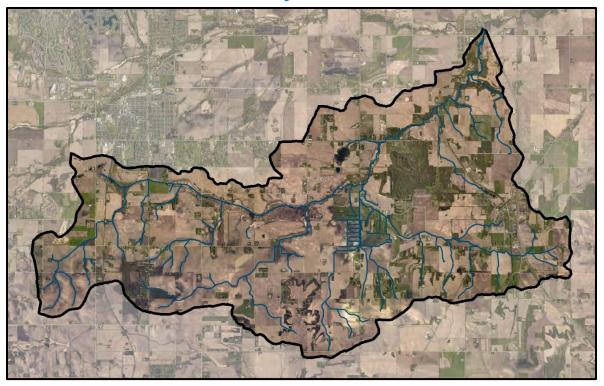
SUBWATERSHED ANALYSIS

FOR

South Branch Vermillion River

DAKOTA COUNTY, MN May 2022



Prepared by:





This report details a rural sub-watershed analysis (SWA) that was completed to generate recommended locations for implementing conservation practices. The SWA prioritizes and targets future efforts of the Dakota County Soil and Water Conservation District (SWCD) and its various partners at a subwatershed scale. This document should be considered one part of an overall watershed restoration plan. Additional watershed restoration efforts include educational outreach, stream restoration, riparian zone management, upstream discharge reductions, upland native plant community restoration, pollutant source control and other rural best management practices.

Results of this analysis are based on the development of conceptual project-specific best management practices that provide pollutant source reductions and water quality treatment on the landscape. Relative comparisons are then made between projects to determine where a stronger focus should occur to further design and initiate implementation efforts. Final designs for each project will need to be developed to obtain more refined estimates of the pollution removal amounts reported herein. This typically occurs after the procurement of committed partnerships and funds relative to the specific target project.

The pollutant removal estimates may be used to prioritize practices within the South Branch Vermillion River subwatershed and for grant applications but in no case should this data be used to represent actual pollutant removal until after installation is complete and site-specific modeling and/or monitoring data is available.

Table of Contents

Exe	cutive Summary	5
Doc	ument Overview	11
	thods	
	tep #1: Project Scoping	
	tep #2: Desktop Analysis	
	tep #3: Field Reconnaissance	
	tep #4: Cost/Treatment Analysis	
	t/Benefit and Project Ranking Table	
•	ect Profiles	
	ureka Township, Section 1ureka Township, Section 11ureka Township, Section 11ureka Township	
	ureka Township, Section 11ureka Township, Section 12	
	• •	
	ureka Township, Section 13	
	ureka Township, Section 14	
	ureka Township, Section 23	
	ureka Township, Section 24	
	astle Rock Township, Section 1	
	astle Rock Township, Section 2	
	astle Rock Township, Section 3	
	astle Rock Township, Section 4	
	astle Rock Township, Section 5	
	astle Rock Township, Section 6	
	astle Rock Township, Section 7	
	astle Rock Township, Section 8	
	astle Rock Township, Section 9	
	astle Rock Township, Section 10	
	astle Rock Township, Section 11	
	astle Rock Township, Section 12	
	astle Rock Township, Section 13	
	astle Rock Township, Section 14	
	astle Rock Township, Section 15	
	astle Rock Township, Section 16	
	astle Rock Township, Section 17	
	astle Rock Township, Section 18	
	astle Rock Township, Section 19	
	astle Rock Township, Section 20	
	astle Rock Township, Section 21	
C	astle Rock Township, Section 22	82
	astle Rock Township, Section 23	
C	astle Rock Township, Section 24	86
	astle Rock Township, Section 26	
C	astle Rock Township, Section 27	90

	Empire Township, Section 34	92
	Empire Township, Section 35	94
	Empire Township, Section 36	96
	Vermillion Township, Section 20	98
	Vermillion Township, Section 29	. 100
	Vermillion Township, Section 30	. 102
	Vermillion Township, Section 31	. 104
	Vermillion Township, Section 32	. 106
	Hampton Township, Section 4	. 108
	Hampton Township, Section 5	.110
	Hampton Township, Section 6	.112
	Hampton Township, Section 7	.114
	Hampton Township, Section 8	.116
	Hampton Township, Section 9	.118
	Hampton Township, Section 15	.120
	Hampton Township, Section 16	.122
	Hampton Township, Section 17	.124
	Hampton Township, Section 18	.126
	Hampton Township, Section 19	.128
	Hampton Township, Section 20	.130
	References	.132
Α	ppendix	.133

Executive Summary

The South Branch Vermillion River is a stream that flows approximately 8 miles through the central portion of Dakota County and is a tributary to the Vermillion River. The South Branch Vermillion River subwatershed encompasses approximately 32 square miles and is generally flat except for the hills along the southern watershed boundary. Land use is primarily agricultural.

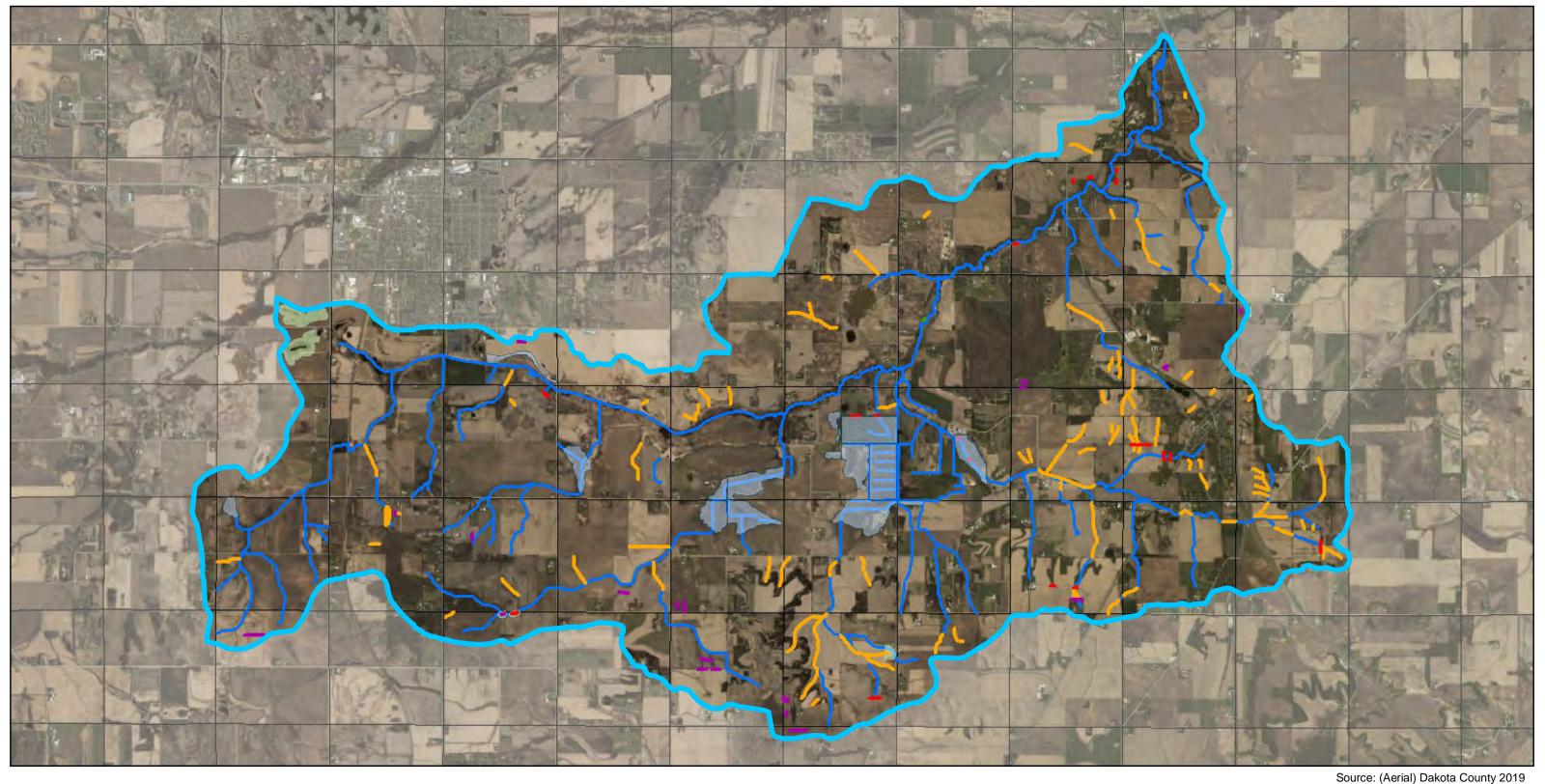
The SWCD has been coordinating the Vermillion River subwatershed analyses (SWAs) with the Vermillion River Watershed Joint Powers Organization (VRWJPO). This SWA focused on the South Branch Vermillion River and a total of 20,635 acres were included in this analysis. Extensive water quality and quantity data is available and routine monitoring has been completed at the outlet of the South Branch subwatershed for over 20 years. Routine monitoring had shown levels of *E. Coli* and total suspended solids (TSS) that exceed the established water quality standards. Through analysis of existing monitoring data and through coordination with the VRWJPO, sediment loads have been identified as the primary pollutant of concern for this analysis.

Land management practices recommended throughout this the subwatershed include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients. These land management practices are also able to address multiple pollutants and are critical to improving surface and groundwater in the South Branch Vermillion River subwatershed and in receiving waterbodies.

This report details an analysis focused on identifying and assessing potential sediment reduction Best Management Practices (BMPs) in the contributing drainage areas to the South Branch Vermillion River. Residue management and cover crops are BMPs that were identified as much-needed BMPs throughout the study area during the field reconnaissance stage of this analysis. These BMPs were not modeled for this report due to the large number of conventionally tilled acres and lack of an accurate treatment analysis model for pollutant reduction. It has been and will continue to be, however, an ongoing goal of the Dakota County SWCD to promote these BMPs throughout the South Branch Vermillion River subwatershed, especially in areas dominated by erosive soils and high potential for pollutant delivery.

Potential projects were identified through a series of steps that included desktop analysis, field reconnaissance, and identifying site-specific constraints and characteristics. After feasible projects were identified, potential sediment reductions were calculated, and preliminary cost estimates were compiled. The projects were then ranked based on the cost per ton of sediment removal per year over a 10-year life cycle. The top 154 practices are identified and prioritized by cost effectiveness.

This report includes maps of the proposed location and aerial extent of recommended BMP projects within the South Branch Vermillion River subwatershed to provide a general understanding and approach to reducing sediment loss and improving water quality. If a specific project outlined in this report is selected for installation, site specific designs, landowner agreements, and funding sources must be secured in order to implement the BMP. The collection of projects listed in this report should be updated on a regular basis as new projects or new technologies are identified.



PROJECT LOCATION

Dakota County State of Minnesota



Vermillion River South Branch Subwatershed

Vermillion River South Branch Subwatershed

- Vermillion River South Branch Watercourse Inventory
- Vermillion River South Branch Subwatershed

Potential Practices

- Grade Stabilization
- Water and Sediment Control Basin
- Waterway
- Stream Stabilization
- Filter Strip / Critical Area Planting
- Wetland Restoration



N

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data located in various City, County, and State Offices and other sources, affecting the area shown, and is to be used for reference purposes only. Dakota County SWCD is not responsible for any innaccuracies herein contained. If discrepencies are found please contact the Dakota County Soil & Water Conservation District at 651.480.7777.

Summary of Potential BMPs

		Feature ID				Sediment	Estimated	Cost/Ton of
Rank	Feasibility Code	(Township- Section-1/4-#)	BMP Type	Size	Units	Reduction (ton/yr)	Project Cost	Sediment Reduction
1	II	HAM-07-03-05	Grassed Waterway	2,817	Lin. Feet	197.22	\$18,310	\$9
2	III	CAS-02-02-02	Grassed Waterway	2,414	Lin. Feet	133.37	\$14,690	\$11
3	III	CAS-07-03-01	Grassed Waterway	1,540	Lin. Feet	93.80	\$11,629	\$12
4	III	VER-32-03-01	Grassed Waterway	2,585	Lin. Feet	106.64	\$15,289	\$14
5	III	VER-30-04-01	Grassed Waterway	1,114	Lin. Feet	58.46	\$10,137	\$17
6	III	CAS-10-02-01	Grassed Waterway	975	Lin. Feet	36.68	\$9,652	\$26
7	III	CAS-08-01-01	Water & Sediment Control Basin	1	Each	28.69	\$7,940	\$28
8	III	CAS-10-03-01	Wetland Restoration	11	Acres	224.20	\$62,200	\$28
9	III	EUR-01-04-01	Filter Strip	11	Acres	26.32	\$7,420	\$28
10	III	CAS-15-02-01	Wetland Restoration	35	Acres	623.10	\$182,200	\$29
11	III	CAS-13-02-01	Wetland Restoration	5	Acres	101.40	\$32,200	\$32
12	III	HAM-08-02-05	Grassed Waterway	1,268	Lin. Feet	33.29	\$10,679	\$32
13	III	CAS-15-04-01	Grassed Waterway	1,156	Lin. Feet	31.80	\$10,287	\$32
14	III	EMP-35-04-01	Grassed Waterway	1,537	Lin. Feet	33.62	\$11,618	\$35
15	III	CAS-23-01-01	Critical Area Planting	2	Acres	8.51	\$3,120	\$37
16	III	HAM-18-01-01	Grassed Waterway	2,642	Lin. Feet	42.10	\$15,486	\$37
17	 III	CAS-02-02-03	Grassed Waterway	715	Lin. Feet	24.31	\$9,900	\$41
18	III	HAM-06-04-03	Grassed Waterway	1,246	Lin. Feet	25.69	\$10,599	\$41
19	 III	CAS-10-01-01	Grassed Waterway	777	Lin. Feet	21.47	\$8,961	\$42
20	III	VER-31-01-03	Grassed Waterway	445	Lin. Feet	18.37	\$7,799	\$42
21	III	HAM-16-02-02	Grassed Waterway	804	Lin. Feet	21.09	\$9,052	\$43
22	III	CAS-15-04-02	Grassed Waterway	1,070	Lin. Feet	22.74	\$9,986	\$44
23		CAS-14-04-01	Grassed Waterway	1,434	Lin. Feet	25.63	\$11,258	\$44
24	III	CAS-10-02-03	Grassed Waterway	583	Lin. Feet	16.10	\$7,189	\$45
25	III	CAS-18-01-01	Grassed Waterway	875	Lin. Feet	19.92	\$9,304	\$47
26	III	CAS-18-02-01	Grassed Waterway	861	Lin. Feet	19.58	\$9,252	\$47
27	III	HAM-08-02-02	Grassed Waterway	695	Lin. Feet	18.24	\$8,672	\$48
28	III	HAM-09-04-01	Grassed Waterway	2,112	Lin. Feet	27.72	\$13,633	\$49
29	III	CAS-11-01-06	Grassed Waterway	797	Lin. Feet	18.12	\$9,028	\$50
30	III	CAS-16-03-01	Grassed Waterway	1,399	Lin. Feet	19.33	\$9,638	\$50
31	III	HAM-08-02-03	Grassed Waterway	1,378	Lin. Feet	21.96	\$11,063	\$50
32	III	CAS-16-01-01	Grassed Waterway	1,868	Lin. Feet	28.34	\$14,513	\$51
33	III	HAM-07-03-04	Grassed Waterway	351	Lin. Feet	14.49	\$7,469	\$52
34		HAM-16-02-03	Grassed Waterway	1,400	Lin. Feet	21.44	\$11,140	\$52
35	III	HAM-17-01-01	Grassed Waterway	602	Lin. Feet	15.80	\$8,346	\$53
36	III	HAM-05-04-01	Grassed Waterway	827	Lin. Feet	17.07	\$9,136	\$54
37	III	HAM-06-04-02	Grassed Waterway	648	Lin. Feet	13.37	\$7,384	\$55

		Feature ID				Sediment	Estimated	Cost/Ton of
Doub	Feasibility Code	(Township-	DAAD Tura	Ci-o	Haita	Reduction	Project	Sediment
Rank		Section-1/4-#)	BMP Type	Size	Units	(ton/yr)	Cost	Reduction
38	III	HAM-07-03-03	Grassed Waterway	1,650	Lin. Feet	21.65	\$12,014	\$55
39		CAS-10-02-02	Grassed Waterway	786	Lin. Feet	17.89	\$10,186	\$57
40	III	CAS-12-04-01	Wetland Restoration	38	Acres	341.75	\$197,200	\$58
41		CAS-23-02-02	Grassed Waterway	2,906	Lin. Feet	31.97	\$18,665	\$58
42	III	HAM-07-01-01	Grassed Waterway	591	Lin. Feet	12.18	\$7,212	\$59
43	III	HAM-07-03-02	Grassed Waterway	586	Lin. Feet	12.09	\$7,198	\$60
44	III	CAS-23-01-02	Grassed Waterway	2,566	Lin. Feet	28.23	\$17,306	\$61
45	II	HAM-09-03-01	Grassed Waterway	1,370	Lin. Feet	17.98	\$11,035	\$61
46	III	CAS-16-04-02	Grassed Waterway	1,393	Lin. Feet	17.76	\$11,114	\$63
47	III	HAM-07-03-01	Grassed Waterway	654	Lin. Feet	13.49	\$8,529	\$63
48	III	HAM-07-01-02	Grassed Waterway	1,266	Lin. Feet	16.62	\$10,671	\$64
49	III	CAS-23-01-03	Grassed Waterway	1,507	Lin. Feet	16.58	\$11,514	\$69
50	III	CAS-08-01-02	Grassed Waterway	315	Lin. Feet	8.70	\$6,384	\$73
51	III	HAM-08-04-03	Grassed Waterway	812	Lin. Feet	10.65	\$7,875	\$74
52	III	HAM-07-01-03	Grassed Waterway	952	Lin. Feet	12.49	\$9,572	\$77
53	II	HAM-09-03-04	Grassed Waterway	706	Lin. Feet	11.26	\$8,712	\$77
54	II	HAM-09-03-03	Grassed Waterway	698	Lin. Feet	11.13	\$8,684	\$78
55	III	CAS-02-02-01	Grassed Waterway	475	Lin. Feet	10.09	\$7,903	\$78
56	III	CAS-24-01-01	Grassed Waterway	838	Lin. Feet	11.00	\$9,172	\$83
57	Ш	HAM-18-04-05	Grassed Waterway	834	Lin. Feet	10.95	\$9,160	\$84
58	III	CAS-09-04-01	Grassed Waterway	1,919	Lin. Feet	16.79	\$14,716	\$88
59	III	HAM-07-01-05	Grassed Waterway	576	Lin. Feet	9.18	\$8,256	\$90
60	III	CAS-17-04-01	Grassed Waterway	1,121	Lin. Feet	12.75	\$11,525	\$90
61	III	CAS-14-01-01	Wetland Restoration	72	Acres	389.61	\$367,200	\$94
62	III	CAS-23-02-01	Grassed Waterway	2,630	Lin. Feet	18.08	\$17,562	\$97
63	III	HAM-08-04-01	Grassed Waterway	518	Lin. Feet	6.80	\$6,994	\$103
64	III	HAM-05-01-01	Grassed Waterway	585	Lin. Feet	7.68	\$8,287	\$108
65	III	HAM-16-01-02	Grassed Waterway	482	Lin. Feet	6.32	\$6,885	\$109
66	III	HAM-07-01-04	Grassed Waterway	565	Lin. Feet	7.41	\$8,216	\$111
67	III	HAM-16-01-01	Grassed Waterway	1,152	Lin. Feet	9.18	\$10,272	\$112
68	III	CAS-23-03-01	Grassed Waterway	858	Lin. Feet	8.25	\$9,242	\$112
69	III	CAS-14-03-02	Grassed Waterway	377	Lin. Feet	6.40	\$7,558	\$118
70	III	CAS-14-03-02	Grassed Waterway	473	Lin. Feet	6.53	\$7,896	\$121
71	III	HAM-08-03-01	Grassed Waterway	395	Lin. Feet	6.30	\$7,623	\$121
72		EUR-01-01-01	Filter Strip	14	Acres	7.31	\$8,920	\$121
73	III	CAS-09-03-01	Wetland Restoration	32.00	Acres	136.73	\$167,200	\$122
74	1	HAM-16-02-01	Grassed Waterway	876	Lin. Feet	7.44	\$9,305	\$125
75	III 	CAS-23-03-02	Grassed Waterway	685	Lin. Feet	6.60	\$8,639	\$131
76	III	HAM-08-04-02	Grassed Waterway	380	Lin. Feet	4.99	\$6,581	\$132

		Feature ID				Sediment	Estimated	Cost/Ton of
Doub	Feasibility	(Township-	DAAD Tura	Cina	Haita	Reduction	Project	Sediment
Rank	Code	Section-1/4-#)	BMP Type	Size	Units	(ton/yr)	Cost	Reduction
77	III 	EUR-13-03-01	Grassed Waterway	1,082	Lin. Feet	7.57	\$10,026	\$132
78	III	HAM-07-04-01	Grassed Waterway	787	Lin. Feet	6.69	\$8,995	\$134
79	II	HAM-06-01-01	Grassed Waterway	2,200	Lin. Feet	11.55	\$15,840	\$137
80	III	CAS-20-02-01	Grassed Waterway	501	Lin. Feet	5.70	\$7,994	\$140
81	II	HAM-09-03-02	Grassed Waterway	405	Lin. Feet	5.31	\$7,657	\$144
82	Ш	HAM-08-01-02	Grassed Waterway	398	Lin. Feet	4.38	\$6,634	\$152
83	II	HAM-08-03-03	Grade Stabilization	1	Each	17.50	\$26,640	\$152
84	II	HAM-08-03-04	Grade Stabilization	1	Each	17.50	\$26,640	\$152
85	III	HAM-08-01-01	Grassed Waterway	306	Lin. Feet	4.02	\$6,359	\$158
86	III	HAM-05-03-01	Grassed Waterway	515	Lin. Feet	4.38	\$6,985	\$160
87	III	HAM-18-04-02	Grassed Waterway	545	Lin. Feet	4.34	\$7,074	\$163
88	Ш	EMP-36-02-01	Grassed Waterway	387	Lin. Feet	3.99	\$6,600	\$166
89	I	CAS-05-04-03	Grassed Waterway	760	Lin. Feet	4.66	\$7,720	\$166
90	III	CAS-09-01-01	Grassed Waterway	303	Lin. Feet	4.24	\$7,301	\$172
91	II	HAM-08-03-02	Grassed Waterway	259	Lin. Feet	4.13	\$7,148	\$173
92	III	HAM-08-02-01	Grassed Waterway	691	Lin. Feet	4.84	\$8,660	\$179
93	III	CAS-23-03-03	Grassed Waterway	411	Lin. Feet	4.24	\$7,679	\$181
94	III	CAS-20-01-02	Filter Strip	0	Acres	1.13	\$2,065	\$183
95	III	CAS-18-01-03	Water & Sediment Control Basin	1	Each	4.20	\$7,940	\$189
96	III	CAS-24-02-01	Grassed Waterway	946	Lin. Feet	4.88	\$9,553	\$196
97	Ш	HAM-18-04-01	Water & Sediment Control Basin	1	Each	3.94	\$7,940	\$202
98	==	HAM-17-01-02	Grassed Waterway	621	Lin. Feet	4.07	\$8,412	\$207
99	=	HAM-18-04-03	Grassed Waterway	438	Lin. Feet	3.72	\$7,772	\$209
100	III	HAM-08-02-04	Grassed Waterway	541	Lin. Feet	3.79	\$8,133	\$215
101	III	HAM-16-01-04	Grassed Waterway	415	Lin. Feet	3.53	\$7,692	\$218
102	III	HAM-17-03-01	Grassed Waterway	748	Lin. Feet	3.86	\$8,859	\$230
103	III	CAS-15-01-01	Wetland Restoration	50	Acres	110.86	\$257,200	\$232
104	III	CAS-18-01-02	Grassed Waterway	244	Lin. Feet	3.42	\$8,017	\$235
105	III	CAS-16-04-01	Water & Sediment Control Basin	1	Each	3.30	\$7,940	\$241
106	III	VER-31-01-01	Grade Stabilization	1	Each	11.00	\$26,640	\$242
107	III	VER-31-01-02	Grade Stabilization	1	Each	11.00	\$26,640	\$242
107	III	VER-31-01-02 VER-31-02-04	Grade Stabilization	1	Each	11.00	\$26,640	\$242
							. ,	
109	III	CAS-05-04-02	Water & Sediment Control Basin	222	Each	5.10	\$14,640	\$287
110		VER-29-01-01	Grassed Waterway	222	Lin. Feet	2.44	\$7,018	\$287
111		HAM-09-02-02	Grassed Waterway	313	Lin. Feet	2.19	\$6,378	\$291
112		HAM-08-03-06	Grade Stabilization	1	Each	12.60	\$37,840	\$300
113	III	CAS-22-02-02	Water & Sediment Control Basin	1	Each	4.78	\$14,640	\$306
114	III	CAS-15-03-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
115	III	CAS-15-03-02	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311

		Feature ID				Sediment	Estimated	Cost/Ton of
	Feasibility Code	(Township-	DMD Time	Cino	Haita	Reduction	Project	Sediment Reduction
Rank		Section-1/4-#)	BMP Type Water & Sediment Control Basin	Size	Units	(ton/yr)	Cost	
116	III	CAS-20-01-01		1	Each	2.55	\$7,940	\$311
117	III 	CAS-22-02-03	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
118	III	CAS-26-02-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
119		EUR-24-02-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
120	III	HAM-06-03-02	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
121	II	HAM-08-03-05	Grade Stabilization	1	Each	8.50	\$26,640	\$313
122	III	HAM-16-01-05	Grassed Waterway	246	Lin. Feet	2.09	\$7,100	\$340
123	III	HAM-16-01-03	Grade Stabilization	1	Each	7.79	\$26,640	\$342
124	III	CAS-01-02-01	Streambank Stabilization	500	Sq. Feet	15.94	\$57,280	\$359
125	III	HAM-05-03-03	Water & Sediment Control Basin	1	Each	3.94	\$14,640	\$372
126	III	HAM-05-03-02	Water & Sediment Control Basin	1	Each	2.10	\$7,940	\$378
127	II	HAM-08-03-07	Grade Stabilization	1	Each	7.00	\$26,640	\$381
128	III	EUR-13-02-01	Wetland Restoration	11	Acres	14.31	\$62,200	\$435
129	III	CAS-05-04-01	Wetland Restoration	16	Acres	19.20	\$87,200	\$454
130	Ш	CAS-11-02-01	Wetland Restoration	9	Acres	11.15	\$52,200	\$468
131	ı	CAS-14-03-01	Grassed Waterway	740	Lin. Feet	2.04	\$10,001	\$491
132	III	HAM-04-02-01	Water & Sediment Control Basin	1	Each	2.55	\$14,640	\$574
133	III	HAM-06-03-01	Water & Sediment Control Basin	1	Each	2.55	\$14,640	\$574
134	Ш	CAS-11-01-02	Grade Stabilization	1	Each	4.40	\$26,640	\$605
135	≡	CAS-10-04-01	Wetland Restoration	49	Acres	36.94	\$252,200	\$683
136	Ш	VER-31-02-05	Grade Stabilization	1	Each	3.50	\$26,640	\$761
137	III	HAM-18-03-01	Grade Stabilization	1	Each	3.19	\$26,640	\$836
138	III	HAM-18-04-04	Grade Stabilization	1	Each	3.19	\$26,640	\$836
139	III	CAS-20-01-04	Filter Strip	0.3	Acres	0.22	\$2,055	\$934
140	III	CAS-11-01-04	Grade Stabilization	1	Each	2.48	\$26,640	\$1,076
141	Ш	CAS-22-02-01	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
142	III	CAS-23-03-06	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
143	III	CAS-23-03-04	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
144	III	CAS-23-03-05	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
145	III	CAS-11-04-01	Wetland Restoration	49	Acres	20.62	\$252,200	\$1,223
146	III	VER-31-03-01	Grade Stabilization	1	Each	1.83	\$26,640	\$1,453
147	III	CAS-11-01-05	Wetland Restoration	75	Acres	23.11	\$382,200	\$1,654
148	III	CAS-12-04-02	Grade Stabilization	1	Each	1.40	\$26,640	\$1,903
149	III	CAS-12-01-01	Grade Stabilization	1	Each	0.70	\$13,940	\$1,991
150	II	CAS-11-04-02	Wetland Restoration	75	Acres	17.25	\$382,200	\$2,216
		CAS-11-04-02 CAS-17-02-01	Water & Sediment Control Basin		Each	0.35		
151				1			\$7,940	\$2,269
152 153	III	CAS-20-01-03 CAS-11-03-01	Grade Stabilization Wetland Restoration	5	Each Acres	1.05 0.98	\$26,640 \$32,200	\$2,537 \$3,286
154	III	CAS-23-04-01	Grade Stabilization	1	Each	0.41	\$26,640	\$6,458

Document Overview

The South Branch Vermillion River Subwatershed Analysis (SWA) is a watershed management tool developed to proactively identify and prioritize potential BMP projects based on performance and cost effectiveness. This process is intended, ultimately, to assist local water management organizations and partner agencies in maximizing the value of each dollar spent.

The methods and analysis behind this document provide the ability to quickly assess subwatersheds for optimal locations for BMPs that are most appropriate and feasible based on analyzed site conditions. While this analysis is accurate and sufficient for that purpose, estimated final construction costs and pollutant removals will need to be refined once projects are selected for construction. Construction projects should be considered as only one part of an overall watershed restoration plan that includes, but is not limited to, educational outreach, upstream discharge reductions, and pollutant source control.

This document is organized into three sections including Methods, Cost/Benefit Analysis Ranking, and Project Profiles for the proposed BMP's. References used in the assessment protocol and appendices provide additional information relevant to the assessment. Each section is briefly described below:

Methods

The Methods section outlines the general procedures used when assessing the subwatershed. It details the processes of *Project Scoping, Desktop Analysis, Field Reconnaissance, and Cost/Treatment Analysis*. This protocol attempts to provide a sufficient level of detail to rapidly assess watersheds and catchments of variable scales and land uses. It provides the assessor defined project goals that aid in quickly narrowing down multiple potential sites to a point where the assessor can look critically at site-specific design options that affect BMP selection.

Cost/Benefit Analysis Ranking

Projects that are 1) most able to address the project goals, 2) are compatible with current land use and 3) appear to have reasonable design, installation and maintenance costs were chosen for a cost/benefit analysis and ranked (see Table 3). The list is sorted by cost per ton of sediment treated by the BMP over a duration (i.e. life-cycle) of 10 years, the typical minimum maintenance period for publicly-funded projects on private land. The final cost per ton of treatment value includes installation and maintenance costs. While sediment is used as the primary ranking tool in this report, project priority would be very similar when projects are ranked for phosphorus reduction due to the correlation between the reduction of sediment and the reduction of phosphorus.

Project Profiles

Each BMP that was identified through the analysis was given its own unique identification code to coincide with the project location, type, and number. This identification code is used to reference each individual project. Within the *Project Profiles* section, BMPs are grouped by section, township,

and range to most easily identify the physical location of each project.

A rendered aerial photo highlights the specific locations identified for each grouping. Additional field inspections may be required to verify project feasibility, but the most ideal locations for BMP project installations based on available data are identified here. Paired with each aerial photograph is a description of the typical land use, soil types, topography, and other relevant information for each section.

The Land Management Recommendation section describes cultural practices that are encouraged as part of ongoing land management. A BMP Cost Benefit Analysis table provides for the direct comparison of the expected amount of treatment within a section per invested dollar estimated. In most cases, several BMP's were reviewed with the most feasible ones recommended based on how it fits with current use of the land, efficiency of pollutant reduction, and estimated cost.

Step #1: Project Scoping

Determining the resource of concern and the subsequent drainage area to analyze is the first step in the assessment process. Water quality monitoring data, inclusion on Minnesota's impaired waters list, availability of accurate GIS data, and availability of other plans or assessments are a few of the considerations in determining which waterbodies are a priority.

Dakota County SWCD has been completing SWAs throughout the agricultural portions of Dakota County, with a goal of covering all agricultural portions of the county within a SWA.



South Branch Vermillion River

To date, 6 SWAs are complete and each of the SWAs have focused on catchments that drain to a specific tributary major river. This SWA focused on the catchments that drain to the South Branch Vermillion River.

The South Branch Vermillion River is located within the Vermillion River watershed and under the authority of the Vermillion River Watershed Joint Powers Organization (VRWJPO). The VRWJPO has identified goals to protect or restore water quality in lakes, streams, and wetlands. To reach that goal, the VRWJPO has identified actions of completing assessments of subwatersheds to identify potential improvement projects and prioritizing projects that are identified through the assessments (Vermillion River Watershed Management Plan 2016).

The South Branch Vermillion River was targeted because it was identified as one of the top priorities for implementing projects. It was also targeted due to its ability to protect downstream resources and availability of existing water quality monitoring data. Dakota County SWCD Staff coordinated with VRWJPO staff in selection of the South Branch Vermillion River subwatershed for this analysis to identify specific BMPs.

The South Branch Vermillion River is a stream that flows approximately 8 miles through the central portion of Dakota County and is a tributary to the Vermillion River. The contributing watershed of the South Branch Vermillion River encompasses approximately 32.2 square miles (20,635 acres) and is generally flat. Land use is primarily agricultural, most of which is row crop agriculture.

Extensive water quality and quantity data for the South Branch Vermillion River is available. Monitoring in this watershed has been performed at 200th St E (Vermillion River Trail, County Road 66) within the MNDNR's South Branch Vermillion River State Aquatic Management Area (AMA) on a routine basis. This includes monitoring biweekly March through October, in addition to runoff samples, for close to twenty years. Monitoring parameters include transparency, total suspended

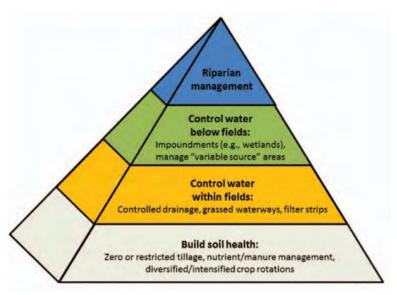
solids, conductivity, dissolved oxygen, pH, temperature, chlorophyll-a, chloride, nitrates, phosphorus, and *E. coli*. The VRWJPO coordinates monitoring activities in partnership with the Dakota County SWCD.

This subwatershed is listed as impaired for fecal coliform (2008). The Draft 2022 Impaired Waters List (2022) includes new impairment listings for the South Branch Vermillion River for macroinvertebrates, fishes, and total suspended solids (TSS). Although the list is not finalized, the impairments for the South Branch Vermillion River are expected to remain on the final list. The mainstem Vermillion River below the confluence with the South Branch Vermillion River is impaired for fecal coliform (2002), fishes (2012), and mercury (2012) and on the draft list for total suspended solids (TSS) (2022).

Through analysis of existing monitoring data and through coordination with the VRWJPO, total suspended solids have been identified as the primary pollutant of concern for this analysis. Since sediment is a major contributor to total suspended solids, contributes to high turbidity within the river, and is detrimental to aquatic life, the Dakota County SWCD, in coordination with the VRWJPO, determined that projects will be prioritized based on the potential to reduce sediment loads from reaching surface waters.

Due to the close association between sediment and phosphorus, many of the identified BMPs would rank similarly when ranked by their cost-benefit ratio with regards to phosphorus reduction. Pollutants including fecal coliform and nitrates are a concern for this subwatershed and are not overlooked. While these pollutants can be addressed partially by structural BMPs, they are most effectively address by non-structural land management practices. As such, the land management practices identified in this subwatershed analysis are intended to address these pollutants along with sediment.

It is important to note that this subwatershed analysis does not explicitly identify and rank practices that may be adopted within fields in order to build soil health, maintain residue cover, improve nutrient use efficiency, reduce runoff, and reduce nutrient leaching. These practices, including cover crops, no-till, proper nutrient management, and alternative crop systems, are recommended on virtually any field and all landowners are encouraged to implement them. These land management practices are recommended as a high priority and may have greater water quality benefit than most structural BMPs. Because the practices are applicable on most landscapes throughout the South Branch Vermillion River subwatershed, they are not specifically identified in the



Land management practices provide foundation to agricultural watershed management (Agricultural Conservation Planning Framework)

cost-benefit rankings but are nonetheless recommended as a high priority.

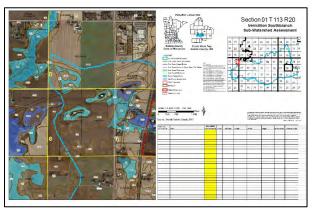
This analysis is not intended to address flooding or surface water quantity issues on a large scale. Projects such as wetland restorations or water and sediment control basins identified within this analysis are for the primary purpose of erosion and sediment reduction. A separate effort is currently underway by Dakota County to study the watershed on a larger scale, analyze rural flow patterns, identify flood prone areas, and identify wetland and water retention projects from a watershed perspective.

Step #2: Desktop Analysis

The purpose of the desktop analysis is to narrow the amount of field reconnaissance and other time-consuming tasks that would be needed to complete the SWA by identifying and prioritizing potential projects within the watershed which would likely yield the greatest pollutant (sediment) reductions. Desktop analysis primarily compiles existing data to highlight the locations where BMPs would be most beneficial.

The desktop analysis involves computer-based scanning of the subwatershed for potential retrofit projects. Accurate GIS data is extremely valuable in conducting the desktop review. Some of the most important GIS layers included: 1-foot topography, soils, watershed and subcatchment boundaries, parcel boundaries, land cover, stream and ditch networks, wetland inventory, culverts, database of existing conservation practices, and high resolution aerial photography (all years that were available).

Topographic data was used to identify steep slopes, areas of concentrated flow, and depressional areas that may be suitable for treatment of runoff and storage within the watershed. Aerial photography was used to identify locations that had indicators of surface erosion from concentrated flow. Photography from multiple years and varied seasons was used to identify issues such as gully erosion that may not have been evident in a single aerial photo due to recent tillage activity, cropping rotations, or variations in weather. Soils information was used to identify highly erodible soils and hydric soils to determine the appropriate BMP for a specific location.



Existing data was analyzed, and maps were created to aid in field reconnaissance.

As a tool for the field reconnaissance, maps were created for each 1-mile by 1-mile section showing the desktop identified BMPs with relevant information including 2020 aerial photos, parcel boundaries, landowner information, existing and previously installed BMPs, wetlands, and contour lines. Staff from the Dakota County SWCD office used the maps to verify the feasibility and effectiveness of each BMP.

Using the created maps for each section as a guide, field investigations were conducted to evaluate as many sites as possible to test assumptions and identify site-limiting factors for BMP design. Site constraints were assessed to determine the most feasible BMP options as well as eliminate sites from consideration. The field investigation also revealed BMP opportunities that could have gone unnoticed using only a desktop analysis. During the investigation, the drainage area and other mapped data was verified. Public right-of-way and public land within priority catchments was used as a starting point for visual assessment. Potential BMP



Example of a location identified for a grassed waterway

locations that were identified during the Desktop Analysis step but could not be seen from public areas were visited by contacting individual landowners and scheduling formal site visits when possible.

Field reconnaissance was done in the spring when soil surfaces were visible and not obstructed by crops. BMPs that were deemed feasible were recorded and appropriate information was gathered to calculate the size, pollutant removal potential, and cost of the BMP. Linear BMPs such as grass waterways that spanned across more than one parcel were split on parcel boundaries and identified as two separate practices. This was done to appropriately estimate installation costs as they would likely need coordination with multiple landowners with separate agreements and design documents. It is important to note that BMPs spanning multiple parcels are likely to be contingent

upon up gradient or downgradient practices being installed on adjacent properties for each of the BMPs to be effective.

BMPs were selected from the Natural Resources Conservation Service (NRCS) practice standards. Sites identified during the field reconnaissance were determined to be the best locations for BMP installations for pollutant treatment based on professional knowledge and experience. Following field reconnaissance, field maps and recorded notes were digitized in preparation for the cost-benefit ranking. Staff identified 154 potential locations that would benefit from BMP installations. Table 1 illustrates pollution reduction practices that were considered for each site.



Construction of a grassed waterway within the South
Branch Vermillion River Subwatershed

Table 1. Pollution Red	uction Practices
Practice & NRCS Code	Description
340 - Cover Crop	Grasses, legumes, and forbs planted for seasonal vegetative cover.
342 - Critical Area Planting (Native plants)	Planting of permanent native grasses, usually on a field with steep slopes over 6%.
393 - Filter Strip	Strip of perennial grasses, forbs, and legumes planted along a stream, ditch, or wetland to capture sediment before it runs into the waterbody.
410 - Grade Stabilization Structure	A structure used in natural or constructed channels to slow the flow of water, stabilize the channel, and reduce erosion.
412 - Grassed Waterway	A perennially vegetated conveyance to reduce erosion where there is concentrated flow of water.
580 - Stream and Shoreline Protection	Treatments to stabilize and protect the banks of streams to prevent the loss of soil and reduce the offsite or downstream effects of sediment resulting from bank erosion.
638 - Water & Sediment Control Basin	An earthen embankment which traps water and sediment running off cropland upslope, thereby slowing the flow of runoff and allowing sediment to drop out of suspension.
657 – Wetland Restoration	Restoring hydrology and vegetation on a former or degraded wetland site. Restored wetlands can filter sediment from runoff and reduce pollutant loading to downstream water resources.

After feasible BMP projects were identified, potential sediment reductions were calculated and preliminary cost estimates compiled. The projects were then ranked based on the cost per ton of sediment removal per year, over a 10-year life-cycle. The final value for the cost per pound of treatment includes construction and installation. The top-ranking projects have the lowest cost per ton of sediment removal.

Treatment Analysis

Modeling of the sediment loading for each selected BMP, before and after project installation, was completed with the Board of Water and Soil Resources (BWSR) Pollution Reduction Estimator and inputs from RUSLE2 as needed. Distance to surface water was calculated based on distances between the project and identified watercourses from the Dakota County SWCD's surface water inventory. For wetland restorations, sediment loads were calculated using RUSLE2 for each contributing drainage area. Sediment reductions were then calculated using maximum drainage area to wetland size ratios along with percent reduction values from the Minnesota Stormwater Manual.

The sediment reduction estimates associated with the installation of each project should be considered as pollutant reduction to surface waters within the South Branch Vermillion River subwatershed, but not necessarily pollutant load reductions to the South Branch Vermillion River or to the Vermillion River. It is important to note that reported treatment levels are dependent upon optimal site selection and sizing. Not all locations and sizes will yield the same results. The pollutant removal estimates may be used to prioritize practices within the South Branch Vermillion River subwatershed and for grant applications but in no case should this data be used to represent actual pollutant removal until after installation is complete and site-specific modeling and/or monitoring data is available.

Cost estimates

Each project was assigned estimated costs for design and installation based on a recent analysis of costs for similar projects installed in Dakota County from 2015 to 2020. The averaged costs used in the calculations can be found in the Appendix. An annual cost per ton of sediment removal was then calculated for the 10-year life-cycle. In the final evaluation and ranking, the estimated project costs for each BMP are listed.

Cost/Benefit and Project Ranking Table

More detail regarding each specific project can be found in the *Project Profiles* pages of this report. In addition to ranking, a "Feasibility Code" was assigned to each project as shown in Table 2. The purpose of this code is to provide a basic indication of the feasibility or "reasonable likelihood" the listed project would be applied and installed by the landowner on a voluntary basis. The selected code is based on relative success Dakota County SWCD staff has had in promoting the selected BMP project type through promotional efforts, landowner engagement initiatives conducted in recent history, and previous work with the project landowner.

The following criteria apply to each of the three codes used:

Table 2. Project	Table 2. Project Feasibility Codes							
Code	Considerations							
I	High likelihood: practice is not dependent on installation of other practices or coordination with other landowners, the landowner has a history of cooperation with SWCD/NRCS, practice does not hinder farmability and/or installation cost is not prohibitive							
II	Medium likelihood: practice may be dependent on installation of one or two other conservation practices and coordination with additional landowners, landowner is willing to work with SWCD/NRCS, practice does not severely hinder farmability and/or cost is not prohibitive							
III	Low likelihood: project requires installation of other practices in order to be effective and coordination with multiple landowners, landowner has not previously worked with SWCD/NRCS, practice disrupts ability to farm the field and/or installation cost is prohibitive							

Table 3 summarizes the identified potential projects within the study area. Potential projects are listed from most cost effective to least cost effective, based on cost per ton of sediment removed over the life-cycle timeframe.

Cost estimates represent design and construction costs for each project installed on that particular site. Depending on complexity, additional project costs ranging from 25% to 50% of the construction cost should be added to account for project outreach and promotion. The reported treatment levels are dependent upon optimal siting and sizing which would be completed during the actual design phase of the proposed project, as well as obtaining landowner cooperation. Due to changing land use over time, these project profiles should be re-assessed periodically to update BMP suitability and priority ranking.

Table 3. Summary of Potential BMPs

			illiary of Foter					
Rank	Feasibility Code	Feature ID (Township- Section-1/4-#)	BMP Type	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	II	HAM-07-03-05	Grassed Waterway		Lin. Feet	197.22	\$18,310	\$9
1			,	2,817				
2	III 	CAS-02-02-02	Grassed Waterway	2,414	Lin. Feet	133.37	\$14,690	\$11
3		CAS-07-03-01	Grassed Waterway	1,540	Lin. Feet	93.80	\$11,629	\$12
4	III	VER-32-03-01	Grassed Waterway	2,585	Lin. Feet	106.64	\$15,289	\$14
5		VER-30-04-01	Grassed Waterway	1,114	Lin. Feet	58.46	\$10,137	\$17
6	III	CAS-10-02-01	Grassed Waterway	975	Lin. Feet	36.68	\$9,652	\$26
7	III 	CAS-08-01-01	Water & Sediment Control Basin	1	Each	28.69	\$7,940	\$28
8	III	CAS-10-03-01	Wetland Restoration	11	Acres	224.20	\$62,200	\$28
9	III	EUR-01-04-01	Filter Strip	11	Acres	26.32	\$7,420	\$28
10	III	CAS-15-02-01	Wetland Restoration	35	Acres	623.10	\$182,200	\$29
11	III	CAS-13-02-01	Wetland Restoration	5	Acres	101.40	\$32,200	\$32
12	III	HAM-08-02-05	Grassed Waterway	1,268	Lin. Feet	33.29	\$10,679	\$32
13	III	CAS-15-04-01	Grassed Waterway	1,156	Lin. Feet	31.80	\$10,287	\$32
14	III	EMP-35-04-01	Grassed Waterway	1,537	Lin. Feet	33.62	\$11,618	\$35
15	III	CAS-23-01-01	Critical Area Planting	2	Acres	8.51	\$3,120	\$37
16	III	HAM-18-01-01	Grassed Waterway	2,642	Lin. Feet	42.10	\$15,486	\$37
17	III	CAS-02-02-03	Grassed Waterway	715	Lin. Feet	24.31	\$9,900	\$41
18	III	HAM-06-04-03	Grassed Waterway	1,246	Lin. Feet	25.69	\$10,599	\$41
19	III	CAS-10-01-01	Grassed Waterway	777	Lin. Feet	21.47	\$8,961	\$42
20	III	VER-31-01-03	Grassed Waterway	445	Lin. Feet	18.37	\$7,799	\$42
21	III	HAM-16-02-02	Grassed Waterway	804	Lin. Feet	21.09	\$9,052	\$43
22	Ш	CAS-15-04-02	Grassed Waterway	1,070	Lin. Feet	22.74	\$9,986	\$44
23	ı	CAS-14-04-01	Grassed Waterway	1,434	Lin. Feet	25.63	\$11,258	\$44
24	III	CAS-10-02-03	Grassed Waterway	583	Lin. Feet	16.10	\$7,189	\$45
25	III	CAS-18-01-01	Grassed Waterway	875	Lin. Feet	19.92	\$9,304	\$47
26	III	CAS-18-02-01	Grassed Waterway	861	Lin. Feet	19.58	\$9,252	\$47
27	III	HAM-08-02-02	Grassed Waterway	695	Lin. Feet	18.24	\$8,672	\$48
28	III	HAM-09-04-01	Grassed Waterway	2,112	Lin. Feet	27.72	\$13,633	\$49
29	III	CAS-11-01-06	Grassed Waterway	797	Lin. Feet	18.12	\$9,028	\$50
30	Ш	CAS-16-03-01	Grassed Waterway	1,399	Lin. Feet	19.33	\$9,638	\$50
31	III	HAM-08-02-03	Grassed Waterway	1,378	Lin. Feet	21.96	\$11,063	\$50
32	III	CAS-16-01-01	Grassed Waterway	1,868	Lin. Feet	28.34	\$14,513	\$51
33	III	HAM-07-03-04	Grassed Waterway	351	Lin. Feet	14.49	\$7,469	\$52
34	I	HAM-16-02-03	Grassed Waterway	1,400	Lin. Feet	21.44	\$11,140	\$52
35	III	HAM-17-01-01	Grassed Waterway	602	Lin. Feet	15.80	\$8,346	\$53
36	III	HAM-05-04-01	Grassed Waterway	827	Lin. Feet	17.07	\$9,136	\$54
37	III	HAM-06-04-02	Grassed Waterway	648	Lin. Feet	13.37	\$7,384	\$55
30 31 32 33 34 35 36		CAS-16-03-01 HAM-08-02-03 CAS-16-01-01 HAM-07-03-04 HAM-16-02-03 HAM-17-01-01 HAM-05-04-01	Grassed Waterway	1,399 1,378 1,868 351 1,400 602 827	Lin. Feet	19.33 21.96 28.34 14.49 21.44 15.80 17.07	\$9,638 \$11,063 \$14,513 \$7,469 \$11,140 \$8,346 \$9,136	\$ \$ \$ \$ \$

		Feature ID				Sediment	Estimated	Cost/Ton of
	Feasibility Code	(Township-	DMD Turns	Cina	Heite	Reduction	Project	Sediment
Rank		Section-1/4-#)	BMP Type	Size	Units	(ton/yr)	Cost	Reduction
38	111	HAM-07-03-03	Grassed Waterway	1,650	Lin. Feet	21.65	\$12,014	\$55
39	III 	CAS-10-02-02	Grassed Waterway	786	Lin. Feet	17.89	\$10,186	\$57
40		CAS-12-04-01	Wetland Restoration	38	Acres	341.75	\$197,200	\$58
41		CAS-23-02-02	Grassed Waterway	2,906	Lin. Feet	31.97	\$18,665	\$58
42	III	HAM-07-01-01	Grassed Waterway	591	Lin. Feet	12.18	\$7,212	\$59
43	III	HAM-07-03-02	Grassed Waterway	586	Lin. Feet	12.09	\$7,198	\$60
44	III	CAS-23-01-02	Grassed Waterway	2,566	Lin. Feet	28.23	\$17,306	\$61
45	II	HAM-09-03-01	Grassed Waterway	1,370	Lin. Feet	17.98	\$11,035	\$61
46	III	CAS-16-04-02	Grassed Waterway	1,393	Lin. Feet	17.76	\$11,114	\$63
47	III	HAM-07-03-01	Grassed Waterway	654	Lin. Feet	13.49	\$8,529	\$63
48	III	HAM-07-01-02	Grassed Waterway	1,266	Lin. Feet	16.62	\$10,671	\$64
49	III	CAS-23-01-03	Grassed Waterway	1,507	Lin. Feet	16.58	\$11,514	\$69
50	III	CAS-08-01-02	Grassed Waterway	315	Lin. Feet	8.70	\$6,384	\$73
51	III	HAM-08-04-03	Grassed Waterway	812	Lin. Feet	10.65	\$7,875	\$74
52	Ш	HAM-07-01-03	Grassed Waterway	952	Lin. Feet	12.49	\$9,572	\$77
53	II	HAM-09-03-04	Grassed Waterway	706	Lin. Feet	11.26	\$8,712	\$77
54	II	HAM-09-03-03	Grassed Waterway	698	Lin. Feet	11.13	\$8,684	\$78
55	III	CAS-02-02-01	Grassed Waterway	475	Lin. Feet	10.09	\$7,903	\$78
56	Ш	CAS-24-01-01	Grassed Waterway	838	Lin. Feet	11.00	\$9,172	\$83
57	Ш	HAM-18-04-05	Grassed Waterway	834	Lin. Feet	10.95	\$9,160	\$84
58	Ш	CAS-09-04-01	Grassed Waterway	1,919	Lin. Feet	16.79	\$14,716	\$88
59	Ш	HAM-07-01-05	Grassed Waterway	576	Lin. Feet	9.18	\$8,256	\$90
60	Ш	CAS-17-04-01	Grassed Waterway	1,121	Lin. Feet	12.75	\$11,525	\$90
61	III	CAS-14-01-01	Wetland Restoration	72	Acres	389.61	\$367,200	\$94
62	III	CAS-23-02-01	Grassed Waterway	2,630	Lin. Feet	18.08	\$17,562	\$97
63	III	HAM-08-04-01	Grassed Waterway	518	Lin. Feet	6.80	\$6,994	\$103
64	Ш	HAM-05-01-01	Grassed Waterway	585	Lin. Feet	7.68	\$8,287	\$108
65	Ш	HAM-16-01-02	Grassed Waterway	482	Lin. Feet	6.32	\$6,885	\$109
66	III	HAM-07-01-04	Grassed Waterway	565	Lin. Feet	7.41	\$8,216	\$111
67	Ш	HAM-16-01-01	Grassed Waterway	1,152	Lin. Feet	9.18	\$10,272	\$112
68	Ш	CAS-23-03-01	Grassed Waterway	858	Lin. Feet	8.25	\$9,242	\$112
69	Ш	CAS-14-03-02	Grassed Waterway	377	Lin. Feet	6.40	\$7,558	\$118
70	Ш	CAS-18-02-02	Grassed Waterway	473	Lin. Feet	6.53	\$7,896	\$121
71	Ш	HAM-08-03-01	Grassed Waterway	395	Lin. Feet	6.30	\$7,623	\$121
72	Ш	EUR-01-01-01	Filter Strip	14	Acres	7.31	\$8,920	\$122
73	Ш	CAS-09-03-01	Wetland Restoration	32.00	Acres	136.73	\$167,200	\$122
74	ı	HAM-16-02-01	Grassed Waterway	876	Lin. Feet	7.44	\$9,305	\$125
75	III	CAS-23-03-02	Grassed Waterway	685	Lin. Feet	6.60	\$8,639	\$131
76	III	HAM-08-04-02	Grassed Waterway	380	Lin. Feet	4.99	\$6,581	\$132

		Feature ID				Sediment	Estimated	Cost/Ton of
	Feasibility	(Township-				Reduction	Project	Sediment
Rank	Code	Section-1/4-#)	BMP Type	Size	Units	(ton/yr)	Cost	Reduction
77	III	EUR-13-03-01	Grassed Waterway	1,082	Lin. Feet	7.57	\$10,026	\$132
78	III	HAM-07-04-01	Grassed Waterway	787	Lin. Feet	6.69	\$8,995	\$134
79	II	HAM-06-01-01	Grassed Waterway	2,200	Lin. Feet	11.55	\$15,840	\$137
80	III	CAS-20-02-01	Grassed Waterway	501	Lin. Feet	5.70	\$7,994	\$140
81	II	HAM-09-03-02	Grassed Waterway	405	Lin. Feet	5.31	\$7,657	\$144
82	III	HAM-08-01-02	Grassed Waterway	398	Lin. Feet	4.38	\$6,634	\$152
83	II	HAM-08-03-03	Grade Stabilization	1	Each	17.50	\$26,640	\$152
84	II	HAM-08-03-04	Grade Stabilization	1	Each	17.50	\$26,640	\$152
85	III	HAM-08-01-01	Grassed Waterway	306	Lin. Feet	4.02	\$6,359	\$158
86	III	HAM-05-03-01	Grassed Waterway	515	Lin. Feet	4.38	\$6,985	\$160
87	III	HAM-18-04-02	Grassed Waterway	545	Lin. Feet	4.34	\$7,074	\$163
88	III	EMP-36-02-01	Grassed Waterway	387	Lin. Feet	3.99	\$6,600	\$166
89	1	CAS-05-04-03	Grassed Waterway	760	Lin. Feet	4.66	\$7,720	\$166
90	Ш	CAS-09-01-01	Grassed Waterway	303	Lin. Feet	4.24	\$7,301	\$172
91	Ш	HAM-08-03-02	Grassed Waterway	259	Lin. Feet	4.13	\$7,148	\$173
92	III	HAM-08-02-01	Grassed Waterway	691	Lin. Feet	4.84	\$8,660	\$179
93	III	CAS-23-03-03	Grassed Waterway	411	Lin. Feet	4.24	\$7,679	\$181
94	III	CAS-20-01-02	Filter Strip	0	Acres	1.13	\$2,065	\$183
95	III	CAS-18-01-03	Water & Sediment Control Basin	1	Each	4.20	\$7,940	\$189
96	III	CAS-24-02-01	Grassed Waterway	946	Lin. Feet	4.88	\$9,553	\$196
97	III	HAM-18-04-01	Water & Sediment Control Basin	1	Each	3.94	\$7,940	\$202
98	III	HAM-17-01-02	Grassed Waterway	621	Lin. Feet	4.07	\$8,412	\$207
99	III	HAM-18-04-03	Grassed Waterway	438	Lin. Feet	3.72	\$7,772	\$209
100	III	HAM-08-02-04	Grassed Waterway	541	Lin. Feet	3.79	\$8,133	\$215
101	III	HAM-16-01-04	Grassed Waterway	415	Lin. Feet	3.53	\$7,692	\$218
102	III	HAM-17-03-01	Grassed Waterway	748	Lin. Feet	3.86	\$8,859	\$230
103	III	CAS-15-01-01	Wetland Restoration	50	Acres	110.86	\$257,200	\$232
104	III	CAS-18-01-02	Grassed Waterway	244	Lin. Feet	3.42	\$8,017	\$235
105	III	CAS-16-04-01	Water & Sediment Control Basin	1	Each	3.30	\$7,940	\$241
106	III	VER-31-01-01	Grade Stabilization	1	Each	11.00	\$26,640	\$242
107	III	VER-31-01-02	Grade Stabilization	1	Each	11.00	\$26,640	\$242
108	III	VER-31-01-02 VER-31-02-04	Grade Stabilization	1	Each	11.00	\$26,640	\$242
							. ,	
109	III	CAS-05-04-02	Water & Sediment Control Basin	222	Each	5.10	\$14,640	\$287
110	III	VER-29-01-01	Grassed Waterway	222	Lin. Feet	2.44	\$7,018	\$287
111	- 111	HAM-09-02-02	Grassed Waterway	313	Lin. Feet	2.19	\$6,378	\$291
112	II	HAM-08-03-06	Grade Stabilization	1	Each	12.60	\$37,840	\$300
113	III	CAS-22-02-02	Water & Sediment Control Basin	1	Each	4.78	\$14,640	\$306
114	III	CAS-15-03-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
115	III	CAS-15-03-02	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311

	F 11 112	Feature ID				Sediment	Estimated	Cost/Ton of
Rank	Feasibility Code	(Township- Section-1/4-#)	BMP Type	Size	Units	Reduction (ton/yr)	Project Cost	Sediment Reduction
116	III	CAS-20-01-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
117	III	CAS-22-02-03	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
118	III	CAS-26-02-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
119	III	EUR-24-02-01	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
120	III	HAM-06-03-02	Water & Sediment Control Basin	1	Each	2.55	\$7,940	\$311
121	II	HAM-08-03-05	Grade Stabilization	1	Each	8.50	\$26,640	\$313
122	III	HAM-16-01-05	Grassed Waterway	246	Lin. Feet	2.09	\$7,100	\$340
123	III	HAM-16-01-03	Grade Stabilization	1	Each	7.79	\$26,640	\$342
124	III	CAS-01-02-01	Streambank Stabilization	500	Sq. Feet	15.94	\$57,280	\$359
125	III	HAM-05-03-03	Water & Sediment Control Basin	1	Each	3.94	\$14,640	\$372
126	III	HAM-05-03-02	Water & Sediment Control Basin	1	Each	2.10	\$7,940	\$378
127	II	HAM-08-03-07	Grade Stabilization	1	Each	7.00	\$26,640	\$381
128	III	EUR-13-02-01	Wetland Restoration	11	Acres	14.31	\$62,200	\$435
129	III	CAS-05-04-01	Wetland Restoration	16	Acres	19.20	\$87,200	\$454
130	III	CAS-11-02-01	Wetland Restoration	9	Acres	11.15	\$52,200	\$468
131	ı	CAS-14-03-01	Grassed Waterway	740	Lin. Feet	2.04	\$10,001	\$491
132	III	HAM-04-02-01	Water & Sediment Control Basin	1	Each	2.55	\$14,640	\$574
133	III	HAM-06-03-01	Water & Sediment Control Basin	1	Each	2.55	\$14,640	\$574
134	III	CAS-11-01-02	Grade Stabilization	1	Each	4.40	\$26,640	\$605
135	Ш	CAS-10-04-01	Wetland Restoration	49	Acres	36.94	\$252,200	\$683
136	Ш	VER-31-02-05	Grade Stabilization	1	Each	3.50	\$26,640	\$761
137	III	HAM-18-03-01	Grade Stabilization	1	Each	3.19	\$26,640	\$836
138	III	HAM-18-04-04	Grade Stabilization	1	Each	3.19	\$26,640	\$836
139	III	CAS-20-01-04	Filter Strip	0.3	Acres	0.22	\$2,055	\$934
140	III	CAS-11-01-04	Grade Stabilization	1	Each	2.48	\$26,640	\$1,076
141	III	CAS-22-02-01	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
142	III	CAS-23-03-06	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
143	III	CAS-23-03-04	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
144	III	CAS-23-03-05	Water & Sediment Control Basin	1	Each	1.28	\$14,640	\$1,148
145	Ш	CAS-11-04-01	Wetland Restoration	49	Acres	20.62	\$252,200	\$1,223
146	III	VER-31-03-01	Grade Stabilization	1	Each	1.83	\$26,640	\$1,453
147	III	CAS-11-01-05	Wetland Restoration	75	Acres	23.11	\$382,200	\$1,654
148	III	CAS-12-04-02	Grade Stabilization	1	Each	1.40	\$26,640	\$1,903
149	III	CAS-12-01-01	Grade Stabilization	1	Each	0.70	\$13,940	\$1,991
150	11	CAS-11-04-02	Wetland Restoration	75	Acres	17.25	\$382,200	\$2,216
151	Ш	CAS-17-02-01	Water & Sediment Control Basin	1	Each	0.35	\$7,940	\$2,269
152	Ш	CAS-20-01-03	Grade Stabilization	1	Each	1.05	\$26,640	\$2,537
153	III	CAS-11-03-01	Wetland Restoration	5	Acres	0.98	\$32,200	\$3,286
154	III	CAS-23-04-01	Grade Stabilization	1	Each	0.41	\$26,640	\$6,458

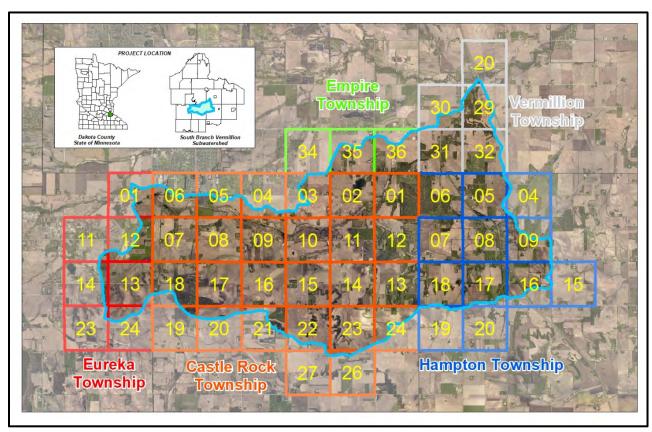


Project Profiles

The following pages provide definition and detailed assessments for each of the projects identified through the field reconnaissance and subsequent evaluation of each BMP. For organizational purposes the selected projects are grouped by section, as shown below. The one-mile sections are identified by the township name and section number. Projects are displayed with 2020 aerial imagery and Dakota County parcel boundaries. Individual projects are identified by a unique number and project specific information is included in the BMP Cost Benefit Analysis table.

The Project Profiles are part of the subwatershed analysis and should be retained with the document to provide context for identified BMPs. The drawings are neither legally recorded maps nor surveys and are not intended to be used as such. The drawings are a compilation of records, information, and data located in various City, County, and State Offices and other sources, affecting the areas shown, and are to be used for reference purposes only. Dakota County SWCD is not responsible for any inaccuracies herein contained. If discrepancies are found, please contact the Dakota County Soil and Water Conservation District at 651-480-7777.

Project Profile Reference Sections



Description:

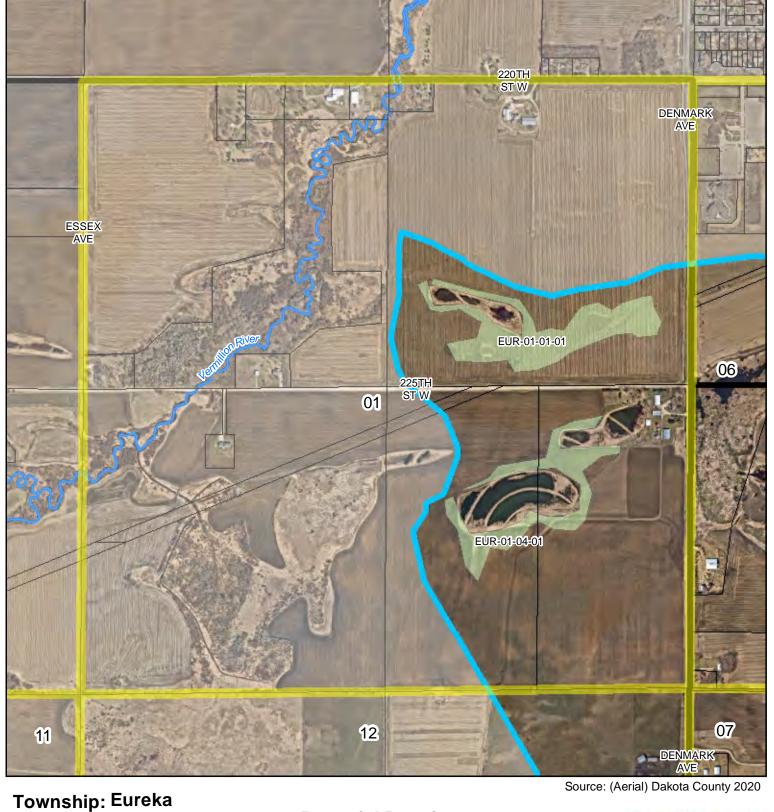
The area of the South Branch Vermillion River Subwatershed that lies within Section 1 of Eureka Township is approximately 185 acres. It consists primarily of agricultural cropland, several wetlands, and one farmsite. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Waukegan silt loam with 0-6% slopes, Cylinder loam, and Marshan silty clay loam are the predominant soil types.

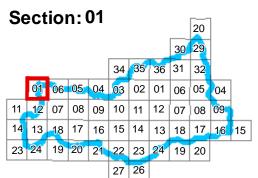
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
EUR-01-04-01	393 - Filter Strip	11	Acres	26.32	\$7,420	\$28
EUR-01-01-01	393 - Filter Strip	14	Acres	7.31	\$8,920	\$122





Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800



Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



1,600



Description:

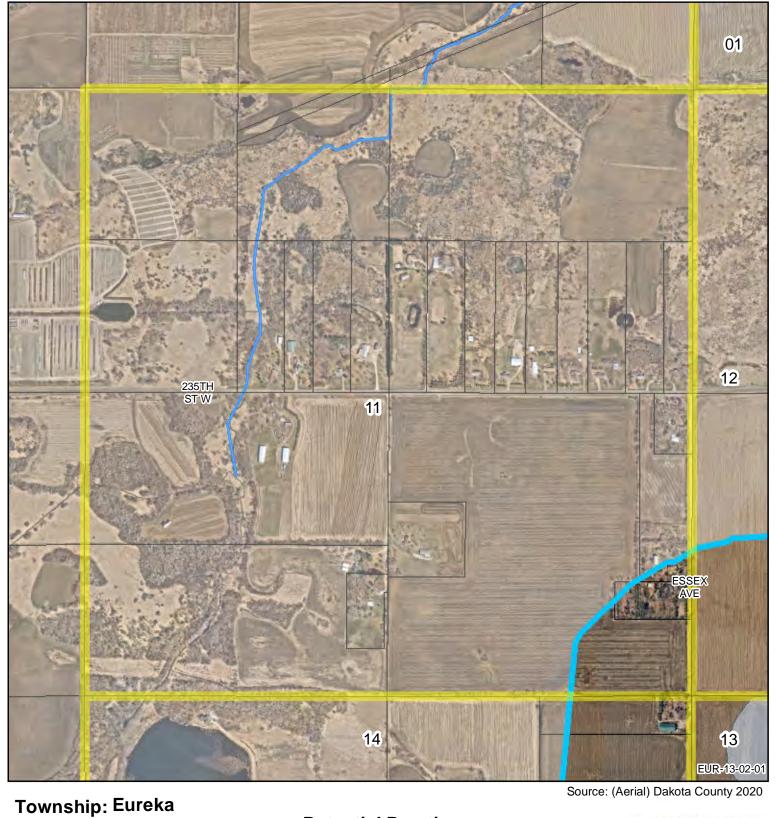
The area of the South Branch Vermillion River Subwatershed that lies within Section 11 of Eureka Township is approximately 22 acres. It consists primarily of agricultural cropland, a homesite, and wooded grassland. Conventional tillage practices are utilized on the majority of the cropland. Wadena loam with 2-6% slopes and Ostrander loam with 1-6% slopes are the predominant soil types.

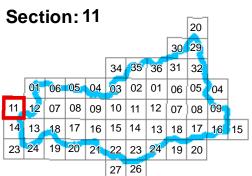
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.





Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed



1,600



Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 12 of Eureka Township is approximately 325 acres. It consists primarily of agricultural cropland with a couple of farmsites and part of a gravel mining operation. Conventional tillage practices are utilized on the majority of the cropland. Most of the surface water runoff from this section passes through a recently constructed nitrate removal wetland on the east side Denmark. Waukegan silt loam with 1-6% slopes, Wadena loam with 2-6% slopes, and Maxfield silty clay loam are the predominant soil types.

Land Management Recommendations:

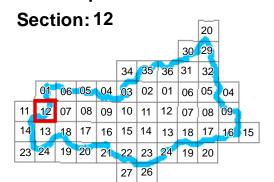
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Potential Practices

Stream Stabilization

--- Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



1,600



Description:

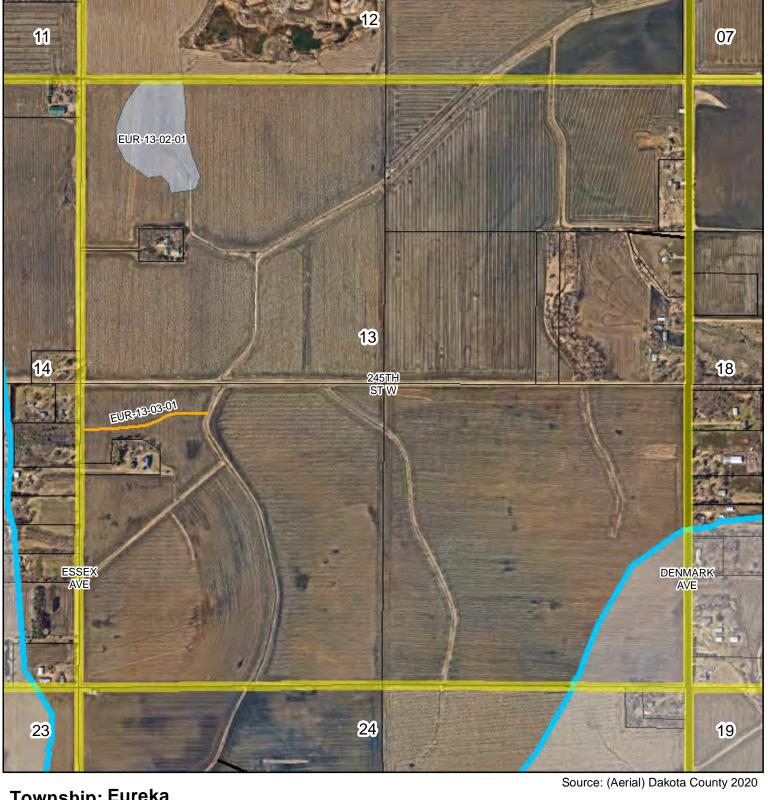
The area of the South Branch Vermillion River Subwatershed that lies within Section 13 of Eureka Township is approximately 615 acres. It consists primarily of agricultural cropland with a few homesites. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Maxfield silty clay loam, and Klinger silt loam with 1-5% slopes are the predominant soil types.

Land Management Recommendations:

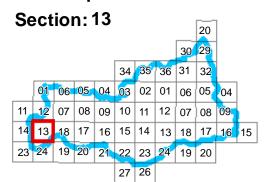
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
EUR-13-03-01	412 - Grassed Waterway - complex 20' design	1,082	Lin. Feet	7.57	\$10,026	\$132
EUR-13-02-01	657 - Wetland Restoration	11	Acres	14.31	\$62,200	\$435







Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



1,600



Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 14 of Eureka Township is approximately 90 acres. It consists primarily of agricultural cropland in the northern portion and homesites in the southern portion. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes and Klinger silt loam with 1-5% slopes are the predominant soil types.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Section: 14 34 35 36 31 06 05 04 03 02 01 06 05 04 08 09 11 12 | 07 08 09 15 14 17 16 15 13 18 19 20 21 22 19 20 23 24

Potential Practices

Stream Stabilization

— Grade Stabilization

— Water and Sediment Control Basin

— Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



1,600



Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 23 of Eureka Township is approximately 11 acres. It consists of agricultural cropland. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes is the predominant soil type.

Land Management Recommendations:

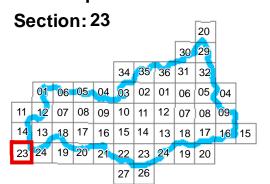
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Township: Eureka



Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





Eureka Township, Section 24

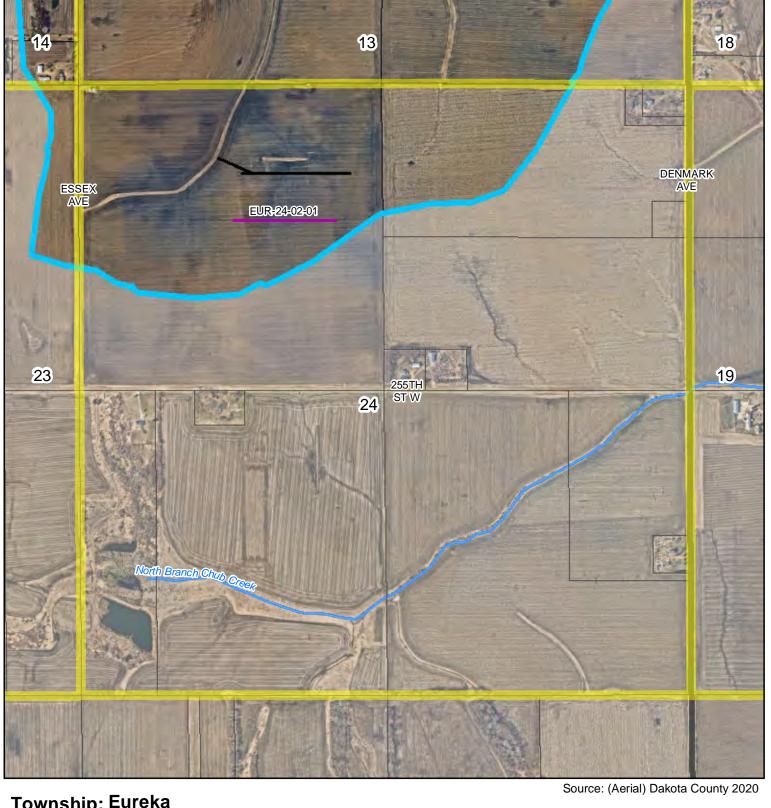
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 24 of Eureka Township is approximately 132 acres. It consists of agricultural cropland. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Klinger silt loam with 1-5% slopes, and Maxfield silty clay loam are the predominant soil types.

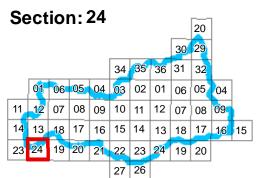
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township-				Sediment Reduction	Estimated Project	Cost/Ton of Sediment
Section-1/4-#)	BMP/Project Name	Size	Units	(ton/yr)	Cost	Reduction
EUR-24-02-01	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7,940	\$311







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Castle Rock Township, Section 1

Description:

All 640 acres of Section 1 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, pasture, deciduous woodland, riparian wetlands, and several homesites. The South Branch Vermillion River flows through the western portion of the section. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Wadena loam with 2-6% slopes, Rockton loam with 2-6% slopes, and Dickinson sandy loam with 2-6% slopes are the predominant soil types.

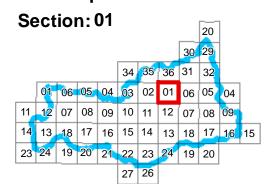
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

						Cost/Ton
Feature ID				Sediment	Estimated	of
(Township-				Reductio	Project	Sediment
Section-1/4-#)	BMP/Project Name	Size	Units	n (ton/yr)	Cost	Reduction
	580 - Streambank and Shoreline					
CAS-01-02-01	Protection	500	Sq. Feet	15.94	\$57,280	\$359







Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



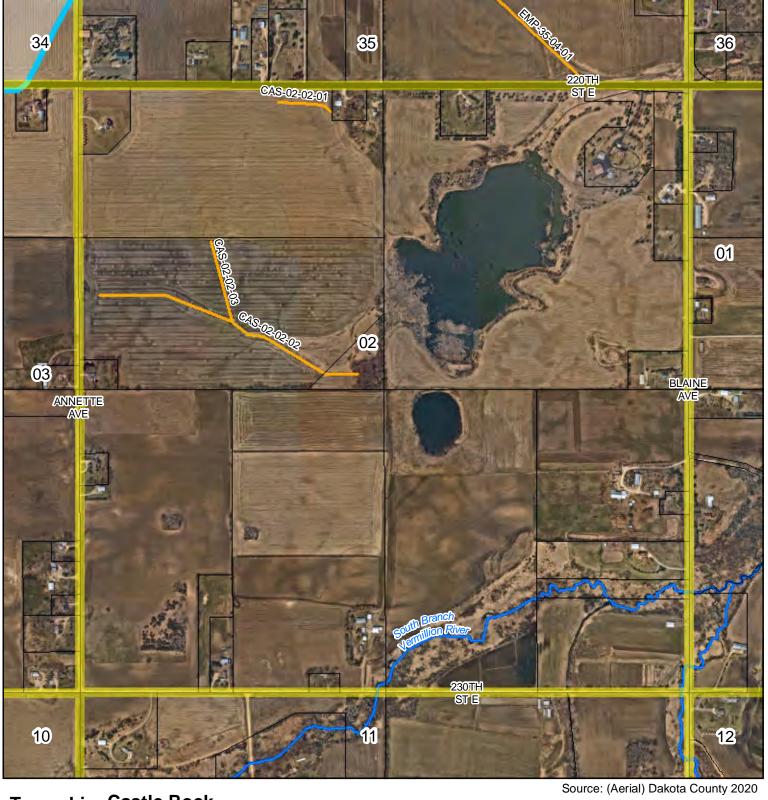


All 640 acres of Section 2 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, a large restored wetland, several farmsites and homesites, several pastures, and some riparian wetlands adjacent to the South Branch Vermillion River. The South Branch Vermillion River flows through the southeastern portion of the section. Conventional tillage practices are utilized on the majority of the cropland. Some of the agricultural fields in the southern portion of the section are in small plots of vegetables and flowers. About half of the cropland is irrigated. Wadena loam with 2-6% slopes and Hawick coarse sandy loam with 6-12% slopes are the predominant soil types.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	412 - Grassed Waterway - complex 20'					
CAS-02-02-02	design	2,414	Lin. Feet	133.37	\$14,690	\$11
	412 - Grassed Waterway- complex 30'					
CAS-02-02-03	design	715	Lin. Feet	24.31	\$9,900	\$41
	412 - Grassed Waterway - complex 20'					
CAS-02-02-01	design	475	Lin. Feet	10.09	\$7,903	\$78



Township: Castle Rock

Section: 02 30 29 34 35 36 31 06 05 04 03 02 01 06 05 04 08 09 10 12 | 07 08 09 15 14 17 16 15 16 13 18 19 20 21 22 23 24 19 20 27 26

Potential Practices

Stream Stabilization

— Grade Stabilization

Orado Otabinization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed





Castle Rock Township, Section 3

Description:

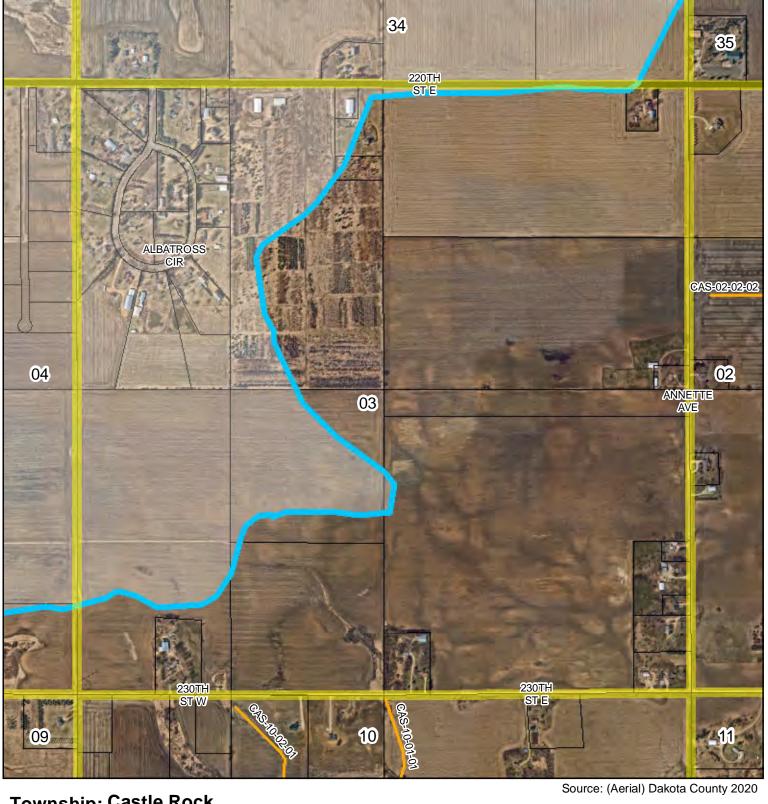
The area of the South Branch Vermillion River Subwatershed that lies within Section 3 of Castle Rock Township is approximately 440 acres. It consists primarily of agricultural cropland, several homesites, and grassland with sparse trees. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Wadena loam with 2-6% slopes is the predominant soil type.

Land Management Recommendations:

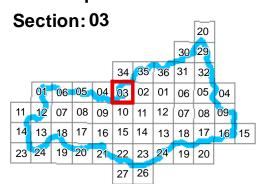
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Castle Rock Township, Section 4

Description:

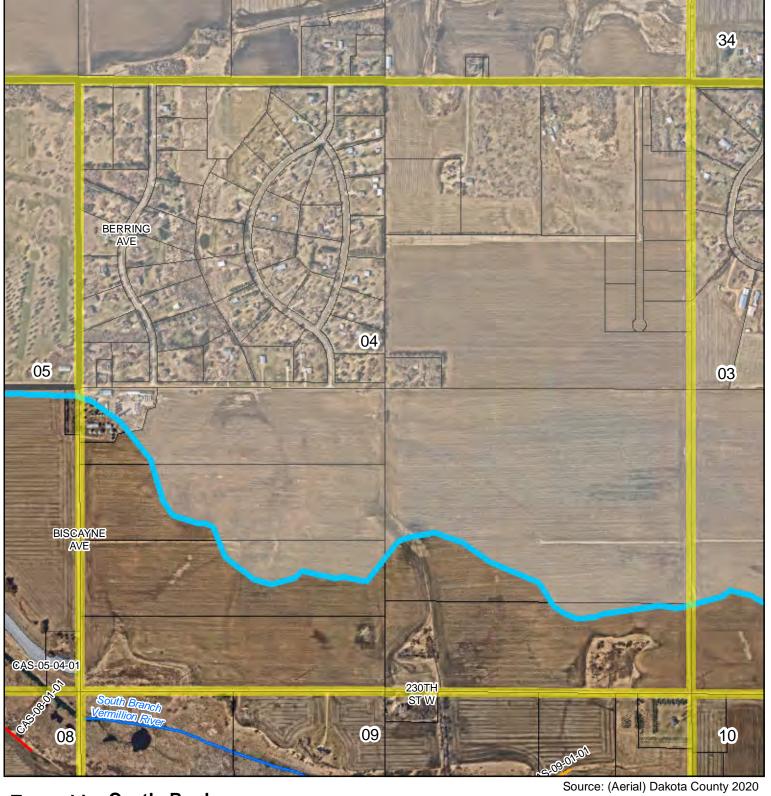
The area of the South Branch Vermillion River Subwatershed that lies within Section 4 of Castle Rock Township is approximately 150 acres. It consists primarily of agricultural cropland with a few dispersed wetlands. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Ostrander loam with 1-6% slopes is the predominant soil type.

Land Management Recommendations:

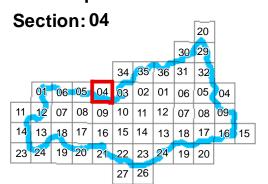
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Township: Castle Rock



Stream Stabilization

Otteam Stabilizatio

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





Castle Rock Township, Section 5

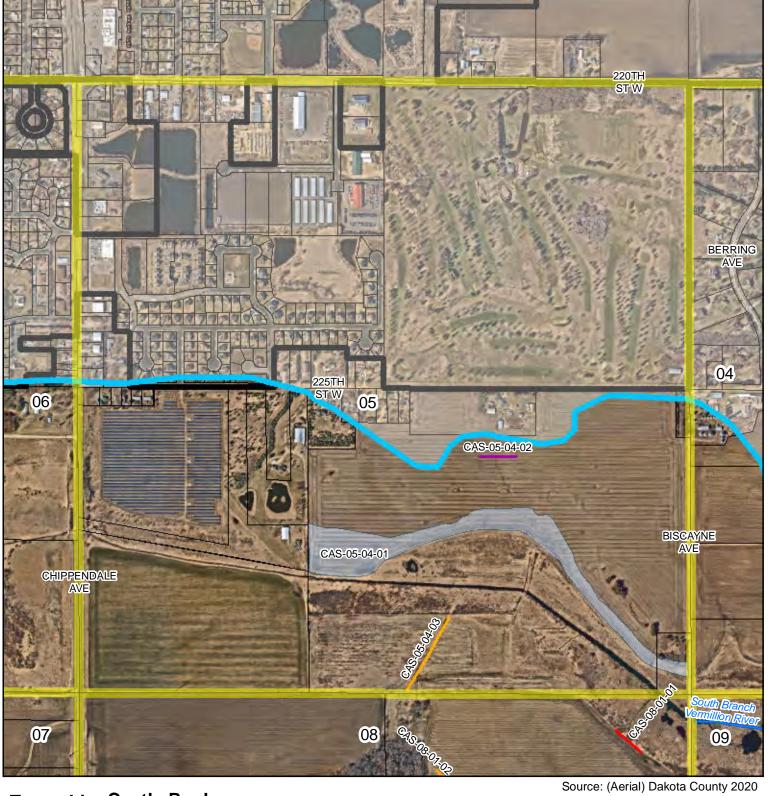
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 5 of Castle Rock Township is approximately 300 acres. It consists primarily of agricultural cropland (both row crops and sod farms), a solar field, wetlands adjacent to the South Branch Vermillion River, and several residential homesites. Conventional tillage practices are utilized on the majority of the cropland. Marshan silty clay loam and Kato silty clay loam are the predominant soil types.

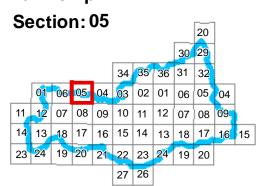
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-05-04-03	412 - Grassed Waterway - simple design	760	Lin. Feet	4.66	\$7,720	\$166
CAS-05-04-02	638 - Water & Sediment Control Basin (wide)	1	Each	5.10	\$14,640	\$287
CAS-05-04-01	657 - Wetland Restoration	16	Acres	19.20	\$87,200	\$454



Township: Castle Rock



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch

Subwatershed



800

400



DAKOTA COUNTY

SOIL & WATER

CONSERVATION DISTRICT

Castle Rock Township, Section 6

Description:

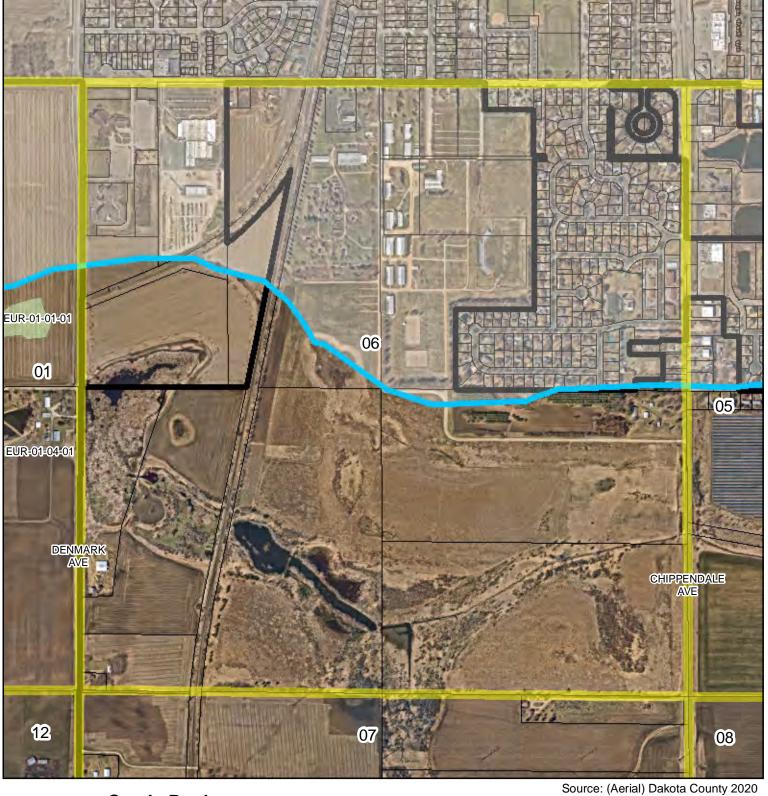
The area of the South Branch Vermillion River Subwatershed that lies within Section 6 of Castle Rock Township is approximately 370 acres. It consists primarily of restored prairie, wetlands adjacent to the South Branch Vermillion River, agricultural cropland, and some homesites. Conventional tillage practices are utilized on the majority of the cropland. Marshan silty clay loam and Wadena loam with 0-2% slopes are the predominant soil types.

Land Management Recommendations:

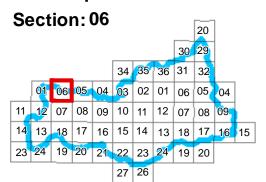
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Township: Castle Rock



Stream Stabilization

— Grade Stabilization

— Water and Sediment Control Basin

Weterwey

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





Castle Rock Township, Section 7

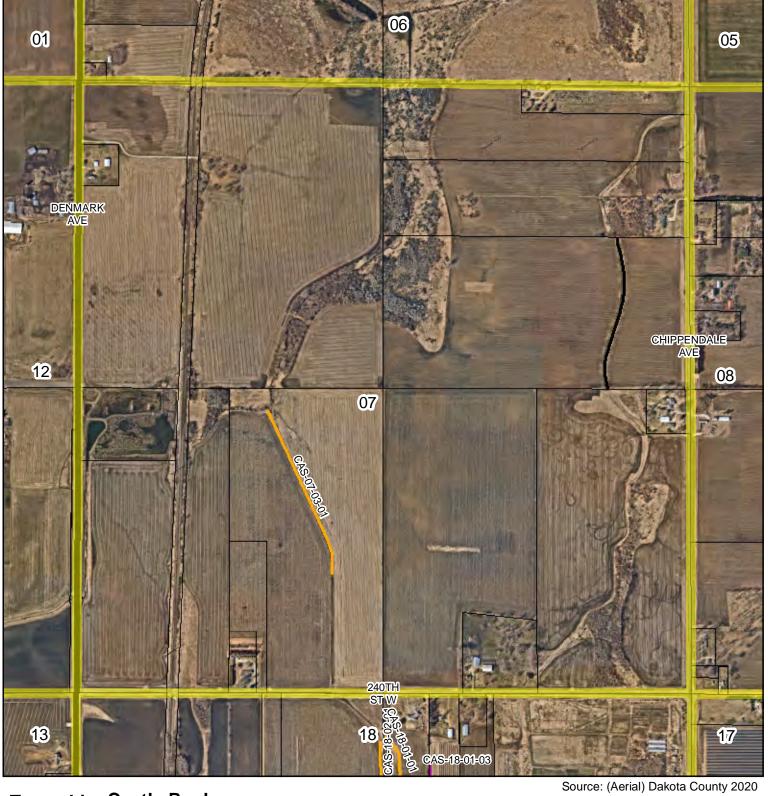
Description:

All 640 acres of Section 7 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, several wetlands, and multiple farmsites/homesites. A nitrate removal wetland was recently constructed in the western portion of the section to treat runoff and tile discharge from upstream properties. Conventional tillage practices are utilized on the majority of the cropland. Maxfield silty clay loam, Waukegan silt loam with 1-6% slopes, and Klinger silt loam with 1-5% slopes are the predominant soil types.

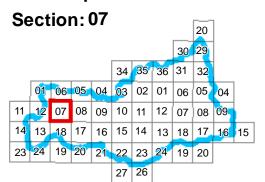
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	412 - Grassed Waterway - complex 20'					
CAS-07-03-01	design	1,540	Lin. Feet	93.80	\$11,629	\$12



Township: Castle Rock



Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Castle Rock Township, Section 8

Description:

All 640 acres of Section 8 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, several home/farmsites, wetlands, and grassland. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Maxfield silty clay loam, Klinger silt loam with 1-5% slopes, and Ostrander-Carmi loams with 2-6% slopes are the predominant soil types.

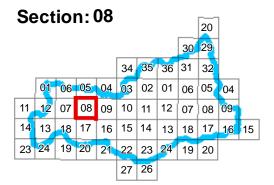
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-08-01-01	638 - Water & Sediment Control Basin (narrow)	1	Each	28.69	\$7,940	\$28
CAS-08-01-02	412 - Grassed Waterway - simple design	315	Lin. Feet	8.70	\$6,384	\$73



Township: Castle Rock



Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





All 640 acres of Section 9 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, wetlands, and several home/farmsites. The South Branch Vermillion River flows through the northern portion of this section and includes sizeable wetlands on both sides of the channel. Conventional tillage practices are utilized on the majority of the cropland. Maxfield silty clay loam, Klossner muck with 0-1% slopes, and Klinger silt loam with 1-5% slopes are the predominant soil types.

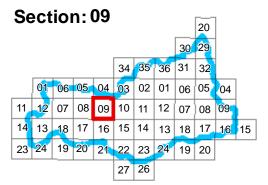
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-09-04-01	412 - Grassed Waterway- complex 30' design	1,919	Lin. Feet	16.79	\$14,716	\$88
CAS-09-03-01	657 - Wetland Restoration	32.00	Acres	136.73	\$167,200	\$122
CAS-09-01-01	412 - Grassed Waterway - complex 20' design	303	Lin. Feet	4.24	\$7,301	\$172



Township: Castle Rock



Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



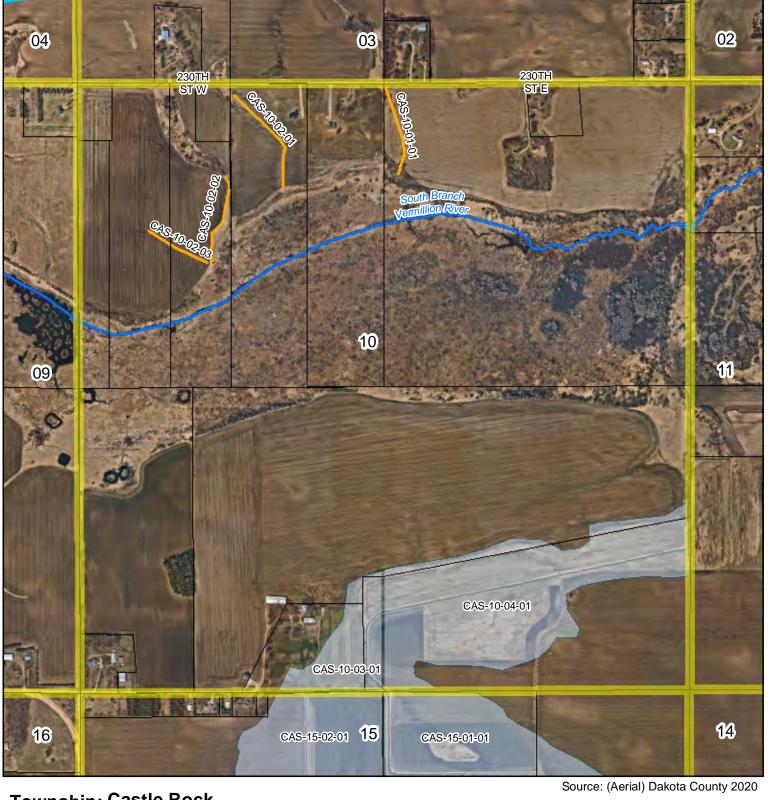


All 640 acres of Section 10 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, wetlands, and several home/farmsites. The South Branch Vermillion River flows through the northern portion of this section and includes sizeable wetlands on both sides of the channel. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Klossner muck with 0-1% slopes, Marshan silty clay loam, and Wadena loam with 2-6% slopes are the predominant soil types.

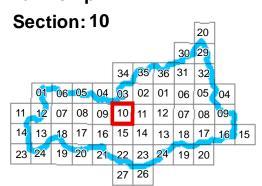
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	412 - Grassed Waterway - complex 20'					
CAS-10-02-01	design	975	Lin. Feet	36.68	\$9,652	\$26
CAS-10-03-01	657 - Wetland Restoration	11	Acres	224.20	\$62,200	\$28
	412 - Grassed Waterway - complex 20'					
CAS-10-01-01	design	777	Lin. Feet	21.47	\$8,961	\$42
CAS-10-02-03	412 - Grassed Waterway - simple design	583	Lin. Feet	16.10	\$7,189	\$45
	412 - Grassed Waterway- complex 30'					
CAS-10-02-02	design	786	Lin. Feet	17.89	\$10,186	\$57
CAS-10-04-01	657 - Wetland Restoration	49	Acres	36.94	\$252,200	\$683







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

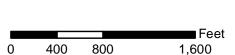
Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





DAKOTA COUNTY

SOIL & WATER

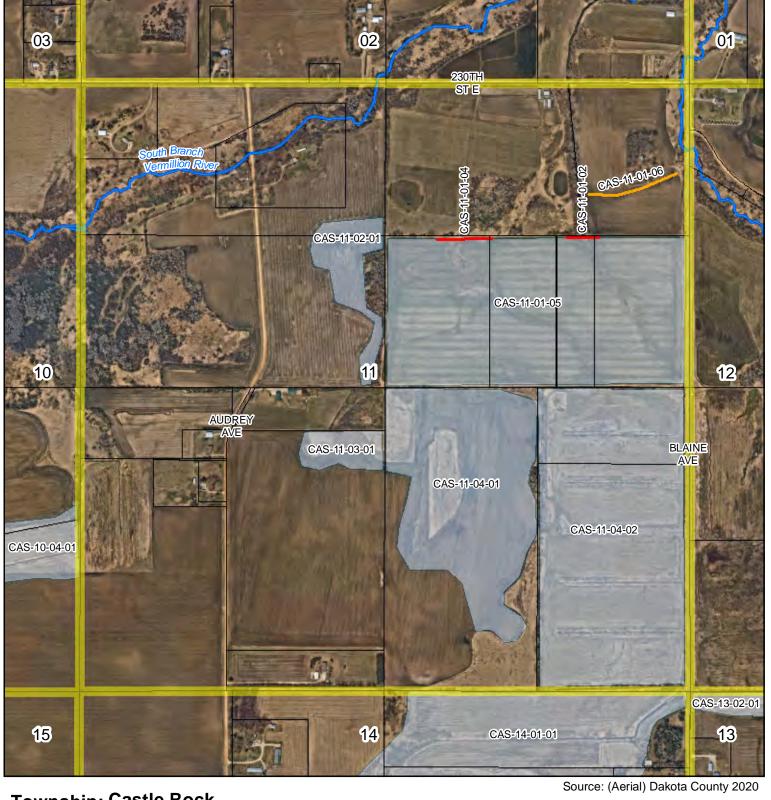
CONSERVATION DISTRICT

All 640 acres of Section 11 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland (both row-crops and sod fields), wetlands, and several home/farmsites. The South Branch Vermillion River flows through the northwest portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Marshan silty clay loam, Klossner muck with 0-1% slopes, Seelyeville muck, and Wadena loam with 2-6% slopes are the predominant soil types.

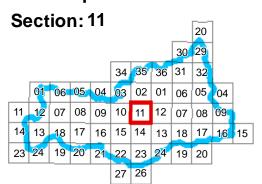
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-11-01-06	412 - Grassed Waterway - complex 20' design	797	Lin. Feet	18.12	\$9,028	\$50
CAS-11-02-01	657 - Wetland Restoration	9	Acres	11.15	\$52,200	\$468
CAS-11-01-02	410 - Grade Stabilization Structure 10-100ac	1	Each	4.40	\$26,640	\$605
CAS-11-01-04	410 - Grade Stabilization Structure 10-100ac	1	Each	2.48	\$26,640	\$1,076
CAS-11-04-01	657 - Wetland Restoration	49	Acres	20.62	\$252,200	\$1,223
CAS-11-01-05	657 - Wetland Restoration	75	Acres	23.11	\$382,200	\$1,654
CAS-11-04-02	657 - Wetland Restoration	75	Acres	17.25	\$382,200	\$2,216
CAS-11-03-01	657 - Wetland Restoration	5	Acres	0.98	\$32,200	\$3,286



Township: Castle Rock



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



DAKOTA COUNTY



All 640 acres of Section 12 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland (both row-crop and sod fields), wetlands, several homesites/farmsites, and grassland with scattered trees. A large wetland restoration has recently been completed on the southwest portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Marshan silty clay loam, Seelyeville muck, and Klossner muck with 0-1% slopes are the predominant soil types.

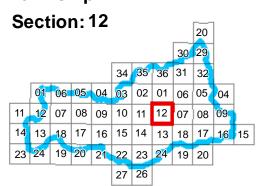
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-12-04-01	657 - Wetland Restoration	38	Acres	341.75	\$197,200	\$58
	410 - Grade Stabilization Structure 10-					
CAS-12-04-02	100ac	1	Each	1.40	\$26,640	\$1,903
CAS-12-01-01	410 - Grade Stabilization Structure 0-10ac	1	Each	0.70	\$13,940	\$1,991



Township: Castle Rock



Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



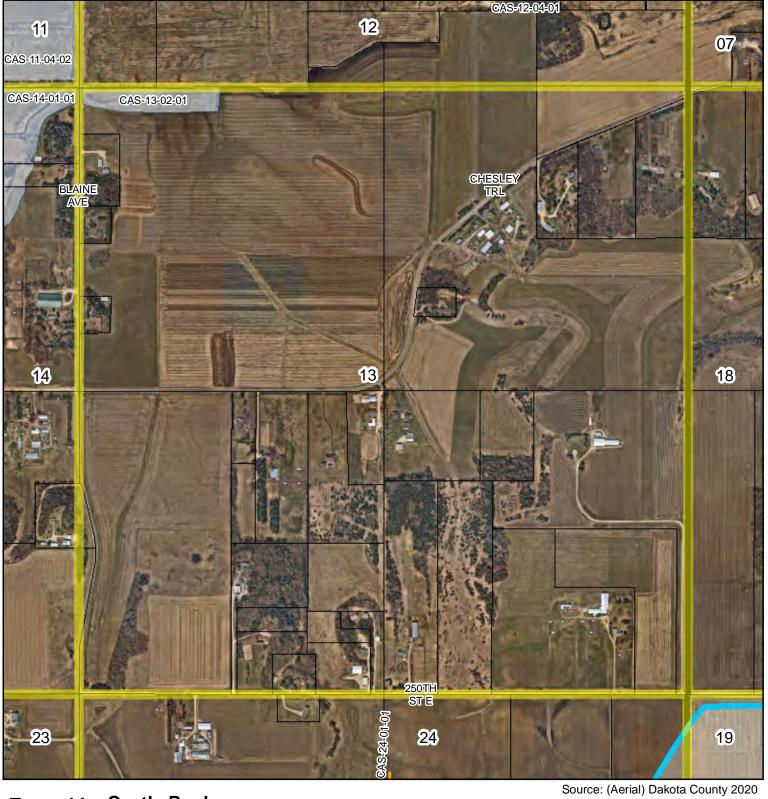


All 640 acres of Section 13 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, grassland with scattered trees, residential homesites, and multiple pastures. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Wadena loam with 0-2% slopes, Etter fine sandy loam with 2-6% slopes, and Ostrander loam with 1-6% slopes are the predominant soil types.

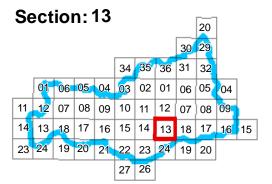
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-13-02-01	657 - Wetland Restoration	5	Acres	101.40	\$32,200	\$32



Township: Castle Rock



Potential Practices

Stream Stabilization

— Grade Stabilization

Orado Otabinization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



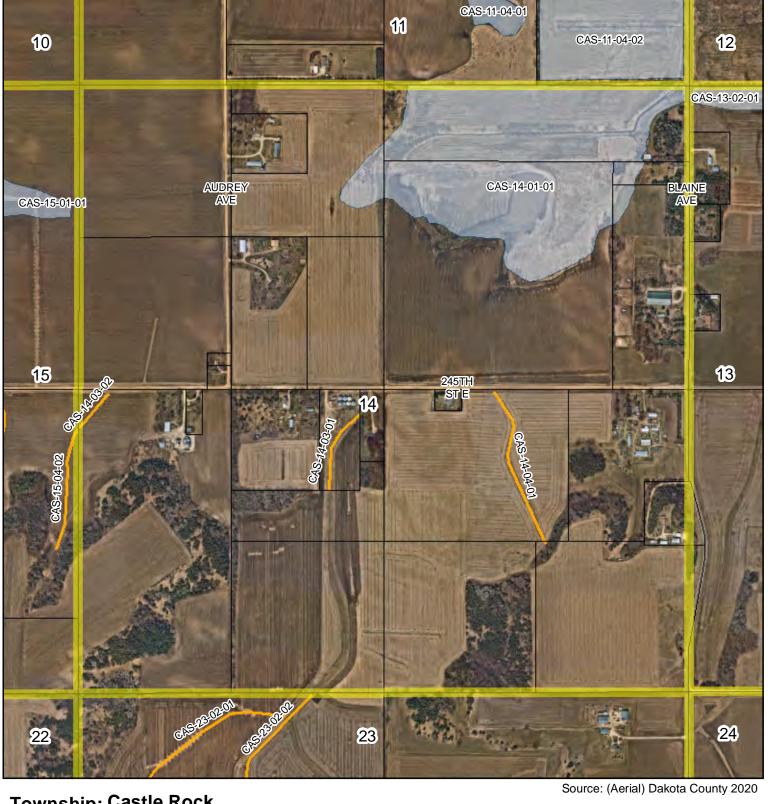


All 640 acres of Section 14 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, and several home/farmsites. There are several areas of steep slopes, most of which are grassland with trees. Conventional tillage practices are utilized on the majority of the cropland. About half of the cropland is irrigated. Etter fine sandy loam with 2-6% slopes and Wadena loam with 0-2% slopes are the predominant soil types.

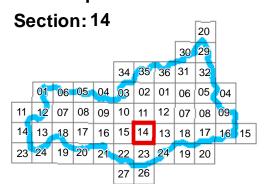
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	412 - Grassed Waterway - complex 20'		Lin.			
CAS-14-04-01	design	1,434	Feet	25.63	\$11,258	\$44
CAS-14-01-01	657 - Wetland Restoration	72	Acres	389.61	\$367,200	\$94
	412 - Grassed Waterway - complex 20'		Lin.			
CAS-14-03-02	design	377	Feet	6.40	\$7,558	\$118
	412 - Grassed Waterway- complex 30'		Lin.			
CAS-14-03-01	design	740	Feet	2.04	\$10,001	\$491







Stream Stabilization Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



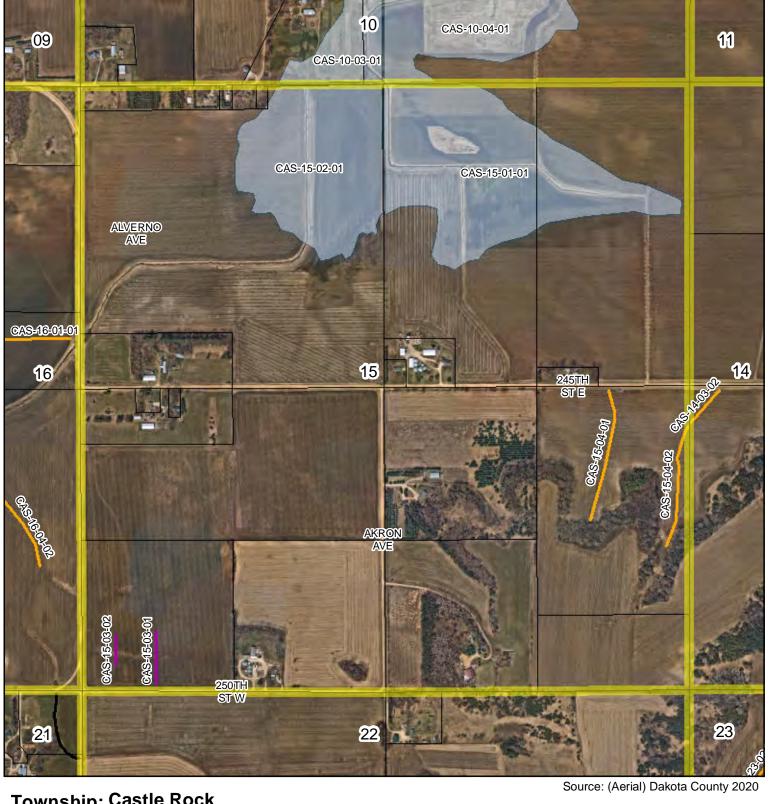


All 640 acres of Section 15 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, and several home/farmsites. There are several areas of steep slopes, most of which are grassland with trees. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Etter fine sandy loam with 2-6% slopes, Marshan silty clay loam, and Ostrander loam with 1-6% slopes are the predominant soil types.

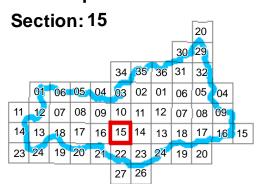
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-15-02-01	657 - Wetland Restoration	35	Acres	623.10	\$182,200	\$29
CAS-15-04-01	412 - Grassed Waterway - complex 20' design	1,156	Lin. Feet	31.80	\$10,287	\$32
CAS-15-04-02	412 - Grassed Waterway - complex 20' design	1,070	Lin. Feet	22.74	\$9,986	\$44
CAS-15-01-01	657 - Wetland Restoration	50	Acres	110.86	\$257,200	\$232
CAS-15-03-01	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7,940	\$311
CAS-15-03-02	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7,940	\$311







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

Wetland Restoration Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



DAKOTA COUNTY

SOIL & WATER

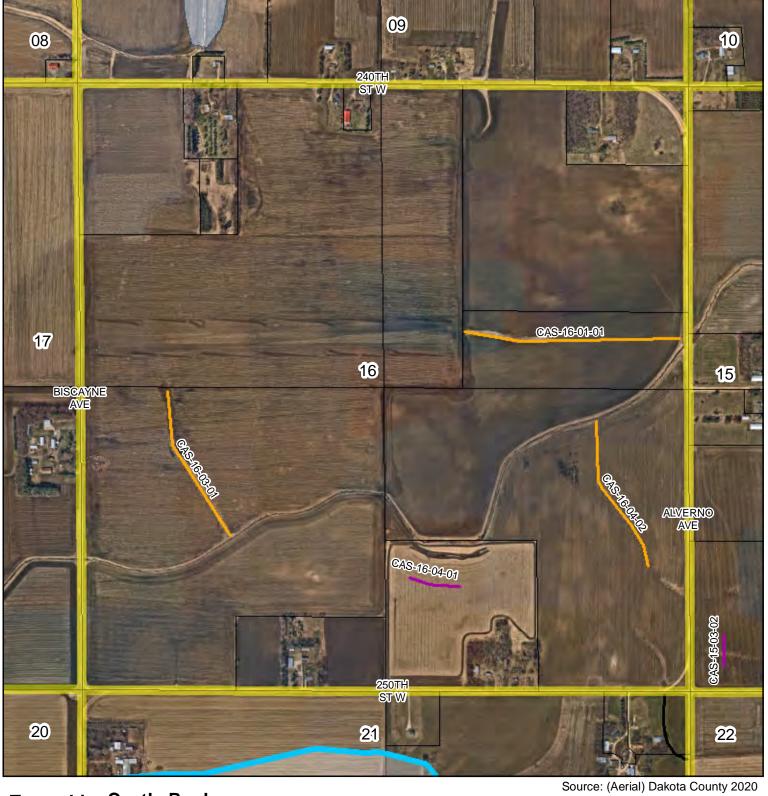
CONSERVATION DISTRICT

All 640 acres of Section 16 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland with several home/farmsites. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes and Klinger silt loam with 1-5% slopes are the predominant soil types.

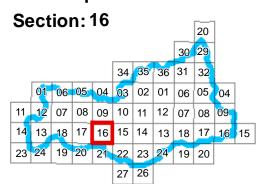
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-16-03-01	412 - Grassed Waterway - simple design	1,399	Lin. Feet	19.33	\$9,638	\$50
CAS-16-01-01	412 - Grassed Waterway- complex 30' design	1,868	Lin. Feet	28.34	\$14,513	\$51
CAS-16-04-02	412 - Grassed Waterway - complex 20' design	1,393	Lin. Feet	17.76	\$11,114	\$63
CAS-16-04-01	638 - Water & Sediment Control Basin (narrow)	1	Each	3.30	\$7,940	\$241



Township: Castle Rock



Stream Stabilization

--- Grade Stabilization

Water and Sediment Control Basin

— Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





DAKOTA COUNTY

SOIL & WATER

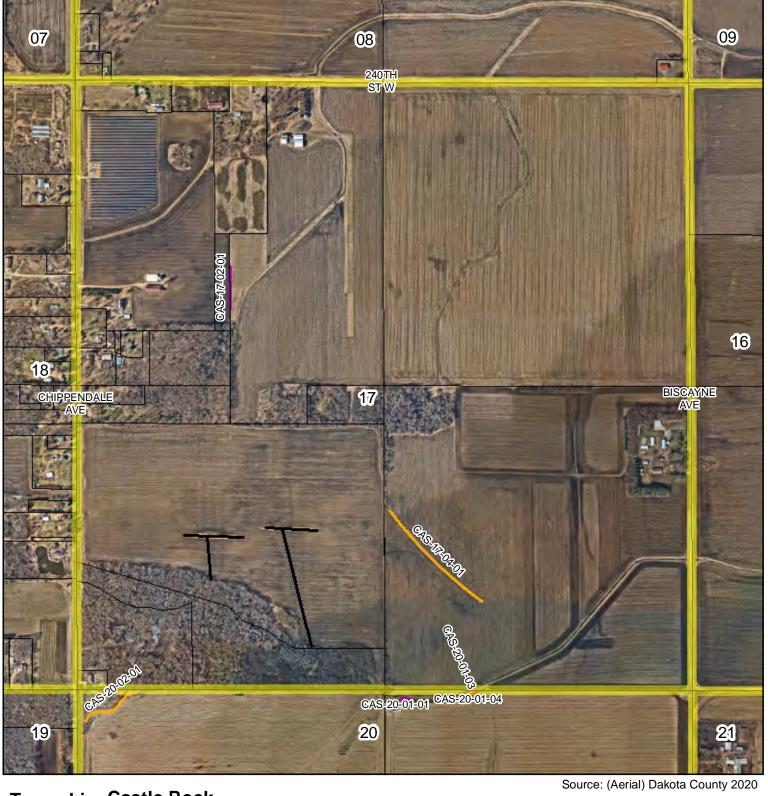
CONSERVATION DISTRICT

All 640 acres of Section 17 of Castle Rock Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, pockets of deciduous woodland, a solar field, and several home/farmsites. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes and Maxfield silty clay loam are the predominant soil types.

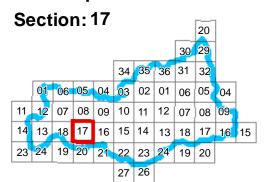
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township-				Sediment Reduction	Estimated Project	Cost/Ton of Sediment
Section-1/4-#)	BMP/Project Name	Size	Units	(ton/yr)	Cost	Reduction
CAS-17-04-01	412 - Grassed Waterway- complex 30' design	1,121	Lin. Feet	12.75	\$11,525	\$90
CAS-17-02-01	638 - Water & Sediment Control Basin (narrow)	1	Each	0.35	\$7,940	\$2,269







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

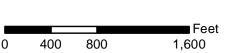
Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





DAKOTA COUNTY

SOIL & WATER

CONSERVATION DISTRICT

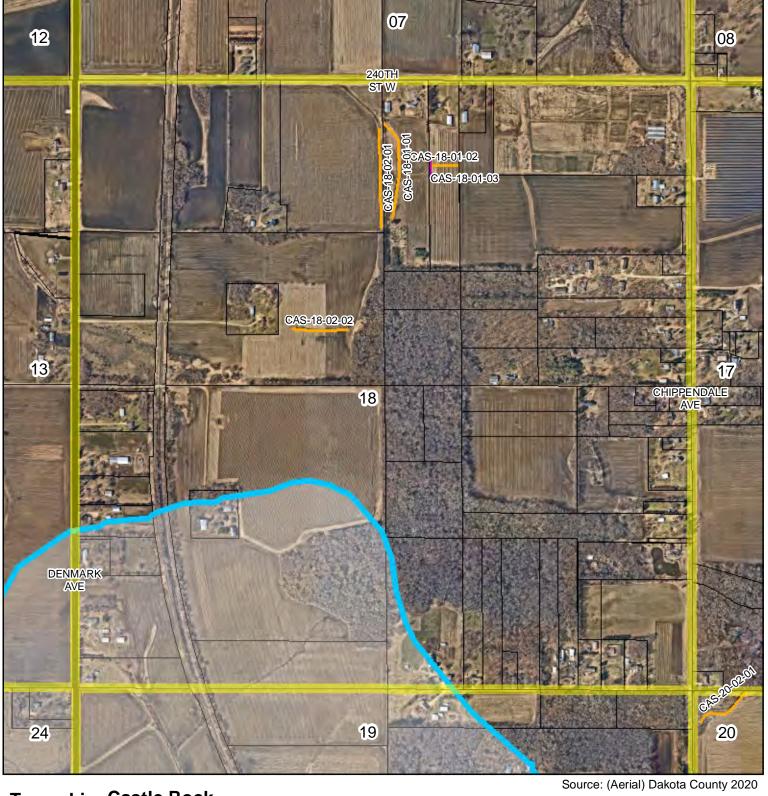
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 18 of Castle Rock Township is approximately 540 acres. It consists primarily of agricultural cropland, deciduous woodland, and several homesites. Railroad tracks pass through the western portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Maxfield silty clay loam, and Klinger silt loam with 1-5% slopes are the predominant soil types.

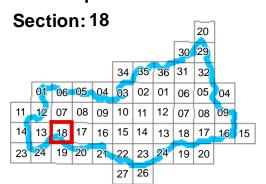
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4- #)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-18-01-01	412 - Grassed Waterway - complex 20' design	875	Lin. Feet	19.92	\$9,304	\$47
CAS-18-02-01	412 - Grassed Waterway - complex 20' design	861	Lin. Feet	19.58	\$9,252	\$47
CAS-18-02-02	412 - Grassed Waterway - complex 20' design	473	Lin. Feet	6.53	\$7,896	\$121
CAS-18-01-03	638 - Water & Sediment Control Basin (narrow)	1	Each	4.20	\$7,940	\$189
CAS-18-01-02	412 - Grassed Waterway- complex 30' design	244	Lin. Feet	3.42	\$8,017	\$235







Stream Stabilization

--- Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed





Castle Rock Township, Section 19

Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 19 of Castle Rock Township is approximately 40 acres. It consists primarily of deciduous woodland, and small agricultural fields. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes and Maxfield silty clay loam are the predominant soil types.

Land Management Recommendations:

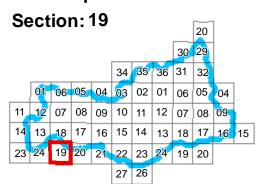
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





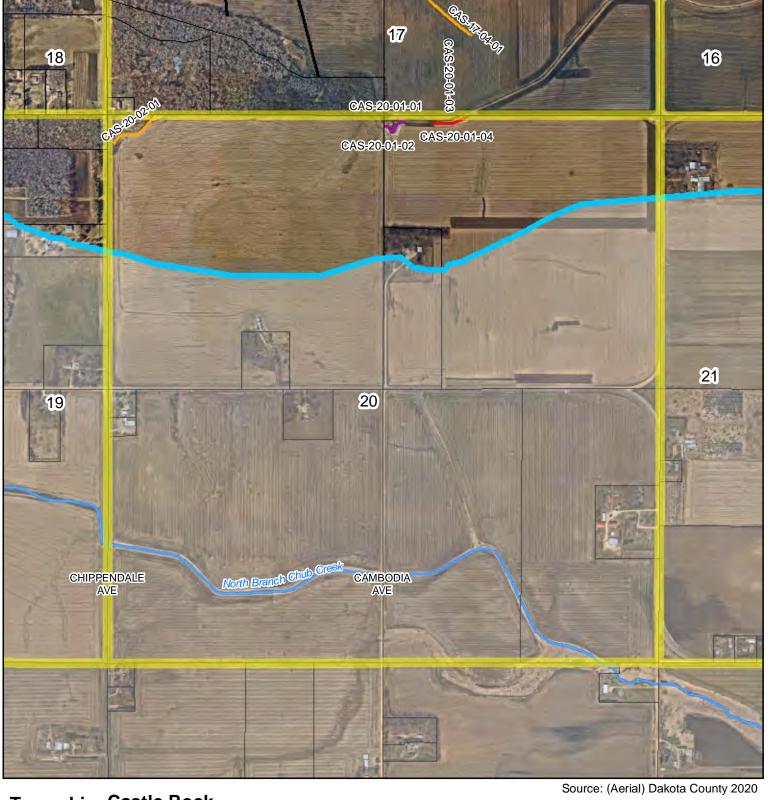
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 20 of Castle Rock Township is approximately 160 acres. It consists primarily of agricultural cropland along with a portion of a farmsite. Conventional tillage practices are utilized on the majority of the cropland. About half of the cropland is irrigated. Ostrander loam with 1-6% slopes and Maxfield silty clay loam are the predominant soil types.

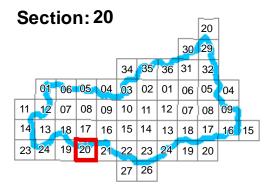
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-20-02-01	412 - Grassed Waterway - complex 20' design	501	Lin. Feet	5.70	\$7,994	\$140
CAS-20-01-02	393 - Filter Strip	0	Acres	1.13	\$2,065	\$183
CAS-20-01-01	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7,940	\$311
CAS-20-01-04	393 - Filter Strip	0.3	Acres	0.22	\$2,055	\$934
	410 - Grade Stabilization Structure 10-					
CAS-20-01-03	100ac	1	Each	1.05	\$26,640	\$2,537



Township: Castle Rock



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

— Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strip

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



Feet



Castle Rock Township, Section 21

Description:

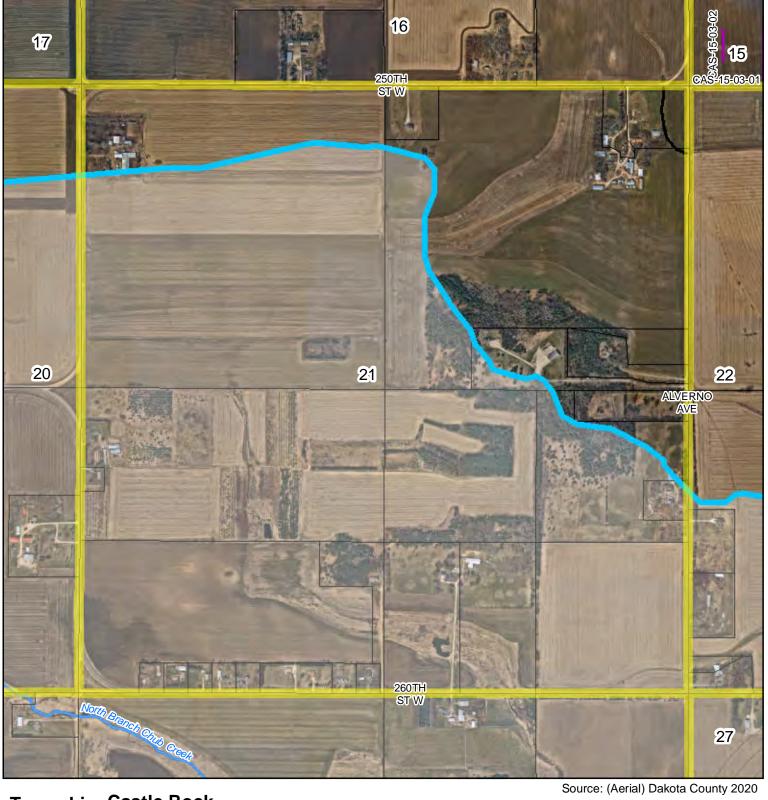
The area of the South Branch Vermillion River Subwatershed that lies within Section 21 of Castle Rock Township is approximately 180 acres. It consists primarily of agricultural cropland with a couple of farmsites. Conventional tillage practices are utilized on some of the cropland and some of the cropland has perennial alfalfa cover. Ostrander loam with 1-6% slopes, Etter fine sandy loam with 2-6% slopes, and Wadena loam with 0-2% slopes are the predominant soil types.

Land Management Recommendations:

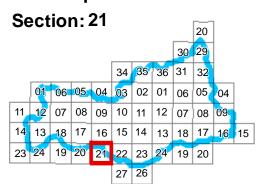
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Township: Castle Rock



Potential Practices

Stream Stabilization

otroam otabinzano

—— Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





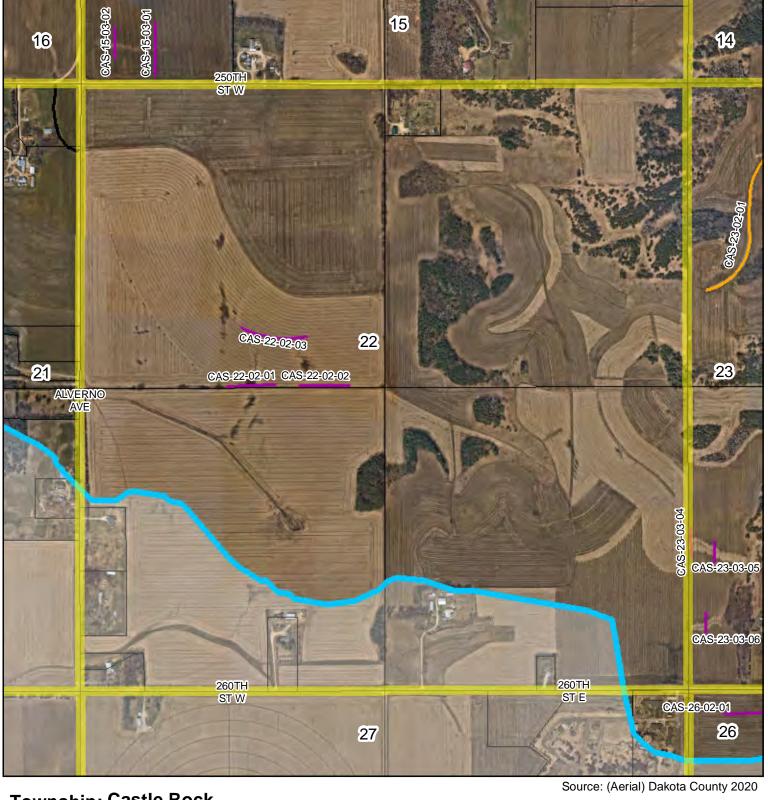
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 22 of Castle Rock Township is approximately 525 acres. The area primarily consists of agricultural cropland. There are several areas of steep slopes, most of which are grassland with trees. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Etter fine sandy loam with 2-6% slopes, and Wadena loam with 2-6% slopes are the predominant soil types.

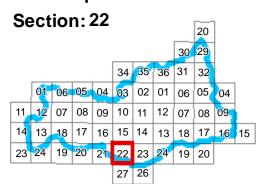
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-22-02-02	638 - Water & Sediment Control Basin (wide)	1	Each	4.78	\$14,640	\$306
CAS-22-02-03	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7.940	\$311
CAS-22-02-01	638 - Water & Sediment Control Basin (wide)	1	Each	1.28	\$14,640	\$1,148







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch

Subwatershed





DAKOTA COUNTY

SOIL & WATER

CONSERVATION DISTRICT

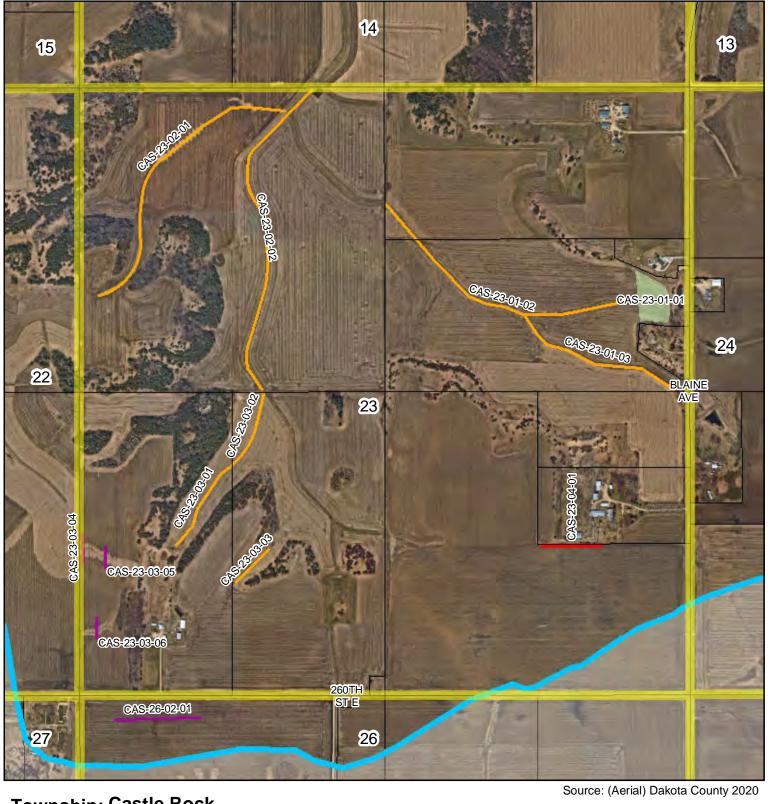
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 23 of Castle Rock Township is approximately 630 acres. The area primarily consists of agricultural cropland and several home/farmsites. There are several areas of steep slopes, most of which are grassland with trees. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Wadena loam with 0-2% slopes, Ostrander loam with 1-6% slopes, and Etter-Brodale complex with 25-60% slopes are the predominant soil types.

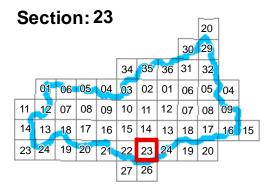
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4- #)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
CAS-23-01-01	342 - Critical Area Planting (Native Plants)	2	Acres	8.51	\$3,120	\$37
CAS-23-02-02	412 - Grassed Waterway- complex 30' design	2,906	Lin. Feet	31.97	\$18,665	\$58
CAS-23-01-02	412 - Grassed Waterway- complex 30' design	2,566	Lin. Feet	28.23	\$17,306	\$61
CAS-23-01-03	412 - Grassed Waterway - complex 20' design	1,507	Lin. Feet	16.58	\$11,514	\$69
CAS-23-02-01	412 - Grassed Waterway- complex 30' design	2,630	Lin. Feet	18.08	\$17,562	\$97
CAS-23-03-01	412 - Grassed Waterway - complex 20' design	858	Lin. Feet	8.25	\$9,242	\$112
CAS-23-03-02	412 - Grassed Waterway - complex 20' design	685	Lin. Feet	6.60	\$8,639	\$131
CAS-23-03-03	412 - Grassed Waterway - complex 20' design	411	Lin. Feet	4.24	\$7,679	\$181
CAS-23-03-06	638 - Water & Sediment Control Basin (wide)	1	Each	1.28	\$14,640	\$1,148
CAS-23-03-04	638 - Water & Sediment Control Basin (wide)	1	Each	1.28	\$14,640	\$1,148
CAS-23-03-05	638 - Water & Sediment Control Basin (wide)	1	Each	1.28	\$14,640	\$1,148
CAS-23-04-01	410 - Grade Stabilization Structure 10-100ac	1	Each	0.41	\$26,640	\$6,458



Township: Castle Rock



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

400

800

Waterway Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 24 of Castle Rock Township is approximately 300 acres. It consists primarily of agricultural cropland with several home/farmsites. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes is the predominant soil type.

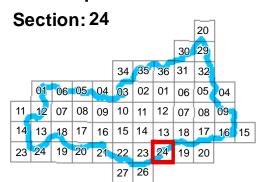
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	412 - Grassed Waterway - complex 20'					
CAS-24-01-01	design	838	Lin. Feet	11.00	\$9,172	\$83
	412 - Grassed Waterway - complex 20'					
CAS-24-02-01	design	946	Lin. Feet	4.88	\$9,553	\$196







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

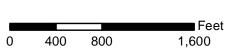
Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





DAKOTA COUNTY



Castle Rock Township, Section 26

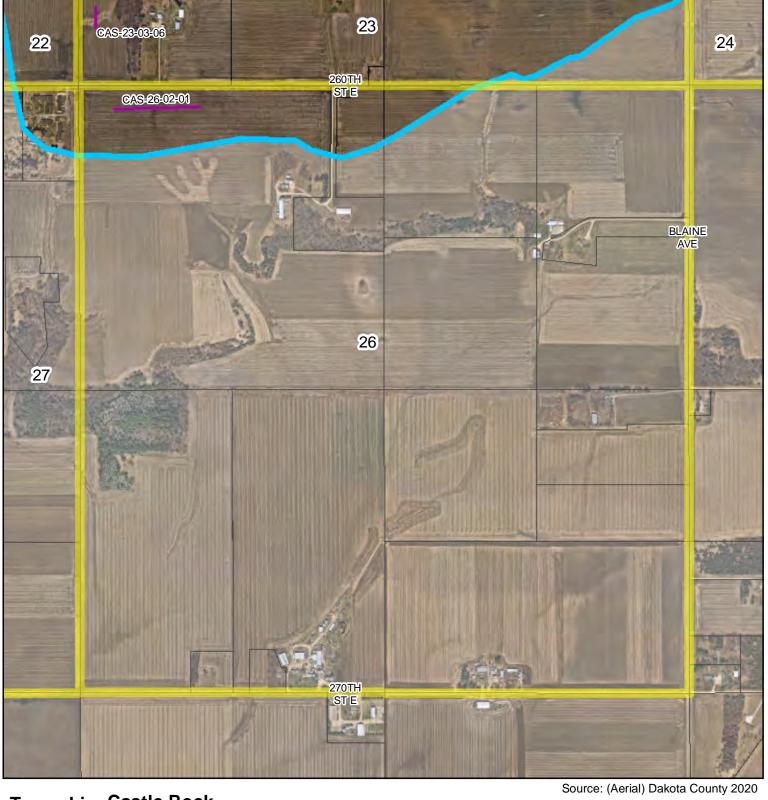
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 26 of Castle Rock Township is approximately 40 acres. The area primarily consists of agricultural cropland. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes is the predominant soil type.

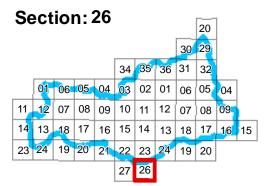
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	638 - Water & Sediment Control Basin					
CAS-26-02-01	(narrow)	1	Each	2.55	\$7,940	\$311



Township: Castle Rock



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



DAKOTA COUNTY



Castle Rock Township, Section 27

Description:

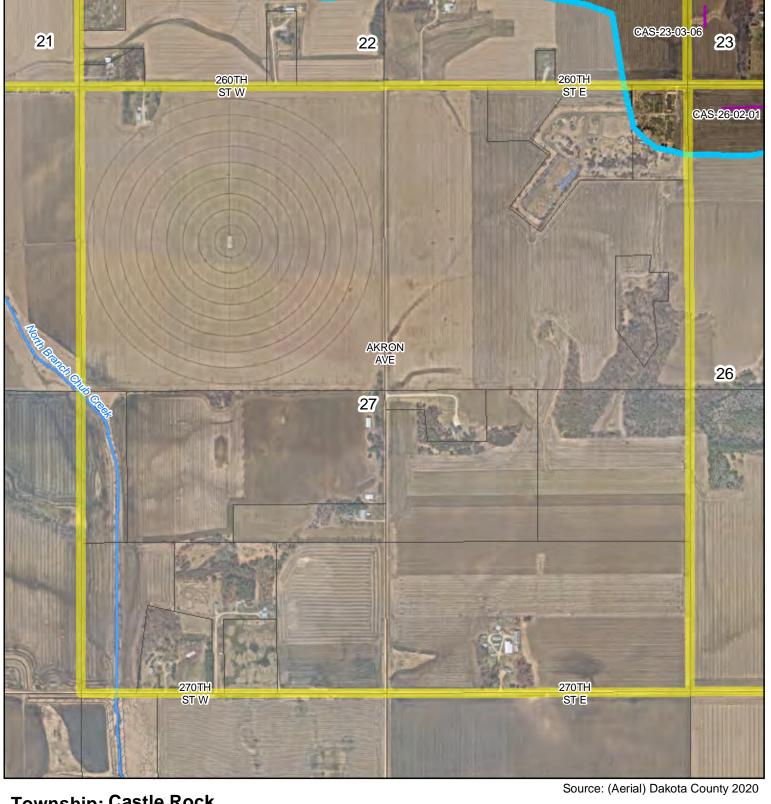
The area of the South Branch Vermillion River Subwatershed that lies within Section 27 of Castle Rock Township is approximately 6 acres. It consists of a former military site. There are several buildings on the site and vegetation is primarily grass with scattered trees. Ostrander loam with 1-6% slopes is the predominant soil type.

Land Management Recommendations:

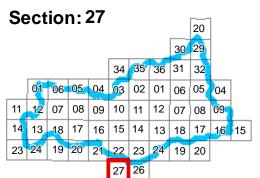
Land use within this section is classified as residential. Land management practices recommended include minimizing compaction to reduce runoff and managing the existing vegetation to prevent the establishment or spread of invasive species.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

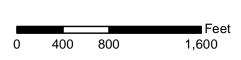
Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch

Subwatershed





DAKOTA COUNTY

SOIL & WATER

CONSERVATION DISTRICT

Empire Township, Section 34

Description:

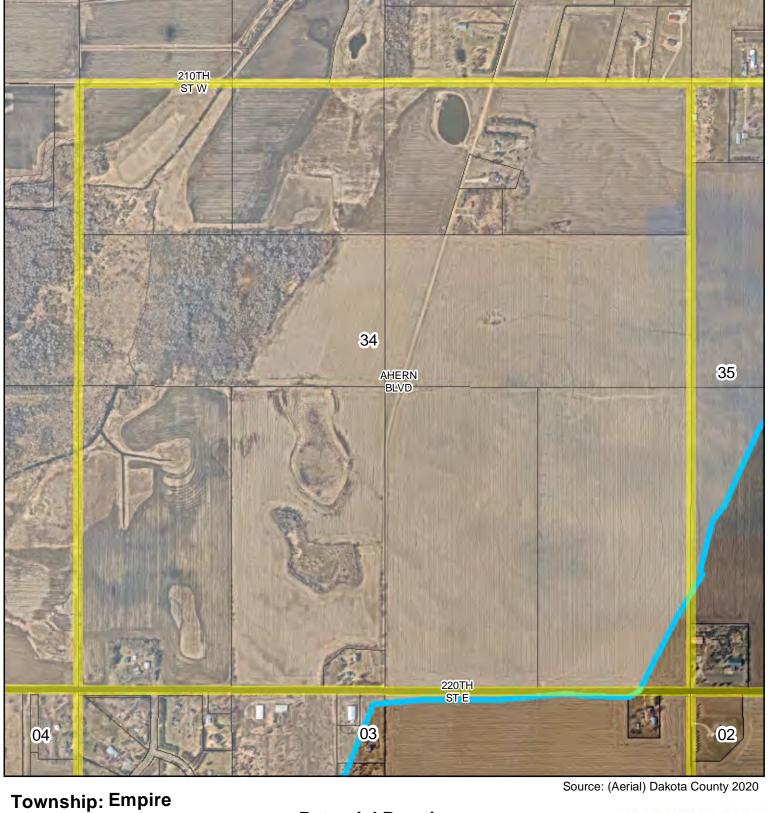
The area of the South Branch Vermillion River Subwatershed that lies within Section 34 of Empire Township is approximately 5 acres. It consists of row-crop agricultural cropland. Conventional tillage practices are utilized on the majority of the cropland. Wadena loam with 0-2% slopes is the predominant soil type.

Land Management Recommendations:

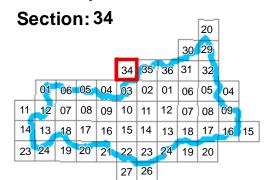
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Empire Township, Section 35

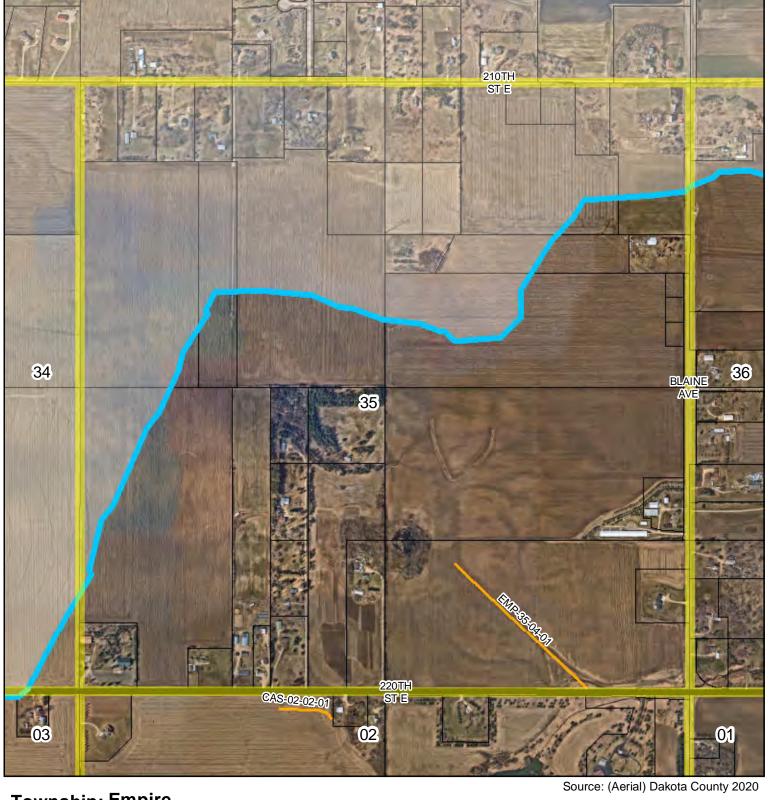
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 35 of Empire Township is approximately 400 acres. It consists primarily of agricultural cropland with several home/farmsites. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Kanaranzi loam with 0-6% slopes and Estherville sandy loam with 0-2% slopes are the predominant soil types.

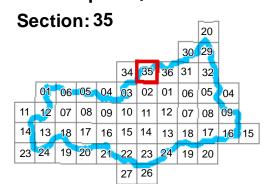
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township-				Sediment Reduction	Estimated Project	Cost/Ton of Sediment
Section-1/4-#)	BMP/Project Name	Size	Units	(ton/yr)	Cost	Reduction
EMP-35-04-01	412 - Grassed Waterway - complex 20' design	1,540	Lin. Feet	33.62	\$11,618	\$35







Stream Stabilization

— Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed





Empire Township, Section 36

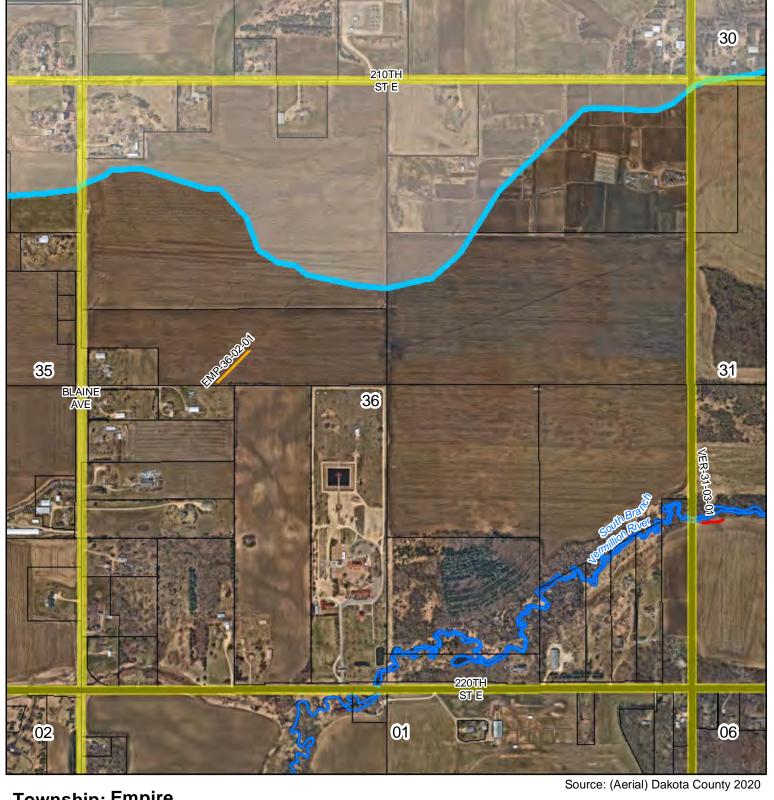
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 36 of Empire Township is approximately 515 acres. It consists primarily of agricultural cropland with numerous home/farmsites. There are also some wooded portions along the South Branch Vermillion River, which flows through the southeast portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Estherville sandy loam with 2-6% slopes, Wadena loam with 2-6% slopes, and Waukegan silt loam with 0-6% slopes are the predominant soil types.

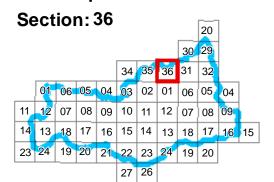
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township-				Sediment Reduction	Estimated	Cost/Ton of Sediment
Section-1/4-#)	BMP/Project Name	Size	Units	(ton/yr)	Project Cost	Reduction
EMP-36-02-01	412 - Grassed Waterway - simple design	387	Lin. Feet	3.99	\$6,600	\$166







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



400

800

DAKOTA COUNTY



Vermillion Township, Section 20

Description:

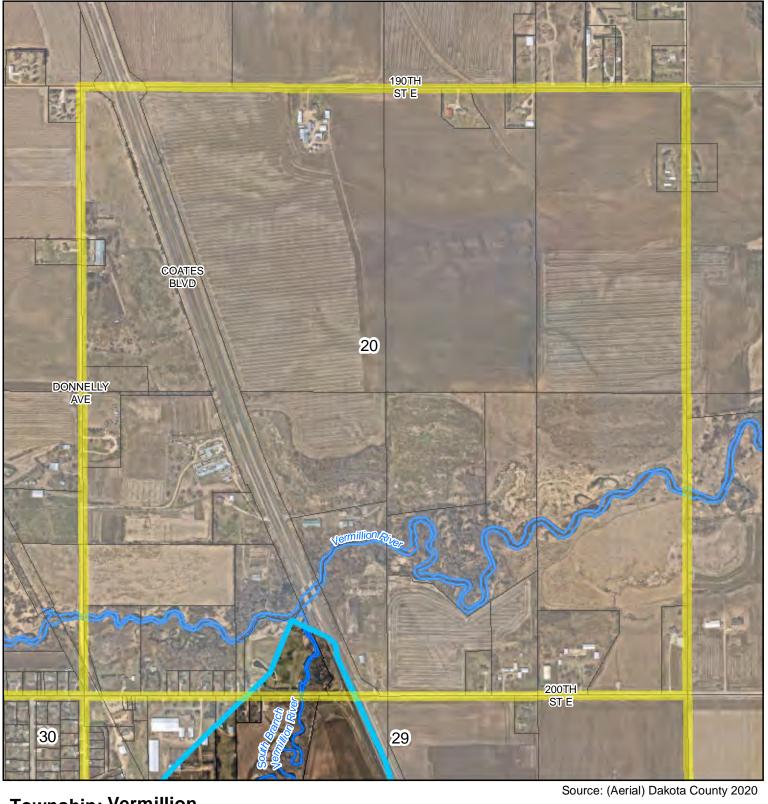
The area of the South Branch Vermillion River Subwatershed that lies within Section 20 of Vermillion Township is approximately 8 acres. This area is the most downstream portion of the subwatershed and includes the lowest reach of the South Branch Vermillion River before the confluence with the mainstem Vermillion River. It consists primarily of mowed grassland, wooded areas within the riparian areas, and a portion of Highway 52. Kalmarville sandy loam and Kato silty clay loam are the predominant soil types.

Land Management Recommendations:

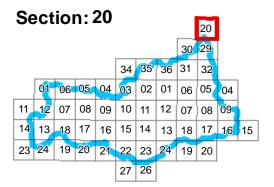
The primary land use within this section is a mix of rural residential, natural areas along the South Branch Vermillion River, and highway. Land management practices recommended throughout this section include maintaining perennial vegetative cover and limiting the establishment or spread of invasive vegetation such as buckthorn. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.



Township: Vermillion



Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

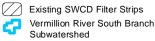
Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices







Vermillion Township, Section 29

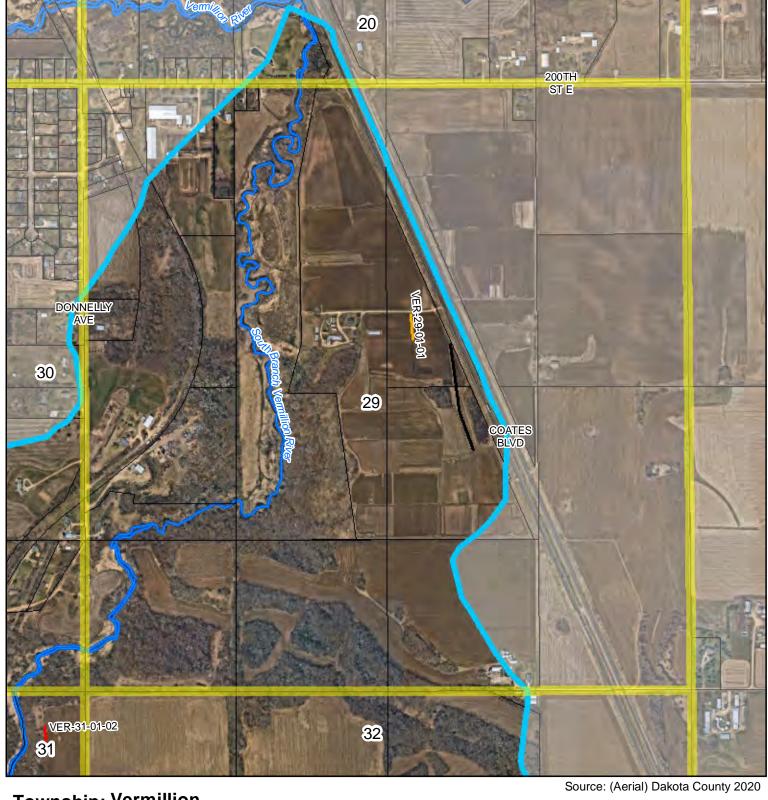
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 29 of Vermillion Township is approximately 360 acres. It is one of the lower reaches and is near the confluence with the mainstem of the Vermillion River. It consists primarily of agricultural cropland (both traditional row-crop and smaller vegetable plots), a 62-acre South Branch Vermillion River Aquatic Management Area that has had significant vegetation restoration work completed in recent years, wooded areas with deciduous trees, and some home/farmsites. A portion of Highway 52 is also within this area. Conventional tillage practices are utilized on the majority of the cropland. Estherville sandy loam with 2-6% slopes, Kalmarville sandy loam, Copaston loam with 6-12% slopes, and Wadena loam with 0-6% slopes are the predominant soil types.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
VER-29-01-01	412 - Grassed Waterway - complex 20' design	222	Lin. Feet	2.44	\$7,018	\$287



Township: Vermillion

Section: 29 34 35 36 31 32 06 05 04 03 02 01 06 05 04 08 09 10 11 12 | 07 08 09 15 14 13 18 17 16 15 16 19 20 21 22 23 24 19 20

Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

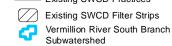
Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration Existing SWCD Practices







Vermillion Township, Section 30

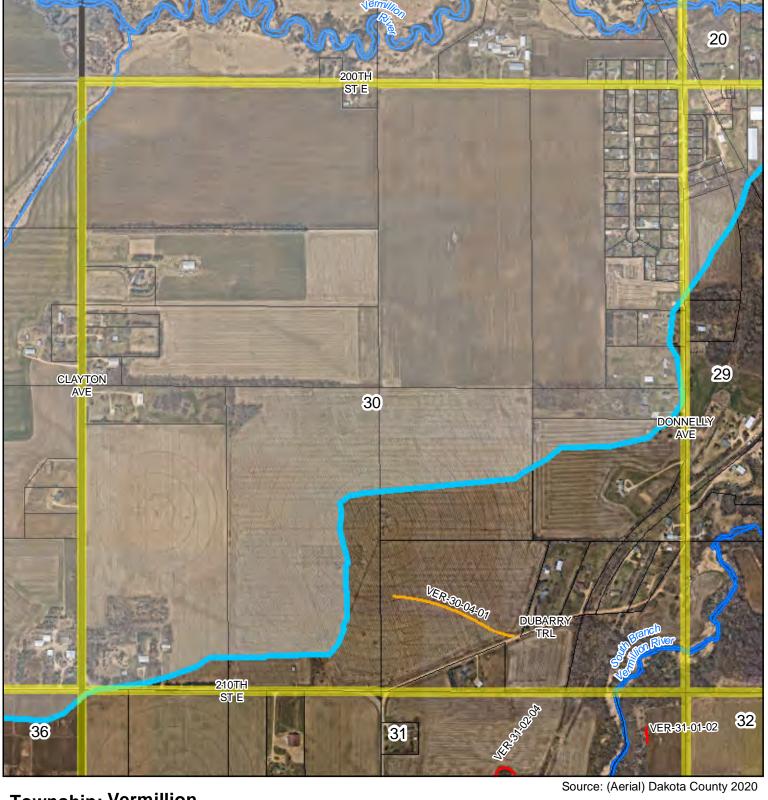
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 30 of Vermillion Township is approximately 145 acres. It consists primarily of agricultural cropland, homesites, and woodland with deciduous trees. The South Branch Vermillion River flows through the southeast portion of this area. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Kanaranzi loam with 0-2% slopes, Estherville sandy loam with 2-6% slopes, and Kanaranzi loam with 2-6% slopes are the predominant soil types.

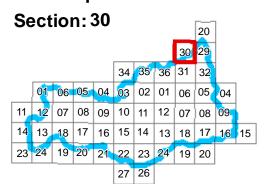
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
VER-30-04-01	412 - Grassed Waterway - complex 20' design	1,114	Lin. Feet	58.46	\$10,137	\$17







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 31 of Vermillion Township is approximately 635 acres. It consists primarily of agricultural cropland, woodland with deciduous trees, grassland with scattered trees near the riparian areas, and multiple home/farmsites. The South Branch Vermillion River flows northeast through this area. Conventional tillage practices are utilized on the majority of the cropland. Most of the cropland is irrigated. Wadena loam with 2-6% slopes, Estherville sandy loam with 2-6% slopes, and Rockton loam with 2-6% slopes are the predominant soil types.

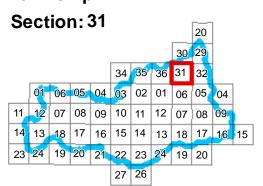
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
VER-31-01-03	412 - Grassed Waterway - complex 20' design	445	Lin. Feet	18.37	\$7,799	\$42
VER-31-01-01	410 - Grade Stabilization Structure 10-100ac	1	Each	11.00	\$26,640	\$242
VER-31-01-02	410 - Grade Stabilization Structure 10-100ac	1	Each	11.00	\$26,640	\$242
VER-31-02-04	410 - Grade Stabilization Structure 10-100ac	1	Each	11.00	\$26,640	\$242
VER-31-02-05	410 - Grade Stabilization Structure 10-100ac	1	Each	3.50	\$26,640	\$761
VER-31-03-01	410 - Grade Stabilization Structure 10-100ac	1	Each	1.83	\$26,640	\$1,453







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Vermillion Township, Section 32

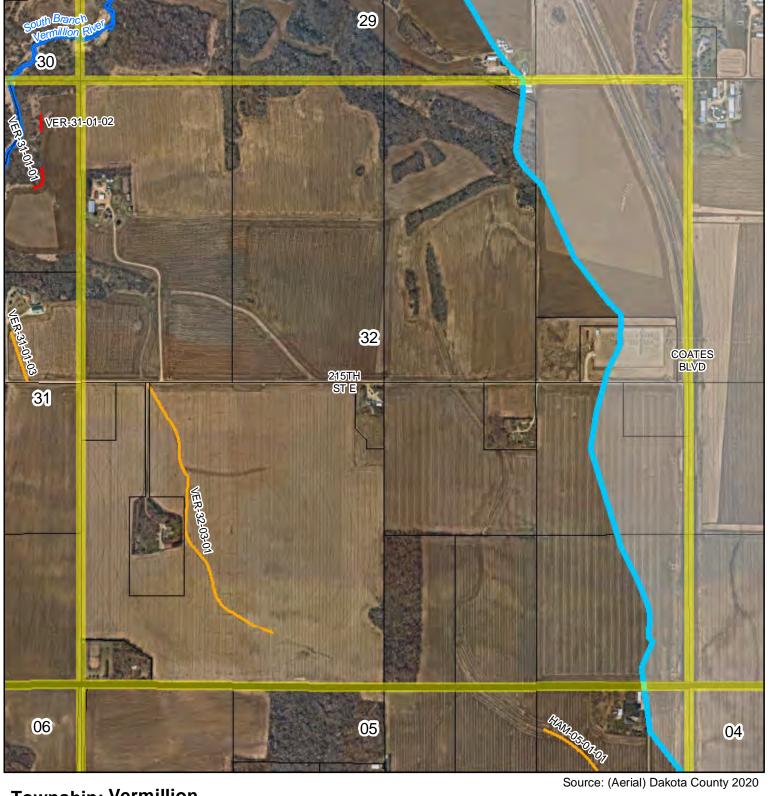
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 32 of Vermillion Township is approximately 535 acres. It consists primarily of agricultural cropland, several areas of deciduous woodland, and several home/farmsites. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Copaston loam with 2-12% slopes, Ostrander loam with 1-6% slopes, and Rockton loam with 2-6% slopes are the predominant soil types.

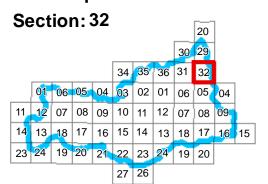
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
VER-32-03-01	412 - Grassed Waterway - complex 20' design	2,585	Lin. Feet	106.64	\$15,289	\$14



Township: Vermillion



Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed





Hampton Township, Section 4

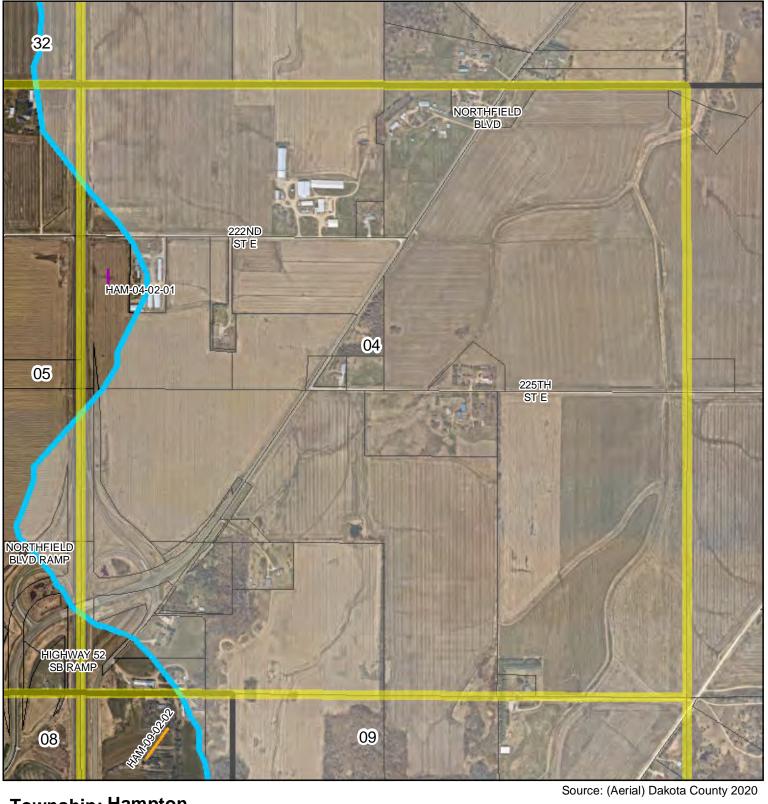
Description:

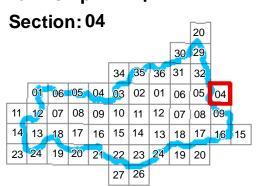
The area of the South Branch Vermillion River Subwatershed that lies within Section 4 of Hampton Township is approximately 24 acres. This is split into two separate areas; the northern portion is primarily agricultural cropland and the southern portion includes part of the Highway 52/47 interchange, agricultural cropland, and part of a farm site. Conventional tillage practices are utilized on the majority of the cropland. Klinger silt loam with 1-5% slopes and Ostrander loam with 1-6% slopes are the predominant soil types.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
	500 W + 0.0 E + 0.0 + 10 + (+1)				444.540	A==4
HAM-04-02-01	638 - Water & Sediment Control Basin (wide)	1	Each	2.55	\$14,640	\$574





Potential Practices

Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800



Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch

Subwatershed



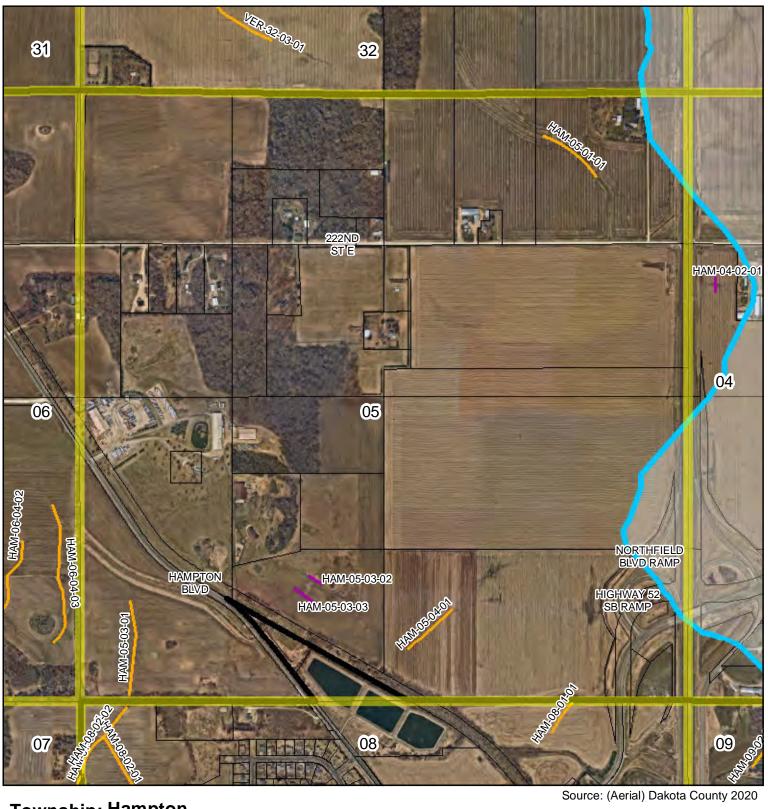


The area of the South Branch Vermillion River Subwatershed that lies within Section 5 of Hampton Township is approximately 625 acres. It consists primarily of agricultural cropland, deciduous woodland, several home, farm, and business sites, part of the Highway 52/47 interchange, and part of the Hampton wastewater facility. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Ostrander loam with 1-6% slopes and Klinger silt loam with 1-12% slopes are the predominant soil types.

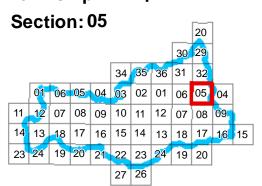
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-05-04-01	412 - Grassed Waterway - complex 20' design	827	Lin. Feet	17.07	\$9,136	\$54
HAM-05-01-01	412 - Grassed Waterway - complex 20' design	585	Lin. Feet	7.68	\$8,287	\$108
HAM-05-03-01	412 - Grassed Waterway - simple design	515	Lin. Feet	4.38	\$6,985	\$160
HAM-05-03-03	638 - Water & Sediment Control Basin (wide)	1	Each	3.94	\$14,640	\$372
HAM-05-03-02	638 - Water & Sediment Control Basin (narrow)	1	Each	2.10	\$7,940	\$378







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

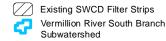
Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices







All 640 acres of Section 6 of Hampton Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, deciduous woodland, and several homesites. About half of the woodland is part of the Hampton Woods Wildlife Management Area. Conventional tillage practices are utilized on the majority of the cropland. Wadena loam with 2-6% slopes, Ostrander loam with 1-6% slopes, Etter fine sandy loam with 2-6% slopes, and Boone loamy fine sand with 2-12% slopes are the predominant soil types.

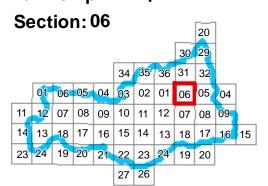
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-06-04-03	412 - Grassed Waterway - complex 20' design	1,246	Lin. Feet	25.69	\$10,599	\$41
HAM-06-04-02	412 - Grassed Waterway - simple design	648	Lin. Feet	13.37	\$7,384	\$55
HAM-06-01-01	412 - Grassed Waterway- complex 30' design	2200.00	Lin. Feet	11.55	\$15,840	\$137
HAM-06-03-02	638 - Water & Sediment Control Basin (narrow)	1	Each	2.55	\$7,940	\$311
HAM-06-03-01	638 - Water & Sediment Control Basin (wide)	1	Each	2.55	\$14,640	\$574







Stream Stabilization

— Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





DAKOTA COUNTY

SOIL & WATER

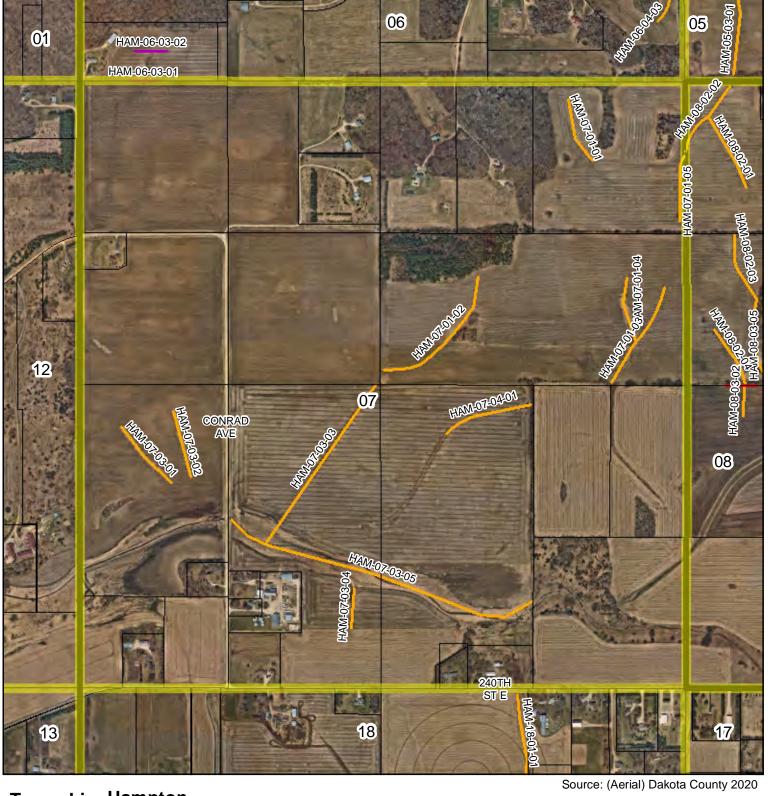
CONSERVATION DISTRICT

All 640 acres of Section 7 of Hampton Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of agricultural cropland, pockets of deciduous woodland, grassland with scattered trees, and several home/farm sites. Conventional tillage practices are utilized on the majority of the cropland. About half of the cropland is irrigated. Wadena loam with 2-6% slopes, and Ostrander loam with 1-6% slopes are the predominant soil types.

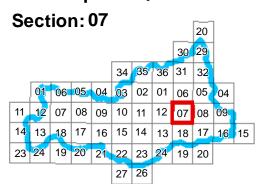
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-07-03-05	412 - Grassed Waterway- complex 30' design	2,817	Lin. Feet	197.22	\$18,310	\$9
HAM-07-03-04	412 - Grassed Waterway - complex 20' design	351	Lin. Feet	14.49	\$7,469	\$52
HAM-07-03-03	412 - Grassed Waterway - complex 20' design		Lin. Feet	21.65	\$12,014	\$55
HAM-07-01-01	412 - Grassed Waterway - simple design	591	Lin. Feet	12.18	\$7,212	\$59
HAM-07-03-02	412 - Grassed Waterway - simple design	586	Lin. Feet	12.09	\$7,198	\$60
HAM-07-03-01	412 - Grassed Waterway - complex 20' design	654	Lin. Feet	13.49	\$8,529	\$63
HAM-07-01-02	412 - Grassed Waterway - complex 20' design	1,266	Lin. Feet	16.62	\$10,671	\$64
HAM-07-01-03	412 - Grassed Waterway - complex 20' design	952	Lin. Feet	12.49	\$9,572	\$77
HAM-07-01-05	412 - Grassed Waterway - complex 20' design	576	Lin. Feet	9.18	\$8,256	\$90
HAM-07-01-04	412 - Grassed Waterway - complex 20' design	565	Lin. Feet	7.41	\$8,216	\$111
HAM-07-04-01	412 - Grassed Waterway - complex 20' design	787	Lin. Feet	6.69	\$8,995	\$134







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



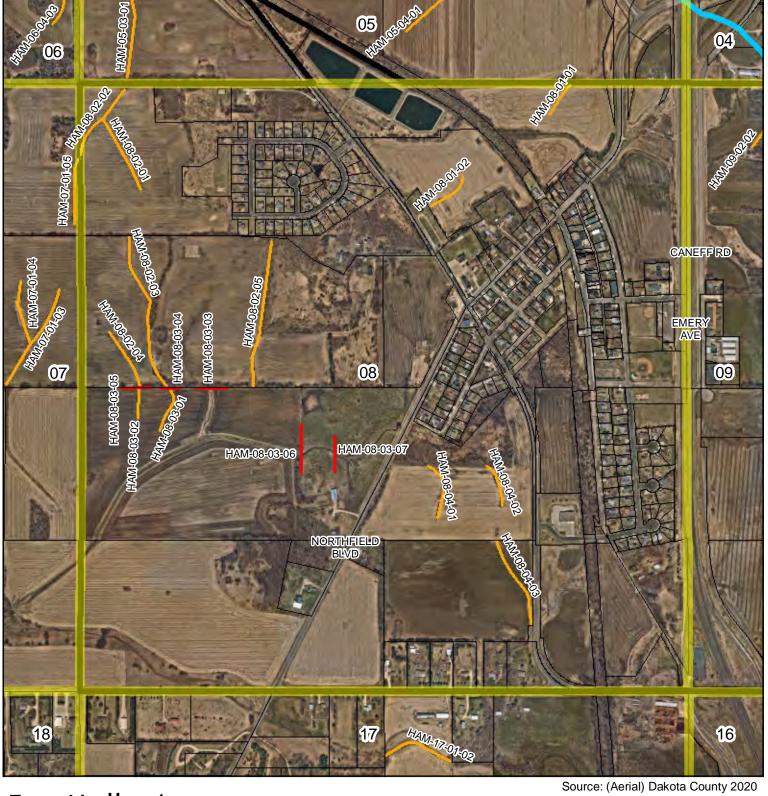


All 640 acres of Section 8 of Hampton Township are in the South Branch Vermillion River Subwatershed. The area primarily consists of the city of Hampton, agricultural cropland, pastures, several large wetlands, and several homesites outside of the city limits. The Hampton wastewater treatment facility is located on the north portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Klinger silt loam with 1-5% slopes, and Maxfield silty clay loam are the predominant soil types.

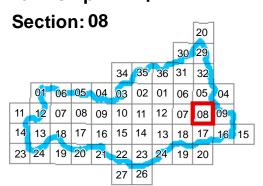
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-08-02-05	412 - Grassed Waterway - complex 20' design	1,268	Lin. Feet	33.29	\$10,679	\$32
HAM-08-02-02	412 - Grassed Waterway - complex 20' design	695	Lin. Feet	18.24	\$8,672	\$48
HAM-08-02-03	412 - Grassed Waterway - complex 20' design	1,378	Lin. Feet	21.96	\$11,063	\$50
HAM-08-04-03	412 - Grassed Waterway - simple design	812	Lin. Feet	10.65	\$7,875	\$74
HAM-08-04-01	412 - Grassed Waterway - simple design	518	Lin. Feet	6.80	\$6,994	\$103
HAM-08-03-01	412 - Grassed Waterway - complex 20' design	395	Lin. Feet	6.30	\$7,623	\$121
HAM-08-04-02	412 - Grassed Waterway - simple design		Lin. Feet	4.99	\$6,581	\$132
HAM-08-01-02	412 - Grassed Waterway - simple design	398	Lin. Feet	4.38	\$6,634	\$152
HAM-08-03-03	410 - Grade Stabilization Structure 10-100ac	1	Each	17.50	\$26,640	\$152
HAM-08-03-04	410 - Grade Stabilization Structure 10-100ac	1	Each	17.50	\$26,640	\$152
HAM-08-01-01	412 - Grassed Waterway - simple design	306	Lin. Feet	4.02	\$6,359	\$158
HAM-08-03-02	412 - Grassed Waterway - complex 20' design	259	Lin. Feet	4.13	\$7,148	\$173
HAM-08-02-01	412 - Grassed Waterway - complex 20' design	691	Lin. Feet	4.84	\$8,660	\$179
HAM-08-02-04	412 - Grassed Waterway - complex 20' design	541	Lin. Feet	3.79	\$8,133	\$215
HAM-08-03-06	410 - Grade Stabilization Structure 100-250ac	1	Each	12.60	\$37,840	\$300
HAM-08-03-05	410 - Grade Stabilization Structure 10-100ac	1	Each	8.50	\$26,640	\$313
HAM-08-03-07	410 - Grade Stabilization Structure 10-100ac	1	Each	7.00	\$26,640	\$381

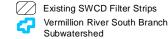


Township: Hampton



- **Stream Stabilization**
- **Grade Stabilization**
- **Water and Sediment Control Basin**
- **Waterway**
 - Filter Strip / Critical Area Planting
- **Wetland Restoration**

Existing SWCD Practices





400

800

DAKOTA COUNTY



Hampton Township, Section 9

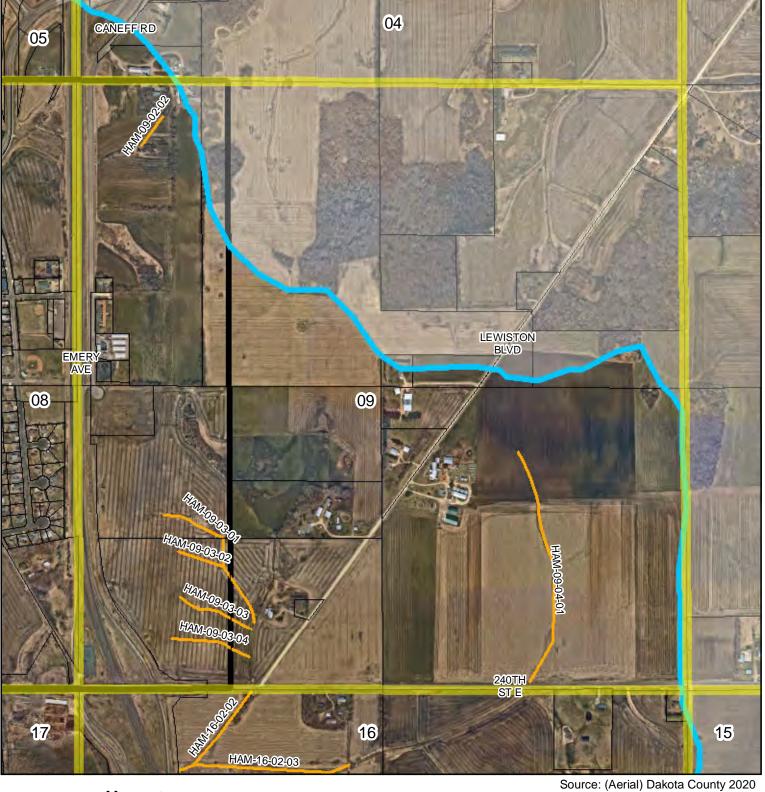
Description:

The area of the South Branch Vermillion River Subwatershed that lies within Section 9 of Hampton Township is approximately 420 acres. It consists primarily of agricultural cropland, several farm sites, and some wetlands. Highway 52 runs along the western portion of this section. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Maxfield silty clay loam, and Klinger silt loam with 1-5% slopes are the predominant soil types.

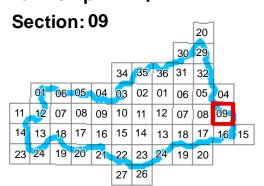
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-09-04-01	412 - Grassed Waterway - complex 20' design	2,112	Lin. Feet	27.72	\$13,633	\$49
HAM-09-03-01	412 - Grassed Waterway - complex 20' design	1,370	Lin. Feet	17.98	\$11,035	\$61
HAM-09-03-04	412 - Grassed Waterway - complex 20' design	706	Lin. Feet	11.26	\$8,712	\$77
HAM-09-03-03	412 - Grassed Waterway - complex 20' design	698	Lin. Feet	11.13	\$8,684	\$78
HAM-09-03-02	412 - Grassed Waterway - complex 20' design	405	Lin. Feet	5.31	\$7,657	\$144
HAM-09-02-02	412 - Grassed Waterway - simple design	313	Lin. Feet	2.19	\$6,378	\$291



Township: Hampton



Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

— Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





Hampton Township, Section 15

Description:

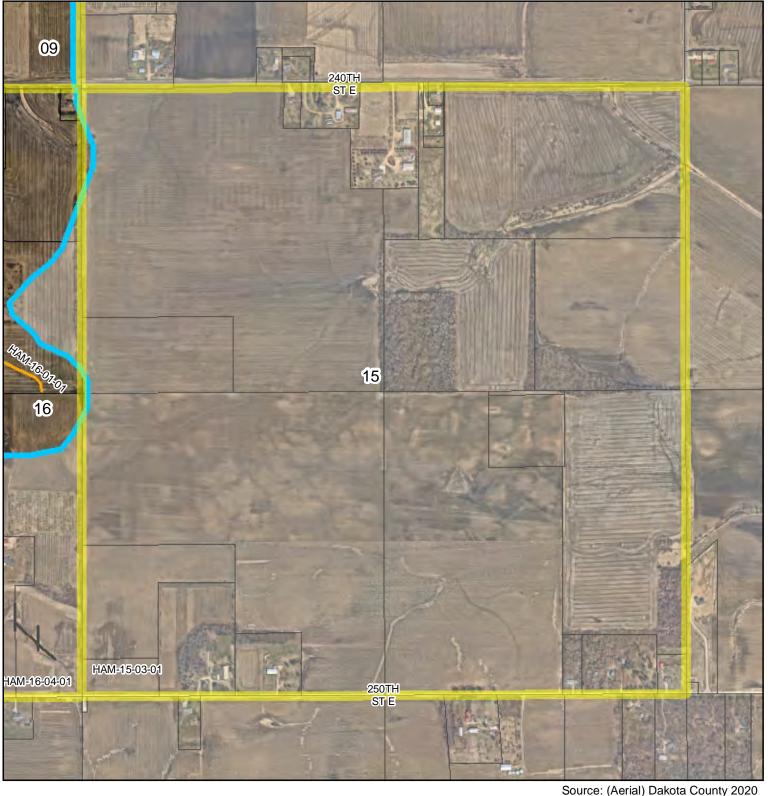
The area of the South Branch Vermillion River Subwatershed that lies within Section 15 of Hampton Township is approximately 1 acre. It consists of agricultural cropland. Conventional tillage practices are utilized on the cropland. Klinger silt loam with 1-5% slopes is the predominant soil type.

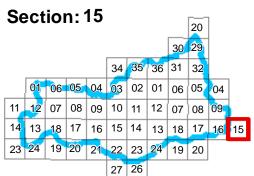
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.





Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

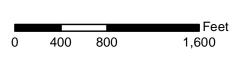
— Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed



DAKOTA COUNTY

SOIL & WATER

CONSERVATION DISTRICT

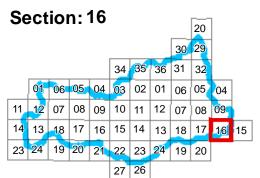
The area of the South Branch Vermillion River Subwatershed that lies within Section 16 of Hampton Township is approximately 420 acres. It consists primarily of agricultural cropland with a few home/farm sites. Highway 52 runs through the western portion of this area. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopes, Wadena loam with 2-6% slopes, and Burkhardt sandy loam with 6-12% slopes are the predominant soil types.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-16-02-02	412 - Grassed Waterway - complex 20' design	804	Lin. Feet	21.09	\$9,052	\$43
HAM-16-02-03	412 - Grassed Waterway - complex 20' design	1,400	Lin. Feet	21.44	\$11,140	\$52
HAM-16-01-02	412 - Grassed Waterway - simple design	482	Lin. Feet	6.32	\$6,885	\$109
HAM-16-01-01	412 - Grassed Waterway - complex 20' design	1,152	Lin. Feet	9.18	\$10,272	\$112
HAM-16-02-01	412 - Grassed Waterway - complex 20' design	876	Lin. Feet	7.44	\$9,305	\$125
HAM-16-01-04	412 - Grassed Waterway - complex 20' design	415	Lin. Feet	3.53	\$7,692	\$218
HAM-16-01-05	412 - Grassed Waterway - complex 20' design	246	Lin. Feet	2.09	\$7,100	\$340
HAM-16-01-03	410 - Grade Stabilization Structure 10-100ac	1	Each	7.79	\$26,640	\$342





Potential Practices

Stream Stabilization

— Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed



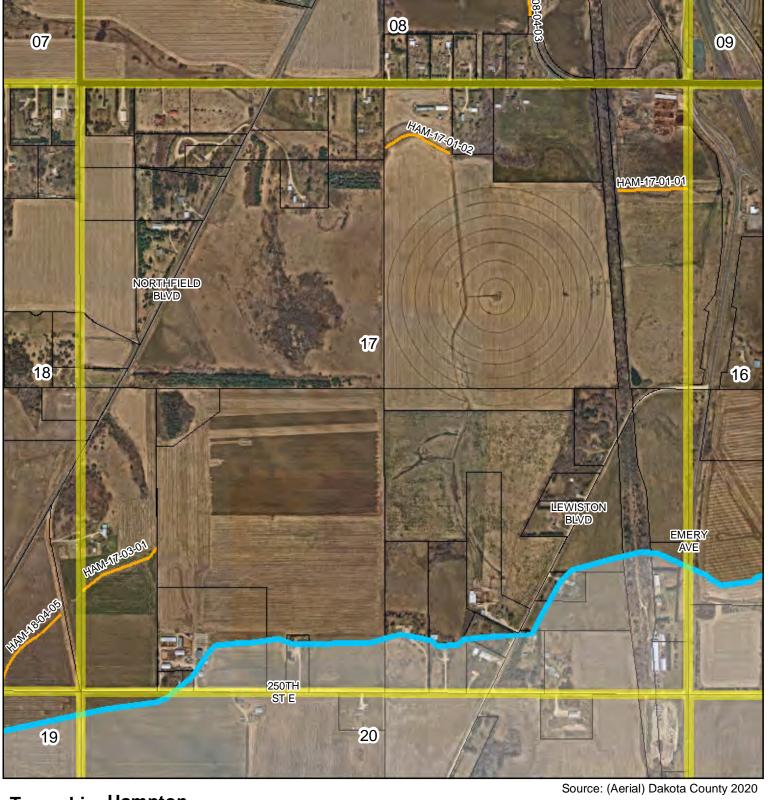


The area of the South Branch Vermillion River Subwatershed that lies within Section 17 of Hampton Township is approximately 575 acres. It consists primarily of agricultural cropland, several home/farmsites, pasture, and a larger area of grassland in the northwest portion of the section. A former railroad grade runs along the eastern portion of this section. Conventional tillage practices are utilized on the majority of the cropland. About half of the cropland is irrigated. Wadena loam with 2-6% slopes is the predominant soil type.

Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-17-01-01	412 - Grassed Waterway - complex 20' design	602	Lin. Feet	15.80	\$8,346	\$53
HAM-17-01-02	412 - Grassed Waterway - complex 20' design	621	Lin. Feet	4.07	\$8,412	\$207
HAM-17-03-01	412 - Grassed Waterway - complex 20' design	748	Lin. Feet	3.86	\$8,859	\$230



Section: 17 20 30 29 34 35 36 31 06 05 04 03 02 01 06 05 04 08 09 10 11 12 | 07 80 09 15 14 17 16 15 16 13 18 19 20 21 22 23 24 19 20

Potential Practices

Stream Stabilization

--- Grade Stabilization

— Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips
Vermillion River South Branch
Subwatershed





The area of the South Branch Vermillion River Subwatershed that lies within Section 18 of Hampton Township is approximately 630 acres. It consists primarily of agricultural cropland, with scattered home/farm sites. There are several areas of steep slopes, most of which are wooded with deciduous trees. Conventional tillage practices are utilized on the majority of the cropland. Some of the cropland is irrigated. Ostrander loam with 1-6% slopes and Wadena loam with 2-6% slopes are the predominant soil types.

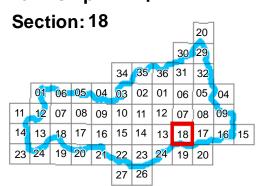
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, irrigation water management, conservation crop rotation, and conservation tillage. For woodland areas, limiting the spread of invasive vegetation such as buckthorn is recommended. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

Feature ID (Township- Section-1/4-#)	BMP/Project Name	Size	Units	Sediment Reduction (ton/yr)	Estimated Project Cost	Cost/Ton of Sediment Reduction
HAM-18-01-01	412 - Grassed Waterway - complex 20' design	2,642	Lin. Feet	42.10	\$15,486	\$37
HAM-18-04-05	412 - Grassed Waterway - complex 20' design	834	Lin. Feet	10.95	\$9,160	\$84
HAM-18-04-02	412 - Grassed Waterway - simple design	545	Lin. Feet	4.34	\$7,074	\$163
HAM-18-04-01	638 - Water & Sediment Control Basin (narrow)	1	Each	3.94	\$7,940	\$202
HAM-18-04-03	412 - Grassed Waterway - complex 20' design	438	Lin. Feet	3.72	\$7,772	\$209
HAM-18-03-01	410 - Grade Stabilization Structure 10- 100ac	1	Each	3.19	\$26,640	\$836
HAM-18-04-04	410 - Grade Stabilization Structure 10- 100ac	1	Each	3.19	\$26,640	\$836







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

Filter Strip / Critical Area Planting

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips Vermillion River South Branch Subwatershed



400

800

DAKOTA COUNTY



Hampton Township, Section 19

Description:

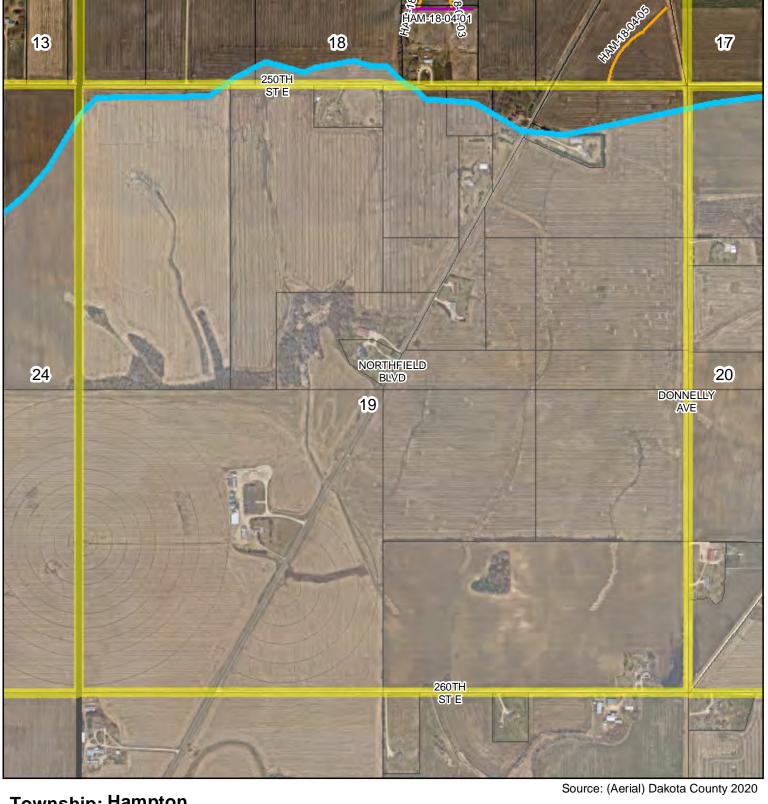
The area of the South Branch Vermillion River Subwatershed that lies within Section 19 of Hampton Township is approximately 18 acres. It consists primarily of agricultural cropland along with one homesite. Conventional tillage practices are utilized on the majority of the cropland. Ostrander loam with 1-6% slopesand Klinger silt loam with 1-5% slopes are the predominant soil types.

Land Management Recommendations:

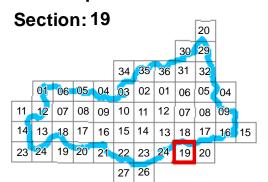
The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.







Stream Stabilization

Grade Stabilization

Water and Sediment Control Basin

Waterway

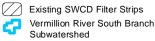
Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices







Hampton Township, Section 20

Description:

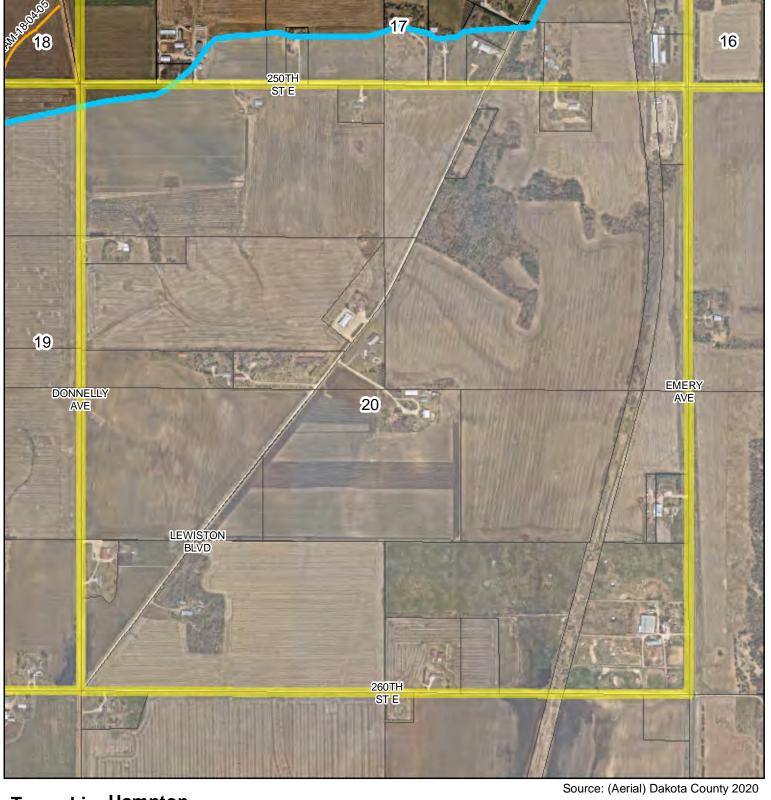
The area of the South Branch Vermillion River Subwatershed that lies within Section 20 of Hampton Township is approximately 2 acres. It consists of agricultural cropland and conventional tillage practices are utilized on the cropland. Ostrander loam with 1-6% slopes is the predominant soil type.

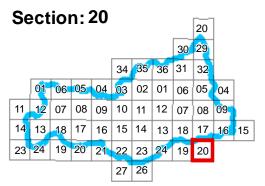
Land Management Recommendations:

The primary land use within this section is agricultural. Land management practices recommended throughout this section include proper use of cover crops, appropriate nutrient management, conservation crop rotation, and conservation tillage. Although the land management practices were not analyzed for pollutant reduction, it is likely that they have a greater benefit than structural practices within the watershed due to their ability to prevent the transport of sediment and other nutrients.

BMP Cost Benefit Analysis:

There were no structural practices that ranked high for cost-effectiveness identified in this section. Focus in this section should be on proper land management practices and non-structural best management practices.





Potential Practices

Stream Stabilization

— Grade Stabilization

Water and Sediment Control Basin

— Waterway

Filter Strip / Critical Area Planting

400

800

Wetland Restoration

Existing SWCD Practices

Existing SWCD Filter Strips

Vermillion River South Branch
Subwatershed





Board of Water and Soil Resources (BWSR). *BWSR Water Erosion Pollution Reduction Estimator*. 4 November 2021 < https://bwsr.state.mn.us/water-quality-tools-and-models >

Center for Watershed Protection. *National Pollutant Removal Performance Database, Version 3*September 2007

Chisago Soil and Water Conservation District. Rural Subwatershed Analysis Protocol. 2015.

Miller T.P., J.R. Peterson, C.F. Lenhart, and Y. Nomura. 2012. The Agricultural BMP Handbook for Minnesota. Minnesota Department of Agriculture.

Minnesota Pollution Control Agency (MPCA). Draft 2022 Impaired Waters List, November 2021

Minnesota Pollution Control Agency (MPCA). Vermillion *River Watershed TMDL Report*, September 2015

Tomer, M.D., S.A. Porter, D.E. James, McLellen, E January 2014. *Draft Middle Whitewater Watershed Conservation Practices Planning Resource*, National Laboratory for Agriculture and the Environment, United States Department of Agriculture, Ames, IA

Tomer, M.D., S.A. Porter, D.E. James, Boomer, Kathleen M. B. Kostel, Jill A. McLellan, E.. "Combining Precision Conservation Technologies into a Flexible Framework to Facilitate Agricultural Watershed Planning." *Journal of Soil and Water Conservation*. 68:5 (2013): 113A-120A. Print

Tomer, M.D., S.A. Porter, D.E. James, 2015. *Agricultural Conservation Planning Toolbox User's Manual* USDA-ARS, Ames, IA.

Tomer, M. D. Porter, S. A. Boomer, K. M. B. James, D. E. Kostel, J. A. Helmers M. J., Isenhart, T. McLellan, M. E. "Agricultural Conservation Planning Framework: 1. Developing Multipractice Watershed Planning Scenarios and Assessing Nutrient Reduction Potential." *Journal of Environmental Quality* 44.3 (April 2015): 754-767

United States Department of Agriculture Natural Resources Conservation Service. *Field Office Technical Guide Practice Standards*. https://efotg.sc.egov.usda.gov

United States Department of Agriculture Natural Resources Conservation Service. *Revised Universal Soil Loss Equation 2 (RUSLE2).*

Vermillion River Watershed Joint Powers Organization (VRWJPO). *Vermillion River Watershed Management Plan*. June 2016

Washington Conservation District. Rural Subwatershed Analysis Protocol. 2013.

Appendix

Cost estimates were developed based upon the type of BMP and the historical cost of installation and management in Dakota County between 2014 and 2019. The following table provides a breakdown of the estimates used for each BMP:

ВМР	Size of BMP (user entered)	Units	Construction Cost per Unit	Design and Project Management	Total BMP Cost (example based on user entered value)
340- Cover Crop	100	Acres	\$50	\$1,920	\$6,920
342 - Critical Area Planting (Native Grasses)	10	Acres	\$500	\$1,920	\$6,920
342- Critical Area Planting (Non Native Grasses)	10	Acres	\$200	\$2,000	\$4,000
393- Filter Strip	10	Acres	\$500	\$1,920	\$6,920
410- Grade Stabilization Structure 0-10ac	1	Each	\$8,500	\$5,440	\$13,940
410- Grade Stabilization Structure 10-100ac	1	Each	\$20,000	\$6,640	\$26,640
410- Grade Stabilization Structure100-250ac	1	Each	\$30,000	\$7,840	\$37,840
410- Grade Stabilization Structure250+ ac	1	Each	\$100,000	\$12,640	\$112,640
412- Grassed Waterway - simple design	500	Lin. Ft.	\$3.00	\$5,440	\$6,940
412- Grassed Waterway - complex 20' design	500	Lin. Ft.	\$3.50	\$6,240	\$7,990
412- Grassed Waterway- complex 30' design	500	Lin. Ft.	\$4.00	\$7,040	\$9,040
468 - Lined Waterway	25	Lin. Ft.	\$50.00	\$5,440	\$6,690
580- Streambank and Shoreline Protection	500	Sq. Ft.	\$100	\$7,280	\$57,280
638-Water & Sediment Control Basin(narrow)	1	Each	\$2,500	\$5,440	\$7,940
638-Water & Sediment Control Basin(wide)	1	Each	\$8,000	\$6,640	\$14,640
645- Upland Wildlife Habitat Management	10	Acres	\$1,000	\$4,640	\$14,640
657- Wetland Restoration	10	Acres	\$5,000	\$7,200	\$57,200
658- Wetland Creation	10	Acres	\$8,000	\$7,200	\$87,200
659- Wetland Enhancements	10	Acres	\$4,000	\$7,200	\$47,200
554- Drainage Water Management (each structure)	1	Each	\$1,500	\$3,920	\$5,420
604- Saturated Buffer (40 acres treated)	1	Each	\$4,000	\$4,800	\$8,800
605- Denitrifying Bioreactor (40 acres treated)	1	Each	\$10,000	\$5,200	\$15,200