SALINITY TMDL FOR SAGE CREEK, MONTANA
(HUC 10050006)

JANUARY 16, 2002

Montana Department of
ENVIRONMENTAL QUALITY

TABLE OF CONTENTS

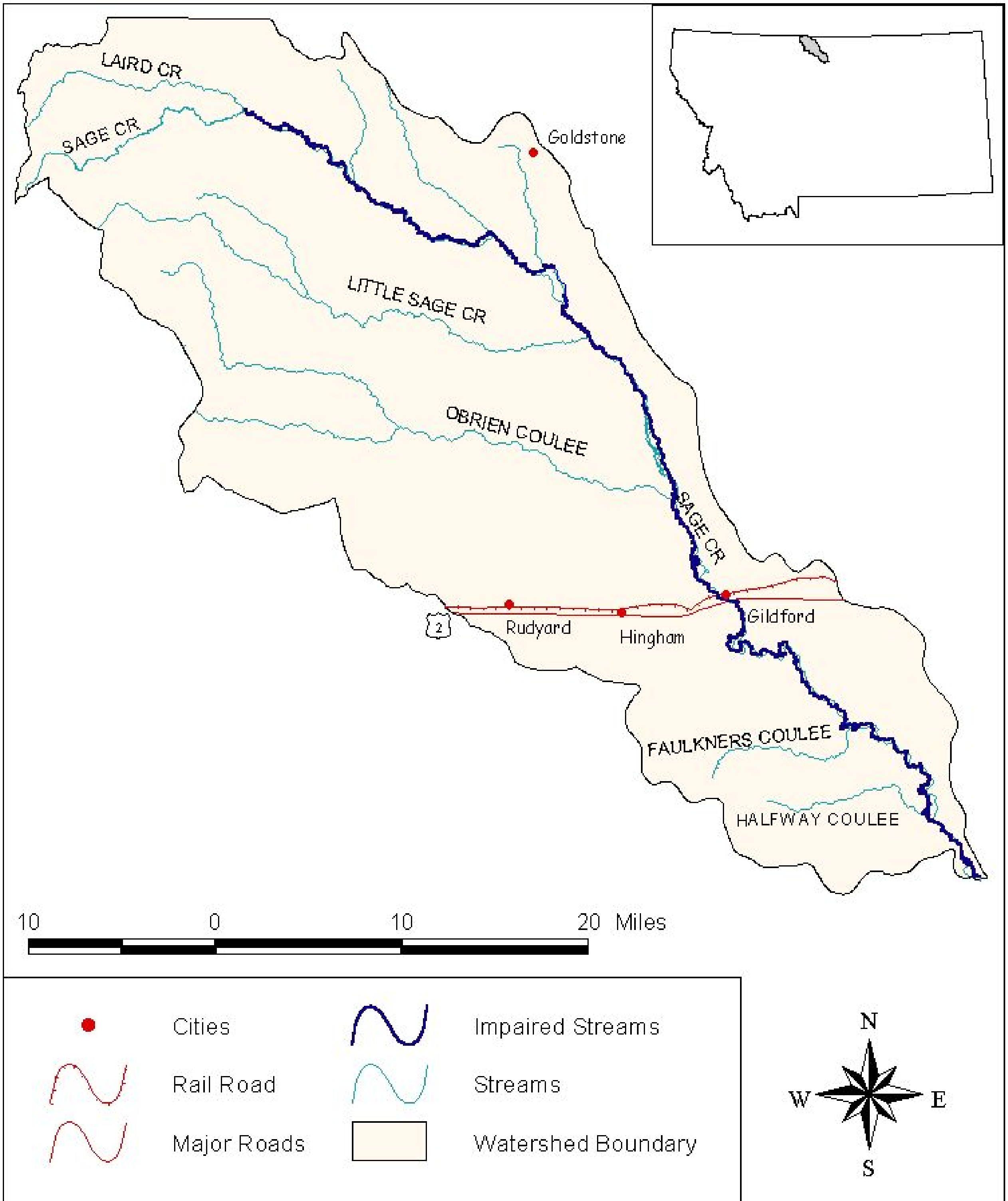
LIST OF FIGURES AND TABLES

SECTION 1.0
INTRODUCTION AND PURPOSE

The water body addressed in this document is Sage Creek (MT40G001_010) which is found in the Sage hydrologic unit (HUC 10050006). Sage Creek flows from the East Butte of the Sweetgrass Hills in Liberty County through Hill County to its confluence with Big Sandy Creek in north central Montana. The reach addressed in this plan is 110 miles long and extends from the confluence with Laird Creek to the mouth of Sage Creek (Figure 1).

In large part, this document is a summary of the **Water Quality Restoration Plan for Sage Creek** submitted to the Montana Department of Environmental Quality (DEQ) on November 19, 2001 by the Sage Creek Watershed Alliance and the Hill and Liberty County Conservation Districts (Appendix A). This summary document has been prepared by the Department of Environmental Quality to fulfill the requirements of Section 303(d) of the Federal Clean Water Act and Montana Water Quality Act (Chapter 75, Part 7) regarding Total Maximum Daily Loads (TMDL). A TMDL is *the total amount of a pollutant that a water body may receive from any source without exceeding state water quality standards*. A TMDL may also be defined as *a reduction in pollutant loading that results in meeting water quality standards*. This document specifically addresses water quality impairments associated with nutrients and salinity/TDS/chlorides.

Unless noted otherwise, the conclusions presented in this TMDL are based on the **Water Quality Restoration Plan for Sage Creek.** The following sections of this document provide a summary of the Sage Creek Watershed characteristics followed by an overview of each of the required components of the TMDL development process. Background information regarding the Sage Creek Watershed and the technical basis for many of the conclusions presented in this document can be found in Appendix A.



Montana Department of Environmental Quality

Figure 1.
Sage Creek Site Location Map

By: DSK
Date: 11/27/2001
G:/PPA/watershed/Lower_Missouri/10050006 Sage NRCS/sagelocation.jpg

SECTION 2.0 RELEVANT WATERBODY/WATERSHED CHARACTERISTICS

The impaired reach of Sage Creek is an intermittent stream as defined by the Administrative Rules of Montana (17.30.602): "a stream or reach of a stream that is above the local water table at least some part of the year, and obtains its flow from both surface run-off and ground water discharge." Streamflow values collected from lower Sage Creek near Kremlin from 1945 through 1951 demonstrate the intermittent nature of flow in Sage Creek (Figure 2).

Figure 2. Historical USGS Daily Streamflow Values Near Kremlin, MT.

Latitude: 48º28'00" Longitude:110º06'00" NAD27
Drainage Area 914.00 square miles
Gage datum: 2680.00 ft msl NGVD29

The major land use in the Sage Creek watershed is dryland farming (71%) with some native range and pasture (23%), farmsteads (4%), and irrigated hay production (1%). Water and forest comprise the remaining one-percent (Figure 3). Most of the land in the watershed is privately owned (93%) (Figure 4). State lands are dispersed throughout the watershed (7%).

Surveys conducted in July and August 1997 found nine species of fish in the drainage. All nine species are common to north-central Montana waters and all are native except northern pike and yellow perch (Gilge, 1997). The five families represented by these species are Catostomidae (suckers), Cyprinidae (minnows), Gasterosteidae (sticklebacks), Esocidae (pike), and Percidae (perch). All nine species can survive low levels of oxygen and a wide range of temperatures .

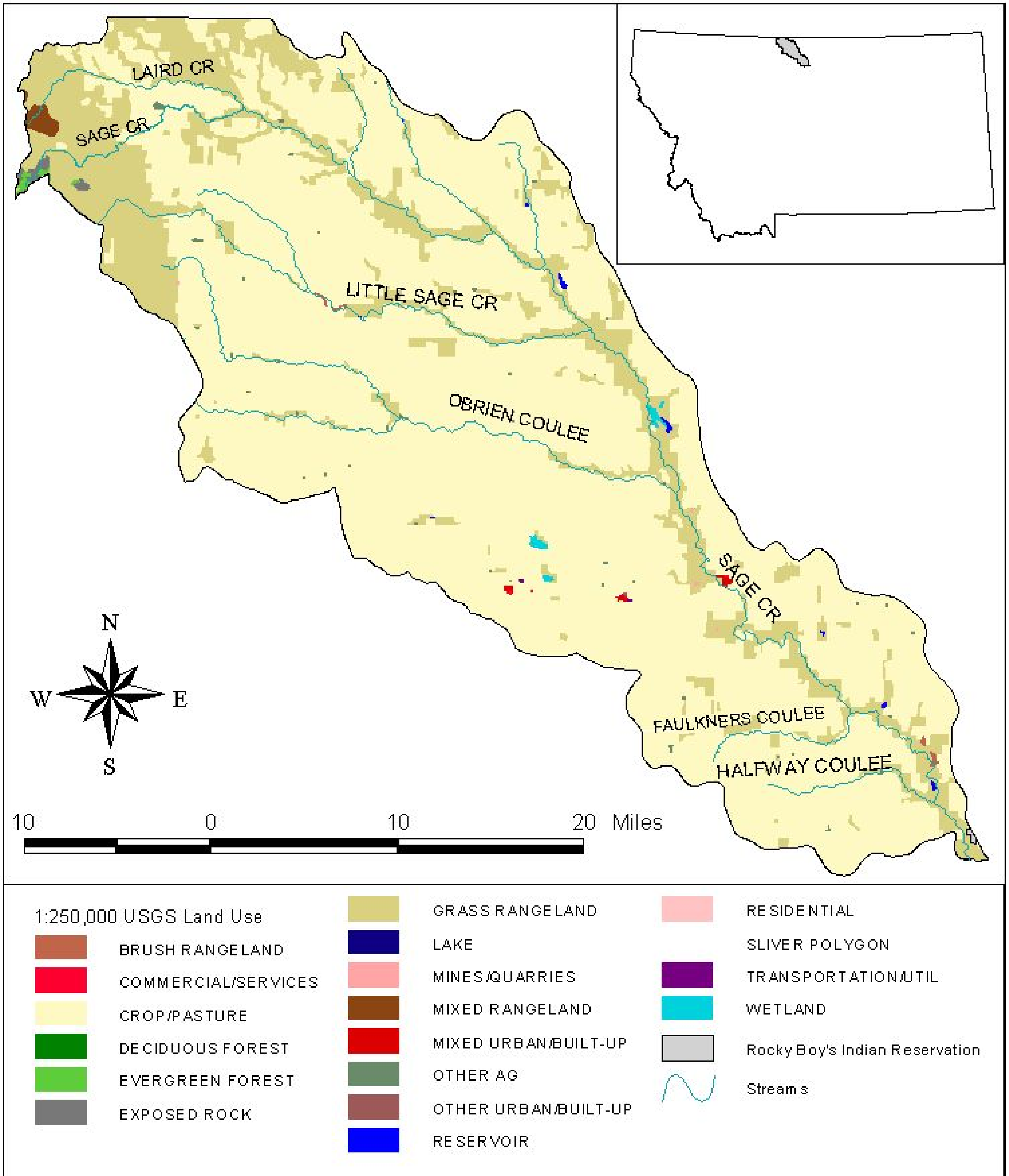


Figure 3. Sage Creek Land Use

Source: 1:250,000 USGS Land Use
Shelby Area 1980
Haver Area 1982

By: DSK

Date: 11/28/2001

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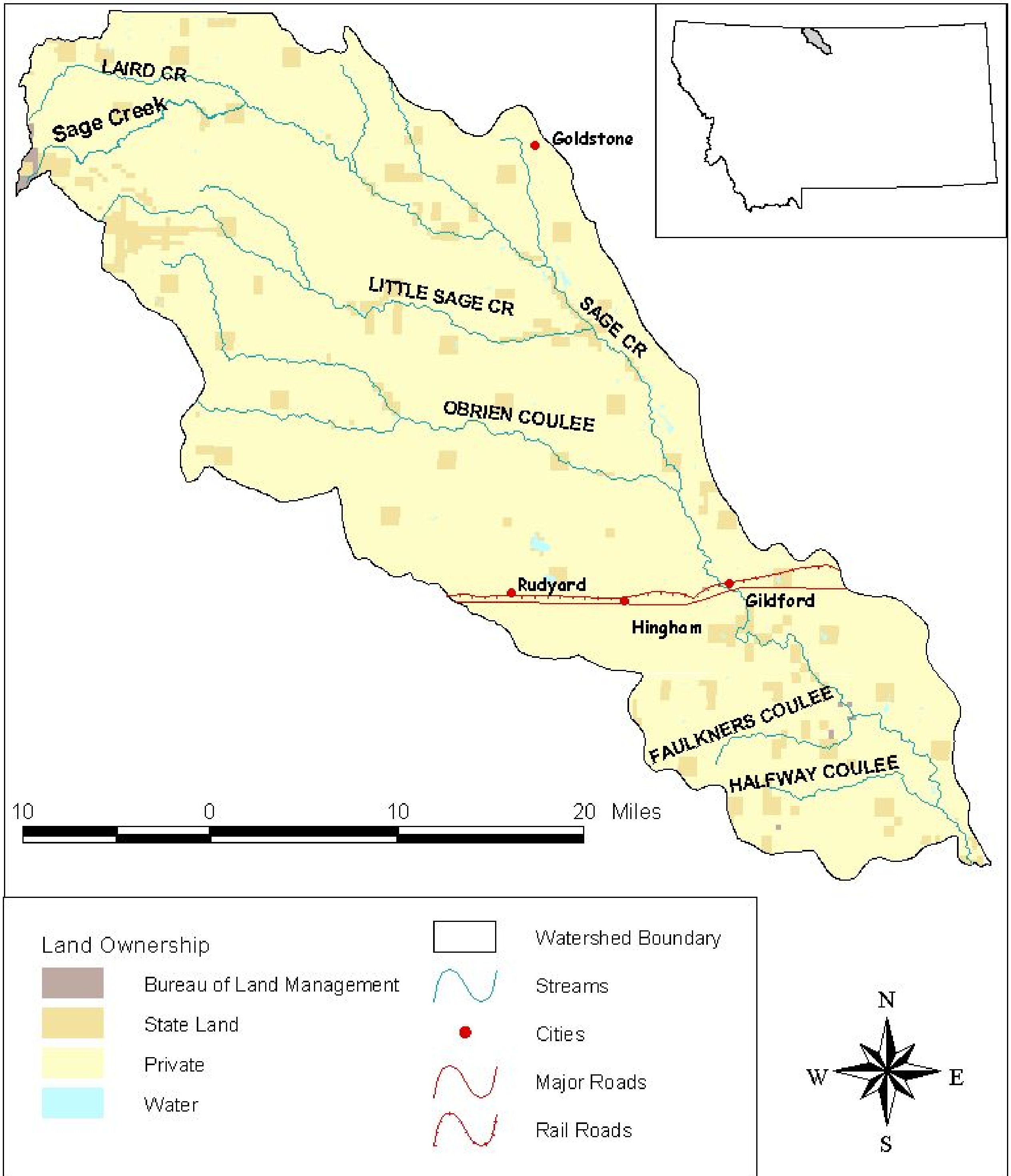
10050006 Sage NRCS/sagelanduse.jpg



Montana Department of Environmental Quality

Figure 4. Sage Creek Land Ownership

Source: MT Natural Heritage Program

By: DSK

Date: 11/28/2001

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SECTION 3.0
WATER QUALITY IMPAIRMENT STATUS AND APPLICABLE WATER QUALITY STANDARDS

3.1 Water Quality Impairment Status

A Federal court order requires DEQ to develop "all necessary TMDLs" for rivers, lakes and streams on the **1996 303(d) List of Impaired Water bodies**. In 1996 Sage Creek was listed as impaired by nutrients and salinity. The most recent EPA-approved 303(d) List also cites nutrients and salinity as causes of impairment. Although riparian degradation was listed as a cause of impairment in 2000, it is the U.S. Environmental Protection Agency's position that TMDLs are required only for "pollutants." EPA defines pollutants as "materials discharged into water." Table 1 summarizes the 1996 and 2000 303(d) list impairments for Sage Creek.

Table 1 *– Sage Creek HUC 1005006 – Comparison of 303(d) listed impairments, causes, and sources**

303(d) List Year	Probable Impaired Uses	Probable Causes	Probable Sources
1996	Aquatic Life Support Warm Water Fishery	Nutrients Salinity/TDS/chlorides	Irrigated Crop Production Non-irrigated Crop Production Agriculture
2000	Aquatic Life Support Warm Water Fishery	Nutrients Riparian degradation Salinity/TDS/sulfates	Irrigated Crop Production Non-irrigated Crop Production Agriculture

*Listing sequence in this table does not denote restoration priority, degree of impairment, or extent of impairment.

3.2 Waterbody Classification

Montana Water Quality Standards classify this segment of Sage Creek as a B-3 water. B-3 waters are suitable for "*drinking, culinary and food processing purposes, after conventional treatment, and for bathing, swimming and recreation, growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply"* (ARM 17.30.625). Surface water in the impaired reach of Sage Creek is not used for human consumption. In spite of its intermittent flow characteristics, as described in Section 2.0, Sage Creek supports a warm-water fishery and is used extensively as a source for stock water.

3.3 Nutrient Standards

Current standards relating to nutrients state that, "*State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create undesirable aquatic life*" (ARM 17.30.637(e)). In the case of nutrients, nuisance algae growth is usually the undesirable aquatic life produced.

When compared to other streams in the Northwestern Glaciated Plains ecoregion with similar runoff characteristics, total nitrate+nitrite, dissolved nitrate, and total Kjeldahl nitrogen data indicate that Sage Creek has similar or lower concentrations of bio-available nitrogen, as well as nitrogen incorporated into organic substances (Appendix B). This limited data suggests that there is no water quality impairment associated with nutrients. Therefore, neither a water quality restoration target nor a TMDL are presented herein for nutrients. Nutrient conditions in Sage Creek may be re-evaluated as additional information on prairie stream nutrients is gathered through DEQ's current effort to develop regional nutrient criteria.

3.4 Salinity Standards

The applicable water quality standard for TDS/salinity/chlorides is: *"State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life"* (ARM 17.30.637(1)(d)).

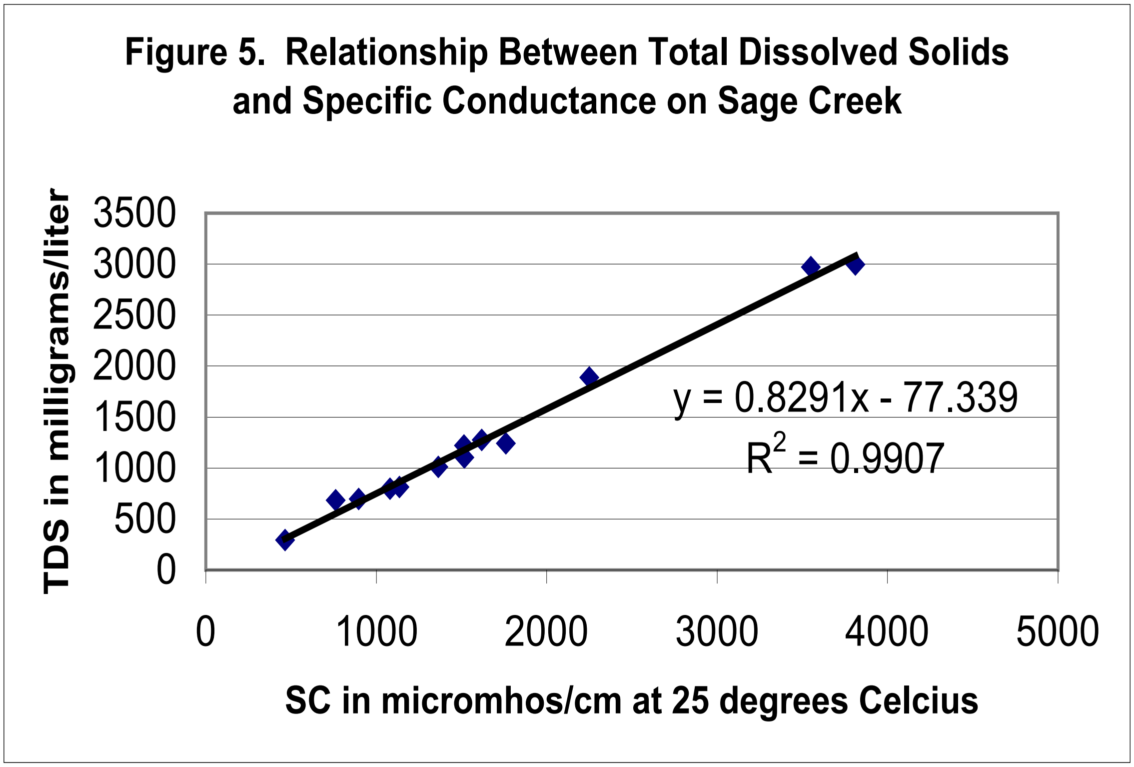
SECTION 4.0
SOURCE ASSESSMENT

The major source of salinity in the Sage Creek watershed is from naturally occurring salts in the glacial deposits. The causes of increased salinity in Sage Creek are attributed to the erodibility and chemical composition of the glacial deposits and dryland cropping practices. In a recharge area, excess ground water moves through the soil profile, dissolves and transports salts in the glacial deposits, and eventually discharges near the surface. Capillary action and evaporation then take over and draw the saline water to the soil surface leaving the salts behind and forming a saline seep. The Montana Bureau of Mines and Geology (MBMG) has demonstrated the water quality effects of ground-water discharge to Upper Sage Creek (Miller, 1997). Water quality changes from calcium-bicarbonate type water at the headwaters to sodium-sulfate type water downstream. This trend of increasing sodium and sulfate suggests that Sage Creek receives ground-water discharge associated with saline seeps. These saline seeps are caused by the crop/fallow farming system on ground-water recharge areas. This ground water subsequently discharges to the Sage Creek channel.

In 1982, the Triangle Conservation District estimated there was a total of 7,073 acres affected by saline seep; this represented a doubling of damaged acreage in dryland crops since 1972. About seventy percent of the Sage Creek Watershed is either dryland farmed or placed in the Conservation Reserve Program. In the upper third of the watershed, color infrared photography showed the effects of saline seep formation on approximately seven percent of the cropland in 1985. The Environmental Quality Incentive Program (EQIP) Sage Creek Priority Area was designed to address 3,225 acres affected by saline seep. The goals were to reduce the seeps to 2,145 acres, decrease the specific conductance of the water by 35 percent, increase soil organic matter by 1.25 percent and decrease the elevation of the water table by eight feet.

SECTION 5.0
WATER QUALITY RESTORATION TARGETS

The target concentration under flowing conditions for Specific Conductance (SC) is 1600 µmhos/cm or 1250 mg/L Total Dissolved Solids (TDS). Figure 5 shows the relationship between these two parameters in Sage Creek.



Mount et al., (1997) presented a statistical model to estimate the acute toxicity of major ions to biota. This model was used by DEQ to evaluate the level of protection provided by the proposed specific conductance and TDS targets (i.e., 1600 µmhos/cm and 1250 mg/L TDS). Toxicity associated with major ions at the specific conductance and TDS targets are predicted at 5.5 percent mortality in 96-hour exposures to fathead minnows (*Pimephales promelas*). Therefore, these targets are considered very protective and should provide an adequate margin of safety relative to toxicity to biota.

The target for non-flowing conditions is a reduction in the overall number of saline seep discharge areas in the impaired reach and a decreasing overall trend in ground water levels in the Quaternary aquifer over a period of 15 years.

The Montana Water Quality Act (MCA 75-5-703(9)) requires that DEQ evaluate the progress of the plan after five years. If, after five years, the targets have not been achieved, the Act provides a mechanism for adaptive management to allow for achievement of the target. This mechanism could include implementing a new or improved phase of voluntary management practices or allowing more time to pass for the system to respond to those management practices that may have been implemented. Alternatively, if future data indicate that Sage Creek does not, in fact, have the potential to achieve the targets, the targets can be modified based on the best available data.

SECTION 6.0
TOTAL MAXIMUM DAILY LOAD

A TMDL is not presented in the *Water Quality Restoration Plan for Sage Creek* (Appendix A). The following TMDL has been developed by DEQ to satisfy the requirements of Section 303(d) of the Federal Clean Water Act and Montana Water Quality Act (Chapter 75, Part 7).

The TMDL can be expressed as follows:

TMDL (lbs/day) = water quality standards target * flow * 5.39

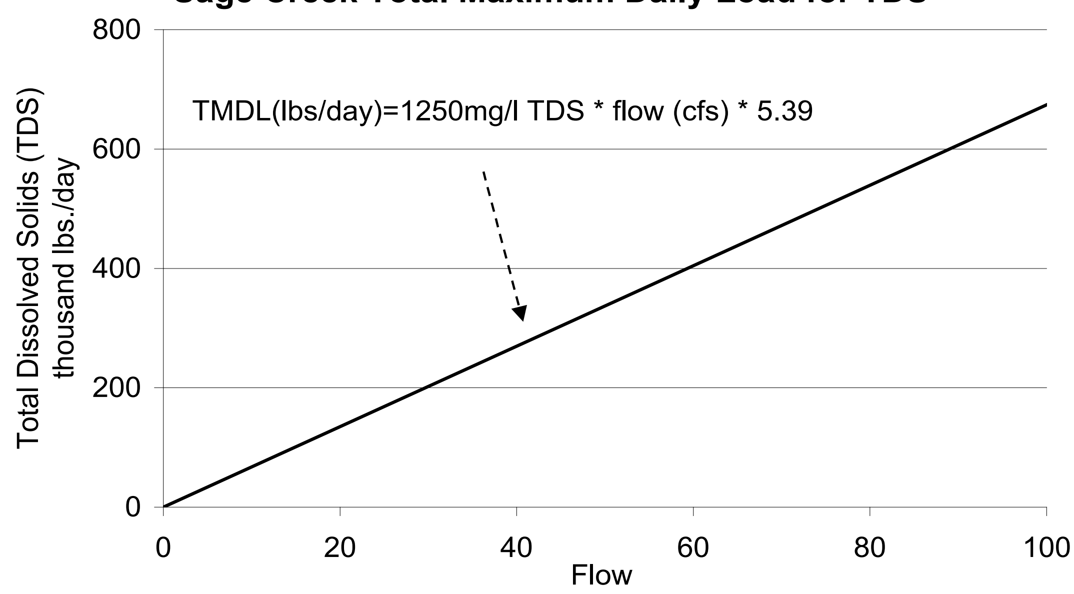
where

water quality restoration target	= 1250 mg/L TDS
flow	= surface water flow in cfs
5.39	= conversion factor to pounds per day

Figure 6 provides a graphical representation of the Total Maximum Daily Load relative to flow in Sage Creek. The TMDL is based upon a target of 1250 mg/L TDS. Variability in TDS concentration, and therefore load, is expected because of the natural buildup of saline conditions during dry weather periods. It is recognized herein, therefore, that there may be short periods of time associated with the "first flush", on the rising limb of the hydrograph, that this TMDL may be exceeded.

When Sage Creek has no surface flow, the TMDL is expressed as a reduction in saline seep discharge acreage near the creek and a decreasing trend in ground water discharge into the impaired stream segment during the next 15 years.

Figure 6 . Relationship between streamflow and the Sage Creek Total Maximum Daily Load for TDS



SECTION 7.0
ALLOCATION

The primary anthropogenic source of increased salinity in Sage Creek is the crop/fallow farming system on groundwater recharge areas within the watershed. The necessary load reductions, therefore, will focus on this land use type. The actual load reductions will be facilitated through the development of local educational efforts, development and implementation of agricultural BMPs, and the continuing efforts of the Conservation Districts and landowners to reduce groundwater levels in saline seep recharge areas.

SECTION 8.0
MARGIN OF SAFETY AND SEASONAL CONSIDERATIONS

Based on the DEQ analysis of the toxicity of the proposed Specific Conductance and TDS targets presented in Section 5.0, the proposed targets, and therefore the TMDL, is very protective of aquatic life. The monitoring strategy, summarized in Section 9.0, will also provide another implicit margin of safety with the inclusion of a feedback mechanism to trigger modification in the implementation plan, if necessary, to achieve water quality standards. The conceptual framework of the adaptive management approach described in Section 10.0 allows for the modification of management practices based upon the evaluation of the effectiveness monitoring data.

Seasonal variation is considered in both the Water Quality Restoration Targets and in the TMDL. As discussed previously and shown in Figure 2, flow in Sage Creek is not perennial. Flow only occurs during some spring runoff events and infrequent summer storms. Throughout most of the year Sage Creek is a series of disconnected pools. The flowing and non-flowing conditions may differ greatly in terms of water chemistry. During periods of flow, Sage Creek is dominated by surface water inputs. During the non-flowing and extreme low flow periods, groundwater inflow dominates. This is the reason that separate Water Quality Restoration Targets are presented in Section 5 for the two flow scenarios. The TMDL is based on flow and, therefore, directly considers all potential seasonal conditions.

SECTION 9.0
MONITORING STRATEGY

The monitoring strategy proposed in the *Water Quality Restoration Plan for Sage Creek* (Appendix A) includes a Best Management Practice (BMP) effectiveness monitoring plan as well as a monitoring plan for surface and groundwater. Specific details of the effectiveness-monitoring plan will be developed as BMPs are implemented. The surface and groundwater monitoring plan will include the following elements:

- Establishment of surface water gauging and sampling locations.
- Monitor ground-water elevations in saline seep wells in identified recharge and discharge areas to determine impact of BMP implementation and verify acceptance of TMDL criteria.
- Collection of surface water chemistry and stream gaging data, simultaneously. Water chemistry to include analysis of total phosphorous, total Kjeldahl nitrogen, nitrate plus nitrite, specific conductance, and total dissolved solids.
- Based upon available resources monitoring may also be performed for chlorophyll a, fish communities, macroinvertebrates and, during the cold weather months, nitrates.

SECTION 10.0
ADAPTIVE MANAGEMENT STRATEGY

A phased, or adaptive management, approach to water quality restoration and TMDL development is proposed due to the lack of an exhaustive data set upon which to base current conclusions, uncertainty in the pollutant loading, and uncertainty in the load reductions that need to occur and targets that need to be met, in order to satisfy water-quality standards. This document constitutes Phase I, wherein the numeric targets and TMDL are based on the best available information and the hypothesis that achieving these targets and TMDL will result in restoring full support of the beneficial uses. A monitoring strategy will be developed and implemented in Phase 2 to test the hypothesis and provide information necessary to adaptively manage the system in the future. Pollutants associated with salinity and nutrients will be monitored. The implementation of BMP's established from the results of the continued monitoring should result in the water quality of Sage Creek approaching the natural, pre-impact state.

SECTION 11.0
PUBLIC INVOLVEMENT

Public outreach and education are important in reaching the goals set by the Sage Creek Watershed Alliance. The alliance has held public meetings, conducted a survey of landowners to identify issues and willingness to participate, held annual watershed tours, and made personal contacts with landowners.

A public notice of availability of an earlier draft of this document and opportunity for providing comments was published on the DEQ home page http://www.deq.state.mt.us on January 9, 2001. A meeting to take public comment was held at the Hingham Catholic Church at 1:30 pm on Tuesday, January 23, 2001. A 30-day public comment period ended February 9, 2001.

The earlier draft has been modified substantially since the prior public comment period. The public comment period for this document is December 15, 2001 to January 16, 2002. See Appendix D for a summary of comments and responses.

References

Gilge, Kent. 1997. *Big Sage Creek Aquatic Investigations – Fishery Inventory*. Montana Fish, Wildlife, and Parks.

Mount, D.A, D.D. Gulley, J.Russel Hockett, T.D. Garrison, and J.M. Evans. 1997. “Statistical Models to Predict the Toxicity of Major Ions to *Ceriodaphnia dubia, Daphnia magna, and Pimephales promelas* (Fathead Minnows).” *Environmental Toxicology and Chemistry*. Vol. 16. No. 10, pp. 2009-2019.

APPENDIX A

WATER QUALITY RESTORATION PLAN FOR SAGE CREEK WATERSHED

Prepared by

Sage Creek Watershed Alliance
Liberty County Conservation District
Hill County Conservation District
Montana Bureau of Mines and Geology

November 19, 2001

Mr. Ron Steg, Supervisor
Watershed Management Section
Montana Department of Environmental Quality
1520 East Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901

RE: Sage Creek HUC 1005006

Dear Mr. Steg:

Section 303(d) of the Clean Water Act requires States to identify those waters that do not meet applicable State water quality standards and support designated beneficial uses. States are also required under Section 303(d) to develop Total Maximum Daily Load (TMDL) plans identifying measures needed to bring the water quality standards of the listed waters into compliance with the applicable standards. The amount of a pollutant that a water body can assimilate without violating State water quality standards is specified in a TMDL.

The Sage Creek Watershed, HUC 1005006, is a sub-basin of the Milk River sub-major basin, located in north-central Montana. The following causes of impairment in Sage Creek were identified on the 1996 303(d) list: nutrients and salinity/TDS/chlorides. In addition to the 1996 listed impairments, the 2000 303(d) list also included riparian degradation.

Discussion with DEQ personnel has led to the development of water-quality targets for TDS that are presented in the enclosed Watershed Restoration Plan. But SCWA feels that the targets for TDS under flowing conditions are based on insufficient data; there are only five flow-correlated water-quality measurements over three stream monitoring sites on the entire 110-mile impaired reach of Sage Creek.

In the case of nutrients, the analysis of current available data indicates nutrients that are most limiting to nuisance algae growth in Sage Creek are comparable to other local prairie streams with similar characteristics. Therefore, it is not necessary to write a TMDL for nutrients, according to existing information.

Salinity is believed to be the major source of riparian degradation. As restoration efforts proceed, and saline seep acreage is reduced, riparian areas will be reclaimed.

Presently, the preponderance of existing flow-corrected water-quality data indicate that the watershed meets the current TDS targets and endpoints for flowing conditions as established in the attached water quality restoration plan. Therefore, the SCWA maintains

Mr. Ron Steg
11-19-01
Page 2

that at this time a TMDL plan for TDS is unnecessary for flowing conditions. When Sage Creek has no flow, the target is expressed as a reduction in saline seep discharge acreage near the creek and a decreasing trend in ground water discharge into the impaired stream segment during the next 15 years. Since its establishment, the SCWA has been working towards that end.

The SCWA agrees that a TMDL plan should be developed if future information indicates that targets are not being met.

On behalf of the members of the Sage Creek Watershed Alliance, The Hill County Conservation District and the Liberty County Conservation District, I submit this Water Restoration Plan for your information. The Sage Creek Watershed Alliance (SCWA) is a grass-roots organization comprised of local landowners that was established to address concerns related to non-point source pollution issues in the watershed. Since its establishment, the SCWA has been working very diligently with other local, State and Federal agencies to characterize the watershed and the interaction between surface water and ground water in an effort to develop management strategies that will help to mitigate the primary problem – saline seep.

Should you have any questions, comments, or concerns, please do not hesitate to contact me.

Respectfully,

Donald J. Dahlen, Chairman
Liberty County Conservation District

Cc: LCCD
HCCD
SCWA members
MBMG
MSCA
Senator Jon Tester
Representative John Witt

WATER QUALITY RESTORATION PLAN

FOR

SAGE CREEK WATERSHED
HUC 10050006

NOVEMBER, 2001

Executive Summary

Section 303(d) of the Clean Water Act requires States to identify those waters that do not meet applicable State water quality standards and support designated beneficial uses. States are also required under Section 303(d) to develop Total Maximum Daily Load (TMDL) plans identifying measures needed to bring the water quality standards of the listed waters into compliance with the applicable standards. The amount of a pollutant that a water body can assimilate without violating State water quality standards is specified in a TMDL.

The Sage Creek Watershed is a sub-basin of the Milk River sub-major basin, located in north-central Montana. The following causes of impairment have been identified in Sage Creek on the 1996 303(d) list: nutrients and salinity/TDS/chlorides. In addition to the 1996 listed impairments, the 2000 303(d) list also includes riparian degradation. This water-quality restoration plan addresses those listed impairments for Sage Creek.

The adaptive management implementation strategy that will be used to mitigate the identified water quality impairments and attain water quality standards in the Sage Creek Watershed is included in this plan. A monitoring strategy that will be used to monitor the effectiveness of the implementation measures is also included in this plan. Based on the results of the monitoring, the implementation measures may be revised in order to attain compliance and/or demonstrate compliance with Montana water quality standards.

The Montana Department of Environmental Quality (DEQ) has developed TDS targets and endpoints for flowing conditions. Presently, the preponderance of existing flow-corrected water-quality data indicates that the watershed meets the current water-quality targets and endpoints. Therefore, the SCWA submits that a TMDL plan for TDS is unnecessary for flowing conditions until and unless future information indicates that targets are not being met.

Table of Contents

SAGE CREEK WATER QUALITY RESTORATION PLAN

1.0 Introduction

Section 303(d) of the Clean Water Act (CWA) requires States to identify those waters that do not meet applicable state water quality standards and support designated beneficial uses. Specifically, the language of this section and related U.S. Environmental Protection Agency (EPA) regulations requires States to identify those waters where quality is impaired (does not fully meet water quality standards) or threatened (is likely to violate water quality standards in the near future). Under the CWA, States are required to submit a biennial 303(d) list of these impaired or threatened waters to the EPA.

States are also required, under Section 303(d), to develop Total Maximum Daily Load (TMDL) plans that identify measures that are needed to bring the water quality of the listed waters into compliance with the applicable standards. In 1997, a federal lawsuit was filed that requested a court order requiring that EPA establish TMDL's for all water quality limited stream segments in Montana. Though the court dismissed the plaintiffs' claims that EPA had a mandatory duty to establish TMDL's for Montana waters, the court did order EPA to establish or approve TMDL's for all waters on Montana's 1996 303(d) list by May 5, 2007. Therefore, the focus of this water quality restoration plan is to address those impairments listed on the 1996 list. Section 75-5-703(4) of the Montana Codes Annotated (MCA) states that the Montana Department of Environmental Quality (DEQ) shall provide guidance for TMDL development on any threatened or impaired water body, if the necessary funding and resources from sources outside the department are available to develop the TMDL, and to monitor the effectiveness of implementation efforts.

The water quality issues addressed by this plan are those listed on the Montana 1996 and 2000 303(d) lists and consist of salinity, nutrient enrichment, and riparian degradation. Table 1 provides a comparison of listed impairments for Sage Creek between the 1996 and 2000 303(d) lists.

Table 1 *– Sage Creek HUC 10050006 – Comparison of 303(d) listed impairments, causes, and sources**

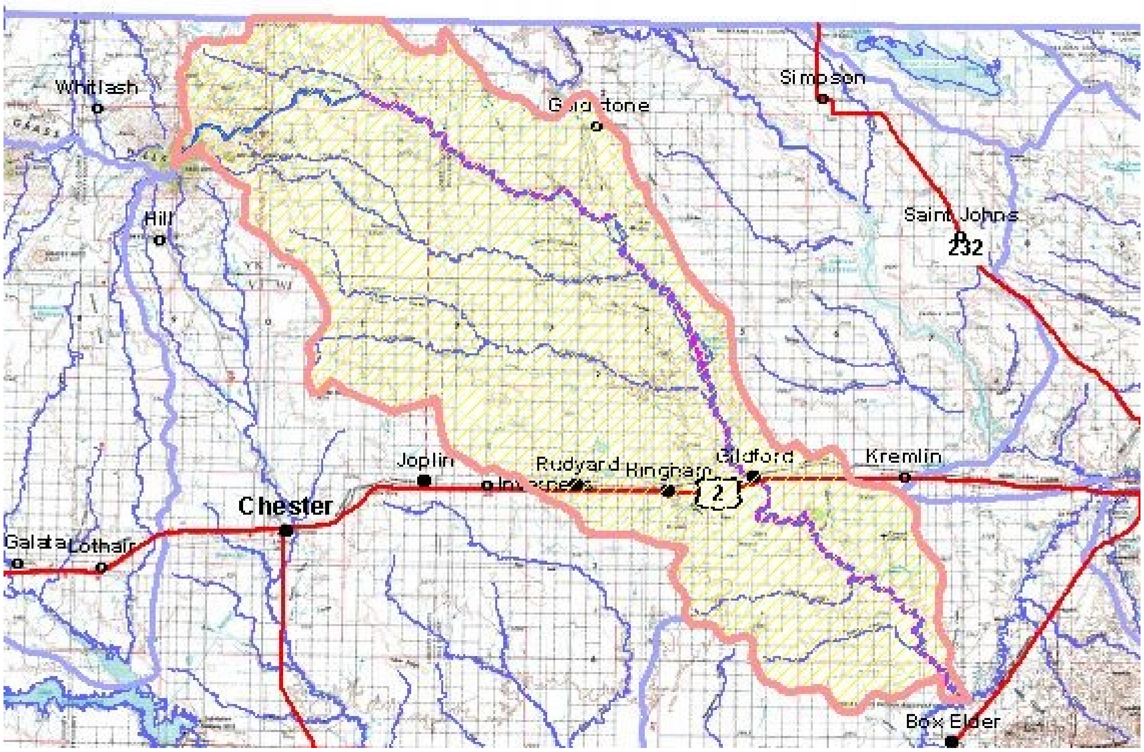
303(d) List Year	Probable Impaired Uses	Probable Causes	Probable Sources
1996	Aquatic Life Support Warm Water Fishery	Nutrients Salinity/TDS/chlorides	Irrigated Crop Production Non-irrigated Crop Production Agriculture
2000	Aquatic Life Support Warm Water Fishery	Nutrients Riparian degradation Salinity/TDS/sulfates	Irrigated Crop Production Non-irrigated Crop Production Agriculture

*Listing sequence in this table does not denote restoration priority, degree of impairment, or extent of impairment.

This water quality restoration plan was developed as a collaborative effort between the Liberty County and Hill County Conservation Districts, the Sage Creek Watershed Alliance, the Montana Department of Environmental Quality (DEQ), the Montana Bureau of Mines and Geology (MBMG), the Montana Salinity Control Association (MSCA), the Department of Natural Resources and Conservation (DNRC), the Natural Resource Conservation Service (NRCS), and numerous Sage Creek watershed users and landowners. The Sage Creek Watershed Alliance has identified the Sage Creek Watershed as priority in resolving water quality and quantity issues.

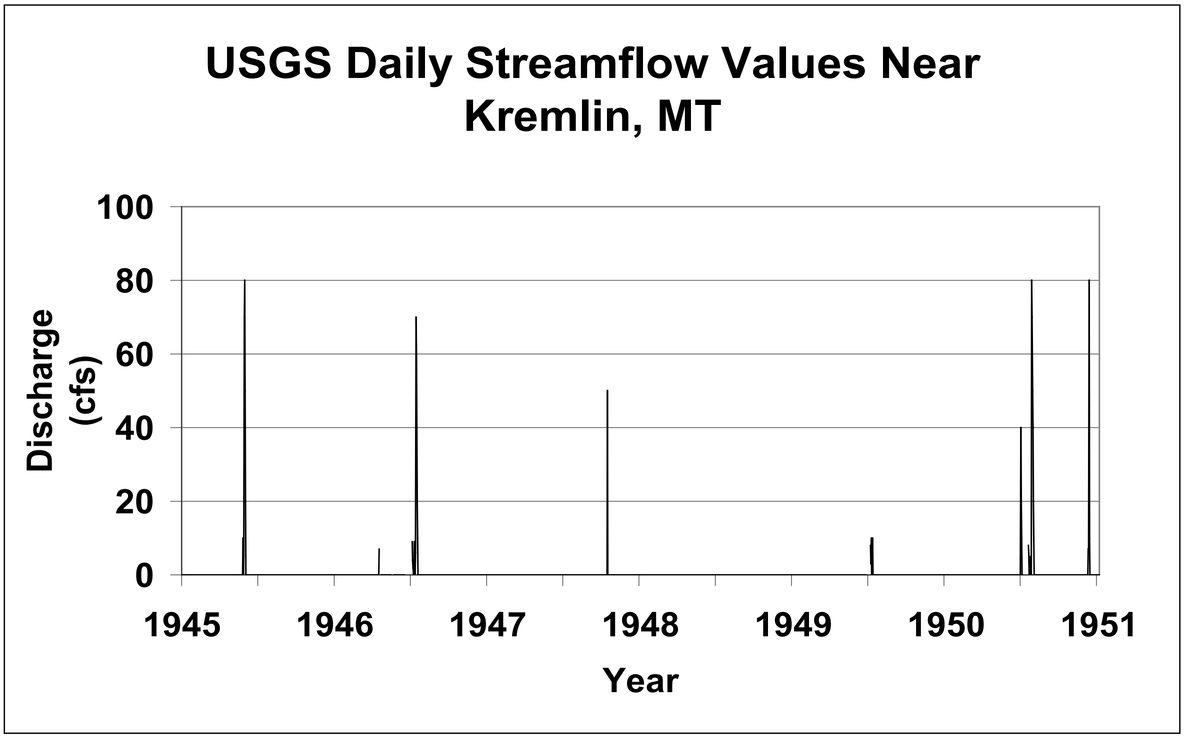
The water body addressed in this water quality restoration plan is Sage Creek (MT40G001_010) which is found in the Sage hydrologic unit (HUC 10050006). Sage Creek flows from the East Butte of the Sweetgrass Hills in Liberty County through Hill County to its confluence with Big Sandy Creek in northcentral Montana (Figure 1). The major land use in the Sage Creek watershed is dryland farming (71%) with some native range and pasture (23%), farmsteads (4%), and irrigated hay production (1%). Water and forest cover the remaining one- percent. The land in the watershed is primarily privately owned (93%). State lands are dispersed throughout the watershed (7%).

Figure 1 – Sage Creek watershed – HUC 10050006



The reach addressed in this plan is 110 miles long and extends from the confluence with Laird Creek to the mouth of Sage Creek. The impaired reach of Sage Creek is an intermittent stream and meets the definition of an intermittent stream provided in 17.30.602 of the Administrative Rules of Montana. An "Intermittent stream" means a stream or reach of a stream that is above the local water table at least some part of the year, and obtains its flow from both surface run-off and ground water discharge. Figure 2 is a graph of daily streamflow values collected from Sage Creek, in the lower part of the watershed, near Kremlin, Montana from 1945 through 1951 and is provided to demonstrate the intermittent nature of flow in Sage Creek.

Figure 2 – Sage Creek discharge near Kremlin, Montana, 1945-1951



Latitude: 48º28'00" Longitude:110º06'00" NAD27
Drainage Area 914.00 square miles
Gage datum: 2680.00 ft msl NGVD29

The data used to develop this water quality restoration plan is limited in quantity. During the course of the Sage Creek watershed characterization effort, the MBMG collected concurrent stream flow measurements and water quality information from three sites in the impaired reach. For two of these sites, data were collected on two separate occasions, the only times during the watershed characterization effort that Sage Creek experienced measurable flow. This is the only stream flow and water quality data from the impaired reach that was collected concurrently. Additionally, observations made by landowners in the impaired reach confirm the intermittent nature of Sage Creek and indicate that in most areas the actual streambed of Sage Creek is overgrown with vegetation. Many landowners maintain that actual stream flow in Sage Creek has not occurred since the June, 1999 event that MBMG personnel gaged and sampled.

Therefore, due to this lack of voluminous data, an adaptive management approach will be used to implement the proposed management controls, in phases, to permit the monitoring and evaluation of the effectiveness of these controls.

The Sage Creek Watershed Alliance (SCWA) is a group comprised of local landowners that was established to address local concerns related to non-point source pollution issues in the watershed. Since its establishment, the SCWA has been working very closely with other local, State, and Federal agencies to characterize the watershed and the interaction between surface water and ground water, and then develop management strategies that will help to mitigate the primary resource problem – saline seep.

2.0 General Watershed Characteristics

Sage Creek is located in northern Hill and Liberty Counties, just south of the U.S.-Canadian border, approximately 25 miles north of the town of Chester, Montana. It is an intermittent 3rd order stream that is approximately 130 miles long and encompasses an area of approximately 1.2 million acres.

2.1 Climate

The topography of the Sweet Grass Hills is an important feature that controls weather patterns in the surrounding region. The area has a semi-arid continental-polar climate typical of the northern Great Plains region (Tuck, 1993). The project area receives an average of 13-inches of precipitation per year. The topographic relief provided by the hills produces orographic effects that increase the average annual precipitation to approximately 20-inches on the summits of the hills (Tuck, 1993). The mean annual temperature is approximately 42°F, with winter lows below zero and summer highs near 100°F common (Tuck, 1993).

2.2 Hydrography

This water quality restoration plan addresses impairments on the Sage Creek mainstem from the confluence of Laird Creek to its confluence with Big Sandy Creek near Box Elder. The Sage Creek drainage is bound on the north by the Milk River drainage and on the south by the Willow Creek and Marias River drainages. The Sage Creek drainage network exhibits an elongated shape and a dendritic pattern.

2.3 Geology and Soils

The following discussion of the geologic setting has been summarized from the more extensive works of Tuck (1993) and Lopez (1995). The headwaters of Sage Creek are located on the northeast flank of East Butte of the Sweet Grass Hills. East Butte, a Tertiary age intrusive igneous structure cored mainly by syenite and syenite porphyry, is surrounded concentrically by sedimentary rocks of Mississippian through Upper Cretaceous age that dip away from the main intrusive mass. The primary geologic units in the watershed consist of the Cretaceous age Eagle Sandstone, Claggett Shale, and Judith River Formation and the Quaternary glacial deposits. The Eagle Sandstone consists of thin sandstone beds with interbedded mudstones, bentonite, carbonaceous shale, and coal. The formation is best exposed in the vicinity of East Butte. The Claggett Shale consists on non-resistant, easily eroded silty and sandy shale with thin interbeds of argillaceous and calcareous sandstone. There are few wells completed in the formation in this watershed, as yields are very limited since the shale is nearly impermeable. The Judith River Formation consists of fine-grained lenticular sandstone and shale that contains thin coal beds in the upper portion. The Judith River Formation is an important aquifer in the watershed, however water quality within the aquifer is highly variable. Pleistocene glaciers covered the area of the Sweet Grass Hills, extending southward to at least the Missouri River. As a result, glacial deposits surround the Sweet Grass Hills and obscure the underlying geology in the lower reaches of the hills. These glacial deposits consist of a mixture of material from clay-size to boulders and form the typical hummocky topography. The thickness of the glacial deposits range from 50 to 100 feet.

Predominant soil types in the watershed include loam and clay loam soils. Sodic to strongly saline soils is found on the low terraces in the watershed.

2.4 Topography

The headwaters of Sage Creek are located on the northeast flank of East Butte of the Sweet Grass Hills. The upper portion of the Sage Creek Watershed is characterized by the prominent features of the Sweet Grass Hills, a group of five northwest-trending intrusive cored buttes that rise approximately 4,000 feet above the surrounding plains to an elevation of approximately 6,598-ft. Below an elevation of 5,000 ft, the Quaternary glacial deposits produce a hummocky surface, typical of these deposits, that becomes less pronounced away from the buttes. The middle and lower portions of the Sage Creek Watershed are characterized by gently rolling to level terrain characteristic of the northern Great Plains.

3.0 Sage Creek Water Quality Restoration Plan

3.1 Stream Classification and Standards

Sage Creek is an intermittent stream classified as B-3 (ARM 17.30.610(8)). Sage Creek (MT40G001_010) is found in the Sage hydrologic unit (HUC 10050006). The flow of water in the stream is discontinuous in all seasons. Flow may occur in the spring of some years when runoff from snowmelt and precipitation occurs. However, pools of water remain most of the year in some locales. The pools that remain are seeps (ground-water discharge areas) primarily from the Quaternary aquifer. The Quaternary aquifer is made up of glacial deposits and alluvium. Water quality within the Quaternary aquifer controls the water quality of the discontinuous pools. The water quality within the Quaternary aquifer is marginal in most locations because of the high concentrations of naturally occurring salts within the sediments, and because of further mineralization from the dryland salinity process coupled with the concentrative effects of evapotranspiration processes (*Sage Creek Watershed Characterization, DRAFT, MBMG).*

The impaired reach of Sage Creek is 110 miles long and extends from the confluence with Laird Creek to its mouth (Figure 1). The 1996 303(d) list identifies the impairments in this reach as salinity and nutrient enrichment. According to ARM 17.30.625, waters classified at B-3 are suitable for drinking, culinary and food processing purposes, after conventional treatment, and for bathing, swimming and recreation, growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply. Surface water in the impaired reach of Sage Creek is not used for human consumption. Because Sage Creek is naturally intermittent, it supports limited fish and associated aquatic life. The primary beneficial use of water in Sage Creek is stockwater.

Nine species of fish were found in the drainage, all were native except northern pike and yellow perch. All nine of these species are common to north-central Montana waters. The five families that were represented by these species were: Catostomidae (suckers), Cyprinidae (minnows), Gasterosteidae (sticklebacks), Esocidae (pike), and Percidae (perch). All of the fish found are very hardy and can survive through a wide range of temperatures and low levels of oxygen.

In order to properly focus restoration efforts, the ultimate source of water-quality impairment must be identified. For Sage Creek, the cause of the water quality impairment is attributable to non-point source pollution. This plan provides estimates of loading rates that include natural background levels, such as ground water contribution from the Quaternary deposits, and from non-point sources. These load estimates are based upon the concurrent water-quality sampling and stream flow gaging and are provided in Figure 3.

This water quality restoration plan will address the narrative standard for salinity and nutrients. "State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create conditions which produce undesirable aquatic life." (ARM 17.30.637(1)(e)). Flow data collected concurrently with water-quality data was evaluated by the MBMG and suggests that when Sage Creek experiences flow, salinity and nutrients may be below the standards. Nitrate-nitrogen and ortho-phosphate constituents were not detected in water quality sampling that was performed in June, 1999 during flow measured in Sage Creek. Table 2 provides a summary of the results of the concurrent stream gaging and water quality sampling. During the course of MBMG's investigations of Sage Creek, it is important to note that the flow recorded during the 1999 event is the only flow that has been concurrently gaged and sampled. Due to the intermittent nature of Sage Creek, measurable flow has not occurred since the 1999 event.

Table 2 – *Results of stream gaging and water quality analyses during flowing conditions on Sage Creek*

Sample Location	Sample Date	Discharge (cfs)	TDS (mg/L)	SC (μmhos/cm)	NO_3-N (mg/L)	PO_4 as P (mg/L)
351033BCBC	6/10/99	29.63	797	1081	<0.50	<0.50
	6/22/99	2.2	1013	1364	<0.50	<1.0
360836DAAD	6/10/99	30.58	816	1135	<0.50	<0.50
	6/23/99	3.70	1275	1618	<0.50	<1.0
360702DDDA	6/23/99	3.52	1222	1514	<0.50	<1.0

3.2 Significant Sources

The significant sources contributing to the pollutants of concern are listed below.

Salinity is the primary cause of the nonpoint source degradation in the impaired reach of Sage Creek. Salinity reduces the productivity of croplands, degrades riparian habitat, contributes to instability of the stream channel, increases sediment transport and renders water unsuitable for irrigation and consumption by livestock and humans. The major source of salinity in the Sage Creek watershed is from naturally occurring salts in the glacial deposits. The causes of increased salinity in Sage Creek are attributed to the erodibility and chemical composition of the glacial deposits and dryland cropping practices. In a recharge area, excess ground water moves through the soil profile, dissolves and transports salts in the glacial deposits, and eventually discharges near the surface. Capillary action and evaporation then take over and draw the saline water to the soil surface leaving the salts behind and forming a saline seep. The MBMG has demonstrated the water quality effects of ground-water discharge to Upper Sage Creek (Miller, 1997). Water quality changes from calcium-bicarbonate type water at the headwaters to sodium-sulfate type water downstream. This trend of increasing sodium and sulfate suggests that Sage Creek receives ground-water discharge associated with saline seeps. These saline seeps are caused by the crop/fallow farming system on ground-water recharge areas. This ground water subsequently discharges to the Sage Creek channel. Subsequent studies by MBMG (Miller, 2001 in review) provide estimates of ground-water flow and TDS loading rates to Sage Creek from the Quaternary deposits.

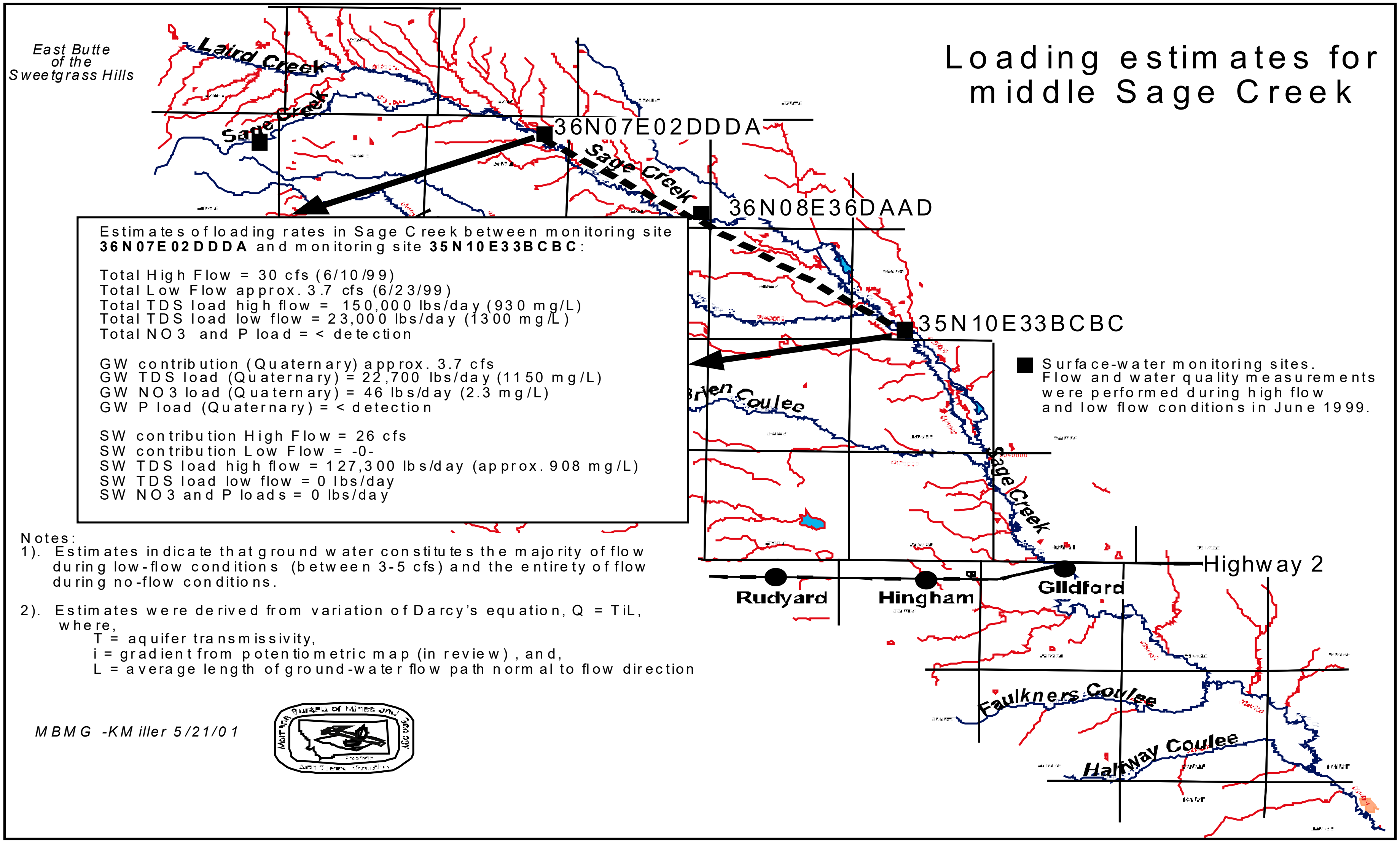
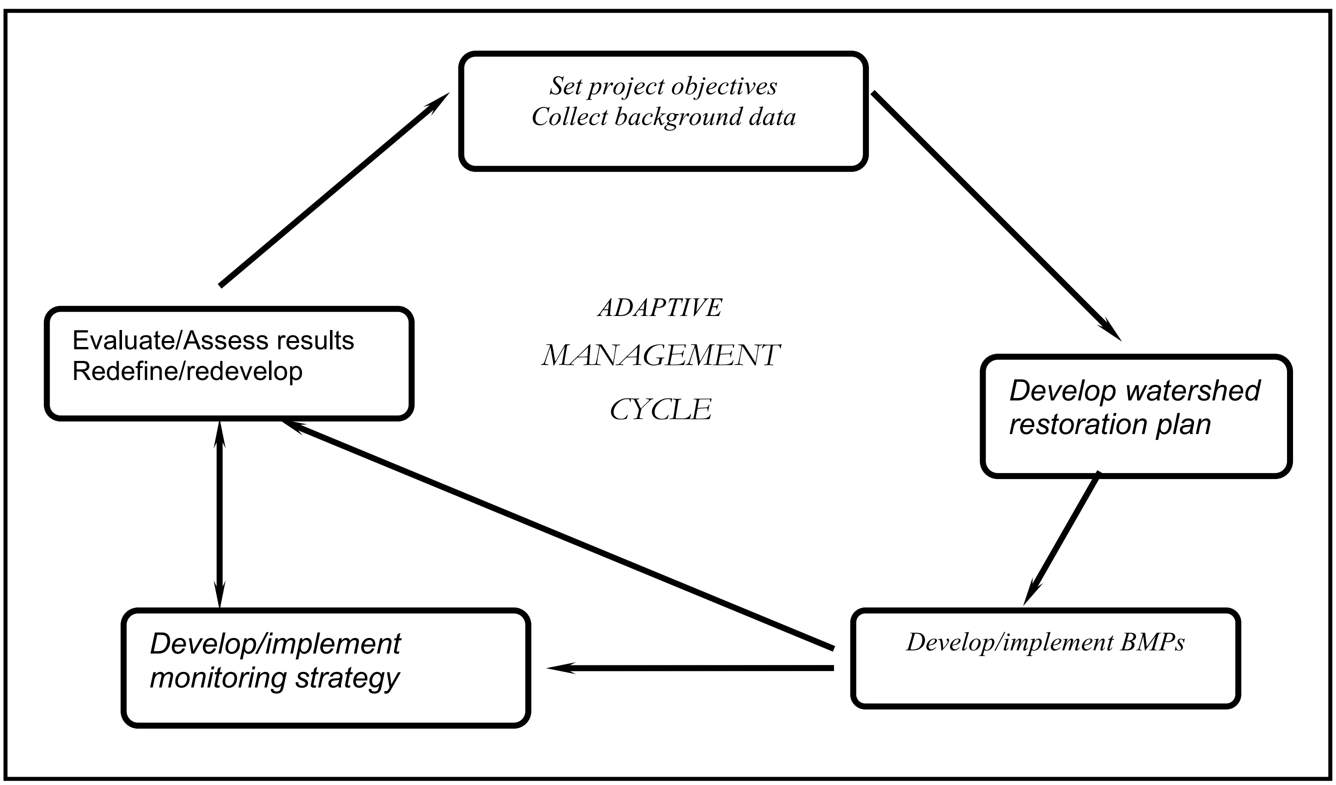


Figure 3 – TDS Loading Estimates in Upper and Middle Sage Creek

3.3 Adaptive Management Process Approach

The application of adaptive management to the water-quality restoration efforts in Sage Creek provides an operational basis to determine the types of conservation practices to implement, the locations in which to implement them, and the types of programs to stimulate the adoption of conservation practices. The results provide recommendations for developing management practices that achieve and maintain watershed restoration outcomes in an effective manner.

The Sage Creek water quality restoration efforts will be completed using this phased, adaptive management approach. Based on scientific data, watershed users will adapt BMPs to optimize water quality impairments. The conceptual model of the application of the adaptive management process is outlined in the following flow chart:



A phased approach to water quality restoration is presented since the nonpoint pollutants that comprise most of the pollutant load are difficult to completely characterize, are a large part of the pollutant load, and existing information is very limited. Under these circumstances, there is often uncertainty in the pollutant loading and sometimes uncertainty in the load reductions that would need to occur and targets that need to be met, in order to satisfy water-quality standards. The following presents an outline for a phased approach, wherein targets are established in Phase I based on the best available information and the hypothesis that achieving these targets will result in restoring full support of the beneficial uses. A monitoring strategy will be developed and implemented in Phase 2 to test the hypothesis and provide information necessary to adaptively manage the system in the future. The implementation of BMP's established from the results of the continued monitoring should result in the water quality of Sage Creek approaching the natural, pre-impact state.

4.0 Water Quality Restoration Plan Targets and Endpoints

The quantifiable targets developed for the Sage Creek Water Quality Restoration Plan are intended to be a translation of Montana's narrative water quality standards. These narrative standards apply to substances or conditions for which sufficient information does not exist to develop specific numeric standards or which may vary from site to site. The water quality restoration plan targets established for Sage Creek will provide a measure of success for restoration and protection efforts and the recovery of beneficial use support. The Sage Creek watershed instream targets were based on:

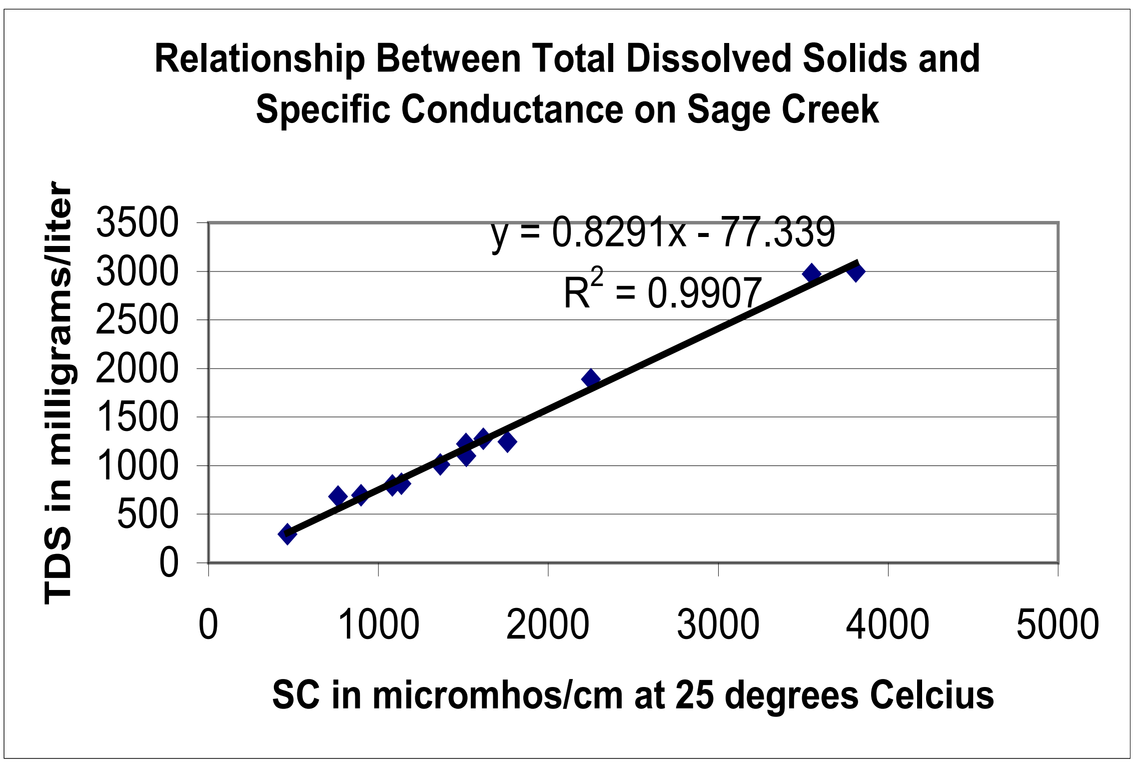
- The water quality standard,
- Scientific literature,
- Available monitoring data,
- Ease of target data collection,
- Ability to interpret target data
- Availability and monitoring experience of watershed stakeholders, and
- Best professional judgement.

The 2000 303(d) list includes riparian degradation. Although specific targets and endpoints are not established for riparian degradation in this plan, salinity is believed to be the major source of riparian degradation. As restoration efforts proceed, and saline seep acreage is reduced, riparian areas will be reclaimed.

4.1 Water Quality Restoration Plan Targets

4.1.1 Salinity/TDS/chlorides

The target concentration under flowing conditions for Specific Conductance (SC) is 1600 µmhos/cm or 1250 mg/L Total Dissolved Solids (TDS). The graph below shows the relationship between these two parameters in the water of Sage Creek. Aquatic life in Montana's prairie streams seems to be adapted to this level of mineralization, but may show signs of stress, such as decreasing diversity, as concentrations increase. The target for non-flowing conditions is a reduction in the overall number of saline seep discharge areas in the impaired reach and a decreasing overall trend in ground water levels in the Quaternary aquifer over a period of 15 years. Since its establishment, the SCWA has been working towards that end.



Presently, the preponderance of existing flow-corrected water-quality data indicates that the watershed meets the current water-quality targets and endpoints. Therefore, the SCWA maintains that a TMDL plan for TDS is unnecessary for flowing conditions.

4.1.2 Nutrients

The current standards in Montana relating to nutrients state that, "*State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create undesirable aquatic* life". In the case of nutrients, nuisance algae growth is usually the undesirable aquatic life produced. Analysis of current available data indicates nutrients that are most limiting to nuisance algae growth in Sage Creek are comparable to other local prairie streams with similar characteristics. Nitrogen is likely the limiting nutrient with regard to nuisance algae growth in Sage Creek. When compared to other streams in the Northwestern Glaciated Plains ecoregion with similar runoff characteristics, total nitrate+nitrite, dissolved nitrate, and total Kjeldahl nitrogen data indicate that Sage Creek has similar or lower concentrations of bio-available nitrogen, as well as nitrogen incorporated into organic substances (Appendix B). This analysis suggests that it is not necessary to write a TMDL for nutrients for Sage Creek, according to existing information. Nutrient conditions in Sage Creek may be re-evaluated as additional information on prairie stream nutrients is gathered through DEQ's current effort of developing regional nutrient criteria.

4.2 Margin of Safety & Seasonal Variation

The Clean Water Act requires that each TMDL take into consideration a margin of safety to address uncertainty within the TMDL as well as consider seasonal variation. Conservative assumptions were made in the development of this Water Quality Restoration Plan as a way of addressing data uncertainty, which constitutes an implicit margin of safety. The effectiveness monitoring plan, described in Section 4.3, will also provide another implicit margin of safety with the inclusion of a feedback mechanism to trigger the modification in the implementation plan, if necessary, to achieve water quality standards. The conceptual framework of the adaptive management cycle allows for the modification of management practices based upon the evaluation of the effectiveness monitoring data.

Seasonal variation is considered because spring runoff occurs during some, but not all, years and the occasional large summer storm or winter snowmelt are the only conditions that result in surface-water flow in Sage Creek. The remainder of the year the stream does not flow but consists of a series of small, discontinuous pools that exist as a result of ground water discharge.

4.3 Effectiveness Monitoring Plan

The Hill and Liberty County Conservation Districts, in cooperation with the Alliance, will assist landowners with the selection and implementation of BMP's. The Conservation Districts and Alliance members will also evaluate the success of the water quality restoration efforts, as funding and staff permit, through a phased adaptive management approach. Inherent to the phased adaptive management approach is a monitoring plan that allows for the implementation and evaluation of restorative measures. The effectiveness-monitoring plan will be developed during the implementation of BMPs and will include the following elements:

- Selection of BMPs;
- Locations for BMP implementation;
- Monitoring plan for surface water/ground water; and,
- Data evaluation procedures.

The surface water/ground water monitoring plan will include the following objectives:

- Establishment of surface water gaging and sampling locations
- Monitor ground-water elevations in saline seep wells in identified recharge and discharge areas to determine impact of BMP implementation and verify acceptance of the Water Quality Restoration Plan criteria.
- Collection of surface water chemistry and stream gaging data, simultaneously. Water chemistry to include analysis of total phosphorous, total Kjeldahl nitrogen, specific conductance, and total dissolved solids

The monitoring plan provides a margin of safety by including multiple parameters that assure that all problems are addressed in the creek.

4.4 Allocation

This water quality restoration plan has been developed to address nonpoint sources and provides estimates of loading rates that include natural background levels, such as ground water contribution from the Quaternary deposits, and from non-point sources. These load estimates are based upon the concurrent water-quality sampling and stream flow gaging and are provided in Figure 3. The nonpoint source load allocation will be managed through the development of educational strategies, development of BMPs, and the continuing efforts of the Conservation Districts and landowners to reduce ground water levels in saline seep recharge areas.

4.5 Public Participation

Public outreach and education are important in reaching the goals set by the Sage Creek Watershed Alliance. The alliance has held public meetings, conducted a survey of landowners to identify issues and willingness to participate, held annual watershed tours, and made personal contacts with landowners.

A public notice of availability of the TMDL and opportunity for providing comments was published on the DEQ home page http://www.deq.state.mt.us on January 9, 2001. A meeting to take public comment was held at the Hingham Catholic Church at 1:30 pm on Tuesday, January 23, 2001. A 30-day public comment period ended February 9, 2001. See Appendix D for a summary of comments and responses.

4.6 Implementation of the Water Quality Restoration Plan

Landowners/operators participation in BMPs is voluntary. Possible BMPs to change vegetation in the recharge areas of saline seeps may include: (1) switch from crop-fallow to annual or flex cropping; they may also assist with monitoring of ground water levels; (2) adopt a 5- to 10-year rotation from crop to perennial vegetation for haying/grazing; (3) place recharge areas into other programs.

Landowners/operators may adopt BMPs to optimize use of fertilizers and reduce runoff from croplands.

Livestock operators may implement BMPs to optimize the health of riparian and wetland areas, the utilization of upland range, and the management of animal waste.

Sage Creek Watershed Alliance will oversee the plan and evaluate the success of implementation.

Montana Salinity Control Association will identify recharge areas for saline seeps as funding permits and assist in disseminating information to landowners and developing plans. Participation in MSCA programs by producers is on a voluntary basis.

Subject to written approval from the NRCS State Conservationist and confirmation of funding and staff, NRCS personnel may assist landowners with selection of BMPs to minimize impacts to the stream from livestock grazing and dryland farming; assist in conservation planning and implementation using USDA programs.

MBMG will assist in inventorying saline seeps, identify the geology and interaction between ground water and surface water; and evaluate the contribution of other sources such as oil and gas to saline seep problems as funding permits.

Hill and Liberty County Conservation Districts will assist in obtaining and administering grant funds for implementing the plan and oversee water quality monitoring and track results.

The components of the Sage Creek Water Quality Restoration Plan addressing salinity and nutrient enrichment are either presently in place or are planned for completion by the year 2015. The major sources of implementation funds are from Environmental Quality Incentives Program (EQIP) provided by United States Department of Agriculture (USDA), a watershed grant from the Department of Natural Resources and Conservation, and grant funds provided by the Environmental Protection Agency (USEPA) with matching funds provided by landowners. The conservation districts are seeking funding to continue as a USDA EQIP priority area.

The Sage Creek Alliance, formed in 1996, cooperates with the private landowners and operators, the Liberty County and Hill County Conservation Districts, MSCA, MBMG, NRCS, Montana Department of Fish, Wildlife and Parks (MDFWP), Montana Extension Service and others. In 1997, MBMG began a surface and ground water assessment of the upper and middle portions of Sage Creek. In 2001, MBMG began the surface and ground water assessment of the lower portion of Sage Creek. Presently, their work in the lower portion of Sage Creek is in progress and scheduled for completion by June 2002. The work on the upper and middle portion of the watershed is essentially complete and the report is in progress. Once data collection is completed in the lower portion of Sage Creek, the evaluation will be combined into one report. Since stream flow has been marginal at best, some additional measurements will be taken when conditions warrant, i.e., when Sage Creek experiences measurable flow.

The MBMG and MSCA have conducted studies of the shallow aquifer found in the glacial deposits. When this highly mineralized aquifer receives significant recharge, it discharges to areas that become saline seeps. Vegetation is altered and runoff carries the salts and nutrients into the streams. Over the past 30 years, areas of salinization increased and took a significant amount of cropland out of production. A project in Hill County demonstrated that reducing crop/fallow farming in recharge areas and converting to practices that vegetate the area each year did dry up saline seeps within a 10- to 15-year period. More recently, MSCA has documented the positive effect that placing recharge areas into perennial vegetation has on drying up saline seeps.

Figure 4 shows differences in water table levels between traditional cropping practices and areas in perennial vegetation. The fluctuation in the crop/fallow hydrograph is in response to seasonal precipitation.

Figure 4 – *Hydrograph showing general groundwater decline from 1986 – 1999 in an area in perennial vegetation and the fluctuation in an area in crop/fallow.*

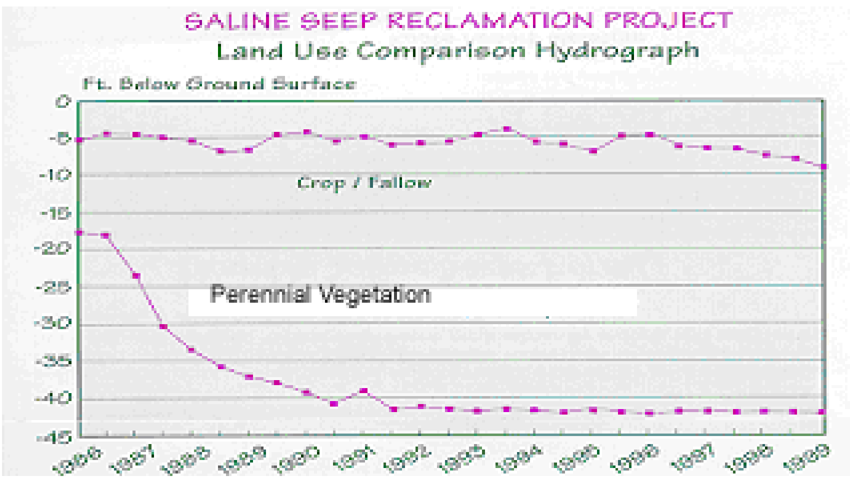
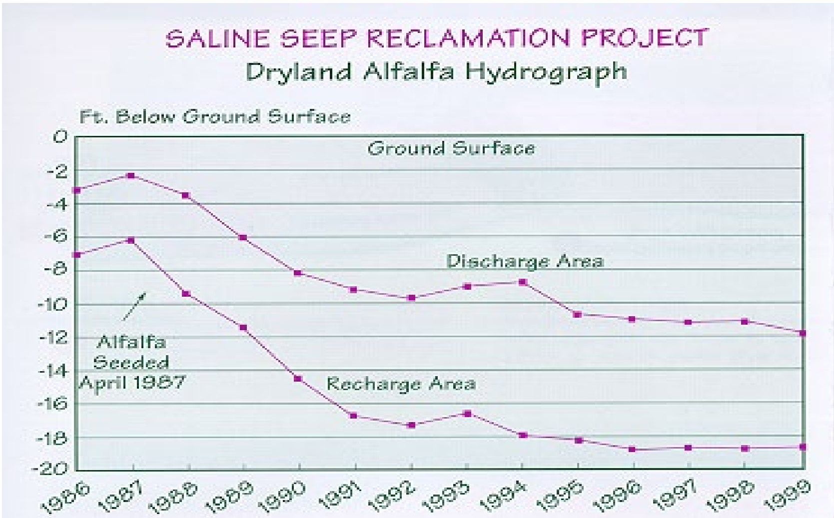


Figure 5 demonstrates how changing traditional cropping practices in the recharge area affects water table levels in the discharge area (saline seep). The planting of alfalfa in ground water recharge areas and the planting of salt-tolerant species in the seep discharge area is the traditional method implemented to reclaim saline seep areas.

Figure 5 – *Hydrograph showing groundwater decline from 1986 – 1999, with alfalfa in the recharge area and salt-tolerant vegetation in the seep/discharge area.*



The Alliance members participated in a Stream Corridor Assessment for natural resource issues coordinated by the DNRC/NRCS watershed coordinator. The Alliance continues to monitor water quality on specific stream reaches. MSCA has been conducting site-specific saline seep investigations and developing recommendations. NRCS has designated the watershed a Priority Area for EQIP, qualifying it for BMP planning and implementation funds.

Additionally, the conservation districts conducted an aerial assessment in 2001. At the time of this submittal, the results of the assessment had not been completed. The assessment was performed during the spring when the saline problems are most visible. Public meetings have been held in each community prior to and following any aerial flights to solicit comments and input. The results of the aerial assessment and the long-term monitoring data will be used to identify stream reaches that have the highest potential for improvement.

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APPENDIX B

Sage Creek Nutrient Comparison Analysis

MT Department of Environmental Quality

September 28, 2001

Introduction

Sage Creek was listed in the 2000 303(d) list as impaired because of nutrient enrichment. The current standards in Montana relating to nutrients in Sage Creek state that, "State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will create conditions which produce undesirable aquatic life." In the case of nutrients, nuisance algae growth is usually the undesirable aquatic life produced. The average nitrogen to phosphorus ratio in Sage Creek water is 1.4:1, thus, nitrogen is likely the limiting nutrient with regard to nuisance algae growth. Because Montana's current nutrient standards are narrative and there is not an appropriate regional reference approach comparable to western Montana's Clark Fork Nutrient Study, a local stream comparison approach was used. Because nitrogen is the most likely the limiting nutrient across this region, nitrogen compounds in Sage Creek are compared to a number of similar streams.

Methods

All nutrient, chlorophyll a, and relevant flow data were gathered for Sage, Willow, Lodge, Cottonwood, Frenchman, and Whitewater Creeks (Appendix C) (Map 1). Data sources were Montana's Storease Water Quality Information Database, USGS, Montana DEQ, and Montana Bureau of Mines and Geology. A number of similar streams were selected because of the scarcity of water quality data across the region. Streams were selected because they were located in the Northwestern Glaciated Plains ecoregion. Ecoregions are delineated areas with similar climate, geology, hydrography, soils, physiography, vegetation, and landuse. The selected streams have somewhat similar runoff characteristics; a spring runoff may occur in each watershed and summer flows either are extremely low or cease. All of the comparison streams are located in the Milk River drainage except Willow Creek, which lies in the Marias River Basin. The comparison streams are not listed in Montana's 2000 303d list for indications of nutrient impairment.

Total Kjeldahl nitrogen (TKN), total nitrate+nitrite, and dissolved nitrate concentrations were analyzed graphically. Mean values, confidence intervals ($\propto$=.10), and the number of samples for each stream are indicated. Parameter vs. flow was plotted for all streams that had associated flow data. Seasonal graphs were constructed for TKN, total nitrate+nitrite and dissolved nitrate. Total nitrate, and total nitrite data is included in the appendix, but was not adequate for watershed comparison and analysis.

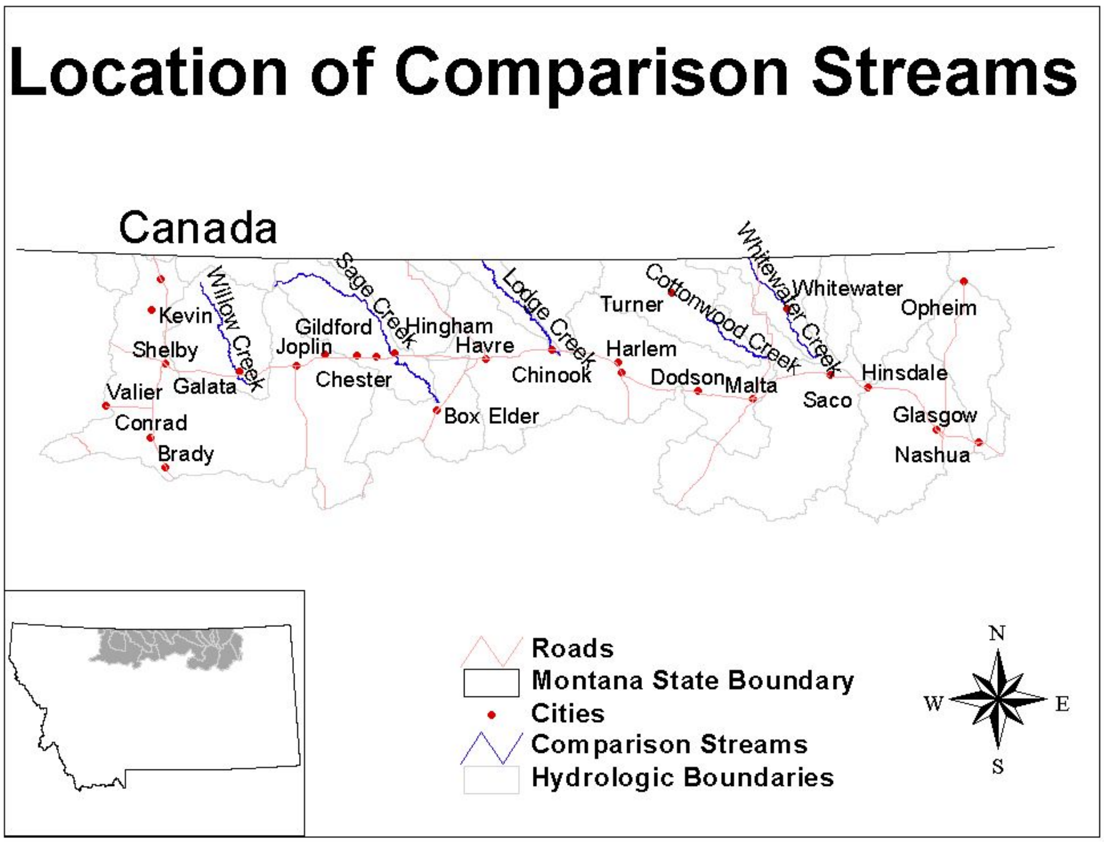
Results

No chlorophyll a data was available. Total nitrate+nitrite concentrations in Sage Creek are comparable to Lodge and Willow Creeks (Fig. 1, 2). Cottonwood and Whitewater Creeks had no nitrate+nitrite data. Dissolved nitrate variance was high within each stream (Fig. 3). Whitewater, Cottonwood, and Sage Creeks had similar dissolved nitrate concentrations. All of Sage Creek dissolved nitrate samples with associated flow measurements were below detection limits (Fig. 4). Willow Creek had one TKN sample that contained double the average of Sage Creek (Fig. 5).

Discussion

Summer periods are the most critical times for analysis of nutrient data. Algae are most productive during warm summer months when thermal and radiant energy peak in the northern latitudes. All of the data was collected between March and August (Figs. 6,7,8). With the current amount of data, seasonal variation is not easily extrapolated.

Total nitrate+nitrite, dissolved nitrate, and TKN data indicate that Sage Creek has similar or lower concentrations of bio-available nitrogen, as well as nitrogen incorporated into organic substances when compared to the other streams. This analysis suggests that it is not necessary to write a nutrient TMDL for Sage Creek according to existing information. Sage Creek nutrient and chlorophyll a data should be revisited, as more information about prairie stream nutrient conditions becomes available through the current effort of developing regional nutrient criteria.



Map 1. Location of streams that are compared to Sage Creek.

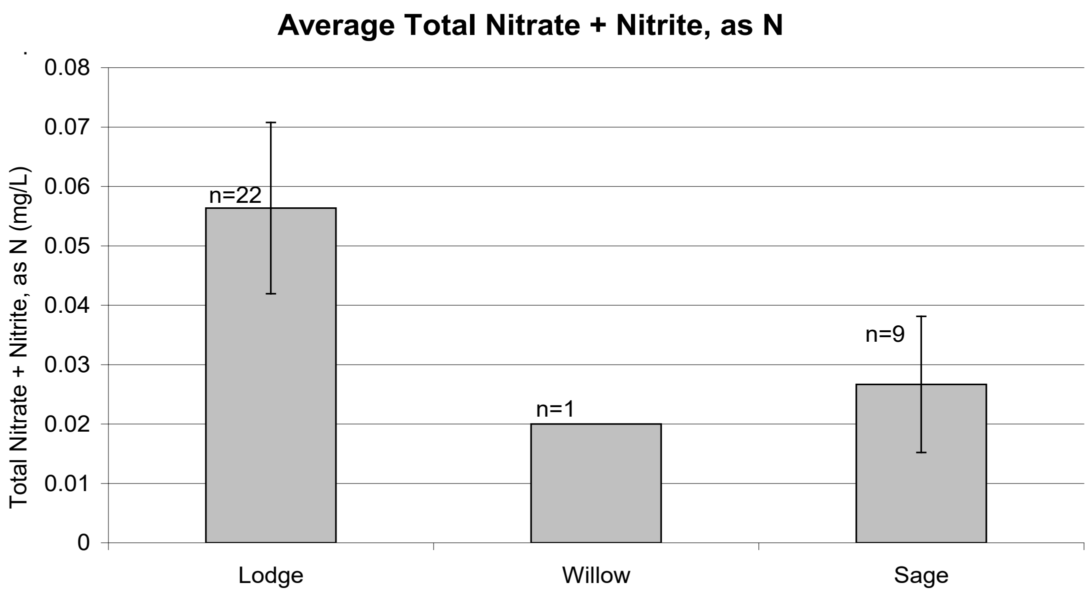


Figure 1. Total nitrate(NO3) + nitrite (NO2) as N. 90% confidence interval shown. Half value of detection limit was used if sample was below the detection limit. No nitrate+nitrite data could be found for a given stream if comparison streams are not on this graph.

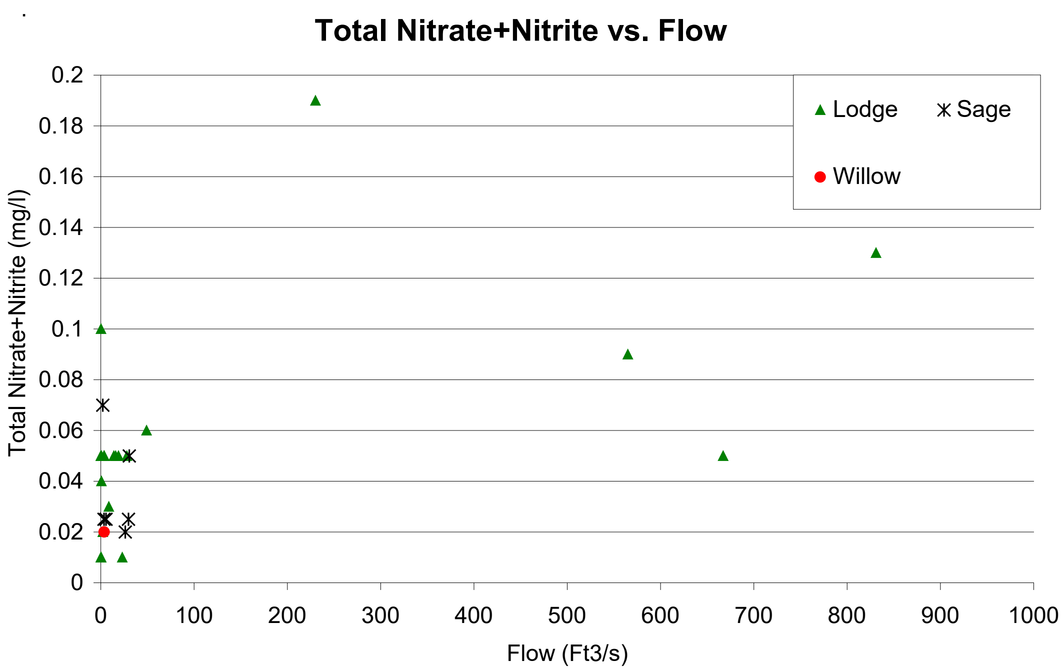


Figure 2. Total nitrate+nitrite vs. flow for Lodge, Willow, and Sage Creeks

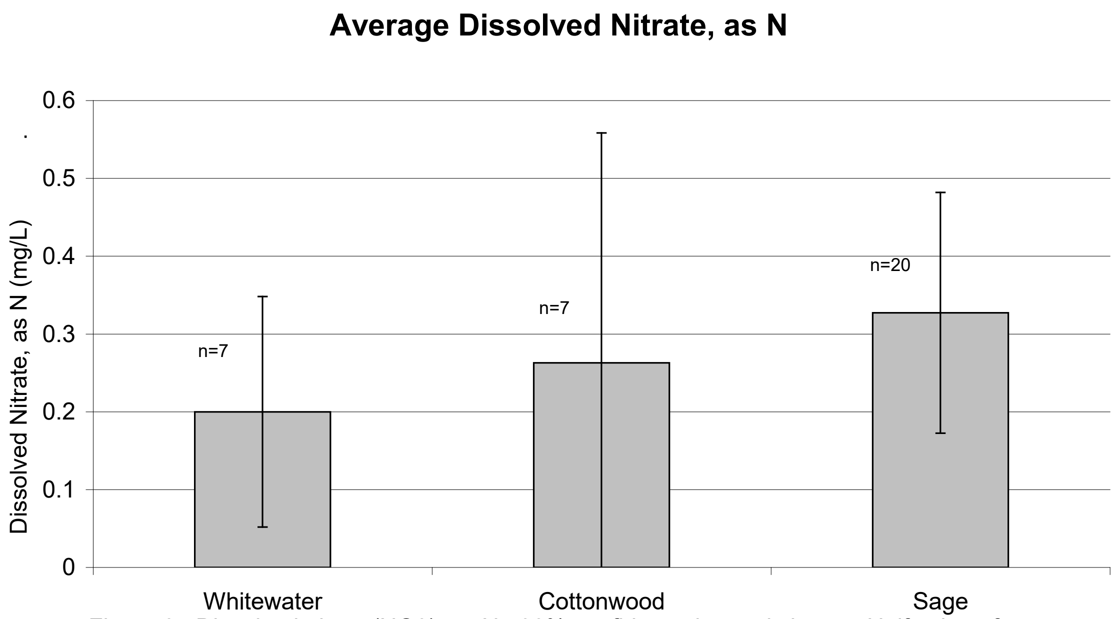


Figure 3. Dissolved nitrate(NO3) as N. 90% confidence interval shown. Half value of detection limit was used if samples were below detection limits. No dissolved nitrate data could be found for a given stream if comparison streams are not on this graph.

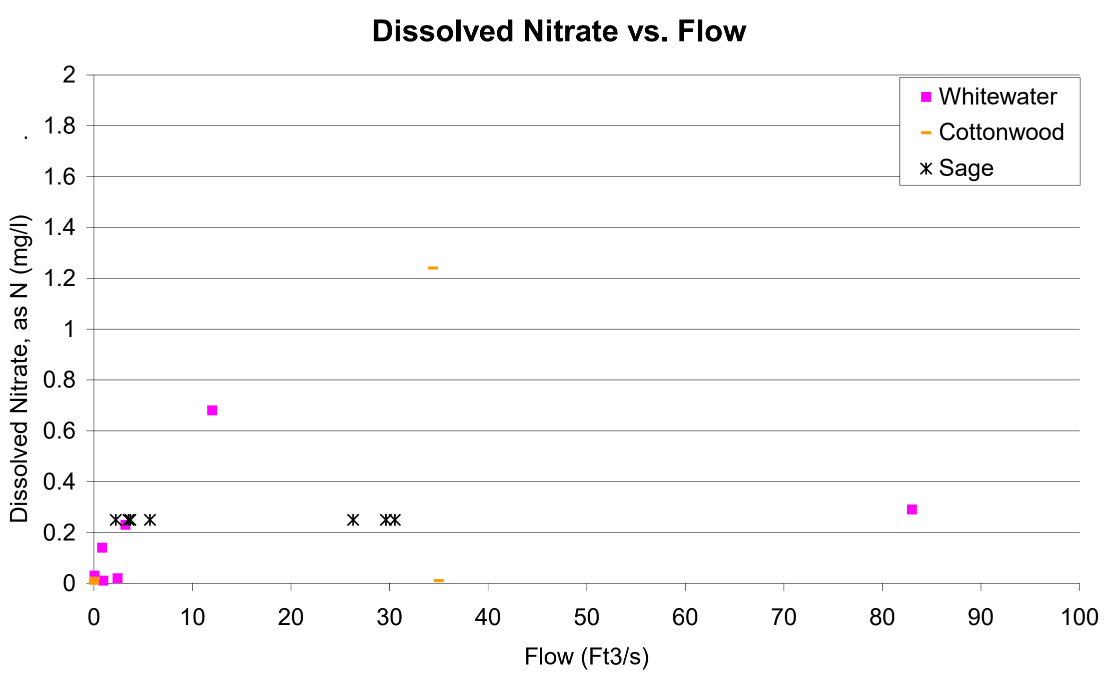


Figure 4. Dissolved Nitrate vs. flow for Whitewater, Cottonwood, and Sage Creeks

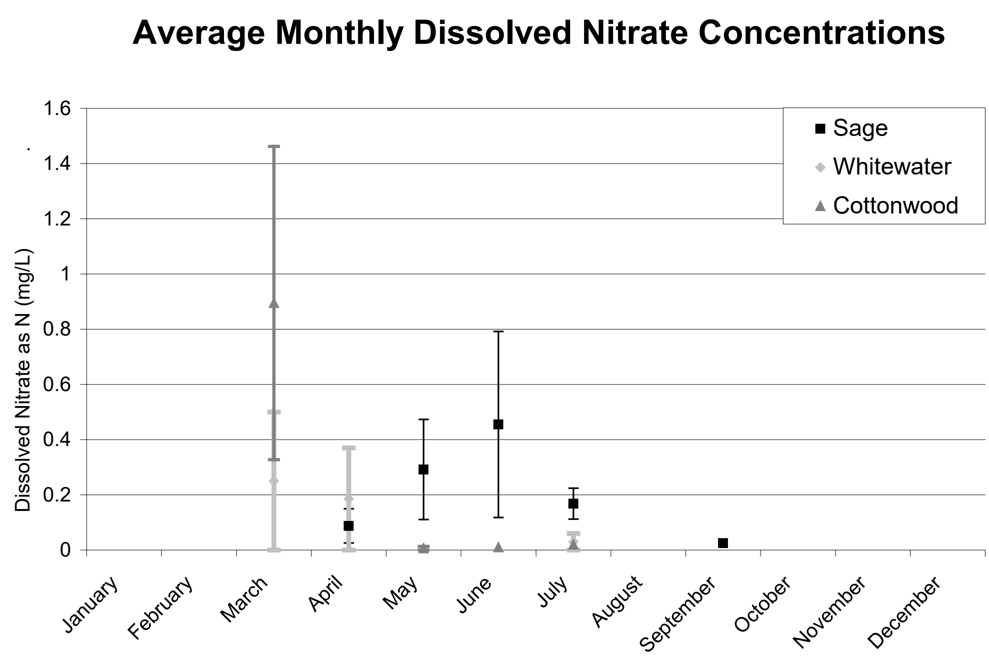


Figure 7. Monthly dissolved nitrate concentrations for Sage, Whitewater and Cottonwood Creeks. 90% confidence intervals shown.

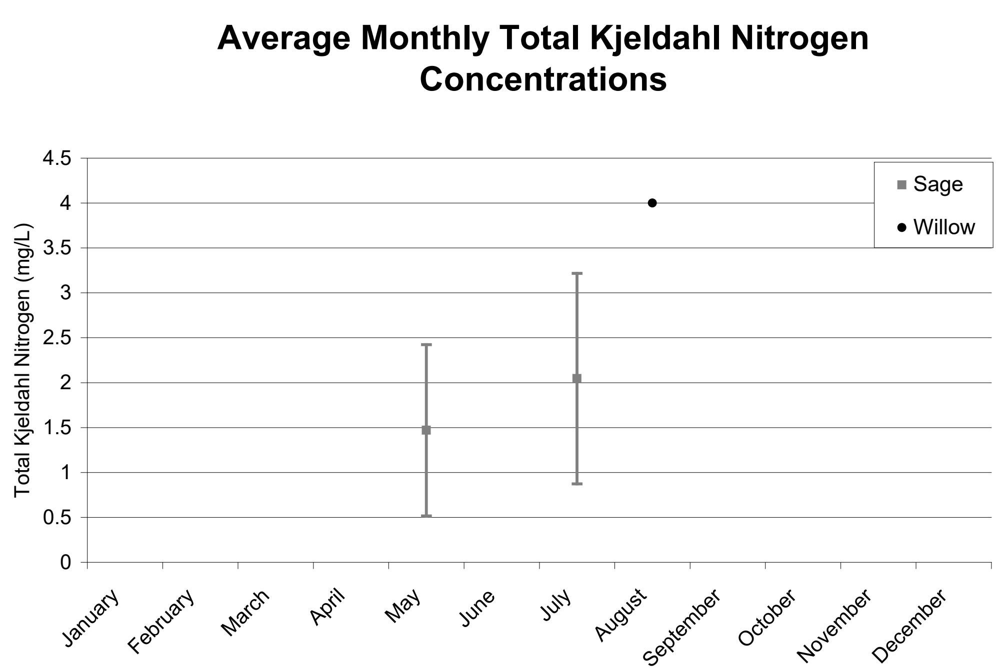


Figure 8. Monthly total Kjeldahl nitrogen concentrations for Sage and Willow Creeks. 90% confidence intervals shown.

APPENDIX C

Data for the
Sage Creek Nutrient Comparison Analysis

MT Department of Environmental Quality

September 28, 2001

Appendix C. Data.

Stream	Site	Date	Flow (CFS)	Nitrate (NO3), as Nitrogen (N), Water, Dissolved, as mg/L	Nitrate (NO3), as Nitrogen (N), Water, Total, as Milligrams -per-Liter
Whitewater	10194	05/03/1965			0.2
Whitewater	10194	03/11/1977	0.97	0.01	
Whitewater	10194	07/18/1978	0.07	0.03	
Whitewater	10194	03/21/1979	83	0.29	
Whitewater	10194	04/03/1979	3.2	0.23	
Whitewater	10194	03/19/1980	12	0.68	
Whitewater	10194	03/21/1980	2.4	0.02	
Whitewater	10194	04/04/1980	0.84	0.14	
Lodge	8966	04/01/1960			0.5
Lodge	8966	06/14/1960			0.2
Lodge	8966	04/21/1964			0.5
Lodge	8966	05/22/1973			
Lodge	8966	06/20/1973			
Lodge	3254	04/14/1974	1920		0
Lodge	3254	08/12/1974	1.17		
Lodge	8966	04/25/1977	0.05		
Lodge	8966	04/26/1977	23		
Lodge	8966	04/06/1978	831		
Lodge	8966	04/12/1978	230		
Lodge	8966	06/22/1978	2.2		
Lodge	8966	03/18/1979	565		
Lodge	8966	04/02/1979	49		
Lodge	8966	06/20/1979	3.4		
Lodge	8966	03/24/1980	0.34		
Lodge	8966	05/13/1980	8.7		
Lodge	8966	06/16/1980	0.65		
Lodge	8966	03/06/1987	667		
Lodge	8966	04/21/1987	28		
Lodge	8966	06/25/1987	0.56		
Lodge	8966	03/28/1988	0.25		
Lodge	8966	04/20/1988	19		
Lodge	8966	06/22/1988	14		
Lodge	8966	03/28/1989	16		
Lodge	8966	04/18/1989	0.02		
Lodge	8966	05/23/1989	3.7		

Appendix C. Continued

Stream	Site	Date	Flow (CFS)	Nitrate (NO3), as Nitrogen (N), Water, Dissolved, as mg/L	Nitrate (NO3), as Nitrogen (N), Water, Total, as Milligrams -per-Liter
Cottonwood	8926	05/01/1979	35	0.01	
Cottonwood	8926	07/12/1979	0.11	0.02	
Cottonwood	8932	03/19/1979	34.4	1.24	
Cottonwood	8932	05/22/1979	0.01	0	
Cottonwood	8932	06/13/1979	0	0.01	
Cottonwood	8926	03/17/1979		0.55	
Cottonwood	8926	05/18/1979		0.01	
Sage	36N05E12CBBAAB	06/06/1999	26.3	<.5	
Sage	36N08E36DAAD	06/10/1999	30.53	<.5	
Sage	35N10E33BCBC	06/10/1999	29.63	<.5	
Sage	35N10E33BCBC	06/22/1999	2.22	<.5	
Sage	36N05E12CBBAAB	06/23/1999	5.68	<.5	
Sage	36N07E02DDDA	06/23/1999	3.52	<.5	
Sage	36N08E36DAAD	06/23/1999	3.7	<.5	
Sage	3071	01/23/1974		0.99	
Sage	36N05E12CBBAAB	04/21/1982		0.05	
Sage	16716	05/24/1993			
Sage	16717	05/24/1993			
Sage	36N05E12CBBAAB	09/28/1994		<0.05	
Sage	16716	07/20/1995		0.09	
Sage	36N08E36DAAD	04/20/1998		<0.25	
Sage	36N07E02DDDA	05/20/1998		<0.25	
Sage	36N08E36DAAD	07/14/1998		<0.25	
Sage	36N07E02DDDA	07/15/1998		<0.25	
Sage	36N05E12CBBAAB	05/06/1999		<.5	
Sage	36N07E02DDDA	05/06/1999		<1.0	
Sage	36N07E02DDDA	06/06/1999		1.89	
Sage	36N07E02DDDA	07/20/1999		<.5	
Sage	36N05E12CBBAAB	07/21/1999		<.5	
Sage	BS-1	07/21/1999			
Sage	BS-9	07/06/1998			
Sage	BS-4	07/06/1998			
Sage	BS-35	07/06/1998			
Sage	BS-1	07/06/1998			
Sage	BS-29	07/21/1999			
Sage	BS-35	07/21/1999			
Sage	BS-9	07/21/1999			
Willow	HW2	08/20/1990			

Appendix C. Continued

Stream	Site	Date	Nitrate plus Nitrite (NO3+NO2), as Nitrogen (N), Water, Total, as Milligrams-per-Liter	Nitrite (NO2), as Nitrogen (N), Water, Total, as Milligrams-per-Liter	Nitrogen (N), Kjeldahl, Water, Total (TKN), as Milligrams-per-Liter
Whitewater	10194	05/03/1965		3	
Whitewater	10194	03/11/1977			
Whitewater	10194	07/18/1978			
Whitewater	10194	03/21/1979			
Whitewater	10194	04/03/1979			
Whitewater	10194	03/19/1980			
Whitewater	10194	03/21/1980			
Whitewater	10194	04/04/1980			
Lodge	8966	04/01/1960			
Lodge	8966	06/14/1960			
Lodge	8966	04/21/1964			
Lodge	8966	05/22/1973	<0.1		
Lodge	8966	06/20/1973	<0.1		
Lodge	3254	04/14/1974			
Lodge	3254	08/12/1974			
Lodge	8966	04/25/1977	0.01		
Lodge	8966	04/26/1977	0.01		
Lodge	8966	04/06/1978	0.13		
Lodge	8966	04/12/1978	0.19		
Lodge	8966	06/22/1978	0.02		
Lodge	8966	03/18/1979	0.09		
Lodge	8966	04/02/1979	0.06		
Lodge	8966	06/20/1979	<0.1		
Lodge	8966	03/24/1980	0.01		
Lodge	8966	05/13/1980	0.03		
Lodge	8966	06/16/1980	0.04		
Lodge	8966	03/06/1987	<0.1		
Lodge	8966	04/21/1987	<0.1		
Lodge	8966	06/25/1987	<0.1		
Lodge	8966	03/28/1988	0.1		
Lodge	8966	04/20/1988	<0.1		
Lodge	8966	06/22/1988	<0.1		
Lodge	8966	03/28/1989	<0.1		
Lodge	8966	04/18/1989	<0.1		
Lodge	8966	05/23/1989	<0.1		
Cottonwood	8926	05/01/1979			
Cottonwood	8926	07/12/1979			

Appendix C. Continued

Stream	Site	Date	Nitrate plus Nitrite (NO3+NO2), as Nitrogen (N), Water, Total, as Milligrams-per-Liter	Nitrite (NO2), as Nitrogen (N), Water, Total, as Milligrams-per-Liter	Nitrogen (N), Kjeldahl, Water, Total (TKN), as Milligrams-per-Liter
Cottonwood	8932	03/19/1979			
Cottonwood	8932	05/22/1979			
Cottonwood	8932	06/13/1979			
Cottonwood	8926	03/17/1979			
Cottonwood	8926	05/18/1979			
Sage	36N05E12CBBAAB	06/06/1999			
Sage	36N08E36DAAD	06/10/1999			
Sage	35N10E33BCBC	06/10/1999			
Sage	35N10E33BCBC	06/22/1999			
Sage	36N05E12CBBAAB	06/23/1999			
Sage	36N07E02DDDA	06/23/1999			
Sage	36N08E36DAAD	06/23/1999			
Sage	3071	01/23/1974			
Sage	36N05E12CBBAAB	04/21/1982			
Sage	16716	05/24/1993	0.02		2.05
Sage	16717	05/24/1993	<0.01		0.89
Sage	36N05E12CBBAAB	09/28/1994			
Sage	16716	07/20/1995			<0.01
Sage	36N08E36DAAD	04/20/1998			
Sage	36N07E02DDDA	05/20/1998			
Sage	36N08E36DAAD	07/14/1998			
Sage	36N07E02DDDA	07/15/1998			
Sage	36N05E12CBBAAB	05/06/1999			
Sage	36N07E02DDDA	05/06/1999			
Sage	36N07E02DDDA	06/06/1999			
Sage	36N07E02DDDA	07/20/1999			
Sage	36N05E12CBBAAB	07/21/1999			
Sage	BS-1	07/21/1999	<0.05		1.1
Sage	BS-9	07/06/1998			6.18
Sage	BS-4	07/06/1998	0.01		2.84
Sage	BS-35	07/06/1998	0.01		2.97
Sage	BS-1	07/06/1998	<0.01		1.38
Sage	BS-29	07/21/1999	0.07		<0.05
Sage	BS-35	07/21/1999	<0.05		2.5
Sage	BS-9	07/21/1999	<0.05		1.1
Willow	HW2	08/20/1990	0.02		4

Appendix C. Continued

Stream	**Site**	***Date***	**Phosphorus (P), ortho-, Water, Dissolved, as Milligrams-per-Liter**	**Phosphorus (P), ortho-, Water, Total, as Milligrams-per-Liter**	**Phosphorus (P), Water, Dissolved, as Milligrams-per-Liter**	**Phosphorus (P), Water, Total, as Milligrams-per-Liter**
Whitewater	10194	05/03/1965				
Whitewater	10194	03/11/1977		0.03		
Whitewater	10194	07/18/1978	0.02	0.06		
Whitewater	10194	03/21/1979			0.23	
Whitewater	10194	04/03/1979			0.08	
Whitewater	10194	03/19/1980			0.18	
Whitewater	10194	03/21/1980			0.18	
Whitewater	10194	04/04/1980			0.01	
Lodge	8966	04/01/1960				
Lodge	8966	06/14/1960				
Lodge	8966	04/21/1964				
Lodge	8966	05/22/1973	<0.01	0		
Lodge	8966	06/20/1973	<0.01	0		
Lodge	3254	04/14/1974				0.05
Lodge	3254	08/12/1974		0.02		
Lodge	8966	04/25/1977	<0.01	0		
Lodge	8966	04/26/1977	<0.01	0		
Lodge	8966	04/06/1978	<0.01	0		
Lodge	8966	04/12/1978	0.07	0.21		
Lodge	8966	06/22/1978	0.01	0.03		
Lodge	8966	03/18/1979			0.15	
Lodge	8966	04/02/1979			0.08	
Lodge	8966	06/20/1979			0.02	
Lodge	8966	03/24/1980			0.09	
Lodge	8966	05/13/1980			0.02	
Lodge	8966	06/16/1980			0.01	
Lodge	8966	03/06/1987			0.15	
Lodge	8966	04/21/1987				
Lodge	8966	06/25/1987				
Lodge	8966	03/28/1988				
Lodge	8966	04/20/1988	0.02			
Lodge	8966	06/22/1988				
Lodge	8966	03/28/1989	0.1			
Lodge	8966	04/18/1989	0.02			
Lodge	8966	05/23/1989	0.02			
Cottonwood	8926	05/01/1979				
Cottonwood	8926	07/12/1979				

Appendix C. Continued

Stream	**Site**	***Date***	**Phosphorus (P), ortho-, Water, Dissolved, as Milligrams-per-Liter**	**Phosphorus (P), ortho-, Water, Total, as Milligrams-per-Liter**	**Phosphorus (P), Water, Dissolved, as Milligrams-per-Liter**	**Phosphorus (P), Water, Total, as Milligrams-per-Liter**
Cottonwood	8932	03/19/1979				
Cottonwood	8932	05/22/1979				
Cottonwood	8932	06/13/1979				
Cottonwood	8926	03/17/1979				
Cottonwood	8926	05/18/1979				
Sage	36N05E12CBBAAB	06/06/1999		<0.05		
Sage	36N08E36DAAD	06/10/1999		<0.05		
Sage	35N10E33BCBC	06/10/1999		<0.05		
Sage	35N10E33BCBC	06/22/1999		<0.05		
Sage	36N05E12CBBAAB	06/23/1999		<0.05		
Sage	36N07E02DDDA	06/23/1999		<0.05		
Sage	36N08E36DAAD	06/23/1999		<0.05		
Sage	3071	01/23/1974		13.37		
Sage	36N05E12CBBAAB	04/21/1982				
Sage	16716	05/24/1993				0.06
Sage	16717	05/24/1993				0.023
Sage	36N05E12CBBAAB	09/28/1994		<0.125		
Sage	16716	07/20/1995				0.004
Sage	36N08E36DAAD	04/20/1998		<1.0		
Sage	36N07E02DDDA	05/20/1998		<1.0		
Sage	36N08E36DAAD	07/14/1998		<1.0		
Sage	36N07E02DDDA	07/15/1998		<1.0		
Sage	36N05E12CBBAAB	05/06/1999		<0.05		
Sage	36N07E02DDDA	05/06/1999		<1.0		
Sage	36N07E02DDDA	06/06/1999		<0.05		
Sage	36N07E02DDDA	07/20/1999		<1.0		
Sage	36N05E12CBBAAB	07/21/1999		<0.05		
Sage	BS-1	07/21/1999		0.03		0.09
Sage	BS-9	07/06/1998		0.016		0.141
Sage	BS-4	07/06/1998		0.023		0.09
Sage	BS-35	07/06/1998		0.023		0.134
Sage	BS-1	07/06/1998		0.02		0.053
Sage	BS-29	07/21/1999		0.02		0.02
Sage	BS-35	07/21/1999		0.03		
Sage	BS-9	07/21/1999		0.05		0.09
Willow	HW2	08/20/1990				0.932

APPENDIX D

The Result of Public Participation in the Salinity TMDL and Water Quality Restoration Plan for Sage Creek

The Result of Public Participation in the Salinity TMDL and Water Quality Restoration Plan for Sage Creek

A public notice of availability of the TMDL and opportunity for providing comments was published on the DEQ home page http://www.deq.state.mt.us on January 9, 2001. A press release was posted on DEQ's Press Release Web Page announcing the availability of the TMDL, the comment period and public meeting location and time. The press release was also posted on the listserve for watershed issues WASHED@listserv.montana.edu. In addition, a hardcopy of the press release was sent to the Liberty County Times and the Havre Daily News. The public meeting information was also posted on DEQ's Public Meetings Web Site. The TMDL regional coordinator contacted the Hill and Liberty County conservation districts and the Milk River International Alliance, gave them copies of the TMDL, and let them know about the meeting.

A meeting to take public comment was held at the Hingham Catholic Church during the regular meeting of the Sage Creek Watershed Alliance at 1:30 p.m. on Tuesday, January 23, 2001. A 30-day public comment period ended February 9, 2001.

DEQ received four letters during the comment period. A summary of the comments and responses follows.

COMMENT	**RESPONSE**
The targets in the draft plan have no historic or reference data indicating that the targets will actually achieve water quality standards. Are the TMDL targets the same as those in Sage Creek planning documents?	The targets consider those recommended in the *Sage Creek Watershed Alliance Area Wide Conservation Plan* when the stream is not flowing. The targets were updated based on new information from MBMG, NRCS and Montana Salinity Control Association.
Will we be held accountable for meeting targets in the TMDL?	Implementation of the TMDL is considered voluntary for nonpoint sources in both the federal Clean Water Act and the Montana Water Quality Act.
Can the targets be changed in the future?	Yes, the DEQ will monitor the effects of restoration activities and the TMDL can be modified based on new information. 75-5-703 (9)(c) MCA.
Has Willow Creek been measured for TKN?	Yes, the last time was in 1992.
Are CAFOs considered nonpoint sources?	No, a facility that meets the EPA-definition of a concentrated animal feeding operation is considered a point source.
Remove the word "destroys" and substitute "damages" or "reduces".	Change made.
Clarify the sites indicated on Map 2.	Map 2 has been replaced by Figure 3 in Appendix A.
Please clarify the units associated with the TMDL endpoints.	Flow is in cubic feet per second, Specific Conductance is in µmhos/cm at 25 degrees Centigrade, and all others are in milligrams/liter. µmhos/cm is a measurement of the amount of electricity that the water can conduct.

How many CAFOs are on Sage Creek?	Only one CAFO currently has a permit. This permit is a general storm water permit (MTG010159) that allows a discharge of animal wastes when a storm exceeds that of a 25-year, 24-hour rainfall event falling during a 15-day period. The permit also allows land application of solid and liquid manure. Groundwater affected by the storage pond is monitored from 5 wells and tested for nitrogen compounds.
No data was included in the draft plan indicating that thermal standards are in fact being met and that fisheries, aquatic life and drinking water are in fact partially supported.	Sage Creek was not listed for thermal modifications in either the 1996 or 2000 303(d) list. Therefore, thermal modification will not be addressed in the TMDL. The sufficient credible data review in 2000 indicated that water quality in Sage Creek provides partial support for these beneficial uses: fisheries, aquatic life and drinking water.
The statement in the plan indicating that a CAFO must comply with a general permit and that livestock operators may implement BMPs does not constitute a TMDL.	The statement is not intended to be the TMDL. The statement is a description of the regulatory and nonregulatory controls being used.
Is Sage Creek an intermittent stream naturally or is the intermittent flow due to stream alteration?	The portion of Sage Creek covered by this TMDL is intermittent due primarily to natural factors. Little water is used for irrigation because Sage Creek is an undependable source of water in the summer.
The term "pollutant" is not appropriate when used to define substances that have a natural source.	The Montana Water Quality Standards list maximum contaminant levels for pollutants. Parameters are considered pollutants if they cause health concerns for humans or damage the environment so as to adversely affect human habitation. A TMDL must consider all sources of pollutants: natural and anthropogenic.
Since the plan allows 10 to 15 years to meet the targets, will Sage Creek be in violation of standards for 15 years?	The Federal Clean Water Act and the Montana Water Quality Act recognize that it may take time to achieve a TMDL and associated targets. In some cases, a TMDL can be achieved in a matter of months, while in other cases, such as Sage Creek, it can take years. The salinity problem has been expanding over the past 30 years and it may take that long to reverse the process.

There is no data or analysis in the plan demonstrating how much of each pollutant is being discharged into the stream by each source. In order to develop a TMDL with allocations, margin of safety, seasonal variation, and reasonable assurance, there must be specific data on each pollutant, its source and impacts.	The restoration projects and the application of BMPs within the watershed are expected to achieve the water quality standards. DEQ has confidence that the BMPs in the plan will be implemented and is working with the watershed group to provide funding. Additionally, uncertainties in this plan are addressed by both monitoring and adaptive management strategies. The monitoring strategy, summarized in section 9.0, will also provide another implicit margin of safety with the inclusion of a feedback mechanism to trigger modification in the implementation plan, if necessary, to achieve water quality standards. The conceptual framework of the adaptive management approach described in Section 10.0 allows for the modification of management practices based upon the evaluation of the effectiveness monitoring data. See response below concerning margin of safety.
There should be a discussion of the aquatic life and fish species that are supposed to be in Sage Creek.	A discussion can be found on page 11 of Appendix A in the final document. The discussion is based on the following documents referenced in the TMDL: Gilge, K. 1997. *Big Sage Creek Aquatic Investigations: Fish Inventory*; Sage Creek Watershed Alliance. 1999. *Sage Creek Watershed Area Wide Conservation Plan and Water Restoration Action Strategy*; and Kellogg, Warren. 1997. *Sage Creek Initial Assessment*.
The TMDL fails to allocate responsibility because it relies on a CAFO's compliance with a general permit and voluntary BMPs for landowners.	Based on available data summarized in Appendix B & C of the TMDL, it does not appear that Sage Creek is currently impaired for nutrients. Nutrients will be further evaluated in the future. See Section 9 and 10 of the document describing the monitoring strategy and adaptive management plan.
The plan erroneously uses monitoring for a margin of safety. A margin of safety may be expressly stated in the TMDL or incorporated into the TMDL as a conservative assumption, but it cannot be simply a monitoring requirement.	Based on the DEQ analysis of the toxicity of the proposed Specific Conductance and TDS targets presented in Section 5.0, the proposed targets, and therefore the TMDL, is very protective of aquatic life. The monitoring strategy, summarized in Section 9.0, will also provide another implicit margin of safety with the inclusion of a feedback mechanism to trigger modification in the implementation plan, if necessary, to achieve water quality standards. The conceptual framework of the adaptive management approach described in Section 10.0 allows for the modification of management practices based upon the evaluation of the effectiveness monitoring data.

The proposed TMDL does not include an adequate discussion on seasonal variation.	Flow only occurs during some spring runoff events and infrequent summer storms. Throughout most of the year Sage Creek is a series of disconnected pools. The flowing and non-flowing conditions may differ greatly in terms of water chemistry. During periods of flow, Sage Creek is dominated by surface water inputs. During the non-flowing and extreme low flow periods, groundwater inflow dominates. This is the reason that separate Water Quality Restoration Targets are presented in Section 5 for the two flow scenarios. The TMDL is based on flow and, therefore, directly considers all potential seasonal conditions.
Is there a contingency plan if the monitoring shows that targets are not being met within the next few years?	Yes, the DEQ will monitor the effects of restoration activities every five years. The TMDL can be modified based on new information.
The TMDL should make it clear that it is not a sum of the loads at all sampling locations along Sage Creek.	The TMDL specifies flow and constituent concentrations at only three locations on Sage Creek. Refer to Figure 3 in Appendix A.
Groundwater monitoring should be done in May and October.	The current monitoring plan does not address groundwater sampling. An effectiveness-monitoring plan is to be developed as part of implementing the TMDL.
State the criteria for selection of monitoring sites. Specify assessment protocols. What about QAQC? Clearly specify the parameters to be collected.	The sites were selected during assessments of Sage Creek done by DEQ, NRCS, and MFW&P. These sites are primarily selected based on ease of access and distribution along the length of the stream. A monitoring plan completed by Carol Endicott in 1999, *Sage Creek Watershed Monitoring Plan: Results and Recommendations* included assessment protocols and QAQC used by DEQ and NRCS. Water chemistry samples will be analyzed for total phosphorous, total Kjeldahl nitrogen, nitrate plus nitrite, specific conductance, and total dissolved solids. Based upon available resources monitoring may also be performed for chlorophyll a, fish communities, macroinvertebrates and, during the cold weather months, nitrates.
Appendices should include the information contained in the documents cited.	Such appendices are included in the final submittal to EPA.
Channel morphology should be assessed every three years.	Agreed.
If a discharge that is authorized under a general permit is causing or contributing to a stream being on the § 303(d) list, then the Department should use its authority to require an individual permit for the discharge.	Based on available data summarized in Appendix B & C of the TMDL, it does not appear that Sage Creek is currently impaired for nutrients. Nutrients will be further evaluated in the future. See Section 9 and 10 of the document describing the monitoring strategy and adaptive management plan.

Following the comment period, the NRCS and Sage Creek Alliance requested that additional time be given to modifying the final document. The Bureau of Mines and Geology worked with the Alliance and suggested extensive changes. It was determined that the changes warranted a second comment period to solicit public comment.

A public notice of the availability of the draft Sage Creek Salinity TMDL and Water Quality Restoration Plan, and opportunity for providing comments was published on the DEQ home page http://www.deq.state.mt.us on December 15, 2001. A press release was posted on DEQ's Press Release Web Page announcing that the draft document was available and that comments would be accepted until December 30, 2001. The press release was also posted on the listserve for watershed issues WASHED@listserv.montana.edu. In addition, a hardcopy of the press release was sent to the Havre Daily News, Liberty County Times, and Big Sandy Mountaineer. Several reviewers of the Big Sandy Salinity TMDL requested an extension of the comment period. The holidays made it difficult for interested individuals to acquire the document and respond in a timely manner. The comment period was extended to January 16, 2002 for both the Big Sandy and Sage Creek Salinity TMDLs. A press release announcing the extension was distributed as above.

The Hill and Liberty County conservation districts made copies of the document available for public review. A 30-day public comment period ended January 16, 2002. One e-mail, a fax and one phone message was received. A summary of the comments and responses follows.

COMMENT	RESPONSE
The allocation is a crucial element of the TMDL. The source category needing corrective action is "dry-land farming operations in recharge areas contributing to saline seeps". The allocation approach identifies BMPs. Please provide more description of the land use category. Is there a map that identifies these areas? Is there an approximate % of land use that comes under this category?	In 1982, the Triangle Conservation district estimated there was a total of 7,073 acres affected by saline seep; this represented a doubling of damaged acreage in dryland crops since 1972. About seventy percent of the Sage Creek Watershed is either dryland farmed or placed in the Conservation Reserve Program. In the upper third of the watershed, color infrared photography showed the effects of saline seep formation on approximately seven percent of the cropland in 1985. The Environmental Quality Incentive Program (EQIP) Sage Creek Priority Area was designed to address 3,225 acres affected by saline seep. The goals were to reduce the seeps to 2,145 acres, decrease the specific conductance of the water by 35 percent, increase soil organic matter by 1.25 percent and decrease the elevation of the water table by eight feet.
Section 4.4 Allocation in Appendix A mentions that the restoration plan estimates "...of loading rates that include natural background levels, ...and from nonpoint sources." Where are the loading rates provided in the plan? This would be important information to add.	These rates are found in Figure 3. They do not distinguish loading rates from natural versus nonpoint sources.
The TMDL did not consider the effect that reservoirs have on increasing the salinity of the water. (Kremlin?)	The reservoirs were not included in the TMDL because they are not considered a significant source of pollutants addressed.
On page 7-1, delete "assigned" and substitute "focused. Assigned implies mandatory landowner participation.	Correction made.

On A-1 correct the Name of the Montana Bureau of Mines and Geology	Correction made.
Correct the last sentence on A-3 to say: "The SCWA further submits that a TMDL plan is warranted at such time that further information indicates that targets are not being met."	Correction made for final. However, members of the Sage Creek Alliance resubmitted a second revision below.
Correct the last sentence on A-3 to say: "Therefore, the SCWA submits that a TMDL plan for TDS is unnecessary for flowing conditions until and unless future information indicates that targets are not being met. "	Correction made.
On page 9-1, delete the fourth bulleted items.	The nutrient data enhances the adaptive management approach suggested by the Water Quality Restoration Plan. The TMDL states that this data would be gathered based on available resources.
Please include the cover letter from the Liberty County Conservation District in Appendix A.	The letter has been added.