Antelope Creek Watershed
Project Implementation Plan

Grant County Soil Conservation District
103 Dakota Street
P.O. Box 259
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Project Summary Sheet

Grant County Soil Conservation District
Antelope Creek Watershed Implement Project

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STATE: North Dakota
WATERSHEDS: Antelope Creek
HYDROLOGIC UNIT CODE: ND-10130203-006-S_00 & ND-10130203-055-S-00

PROJECT TYPES
[ ] STAFFING/SUPPORT
[X] WATERSHED
[ ] GROUNDWATER
[ ] INOFRMATION/EDUCATION

WATERBODY TYPES
[ ] GROUNDWATER
[ ] LAKES/RESERVOIRS
[ ] RIVERS
[X] STREAMS
[ ] WETLANDS
[ ] OTHER

NPS CATEGORY
[X] AGRICULTURE
[ ] URBAN RUNOFF
[ ] SILVER CULTURE
[ ] CONSTRUCTION
[ ] RESOURCE EXTRACTION
[ ] STOWAGE/LAND DISPOSAL

PROJECT LOCATION: Grant County, North Dakota

MAJOR GOAL: The Grant County Antelope Creek Watershed Project is designed to provide technical, financial, and educational assistance to agricultural producers and landowners within the watershed. The goal of this project is to improve water quality to enhance the recreational activities available on the Antelope Creek and restore riparian habitat by implementing Best Management Practices (BMPs).

PROJECT DESCRIPTION: The project sponsors intend to prioritize technical and financial assistance to lands that have the most impact on water quality, track water quality trends over the life of the project, develop educational programs to heighten public awareness of nonpoint source pollution concerns and solutions and develop working partnerships in the local community to benefit natural resources.

FY 2017 319 Funds requested $310,644

Match $372,096.00 (Cash costs plus In-Kind)

Other Federal Funds - $52,500.00

Total Project Cost $735,240.00

319 Funded Full Time Personnel 1

319 Funded Part Time Personnel 1

1.0 Overview and Monitoring Goals

Antelope Creek, a tributary to the Heart River, is located within the Lower Heart River watershed. The Antelope Creek watershed extends from the eastern portion of Hettinger County to three miles west of Carson in Grant County, North Dakota. The contributing sub watersheds vary from 16,216 to 33,063 acres in size with a total watershed size of approximately 153,612 acres.

Identifying potential water quality impacts to aquatic life and recreation uses of Antelope Creek was the primary focus of this assessment. Chemical, biological and physical data was collected from sampling sites in the watersheds to: 1) determine current water quality conditions in Antelope Creek; and 2) assess potential effects on beneficial uses resulting from pollutant loadings, stressors and sources indicated by the data. Currently, Antelope Creek is identified on the "North Dakota 2014 Section 303(d) List of Impaired Waters" as not supporting recreational uses due to Escherichia coli.

In the state's water quality standards, attainment of recreational uses is defined using E. coli bacteria as the indicator organism. This criterion is only valid during the recreation period of May 1 through September 30. Two separate E. coli bacteria criteria are used to determine if the waterbody is classified as fully supporting, fully supporting, but threatened or not supporting for recreational uses. The first criterion is that the geometric mean of the samples should not exceed 126 colony forming units (CFU) per 100 milliliters (mL). The second criterion is that not more than 10 percent of the samples should exceed 409 CFU per 100 mL. The waterbody is classified as fully supporting if both criteria are met, fully supporting but threatened if only the first criteria is met, and not supporting if neither of the criteria are met by the waterbody (NDDH, 2014).

In 2013-2014 the Grant County Soil Conservation District implemented the Antelope Creek Watershed Assessment Project to evaluate water quality and beneficial use conditions in the creek and identify any potential sources of pollutants impairing the beneficial uses. Four sampling locations were selected on Antelope Creek for collection of various chemical and physical data. Descriptions and locations of sites and parameters sampled are illustrated in Table 1 and Figure 1. Sampling frequency for each site was scheduled to occur five times per month (a minimum of once per week). Samples were only collected when flow was present.

Table 1. Water Quality Monitoring Stations in the Antelope Creek Watershed.

Storet ID	Site Description	Data to be Collected	Collection Year
385582	7 miles north of Carson, ND	Water Quality	2013, 2014
380064	5 miles north of Carson, ND	Water Quality	2013, 2014
385583	6 miles west of Carson, ND	Water Quality	2013, 2014
385584	6 miles north of Elgin, ND	Water Quality	2013, 2014

2.0 Assessment Data

2.1 Total Nitrogen, Total Phosphorus, and Total Suspended Solids

Table 2 summarizes the total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) data collected during the Antelope Creek Watershed Assessment. Figures 2 through 4 summarize TN, TP and TSS trends at each of the sites over the course of the sampling season. Descriptive statistics show that TN, TP and TSS concentrations varied widely during the course of seasonal monitoring, as well as between sites.

Table 2. Summary of Descriptive Statistics for Nutrients Calculated at Each Site.

2013-2014				
	385584	**385583**	**380064**	**385582**
#Samples	75	75	75	75
Total Nitrogen (mg/L)				
Mean	2.68	2.10	1.63	1.48
Maximum	11.10	10.10	6.64	6.50
Median	2.30	1.57	1.29	1.18
Total Phosphorus (mg/L)				
Mean	0.12	0.09	0.08	0.08
Maximum	0.42	0.27	0.26	0.37
Median	0.08	0.07	0.06	0.05
Total Suspended Solids (mg/L)				
Mean	35.04	26.71	20.55	43.42
Maximum	189.00	157.00	149.00	374.00
Median	28.00	19.50	9.00	15.00

TN data for sites 385584, 385583, 380064 and 385582 was compiled for years 2013-2014 in Figure 2. Average annual concentrations for TN ranged from a low of 0.09 mg/L at site 385584 in 2013 to a high of 11.10 mg/L at site 385584 in 2014. It should be noted that a TN concentration of 11.10 mg/L exceeds the state drinking water standard of 10 mg/L. TP data for monitoring sites 385584, 385583, 380064 and 385582 was compiled for years 2013-2014 in Figure 3. Average annual TP concentrations showed very little temporal variation at most sites, however there appeared to be elevated levels of TP in mid to late summer of 2013 and 2014 at all sites which is probably associated with rain events. Analysis of the data shows concentrations of TP are steady throughout Antelope Creek where TN concentrations are highest at the furthest site upstream. Total suspended solid concentrations increase from upstream to downstream (Figure 4). Site 385582 had the highest average concentration at 374.00 mg/L. The highest concentrations of TN, TP and TSS were correlated with peak flows and runoff events.

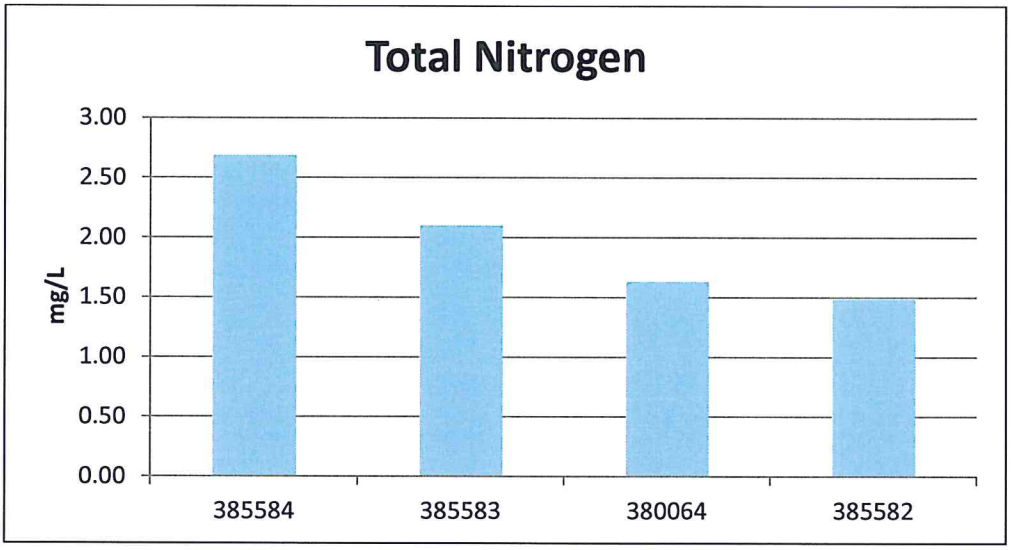


Figure 2. Annual Mean Total Nitrogen Concentrations for Antelope Creek

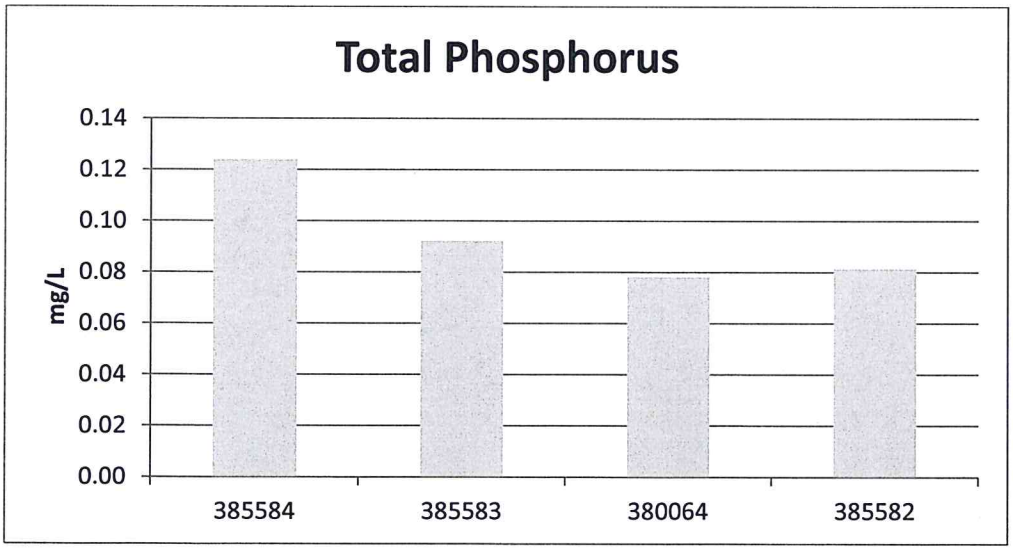


Figure 3. Annual Mean Total Phosphorus Concentrations for Antelope Creek

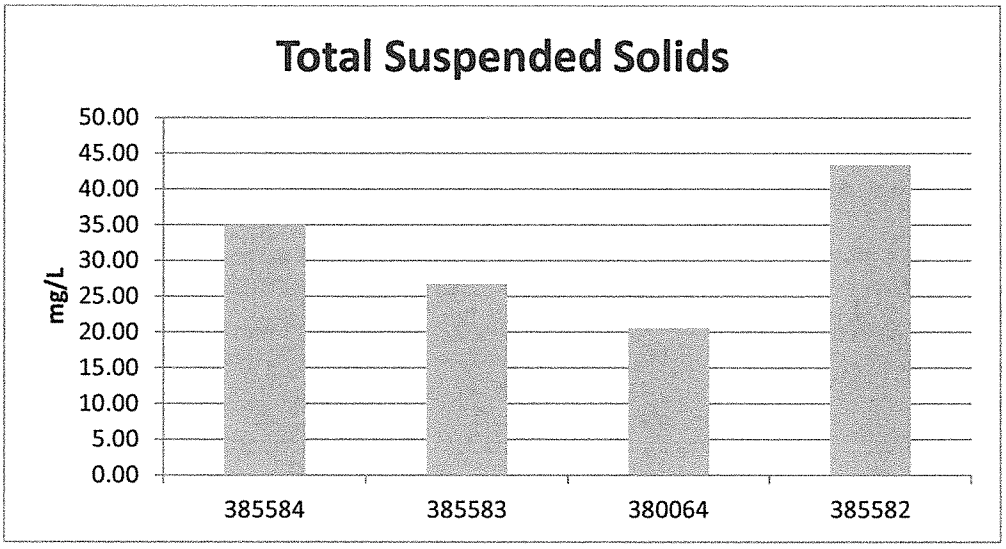


Figure 4. Annual Mean Total Suspended Solid Concentrations for Antelope Creek

2.1 Antelope Creek, (Assessment Unit ID: ND-10130203-006-S_00 & ND-10130203-055-S-00), which is a tributary to the Heart River, will be the primary focus for the project. The Antelope Creek Watershed is 153,524 acres in size and is listed in the 2014 Integrated Report as not supporting recreational uses due to E. coli bacteria impairments. Primary sources of E. coli bacteria in the watershed include concentrated livestock feeding areas and riparian pastures. Approximately 20 concentrated livestock feeding operations are in the watershed. The average number of animals is 100-150 head/system. Of the livestock feeding operations in the watershed, 10 are considered high priorities due to the close proximity to the creek and feeding area size. All the riparian pastures identified on the AnnAGNPS maps in Appendix 2 are considered high priority areas. The amount of pollutants delivered from either of these sources is dependent on existing management practices, precipitation amounts, intensities and frequencies as well as the number of livestock and duration they are in the priority areas. All of these factors are extremely variable, which makes it very difficult to assign a specific annual contribution value to either source. As such, the contributions from the feeding areas versus the riparian pastures will be considered approximately equal for the purposes of delivering technical and financial assistance.

The city of Elgin and Carson are the only point sources located in the watershed. The city of Carson has not reported any discharges in recent years and Elgin typically only discharges once per year. Given the limited discharge volume and location, neither city is considered a significant source for E. coli bacteria being delivered to Antelope Creek.

2.2 (See Appendix 2 for map)

This project will address water quality on stream segments ND-10130203-006-S-OO and ND-10130203-055-S_OO and their accompanying watersheds. These stream segments are physically located in or directly adjacent to Grant County.

2.2 E. coli Bacteria

Table 3 summarizes the E. coli bacteria data collected during the Antelope Creek Watershed Assessment.

Table 3. Summary of E. coli Bacteria Data Calculated at Each Site.

385584										
	May		June		July		August		September	
	5/1/2013	40	6/3/2013	420	7/1/2013	180	8/5/2013	370	9/3/2013	200
	5/7/2013	20	6/5/2013	220	7/8/2013	280	8/7/2013	110	9/9/2013	680
	5/15/2013	140	6/10/2013	310	7/10/2013	130	8/12/2013	300	9/11/2013	290
	5/20/2013	50	6/17/2013	50	7/15/2013	10	8/14/2013	230	9/16/2013	90
	5/22/2013	4200	6/19/2013	310	7/22/2013	60	8/20/2013	420	9/24/2013	90
	5/29/2013	10	6/25/2013	400	7/29/2013	180	8/26/2013	240	9/30/2013	110
	5/5/2014	10	6/2/2014	900	7/7/2014	520	8/5/2014	160	9/3/2014	150
	5/7/2014	10	6/9/2014	550	7/9/2014	430	8/11/2014	120	9/8/2014	60
	5/12/2014	10	6/16/2014	430	7/14/2014	340	8/13/2014	90	9/15/2014	20
	5/19/2014	10	6/23/2014	220	7/16/2014	1000	8/18/2014	200	9/17/2014	30
	5/21/2014	100	6/25/2014	200	7/21/2014	5000	8/25/2014	8000	9/22/2014	10
	5/27/2014	1200	6/30/2014	900	7/28/2014	60			9/24/2014	40
# Samples	11		12		12		11		12	
Geo Mean	38		327		224		279		81	
% Greater 409	9%		42%		33%		18%		8%	
Status	FS		NS		NS		NS		FS	

385583										
	May		June		July		August		September	
	5/1/2013	10	6/3/2013	260	7/1/2013	120	8/5/2013	180	9/3/2013	10
	5/7/2013	10	6/5/2013	40	7/8/2013	140	8/7/2013	40	9/9/2013	90
	5/15/2013	10	6/17/2013	20	7/10/2013	180	8/12/2013	40	9/11/2013	50
	5/20/2013	280	6/19/2013	600	7/15/2013	100	8/14/2013	30	9/16/2013	30
	5/22/2013	4200	6/25/2013	500	7/22/2013	70	8/20/2013	30	9/24/2013	10
	5/29/2013	60	6/2/2014	250	7/29/2013	60	8/26/2013	70	9/30/2013	90
	5/5/2014	10	6/9/2014	50	7/7/2014	130	8/5/2014	110	9/3/2014	170
	5/7/2014	10	6/16/2014	60	7/9/2014	110	8/11/2014	170	9/8/2014	140
	5/12/2014	10	6/23/2014	90	7/14/2014	140	8/13/2014	160	9/15/2014	20
	5/19/2014	10	6/25/2014	80	7/16/2014	70	8/18/2014	320	9/17/2014	10

	5/21/2014	10	6/30/2014	100	7/21/2014	190	8/25/2014	4300	9/22/2014	10
	5/27/2014	60			7/28/2014	210			9/24/2014	20
# Samples	12		11		12		11		12	
Geo Mean	29		112		118		120		32	
% Greater 409	8%		18%		0%		9%		0%	
Status	FS		FST		FS		FS		FS	

380064										
	May		June		July		August		September	
	5/1/2013	10	6/3/2013	300	7/1/2013	140	8/5/2013	110	9/3/2013	110
	5/7/2013	10	6/5/2013	110	7/8/2013	150	8/7/2013	70	9/9/2013	560
	5/15/2013	100	6/10/2013	100	7/10/2013	120	8/12/2013	100	9/11/2013	260
	5/20/2013	680	6/17/2013	180	7/15/2013	380	8/14/2013	40	9/16/2013	140
	5/22/2013	1000	6/19/2013	1900	7/22/2013	160	8/20/2013	130	9/24/2013	330
	5/29/2013	30	6/25/2013	540	7/29/2013	90	8/26/2013	180	9/30/2013	2100
	5/5/2014	10	6/2/2014	210	7/7/2014	190	8/5/2014	110	9/3/2014	160
	5/7/2014	10	6/9/2014	120	7/9/2014	100	8/11/2014	70	9/8/2014	80
	5/12/2014	20	6/16/2014	400	7/14/2014	120	8/13/2014	70	9/15/2014	160
	5/19/2014	10	6/23/2014	100	7/16/2014	90	8/18/2014	680	9/17/2014	370
	5/21/2014	10	6/25/2014	160	7/21/2014	160	8/25/2014	1200	9/22/2014	200
	5/27/2014	80	6/30/2014	600	7/28/2014	60			9/24/2014	480
Geo Mean	35		250		132		137		264	
% Greater 409	17%		25%		0%		18%		25%	
Status	FST		NS		NS		NS		NS	

385582										
	May		June		July		August		September	
	5/1/2013	130	6/3/2013	280	7/1/2013	210	8/5/2013	630	9/3/2013	200
	5/7/2013	30	6/5/2013	300	7/8/2013	110	8/7/2013	420	9/9/2013	1200
	5/15/2013	40	6/10/2013	40	7/10/2013	690	8/12/2013	230	9/11/2013	430
	5/20/2013	720	6/17/2013	60	7/15/2013	270	8/14/2013	220	9/16/2013	230
	5/22/2013	330	6/19/2013	60	7/22/2013	2100	8/20/2013	270	9/24/2013	360

	5/29/2013	40	6/25/2013	770	7/29/2013	480	8/26/2013	110	9/30/2013	280
	5/5/2014	70	6/2/2014	220	7/7/2014	310	8/5/2014	340	9/3/2014	330
	5/7/2014	20	6/9/2014	260	7/9/2014	100	8/11/2014	740	9/8/2014	330
	5/12/2014	90	6/16/2014	250	7/14/2014	30	8/13/2014	350	9/15/2014	90
	5/19/2014	140	6/23/2014	150	7/16/2014	100	8/18/2014	130	9/17/2014	90
	5/21/2014	230	6/25/2014	220	7/21/2014	170	8/25/2014	8000	9/22/2014	60
	5/27/2014	400	6/30/2014	1200	7/28/2014	80			9/24/2014	60
Geo Mean	108		204		205		395		211	
% Greater 409	8%		17%		25%		36%		17%	
Status	FS		NS		NS		NS		NS	

[1]FS=Fully Supporting, [2]FST=Fully Supporting, but Threatened, [3]NS=Non-supporting.

Levels of bacteria varied throughout the watershed. All sites experienced geometric mean concentrations of E. coli bacteria in excess of state water quality guidelines with the exception of site 385583. Also, all four sites exceeded the state guidelines where more than 10% of the samples exceeded 409 CFU/100 mL for E. coli bacteria. It should be noted site 385583 only exceeded the 10% guideline for the month of June. There were large peaks in bacteria concentrations at all sites in midsummer which can be attributed to riparian grazing and feedlot runoff. Excluding these concentration peaks, there were no significant trends identified that could be attributed to an explanatory variable. It should be noted that some of the samples returned results of "too numerous to count" and a value of 8,000 CFU/100 mL was used in these situations. Hence, the geometric mean concentrations may be underestimated in some situations.

2.3 Rapid Geomorphic Assessment

To evaluate channel-stability conditions and stage of channel evolution of Antelope Creek a Rapid Geomorphic Assessment (RGA) was completed using the Channel-Stability Ranking Scheme. RGA's utilize diagnostic criteria of channel form to infer dominant channel processes and the magnitude of channel instabilities through a series of nine criteria. Evaluations of this sort do not include an evaluation of watershed or upland conditions; however, stream channels act as conduits for energy, flow and materials as they move through the watershed and will reflect a balance or imbalance in the delivery of sediment. RGA's provide a rapid characterization of stream stability conditions.

The RGA procedure consisted of four steps completed on site:

1. Determine the 'reach'. The 'reach' is described as the length of channel covering 6-20 channel widths, thus is scale dependent and covers at least two pool-riffle sequences.
2. Take photographs looking upstream, downstream and across the reach; for quality assurance and quality control purposes. Photographs are used with RGA forms to review the field evaluation.
3. Make observations of channel conditions and diagnostic criteria listed on the channel-stability ranking scheme.
4. Sample bed material.

A field form containing nine criteria was used to record observations of field conditions during RGA's. Each criterion was ranked from zero to four and all values summed to provide an index of relative channel stability. The higher the number the greater the instability. Sites with values greater than 20 exhibit considerable instability, while stable sites generally rank 10 or less. Intermediate values denote reaches of moderate instability. Rankings are not weighted, thus a site ranked 20 is not twice as unstable as a site ranked 10. The process of

filling out the form enables the final decision of "Stage of Channel Evolution". For purposes of the Antelope Creek assessment, sites with total scores of 0 to 10 are considered as stable and sites with scores of 20 to 30 as unstable, recognizing that scores which fall in the range of 10 to 20 have moderate instability and will rely on specific assessment values to determine the trend toward improvement or greater instability.

Thirty sites were randomly selected on Antelope Creek plus four macroinvertebrate sites. At each site numeric values were assigned to each of the nine RGA criteria and then summed to calculate an overall RGA score for each site. By analyzing the scores for the 34 randomly selected sites, an overall assessment of stream stability can be made for Antelope Creek.

The average score for Antelope Creek was 17 which is considered moderately unstable. Of the 34 sites sampled, four (12 percent) were assessed as stable, 24 (70 percent) were in the moderately unstable range and six (18 percent) sites were assessed as unstable (Table 4). The most unstable sites had cattle present or bank scaring from previous flood events.

Table 4. RGA Scoring Ranges and Percentages of Antelope Creek.

RGA Scoring Range	0 – 10	10 – 20	20 – 30
Classification	Stable	Moderate Instability	Unstable
Percentage of Stream Sites	12%	70%	18%

2.4 Biological Assessment

In September of 2013, macroinvertebrates were sampled from four sites (553192, 553236, 553237 and 553238) on Antelope Creek. The macroinvertebrate Index of Biotic Integrity (IBI) score for sites 553236 and 553238 were fair with scores of 34 and 25, respectively. Sites 553192 and 553237 had scores of 52 and 42, respectively, indicating the conditions at those sites are good (Table 5).

Table 5. IBI Scoring and Condition Class for Antelope Creek.

Station ID	Date	IBI Score	Condition Class
553192	04-Sep-13	52	Good
553236	04-Sep-13	34	Fair
553237	04-Sep-13	42	Good
553238	04-Sep-13	25	Fair

2.5 Water quality issues as documented by the North Dakota Department of Health.

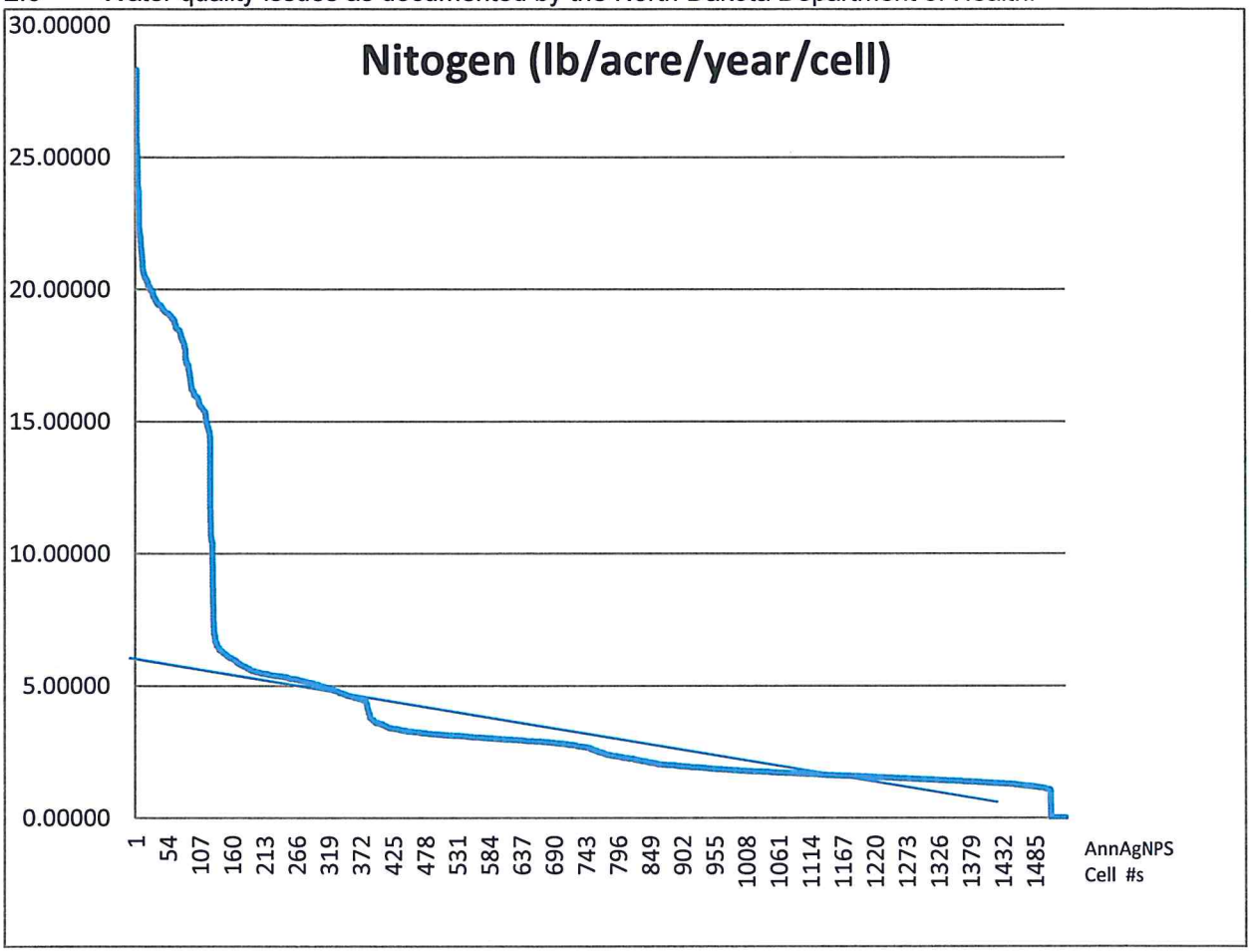


Figure 5: AnnAGNPS cell rankings for nitrogen yields. The cells nearest the y-axis are the highest priority cells. Similar charts have been developed for phosphorus and sediment yields.

An AnnAGNPS model was completed for the watershed to identify priority cropland and noncropland areas. Figure 5 shows how the high priority areas for cropland nitrogen management were identified. The cells above the straight line drawn on the Figure 5 chart are considered high priority. This same process was also used to identify priority for sediment. The high priority AnnAGNPS cells will be focused on to coordinate with producers to evaluate needs and implement BMP that reduce/prevent the delivery of E. coli bacteria and nutrients to Antelope Creek. Based on the E.coli bacteria and nutrient data, particular emphasis will be placed on delivering assistance to producers managing land within the AnnAGNPS priority areas on cropland in the upper reaches of the watershed and on the non-cropland areas in the lower end of the watershed. If the project enters into a second phase, the AnnAGNPS model will be re-run to establish new high priority areas. **Appendix 2** includes the AnnAGNPS priority maps as well as other maps of the watershed, sampling site locations, etc. Of the AnnAGNPS high priority areas, emphasis will be placed on addressing nitrogen management needs in the priority areas in the upper most 12 digit HU and TSS management needs in the priority areas in the lowest 12 digit HU in the watershed. These two HUs are identified on the priority area map in **Appendix 2.**

3.0 Beneficial Use Assessment

3.1 Aquatic Life Use

Nutrients

Eutrophication is defined as the increase in primary productivity resulting from excessive nutrient inputs into rivers. The negative impacts from eutrophication may include the reduction of dissolved oxygen due to algal growth and subsequent decomposition by microbial activity and also alteration of the algal community. The

alteration of the algal community can lead to a decrease in food resource quality for aquatic insects and fish and an alteration of the aquatic insect and fish communities to include less intolerant species (e.g., stonecats, mayflies, stoneflies). Concentrations of TN or TP at which rivers are considered eutrophic can be influenced by spatial and temporal variations in a variety of factors and is still an area of significant research. Based on nutrient concentrations, aquatic life uses could be impacted due to runoff of manure from pasture and animal feeding areas, runoff from riparian grazing by livestock or direct deposit of manure into Antelope Creek.

Total Suspended Solids

In addition to nutrients, TSS concentrations can have an impact on aquatic life use in streams. TSS is the amount of both mineral and organic solids suspended in water, and is often used as a surrogate measure for suspended sediments. North Dakota, along with most other states, does not have TSS criteria designed to protect aquatic life use. The development of criteria is a complex process influenced by numerous spatial and methodological variations and is the subject of current research. The negative effects of TSS on aquatic life are dependent on the concentration and the duration of the exposure. Long durations of high concentrations of TSS can negatively impact the reproduction, feeding, and movement of fish and aquatic insect communities. In addition, suspended solids can eventually settle and cause sedimentation problems like the filling of interstitial space and the smothering of benthic organisms. South Dakota has set a standard for TSS at a 30-day average of 90 mg/L and a daily maximum of 158 mg/L for permanent warm-water fisheries. The South Dakota TSS standard will be used as a reference for this project.

Sampling site 385582, the furthest downstream site, demonstrated consistent exposure to TSS concentrations above 30 mg/L, which may negatively affect aquatic life (Figure 4). Approximately 26 percent of the samples collected at site 385582 had TSS concentrations above 30 mg/L. Based on South Dakota's criteria, there were six exceedances of the 158 mg/L daily maximum standard at site 385582. The results of this assessment show that our most impaired reach for TSS was 385582. All other locations generally had acceptable levels of TSS except 385584 (Figure 4). Site 385584 also saw concentrations of TSS above 30 mg/L.

3.1 Goal

The goal of this project is to reduce E. coli bacteria concentrations at all monitoring sites in the Antelope Creek to achieve "fully supporting" status of the recreational use of the Antelope Creek.

As a secondary goal, the project will also maintain aquatic life uses of the creek by reducing mean annual nitrogen concentrations at site 385584 and mean annual TSS concentrations at 385582. (See App. 2 Maps)

Objective 1:

By the end of the project period, the quality of water from all monitoring stations on the Antelope Creek will meet the North Dakota E. coli bacteria standard of a geometric mean of 126 CFU/100 ml with less than 10 percent of samples exceeding 409/CFU/100 ml. A downward trend in nitrogen and TSS concentrations will also be achieved at monitoring sites 385584 and 385582. (See App. 2 Maps)

Task 1

Employ personnel needed to provide technical and administrative assistance to producers in the watershed area.

Planned Product: Employ a full-time watershed coordinator and an administrative assistant.

Cost: $8232.00 for administrative assistant

$116,212.00 for the watershed coordinator 60% of the time.

Task 2

Provide assistance to producers to execute Best Management Practices (BMPs) that reduce E. coli, nitrogen and TSS loads in the watershed by improving grazing and cropland management. Priority will be given to practices that focus on improving the riparian areas of the Antelope Creek and its tributaries.

Planned Product: Conservation planning on 500 acres in 2017, 1,000 acres in 2018, 4,000 acres in 2019, 10,000 acres in 2020 and 1,120 acres in 2021. Technical assistance for conservation planning will be accomplished as a joint venture between the watershed project coordinator and NRCS staff. BMP installation cost will be funded through the project; however, additional funds for BMPs may be available through EQIP, CSP or alternative sources.

Cost: $334,396.00

Task 3

Install partial manure management systems throughout the watershed. Priority will be given to those AFOs that consistently use the Antelope Creek as a winter feeding area. Practices may include wells, pipelines, insulated water tanks and/or windbreak panels. A partial manure management system is a winter feeding system that focuses on changes in management to remove livestock from a concentrated feeding system and enters them into a rotational feeding system that moves through several designated fields (ie;, croplands, tame pasture, etc.)

Planned Product: 5 partial manure management systems.

Cost: $25,000.00

Task 4

A full containment manure management systems may be needed to adequately address larger feeding operations along the creek to reduce E.coli, nitrogen and TSS in the riparian areas of the watershed.

Planned Produce: 1 Full containment manure management system.

Cost: Funding will be secured through Stockmen's Association or ND Ag Dept.

Task 5

Promotion of cover crops to increase diversity in crop rotation and extend the grazing season with aftermath grazing, relieving pressure on range and pasture land.

Planned Product: Cover crop mixes planted on 160 acres of cropland in 2017, 160 acres in

2018, 240 acres in 2019, 240 acres in 2020 and 320 acres in 2021.

Cost: $22,400.00

Task 6

Conduct follow-up contacts to assist with conservation plan updates and monitor operation and maintenance of Section 319 cost shared products during the watershed project.

Planned Product: Database of applied BMPs with yearly status reviews throughout the watershed project.

Cost: Cost included with Task 1

Task 7

Coordinate with the entities involved in the EQIP locally led work group process to maximize the amount of EQIP funding available to improve water quality. This will include both technical and financial assistance needed to implement current and future projects on the Antelope Creek to address water quality issues.

Planned Product: Target EQIP funding to improve riparian areas through grazing practices and improved land management through this project.

Cost: Cost included with Task 1

Objective 2

Increase the producers' understanding of the impacts and solutions to improve water quality.

Task 8

Organize and conduct scheduled information and educational programs focusing on grazing and land management within agricultural areas and coordinate them with ongoing state/federal sponsored information and education programs. Examples would be range, cover crop, soil health, and Grazing Land Coalition tours.

Planned Product: Four workshops, four tours/demonstrations and five informational meetings conducted throughout the project period.

Cost: $4,000.00

Task 9

Prepare newsletter articles and direct mailings to local land users, general public and media to promote the project and disseminate information on improving water quality through better land management. Topics will include nutrient management, rotational grazing, benefits of cover crops, and other pertinent information on water quality.

Planned Product: Minimum of 10 newsletters and 5 direct mailings.

Cost: Included in Task 1

Task 10

Promote watershed activities and water quality practices at district sponsored events. Targeted audience would be all encompassing to include agricultural producers, urban and country dwellers and school aged children. Examples are Eco-Ed, Grant County Ag Day, County Producer meetings.

Planned Product: Minimum of 6 events throughout the watershed project.

Cost: $0 Cost will be incurred by district

See attached Milestone Table (Appendix 3)

All necessary permits will be acquired as needed. These may include Clean Water Act (CWA) Section 404 permits and cultural resource reviews through the State Historical Preservation office, when needed.

4.0 Coordination Plan

4.1 Cooperating Agencies

The Grant County Soil Conservation District (GCSCD) is the appropriate entity to coordinate and implement this project. The SCD is a locally elected volunteer conservation organization that serves all the people in the county. The GCSCD has legal authorization to employ personnel and receive and expend funds. The GCSCD has sponsored four other 319 projects.

The local NDSU Extension agent will assist with topics of discussion and educational and informational meetings. She is also a regular attendee of the Grant County Soil Conservation District monthly meetings. Assisting with and bringing up new ideas to generate interest among local producers to actively engage in conservation practices.

NRCS Carson Field office shares a building and works alongside Grant County Soil Conservation District in preparing and managing its' annual work plan. NRCS also has various conservation programs that are being run in the same geographical location as the proposed watershed. This cooperation is assured through a Memorandum of Understanding as well as a Contribution Agreement between the State Office of NRCS and Grant County Soil Conservation District.

The Stockmen's Association's Environmental Services and/or the ND Ag Department's Livestock Pollution Prevention Program will also be recommended to watershed producers for further assistance in addressing water quality issues.

4.2 Coordination Program

While there are several business or organizations like Wilbur-Ellis Company, Dakota Farm Equipment, Dakota Grain and Fertilizer, Southwest Grain and Miller Distributing that operate or conduct conservation activities located within the boundaries of the proposed watershed, they tend to lend a hand in specific conservation methods. These methods do not normally maintain water quality as a top priority, but also do not risk contamination of water ways located in the vicinity of their own conservation efforts. However they do provide specific services to the sixty-nine watershed producers in regards to soil testing, proper fertilizer application and minimum/no-till equipment. About one-fourth of the operators in the watershed participate in other programs that address conservation ie.(EQIP, CSP, CRP, OMG etc.)

5.0 Evaluation and Monitoring Plan

5.1

The ND Department of Health will develop a Quality Assurance Project Plan to direct the monitoring efforts of the project. The QAPP will be completed after the project is fully approved and be implemented in 2018.

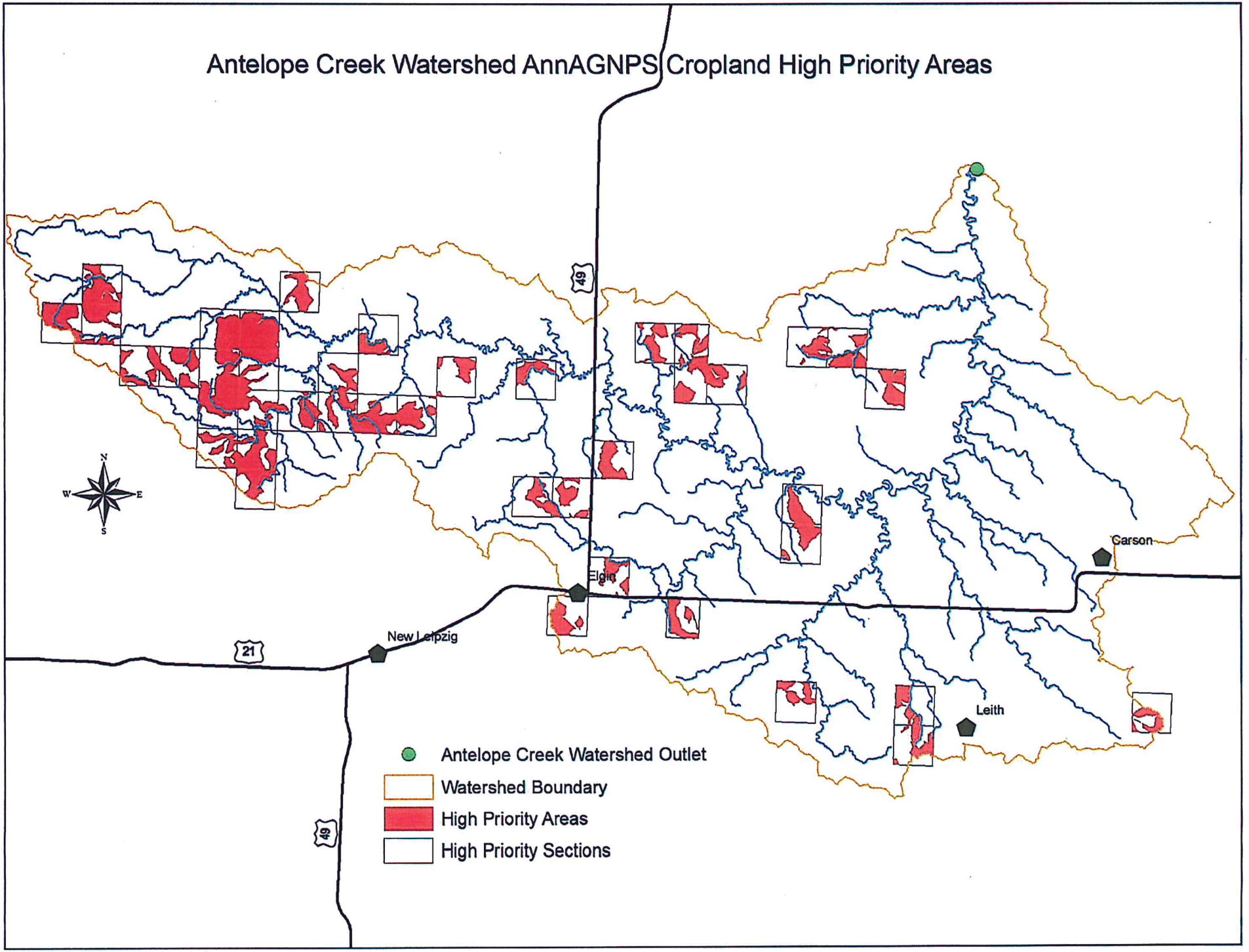
5.2

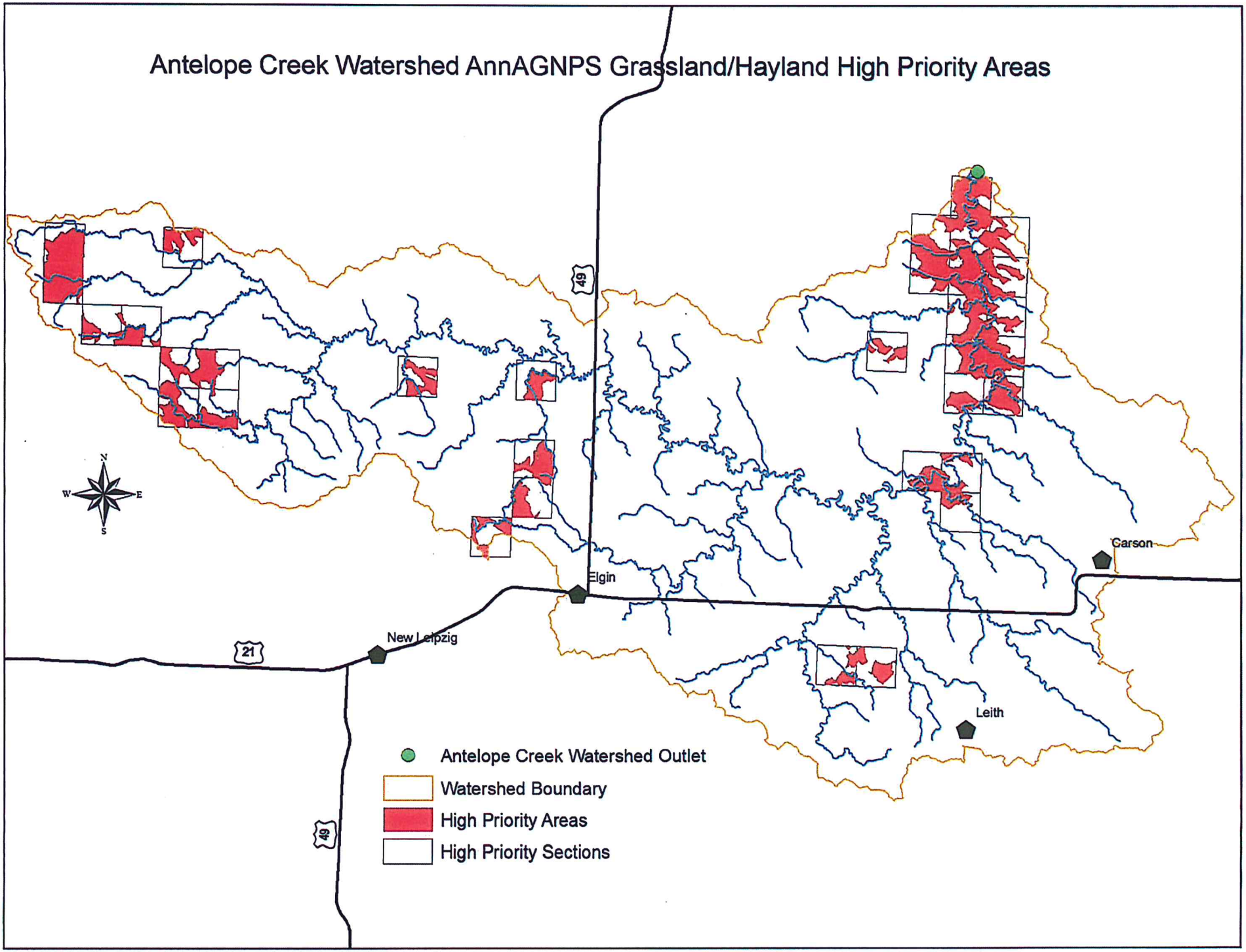
The sponsoring organization will conduct the water quality sampling as well as maintain an accurate database of BMP location and implementation dates along with financial accountability utilizing the BMP Tracker.

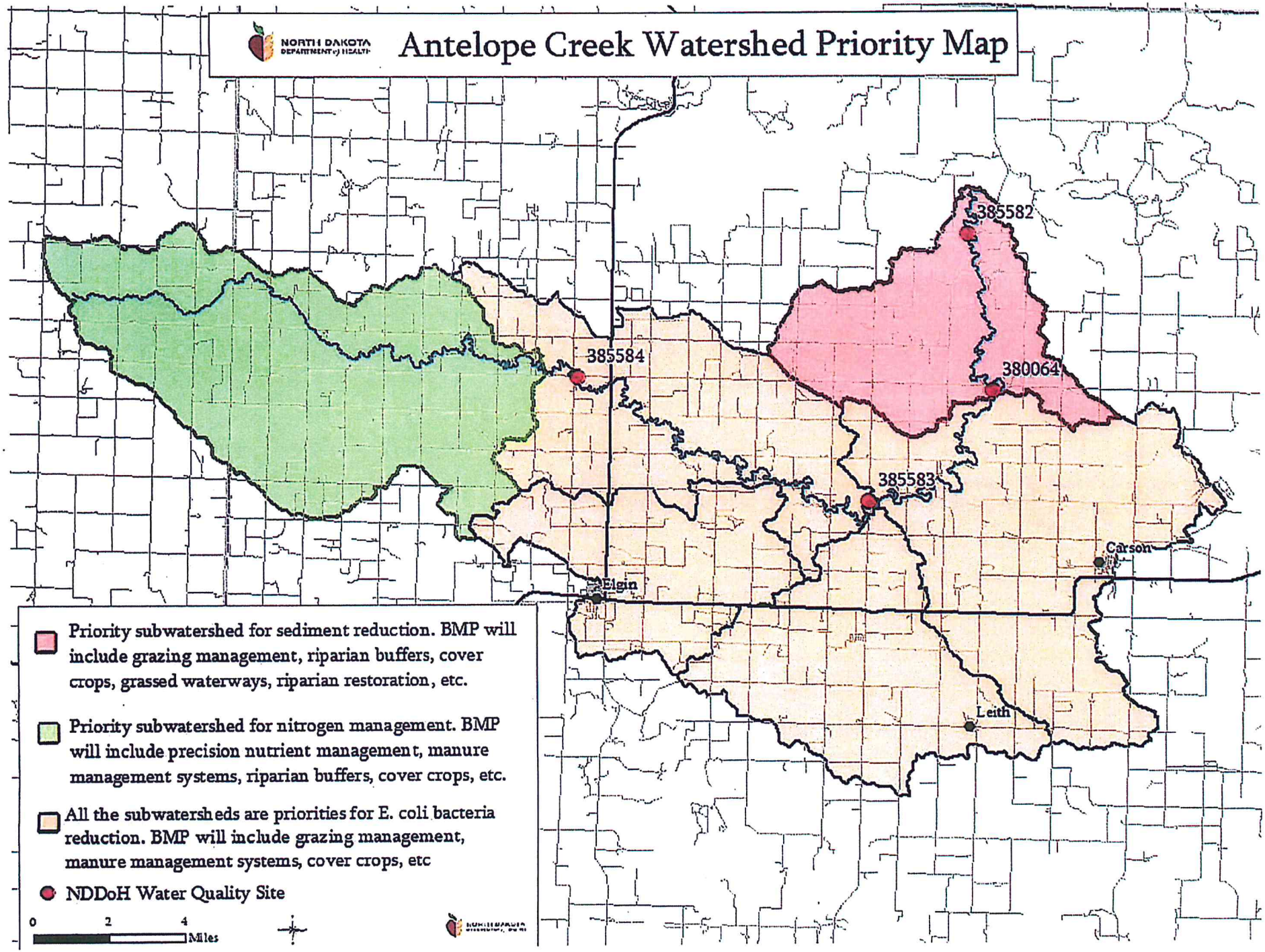
The Grant County Soil Conservation District will be responsible for auditing Operations & Maintenance Agreements (O&M) on BMP's during the project period through yearly status reviews of EPA-319 contracts. The lifespan of each BMP will be listed in the individual contracts to ensure longevity of the practices

Appendix 2

Maps of Project Area


Antelope Creek Watershed AnnAGNPS Cropland High Priority Areas
49
N
W
E
S
Carson
Elgin
New Leipzig
21
Leith
49
Antelope Creek Watershed Outlet
Watershed Boundary
High Priority Areas
High Priority Sections


Antelope Creek Watershed AnnAGNPS Grassland/Hayland High Priority Areas
N
W
E
S
49
21
49
Elgin
New Leipzig
Carson
Leith
Antelope Creek Watershed Outlet
Watershed Boundary
High Priority Areas
High Priority Sections


NORTH DAKOTA DEPARTMENT of HEALTH
Antelope Creek Watershed Priority Map
385582
385584
380064
385583
Carson
Elgin
Leith
Priority subwatershed for sediment reduction. BMP will include grazing management, riparian buffers, cover crops, grassed waterways, riparian restoration, etc.
Priority subwatershed for nitrogen management. BMP will include precision nutrient management, manure management systems, riparian buffers, cover crops, etc.
All the subwatersheds are priorities for E. coli bacteria reduction. BMP will include grazing management, manure management systems, cover crops, etc
NDDoH Water Quality Site
0
2
4
Miles

Appendix 3

Milestone Table

Task	Output	Quantity	2017	2018	2019	2020	2021
Task 1: Employ personnel to provide technical and administrative assistance to producers in the watershed area.	Watershed Coordinator, Administrative assistant	2					
Task 2: Provide assistance to producers to execute BMP's that reduce E. coli, nitogen & TSS loads within the watershed.	Conservation Planning	16,620 acres	500 acres	1,000 acres	4,000 acres	10,000 acres	1,120 acres
Task 3: Install Partial Manure Management systems throughout the watershed.	Partial Manure Management Systems	5	1	1	1	1	1
Task 4: A full containment manure management system may be needed to adequately address larger feeding operations to reduce E.coli, nitrogen & TSS.	Full containment management system	1				1	
Task 5: Promotion of cover crops to increase diversity in crop rotations and extend the grazing season. Which will reduce pressure on rangeland and pasture land.	Cover Crop Usage	1120 acres	160 acres	160 acres	240 acres	240 acres	320 acres
Task 6 : Conduct follow up contacts to assist with conservation plan updates and monitor operation and maintenance of Section 319 cost shared products throughout the watershed project.	Database of applied BMP's with yearly status reviews throughout the watershed.	1					

Task 7: Coordinate with entities involved in the EQIP locally led work group to maximize the amount of EQIP funding available to improve water quality.	Expertise and financial resources to producers in watershed area installing grazing practices through EQIP.	1					
Task 8: Organize and conduct scheduled information and educational programs focused on grazing and land management within agricultural areas and coordinate with ongoing sponsored information.	workshops/tours/ demonstrations/ and informational meetings	13	2 information meeting	1 information meeting 1 workshop 1 tour	1 information meeting 1 workshop 1 tour	1 information meeting 1 workshop 1 tour	1 workshop 1 tour
Task 9: Prepare newsletter articles and direct mailings to local land users, general public and media to promote the project.	newsletters direct mailings	10 news letters 5 direct mails	2 letters 1 mailing	2 letters 1 mailing	2 letters 1 mailing	2 letters 1 mailing	2 letters 1 mailing
Task 10: Promote water quality activities and water quality practices at district sponsored events. Examples: Eco-Ed, County Ag Day, county producer meetings.	District sponsored events	6	1	2	2	1	0

Appendix 4

Letters of Support

GRANT COUNTY
Auditor/Treasurer
PO BOX 227
CARSON, ND 58529-0227

December 21, 2016

Grant County Soil Conservation District
PO BOX 257
Carson, ND 58529

To Whom it May Concern"

The Grant County Commissioners are in favor of the SCS pursuing an EPA 319 Project on the Antelope Creek Watershed. With these types of projects it has a positive impact on the residents of Grant County. We are in support of these efforts.

Alton Zenker –Commissioner
Myles Stoller-Commissioner
John Reinhardt-Commissioner

Alton Zenker **Myles Stoller** **John Reinhardt**

Office Hours: Mon-Fri 8:00 AM – 4:00 PM MST
Telephone: (701) 622-3422 or (701) 622-3275
Fax: (701) 622-3005
E-mail: lmutschelknaus@nd.gov

Grant County Water Resource District
PO Box 161, Elgin, ND 58533

December 21, 2016

Grant County Soil Conservation District
PO Box 257
Carson, ND 58529

To whom it may concern:

The Grant County Water Resource District submits its support in the Grant County Soil Conservation District's efforts to promote water quality and quantity in the Antelope Creek watershed through the promotion and use of Best Management Practices (BMPs).

It is our understanding that this practice will address the high levels of E.coli bacteria and nitrates found during the assessment phase conducted in the watershed.

Sincerely,

Jerald Christensen

Jerald Christensen, Chairman

Gary E. Meyer

Gary Meyer, Vice Chairman

Harold Gaugler

Harold Gaugler, Director

jml

NDSU | EXTENSION SERVICE
GRANT COUNTY

January 6, 2017

Grant County SCD
PO Box 257
Carson, ND 58529

To Whom It May Concern:

The Grant County Soil Conservation District (GCSCD) is well-known for their efforts in assisting Grant County producers with water and soil quality. The GCSCD is seeking assistance for what is called the Antelope Creek Watershed Project to provide funds and plans for producers to implement practices that address the water quality in Antelope Creek.

Results show that both nitrates and E.coli are at high levels in parts or all of the Creek. Nitrates are especially concerning due to the ill effects and possible death to livestock. E.coli is a significant human health concern. Additionally, having high levels in water used for livestock might increase the risk of cross contamination in meat that enters the food chain. Farming and Ranching practices like vegetative buffers between field and stream, and livestock waste containment systems could help improve the water quality in the Antelope Creek Watershed area.

The Grant County Extension Service supports and encourages the approval of the Grant County Soil Conservation District's proposal for the Antelope Creek Watershed Project.

Sincerely,

Katie Wirt
North Dakota State University, Grant County Ag and Natural Resource Extension Agent

North Dakota State University
NDSU EXTENSION SERVICE | GRANT COUNTY
Courthouse | 106 2nd Ave NE | PO Box 137 | Carson ND 58529-0137 | 701.622.3470 | Fax 701.622.3717
NDSU.Grant.Extension@ndsu.edu | www.ag.ndsu.edu/grantcountyextension | www.ag.ndsu.edu/extension

County Commissions, North Dakota State University and U.S. Department of Agriculture Cooperating | NDSU is an equal opportunity institution

USDA

Natural Resources
Conservation Service

Carson Field Office

103 Dakota ST, Box
257
Carson
ND, 58529
Voice 701.622.3381
Ext. 3
Fax 877.478.4506

January 12, 2017

Grant County SCD
PO BOX 257
Carson, ND 58529

To Whom it May Concern:

I would support the Grant County Soil Conservation District in their request for the Antelope creek Watershed Project. The District has had numerous projects in the past and has demonstrated their ability to complete the work and get conservation on the ground in Grant County.

In addition to the water quality benefits that accompany many of these practices that will be implemented through the project the improvement of grazing distribution, livestock health, and carbon sequestration will be additional benefits to the reduction of nitrate and E. coli levels.

We've also seen that 319 projects work well with other USDA programs to provide maximum benefit to address resource concerns in the county. It is quite often that one producer will start with one program and then continue their conservation work with another.

I would encourage the approval of the Grant County Soil Conservation District's proposal for the Antelope Creek Watershed Project.

Sincerely,

Jonathan J. Fettig
Acting District Conservationist

An Equal Opportunity Provider and Employer

Appendix 5

Water Quality

Assessment Report

Water Quality Monitoring Results for the Antelope Creek Watershed Assessment Project

Final: September 2016

Prepared for:
Grant County SCD
103 Dakota St
Carson, ND 58529

Prepared by:
Paul Olson
ND Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

Water Quality Monitoring Results for the Antelope Creek Watershed Assessment Project

Jack Dalrymple, Governor
Terry Dwelle, M.D., State Health Officer

North Dakota Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947
701.328.5210

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1.0 Overview and Monitoring Goals

Antelope Creek, a tributary to the Heart River, is located within the Lower Heart River watershed. The Antelope Creek watershed extends from the eastern portion of Hettinger County to three miles west of Carson in Grant County, North Dakota. The contributing subwatersheds vary from 16,216 to 33,063 acres in size with a total watershed size of approximately 153,612 acres.

Identifying potential water quality impacts to aquatic life and recreation uses of Antelope Creek was the primary focus of this assessment. Chemical, biological and physical data was collected from sampling sites in the watersheds to: 1) determine current water quality conditions in Antelope Creek; and 2) assess potential effects on beneficial uses resulting from pollutant loadings, stressors and sources indicated by the data. Currently, Antelope Creek is identified on the "North Dakota 2014 Section 303(d) List of Impaired Waters" as not supporting recreational uses due to Escherichia coli.

In the state's water quality standards, attainment of recreational uses is defined using E. coli bacteria as the indicator organism. This criterion is only valid during the recreation period of May 1 through September 30. Two separate E. coli bacteria criteria are used to determine if the waterbody is classified as fully supporting, fully supporting, but threatened or not supporting for recreational uses. The first criterion is that the geometric mean of the samples should not exceed 126 colony forming units (CFU) per 100 milliliters (mL). The second criterion is that not more than 10 percent of the samples should exceed 409 CFU per 100 mL. The waterbody is classified as fully supporting if both criteria are met, fully supporting but threatened if only the first criteria is met, and not supporting if neither of the criteria are met by the waterbody (NDDH, 2014).

Four sampling locations were selected on Antelope Creek for collection of various chemical and physical data. Descriptions and locations of sites and parameters sampled are illustrated in Table 1 and Figure 1. Sampling frequency for each site was scheduled to occur five times per month (a minimum of once per week). Samples were only collected when flow was present.

Table 1. Water Quality Monitoring Stations in the Antelope Creek Watershed.

Storet ID	Site Description	Data to be Collected	Collection Year
385582	7 miles north of Carson, ND	Water Quality	2013, 2014
380064	5 miles north of Carson, ND	Water Quality	2013, 2014
385583	6 miles west of Carson, ND	Water Quality	2013, 2014
385584	6 miles north of Elgin, ND	Water Quality	2013, 2014

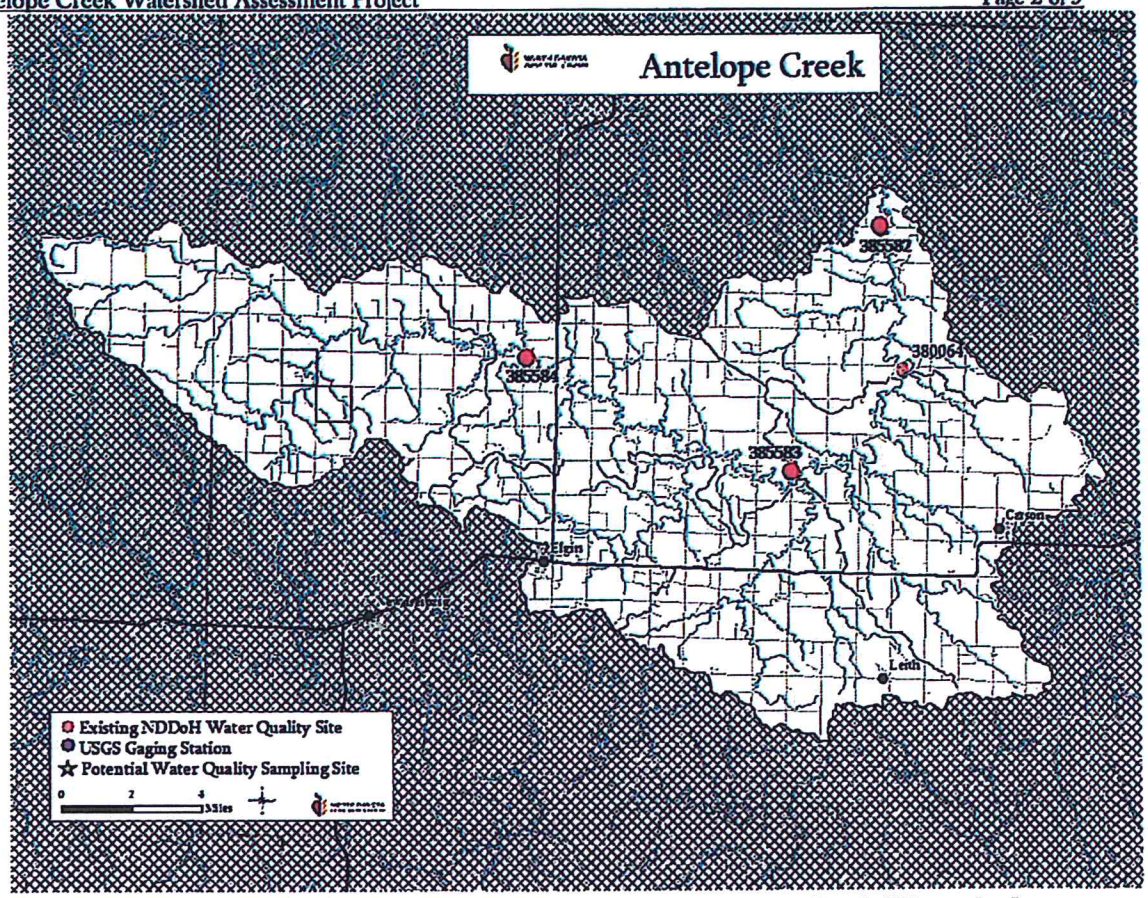

Figure 1. Water Quality Monitoring Locations in the Antelope Creek Watershed

2.0 Assessment Data

2.1 Total Nitrogen, Total Phosphorus, and Total Suspended Solids

Table 2 summarizes the total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) data collected during the Antelope Creek Watershed Assessment. Figures 2 through 4 summarize TN, TP and TSS trends at each of the sites over the course of the sampling season. Descriptive statistics show that TN, TP and TSS concentrations varied widely during the course of seasonal monitoring, as well as between sites.

Table 2. Summary of Descriptive Statistics for Nutrients Calculated at Each Site.

2013-2014				
	385584	385583	380064	385582
#Samples	75	75	75	75
Total Nitrogen (mg/L)				
Mean	2.68	2.10	1.63	1.48
Maximum	11.10	10.10	6.64	6.50
Median	2.30	1.57	1.29	1.18
Total Phosphorus (mg/L)				
Mean	0.12	0.09	0.08	0.08
Maximum	0.42	0.27	0.26	0.37
Median	0.08	0.07	0.06	0.05
Total Suspended Solids (mg/L)				
Mean	35.04	26.71	20.55	43.42
Maximum	189.00	157.00	149.00	374.00
Median	28.00	19.50	9.00	15.00

TN data for sites 385584, 385583, 380064 and 385582 was compiled for years 2013-2014 in Figure 2. Average annual concentrations for TN ranged from a low of 0.09 mg/L at site 385584 in 2013 to a high of 11.10 mg/L at site 385584 in 2014. It should be noted that a TN concentration of 11.10 mg/L exceeds the state drinking water standard of 10 mg/L. TP data for monitoring sites 385584, 385583, 380064 and 385582 was compiled for years 2013-2014 in Figure 3. Average annual TP concentrations showed very little temporal variation at most sites, however there appeared to be elevated levels of TP in mid to late summer of 2013 and 2014 at all sites which is probably associated with rain events. Analysis of the data shows concentrations of TP are steady throughout Antelope Creek where TN concentrations are highest at the furthest site upstream. Total suspended solid concentrations increase from upstream to downstream (Figure 4). Site 385582 had the highest average concentration at 374.00 mg/L. The highest concentrations of TN, TP and TSS were correlated with peak flows and runoff events.

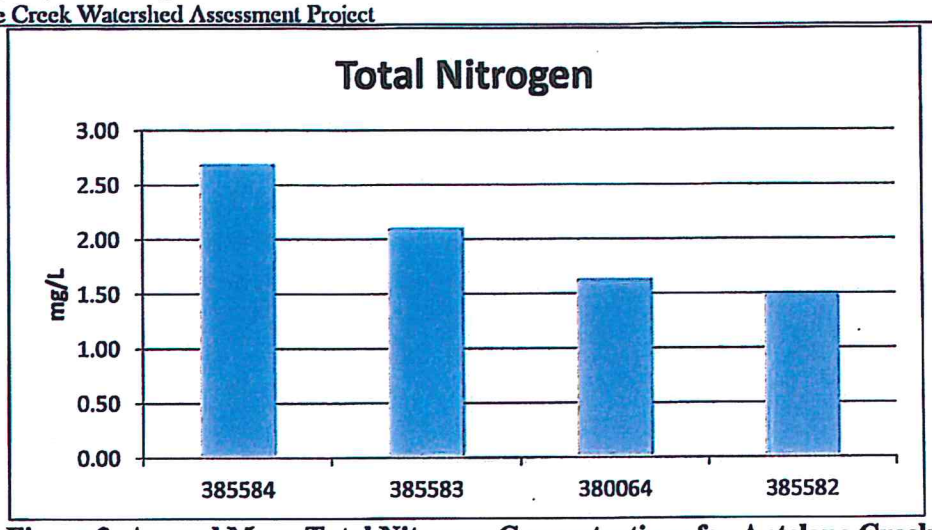

Figure 2. Annual Mean Total Nitrogen Concentrations for Antelope Creek

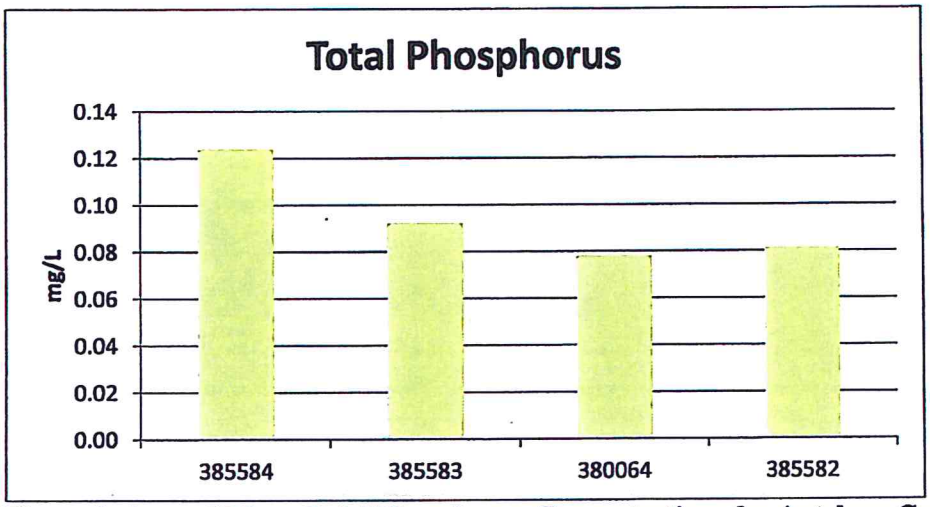

Figure 3. Annual Mean Total Phosphorus Concentrations for Antelope Creek

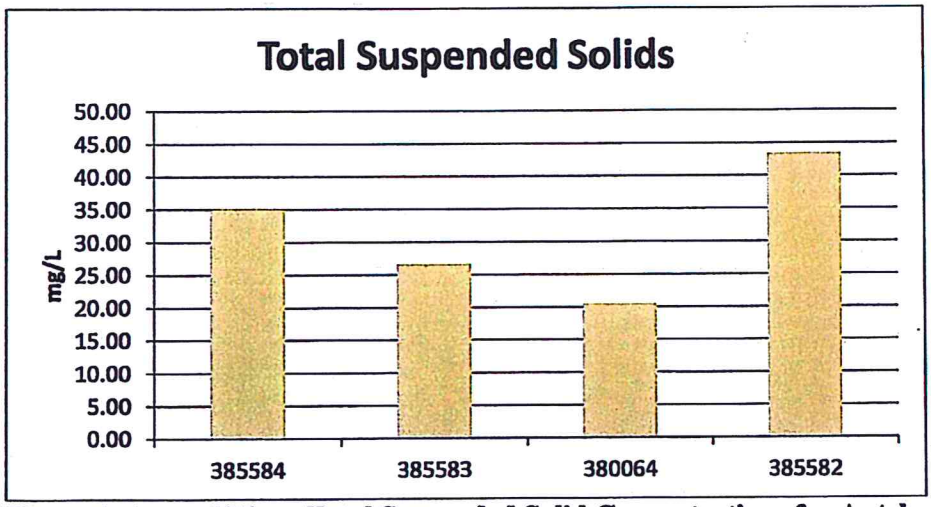

Figure 4. Annual Mean Total Suspended Solid Concentrations for Antelope Creek

2.2 E. coli Bacteria

Table 3 summarizes the E. coli bacteria data collected during the Antelope Creek Watershed Assessment.

Table 3. Summary of E. coli Bacteria Data Calculated at Each Site.

385584										
	May		June		July		August		September	
	5/1/2013	40	6/3/2013	420	7/1/2013	180	8/5/2013	370	9/3/2013	200
	5/7/2013	20	6/5/2013	220	7/8/2013	280	8/7/2013	110	9/9/2013	680
	5/15/2013	140	6/10/2013	310	7/10/2013	130	8/12/2013	300	9/11/2013	290
	5/20/2013	50	6/17/2013	50	7/15/2013	10	8/14/2013	230	9/16/2013	90
	5/22/2013	4200	6/19/2013	310	7/22/2013	60	8/20/2013	420	9/24/2013	90
	5/29/2013	10	6/25/2013	400	7/29/2013	180	8/26/2013	240	9/30/2013	110
	5/5/2014	10	6/2/2014	900	7/7/2014	520	8/5/2014	160	9/3/2014	150
	5/7/2014	10	6/9/2014	550	7/9/2014	430	8/11/2014	120	9/8/2014	60
	5/12/2014	10	6/16/2014	430	7/14/2014	340	8/13/2014	90	9/15/2014	20
	5/19/2014	10	6/23/2014	220	7/16/2014	1000	8/18/2014	200	9/17/2014	30
	5/21/2014	100	6/25/2014	200	7/21/2014	5000	8/25/2014	8000	9/22/2014	10
	5/27/2014	1200	6/30/2014	900	7/28/2014	60			9/24/2014	40
# Samples	11		12		12		11		12	
Geo Mean	38		327		224		279		81	
% Greater 409	9%		42%		33%		18%		8%	
Status	FS		NS		NS		NS		FS	

385583										
	May		June		July		August		September	
	5/1/2013	10	6/3/2013	260	7/1/2013	120	8/5/2013	180	9/3/2013	10
	5/7/2013	10	6/5/2013	40	7/8/2013	140	8/7/2013	40	9/9/2013	90
	5/15/2013	10	6/17/2013	20	7/10/2013	180	8/12/2013	40	9/11/2013	50
	5/20/2013	280	6/19/2013	600	7/15/2013	100	8/14/2013	30	9/16/2013	30
	5/22/2013	4200	6/25/2013	500	7/22/2013	70	8/20/2013	30	9/24/2013	10
	5/29/2013	60	6/2/2014	250	7/29/2013	60	8/26/2013	70	9/30/2013	90
	5/5/2014	10	6/9/2014	50	7/7/2014	130	8/5/2014	110	9/3/2014	170
	5/7/2014	10	6/16/2014	60	7/9/2014	110	8/11/2014	170	9/8/2014	140
	5/12/2014	10	6/23/2014	90	7/14/2014	140	8/13/2014	160	9/15/2014	20
	5/19/2014	10	6/25/2014	80	7/16/2014	70	8/18/2014	320	9/17/2014	10
	5/21/2014	10	6/30/2014	100	7/21/2014	190	8/25/2014	4300	9/22/2014	10
	5/27/2014	60			7/28/2014	210			9/24/2014	20
# Samples	12		11		12		11		12	
Geo Mean	29		112		118		120		32	
% Greater 409	8%		18%		0%		9%		0%	
Status	FS		FST		FS		FS		FS	

Table 3. Summary of E. coli Bacteria Data Calculated at Each Site (cont.)

380064										
	May		June		July		August		September	
	5/1/2013	10	6/3/2013	300	7/1/2013	140	8/5/2013	110	9/3/2013	110
	5/7/2013	10	6/5/2013	110	7/8/2013	150	8/7/2013	70	9/9/2013	560
	5/15/2013	100	6/10/2013	100	7/10/2013	120	8/12/2013	100	9/11/2013	260
	5/20/2013	680	6/17/2013	180	7/15/2013	380	8/14/2013	40	9/16/2013	140
	5/22/2013	1000	6/19/2013	1900	7/22/2013	160	8/20/2013	130	9/24/2013	330
	5/29/2013	30	6/25/2013	540	7/29/2013	90	8/26/2013	180	9/30/2013	2100
	5/5/2014	10	6/2/2014	210	7/7/2014	190	8/5/2014	110	9/3/2014	160
	5/7/2014	10	6/9/2014	120	7/9/2014	100	8/11/2014	70	9/8/2014	80
	5/12/2014	20	6/16/2014	400	7/14/2014	120	8/13/2014	70	9/15/2014	160
	5/19/2014	10	6/23/2014	100	7/16/2014	90	8/18/2014	680	9/17/2014	370
	5/21/2014	10	6/25/2014	160	7/21/2014	160	8/25/2014	1200	9/22/2014	200
	5/27/2014	80	6/30/2014	600	7/28/2014	60			9/24/2014	480
Geo Mean	35		250		132		137		264	
% Greater 409	17%		25%		0%		18%		25%	
Status	FST		NS		NS		NS		NS	

385582										
	May		June		July		August		September	
	5/1/2013	130	6/3/2013	280	7/1/2013	210	8/5/2013	630	9/3/2013	200
	5/7/2013	30	6/5/2013	300	7/8/2013	110	8/7/2013	420	9/9/2013	1200
	5/15/2013	40	6/10/2013	40	7/10/2013	690	8/12/2013	230	9/11/2013	430
	5/20/2013	720	6/17/2013	60	7/15/2013	270	8/14/2013	220	9/16/2013	230
	5/22/2013	330	6/19/2013	60	7/22/2013	2100	8/20/2013	270	9/24/2013	360
	5/29/2013	40	6/25/2013	770	7/29/2013	480	8/26/2013	110	9/30/2013	280
	5/5/2014	70	6/2/2014	220	7/7/2014	310	8/5/2014	340	9/3/2014	330
	5/7/2014	20	6/9/2014	260	7/9/2014	100	8/11/2014	740	9/8/2014	330
	5/12/2014	90	6/16/2014	250	7/14/2014	30	8/13/2014	350	9/15/2014	90
	5/19/2014	140	6/23/2014	150	7/16/2014	100	8/18/2014	130	9/17/2014	90
	5/21/2014	230	6/25/2014	220	7/21/2014	170	8/25/2014	8000	9/22/2014	60
	5/27/2014	400	6/30/2014	1200	7/28/2014	80			9/24/2014	60
Geo Mean	108		204		205		395		211	
% Greater 409	8%		17%		25%		36%		17%	
Status	FS		NS		NS		NS		NS	

[1]FS=Fully Supporting, [2]FST=Fully Supporting, but Threatened, [3]NS=Nonsupporting.

Levels of bacteria varied throughout the watershed. All sites experienced geometric mean concentrations of E. coli bacteria in excess of state water quality guidelines with the exception of site 385583. Also, all four sites exceeded the state guidelines where more than 10% of the samples exceeded 409 CFU/100 mL for E. coli bacteria. It should be noted site 385583 only exceeded the 10% guideline for the month of June. There were large peaks in bacteria concentrations at all sites in midsummer which can be attributed to riparian grazing and feedlot runoff. Excluding these concentration peaks, there were no significant trends identified that could be attributed to an explanatory variable. It should be noted that some of the samples returned results of "too numerous to count" and a value of 8,000 CFU/100 mL was used in these situations. Hence, the geometric mean concentrations may be underestimated in some situations.

2.3 Rapid Geomorphic Assessment

To evaluate channel-stability conditions and stage of channel evolution of Antelope Creek a Rapid Geomorphic Assessment (RGA) was completed using the Channel-Stability Ranking Scheme. RGA's utilize diagnostic criteria of channel form to infer dominant channel processes and the magnitude of channel instabilities through a series of nine criteria. Evaluations of this sort do not include an evaluation of watershed or upland conditions; however, stream channels act as conduits for energy, flow and materials as they move through the watershed and will reflect a balance or imbalance in the delivery of sediment. RGA's provide a rapid characterization of stream stability conditions.

The RGA procedure consisted of four steps completed on site:

1. Determine the 'reach'. The 'reach' is described as the length of channel covering 6-20 channel widths, thus is scale dependent and covers at least two pool-riffle sequences.
2. Take photographs looking upstream, downstream and across the reach; for quality assurance and quality control purposes. Photographs are used with RGA forms to review the field evaluation.
3. Make observations of channel conditions and diagnostic criteria listed on the channel-stability ranking scheme.
4. Sample bed material.

A field form containing nine criteria was used to record observations of field conditions during RGA's. Each criterion was ranked from zero to four and all values summed to provide an index of relative channel stability. The higher the number the greater the instability. Sites with values greater than 20 exhibit considerable instability, while stable sites generally rank 10 or less. Intermediate values denote reaches of moderate instability. Rankings are not weighted, thus a site ranked 20 is not twice as unstable as a site ranked 10. The process of filling out the form enables the final decision of "Stage of Channel Evolution". For purposes of the Antelope Creek assessment, sites with total scores of 0 to 10 are considered as stable and sites with scores of 20 to 30 as unstable, recognizing that scores which fall in the range of 10 to 20 have moderate instability and will rely on specific assessment values to determine the trend toward improvement or greater instability.

Thirty sites were randomly selected on Antelope Creek plus four macroinvertebrate sites. At each site numeric values were assigned to each of the nine RGA criteria and then summed to calculate an overall RGA score for each site. By analyzing the scores for the 34 randomly selected sites, an overall assessment of stream stability can be made for Antelope Creek.

The average score for Antelope Creek was 17 which is considered moderately unstable. Of the 34 sites sampled, four (12 percent) were assessed as stable, 24 (70 percent) were in the moderately unstable range and six (18 percent) sites were assessed as unstable (Table 4). The most unstable sites had cattle present or bank scaring from previous flood events.

Table 4. RGA Scoring Ranges and Percentages of Antelope Creek.

RGA Scoring Range	0 – 10	10 – 20	20 – 30
Classification	Stable	Moderate Instability	Unstable
Percentage of Stream Sites	12%	70%	18%

2.4 Biological Assessment

In September of 2013, macroinvertebrates were sampled from four sites (553192, 553236, 553237 and 553238) on Antelope Creek. The macroinvertebrate Index of Biotic Integrity (IBI) score for sites 553236 and 553238 were fair with scores of 34 and 25, respectively. Sites 553192 and 553237 had scores of 52 and 42, respectively, indicating the conditions at those sites are good (Table 5).

Table 5. IBI Scoring and Condition Class for Antelope Creek.

StationID	Date	IBI Score	Condition Class
553192	04-Sep-13	52	Good
553236	04-Sep-13	34	Fair
553237	04-Sep-13	42	Good
553238	04-Sep-13	25	Fair

3.0 Beneficial Use Assessment

3.1 Aquatic Life Use

Nutrients

Eutrophication is defined as the increase in primary productivity resulting from excessive nutrient inputs into rivers. The negative impacts from eutrophication may include the reduction of dissolved oxygen due to algal growth and subsequent decomposition by microbial activity and also alteration of the algal community. The alteration of the algal community can lead to a decrease in food resource quality for aquatic insects and fish and an alteration of the aquatic insect and fish communities to include less intolerant species (e.g., stonecats, mayflies, stoneflies). Concentrations of TN or TP at which rivers are considered eutrophic can be influenced by spatial and temporal variations in a variety of factors and is still an area of significant research. Based on nutrient concentrations, aquatic life uses could be impacted due to runoff of manure from pasture and animal feeding areas, runoff from riparian grazing by livestock or direct deposit of manure into Antelope Creek.

Total Suspended Solids

In addition to nutrients, TSS concentrations can have an impact on aquatic life use in streams. TSS is the amount of both mineral and organic solids suspended in water, and is often used as a surrogate measure for suspended sediments. North Dakota, along with most other states, does not have TSS criteria designed to protect aquatic life use. The development of criteria is a complex process influenced by numerous spatial and methodological variations and is the subject of current research. The negative effects of TSS on aquatic life are dependent on the concentration and the duration of the exposure.

Long durations of high concentrations of TSS can negatively impact the reproduction, feeding, and movement of fish and aquatic insect communities. One study proposed that the level of risk to the fish community from suspended sediment concentration be based on a level above the background concentration. A level less than 25 mg/L above the background level would represent a very low risk, 25-100 mg/L above the background would represent low risk, 100-200 mg/L above the background would represent a moderate risk, 200-400 mg/L above background would represent a high risk, and greater than 400 mg/L above the background would represent an unacceptable risk (DFO, 2000). Using existing literature, the European Inland Fisheries Advisory Commission developed the following criteria: (1) less than 25 mg/L of suspended solids had no harmful effect on fisheries, (2) 25-80 mg/L could maintain moderate fisheries, (3) 80-400 mg/L was unlikely to support good freshwater fisheries, and (4) greater than 400 mg/L was likely to support only poor fisheries (DFO, 2000). South Dakota has set a standard for TSS at a 30-day average of 90 mg/L and a daily maximum of 158 mg/L for permanent warm-water fisheries. In addition, suspended solids can eventually settle and cause sedimentation problems like the filling of interstitial space and the smothering of benthic organisms. The South Dakota TSS standard will be used as a reference for this report.

Sampling site 385582, the furthest downstream site, demonstrated consistent exposure to TSS concentrations above 30 mg/L, which may negatively affect aquatic life (Figure 4). Approximately 26 percent of the samples collected at site 385582 had TSS concentrations above 30 mg/L. Based on South Dakota's criteria, there were six exceedances of the 158 mg/L daily maximum standard at site 385582. The results of this assessment show that our most impaired reach for TSS was 385582. All other locations generally had acceptable levels of TSS except 385584 (Figure 4). Site 385584 also saw concentrations of TSS above 30 mg/L.

3.2 Recreational Use

To determine if Antelope Creek supports recreational uses the data collected at each site during the recreation season (May 1 through September 30) was compared to the North Dakota water quality criteria for the pathogen indicator, E. coli bacteria. From the assessment data, all sites on Antelope Creek were not supporting recreational uses due to elevated E. coli bacteria levels except site 385583 (Table 3). The cause of this contamination is varied. Riparian grazing and feedlot runoff are all possible causes of the elevated E. coli bacteria levels at these sites.

Appendix 6

Budget Tables

ANTELOPE CREEK WATERSHED PROJECT BUDGET TABLE						
PART 1: FUNDING SOURCES	**2017**	**2018**	**2019**	**2020**	**2021**	**TOTAL**
EPA SECTION 319 FUNDS						
1) FY17 319 Funds (FA)	$ 31,064	$ 69,895	$ 69,895	$ 69,895	$ 69,895	$ 310,644
Subtotals	***$ 31,064***	***$ 69,895***	***$ 69,895***	***$ 69,895***	***$ 69,895***	***$ 310,644***
OTHER FEDERAL FUNDS						
1) NRCS (TA)	$ 1,500	$ 3,375	$ 3,375	$ 3,375	$ 3,375	$ 15,000
2) NRCS (FA)	$ 3,750	$ 8,438	$ 8,438	$ 8,438	$ 8,438	$ 37,500
Subtotals	***$ 5,250***	***$ 11,813***	***$ 11,813***	***$ 11,813***	***$ 11,813***	***$ 52,500***
STATE/LOCAL MATCH						
1) Local SCD (FA)	$ 2,569	$ 6,422	$ 6,422	$ 6,422	$ 6,422	$ 28,258
2) Local SCD (TA)	$ 2,419	$ 4,988	$ 4,988	$ 4,988	$ 4,987	$ 22,370
3) Cooperative Extension (TA)	$ 150	$ 150	$ 150	$ 150	$ 150	$ 750
6) Grant County Participating Producers (FA)	$ 6,652	$ 34,368	$ 34,368	$ 34,368	$ 46,362	$ 156,118
7) BMP (In-Kind match) Prescribed Grazing	$ 7,500	$ 16,875	$ 16,875	$ 16,875	$ 16,875	$ 75,000
Subtotals	***$ 19,290***	***$ 62,803***	***$ 62,803***	***$ 62,803***	***$ 74,796***	***$ 282,496***
Total 319 & State/Local match	***$ 50,354***	***$ 132,698***	***$ 132,698***	***$ 132,698***	***$ 144,691***	***$ 593,140***
TOTAL BUDGET including Federal Funds	**$ 55,604**	**$ 144,511**	**$ 144,511**	**$ 144,511**	**$ 156,504**	**$ 645,640**

FA = Financial Assistance
TA = Technical Assistance

NRCS = Natural Resource Conservation Service
SCD = Soil Conservation District

ANTELOPE CREEK WATERSHED PROJECT

BUDGET TABLE

PART 2: Section 319/Non-Federal Budget Funds	2017	2018	2019	2020	2021	TOTAL	FUNDING		
							Cash Costs	In-Kind Match*	319 Match
1) Salary/Fringe - Watershed Coordinator (full-time : 2080 hrs.)	$ 10,764	$ 22,152	$ 22,464	$ 22,776	$ 23,088	$ 101,244	$ 20,249	$ 20,249	$ 60,746
2) Salary/Fringe - Admin. Assistant (part-time : 96 hrs./yr.)	$ 888	$ 1,800	$ 1,824	$ 1,848	$ 1,872	$ 8,232	$ 1,646	$ 1,646	$ 4,939
3) Travel (3,500 miles/per year at $.54/mile)	$ 945	$ 1,890	$ 1,890	$ 1,890	$ 1,890	$ 8,505	$ 1,701	$ 1,701	$ 5,103
4) Equipment/Supplies ($30/mo.)	$ 180	$ 346	$ 338	$ 173	$ 26	$ 1,063	$ 213	$ 213	$ 638
5) Telephone/Postage (8/mo @ $150/mo.)	$ 600	$ 1,200	$ 1,200	$ 1,200	$ 1,200	$ 5,400	$ 1,080	$ 1,080	$ 3,240
Subtotals	*$ 13,377*	*$ 27,388*	*$ 27,716*	*$ 27,887*	*$ 28,076*	*$ 124,444*	*$ 24,889*	*$ 24,889*	*$ 74,666*
OBJECTIVES 1: By the end of the project period, the quality of water from all monitoring stations on the Antelope Creek will meet the N.D. E.coli bacteria standard of a geometric mean of 126 CRU/100mL with less than 10% of samples exceeding 409 colonies/100 mL. A downward trend in nitrogen and TSS conserntrations will also be achieved at monitoring sites 385584 and 385582. (See Appendix 2 Maps)									
1) Implement BMP Practices (Task 2)	$ 37,776	$ 75,968	$ 76,176	$ 76,384	$ 76,592	$ 342,896	$ 137,158	$ -	$ 205,738
2) Partial Manure Management (Task 3)	$ 2,500	$ 5,000	$ 5,000	$ 6,000	$ 6,500	$ 25,000	$ 10,000	$ -	$ 15,000
3) Cover Crops (Task 4)	$ 1,600	$ 3,200	$ 4,800	$ 6,400	$ 6,400	$ 22,400	$ 8,960	$ -	$ 13,440
4) Prescribed Grazing	$ 7,500	$ 15,000	$ 15,000	$ 15,000	$ 22,500	$ 75,000		$ 75,000	
5) Full containment manure management system	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Subtotals	*$ 49,376*	*$ 99,168*	*$ 100,976*	*$ 103,784*	*$ 111,992*	*$ 465,296*	*$ 156,118*	*$ 75,000*	*$ 234,178*
OBJECTIVE 2: Increase producers' understanding of impacts and solutions to improve water quality.									
1) Educationalt workshops (4)	$ 250	$ 275	$ 275	$ 150	$ -	$ 950	$ 190	$ 190	$ 570
2) Field Tours and demonstrations (4)	$ 250	$ 500	$ 500	$ 200	$ -	$ 1,450	$ 290	$ 290	$ 870
3) Information/Education Meetings (5 mtgs.)	$ 150	$ 150	$ 150	$ 150	$ -	$ 600	$ 120	$ 120	$ 360
Subtotals	*$ 650*	*$ 925*	*$ 925*	*$ 500*	*$ -*	*$ 3,000*	*$ 600*	*$ 600*	*$ 1,800*
TOTAL 319/NON-FEDERAL BUDGET	$ 63,403	$ 127,481	$ 129,617	$ 132,171	$ 140,068	$ 592,740	$ 181,607	$ 100,489	$ 310,644

ANTELOPE CREEK WATERSHED PROJECT

PART 3: Selected Best Management Practices (BMPs)

Land Use Code	NRCS Code	Practice	No.	Acres	Linear Feet (LF)	*Rate*	TOTAL	FUNDING		
								Cost-share Rate	Cash Costs	319 Match
2, 3, 4	382	Fencing			31,720	*$ 1.80*	$ 57,096	60%	$ 22,838	**$ 34,258**
2, 3, 4	56	Alternative Power	1			*$ 5,000.00*	$ 5,000	60%	$ 2,000	**$ 3,000**
2, 3, 4	4	Solar Power	6			*$ 8,000.00*	$ 48,000	60%	$ 19,200	**$ 28,800**
2, 3, 4	516	Pipelines			30,000	*$ 4.00*	$ 120,000	60%	$ 48,000	**$ 72,000**
3	528	Prescribe Grazing		15,000		*$ 5.00*	$ 75,000	60%	$ -	
2, 3	614	Trough & Tank	32			*$ 1,250.00*	$ 40,000	60%	$ 16,000	**$ 24,000**
2, 3, 4	642	Well (livestock only)	6			*$ 7,800.00*	$ 46,800	60%	$ 18,720	**$ 28,080**
1,	340	Cover Crops		1,120		*$ 20.00*	$ 22,400	60%	$ 8,960	**$ 13,440**
1,	512	Pasture/Hay land Planting (Forage & Biomas planting)		500		*$ 52.00*	$ 26,000	60%	$ 10,400	**$ 15,600**
4,	312	Livestock Manure Management System	1			*$ -*	$ -	60%	$ -	**$ -**
4,	312	Partial Manure Management	5			*$ 5,000.00*	$ 25,000	60%	$ 10,000	**$ 15,000**
		SUBTOTALS	**51**	**16,620**	**61,720**		**$ 465,296**		**$156,118**	$ 234,178

Land Use Codes: 1 = Cropland 2 = Pasture Hayland 3 = Rangeland 4 = Farmstead/Misc