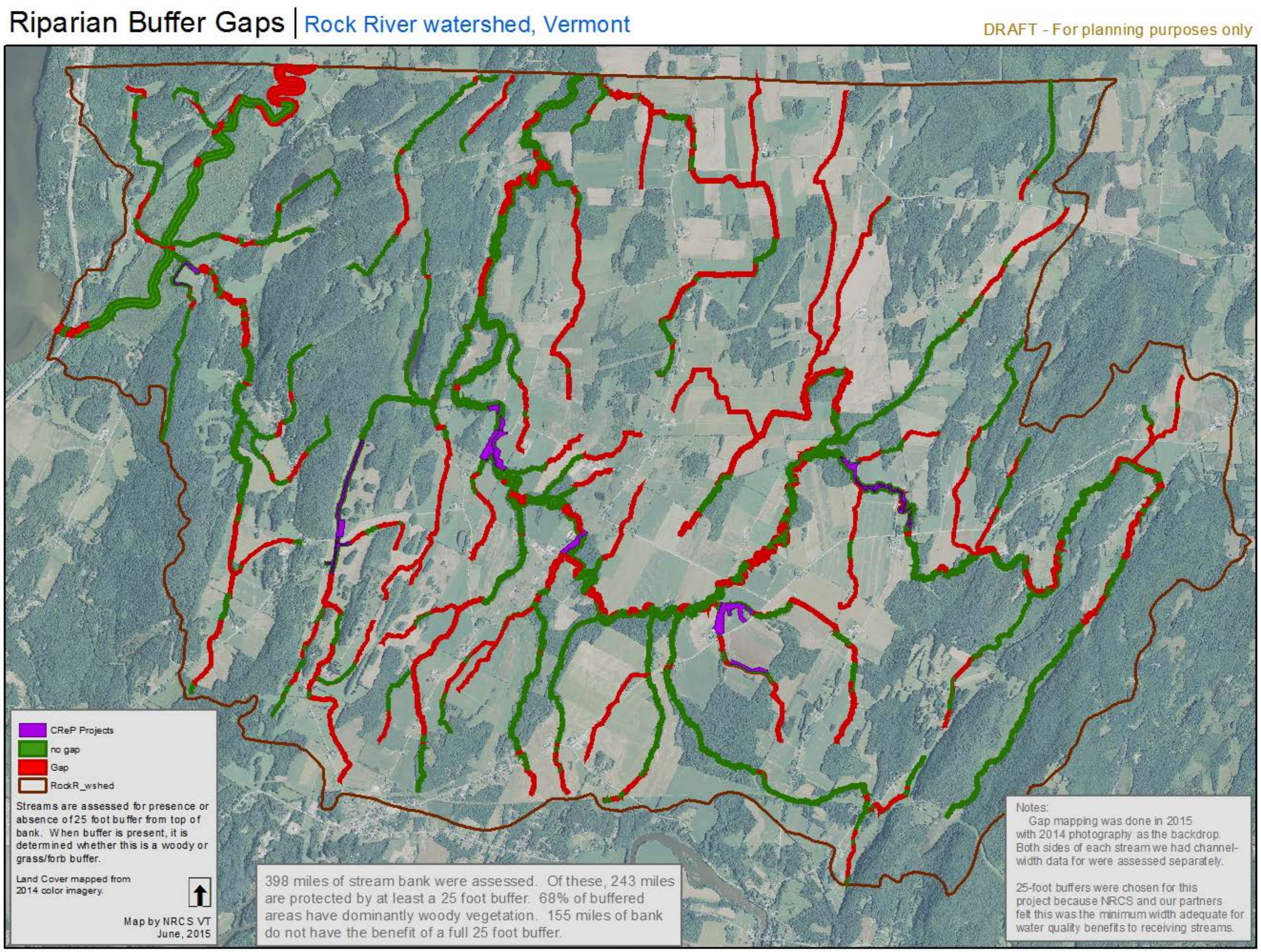


Riparian Buffer Gaps

Riparian corridors were evaluated in the Rock River Watershed to determine locations where adequate riparian buffers were lacking. The identification of these riparian buffer gaps was based on visual interpretation of 2014 aerial imagery and channel width information from the Vermont Department of Environmental Conservation (VTDEC) Rivers Program database. Riparian zones were evaluated to determine if at least a 25 foot wide vegetated buffer was present, either herbaceous or woody. Twenty-five feet was used as the minimum requirement since the NRCS practice standard for Filter Strip requires a minimum of 25 ft and the practice standard for Riparian Forest Buffer requires a minimum of 35 ft.

A total of 398 miles of streambank (both sides of the stream) were evaluated. Of these, 243 miles of streambank have an adequate buffer and 68% of these are woody buffers. However, it was estimated that 155 miles of streambank in the Rock River Watershed do not have an adequately vegetated riparian buffer. It may be useful to overlay the Riparian Buffer Map data with continuous cropland and/or erosion and runoff risk potential data. These areas may exhibit greater rates of erosion and runoff and would be a priority for well vegetated riparian buffers.

Figure 17 – Map of Riparian Buffer Gaps



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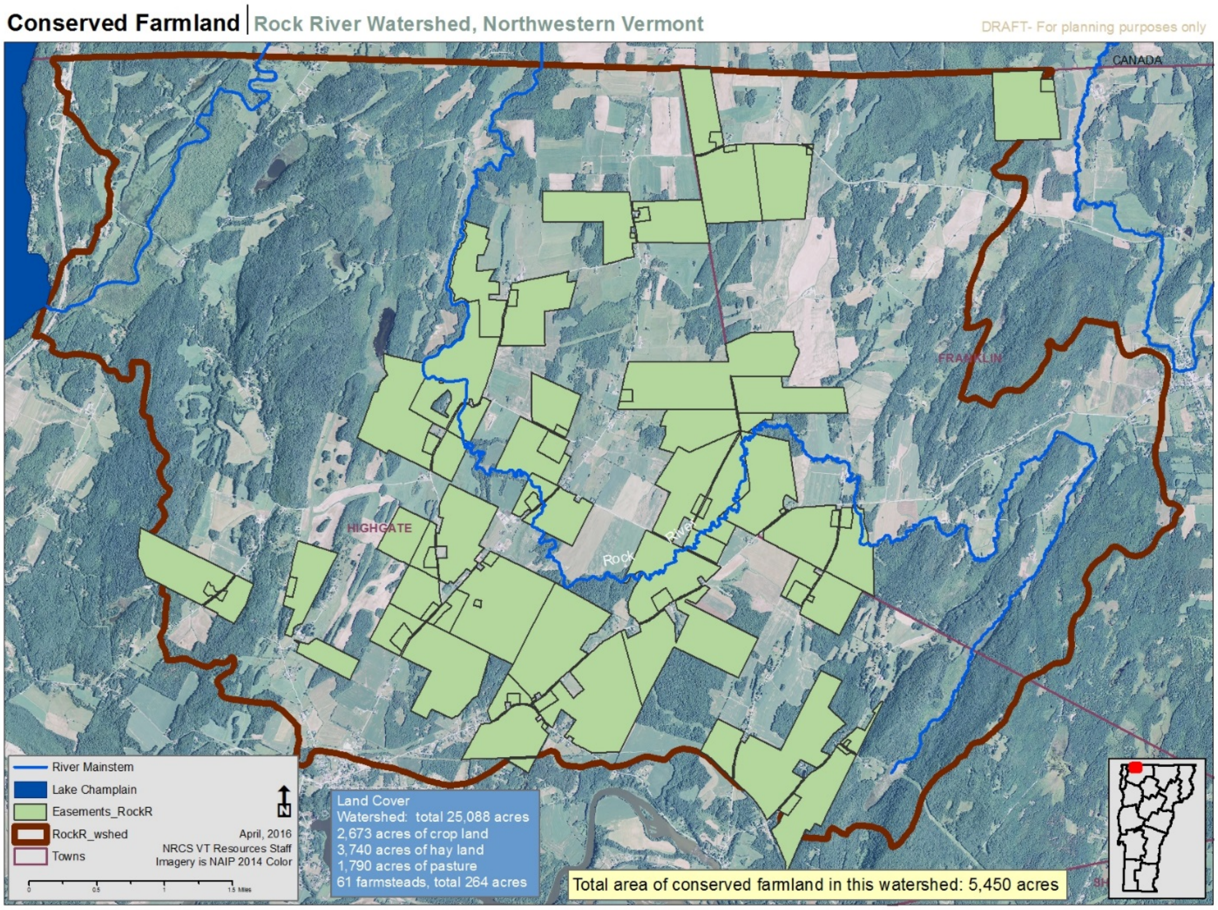
Conserved Farmland

In partnership with other groups such as the Vermont Land Trust, the Vermont Housing and Conservation Board has operated a farmland conservation program in Vermont since 1987. NRCS has contributed significant funds to this program over the years through what is now the Agricultural Easement Program. In some areas large contiguous blocks of conserved farmland are forming. The map in Figure 18 shows conserved farmland in the Rock River Watershed. A total of 5,450 ac. of farmland have been conserved to date in this watershed. Conserved farmland maps can help direct funds and efforts of programs such as the Regional Conservation Partnership Program (RCPP) and other water quality initiatives.

Figure 18 – Conserved Farmland in the Rock River Watershed



Watershed Phosphorus Reduction and Practice Implementation Goals and Projected Costs

EPA has proposed phosphorus reduction goals for all the HUC-8 watersheds or lake segments in the Lake Champlain Basin. The current overall phosphorus reduction goal for the Missisquoi HUC-8 watershed is 64%. Since the TMDL is not finalized at this point there is a chance the reduction goal could still change. EPA then allocated different reduction goals for each sector within the HUC-8 watershed, agriculture is one of these sectors. The phosphorus reduction goal for agriculture in the watershed is 83%.

NRCS has attempted to use the TMDL goals and EPA developed tools to estimate phosphorus loads and reductions to the extent possible. This includes use of the new EPA HUC-12 Tool and the EPA Scenario Tool. All costs are based on NRCS payment schedules, except for a couple of situations where estimated practice costs were developed (ex. average farmstead wide practice costs).

Watershed Phosphorus Reduction Goals for Agriculture

Watershed phosphorus reduction goals for agriculture were estimated using the EPA HUC-12 Tool. This tool provides an estimate of phosphorus loading for each land cover type at the HUC-12 level. Phosphorus loading from continuous corn, crop/hay rotation, continuous hay, pasture and farmsteads were totaled from the HUC-12 Tool to determine the total estimated phosphorus loading from agriculture. The needed amount of phosphorus reduction in lbs/yr was then estimated by multiplying the total agricultural load by the percentage reduction determined by EPA to be necessary for the larger HUC-8 watershed. Table 1 provides the necessary load reductions for the four targeted watersheds. For the Rock River Watershed the total agricultural loading was estimated to be 19,248 lbs/yr, the reduction goal at this time was set by EPA to be 83%, and **the resulting agricultural phosphorus reduction goal for the Rock was estimated to be 15,976 lbs/yr.** The Rock River Watershed has the second highest estimated phosphorus load reduction, second only to the McKenzie Brook Watershed which is a very intensive agricultural watershed.

Table 1 – Agricultural Phosphorus Reduction Goals for the Four Targeted Watersheds

2016 Priority Watershed Estimated Ag Phosphorus Loadings and Targeted Reductions August, 2015 - Draft				
Watershed Name	**Watershed Area (acres)**	**Total Estimated Ag P Loading (lbs/yr)**	**TMDL Reduction Goal**	**Ag P Reduction Goal (lbs/yr)**
Rock River	22,743	19,248	83%**	15,976
Pike River	25,088	9,599	83%**	7,967
St. Albans Bay	33,515	23,047	35%	8,066
McKenzie Brook	21,222	43,276*	60%	25,965
*Total loading reduced 25% to remove loading from East Creek (included in the BMP Scenario Tool)				
** The Rock River and Pike River are part of the Missisquoi Direct watershed in the BMP Scenario Tool.				

Individual Practice and Practice System Efficiencies

The EPA Scenario Tool is a spreadsheet tool based on SWAT modelling of watersheds in the Lake Champlain Basin. It was developed by a private consultant under contract by EPA Region I. Early on in the model development EPA convened a workgroup of local experts to help develop reduction efficiencies for conservation practices that are included in the SWAT model. These efficiencies and ones produced by the model were then incorporated into the EPA Scenario Tool. As such the EPA Scenario Tool is subject to the same limitations as the SWAT model. Certain agricultural practices cannot be easily included in the SWAT model, including many farmstead related practices. In the EPA Scenario Tool efficiencies for a conservation practice vary based on factors such as cropping system, soil hydrologic group and slope.

Table 2 lists the agricultural conservation practices and systems of practices that are included in the EPA Scenario Tool and provides example efficiencies for each practice. It is important to consider when multiple practices are applied to the same field as a system since the individual efficiency of each practice will decrease as additional practices are added to the same field. The efficiencies used in the model will be adjusted as better information becomes available, such as information from the Vermont Edge of Field Monitoring Projects.

Table 2 - List of Available Ag Practice and Practice Systems in the EPA Scenario Tool and Example Practice Efficiencies*

1.	Change in crop rotation	25%
2.	Change in crop rotation and conservation tillage	63%
3.	Change in crop rotation, grassed waterway, ditch buffer and riparian buffer**	84%
4.	Change in crop rotation, grassed waterway riparian buffer	67%
5.	Change in crop rotation and riparian buffer	56%
6.	Conservation tillage	50%
7.	Cover crop	28%
8.	Cover crop, conservation tillage, grassed waterway, ditch buffer and riparian buffer	92%
9.	Cover crop, conservation tillage and manure injection	64%
10.	Cover crop and manure injection	28%
11.	Ditch buffer	51%
12.	Grassed waterway	25%
13.	Grassed waterway and riparian buffer	56%
14.	Manure injection and reduced manure P applied	5%
15.	Reduced manure P applied	5%
16.	Reduced manure P applied and grassed waterway	29%
17.	Annual cropland to permanent grass	92%
18.	Riparian buffer	41%
19.	Livestock exclusion/fencing/grazing system	73%
20.	Farmstead practices	80%

*BMP efficiencies vary with cropping system, soil type and slope
**Riparian forest buffers and grassed filter strips are both considered as riparian buffers
Note: These practice efficiencies should only be used for planning purposes and will change as better practice efficiency data is developed.

Existing and Planned Practice Implementation

NRCS has been working with farmers in The Rock River Watershed for an extended period of time. Over the years farmers have signed contracts with NRCS to implement a variety of different conservation practices. It is important to recognize that many of the early contracts have expired and some of the practices were either discontinued or not maintained. Table 3 provides a list of practices that were installed in the Rock River Watershed with NRCS support over the 5 year period from 2010 – 2014. During this period practices were tracked to determine which specific years during that time period they were implemented. It cannot be determined which practices were continued after the contracted period.

The practices that were implemented to the greatest extent included cover crops (907 ac.), nutrient management (1309 ac.) and some of the grazing system practices. Table 3 also shows estimated phosphorus reductions as a result of the implementation of these practices. The largest phosphorus reductions resulted from cover crops (566 lbs/yr), nutrient management (146 lbs/yr) and conservation crop rotation (46 lbs/yr). The total annual average reduction in phosphorus reduction resulting from the implementation of these practices was 1,019 lb/yr. It is important to note that this is only 6% of the total reduction (15,976 lb/yr) that will be required under the new TMDL.

Table 3 – NRCS Practices Implemented in the Rock River, 2010- 2014

NRCS Practices Implemented in the Rock River Watershed, 2010 - 2014

Practice Group	Practice Code	Practice Name	Units	Sum of Applied Amount	Count of Practices Applied	Estimated P Loading by Landcover* (lbs/ac/yr)	Total P Load from Untreated Acres (lb/yr)	Reduction from Treated Acres (lb/yr)	Cumulative P Reduced Over 5 Year Baseline** (lbs)
Farmstead	313	Waste Storage Facility	no	1	1	3.35	14	11	110
	558	Roof Runoff Structure	no	1	1				
	560	Access Road	ft	835	1				
	561	Heavy Use Area Protection	sq ft	0	1				
Grazing (Pasture)	528	Prescribed Grazing	ac	19	4	2.49	47	19	188
	516	Livestock Pipeline	ft	2,000	6				
	575	Trails and Walkways	ft	325	1				
	382	Fence	ft	593	2				
	614	Watering Facility	no	9	3				
Agronomic (Crop & Hay Fields)	328	Conservation Crop Rotation	ac	130	12	2.23	291	73	218
	329	Residue and Tillage Management, No-Till	ac	25	5	2.23	56	28	85
	340	Cover Crop	ac	907	74	2.23	2,023	566	1,699
	345	Residue and Tillage Management, Reduced Till	ac	23	4	2.23	52	26	78
	391	Riparian Forest Buffer***	ac	2	3	2.23	85	35	347
	393	Filter Strip***	ac	1	1	2.23	36	15	146
	512	Forage and Biomass Planting	ac	77	8	2.23	173	40	119
	578	Stream Crossing	no	1	1	NA			
	590	Nutrient Management	ac	1,310	87	2.23	2,920	146	438
	620	Underground Outlet	ft	100	1	NA			
	633	Waste Recycling	ac	551	54	2.23	1,229	61	184
Totals:							6,924	1,019	3,612

*Land Use & P Load data from EPA HUC-12 Tool

**Used 3 years of practice implementation for agronomic, 10 years for structural and buffer practices

***Assumed that buffer practices treated 20 acres for every acre of buffer

Contracts with farmers written during this period also include practices that are still planned for implementation. These planned practices are summarized in Table 4. This includes a lot of grazing related practices such as prescribed grazing (175 ac.), fence (4,379 ft.) and pipelines (2,000 ft.). It also includes a significant amount of access roads (1,250 ft.), lined waterway (910 ft.) and cover crop (352 ac.). These recently implemented and planned practices should be considered when establishing practice implementation goals for the watershed.

Table 4 also summarizes the expected phosphorus reductions associated with the implementation of these practices over the lifespan of the practices. If implemented as planned forage and biomass planting (permanent seeding) would provide the greatest reduction (523 lbs/yr), followed by prescribed grazing (174 lbs P) and cover crop (99 lbs/yr). **The total expected phosphorus reduction as a result of all planned and implemented practices is 1,949 lbs/yr, which is 12% of the EPA target for agriculture in the watershed.**

Table 4 – Practices Planned for Implementation in the Rock River Watershed, 2/2015

NRCS Practices Planned for the Rock River Watershed, as of February 2015									
Practice Group	Practice Code	Practice Name	Number of Planned Practices	Total Planned Amount	Units	Estimated P Loading by Landcover* (lbs/ac/yr)	Total P Load from Untreated Acres (lb/yr)	Annual P Reduction from Treated Acres (lb/yr)	Cumulative P Reduced Over Life of Practice* (lbs)
Farmstead	313	Waste Storage Facility	2	2.0	no	3.35	27	23	233
	317	Composting Facility	2	2.0	no				
	360	Waste Facility Closure	2	2.0	no				
	367	Roofs and Covers	1	1.0	no				
	533	Pumping Plant	2	2.0	no				
	558	Roof Runoff Structure	1	1.0	no				
	560	Access Road	3	1,250.0	ft				
	561	Heavy Use Area Protection	5	0.5	sq ft				
	629	Waste Treatment	2	2.0	no				
	634	Waste Transfer	3	3.0	no				
Agronomic	104	Nutrient Management Plan - Written	3	3.0	no	NA			
	328	Conservation Crop Rotation	1	6.5	ac	2.23	14	4	11
	329	Residue and Tillage Management, No-Till	6	18.1	ac	2.23	40	20	61
	340	Cover Crop	33	351.8	ac	2.23	785	99	296
	345	Residue and Tillage Management, Reduced Till	9	48.5	ac	2.23	108	54	162
	382	Fence	1	4,379.4	ft	NA			
	410	Grade Stabilization Structure	6	6.0	no	NA			
	412	Grassed Waterway***	1	0.1	ac	2.23	4	1	11
	468	Lined Waterway or Outlet	9	910.0	ft	NA			
	512	Forage and Biomass Planting	31	293.3	ac	2.23	654	523	1,570
	578	Stream Crossing	4	4.0	no	NA			
	580	Streambank and Shoreline Protection	1	100.0	ft	NA			
	590	Nutrient Management	1	2.6	ac	2.23	6	0	1
	620	Underground Outlet	1	200.0	ft	NA			
	633	Waste Recycling	23	284.4	ac	2.23	634	32	95
	782	Phosphorous Removal System	1	1.0	no	NA			
Grazing (Pasture)	528	Prescribed Grazing	12	174.6	ac	2.49	435	174	1,739
	516	Livestock Pipeline	2	4,091.0	ft				
	614	Watering Facility	3	3.0	no				
			171						
						TOTALS		930	4,179

*Land Use & P Load data from EPA HUC-12 Tool

**Used lifespan of 10 years for constructed practices and prescribed grazing, used 3 years for agronomic practices

***Assumed that buffer practices treated 20 acres for every acre of buffer

Potential Phosphorus Load Reductions Associated with One Practice Scenario

A suite of individual practices and practice systems was develop as an example scenario to try and meet the required phosphorus reduction for agriculture in the Rock River Watershed. This example practice scenario was developed to provide additional guidance to the Local Watershed Team and is intended as an example for planning purposes only. The actual amount and type of practices identified and implemented by the Local Watershed Team will be different than the example provided here. **Using this suite of practices, at the level specified, falls short of meeting the reduction goal by approximately a third (Table 5).** The example does provide several pieces of useful information, it indicates the magnitude of the work that needs to be accomplished in order to meet the reduction goal, it provides a comparison of the effectiveness of different practices or practice systems, it provides information on the extent of available land area for different practices or practice systems and it provides one cost estimate of the necessary practices.

Table 5 provides summary information on land use in the Rock River Watershed, an example conservation practice scenario list, estimated extent of practice application, estimated phosphorus reductions by conservation practice and estimated costs. Some of the underlying assumptions built into this scenario include:

- the scenario represents a very high implementation rate of conservation practices,
- approximately 50% of the land in corn in 2014 was continuous corn,
- that 90% of off annually tilled cropland will planted to cover crops,
- overall, 50% of the land in corn would use a conservation tillage-manure injection-cover crop system,
- the average cost of a grazing system that includes livestock exclusion is $50,000,
- the average cost of improvements necessary on a farmstead is $200,000.

From Table 5 you can see that the greatest reductions in phosphorus loading are achieved with conservation-manure injection-cover crop system on cropland, cover crops on annual cropland (2,441 lbs/yr), crop rotations (1,432 lbs/yr), and livestock exclusion (1,391 lbs/yr).

Table 5 – Example Practice Scenario with Phosphorus Reductions and Costs

Rock River - Practice Scenario to Reach TMDL Goal
March 2015

Based on a Watershed TMDL Targeted Reduction of 83% (estimated TMDL Target is 16,000 lbs/yr)

Cropping System	No. of Acres	
Corn in 2014	**4,995**	
Hay in 2014	**3,707**	
Pasture in 2014	**1,162**	
Farmstead in 2014	**224**	**48 HQ's**
Cont. Corn*	**2,558**	*** From data estimated 50% of corn in 2014 was continuous corn**
Cont. Hay**	**3,840**	****Assumed 30% of the hay in 2014 was continuous hay**
Corn-Hay Rotation***	**2,304**	***** Acres of corn/hay rotation equals the remainder from above**

Scenario Components	Selected BMP	No. of Acres Available	Total Practice Acres Applied	Percent of Total Acres	TP Load Reduction (lbs/yr)	Practice Cost per Acre	NRCS Cost
Cont. Corn	Cover Crop-Conservation Tillage-Manure Injection	2,558	1,279	50%	1074	$164	$ 629,268
Corn/Hay	Cover Crop-Conservation Tillage-Manure Injection	3,850	1,925	50%	1367	$164	$ 947,100
Cont. corn	Cover Crop	2558	1,023	40%	563	$79	$ 404,085
Corn/Hay	Cover Crop	3,850	1,540	40%	693	$79	$ 608,300
Cont. Corn	Crop Rotation	2558	1,540	60%	739	$16	$ 73,920
Corn/Hay	Crop Rotation	3,850	1,925	50%	693	$16	$ 92,400
Cont. Corn	Riparian Buffer	41	24	60%	95	$750	$ 18,300
Corn/Hay	Riparian Buffer	67	34	60%	109	$750	$ 25,125
Corn/Hay	Grassed Waterays	54	27	50%	130	$5,000	$ 135,000
Cont. Corn	Reduced Manure P (Nutrient Management and CAP)	2558	2,053	80%	349	$19	$ 117,032
Corn/Hay	Reduced Manure P (Nutrient Management and CAP)	3,840	3,056	80%	306	$19	$ 174,192
Cont. Corn	Ditch Buffer	50	45	90%	878	$550	$ -
Corn/Hay	Ditch Buffer	80	72	90%	907	$550	$ -
Hay	Reduced P inputs and Injection	3,708	2,300	62%	230	$70	$ 464,772
Pasture	Livestock Exclusion	1,162	292	25%	672	$50,000 ea.	$ 292,400
Pasture	Livestock Exclusion and Riparian Buffer (CREP)	1,162	232	20%	719	N/A	$ -
Farmstead	Waste Management Improvements	48 HQ's	48	100%	480	$200,000	$ 9,600,000
Total Reduction					**10,003**	**52% of Total Load**	
TMDL Target					**16,000**	**83% of Total Load**	
Total Load					**19,248**		
Total Cost							$ 13,581,894

Note: The TMDL goal not achieved with this scenario!

Estimated Practice Costs and Costs per lb of Phosphorus

Important information for the Local Watershed Teams will be the cost of practice implementation. This information will be needed for the Teams to establish reasonable reduction goals for their local project and the timeline necessary to implement the project. The costs presented in Table 5 are the NRCS payments (based on 2015 payment schedules) to farmers to implement these practices and as such represent an average of 75% of the total cost. The greatest costs are for implementing conservation tillage systems ($1,576,368), crop rotations ($1,012,385), and for farmstead practices ($9,600,000). The high cost for the conservation tillage system and for crop rotations is because of the large acreage available for implementation. Farmstead costs are high because of the high cost of structural practices.

The total cost of using the practices in this scenario to meet the phosphorus reduction goals for agriculture is $13,582,000. This does not include any cost inflation factor if the implementation of practices is extended over a long time period. Another concern not addressed in this scenario is the relatively short time period for which NRCS can financially support annual practices such as cover crops. This scenario assumes only 5 years of financial support for cover crops and 3 years for other annual practices. It is unclear who will support the farmers to continue these annual practices after their NRCS contract expires, or if farmers will continue these practices without financial support.

One way to reduce the total cost of a project such as this one in the Rock River Watershed is to focus on implementing those practices where you get the greatest reduction of phosphorus per dollar. Table 6 shows the phosphorus reduction efficiency of the different practices based on cost per pound of phosphorus. According to these calculations ditch buffers and crop rotations are the most cost effective practices in reducing phosphorus losses ($2 and $35/lb of P), while the farmstead practices are the least cost effective at over $5,000 per lb of P.

However, there may not be much flexibility in the Rock River Watershed to maximize phosphorus reduction based on cost because the underlying assumption with this scenario was that it represented all reasonable practices that could be implemented by farmers.

Table 6 – Cost Efficiency of Available Conservation Practices

Agricultural Conservation Practice Efficiency in Cost Per Pound of Phosphorus Reduced per year Averaged Over a Five Year Period			
Conservation Practice	NRCS Payment	Total Practice Cost	Practice Cost Efficiency ($/lb P reduction)*
1. Change in crop rotation	$16	$21	$35
2. Change in crop rotation and conservation tillage	$51	$68	NA
6. Conservation tillage	$34	$45	NA

7. Cover crop	$79	$105	$147
8. Manure injection	$51	$68	NA
10. Cover crop, conservation tillage and manure injection	$164	$219	$181
12. Annual crop to permanent hay	$209	$279	$101
13. Ditch buffer	$550	$733	$2**
14. Grassed waterway	$5,000	$6,666	$140
16. Manure injection and reduced manure P applied	$70	$93	NA***
17. Reduced manure P applied	$19	$25	$320
19. Riparian buffer	$750	$1,000	$52
20. Livestock Exclusion /Grazing system (estimated average)	$50,000	$66,666	$297
21. Farmstead practices (estimated average)	$200,000	$266,666	$5,540
NA- practice was not included in example scenario			
*Based on the total NRCS cost			
**Assumes NRCS payment of $550/ac			
***Error in Model			

NEPA Concerns and Compliance

The National Environmental Policy Act of 1964 requires all federal agencies to conduct an environmental review of all federal actions. NRCS requires all agency planning activities to be in compliance with NEPA, this includes area-wide plans. The responsible federal agency is required to evaluate the individual and cumulative effects of the actions being proposed. Any project that has significant environmental impacts must be evaluated with an Environmental Assessment (EA) or Environmental Impact Statement (EIS) unless the activities are already covered under a categorical exclusion or by an existing EA or EIS.

NRCS utilizes a planning process that incorporates an evaluation of potential environmental impacts using an Environmental Evaluation checklist. NRCS also has categorical exemptions for a number of different activities that include many of our conservation practices. These categorical exemptions include conservation practices that reduce soil erosion, involve the planting of vegetation and/or restore areas to natural ecological systems.

The watershed plan for the Rock River Watershed calls for the accelerated implementation of conservation practices that have been used in the region for a number of years. This includes erosion control practices and field based practices that are covered by categorical exclusions, and a range of structural practices that are used to address waste management issues on the farmstead. These farmstead based practices are included in a Programmatic Environmental Assessment for the Environmental Quality Incentive Program A list of practices that are likely to be used to implement the plan are included in Table 7.

Table 7 - List of Practices and Practice Systems Likely to be Used to Implement the Rock River Watershed Plan
(CE = categorically excluded, EA = included in exiting environmental assessment)

1) Change in crop rotation	CE
2) Change in crop rotation and conservation tillage	CE
3) Change in crop rotation, grassed waterway, ditch buffer and riparian buffer**	CE
4) Change in crop rotation, grassed waterway riparian buffer	CE
5) Change in crop rotation and riparian buffer	CE
6) Conservation tillage	CE
7) Cover crop	CE
8) Cover crop, conservation tillage, grassed waterway, ditch buffer and riparian buffer	CE
9) Cover crop, conservation tillage and manure injection	CE
10) Cover crop and manure injection	CE
11) Annual crop to permanent hay	CE
12) Ditch buffer	CE
13) Grassed waterway	CE
14) Grassed waterway and riparian buffer	CE
15) Manure injection and reduced manure P applied	CE
16) Reduced manure P applied	CE
17) Reduced manure P applied and grassed waterway	CE
18) Annual cropland to permanent grass	CE
19) Riparian buffer	CE
20) Livestock exclusion/fencing/grazing system	CE
21) Farmstead practices	EA

As mentioned above, as part of the planning process each planned practice will be evaluated individually and combination with other planned practices to ensure it meets the criteria of the categorical exclusions and any existing Environmental Assessments. Any significant negative practice impacts, either individually or cumulatively, will first try to be avoided, then minimized and/or mitigated to the extent possible, or eliminated from the individual farm plan if necessary. It is not expected that the practices planned for implementation in the Rock River Watershed will necessitate an Environmental Assessment or an Environmental Impact Statement.

Local Watershed Team Actions and Outcomes

The Rock River Watershed Plan will be provided to the local NRCS office(s) working with farmers in the watershed. The Watershed Plan is not considered confidential and as such it will also be made available to all partners and the public. The Local Watershed Team also developed a number of products to guide and coordinate conservation practice implementation in the watershed.

Field Scale Land Cover and Resource Maps

These maps will be developed by the local NRCS office based on the spatial data layers provided to them and described in the Watershed Plan. The data layers may be used alone or overlain with layers as suggested in the Watershed Plan or as deemed necessary by the conservation planners. These maps will generally contain Personally Protected Information and will be considered confidential.

Local Watershed Team Products

The Rock River Local Watershed Team was composed primarily of representatives of NRCS, FSA, UVM-Extension, VDEC and VAAFM and representatives of local watershed groups including the FNLC. There were also several farmer representatives on the Local Watershed Team.

The Team started the process by establishing 4 Key Strategies for successfully working with farmers to meet water quality goals. The four key strategies are farmer engaged conservation, outreach to farmers, technical assistance to farmers, and financial assistance to farmers.

Logic diagrams were developed to capture watershed outcomes and actions needed for each of the key strategies (see Figures 19 – 22). An Action Plan for the watershed project was then developed that identified responsibility for each action and a timeline to complete the action as shown in Figure 23.

The Local Watershed Team also developed a five year practice implementation plan for the watershed. **As part of this plan the Team identified a phosphorus reduction goal that meets 48% of the TMDL goal for the watershed (7,700 lbs/yr).** Using information from the watershed plan the group identified a suite of practices that could potentially meet this (Table 7). Practice implementation was distributed over a five year period and included high rates of implementation for practices such as conservation tillage systems, cover crops, crop rotations and ditch buffers. The annual cost of practices contracted ranged from $795,000 to $1,873,000 and totaled to over $6,986,000 for the five year period.

From Tables 3 and 4 it was estimated that conservation practices implemented or planned since 2010 would result in an estimated reduction of 1,949 lbs/year of phosphorus from the Rock River Watershed. The cumulative reduction in loading from the Rock River Watershed would include some portion of this phosphorus reduction in addition to any reductions achieved during the 5 year project. As local planners work with farmers in the watershed they will verify that these practices have been maintained and that phosphorus loading reductions should be applied.

Tracking Database

An interim database will be developed to track practice implementation and estimated phosphorus reductions. This database will be updated at least annually and the results will be shared among partners and watershed farmers. This interim database will eventually be replaced by the “partner database” that is currently under development by the VAAFM and their consultant. Factsheets and media releases will be used to communicate progress in meeting the project goals to a wider audience.

Figure 19 – Conservation Actions and Outcomes

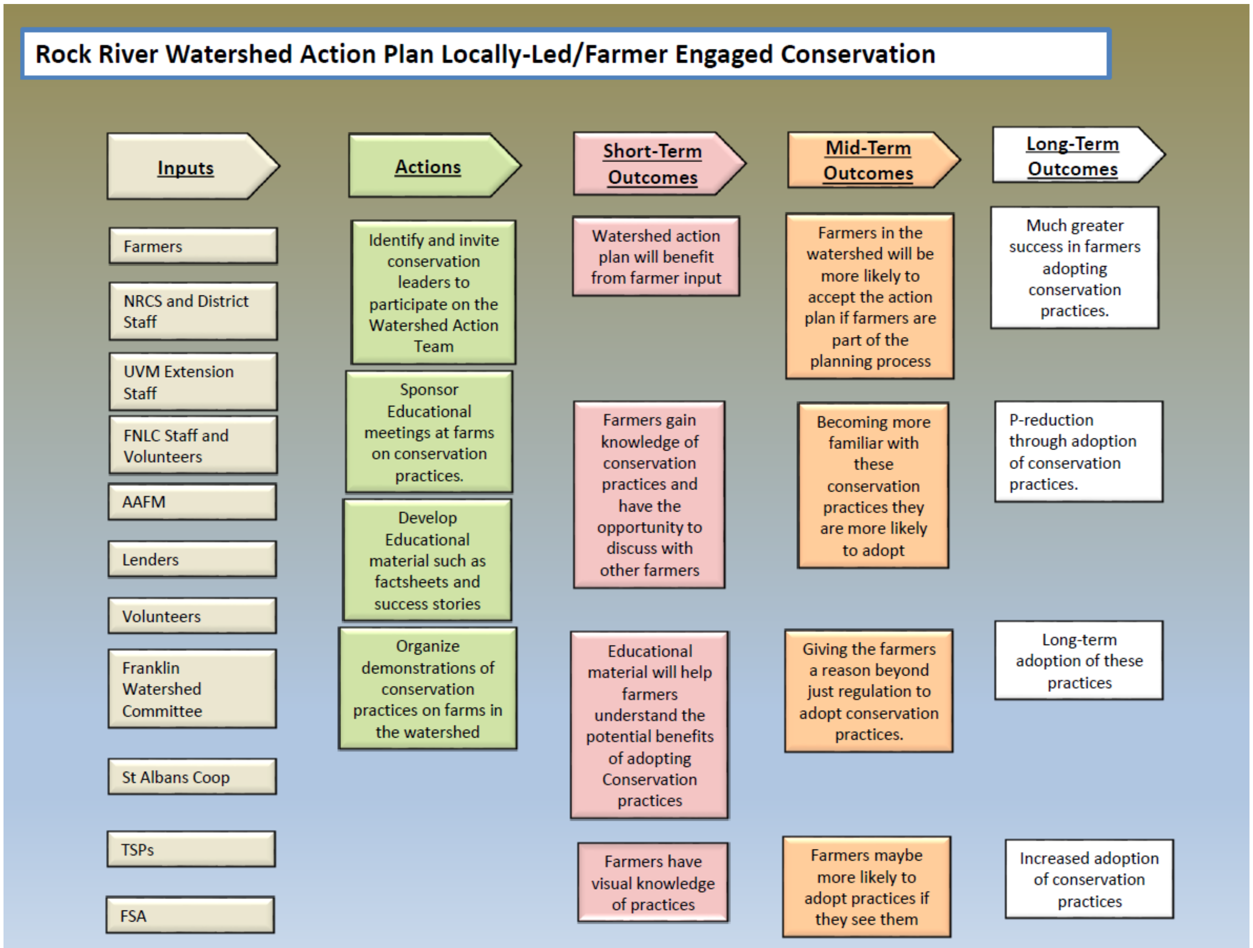


Figure 19 (continued)

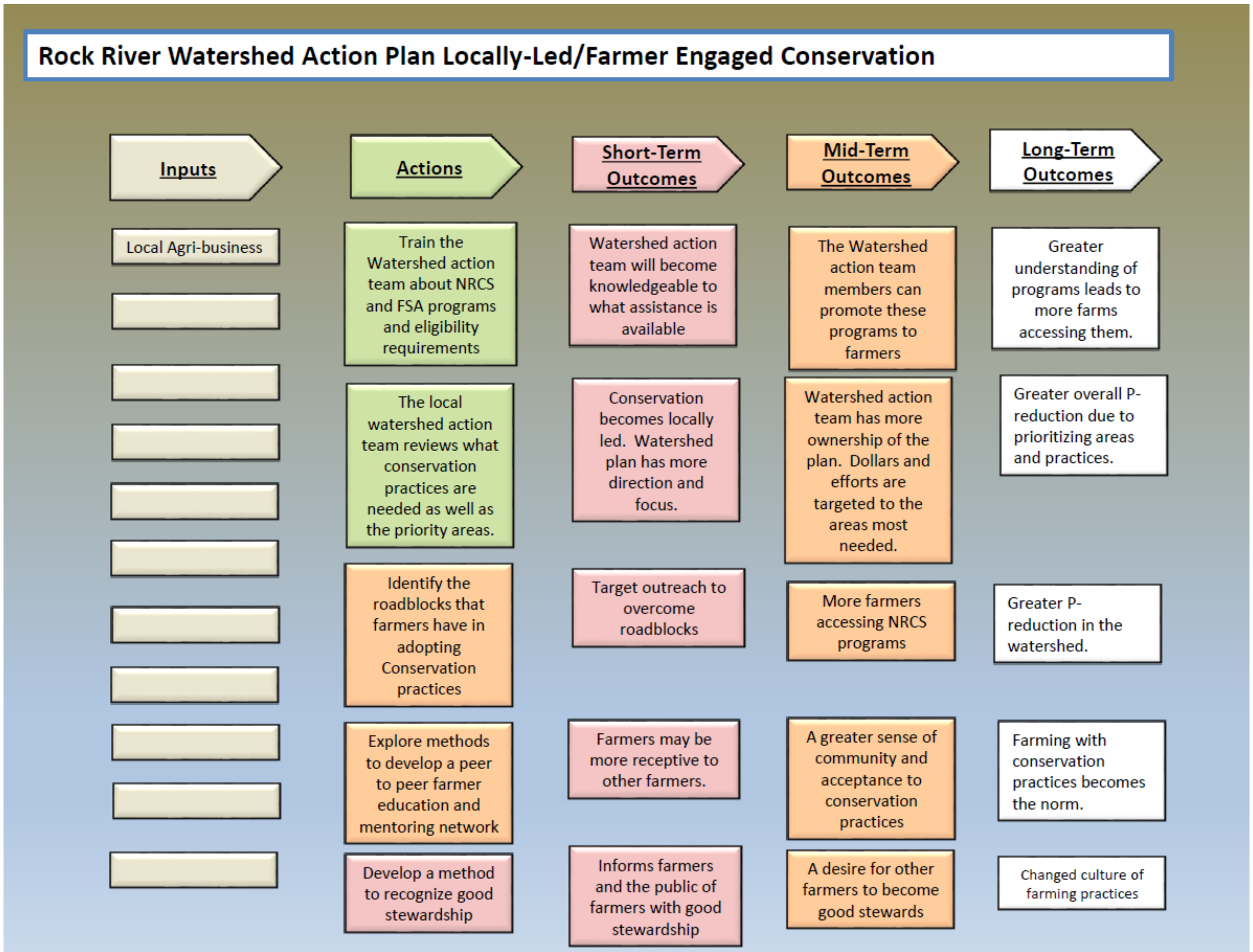


Figure 20 – Outreach Actions and Outcomes

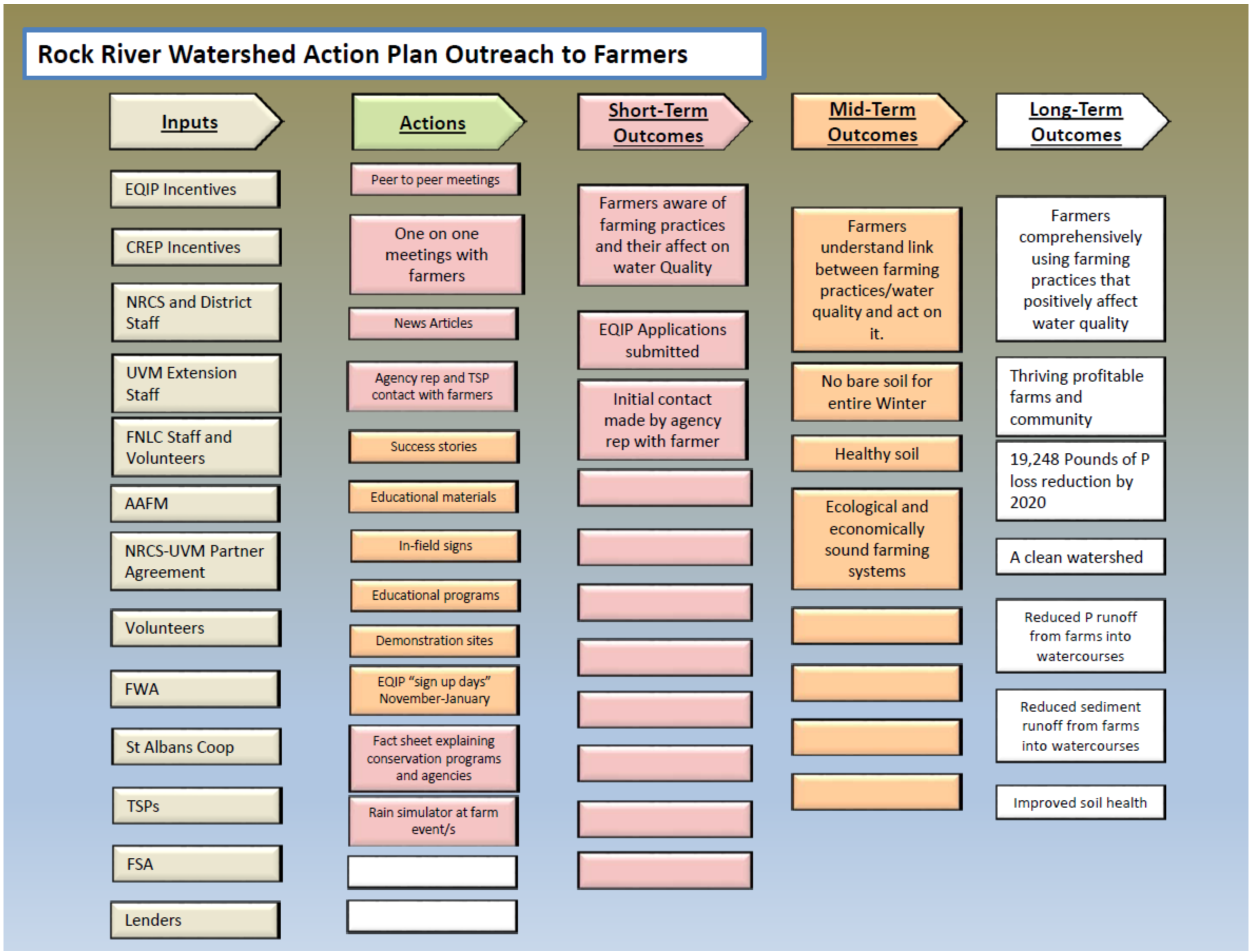


Figure 21 – Technical Assistance Actions and Outcomes

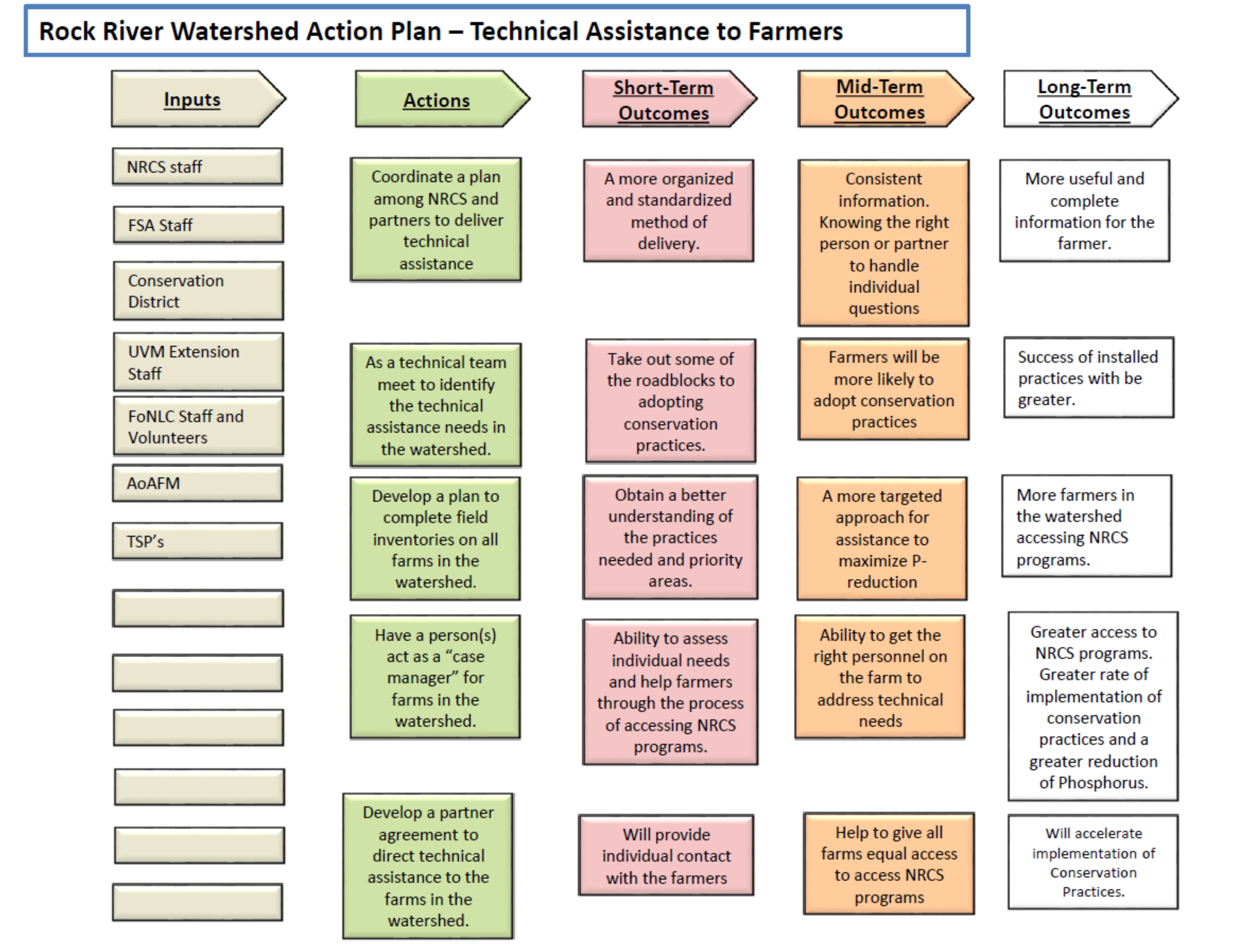


Figure 22 – Financial Assistance Actions and Outcomes

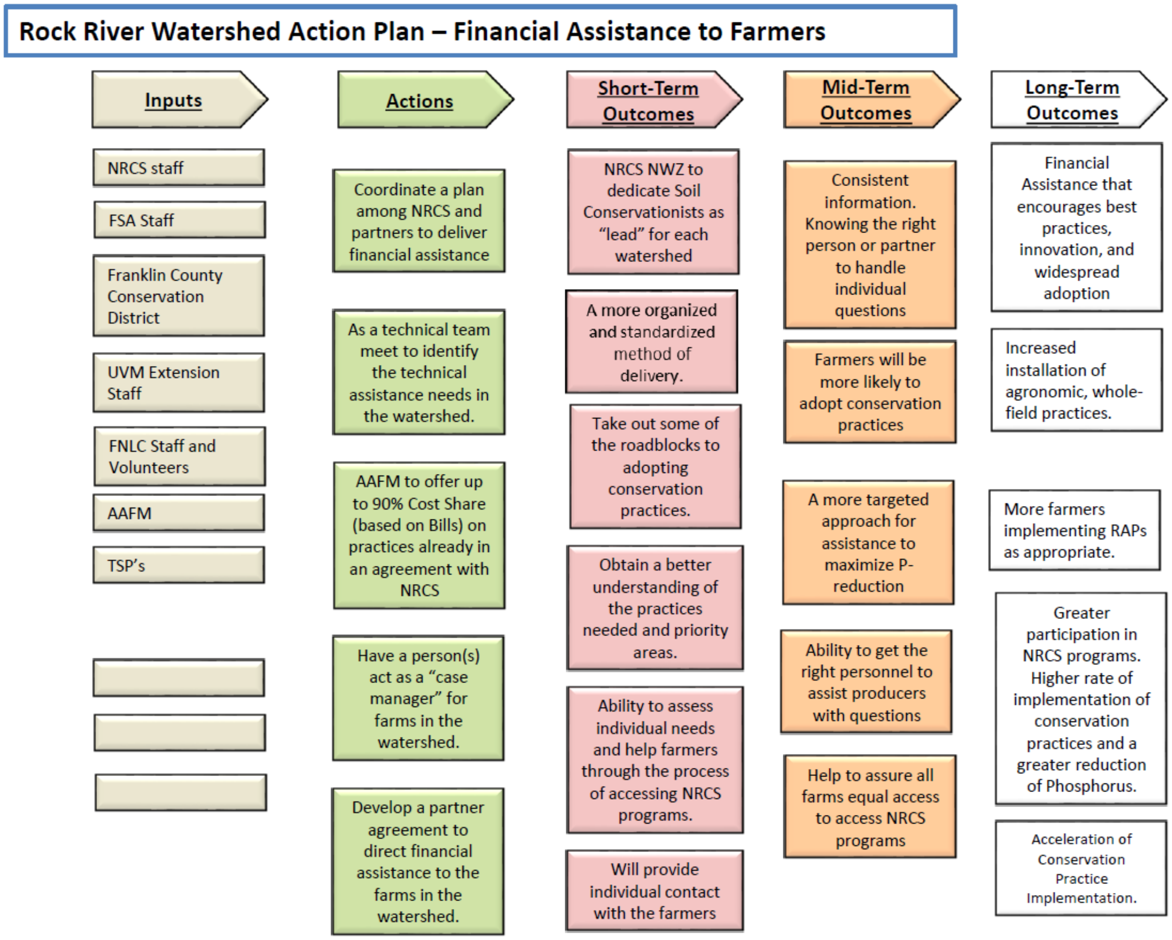


Figure 23 – Action Plan, Responsibility and Timeline

Action Plan for Rock River Watershed Project				
Strategy I: Locally-Led/Farmer Engaged Conservation				
Actions:	Description	Who is responsible?	When Begin	When End
Farmer to Farmer Meetings.	Two kitchen/shop meetings will be held with small groups of farmers to encourage EQIP applications.	FNLC will organize. NRCS will attend. Other partners may be asked to present material	03/15/16	11/30/16
Active involvement of producers in watershed planning process. Identify and invite Conservation leaders to participate on the watershed action team.	Attempt to get 2 or 3 farmers in the watershed to take an active role in the planning and implementation of the action plan.	Watershed action team. Team members need to be covered by the 1619 agreement with NRCS to preserve PII.	03/01/16	04/30/16
Educate farmers about technical and financial assistance available to reach conservation goals	This could be completed at the kitchen meetings or with factsheets and farm visits.	FNLC, NRCS, FSA, USF&W, UVM Extension, VT Agency of Agriculture	03/15/16	11/30/16
Create "farm neighborhood" peer-to-peer farmer education, networking and mentoring groups/pairs	Explore a method of matching farmers who have adopted conservation practices with those who are interested in starting to use them.	FNLC	03/15/16	12/31/16
Sponsor Educational meetings and demonstrations at farms on conservation practices.	Have at least one meeting per year to provide education and demonstrations on conservation practices such as no-till seeding,	UVM EXT and other partners.	05/01/16	12/31/20

	cover crops or riparian buffers.			
Develop educational material such as factsheets and success stories.	Success stories could be published in the newspaper to show farmers and the public that conservation practices are being used and have value.	FNLC, NRCS	03/01/16	12/31/20
Train the watershed action team about NRCS and FSA programs and eligibility requirements	This will provide watershed action team members a basic knowledge of the programs available and what is needed to qualify for them.	NRCS, FSA	03/15/16	04/30/16
The Watershed action Planning Group will meet semiannually.	The purpose of these meetings will include updating group on progress in implementing the action plan and discussing any changes or additions needed. Informs the group that progress is being made.	FNLC organizes meetings	03/01/16	12/31/16
The watershed action team will meet quarterly.	The purpose of these meeting will be to discuss how to implement the action plan and updates on progress made.	FNLC organizes meetings	03/01/16	12/31/20
Develop a method to recognize good stewardship.	The purpose of this would be to demonstrate to farmers and the public that conservation practices are being	FNLC leads. Watershed Action Planning Group and/or Watershed action team.	03/01/16	12/31/20

	implemented in the watershed.			
<u>Strategy 2: Technical Assistance to Farmers</u>				
Actions:	Description	Who is responsible?	When Begin	When End
Develop technical Assistance plan to farmers in watershed	Discuss and develop a plan to bring technical assistance to farms. Who does what task.	FNLC with the Watershed Action team.	03/01/16	04/30/16
Locate high risk areas to focus or target technical assistance.	Arc-GIS maps provided by NRCS. Watershed teams first-hand knowledge and observation.		03/01/16	05/31/16
Establish and fill a non-NRCS staff position (via MOU) to enhance technical assistance	NRCS goes into an agreement with a non-profit entity to dedicate staff for various tasks such as outreach and individual contact with farmers in the watershed.	ASTC-Operations NRCS	09/20/15	01/30/16
Identify and remove roadblocks to adopting conservation practices.	Discuss possible reasons that keep farms from accessing financial assistance programs. Develop a process to overcome those roadblocks.	Watershed Action Team	03/01/16	09/30/16
Meet 2X per year as a technical assistance team to discuss needs in the watershed.	The purpose of these meetings are to update each other on activities and needs.	NRCS, FNLC	03/01/16	12/31/20
Create a map that identifies farm locations and land base. Provide	This map will assist the technical assistance team in setting priorities.	NRCS, FNLC	03/01/16	04/30/16

information on any relevant conservation practices that have been installed.				
Provide technical training in CREP to NRCS Soil Conservationist.	There is a training session in March to begin to train Soil Conservationists.	NRCS, FSA, AAFM	03/21/16	06/30/16
Explore the use of the STEP tool for farm planning.	Discuss the viability of using this new tool to complete some farm assessments in the watershed.	NRCS (KIP)	09/30/16	06/30/17
Develop a partner agreement to direct technical assistance to the farms in the watershed.	Create an agreement to empower local partners to assist in watershed work	NRCS, FNLC	01/30/16	12/31/20
Have a person(s) act as a case manager for 5 farms per year in the watershed.	Work more closely with producers not already familiar with NRCS if possible to give the support needed to apply and be successful in implementing conservation practices	FNLC	06/30/16	12/31/20
Develop a plan to complete field inventories on 25% of the farms in the watershed.	Inventory farms not already visited or who have participated very infrequently.	NRCS, FNLC	06/30/16	09/30/17
Introduce technical team to the use of soil erosion, soil quality and water quality tools on farms	Provide hands on training for NRCS' soil quality tools such as rainfall simulator or slake demonstration. Encourage these tools to be borrowed as appropriate.	NRCS, FNLC	06/30/16	09/30/16

Use soil erosion, soil quality and water quality tools on at least 2 farms each year.	Rainfall simulator during events already held on farm, for instance.	NRCS, FNLC	06/30/16	09/30/16
<u>Strategy 3: Financial Assistance to Farmers</u>				
Actions:	**Description**	**Who is responsible?**	**When Begin**	**When End**
Assist producers in application/assurance of eligibility for NRCS programs	Work closely with producers not already familiar with NRCS if possible to give the support needed to apply for relevant programs.	FNLC with the Watershed Action team.	03/01/16	12/31/20
ID alternative funding sources to enable equipment purchases by farmers/coops (CIG grants/etc.)	List of alternative funding options	FNLC, UVM, NRCS(Overstreet?), AAFM	09/30/16	09/30/17
Incentivize early applicants/early adopters via sliding scale cost-share and flexibility of cost share rates	Develop list of incentives that can be utilized for outreach	NRCS, AAFM	03/03/16	05/30/16
Prioritize Agronomic BMPs	When promoting practices assure highest promotion is given to field-level, proven agronomic practices.	NRCS, FNLC, AAF, UVM	03/15/16	09/30/16
Develop and coordinate a plan among NRCS and partners to deliver financial assistance	Assure funding amounts, screening rules, and deadlines are clearly communicated amongst partners.	NRCS, FNLC, AAF, UVM	02/01/16	05/31/16
Develop a partner agreement to serve as	Create an agreement to empower local	NRCS, FNLC	05/01/15	02/01/16

a POC to farms in the watershed.	partners to assist in watershed work			
As a technical team meet to identify the technical assistance needs in the watershed.	Meet as a smaller group to clarify TA needs in watershed.	NRCS, FNLC	02/01/16	05/01/16
ID and then remove any roadblock to implementation of conservation practices	Discuss specific challenges to implementing conservation practices in existing contracts.	NRCS, FNLC	02/02/16	05/02/16
AAFM to augment NRCS incentive up to 90% (based on bills)	Confirm details, exclusions and total funds available for this funding offered by AAFM.	AAFM, NRCS	02/03/16	05/03/16
Have a person(s) act as a case manager for 5 farms per year in the watershed.	Work more closely with producers not already familiar with NRCS if possible to give the support needed to apply and be successful in implementing conservation practices	FNLC	02/04/16	08/01/20
<u>Strategy 4: Outreach and Education</u>				
Actions:	Description	Who is responsible?	When Begin	When End
News Articles	Articles targeted to the general public related to watershed activities/successes (aggregated) to be written and disturbed to the press. (St Albans	FNLC, NRCS (Overstreet/Brink)	12/01/16	08/01/20

	Messenger). One or two per year.			
Agency Rep and TSP contact with Farmers	Initiate individual contact with 25% or farmers in the watershed to explain the water quality issues in the Rock River watershed and the goals of the watershed planning group as it relates to the EPA TMDL.	Kent Henderson and AmeriCorps, Jaime Tidbits - Agrilabs	04/01/16	08/01/20
Success Stories	Identify and contact one Rock River watershed farmer who is willing to be profiled in published success stories with the intent of motivating other farmers to adopt conservation practices. Coordinate with the NRCS Public Affairs Specialist to develop outreach press release to the general public. 1 per year	Denise Smith - FNLC and Amy Overstreet - NRCS	04/01/16	08/01/20
Educational Materials	Create and provide	NRCS, FNLC	05/01/16	07/01/16
Demonstration Sites	Establish one demonstration day on farm by the end of the first year of the contract that has shown success in implementing NRCS conservation practices that may	FNLC	05/02/16	08/01/20

	include farmstead, agronomic, buffer or other practices. 1 per year			
Educational Programs	Educational Programs relating to water quality issues and conservation practices to be held in the watershed or surrounding area. In the field focusing on no-till, interseeded cover crops, One per year.	FNLC, NRCS	05/03/16	08/02/20
Fact sheet explaining conservation programs and agencies	A Fact Sheet explaining conservation programs offered by different agencies.	NRCS	03/01/16	06/01/16
Rain Simulator at farm events	Provide rain simulator at all Farm events	FNLC, NRCS	06/01/16	08/01/20
Door to door in watershed to make contact with lesser-served producers	Visit all ag residences in the watershed to provide outreach	FNLC, NRCS	09/01/16	08/02/20
In-Field signs	Work with UVM, NRCS (Overstreet), and FNLC to develop campaign sized signs that will demonstrate a conservation practice, and allow for some individual modification so that each farmer can	FNLC, NRCS, UVM	05/01/16	08/01/20

	demonstrate P removed from the practice			
Peer to peer farmer meetings	On the farm, or kitchen/shop meetings will be held with small groups of farmers to encourage EQIP applications.	FNLC	06/01/16	08/01/20
One on One meetings with Farmers	More individualized meetings will be held with individual farmers (or smaller groups) to encourage communication, collaboration and mentoring between compatible subgroups of farmers	FNLC	06/02/16	08/02/20
Collaborate with the Farmers Watershed Alliance	Collaborate with the Farmers Watershed Alliance to provide peer-to-peer farmer education and networking opportunities to broaden conservation collaboration in the watershed.	Jeff Sanders with assistance of John Thurgood and DCs, Corey Brink and Dave Blodgett, and Denise Smith and Kent Henderson, FNLC	06/03/16	08/03/20
Develop a list of all farms in the Rock River watershed.	Generate a complete list of active farmers	NRCS, Kent Henderson (FNLC)	08/01/16	05/01/16
Encourage Feed Management Practice	Check the excretion rate of P from dairy cattle in the RRB. This will be done by looking at manure pit samples. Work to have 2 farmers	Kent Henderson and Jeff Sanders at UVM Extension	06/01/16	08/01/20

	apply for Feed Management plans.			

Table 7 – Five Year Implementation Goals and Cost for the Rock River Watershed

Rock River - Five Year Project Goals
March 2015

Based on a Watershed Team Reduction Goal of 48% from the Total Estimated Watershed Loading (TMDL Target is 83%)

Cropping System	No. of Acres	
Corn in 2014	4,995	
Hay in 2014	3,707	
Pasture in 2014	1,162	
Farmstead in 2014	294	71 HQ's
Cont. Corn*	500	* Assumed 10% of corn in 2014 was continuous corn
Cont. Hay**	1,112	**Assumed 30% of the hay in 2014 was continuous hay
Corn-Hay Rotation***	7,090	*** Acres of corn/hay rotation equals the remainder from above

			Acres of Practice by Year and Total										Cost by Year					
Scenario Components	**Selected BMP**	**No. of Acres Available**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total Practice Acres Applied**	**Percent of Total Acres**	**Reduction (lbs/yr)**	**Practice Cost per Acre**	**Total Cost**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Cont. Corn	Cover Crop-Conservation Tillage-Manure Injection	500	30	30	30	30	30	150	30%	126	$164	$73,800	14,760	14,760	14,760	14,760	14,760	73,800
Corn/Hay	Cover Crop-Conservation Tillage-Manure Injection	7,090	355	355	425	355	355	1,843	26%	1309	$164	$906,952.80	174,414	174,414	209,297	174,414	174,414	906,953
Cont. corn	Cover Crop	500	50	50	50	50	0	200	40%	110	$79	$79,000	19,750	19,750	19,750	19,750	0	79,000
Corn/Hay	Cover Crop	7,090	1064	1064	1064	1064	0	4,254	60%	1914	$79	$1,680,330	420,083	420,083	420,083	420,083	0	1,680,330
Cont. Corn	Crop Rotation	500	75	75	75	75	0	300	60%	144	$16	$14,400	3,600	3,600	3,600	3,600	0	14,400
Corn/Hay	Crop Rotation	7,090	709	709	709	709	709	3,545	50%	1276	$16	$170,160	34,032	34,032	34,032	34,032	34,032	170,160
Cont. Corn	Riparian Buffer	8	1	1	1	1	1	4	50%	16	$750	$3,000	600	600	600	600	600	3,000
Corn/Hay	Riparian Buffer	120	12	12	12	12	12	60	50%	195	$750	$45,000	9,000	9,000	9,000	9,000	9,000	45,000
Corn/Hay	Grassed Waterays	54	5	5	5	5	5	27	50%	130	$5,000	$135,000	27,000	27,000	27,000	27,000	27,000	135,000
Cont. Corn	Reduced Manure P (Nutrient Management and CAP)	500	50	50	50	50	50	250	50%	43	$19	$14,250	$2,850.00	$2,850.00	$2,850.00	$2,850.00	$2,850.00	14,250
Corn/Hay	Reduced Manure P (Nutrient Management and CAP)	7,090	709	709	709	709	709	3,545	50%	355	$19	$202,065	$40,413.00	$40,413.00	$40,413.00	$40,413.00	$40,413.00	202,065
Cont. Corn	Ditch Buffer	12	1	1	1	2	2	8	70%	55	$550	$0	0	$0	$0	$0	$0	0
Corn/Hay	Ditch Buffer	162	16	16	16	32	32	113	70%	476	$550	$0	0	$0	$0	$0	$0	0
Hay	Reduced P inputs and Injection	3,708	371	371	371	371	371	1,854	50%	185	$70	$389,340	$77,868.00	$77,868.00	$77,868.00	$77,868.00	$77,868.00	389,340
Pasture	Livestock Exclusion	1,162	29	29	29	29	29	145	13%	334	$50,000 ea.	$72,625	14525	14525	14525	14525	14525	72,625
Pasture	Livestock Exclusion and Riparian Buffer (CREP)	1,162	58	58	58	58	58	291	25%	901	N/A	$0	0	$0	$0	$0	$0	0
Farmstead	Waste Management Improvements	71 HQ's	2	5	5	2	2	16	23%	160	$200,000	$3,200,000	400,000	1,000,000	1,000,000	400,000	400,000	3,200,000
			3537	3540	3610	3554	2365	16,606					1,238,895	1,838,895	1,873,777	1,238,895	795,462	6,985,923
Total Estimated Reduction										**7,727**	**48% of TMDL Reduction = 7,700**							
TMDL Estimated Reduction										**16,000**	**83% of Total Load**							
Total Watershed Load										**19,248**								
Total Cost												**$6,985,923**						