Cow Creek Watershed

Total Maximum Daily Load

Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality
Prepared by the Idaho Soil Conservation Commission
In Cooperation with the Latah Soil and Water Conservation District
July 2008

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INTRODUCTION

Cow Creek is a small (<15 ft. wide) interstate drainage on the State of Idaho's §303(d) list of impaired waterbodies. The listed water quality parameters of concern include: habitat alteration, nutrients and temperature. Cow Creek is listed from its headwaters to the Washington State line. For waterbodies identified on the list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards (IDEQ, 2005). The Cow Creek TMDL was developed in 2005 by IDEQ for nutrients and approved by EPA in 2006.

The Cow Creek Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for the Cow Creek TMDL. The plan will specify projects and controls designed to improve Cow Creek water quality and meet the load allocations presented in the TMDL document. Implementation of best management practices within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis (IDEQ, 2005). This "Implementation Plan for Agriculture" will be a component of the Cow Creek TMDL Implementation Plan.

As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may be revisited. In the event that new data or information shows that changes are warranted, TMDL revisions will be made with the assistance of the Cow Creek WAG. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved (IDEQ, 2005).

The Idaho Soil Conservation Commission (ISCC) works with the Latah Soil and Water Conservation District (LSWCD), the Nez Perce Soil and Water Conservation District (NPSWCD), the Idaho Association of Soil Conservation Districts (IASCD), and the USDA Natural Resource Conservation Service (NRCS) in a partnership to reach common goals and successfully deliver conservation programs within the Cow Creek Watershed, which straddles Latah and Nez Perce Counties (Figure 1). ISCC is the designated state agency in Idaho for managing agricultural nonpoint source pollution (Idaho Code § 39-3601).

Purpose

The agricultural component of the Cow Creek Total Maximum Daily Load (TMDL) Implementation Plan outlines an adaptive management approach for implementation of Best Management Practices (BMPs) to meet the requirements of the TMDL. The purpose of this plan is to assist and/or complement other watershed stakeholders in restoring and protecting beneficial uses for the 303(d) listed stream segments.

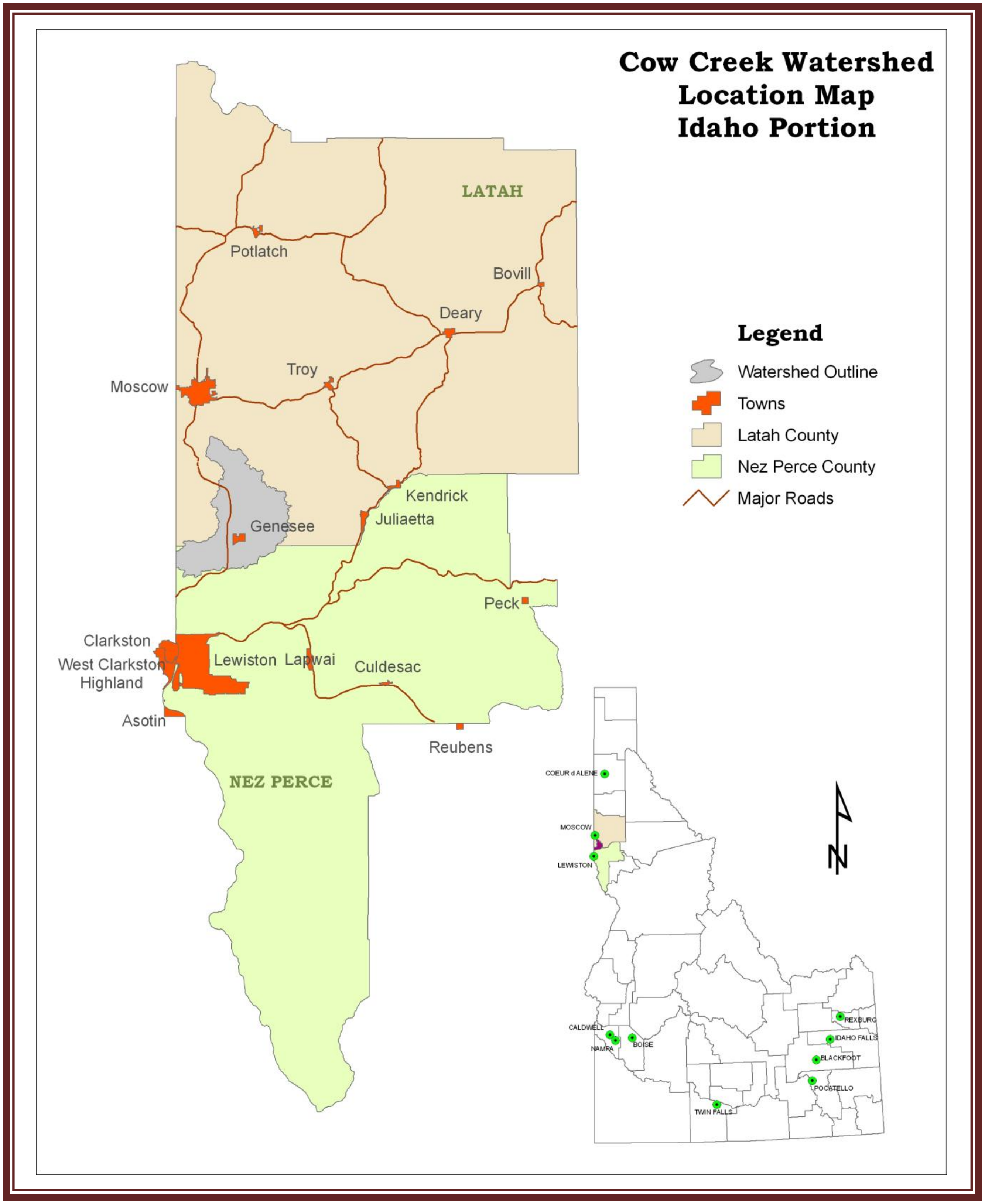


Figure 1. Cow Creek Watershed Location Map

Goals and Objectives

This component implementation plan is intended to assist and document ongoing efforts of the Latah Soil and Water Conservation District, the Nez Perce Soil and Water Conservation District and agricultural producers in the Cow Creek watershed to identify critical agricultural acres and suggest BMPs necessary to meet the requirements of the Cow Creek TMDL. This work has already begun due to the efforts of the two Conservation Districts and individual farm operators within the watershed combined with funding assistance from the Idaho Department of Environmental Quality (IDEQ) and the Idaho Soil Conservation Commission (ISCC). Whether the TMDL targets are attainable remains to be seen. The main goal of this plan will be to identify critical agricultural acres and to outline practices to reduce the amount of nutrients entering these waterbodies from agricultural sources, where economically feasible. The Cow Creek TMDL document does not currently address temperature; the determination whether a temperature TMDL is necessary will be determined through on-going monitoring (IDEQ, 2005).

Agricultural pollutant reductions will be achieved through the application of BMPs developed and implemented on-site with willing individual agricultural landowners and operators. The majority of county roads intersect agricultural lands; although some road related BMPs may be suggested, it is the responsibility of the county roads district to determine the optimum BMPs to use and their subsequent implementation.

A long range objective of this plan will be to provide BMP effectiveness evaluation and monitoring to determine pollutant load reductions and the cumulative impact on the designated beneficial uses of the listed stream segments. Emphasis will also be placed on the continuance of an on-going water quality outreach program initiated by the two Conservation Districts to encourage landowner participation in water quality remediation efforts within the watershed. In addition to fulfilling specific goals and objectives within the agricultural sector, this plan supports comprehensive management of ground water quality in a designated nitrate priority area.

Background

The Cow Creek TMDL was submitted by the Idaho Department of Environmental Quality (IDEQ) in December, 2005 and approved by the US Environmental Protection Agency (EPA) in February, 2006. The only permitted point source of pollution is the Genesee wastewater treatment facility. The primary nonpoint sources (NPS) of pollutants in the Cow Creek Watershed are non-irrigated croplands, grazing lands, land development (construction activities), urban runoff, and roads.

In 1998, two Idaho State Waterbody Identification Assessment Units #s ID17060108CL001_02 and ID17060108CL001_03, commonly referred to as Cow Creek, were listed as water quality limited under §303(d) of the Clean Water Act (CWA). Pollutants of concern included habitat alteration, temperature and nutrients. Habitat alteration has been deemed by Idaho DEQ to be unsuitable to management by the TMDL process. Insufficient temperature information was available to formulate a viable temperature TMDL response (IDEQ, 2005). **The Cow Creek Watershed TMDL was developed for nutrients only.**

Table 1. [2002] § 303(d) list for the Cow Creek Watershed.

Waterbody	Listed Pollutants
ID17060108CL001_02	Nutrients, Temperature, Habitat Alteration
ID17060108CL001_03	Nutrients, Temperature, Habitat Alteration

Section 303(d) of the Clean Water Act requires states to devise a TMDL management plan for waterbodies determined to be water quality limited. A waterbody is determined water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a waterbody can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. TMDLs are the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and natural background conditions (IDEQ, 2005).

Project setting

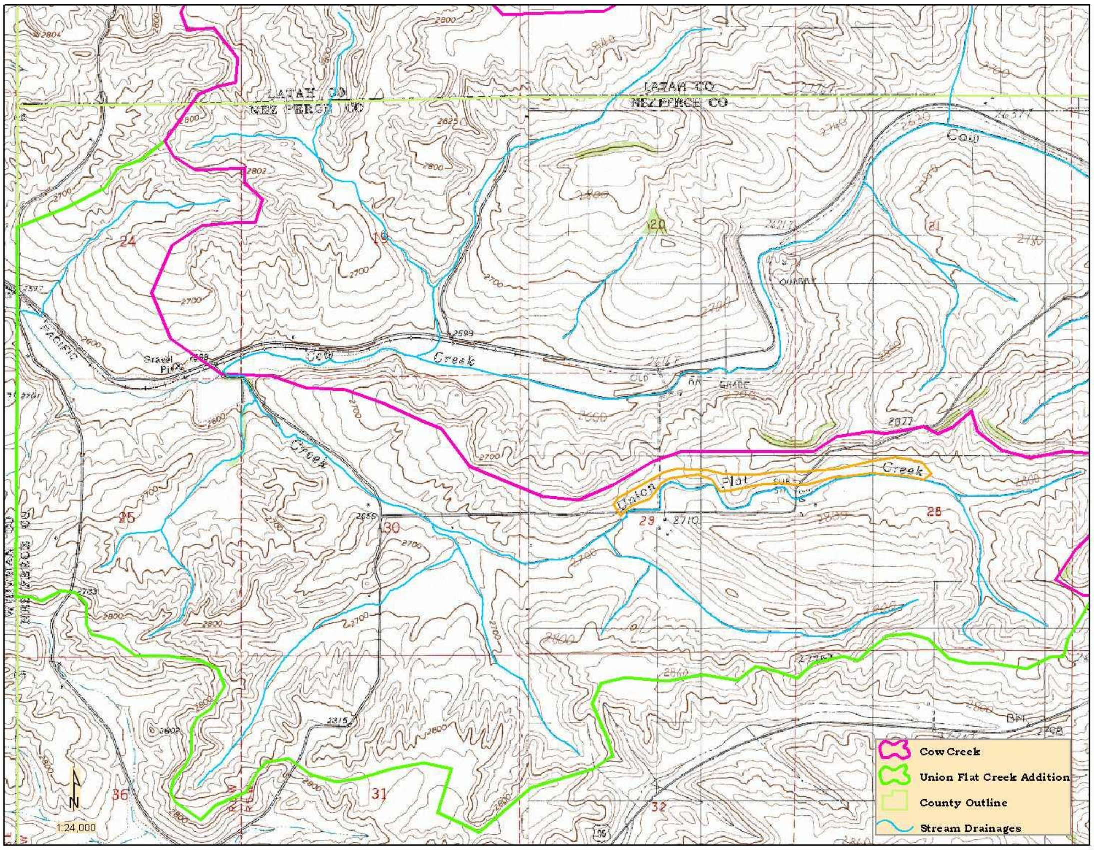
The Cow Creek Watershed spans an area that extends from the top of the Paradise Ridge, several miles south of Moscow, Idaho to Cow Creek's confluence with Union Flat Creek approximately 1 mile east of the Washington stateline. A portion of the Union Flat Creek (2,700 acres) watershed in Idaho (Figure 2) is included in the Cow Creek TMDL analysis, although not acknowledged in the TMDL document. The watershed area assessed totals 35,760 acres (note: acreage was miscalculated as 21,000 acres in IDEQ's TMDL). Elevations (Figure 3) range from 3,700 feet on Paradise Ridge to 2,570 feet at the Idaho-Washington border. Cow Creek is a tributary of Union Flat Creek which drains to the Palouse River near the boundary line of Whitman and Adams counties in Washington. The headwaters of Cow Creek are fully contained within Latah County; the lower third of the watershed is located in Nez Perce County, approximately 15 miles north of Lewiston, Idaho.

Climate

Temperatures range from an average daily high of 83°F degrees in the summer to 35°F in the winter. Average daily minimum temperatures are less than 50°F in the summer and approximately 23°F in the winter. Precipitation for the area ranges from 21 to 31 inches per year, with an average of about 25 inches. Most precipitation occurs during the months of November, December and January ($\geq$3 inches monthly average). The months of July, August and September receive the least amount of precipitation, averaging less than 1.4 inches per month. During the spring months, rainfall onto frozen soils coincident with snowmelt typically drive peak flows within the watershed (Barker, 1981).

Figure 2. Union Flat Creek Watershed/Cow Creek Watershed

Note: this portion of Union Flat Creek is included in the Cow Creek TMDL analysis by IDEQ, 2005.



Soils

Three major soil groups are present in the Cow Creek watershed. The uplands ,which comprise most of the watershed, primarily have soils of the Palouse-Naff soil group. These are very deep, well drained soils, derived from loess, that occur on gentle to moderately sloping landscapes. The lowlands, in the valley of Cow Creek, are primarily very deep and poorly drained alluvial soils of the Latahco-Lovell group which are interspersed with small quantities of Palouse Silt Loam soils. The valley soils groups, especially the Latahco-Lovell soil, generally occur in flat areas and are the most commonly occurring soil group immediately adjacent to the stream drainages (Barker, 1981).

Drainage description

Cow Creek flows through farmland and pasture at moderate slopes (5%) in the upper reaches to lower slopes (1-4%) above Calf Creek, with less than 1% slope from Calf Creek to its confluence with Union Flat Creek (Figures 3&4). Union Flat Creek flows west for about a mile before it crosses the Washington stateline. Union Flat Creek flows through the Palouse farm country toward its confluence with the Palouse River, which is a tributary of the Snake River, several miles west of Lacrosse, Washington.

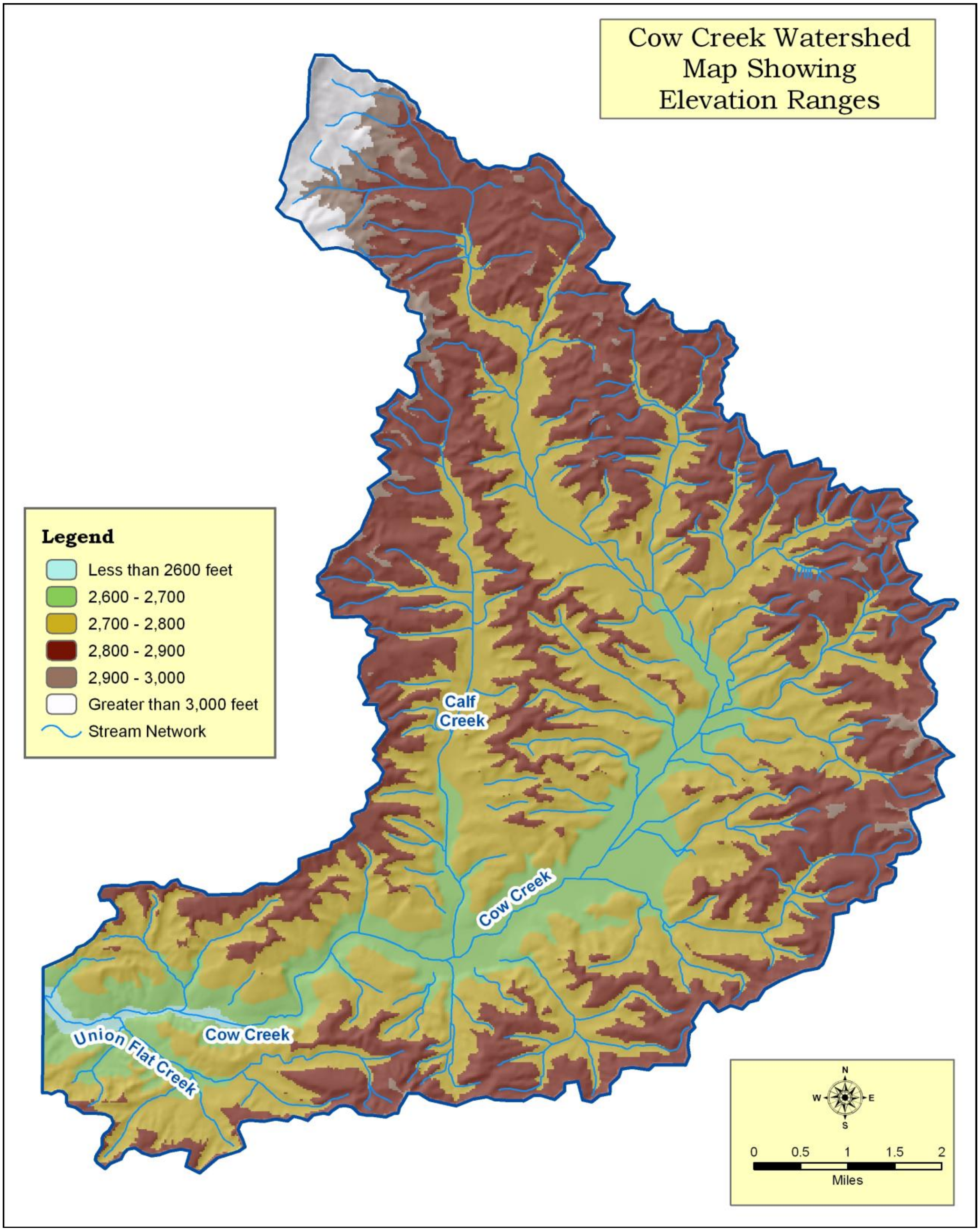


Figure 3. Elevation Map

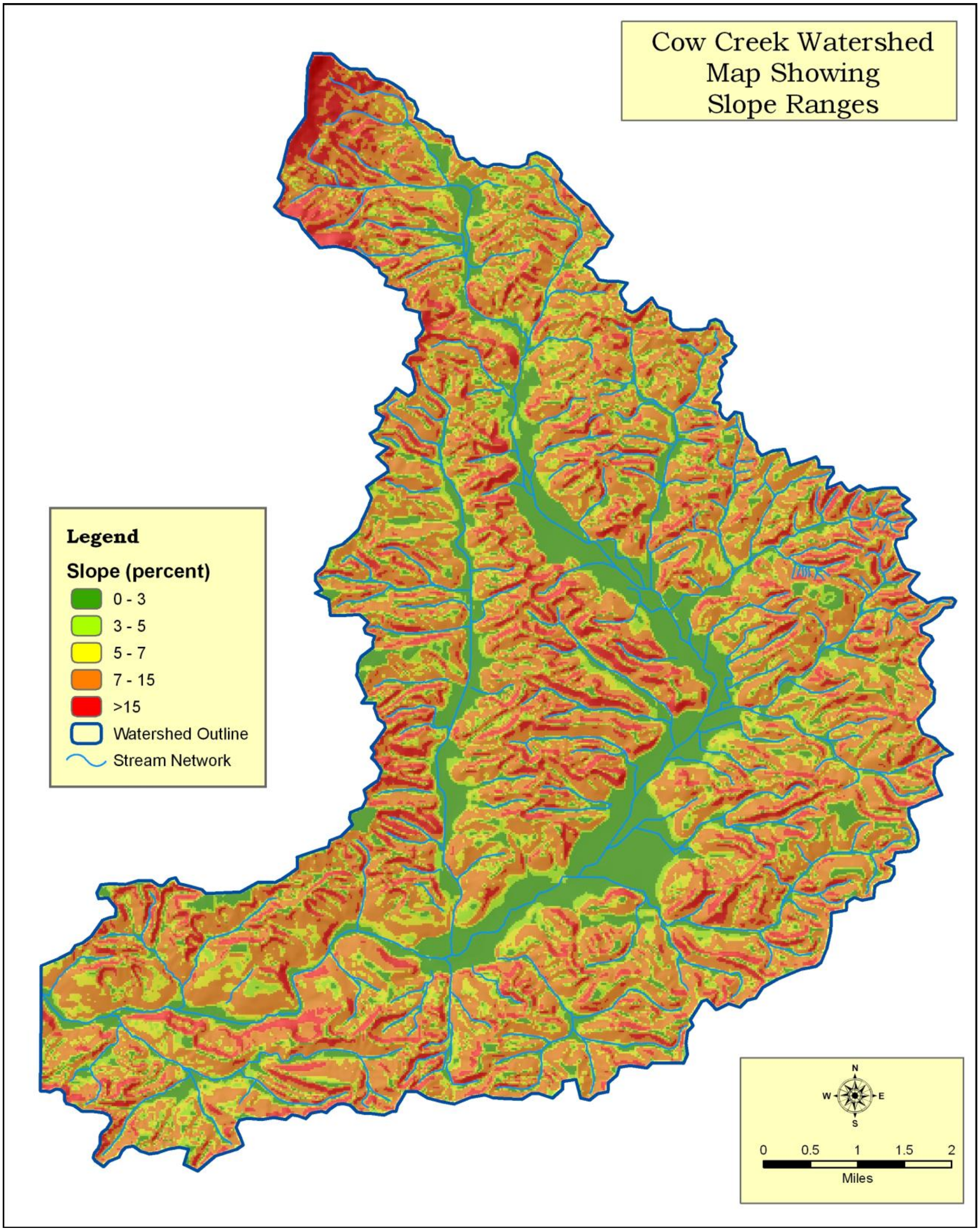


Figure 4. Slope Map

Subwatersheds

The Cow Creek watershed has three distinct sections: Calf Creek, upper Cow Creek, and lower Cow Creek (Figure 5). The upper subwatershed is approximately 37 square miles and is almost entirely dry cropland; upper Cow Creek is an intermittent stream. The Calf Creek subwatershed is approximately 8 square miles and parallels Idaho Highway 95 for most of its length. Lower Cow Creek subwatershed starts just above where Calf Creek enters the mainstem; in the TMDL it includes the Union Flat Creek addition and encompasses an area of approximately 11 square miles. The lower subwatershed is dominated by annual crop production but also has the majority of cattle grazing that occurs in the watershed; the mainstem creek is intermittent in the upper section but flows year round closer to the stateline. There are numerous ephemeral creeks within the watershed that contribute flow to Cow Creek in the winter and spring. These creeks, including Calf Creek, contribute flow from November through May, but are generally dry all summer (IDEQ, 2005).

Land Use

Primary land uses (Figure 6) in the watershed consist of dryland agriculture, cattle grazing operations and the town of Genesee's urban area. A sewage lagoon facility is located along Cow Creek just downstream of Genesee. US Highway 95 splits the watershed from north to south; most grazing activity occurs west of the highway. The county roads network within the watershed totals 121 miles.

Outside of the town of Genesee, the Cow Creek watershed consists of mostly agricultural lands. Cereal crops, such as wheat and barley, and legume crops, such as peas, lentils, and garbanzo beans, dominate land use within the watershed (IDEQ, 2005). Dryland farming is conducted throughout the watershed; irrigation is uncommon. Some land is used as pasture for grazing animals, generally less than 25 head per pasture.

Table 2. Land use in the Cow Creek Watershed.

Land Use Category	Acres	% of Subbasin
Cropland	34,500	97%
Shrubland/Grassland	500	1.4%
Forest	23	<0.1%
Urban	375	1.5%
Roads	121 miles/400 acres	1%
TOTAL:	35,800	100%

Land Ownership

Outside the municipal area of Genesee, excluding the network of county roads and US Highway 95, the watershed is privately owned in its entirety. Most of the watershed is located in Latah County. The lower portion of the watershed is part of Nez Perce County. The city of Genesee is the only incorporated municipality in the watershed and was once a fairly active town with numerous businesses that supported local farmers; it is

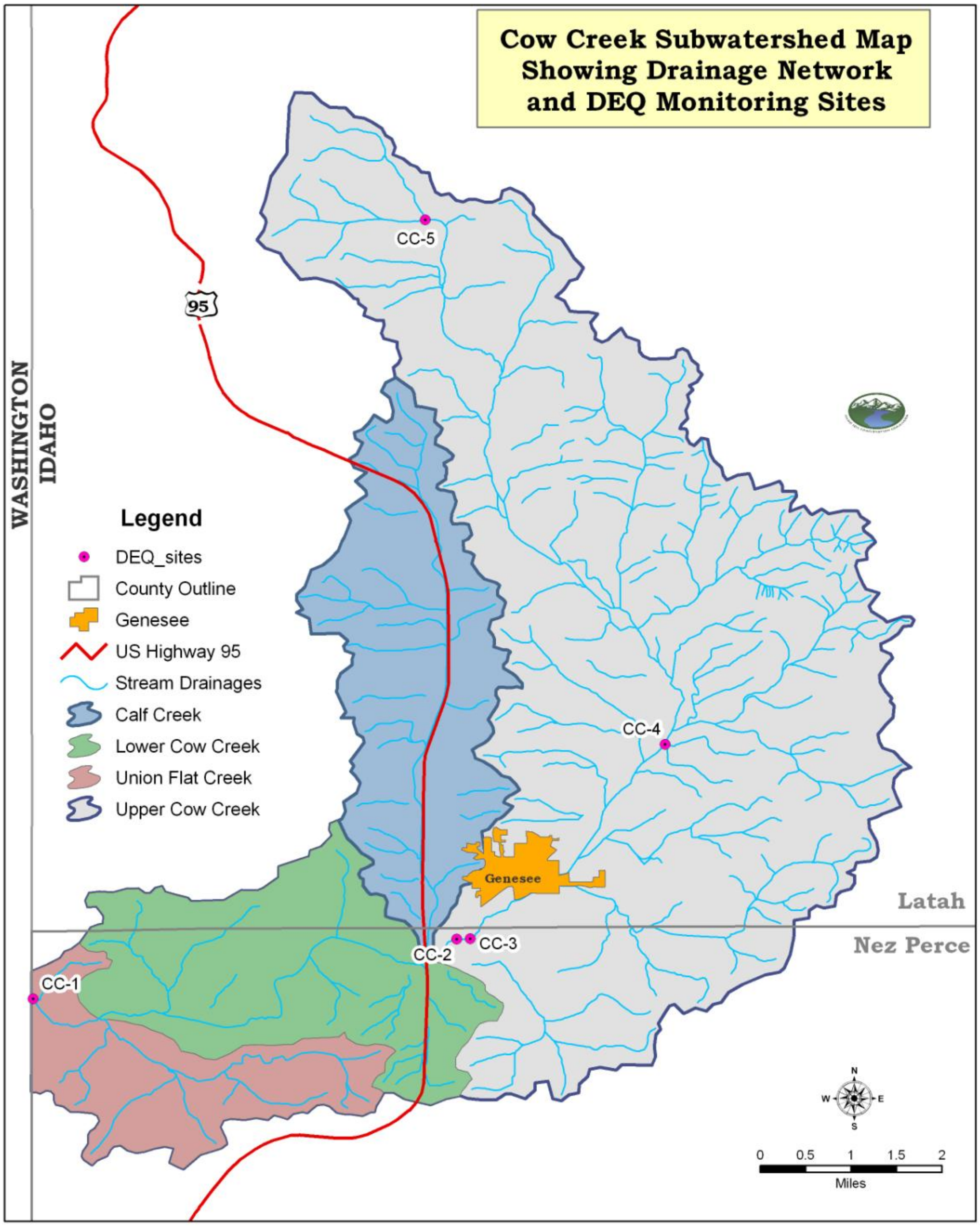


Figure 5. Subwatersheds Map

currently home to about 1,000 residents. The city of Genesee treats its municipal wastewater with a facultative lagoon located southwest of town adjacent to Cow Creek. Rural residents treat their wastewater with septic systems and drain fields. (IDEQ, 2005).

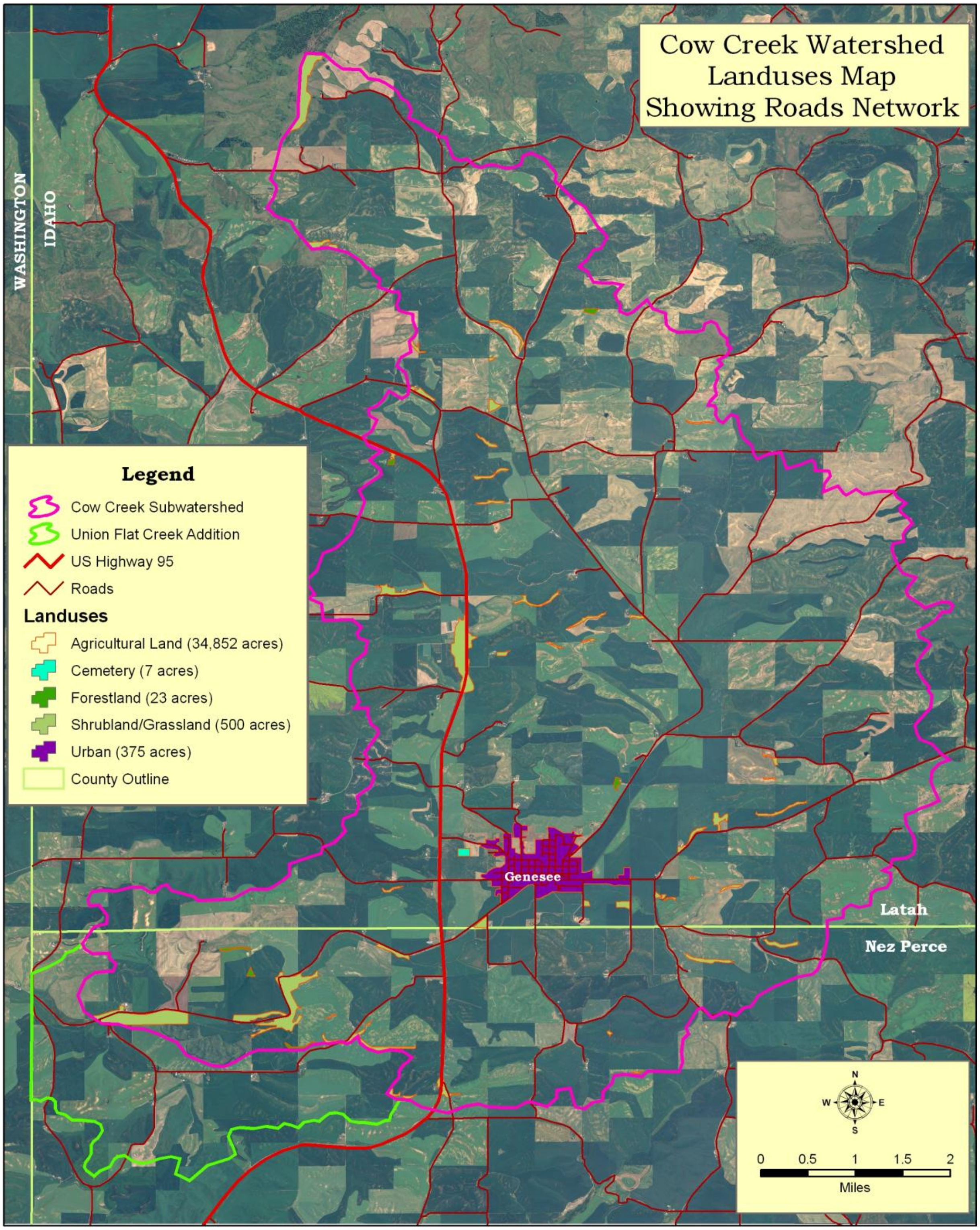


Figure 6. Landuses Map

Accomplishments

Restoration efforts have been on-going in the Cow Creek Watershed for the past several years. Implementation efforts were initiated by the Latah Soil and Water Conservation District (LWSCD) in 2004, during the development of the TMDL. The LWSCD applied for and was awarded a CWA §319 grant through IDEQ to fund the Cow Creek Water Quality Improvement Project (CCWQIP), with non-federal match provided by both ISCC Water Quality Program for Agriculture (WQPA) funds and landowner CCWQIP participants.

Landowners and operators were informed about the Cow Creek Water Quality Improvement Project (CCWQIP). A direct mailing was sent to each operator within the watershed. In addition, the program was formally announced through the LWSCD newsletters and through the Cow Creek watershed advisory group (WAG). In coordination with the co-chairs of the Cow Creek WAG and district supervisors for both the Latah and the Nez Perce Soil and Water Conservation Districts, a direct-seed implementation policy was developed.

The Cow Creek Advisory Committee (CCAC) advisory committee reviewed project applications from landowners and/or operators. The committee consisted of two district supervisors from each conservation district and a participant from the Cow Creek WAG. A technical advisory committee was developed to assist the CCAC with the selection process, if needed. Members included staff from the following: IDEQ, Cooperative Extension, University of Idaho College of Agriculture, Latah and Nez Perce Conservation Districts, USDA Natural Resources Conservation Service and USDA Agriculture Research Service.

Project sites for BMP installation were identified. Contracts and associated plans were developed for approximately 3,750 acres with 13 operators. This was well in excess of the 2,500 acres proposed in the grant application. There was extensive producer interest in the program and the producers, CCAC, and both conservation district boards agreed to distribute the available funding evenly to all eligible producers to contract as many acres as possible.

Conservation tillage transition BMPs were installed. Associated practices required by operator participants included contour farming, conservation crop rotation (minimum 3-year rotation), and pest management. Additional requirements included: no crop residue burning, soil quality measurements prior to and after practice implementation, and annual record keeping. In addition, four erosion control structures have been completed and riparian plantings have occurred on several properties within the watershed.

The Idaho Association of Soil Conservation Districts (IASCD) has developed a watershed monitoring plan that is used for watershed-scale monitoring. IASCD staff recently completed two years of water quality monitoring throughout the watershed. The City of Genesee conducts ongoing monitoring for several water quality parameters associated with the wastewater treatment plant.

Current estimated annual load reduction (LWSCD, 2008) due to conservation tillage transition on 3,750 acres is:

	Sediment:	9,375 tons
	Phosphorus:	25 tons
	Nitrogen:	35 tons

Due to the efforts of landowner/operators within the watershed, with the assistance of the two Conservation Districts and state cost-share programs, conservation tillage is currently practiced on most watershed cropland (Preston, 2008).

WATER QUALITY PROBLEMS

Beneficial uses/status

The Idaho Water Quality Standards designate cold water aquatic life, secondary contact recreation, and agricultural water supply as beneficial uses for Cow Creek. Downstream in Washington State, Cow Creek is classified as a Class A waterbody by default until fully assessed, and is protected for domestic, industrial and agricultural water supply, stock watering, primary contact recreation, aesthetic enjoyment, wildlife habitat, salmonid and other fish spawning, rearing, migration and harvesting. Interstate waters, such as Cow Creek, are required to meet the receiving state's water quality standards at the state line (IDEQ, 2005).

Table 3. Beneficial uses for 303(d) listed stream segments in the Cow Creek Watershed

Waterbody	Boundaries	Assessment Unit ID#	Beneficial Uses	Support Status
Cow Creek	Headwaters to Idaho state line	ID17060108 CL001_02 & 03	Designated: CW, SCR, A&I WS ,WH, A	Non-support
Beneficial Uses Key: CW = cold water aquatic life; SCR = secondary contact recreation; A&I WS = agricultural and industrial water supply, WH = wildlife habitat A=aesthetics				

The Cow Creek TMDL was developed to foster water quality appropriate to the protection and maintenance of the designated beneficial use of cold water aquatic life. Pollutants that most often affect this beneficial use include nutrients (that can result in aquatic plant growth and low dissolved oxygen), increased sediment loading, and temperature/heat loading (IDEQ, 2005).

Pollutants

Section 303(d) of the Clean Water Act requires states to develop a TMDL management plan for waterbodies determined to be water quality limited. A waterbody is determined as water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a waterbody can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. TMDLs are the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and natural background conditions (IDEQ, 2005).

Water quality standards for the State of Idaho are intended to provide protection of designated beneficial uses. TMDL targets are based on these water quality standards. Numeric water quality criteria are used where they exist. Narrative water quality criteria have numerical interpretations that are applied to Cow Creek for nutrients. Load capacities reflect these water quality targets based on available and estimated instream flow data. Load allocations (Table 4) distribute the existing pollutant loading between point and nonpoint sources within the watershed based on the available load capacity of Cow Creek (IDEQ, 2005).

Table 4. [2005] Phosphorus Load Allocation (From IDEQ, 2005)

Pollutant	Target	Site ID	Existing Load	Total Load Capacity	Load Reduction (after 10% margin of safety removed)
Total Phosphorus	0.10 **mg/l**	CC-5	0.19 kg/day	0.13 kg/day	37%
		CC-4	1.42 kg/day	0.49 kg/day	69%
		CC-3	0.74 kg/day	0.69 kg/day	16%
		CC-2	1.05 kg/day	0.69 kg/day	41%
		CC-1	1.65 kg/day	1.31 kg/day	28%

Table 5. [2005] Summary of Assessment Outcomes (From IDEQ, 2005)

Water Body Name	Assessment Unit ID	§303(d) Boundaries	Pollutants	Listing Basis
Cow Creek	ID17060108 CL001_02 & 03	2003 – headwaters to WA border	Nutrients	305 (b) report, 303d list (1996 and 1998)

The listed water quality parameters of concern for the Idaho portion of the Cow Creek watershed include: nutrients, temperature and habitat alteration. Although habitat alteration is not a pollutant requiring a TMDL load allocation, improvements to water quality related to nutrient, temperature and sediment loads will improve habitat conditions within Cow Creek.

A critical limiting factor for cold water biota is low levels (<6 mg/l) of dissolved oxygen. The nutrient rich stream system stimulates algal and macrophyte populations. The respiration cycles of these algal and macrophyte populations cause seasonal fluctuations in dissolved oxygen concentrations, which can lead to depletion of dissolved oxygen during the late summer low flow periods.

The nutrient load capacities and existing loads, established by the TMDL (IDEQ, 2005), were estimated by stream segment in kilograms per day for the months April through September. Although nutrients are delivered at other times of the year, the April to September time period coincides with the interval most likely to contain the critical flow stage for poor dissolved oxygen conditions. Total phosphorus is targeted for reduction by at least 28% as measured at the compliance point (CC-1) where Union Flat Creek flows west across the Washington stateline. Station CC-1 (Figure 5) is used as the watershed TMDL compliance point because it represents the only reach that has an annual mean flow of at least 1 cfs for eight months of the year and has any significant measurable flow between July and September (IDEQ, 2005).

During the summer critical low-flow period that IDEQ monitored during 2002, portions of Cow Creek showed temperatures that exceeded the Idaho standard. A temperature TMDL is not currently included in the Cow Creek document. Temperatures in the watershed will continue to be monitored to determine if a temperature TMDL is needed, particularly if Genesee is successful in reducing its discharge to Cow Creek (IDEQ, 2005).

During 2002, low flow periods in Cow Creek between July and September coincided with periods of diurnal (having a 24 hr. cycle) dissolved oxygen exceedances in both the intermittent and perennial reaches of the watershed. A key assumption is made that by reducing the nutrient concentrations, instream dissolved oxygen sags will be reduced. The Cow Creek TMDL is intended to manage instream phosphorus concentrations, to reduce aquatic plant growth, and to enhance dissolved oxygen during the mid to late summer critical flow period between July and September (IDEQ, 2005).

The Genesee wastewater treatment lagoon is the only point source permitted to discharge to Cow Creek. In February 2005, the EPA issued an NPDES permit to the city of Genesee, effective April 2005, allowing discharge year round. Historically, the city only discharged from November to July. The April 2005 permit requires the city to monitor effluent quality as well as the receiving surface waters of Cow Creek. Surface water monitoring is being required for temperature, pH, total phosphorus and ammonia. The TMDL provides a waste load allocation for total phosphorus of 0.60 kg/d during the annual critical low flow period of July through September (IDEQ, 2005).

The largest potential nonpoint source of pollutants in the watershed is agricultural activities. Agricultural production requires inputs of nutrients, which can reach Cow Creek carried by surface runoff or through subsurface tile drains in the watershed. Some tillage operations increase soil erosion resulting in sediment delivery, with attached phosphorus and nitrogen, to Cow Creek. Livestock grazing along the creek contributes nitrogen and phosphorus directly into the stream and also indirectly by streambed deterioration. Streambed deterioration includes streambank destruction and soil compaction; both contribute to increased runoff. Residential lawn fertilizer and drain field systems may also be nonpoint sources in the watershed (IDEQ, 2005).

Water Quality Monitoring

During the summer of 2001, the Idaho Department of Environmental Quality (Lewiston) sampled 32 domestic water wells, one municipal well, and five springs located in and around the Cow Creek watershed. Samples from the wells and springs were analyzed for nitrite plus nitrate as N. The 33 wells and five springs sampled in the Cow Creek watershed exhibited assorted results. Nitrate concentrations ranged from below detection limits (less than 0.05 mg/L) to over 14 mg/L. Of the 38 sample sites, 25 sites had nitrate concentrations below background concentrations of 2 mg/L while 5 sites had nitrate concentrations over the recommended maximum contaminant level (MCL) of 10 mg/L for Idaho ground water. Four of five spring samples had nitrate concentrations above 10 mg/L; one of 33 well samples had nitrate above 10 mg/L (Strausz, 2001).

From April to September 2002, IDEQ conducted water quality monitoring throughout the watershed in an effort to establish baseline water quality conditions to begin the development of the Cow Creek TMDL. The water quality data collected from five sites (Figure 5) throughout the watershed was analyzed by IDEQ. The measured parameters included: flow, dissolved oxygen, water temperature and nutrients (phosphorous, nitrogen). Based on analysis of this very limited data set, the parameters monitored exceeded Idaho water quality standards on a seasonal basis (IDEQ, 2005).

During the winter of 2002-2003, the Idaho Department of Environmental Quality (Lewiston) sampled 27 drain outlets and 4 channel sites on the Cow Creek mainstem. Tile drain samples were tested for nitrate, nitrite, ammonia, pH, electrical conductivity, and temperature. The tile drains sampled typically showed nitrate levels ranging from 8.8 mg/L to 12.5 mg/L with a 10.6 mg/l mean value. The drinking water MCL (maximum contaminant level) is 10 mg/L; however, nobody is drinking drain tile discharge. The study concluded a direct correlation between land use practices, nitrate concentration and electrical conductivity levels in the tile discharge. Drain discharge from fields with standing stubble tended to have lower levels of nitrate and total dissolved solids than fields with no stubble. Nitrate loading increased but nitrate concentrations decreased with increased flow rates (Crook, 2003). Nitrite, ammonia, pH, and electrical conductivity were at or below levels commensurate with typical regional groundwater values (Crockett, 1995).

The Idaho Association of Conservation Districts (IASCD) collected water quality samples from five stream sites from April 2006 to April 2008; these were the same locations used during 2002 by IDEQ for their initial TMDL assessment effort. Ninety eight samples were collected during this time period. Only 5 samples were collected at the monitoring site nearest the headwaters; the stream channel was typically dry. The stateline location was the lone monitoring site with measurable flow for the entire monitoring period; 30 water quality samples were collected and analyzed. The remaining three sites showed intermittent flow; 21 samples were collected at each site. From July through October, the creek bed was dry at the monitoring stations upstream of the stateline site. Total phosphorus (TP) values generally exceeded the TMDL target, but **no** violations of the Idaho standard for dissolved oxygen (DO) were recorded. The relationship of elevated TP values to any detriment to designated beneficial use in the Cow Creek Watershed is not demonstrated by this recent monitoring effort; it indicates an improvement in support conditions since TMDL completion . This monitoring effort is much more comprehensive than IDEQ’s 2002 monitoring which provided the baseline information for the TMDL.

Agricultural Water Quality Inventory and Evaluation

There are approximately 35,000 acres of non-irrigated cropland within the Idaho portion of the Cow Creek/Union Flat Creek Watershed.

Dry Cropland

The cropland occurs within the Major Land Use Area B-9, the Palouse and Nez Perce Prairies. The soils are generally deep, loess soils, and often considered highly erodible when they occur on slopes greater than 3%. In general, the cropland has been under production for decades, often since the late 19th century (~1870).

Most cropland is under an Idaho/Washington Coordinated Conservation agreement (Knecht, 2008), with requirements regarding tillage practices (contour farming), residue management and crop rotations. Tillage practices used varied among operators; conventional tillage, mulch-till, and direct-seeding practices were all utilized to different extents within the watershed. Typical crop rotation consisted of 3 year rotations of winter wheat, spring cereal (barley or wheat), and a legume (peas, lentils, garbanzo beans) or canola.

Approximately 80 percent of the cropland acres are classified as Highly Erodible Land (HEL) under the 1985 Food Security Act. Sheet and rill erosion is variable, depending primarily on slope gradient; it may exceed 10 tons per acre in the steepest areas, with little cropland erosion evident on the floodplains. Typical annual erosion cycles include winter rains on semi-frozen ground and spring cloud bursts. Some concentration (gully) erosion occurs in places due to the steepness of the slopes, even though high residue levels are maintained on the fields (LSWCD, 2004).

Within the watershed, it is believed that all landowners/operators are participating in USDA programs (Knecht, 2008). It is estimated that 195 acres or less than 1% of cropland acres are contracted under the Conservation Reserve Program (CRP).

Pasture/hayland/shrubland

Pasture and hayland within the Cow Creek Watershed totals about 500 acres. Most of the pasture and hay fields are located west of Highway 95, primarily in lowland areas adjacent to the drainages. Some hay is cut on these lands, but most is pastureland for grazing horses and cattle; most fields are 20 acres or less in size. A few goats also pasture in the watershed. There may be a minor amount of concentrated winter feeding of cattle that occurs along the lower reach of Cow Creek/Union Flat Creek near the stateline. Pasture/hayland species are made up mostly of smooth brome, orchard grass, timothy, and intermediate wheatgrass. On upland fields that are in somewhat of a deteriorated condition, Kentucky bluegrass is an invader species. In the wetter fields, meadow foxtail is the invader species. Erosion potential is based primarily on steepness of slope and vegetative cover.

Some idle areas of herbaceous cover associated with edges of cropland fields and adjacent to access roads are typically less than 1 acre in size and not utilized except by wildlife. Approximately 90% of the fields have good vegetative cover; the erosion potential is slight if that good vegetative cover is maintained.

The native grass and shrubland areas are scattered randomly throughout the watershed in small plots. Most are located on steep slopes inaccessible to farming operations; they are often comprised of remnant islands of grass and shrub mixtures with occasional pine or cottonwood that separate cultivated fields. These isolated patches offer zones of stable vegetation that intercept overland flow from cropped fields and filter sediment from upslope farming operations. They also act as small refuges, containing food and cover for wildlife.

Riparian areas

Erosion is occurring along most streambanks adjacent to cropland and pastureland fields because of the lack of woody vegetation and rhizomatus herbaceous species. This lack of root mass allows for bank sloughing which contributes significant amounts of sediment into Cow Creek. Many portions of the stream have been channelized or have had woody vegetation removed when cropland fields were established. Herbicide spray and tillage operations, as well as grazing activities, have prevented the re-establishment of woody species. There are few remnant areas; well under one percent of the linear streambank has diverse and multi-layered vegetation along the stream.

Water Quality Concerns Related to Agricultural Land Use

Agricultural activities in the Cow Creek watershed contribute to nutrient problems identified in the TMDL. Phosphorus and sediment contributions are associated with sheet and rill, concentrated flow, and streambank soil erosion processes. High stream temperatures are a function of both an inadequate/absent vegetative canopy as well as low flows.

While there is some uncertainty identifying specific nonpoint sources of phosphorus from agricultural lands, phosphorus is generally assumed to be transported with sediment. Those activities and problem areas that contribute sediment to the stream due to runoff or bank erosion are assumed to provide the largest sources of phosphorus. Additionally, some phosphorus enters the drainage network from forested areas, from roads and rural landscapes, and from groundwater. Initial results from sampling of tile drains in recent years indicate that the concentration of nutrients in these drains is similar to that in the creek itself.

Because data gaps exist about specific sources in this watershed, load allocations are applied broadly, not specifically. Improvements in the watershed, wherever they occur, that cumulatively result in lower phosphorus loadings are assumed to be beneficial (IDEQ, 2005).

The Cow Creek TMDL analysis indicates that existing phosphorus levels will need to be reduced from 16% to 69% at various locations in order for beneficial uses to be returned to full support. The phosphorus load needs be reduced 16% at monitoring site CC-3 (Figure 5) which represents the cumulative nonpoint source contribution (0.74 kg/day) from the upper 2/3 of the watershed. The load jumps to 1.05 kg/day immediately downstream of the Genesee Wastewater Treatment facility, with an associated 41% load reduction indicated. The phosphorus load gradually increases downstream, but due to associated increases in flow that dilutes the pollutant concentration, a reduction of 28% is targeted at the Washington stateline. In the agricultural setting, phosphorus is most likely introduced to the stream when it is adsorbed to sediment particles; a 69% reduction in sediment delivery would likely result in a similar reduction in phosphorus.

During the summer months, when in-stream temperatures are likely to impair beneficial uses, the portions of Cow Creek that flow through agricultural lands in the upper two thirds of the watershed are likely to be dry. If addressing temperature concerns becomes necessary, the most effective practices will be the ones that increase base flow during the summer rather than ones that emphasize shading.

Threatened And Endangered Species

No bull trout or anadromous salmonids occur within the Cow Creek watershed. Lynx, listed as threatened for both Latah and Nez Perce counties, are unlikely to be found in the generally treeless environment found throughout the watershed. Spalding's silene, a threatened plant, has potential to exist within the watershed.

IMPLEMENTATION PRIORITY

The TMDL implementation planning process included assessing impacts to water quality in the Cow Creek watershed from agricultural lands on 303(d) listed streams and recommending priorities for installing BMPs to meet water quality objectives stated in the TMDL. Data from water quality monitoring, field inventory and evaluations were used to identify critical agricultural areas affecting water quality and set priorities for treatment.

Critical Areas

The Cow Creek watershed is mostly (97%) cropland, with less than 2% of the watershed comprised of other agricultural lands. Minor pastureland or other grazing lands occur as small scattered patches of ground, primarily to the west of Highway 95. Some hay production may occur in areas later utilized for grazing, but was not observed. Approximately 50 cattle, 20 horses, and six goats were inventoried, for the entire watershed, in April of the current year (Dansart, 2008).

Areas of agricultural lands that contribute excessive pollutants to waterbodies are defined as critical areas for BMP implementation. Critical areas are prioritized for treatment based on their proximity to a waterbody of concern and the potential for pollutant transport and delivery to the receiving waterbody. Critical areas are those areas in which treatment is considered necessary to address resource concerns affecting water quality.

Agricultural critical areas within the Cow Creek watershed potentially include:

Cropland
- Areas generating erosion (sheet or rill)
- Areas of severe gully erosion

Riparian zones
- Unstable and erosive stream banks
- Areas where livestock have access to streams

Pasture Lands

Road Corridors

Recommended Priorities for BMP implementation

The highest priority for BMP implementation is the adoption of conservation tillage practices to minimize cropland sheet and rill erosion and decrease sediment delivery to the Cow Creek drainage network. Reduction of ephemeral gully erosion is also a priority. On-site retention of nutrient-laden sediment should reduce phosphorus and nitrogen loads for Cow Creek during the critical flow periods identified in the TMDL. Adoption of nutrient management plans to decrease excess nutrient levels in cropland soil is an important associated practice. This should result in a decrease in violations of the Idaho Water Quality Standard for dissolved oxygen.

No subwatersheds are prioritized for treatment. Cow Creek is a relatively small (36,000 acres) watershed, primarily cropland, with similar problems throughout.

TREATMENT

Treatment Units (TU)

Three agricultural treatment units are established for inventory and evaluation purposes. A treatment unit is defined as a unit of land with similar soil and water conservation problems requiring similar combinations of conservation treatment. Treatment units developed for agricultural lands within the Cow Creek watershed are: cropland, riparian areas, and pasture lands. A fourth treatment unit (road corridors) intersects agricultural lands throughout the watershed; it falls under the authority of the South Latah County Highway District along with the responsibility for roads BMPs installation.

Cropland

The cropland occurs within the Major Land Use Area B-9, the Palouse and Nez Perce Prairies. The soils are generally deep, loess soils, and often considered highly erosive when they occur on slopes greater than 3%. In general, the cropland has been under production for decades, often since the 19th century (~1870).

Most cropland is under an Idaho/Washington Coordinated Conservation agreement, with requirements regarding tillage practices (contour farming), residue management and crop rotations. Typical crop rotations include legumes (peas, lentils, garbanzo beans), spring cereals (barley, wheat), winter wheat, and canola.

Concentration erosion continues in places due to the steepness of the slopes, even though high residue levels are maintained on the fields.

Cropland Resource Issues

Soil

Sheet/rill erosion

Problem: Erosion rates exceed the soil loss tolerance (T)

Treatment: Reduce soil erosion through implementation of reduced tillage systems. Conversion to such systems from conventional tillage resulted in a reduction of soil loss that averaged 8 tons per acre on average within the similar Paradise Creek watershed, 10 miles to the north (Dansart, 2002). Because Cow Creek farm operators, at the time of TMDL development, had adopted some conservation tillage practices on cropland, actual reductions in erosion are expected to be significantly less. Conversion to reduced tillage systems was initially estimated to result in a 3 tons/acre drop in soil erosion (LWSCD, 2004).

Ephemeral gully erosion

Problem: Small channels formed by concentrated surface water flow tend to increase in depth over time. On cropland the gullies can be obscured by heavy annual tillage.

Treatment: Reduce or eliminate gully erosion by installing water and sediment control structures.

Water

Surface water – excessive nutrients and organics

Problem: WQ monitoring indicates TP exceeds 0.10 mg/L TMDL target.

Treatment: Apply nutrients at a time and rate that maximizes plant uptake, to achieve reduced nutrient loading; reduce sediment attached phosphorus delivery by conservation tillage system.

Reduce or eliminate gully erosion by installing water and sediment control structures and minimize transport of phosphorus bound to soil particles.

Surface water – excessive suspended sediment and turbidity

Problem: Suspended sediment is a concern for downstream and onsite water quality and stream-dwelling organisms. Tillage is the source within the watershed.

Treatment: Reduce soil erosion through implementation of a reduced tillage system. Conversion to such a system may result in a reduction of soil loss by 3 tons/acre on average.
Treatment: Reduce or eliminate gully erosion (concentrated source of soil erosion) by installing water and sediment control structures.

Riparian Zones

Channel erosion may be the largest source of sedimentation in the Cow Creek watershed. A cursory examination of the watershed revealed that most streambanks are unstable. Fields are usually cultivated to the channel edge, sometimes overtopping the bank edges and delivering sediment directly into the adjacent channels or road ditches. The stream channels are comprised mostly of silt and clay sized material; downcutting by the stream occurs during spring runoff until the stream channel encounters a compacted clay layer or other more resistive substrate, then the stream's energy is re-directed to bank erosion.

Riparian Resource Issues

Erosion from adjacent cropland
Problem: Suspended sediment is a concern for downstream water quality and the habitat of stream-dwelling organisms. Cropland is cultivated to streams edge, sometimes overtopping banks and delivering sediment directly into adjacent channels or road ditches.
Treatment: Install vegetative buffers to filter sediment from adjacent fields and prevent cultivation to channel edge.
Channel Erosion
Problem: Channel bank erosion
Treatment: Slope banks to natural angle of repose; vegetative cover on banks.

Pasture

The watershed contains relatively few (<200) acres of pastureland and a small number of grazing animals. Pasture lands are adjacent to stream channels where some animals access water. Some concentrated winter feeding may occur in the future.

Problem: Channel bank erosion due to livestock traffic that contributes suspended sediment with attached nutrients in addition to nutrient/bacteria enrichment from direct manure deposition or manure-laden runoff.
Treatment: Limit livestock access to stream by fencing and off-site water development. Develop waste storage facility where concentrated feeding occurs.

Conservation Treatments

Mulch till or No Till/Strip Till/Direct Seed
Pest Management and Conservation Crop Rotation – Minimum 3 year rotation

Nutrient Management – Best management practices to reduce pollution related to fertilizer applications include optimizing timing and rate of application, maintenance of high amounts of residue on the field, and buffering waterways.
Water and Sediment Control Structures (Gully Plugs); grade stabilization structures
Vegetative Filter Strips (VFS) buffers adjacent to stream channels
Offsite water facilities for livestock

Recommended BMPs And Estimated Costs

Best management practices (or BMPs) are defined as a practice or combination of component practices determined to be the most effective, workable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Nonpoint source loads are largely driven by climatic conditions and the effects of some best management practices (forest buffer strips, bank stabilization, etc.) may take years to be fully realized. The agricultural implementation plan should be viewed as a dynamic document, subject to change as current conditions dictate. Table 6 summarizes the recommended BMPs and associated implementation costs of pollution control efforts in the Cow Creek watershed. In addition to outlining specific goals and objectives related to the agricultural sector, this document will support the Cow Creek TMDL approved by EPA in February 2006, and promote comprehensive management of ground water quality in a nitrate priority area. The primary focus of this implementation plan is to address nonpoint pollution sources.

Agricultural resource management planning to address water quality typically involves the application of BMPs to address particular resource concerns. For the Cow Creek watershed, there are three groups of practices that are applicable: agronomic, structural, and riparian. It is difficult to accurately predict the effectiveness of any BMP; ultimately, the impact any conservation activity has on a resource concern is a function of a wide assortment of variables. The goal of any implementation project is to provide the most practical, cost-effective solution to correct the resource concern.

For the Cow Creek watershed, the most practical and cost-effective implementation strategy involves a phased or incremental approach. Practices with the best cost/benefit ratio will be implemented initially. If monitoring shows that additional practices are needed, the next cost/benefit tier of practices will be used; this process will continue until the resource concerns are addressed.

<u>Agronomic Practices</u>

Keeping the land under some form of surface cover is the single most important factor in preventing soil erosion. Surface cover absorbs the explosive power of rain, which can detach soil particles from the soil mass, setting up transport by runoff water. Cover also slows the flow of water across the soil surface, further reducing the threat of erosion.

Conservation Cropping Sequence / Conservation Tillage / Residue Management

Conservation tillage in all its various forms (such as shank and seed, minimum tillage and no-till direct seeding), leave residue on the soil surface, generally from the previously harvested crop. If adequate residue remains on the surface upon entering the critical erosion period, the BMP is effective at reducing soil erosion.

Locally, extended research efforts at the Palouse Conservation Field Station from 1978 through 1985 showed that with a 50% surface residue cover, a 92% reduction in soil loss was achieved (McCool, *et al*., 1993) when comparing conservation tillage to conventional tillage (Gilmore, 1995). Conservation tillage is proposed for use on cropland acres in the Cow Creek watershed. Direct seeding practices undertaken on cropland in the Paradise Creek watershed, several miles north of the Cow Creek watershed, reduced sediment delivery by an average of 2.3 tons/acre/year (Dansart, 2002).

EPA (2002) reported that reduced tillage systems could decrease sediment by 75%, total phosphorus by 45% and total nitrogen by 55% over conventional tillage practices. A one-ton reduction in sediment can reduce orthophosphate (H_2PO^4) loads by 14,000 mg and total nitrogen loads by 4,500 mg (Gardner, 2003). Phosphorus values in water quality samples collected from Cow Creek typically show a 2:1 ratio of total phosphorus to orthophosphate. A 5,000 ton reduction in sediment delivered to Cow Creek would equate to a 140 kg reduction (.014 kg *2*5,000) in TP delivered to Cow Creek annually. This is in the ballpark of the total load reduction targeted at the compliance point (CC-1); 0.47 TP/daily * 360 = 169 kg/year. *Note: The Cow Creek Water Quality Improvement Project has 3,750 acres under contract for transition to conservation tillage. An associated average 1.6 ton/acre reduction (significantly less than estimated for the nearby Paradise Creek watershed) in sediment delivery would meet the targeted reduction at the compliance point, if the entire load reduction was reflected at the state line. Exactly how sediment transport within the stream channel from the multiple delivery points to the compliance point factors into the hypothetical scenario is unknown.*

In addition to nutrient-rich sediment reductions, additional nutrient reductions can occur through the implementation of comprehensive nutrient management plans developed with collaborative individual growers. Nutrient management plans seek to reduce excess nutrient applications to agricultural fields that may eventually leave the fields and enter local surface and ground waters. Nutrient management planning is a recommended BMP for controlling nitrogen pollution in ground and surface waters (Mahler, Tindall & Mahler 2002). EPA (2002) has summarized research indicating an 8% to 32% decrease in median nitrate concentrations in ground water samples following decreases of 39% to 67% in nitrogen application rates under implemented nutrient management plans.

Continuous Direct Seeding High Residue Management Systems

Development of crop sequences and equipment requirements for continuous direct seeding have not been fully realized in this watershed. Recent research has shown that continuous direct seeding can be profitable, but to succeed it requires careful management of all components of the production and marketing system. Profitable continuous direct seeding requires more than high crop yield, it requires careful control of costs at each stage of the production process.

As in other areas of farming, the economic performance of direct seeding varies considerably from grower to grower. These differences appear to be associated with site factors, management, and luck (Young, 1999). Research has shown that there is a transition of 3 to 6 years for the soil/weeds/microorganisms to reach equilibrium and for operators to make sound management decisions based on good and bad experiences, research, and technical assistance. Some problems which need to be worked out during this transition period are: 1) dealing with excess residue without burning stubble; 2) dealing with increased weed problems during the first 2 to 3 years; 3) instituting longer crop rotations to reduce the potential for soil-borne diseases; 4) handling problems with continuous direct seeding specifically prevalent in high rainfall areas such as the Palouse; and 5) bearing new equipment costs.

Continuous direct seeding systems provide the most effective cropland erosion protection, other than establishing grass and trees. Continuous direct seeding reduces soil disturbance, increases organic matter content, improves soil structure, buffers soil temperature and allows soil to catch and hold more melt water (Clapperton, 1999). After a transition period, the practice of continuous direct seed high residue management improves soil biological health. Continuous direct seeding retains residue on the surface and minimizes spring soil compaction, thus reducing the potential for runoff and soil erosion and improving water infiltration (Veseth, 1999). When applied to the nearby and similar Paradise Creek watershed, the Revised Universal Soil Loss Equation (RUSLE) predicted erosion on continuous direct seeded fields would decrease by rates ranging from 14 tons/ac to 3 tons/ac, when compared to conventional seeding. Without financial incentive to try continuous direct seeding, some landowners/operators cannot and will not risk the chance of failure in today's financial climate and will continue to use conventional tillage.

Once fully adopted, direct seeding systems make significant contributions to the reduction in sediment and nutrient delivery to local waterbodies through the minimization of sheet and rill erosion. In the Paradise Creek watershed, direct seeding practices, supported by IDEQ §319 and ISCC WQPA funding, reduced sediment delivery to Paradise Creek by an average of 2.3 tons/acre/year (Dansart, 2002). With over 1,300 acres of continuous direct seeded cropland within the Paradise Creek watershed, this resulted to approximately 3,000 tons/year of projected sediment reduction to the stream. This sediment reduction directly relates to reductions in nutrients. Since there are numerous similarities (e.g., topography, climate, soil types, agronomic practices) between the Paradise Creek and Cow Creek watersheds, comparable results could be expected within the Cow Creek watershed.

An additional benefit of continuous direct seeding systems is carbon sequestration. Local area growers that have incorporated direct seeding systems have entered into 10-year carbon sequestration leases with a Louisiana-based energy generation and holding company for the "production" of carbon credits that are tradable on the open market. This is the first carbon sequestration contract for direct seeding in the country (PNDSA, 2002).

With an informal survey, agricultural producers expressed interests in expanding continuous direct seeding practices on over 4,000 acres within the Cow Creek watershed (Latah SWCD, 2004).

Contour Farming / Strip-cropping

Performing farming operations across slopes and following the shape of the land has proven to be an effective practice for reducing erosion compared to farming up and downhill, particularly on gentle slopes. On steeper slopes it is less effective, unless combined with strip-cropping or buffer strips. The use of strip-cropping and contour buffer strips on the steeper slopes characteristic of much of the Cow Creek Watershed will be encouraged.

Structural Practices

Erosion associated with concentrated flow is best addressed with structural practices. Structural practices that address concentrated flow erosion work in two ways; structures trap sediment that has been eroded by concentrated water flow, or impede the eroding action of the water (either by armoring the soil or by slowing the water down to reduce the eroding energy). When properly designed, installed, and maintained, the right combination of structural practices can virtually eliminate erosion associated with concentrated flow. The practices most applicable to the Cow Creek Watershed are grade stabilization structures and water and sediment control structures (gully plugs).

In the Paradise Creek watershed the reduction in sediment delivery from individual water and sediment control structures averaged 55 tons/year, ranging from 10 to 288 tons/year per structure. Since there are strong similarities between the Paradise Creek and Cow Creek watersheds, it is anticipated each proposed structure within the Cow Creek watershed should reduce sediment delivery within the range mentioned. Gully erosion does not appear to be a major problem in the watershed based on a cursory field examination of the watershed this spring (Dansart, 2008).

When direct seeding and erosion control structures are coordinated within a watershed, significant reduction in erosion and sedimentation can occur. The 1,300 acres of direct seeding in combination with the 24 erosion control structures reduced sediment delivery to Paradise Creek by approximately 4,000 tons/year. Due to common watershed characteristics, substantial reductions are expected within the Cow Creek watershed through the implementation of the suggested cropland BMPs.

Riparian Buffer Strips

Riparian buffer strips, also known as filter strips, have been shown to be effective in reducing suspended sediments from overland flows by reducing the velocity of runoff. Analysis of vegetative filter strips (VFS) has shown that a 30-foot wide grassed buffer will trap from 70 to 98% of the sediment in water filtering through the strip (Gilmore, 1995). EPA (2002) has reported that riparian filter strips, alone, have been shown to reduce sediment by 70%, total phosphorus by 70% and total nitrogen by 65% as compared to those areas with no riparian filters.

Sheet and rill erosion are the types of erosion most likely to be mitigated by a VFS. Erosion associated with concentrated flow cannot be addressed by VFS implementation. With respect to temperature, VFS on the agricultural lands may slightly improve base flow conditions in Cow Creek. However, given the predicted size of the strips, this effect is likely to be negligible.

Analysis of USGS 24K topographic maps shows 171miles of stream (intermittent and perennial), of which almost all (98%) flows through agricultural land. A 30-foot buffer strip on each side of the creek in the agricultural land would encompass a total of 1240 acres. Figure 7 outlines the potential extent of vegetative buffer strips within the Cow Creek watershed.

Channel erosion may be the largest source of sedimentation in the Cow Creek watershed. A cursory examination of the watershed revealed that most streambanks are unstable. Fields are usually cultivated to the channel edge, sometimes overtopping the bank edges and delivering sediment directly into the adjacent channels or road ditches. The stream channels are comprised mostly of silt and clay sized material. During high flow periods, downcutting by the stream occurs until the stream channel encounters a compacted clay layer or other more resistive substrate, the stream's energy is then re-directed to bank erosion. Aggradation (deposition) of sediment occurs at some locations along the stream course. The annual effects of these natural stream processes to achieve hydraulic equilibrium vary depending on the unique characteristics of the annual runoff regime. Coarse streambank erosion estimates were compiled in an NRCS Preliminary Investigation (1995) for the nearby Paradise Creek. Average streambank erosion rates were estimated at 0.04 tons/year per linear foot of stream channel. Permanent vegetative buffers could eventually reduce streambank erosion substantially once stream channel stability and hydraulic equilibrium are restored.

In addition to filter strips, woody vegetative buffers would be highly desirable, but may be economically impractical for working farm operators; problems include stand establishment due to weeds and rodents, loss of productive cropland and associated income, future large woody debris causing obstruction and flood problems. Installation should be encouraged, particularly on idle cropland or pastureland. Besides filtering sediment and helping stabilize streambanks through additional rootmass, such a buffer strip would help maintain base flow to the creek by decreasing upland runoff to the creek, encouraging infiltration, and increasing interception and depression storage of precipitation. Rather than runoff from the land surface to the creek, more water would be stored beneath the floodplains and slowly released to the stream channel. As the woody vegetation matured, canopy cover to the stream would increase, likely resulting in some water temperature decrease as well as blocking the sunlight necessary for algal growth. Fish habitat would be improved over time with recruitment of large woody debris and development of undercut banks; wildlife habitat would be enhanced for both game and nongame species.

Wide vegetated buffers would allow streams, particularly channelized portions, to meander and establish equilibrium over time without the need to perform channel re-alignment using heavy equipment. Increased stream length will result in decreased flood intensity through increased channel storage capacity and decreased flow velocity. This will result in a reduction in sediment load and bank erosion.

For eligible landowners, the USDA Conservation Reserve Program (CRP) is viewed as the program most attractive for installation of filter strips and riparian forest buffers. By enrolling in CRP, landowners and operators will receive assistance with installation costs for approved practices, and will additionally receive annual rental payments.

Table 6. Recommended BMPs and Estimated Costs

Treatment Unit-Riparian		
Recommended BMPs	Amount/Unit	Estimated Costs
Grassed Filter Strips (30ft)	1240 acres	$127,000
Woody Vegetative Buffer (100 ft)	200 acres	$303,000
Subtotal		**$430,000**
Treatment Unit - Cropland		
Recommended BMPs	Amount	Estimated Costs
Direct Seed Tillage Transition (3 years)	15,000 acres	$1,552,000
Nutrient Management	30,000 acres	$600,000
Gully Plugs (1 per mi^2)	50	$103,000
Grade Stabilization Structure	10	$20,000
Subtotal		**$2,275,000**
Treatment Unit Pasture		
Recommended BMPs	Amount	Estimated Costs
Fencing	8,000 feet	$14,000
Watering Facility	3	$3500
Well	1	$3000
Pumping Plant (Riparian)	1	$2000
Waste Storage Facility (Winter feed)	1	$15,500
Subtotal		**$38,000**
TOTAL:		**$2,743,000**

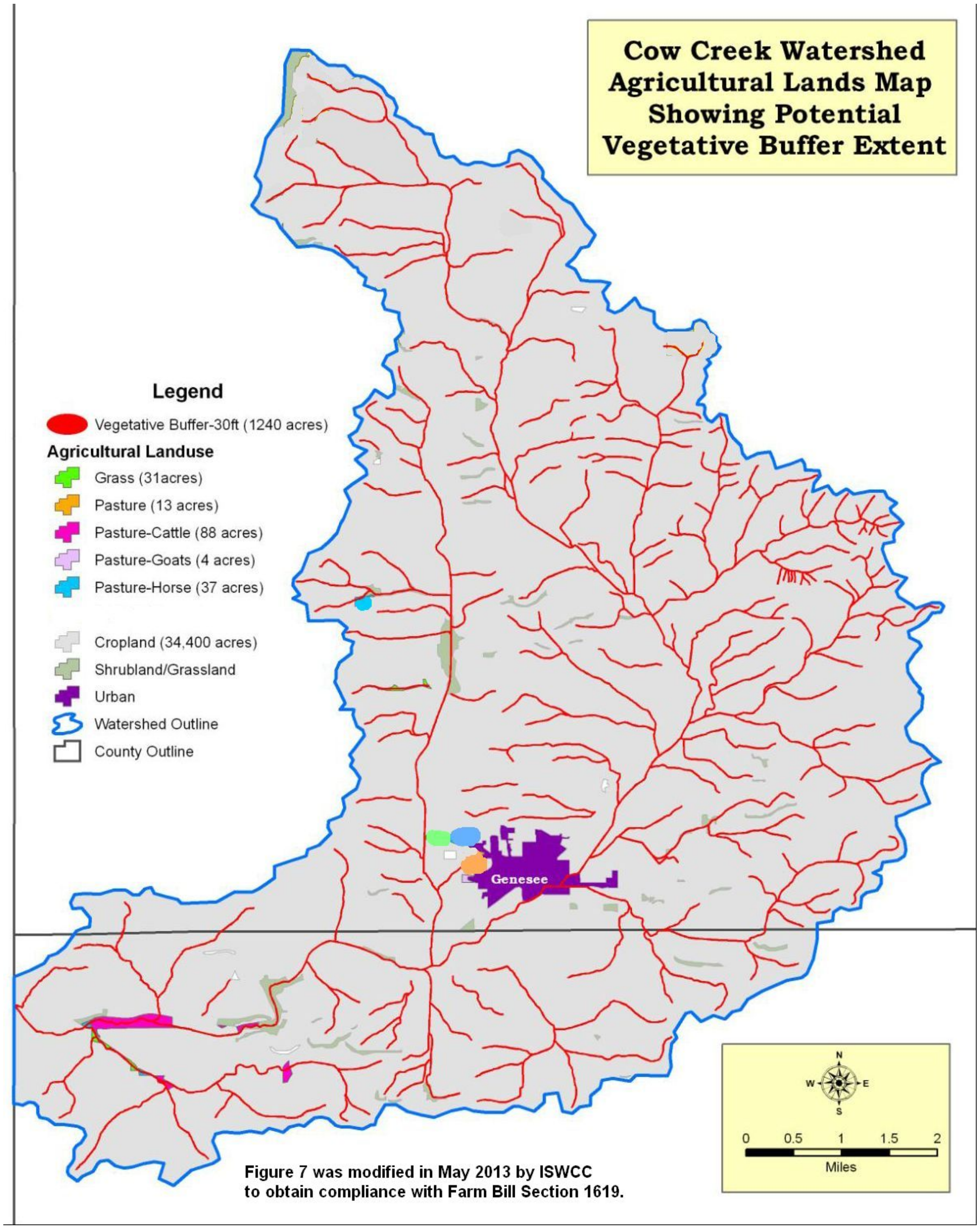


Figure 7. Agricultural Lands

Current BMP Status

Restoration activities have been on-going in the Cow Creek Watershed for the past several years. Implementation efforts were initiated by the Latah Soil Water Conservation District (LWSCD) in 2004, during the development of the TMDL. The LWSCD applied for and was awarded a 319 grant through IDEQ to fund the Cow Creek Water Quality Improvement Project (CCWQIP), with non-federal matching funds provided by both the ISCC Water Quality Program for Agriculture (WQPA) and landowner CCWIP participants. Project sites for BMP installation were identified. Contracts and associated plans were developed for approximately 3,750 acres with 13 operators. This was well in excess of the 2,500 acres proposed. There was extensive producer interest in the program and the producers, the Cow Creek Advisory Committee, and both conservation district boards agreed to distribute the available funding evenly to all eligible producers to contract as many acres as possible.

Conservation tillage transition BMPs that consisted of implementation of continuous mulch till or direct seeding systems were installed; cost-share rates were established based on the projected water quality benefit due to the transition. Associated practices required by operator participants included contour farming, conservation crop rotation (minimum 3-year rotation), and pest management. Additional requirements included: no crop residue burning, soil quality measurements prior to and after practice implementation, and annual record keeping. Four erosion control structures have been completed. Riparian plantings have taken place on several properties within the watershed. The current estimated cost of the Cow Creek Water Quality Improvement Project is $***450,000***. This cost does not include the operator costs for conversion to reduced tillage systems on non-cost shared acres throughout the watershed.

The Latah Soil and Water Conservation District (2008), in their most current 319 Cow Creek Semiannual Report, show estimated load reductions, based on 3,750 acres of conservation tillage implementation as follows:

Sediment:	9,370 tons
Phosphorus:	25 tons
Nitrogen:	35 tons

Treatment Alternative Considerations

Although, when implemented, the recommended BMPs will likely lead to improvement in water quality, the cost of installation pales in comparison to the costs of income lost to the landowner/operator. The cost/benefit tradeoff is considerable. The Cow Creek watershed contains the most productive cropland in Latah County. Using the filter strip BMP as an example, installation cost of the complete recommended treatment (1240 acres) is estimated at $127,000 but would sacrifice significant prime cropland acres. Using an estimate of 100 bushels/acre yield for wheat and average price of $10/bu, the conversion of the recommended acreage from cropland to filter strips would result in a cost to the landowner/operator(s) of $1,200,000 annual gross income for those years when wheat was planted in the rotation. The economic tradeoffs can be lopsided, but the environmental benefit is open to discussion as well.

The Cow Creek TMDL was completed for nutrients; targets for phosphorus (TP) were developed. The TMDL document states "Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved" (IDEQ, 2005). Idaho has a narrative, not numeric, standard for nutrients that states *"Surface waters of the state will be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses"* (IDAPA 16.01.02.). The Cow Creek TMDL was developed to foster water quality appropriate to the protection and maintenance of the designated beneficial use of cold water aquatic life. The critical limiting factor for cold water biota that can be tied to Idaho's narrative standard for excess nutrients is low levels (<6 mg/l) of dissolved oxygen (DO). Nutrient rich stream systems stimulate algal and macrophyte populations. The respiration cycles of these algal and macrophyte populations cause seasonal fluctuations in dissolved oxygen concentrations, which can lead to depletion of dissolved oxygen during the late summer low flow periods. Although some DO violations were reported for Cow Creek during IDEQ's limited monitoring effort (April to September, 2002) that served as the baseline for the TMDL, no DO violations were reported by the much more extensive monitoring conducted by IASCD (April 2006 to April 2008). The relationship of elevated TP values to any detriment to designated beneficial use in the Cow Creek Watershed is not demonstrated by this recent monitoring effort; it indicates an improvement in support conditions since TMDL completion .

A viable alternative to an immediate major BMP implementation effort on agricultural lands within the Cow Creek watershed might be to work with willing landowners as the opportunities present themselves to promote conservation tillage practices and encourage riparian buffer strip installation on marginal cropland or uncropped ground. Replacement of low-residue legumes in the crop rotation with a higher residue crop or a profitable perennial crop would decrease erosion by maintaining soil cover for longer intervals and contribute more post-harvest residue to interrupt overland flow. Regularly scheduled (ex. two consecutive years of monitoring spaced at 5 year intervals) water quality monitoring should be utilized to track the effects of previous implementation efforts as well as guide future implementation priorities. Limited funding could then be directed to Cow Creek to build upon the efforts of the Cow Creek Water Quality Improvement Project (CCWQIP) or to higher priority watersheds, as monitoring results indicate.

FUNDING

To adequately address the TMDL concerns within the Cow Creek watershed it will require a significant collaborative effort for technical and financial assistance. The Latah Soil and Water Conservation District has received funding for the Cow Creek Water Quality Improvement Project (CCWQIP) to implement BMPs on private agricultural and grazing lands; depending on the project results, additional funding may be pursued in the future. These sources are (but are not limited to):

CWA §319 –These are Environmental Protection Agency funds allocated to the Nez Perce Tribe and the State of Idaho. The Idaho Department of Environmental Quality (IDEQ) administers the Clean Water Act §319 Non-point Source Management Program for areas outside the Nez Perce Reservation. Funds focus on projects to improve water quality and are usually related to the TMDL process. The Nez Perce tribe has CWA 319 funds available for projects on Tribal lands on a competitive basis. Source: IDEQ http://www.deq.idaho.gov/water/prog_issues/surface_water/nonpoint.cfm#management

Water Quality Program for Agriculture (WQPA) –The WQPA is administered by the Idaho Soil Conservation Commission (ISCC). This program is also coordinated with the TMDL process. Source: ISCC http://www.scc.state.id.us/programs.htm

Resource Conservation and Rangeland Development Program (RCRDP) –The RCRDP is a loan program administered by the ISCC for implementation of agricultural and rangeland best management practices or loans to purchase equipment to increase conservation. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Improvement Grants – These grants are administered by the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Reserve Program (CRP) –The CRP is a land retirement program for blocks of land or strips of land that protect the soil and water resources, such as buffers and grassed waterways. Source: NRCS http://www.nrcs.usda.gov/programs/crp/

Environmental Quality Incentives Program (EQIP): EQIP offers cost-share and incentive payments and technical help to assist eligible participants in installing or implementing structural and management practices on eligible agricultural land. Source: NRCS http://www.nrcs.usda.gov/programs/eqip/

Wetlands Reserve Program (WRP) –The WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Easements and restoration payments are offered as part of the program. Source: NRCS http://www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentives Program (WHIP) –WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Cost-share payments for construction or re-establishment of wetlands may be included. Source: NRCS http://www.nrcs.usda.gov/programs/whip/

State Revolving Loan Funds (**SRF) –**These funds are administered through the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Security Program (**CSP) –**CSP is a voluntary program that rewards the Nation's premier farm and ranch land conservationists who meet the highest standards of conservation environmental management. Source: NRCS http://www.nrcs.usda.gov

Habitat Incentive Program (HIP) – This is an Idaho Department of Fish and Game program to provide technical and financial assistance to private landowners and public land managers who want to enhance upland game bird and waterfowl habitat. Funds are available for cost sharing on habitat projects in partnership with private landowners, non-profit organizations, and state and federal agencies. Source: IDFG http://fishandgame.idaho.gov/cms/wildlife/hip/default.cfm

Partners for Fish and Wildlife Program in Idaho – This is a U.S. Fish and Wildlife program providing funds for the restoration of degraded riparian areas along streams, and shallow wetland restoration. Source: USFWS http://www.fws.gov/partners/pdfs/ID-needs.pdf

Forestland Enhancement Program - The Forest Land Enhancement Program (FLEP) was part of Title VIII of the 2002 Farm Bill. FLEP replaces the Stewardship Incentives Program (SIP) and the Forestry Incentives Program (FIP). FLEP is optional in each State and is a voluntary program for non-industrial private forest (NIPF) landowners. It provides for technical, educational, and cost-share assistance to promote sustainability of the NIPF forests. http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml

OUTREACH

The Latah and Nez Perce Soil and Water Conservation Districts have undertaken formal outreach efforts to inform residents within the Cow Creek watershed of the status of the Cow Creek Watershed Improvement Project and the applicability of these practices to other areas in the region. Formally and informally, landowners were notified about the available programs. A direct mailing was sent to each operator within the watershed. In addition, the program has been formally announced through district newsletters and through the Cow Creek Watershed Advisory Group. Information to the agricultural community, conservation agencies and organizations, and the general public will be relayed through public presentations, district newsletters and announcements to various agencies and local news media.

Once a variety of functional BMPs are installed, field tours will be conducted to educate operators and landowners about benefits and costs of implementing BMPs. Additionally, conservation district newsletters will periodically update local landowners on project progress and status.

MONITORING AND EVALUATION

Monitoring is an important component of the implementation plan and will be used to measure the success of both individual activities and the overall effort. Due to the phased structure of the Cow Creek TMDL, an on-going, long-term monitoring effort is required to determine beneficial use status. The results of this monitoring effort will be used to evaluate the changing condition of the watershed and may lead to adjustments in pollutant targets throughout the implementation phase of the TMDL. The monitoring plan will utilize several approaches to obtain water quality data from Cow Creek.

Field Level

At the field level, annual status reviews will be conducted to insure that the contracts are on schedule and that BMPs are being installed according to standards and specifications. BMP effectiveness monitoring will be conducted on installed projects to determine installation adequacy, operation consistency and maintenance, and the relative effectiveness of implemented BMPs in reducing water quality impacts. This monitoring will also measure the effectiveness of BMPs in controlling agricultural nonpoint-source pollution. These BMP effectiveness evaluations will be conducted according to the protocols outlined in the Agriculture Pollution Abatement Plan and the ISCC Field Guide for Evaluating BMP Effectiveness.

Digital photographs will be used to document before and after conditions of individual project sites. This documentation should prove useful for reviewing qualitative changes in resource conditions.

Gully erosion sites needing treatment will be identified; gully measurements will be collected. Subsequent gully measurements will be taken during the spring(s) of the year(s) following structural practice installation to determine effectiveness of the BMP.

RUSLE (Revised Universal Soil Loss Equation) will be used to calculate reduction in erosion for cropland acres that transition to high residue conservation tillage systems.

Watershed Level

At the watershed level, there are many governmental and private groups involved with water quality monitoring. The Idaho Department of Environmental Quality uses the Beneficial Use Reconnaissance Protocol (BURP) to collect and measure key water quality variables that aid in determining the beneficial use support status of Idaho's waterbodies. The determination will tell if a waterbody is in compliance with water quality standards and criteria. In addition, IDEQ will be conducting five-year TMDL reviews.

Annual reviews for funded projects will be conducted to insure the project is kept on schedule. With many projects being implemented across the state, ISCC developed a software program to track the costs and other details of each BMP installed. This program can show what has been installed by project, by watershed level, by subbasin level, and by state level. These project and program reviews will insure that TMDL implementation remains on schedule and on target. Monitoring BMPs and projects will be the key to a successful application of the adaptive watershed planning and implementation process.

The Latah SWCD's Cow Creek Water Quality Improvement Project has updated DEQ's April to September, 2002 monitoring program with an additional two years (April 2006 to April 2008) monitoring to determine project effectiveness at a watershed scale. Water quality monitoring staff with the Idaho Association of Soil Conservation Districts (IASCD) monitored the sites IDEQ established as a development component of the Cow Creek TMDL. Water quality parameters monitored within the Cow Creek watershed included total suspended solids (TSS), bacteria, instantaneous temperature, total dissolved solids, conductivity, pH, dissolved oxygen, percent saturation, turbidity, flow, nutrients, and phosphorus. Water quality data collected during the most recent study is currently being evaluated. The summary information will be presented as a public document and distributed to interested individuals and agencies. Summary reports will be posted on the ISDA and LSWCD websites.

The Latah and Nez Perce Conservation Districts, IASCD and the Cow Creek WAG will coordinate the development of a long-term monitoring program for the watershed similar to the Paradise Creek monitoring plan adopted by the Paradise Creek WAG. The Paradise Creek WAG, in cooperation with IASCD and LSWCD, approved a monitoring plan whereby IASCD will return in five years to monitor throughout the watershed to determine watershed changes and effects of implemented BMPs.

RUSLE (Revised Universal Soil Loss Equation) in combination with a flow routing model processed using GIS may be used to calculate erosion from cropland acres under different tillage scenarios on a watershed scale.

REFERENCES

Barker, 1981. Soil Survey of Latah County Area, Idaho. U.S. Department of Agriculture, Soil Conservation Service. Washington, D.C. 168pp plus maps.

Clapperton, 1999. The Benefits of Direct Seeding for Soil Ecology. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan 5-7,1999, Spokane, WA.

Crockett, 1995. Idaho Statewide Ground Water Quality Monitoring Program-Summary of Results, 1991 through 1993. Idaho Department of Water Resources Water Information Bulletin No. 50, Part 2.

Crook, 2003. A Reconnaissance of Subsurface Tile Drain Ground Water in the Cow Creek Watershed. Prepared for the Idaho Department of Environmental Quality, Lewiston Regional Office.

Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. §1251-1387. 1972.

Dansart, 2000. Idaho Agricultural Water Quality Program, Paradise Creek Watershed Project Proposal Draft. Idaho Soil Conservation Commission. Moscow, ID.

Dansart, 2002. Paradise Creek Water and Sediment Control Structure Efficiency. Draft Report. Idaho Soil Conservation Commission. Moscow, ID.

Dansart, 2008. Idaho Soil Conservation Commission. Moscow, ID. Personal communication.

IDEQ, 2005. Cow Creek Subbasin Assessment and Nutrient Total Maximum Daily Load. Idaho Department of Environmental Quality, Lewiston Regional Office.

Gardner, 2003. Soil Scientist, Idaho Soil Conservation Commission. Personal communication.

Gilmore, 1995. BMP Effectiveness Review. Report prepared for the Latah Soil and Water Conservation District.

IDAPA 58.01.02. Idaho Water Quality Standards and Wastewater Treatment Requirements.

Idaho Code § 39-3601 (7). Designation of agencies.

IDHW-DEQ, 1997. Paradise Creek TMDL.

Knecht, 2008. FSA Latah County Executive Director. Personal communication.

LSWCD, 2004. Idaho Nonpoint Source Program 319 Grant Proposal. Cow Creek Water Quality Improvement Project.

LSWCD, 2008. Cow Creek Semiannual 319 FY04 Report.

Mahler, et.al, 2002. Best management practices for phosphorus management to protect surface water (Quality Water for Idaho Current Information Series No. 963). Moscow, ID: University of Idaho, College of Agriculture.

McCool, et al. 1993. Unpublished, for presentation at the 1993 International Winter Meeting of American Society of Agricultural Engineers. Crop Management Effects on Winter Hydrology of the Northwestern Wheat Region. Paper 93-2535.

PNDSA, 2002. Pacific Northwest Direct Seed Association. *Direct Link. Volume 3(2)*.

Preston, 2008. Latah SWCD Resource Conservation Planner. Personal communication.

Strausz, 2001. A Reconnaissance of Ground Water Nitrite/Nitrate in the Cow Creek Watershed, Latah and Nez Perce County, Idaho, Volume I of II. Ground Water Quality Technical Report No. 18. Prepared for the Idaho Department of Environmental Quality, Lewiston Regional Office.

USDA – NRCS, 1995. Preliminary Investigation Report for the Paradise Creek Watershed.

EPA, 2002. National management measures to control nonpoint source pollution from agriculture. Retrieved from http://www.epa.gov/owow/nps/agmm.

Veseth, 1999. Grower Direct Seed Pea Trials in Eastern Washington and Northern Idaho. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan5-7. 1999, Spokane, WA.

Young, 1999. Cost and Profitability Results of Farmers Using Direct Seed Systems in the Pacific Northwest. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan 5-7, 1999, Spokane, WA.

APPENDIX A

Acronyms/abbreviations

BMP -	Best Management Practice
BURP -	Beneficial Use Reconnaissance Project
CCWQIP -	Cow Creek Water Quality Improvement Project
CFR -	Code of Federal Regulations
cfs -	cubic feet per second
CRP -	Conservation Reserve Program
CWA -	Federal Clean Water Act
CWE -	Cumulative Watershed Effects
DO -	dissolved oxygen
EPA -	U.S. Environmental Protection Agency
FPA -	Idaho State Forest Practices Act
FSA -	USDA Farm Service Agency
GWWTF -	Genesee Waste Water Treatment Facility
HEL -	Highly Erodible Land
IASCD-	Idaho Association of Soil Conservation Districts
IDEQ -	Idaho State Division of Environmental Quality
IDHW-	Idaho Department of Health and Welfare
IDL -	Idaho State Department of Lands
ISCC -	Idaho State Soil Conservation Commission
ISDA-	Idaho State Department of Agriculture
IWRRI -	Idaho Water Resources Research Institute
kg/d -	kilograms per day
LA -	Load Allocation
LSWCD -	Latah Soil and Water Conservation District
MCL -	maximum contaminant level
mg/l -	milligrams per liter
NPDES -	National Pollution Discharge Elimination System
NPS -	Nonpoint Source Pollution
NPSWCD-	Nez Perce Soil and Water Conservation District
NRCS -	USDA Natural Resource Conservation Service
RUSLE -	Revised Universal Soil Loss Equation
SLCHD-	South Latah County Highway District
TMDL -	Total Maximum Daily Load
TP -	total phosphorus
USDA -	United States Department of Agriculture
USGS -	United States Geologic Service
VFS -	Vegetative Filter Strip
WAG -	Watershed Advisory Group
WLA -	Waste Load Allocation
WQPA -	Water Quality Program for Agriculture (ISCC)

APPENDIX B

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