United States
Department of
Agriculture

Natural Resources
Conservation Service

Nez Perce Soil and Water
Conservation District

Idaho Soil Conservation
Commission

Idaho Department of
Environmental Quality

Nez Perce County
Commissioners

Idaho Department of
Fish and Game

Nez Perce Tribe

Preliminary Investigation Report

Cottonwood Creek Watershed

Nez Perce County, Idaho

July 2001

COTTONWOOD CREEK WATERSHED PRELIMINARY INVESTIGATION

Nez Perce County, Idaho

Requested by:

Nez Perce Soil and Water Conservation District

Prepared by:

United States Department of Agriculture
Natural Resources Conservation Service

In Consultation with:

Nez Perce Soil and Water Conservation District

Nez Perce County Commissioners

Idaho Department of Environmental Quality

Idaho Soil Conservation Commission

Idaho Department of Fish and Game

and

Nez Perce Tribe

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The philosophy of a preliminary investigation (PI) is to identify and assess a specific watershed's problems, develop potential solutions, and evaluate their relative impacts in a cost efficient manner. The PI is intended to provide decision makers with information regarding the appropriateness of project action, the magnitude of project costs, the scope of project benefits, and the potential for program eligibility and funding.

While developing this report, numerous published reports and interviews with local, state, federal, tribal representatives and private landowners were conducted. This information was combined with personal observations, field measurements, professional experience and judgment to produce the PI report.

A large number of assumptions were made by the team and are detailed in this report. Although further study is recommended before proceeding with any project implementation, the USDA - Natural Resources Conservation Service (NRCS) feels that the results presented are both reasonable and reliable for this stage of planning and decision making.

The Nez Perce Soil and Water Conservation District (SWCD) requested assistance from the United States Department of Agriculture - Natural Resources Conservation Service (NRCS) to complete a preliminary investigation (PI) of the Cottonwood Creek watershed.

To accomplish this effort, the SWCD invited representatives from local, state, federal and tribal agencies, special interest groups, agricultural operators, and private industrial forestland managers to participate in the PI process.

Under the Idaho Water Quality Standards and Wastewater Treatment Requirements, Cottonwood Creek is currently designated as:

1) protected for general use for secondary contact recreation
2) protected for general use for agricultural water supply.

The 1989 Idaho Water Quality Status Report and Non-point Source Assessment, prepared by the Idaho Department of Environmental Quality (DEQ), indicated the agricultural water supply beneficial use was partially supported, and the secondary contact recreation use was in a non-support status. This report also lists the following non-point pollution sources for the Cottonwood Creek watershed:

1) non-irrigated agriculture;
2) land development (construction activities);
3) forestland harvest activities;
4) grazing activities.

Potential point sources of pollution identified from previous water quality studies include:

1) above and underground fuel storage tank facilities
2) septic tank systems
3) agricultural chemical facilities
4) animal feeding operations

Cottonwood Creek (PNRS # 1160) has been identified as a water quality limited segment (WQLS) in Idaho, due to sediment, nutrients, and bacteria. A WQLS is defined as any segment where it is determined that water quality does not meet applicable water quality standards or is not expected to meet applicable standards even after the application of effluent limitations required by Sections 301 (b)(1)(A) and 301(b)(1)(B) of the Clean Water Act. Section 303(d)(3) of the Clean Water Act requires the development of a total maximum daily load (TMDL) for each identified pollutant of a designated WQLS.

The Clean Water Act 303(d) list identifies pollutants in the Cottonwood Creek watershed as:

1) pathogens
2) flow alteration
3) habitat alteration
4) nutrients
5) sediment
6) thermal modification
7) dissolved oxygen
8) ammonia

Based on the need to reduce further water quality degradation in the Cottonwood Creek watershed, the SWCD established the following objectives for the purposes of conducting the PI;

1) Identify the major point and non-point sources of pollution that are impairing or threatening the beneficial uses.
2) Develop alternative solutions that will reduce point and non-point sources of pollution loading.
3) Coordinate the preliminary investigation with all past, current, and future planning activities in order to minimize duplication and provide for a balanced and coordinated approach to watershed treatment.
4) Determine the appropriateness of future project action.
5) Identify the potential for program eligibility and funding.

Technical assistance to implement immediate water quality improvements in the watershed could be provided through the NRCS Conservation Operations Program (CO-01).

Future planning and implementation funding to provide for additional water quality improvements could be obtained through the Idaho Water Quality Program for Agriculture, EPA 319 program, and/or NRCS PL566 Program. It was determined that the length of future planning efforts could be reduced to approximately 12 to 18 months due to the availability of existing data and information.

It was the consensus of the PI team that a total watershed approach must be utilized to treat all major point and non-point sources of pollution. Emphasis must be placed on all major contributors, if water quality improvements are to be realized.

Cooperating Agencies:

Idaho Department of Environmental Quality (DEQ)

Idaho Department of Fish and Game (IDFG)

Idaho Department of Lands (IDL)

Idaho Soil Conservation Commission (SCC)

Nez Perce County Board of Commissioners (NPC)

Nez Perce Tribe (NPT)

The SWCD developed the following objectives to address the water quality related problems present in the watershed:

- Objective 1 - Identify the major point and non-point pollution sources that are impairing or threatening the beneficial uses.
- Objective 2 - Develop alternative solutions to reduce point and non-point sources of pollution loading.
- Objective 3 - Coordinate the preliminary investigation with all past, current, and future planning activities in order to minimize duplication and provide for a balanced and coordinated approach to watershed treatment.
- Objective 4 - Determine the appropriateness of future project action.
- Objective 5 - Identify the potential for program eligibility and funding.

Location, Size, and Topography

Cottonwood Creek (PNRS #1160) (hydrologic unit # 17060306-069) is located in the Clearwater River hydrologic basin. The headwaters are located near Reubens, Idaho. The size of the watershed is 40,980 acres. Cottonwood Creek flows in a northwesterly direction through the Nez Perce Indian Reservation joining with the Clearwater River near Myrtle (Figure 1).

Elevations range from 850 feet at the mouth of Cottonwood Creek to 3,500 feet at the watershed headwaters. Rolling upland plateaus of non-irrigated cropland with steep canyon walls and a somewhat inaccessible canyon floor typify the topography.

Steep slopes and narrow bottomlands characterize the watershed. Generally, the north and east facing slopes are forested with various tree and shrub species, whereas the south facing slopes and the flatter plateau areas are cropland.

A preliminary Rosgen classification completed in July of 1996 concluded that stream channel types include A, B, and C.[1]

Climate

Average annual precipitation in the Cottonwood Creek watershed is 25 inches. However precipitation ranges from 18 to 25 inches. Lower elevations receive the least precipitation during July and August and the most during December and January. Precipitation in the higher elevations is more evenly distributed during the year. Maximum precipitation occurs in May (2.8 inches) with the minimum in August (1.0 inches).

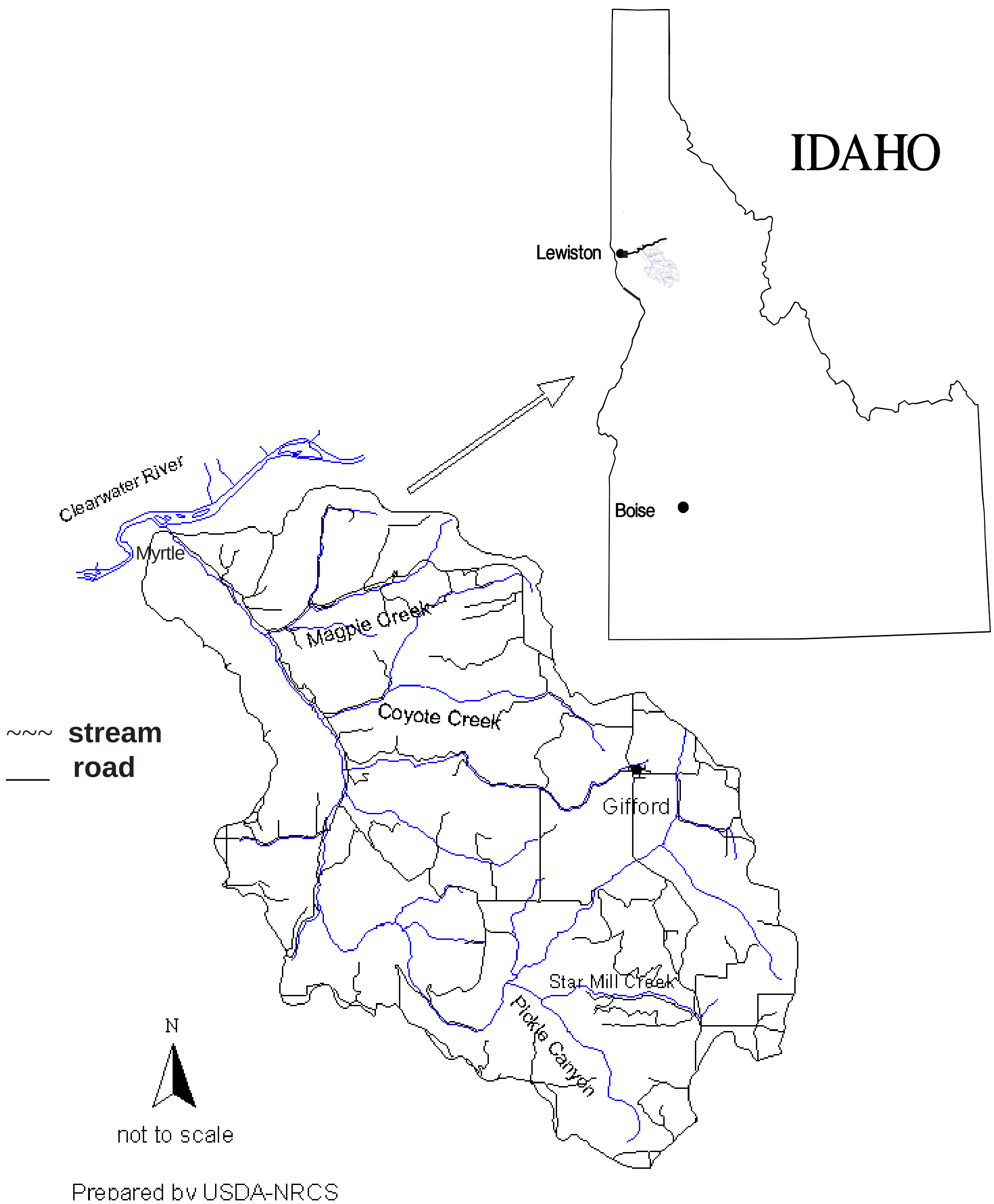
Much of the winter precipitation is in the form of rain, which thaws the frozen soil surface. This shallow thawing creates rapid runoff from the area's non-irrigated cropland since the soil remains frozen below the surface and prevents infiltration.

Cool moist winters and warm dry summers characterize the watershed's climate. Summer high temperatures range from 90°F in the valleys to the upper 70° F in the uplands. January low temperatures average 24°F in the valleys and 20°F at higher elevations. Temperatures below 0°F are not uncommon during the winter.

Based on climatic data from the Orofino and Craigmont stations, the growing season decreases as elevation increases. Consecutive frost free periods (above 32°F) range from 158 days in the valleys to 108 days in the uplands.

[1] Rosgen classification completed in a preliminary survey taken at 5 points in the watershed. Note that the classification is preliminary and was obtained for the sole purpose of this report. Additional transects should be completed in order to improve accuracy.

Figure 1. Cottonwood Creek Watershed Location.



Land Ownership

Land ownership is mixed geographically (Figure 2). Ownership consists of private (87.3%), tribal (12.6%), and public (0.1%). (Table 1).

Table 1. Land ownership in the Cottonwood Creek watershed.

Ownership Type	Acres	%
Private	35,776	87.3
Nez Perce Tribe	5,167	12.6
Public	37	0.1
TOTAL	40,980 acres	

Land Use

Land use consists of non-irrigated cropland (50.9%), rangeland (34.4%), forestland (13.7%) urban areas (0.5%), roads (0.2%), and pastureland (0.3%). Refer to Figure 3 (Land Use Map) for detail. Agricultural crops produced include wheat, barley, lentils, garbanzo beans, canner peas, dry peas, buckwheat, and bluegrass for seed production. Crop rotations throughout the watershed consist mainly of two and three-year rotations[2]. However, some small grain/summer fallow rotations occur in lower precipitation areas. Average yields for the most commonly grown crops are 65 bushels per acre for winter wheat, 3,000 pounds per acre for spring barley, 1,700 pounds per acre for spring peas, and 1,000 pounds per acre for lentils.[3]

Approximately 1,300 acres of cropland is enrolled in the USDA - Conservation Reserve Program. The majority of these acres have been seeded to orchard grass, smooth brome, intermediate wheatgrass and small burnet[4] .

Table 2. Land use in the Cottonwood Creek watershed.

Land Use	Acres	%
Non-irrigated Cropland	20,874	50.9
Rangeland	14,108	34.4
Forestland	5,623	13.7
Pastureland	117	0.3
Urban/Suburban	200	0.5
Roads	58	0.2
TOTAL	40,980 acres	

[2]Data obtained from landowner interviews and from the Big Canyon Creek Farming Practices Survey completed February 1995 (Rasmussen et al).
[3]Data obtained from land owner interviews and the Big Canyon Creek Environmental Assessment (Rasmussen et al).
[4]Data obtained from the Natural Resource Conservation Service-Lewiston Field Office (March 1995).

Figure 2. Cottonwood Creek Land Ownership.

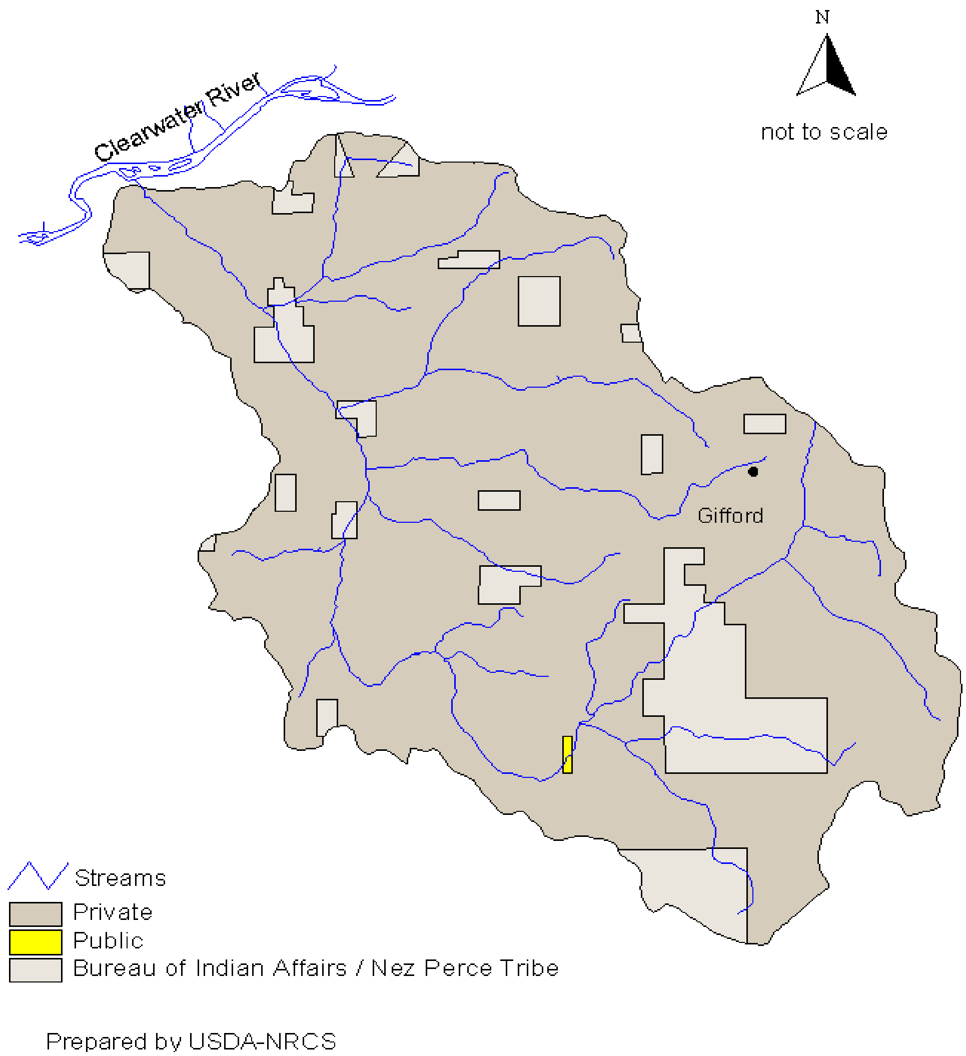
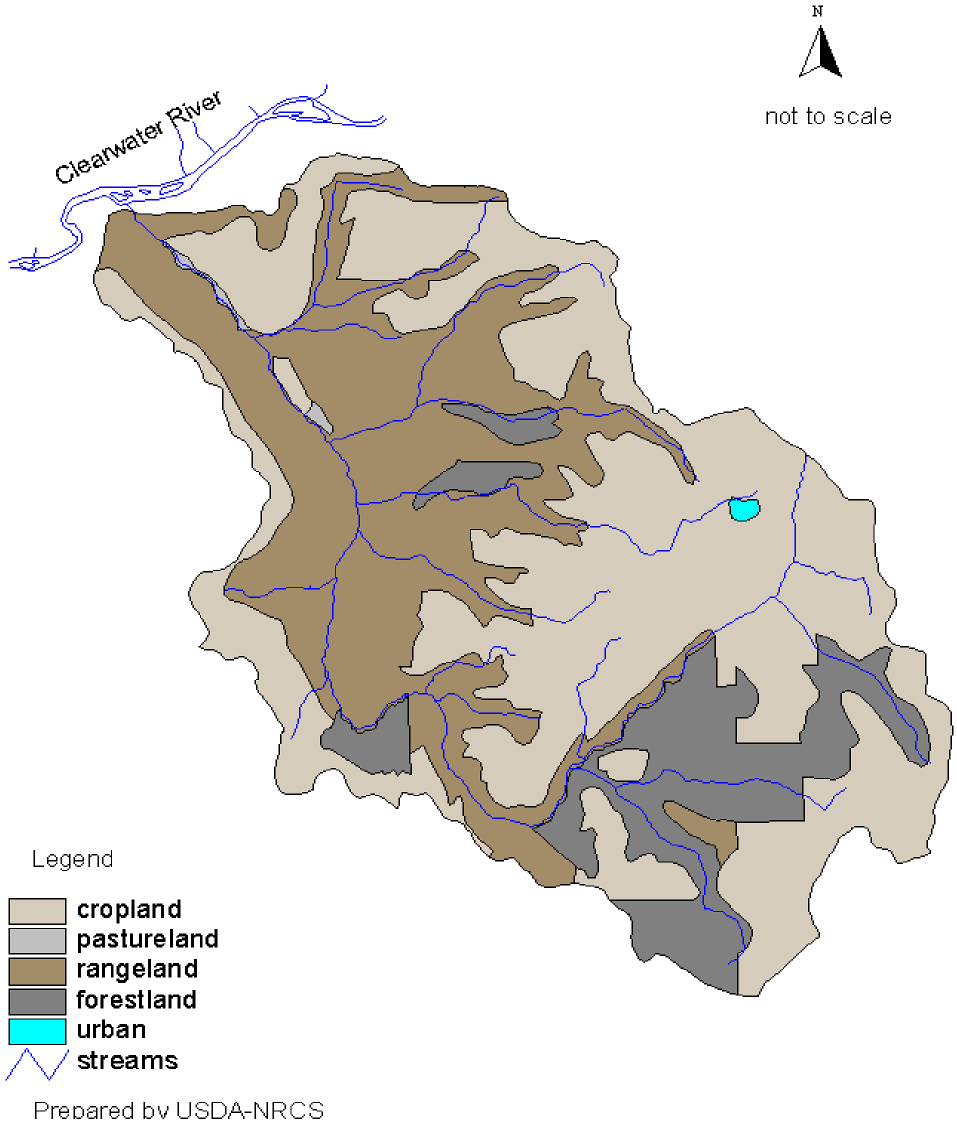


Figure 3. Land Use Distribution in Cottonwood Creek Watershed.



Geology

The Cottonwood Creek watershed is within the Columbia Plateau Geomorphic Province. Bedrock geology is layered, Tertiary age (7 to 40 million years ago) Columbia river basalt overlain by Quaternary age windblown silt of Palouse Loess.

The main Cottonwood Creek valley is formed by a block fault, with the downthrown block on the northeast side of the drainage. The fault scarp forms the steep southwest canyon side. The Magpie Creek drainage follows the trace of a syncline or structural downwarp.

Cottonwood Creek follows the fault trace which is filled with a wedge of alluvial or stream-laid material. The alluvial material consists of coarse cobble-gravel deposits interlayered with silt and sand which has been eroded from the uplands.

Soils

The primary soils in the Cottonwood Creek Watershed include:

- *Bridgewater-Joseph Complex*, 1 to 3 percent slopes, nearly level, very deep, moderately well to well drained soils formed in alluvium on flood plains.
- *Wilkins Silt Loam*, 0 to 5 percent slopes, nearly level to gently sloping, very deep, somewhat poorly drained soils formed in drainageways on plateaus.
- *Naff-Palouse*, 2 to 10 percent slopes, gently sloping to strongly sloping, very deep, well drained soils formed on loess hills on plateaus.
- *Naff- Palouse-Thatuna*, 8 to 25 percent slopes, strongly sloping to moderately steep, very deep, moderately well to well drained soils formed on loess hills on plateaus.
- *Naff- Waha*, 25 to 40 percent slopes moderately steep and steep, moderately deep to very deep, well drained soils formed on hills on plateaus.
- *Southwick- Driscoll-Larkin*, 2 to 12 percent slopes, gently sloping to strongly sloping, very deep, moderately well to well drained soils formed on loess hills on plateaus.
- *Southwick-Driscoll-Larkin*, 8 to 25 percent slopes, strongly sloping to moderately steep, very deep moderately well to well drained soils formed on loess hills on plateaus.
- *Kettenbach-Keuterville-Gwin*, 35 to 75 percent slopes, steep to very steep, shallow to very deep, well drained soils formed in loess and basalt colluvium and residuum.
- *Klickson-Jacket-Keuterville*, 20 to 90 percent slopes steep to very steep, very deep, well drained soils formed in loess and material weathered from basalt on canyons.

Additional soils information is included in Appendix B.

Water Resources

Surface water:

Major tributaries in the watershed include Magpie, Coyote, Starmill, and Pickle Canyon Creeks. Cottonwood Creek enters the Clearwater River downstream of Orofino, Idaho as it flows westerly towards its confluence with the Snake River at Lewiston, Idaho.

Data from a Cottonwood Creek streamflow measurement station installed by the Nez Perce Tribe indicates high stream flow variability during the year. The mean daily streamflow ranges from 265 cubic feet per second (cfs) during spring runoff to 1 cfs during the late summer months. The majority of flow occurs from November to May from snowmelt and precipitation.

Typically, peak runoff occurs in March or April from a combination of snowmelt and rain. Drainages, such as Cottonwood Creek, that are lower than 4,000 feet in elevation are susceptible to rain on snow events. Rain on snow events which produce rapid runoff and subsequent flooding may occur December through February. Such an event occurred in February 1996 as a result of above average fall precipitation that saturated the soils followed by rain or heavy winter snowfall.

A review of newspaper articles and interviews with local residents indicated that flood events occur periodically in the area. Floods also occurred in 1986, 1974, 1969 and 1965. Some residents stated that the 1996 flood may have been larger than the 1965 flood.

Based on local information, Cottonwood Creek becomes an intermittent stream approximately eight miles above the mouth of the watershed. Springs contribute to the stream around the eight-mile marker to maintain the streamflow during the summer months.

Groundwater:

The Cottonwood Creek watershed lies over the Clearwater Plateau groundwater system. The aquifer is recharged by area streams where permeable basalt is exposed in stream channels and by precipitation percolating through fractured bedrock in the upland areas.

This groundwater system is prioritized as tenth within Idaho with the following potential agricultural contamination sources (listed in order of priority):

- Feedlots
- Hazardous material handling
- Pesticide handling and use
- Surface runoff
- Fertilizer application
- Septic tank systems
- Domestic wells
- Silvicultural activities

Wildlife

A variety of wildlife inhabit the watershed on a permanent, seasonal, or migrational basis. A variety of habitat types in the watershed provide food, shelter, and water for upland game birds (ring-neck pheasant, mourning dove, valley quail, grey partridge, chukar, and wild turkey), migratory waterfowl (canada goose, barrows goldeneye, wood duck, buffle-head, mallard, merganser, cinnamon teal and green-winged teal), big game species (white-tailed deer, elk, black bear, mountain lion and moose) and furbearers (coyote, skunk, fox, badger, mink, porcupine, weasel, bobcat, beaver and muskrat). The management of recreational and agricultural purposes influences the quality of habitat.

Fisheries

Historically, many of the tributaries of the lower Clearwater River supported substantial populations of anadromous salmonids, primarily A-Run steelhead rainbow trout *(Oncorhynchus mykiss).* These fish typically move into the Clearwater River system in the fall and overwinter in the main stem of the Clearwater River. The fish move into the Cottonwood Creek watershed in January or February and spawn in March or April (Cochnauer, 1991). This corresponds to the period when flows are the largest in the watershed. The Idaho Department of Fish and Game (IDFG) classified the steelhead trout species to be of high significance in the fisheries management plan for 1991-1995 (IDFG, 1991).

Aquatic resources in the watershed are tied to Cottonwood Creek and its tributaries; Magpie, Coyote, Star Mill and Pickle Canyon Creeks. Fish species are listed in Table 3.

Table 3. Cottonwood Creek Fish Species

Steelhead (*Oncorhynchus mykiss*)	Chiselmouth (*Acrocheilus alutaceus*)
Brook trout (*Salvelinus fontinalis)*	Northern Squawfish (*Ptychocheilus oregonensis*)
Speckled Dace (*Rhinichthys osculus*)	Redside Shiner (*Richarsonius balteatus*)
Paiute Sculpin (*Cottus beldingi*)	Bridegelip Sucker (*Catastomus columbianus*)

Table 4. Cottonwood Creek Steelhead: Periods of Utilization

Activity	**Steelhead Time Frame**
Adult upstream or downstream migration (pre-spawning)	March-April
Adult upstream or downstream migration	April-May
Spawning	March-April
Emergence	June
Rearing	June through 2nd April
Juvenile migration**	2nd April after emergence
Non-specific adult upstream and downstream migration	October-April
Non-specific juvenile upstram and downstram migration	April-November

** Juvenile migration refers to the movements of juvenile fish to the ocean.

Threatened and Endangered Species

Mammals:	Gray Wolf (*Canis lupus*)-listed threatened
Birds:	Bald Eagle (*Haliaeetus leucocepahlus*)-listed threatened
Fish:	Snake River Fall Chinook Salmon (*Oncorhynchus tschawytscha*)--listed endangered
	Snake River Basin Steelhead Trout (*Oncorhynchus mykiss*)-listed threatened
Plants:	Jessica's aster (*Jessicae aster*)-species of concern
	Palouse Goldenweed (*Haplopappus liatriformis*)-species of concern

Wetlands

Limited information exists about the wetland environment prior to watershed settlement. A review of wetland soil types indicates wetlands were more extensive than they are now. In addition, historic photographs and USDA farm records show drainage modification activities occurring in agriculture, transportation and timber areas.

Cultural Resources

Historic buildings in the watershed date back to the late 1800's. Native American use for hunting and fishing dates prior to 1800's.

Economic Profile

The average annual wage per employee for the Cottonwood Creek watershed area was $22,109 according to 1999 Idaho Job Service Data. Data generated from the Lewiston Job Service (Tweedy, 2000) reports that lumber manufacturing comprises 19 percent of the total jobs within Nez Perce County, with agriculture and trade at 11 percent and 24 percent respectively. The remainder of jobs are primarily government related positions and assorted miscellaneous jobs. The unemployment rate has decreased steadily over the last several years, dropping to 3.7 percent in 1999.

[5]Tweedy, Doug. 2000. Unpublished correspondence. Job Service, Lewiston, Idaho.

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Introduction

The 1989 Idaho Water Quality Status Report and Non-point Source Assessment by DEQ, indicates that Cottonwood Creek does not support the designated beneficial uses. The report lists siltation / sedimentation, nutrients (including nitrate), thermal modification, organic enrichment, dissolved oxygen, habitat alterations, pathogens (bacteria), ammonia and flow alterations as the primary pollutants of Cottonwood Creek.

Problem Statement

Earth cover changes resulting from land use and management activities within the Cottonwood creek watershed have affected the hydrological functional aspects of the basin resulting in detrimental effects to instream and downstream water uses.

Sources of Pollutants:

- non-irrigated cropland production practices
- forestland road construction and maintenance practices
- forestland harvesting and reforestation practices
- rangeland practices
- hydrologic / habitat modifications (including channelization, removal of riparian vegetation, and streambank destabilization)

Causes of Pollution:

- conventional tillage practices that leave inadequate surface residues
- lack of structural BMP's to control or reduce concentrated flow and gully erosion
- improper livestock grazing and associated activities in riparian and wetland areas
- improper forest road and skid trail construction
- livestock feeding operations
- flood damage from large runoff events

Effects of Pollutants:

- low summer flows
- extreme fluctuations of annual streamflow
- high stream temperatures during the summer
- lack of instream cover
- lack of instream structure and habitat diversity
- floodplains not accessible to streams
- increased municipal and industrial water treatment costs
- increased operation and maintenance costs due to sediment deposition on roads, culverts and borrow pits
- crop damages and losses due to sedimentation
- crop yield losses due to erosion
- reduction in wildlife populations and of species diversity due to riparian and wetland habitat loss

Scoping of Concerns

The PI team focused on all suspected point and non-point sources of pollution on all land uses within the watershed.

Inventory Data

Cropland

Fifty-one percent of the watershed acreage is non-irrigated cropland. The majority of cropland occurs on gentle to moderately steep slopes of loess covered basalt plateaus. The typical crop rotation within the watershed is a wheat/pea or lentil rotation. Other crops grown include alfalfa hay, barley, bluegrass, canola, garbanzo beans, and summer fallow. Average yields for the most commonly grown crops: 65 bushel per acre for wheat, 3,000 pounds per acre for barley, 1,700 pounds per acre for spring peas, and 1,000 pounds per acre for lentils.

Weather conditions, lease agreements, farm programs, crop markets, weed and crop disease conditions all play a role in which crops are grown and how the cropland resource is managed resulting in a variety of tillage systems and rotations in the watershed (Table 5).

Table 5. Common Crop Rotations and Tillage Systems in Cottonwood Creek watershed.

Crop Rotation	Tillage System
Grass or hay to lentils or peas.	Spray with Roundup and use no till seeding.
Grass or hay to wheat or barley.	Spray with Roundup, moldboard plow and seed.
Peas or lentils to wheat or barley.	Shank and seed **or** cultivate, fertilize, shank and seed.
Wheat or barley to lentils or peas.	Fall plow; Spring cultivate (3 times), spray, harrow, and seed.

Farm chemicals used include Roundup, Fargo, Hoelon, 2,4-D, Lexone, Harmony Extra, Buctril, and Benlate. Selective type herbicides are most commonly used with tank mixes that treat an entire field for identified problems. The cost of these materials and the impact on net return plays a strong role on when they are actually used.

Fertilizers are most often fall applied. Soil tests are made on the average of every 5 years. Fertilizer rates per acre are 90 to 100 pounds of nitrogen, and 12 to 24 pounds of sulfur and phosphate. Growers indicated that fertilizer placement was a key component for plant uptake and growth with the desired placement depth being 4 to 6 inches.

Much of the cropland occurs on soils with fragipan characteristics. This results in a saturated soil profile during the December-March critical erosion period. Sediment loss from sheet, rill, and ephemeral gull erosion is accelerated under these conditions. Table 6 displays erosion rates for sheet and rill, and concentrated flow for land slope groups 15 percent and less and greater than 15 percent.

Water permeability through the fragipan is very slow, delaying planting of spring crops. With extended wet soil conditions, compaction from spring farming practices occurs, resulting in poor root penetration and slow infiltration, also accelerating the erosion potential.

Table 6. Estimated average annual erosion rates in the Cottonwood Creek watershed.

Estimated average annual erosion rates (Tons/Acre/Year)

Slope Group	Sheet & Rill	Concentrated Flow	Total
<15%	5.0	1.6	6.6
15%+	8.0	2.9	10.9

Estimated total average annual erosion (Tons/Acre/Year)

Slope Group	Total Acres	Erosion Rate	Total Erosion (Tons)
<15%	11,200	6.6	73,900
15 % +	16,780	10.9	182,900
			Total 256,800

The estimated average annual rate of erosion for both sheet, rill and concentrated flow erosion is 9.2 tons per acre per year.

Currently over 1300 acres of CRP exists in the watershed. An increase in sedimentation may occur when these acres are returned to agricultural production.

Pastureland

Approximately 500 acres of pasture and hayland exist with the watershed. The majority of pastureland is located in lowland areas adjacent to perennial and intermittent drainages. Predominant pastureland grasses include orchard grass, smooth brome, timothy, intermediate and pubescent wheatgrass. Hayland areas are alfalfa or mixed with one or more grasse species. Pastureland is primarily grazed by moderately sized beef cattle operations, small dairy operations and a few horses, pigs and sheep.

Problems associated within the pastureland include weed control, sloughing, gullies and streambank scouring. Some fields, especially on very small ranches, are exposed to season long grazing pressure with no rest. Steep, uneven topography and the lack of water developments encourage uneven livestock distribution on larger pastures. Soil erosion is not a serious problem in pastures, but has occurred near streambanks from trampling, livestock trails, and lack of channel vegetation.

Soil compaction by both equipment and livestock has become a problem. Surface wetness also causes potential problems with nutrients and pesticides in runoff. Lack of soil testing, low fertilizer rates and lowered soil pH have adversely affected the productivity potential and longevity of hay and pasture fields. In addition, the lack of animal shelter, primarily trees, causes undue stress to livestock during temperature extremes. Livestock use wetland and riparian areas for shade and shelter which reduces the amount of woody vegetation in these areas.

Rangeland

Rangeland is 34.4% (14,108 acres) of the land within the Cottonwood Creek watershed. The majority of rangeland is located on steep exposed slopes which are not suitable for cropping. Small areas of rangeland are intermingled with cropland on shallow soils or steep slopes and are not accessible to grazing. The rangelands on the west side of Cottonwood Creek are associated with the steep, cool, north exposures that are forested. Traditionally, rangelands in the watershed would have been dominated by bluebunch wheatgrass (35% to 60% composition) with lesser amounts of Idaho fescue, Sandberg bluegrass, perennial forbs, and minor amounts of shrubs such as snowberry. In cooler sites at higher elevations, Idaho fescue would have been dominant with increased amounts of forbs and shrubs. However, the present plant communities on the rangelands are dominated by exotic annuals, primarily cheatgrass and yellow starthistle. Compared to the potential natural communities, these communities rate in poor ecological condition (poor range condition).

Rangeland soils are adequately covered by vegetation and litter such that annual sheet and rill erosion does not exceed “T”. However, present plant community root systems do not provide the mass of deep fibrous roots which are found in natural communities. An adequate root system helps to bind soil particles allowing increased water infiltration and water retention in the watershed. Because of this, a greater proportion of the precipitation is surface runoff, increasing erosion potential in areas of concentrated flow and streambanks.

Present plant communities also produce low amounts of desirable forage for livestock and wildlife. Forage production varies widely in response to annual weather fluctuations. The present plant communities carrying capacity is approximately 25% of that expected from the potential natural plant communities. Reduced plant diversity, forage production, and forage availability has limited the livestock and wildlife uses of the rangelands.

Forestland

Currently there are 5,623 acres of forestland (14%) in the Cottonwood Creek watershed. However, forestlands may have occupied 40-60% of the watershed prior to settlement. Currently forestlands are predominantly ponderosa pine/snowberry and Douglas-fir/snowberry habitat types.

Forestland is located along steep canyon areas on the cooler and wetter aspects. Many of the indigenous forest soils on the gently sloping uplands have been converted to cropland and pasture uses, with the exception of a portion (approximately 1,000 acres) of Nez Perce Tribal land managed for forest products.

In general, most of the steeper forested land is in private, nonindustrial ownership, with the less sloping land being managed predominantly by the Nez Perce Tribe.

In the private nonindustrial ownership, forest management is generally nonexistent except for periodic harvesting activities. Harvest occurs in most instances without professional forestry assistance. Forest resource conditions would improve by implementing silvicultural principles.

In addition to generating forest products, the forestland within Cottonwood Creek watershed provides understory, livestock grazing, wildlife habitat, aesthetic and recreational values. Many areas are heavily grazed by cattle which impact the potential native plant community.

In most forest management situations, 85 to 95 percent of all sedimentation comes from forest roads and skid trails. The rate of erosion and sediment delivery is highest during road construction and for the immediate years near the time(s) of timber harvesting. Roads with on-going use and travel are subject to perpetual resource degradation.

Forestland resource concerns include:

- Poor timber management practices applied on nonindustrial private forestland, lead to decreased timber productivity, decreased watershed protection abilities, and decreased wildlife values.

- Roads designed for timber transport are often sources of erosion and sedimentation. Many problems associated with forested roads occur outside of the time periods that are in the jurisdiction of IFPA.

- The majority of forest roads pre-dating IFPA are not stable.

- Sediment from roads is delivered to Cottonwood Creek. In addition, areas which are heavily logged change the hydrologic character of the watershed due to a decreased ability to capture and retard precipitation. The same shift in the hydrologic profile of Cottonwood Creek occurred as a result of the conversion of forestland to cropland after the turn of the century.

Wildlife

Terrestrial Wildlife - Terrestrial wildlife in the watershed is driven by the availability of food, water and cover. The quality of habitat is influenced by the management of the area for recreational and agricultural purposes.

<u>Upland Game Species:</u>

Upland game species in the watershed include ring-neck pheasant, mourning dove, valley quail, grey partridge, chukar, ruffed grouse, cottontail and pygmy rabbit, and wild turkey. Historically mountain quail did exist in this watershed but due to habitat degradation and land use changes they are likely not present today. The diversity of habitat types (range, forest, agricultural) lends itself to a diversity of upland game. Agricultural and upland areas are limited by the amount of suitable nesting, winter and escape cover. Riparian areas along Cottonwood Creek and its tributaries also lack multi-level plant communities important for upland game use throughout the year. Undisturbed herbaceous and woody areas provide the most diverse cover for all seasons of the year.

<u>Recommendations for Habitat Enhancement include:</u>

Riparian Zones

- Leave standing snags and down woody debris in riparian and forest zones
- Protect wetland and back water areas along Cottonwood Creek and tributaries
- Restore wetlands in riparian areas.
- Plant woody vegetation on streambanks and in riparian areas that naturally supported woody vegetation.
- Fence riparian areas and apply proper management to enhance woody vegetation regeneration

Agricultural and Upland Zones

- Establish filter strips and buffers along tertiary riparian areas. Where appropriate establish shrubs for structural diversity.
- Where feasible on non-cropped areas, remove starthistle and replace with appropriate herbaceous and woody shrub vegetation.
- Leave more crop stubble, especially along field edges and adjacent to suitable woody winter cover.
- When possible establish blocks (25 acres +) of habitat (for nesting, winter and escape cover) instead of narrow strips and maintain connectivity between large blocks of habitat. Manage these areas for wildlife cover leaving the height of hedges and woody cover suitable for nesting and winter cover.
- Establish long term food plots, approximately five one acre plots per square mile. Plots should be strategically placed close to suitable winter cover.
- Enhance sediment basins by adding herbaceous vegetation as buffers surrounding the basins. Manage the buffer strips for wildlife habitat.
- Secure and conserve established habitat areas from future development.

Migratory Waterfowl:

Migratory waterfowl include Canada geese, common snipe, mourning dove, barrows golden-eye, wood duck, bufflehead, mallard, common merganser, cinnamon teal, and green-winged teal.

Waterfowl are tied extensively to the wetlands, riparian areas, and streams for most of their life requirements. The management of these areas for agriculture and urban development have decreased waterfowl habitat quality. Suitable breeding and brood rearing areas are limiting waterfowl populations throughout the watershed.

Recommendations for Habitat Enhancements

- Restore and enhance wetlands.
- Establish large sediment basins with grass buffers and aquatic plantings.
- Establish wood duck boxes and goose nesting platforms.
- Establish and maintain woody riparian vegetation along riparian areas
- Encourage beaver activity

Big Game:

Big game includes mule and white-tailed deer, elk, black bear, lion and moose. These species have large home ranges throughout all land use cover types in the watershed. Critical habitat is driven by the quality of the available summer and winter cover. Large blocks of relatively undisturbed (from human) habitat with adequate woody cover for thermal protection and escape cover are needed throughout the watershed.

Recommendations for Habitat Enhancements

- Protect and enhance large blocks (25 ac,+) of cover by maintaining timber and shrubs for summer and winter use.
- Protect special habitat components including travel corridors on ridges and saddles, mineral licks, and wallows by maintaining tree and shrub cover in large blocks.
- Protect and enhance tree canopy cover and shrub/grass forage on winter ranges on south and west facing slopes at mid and upper elevations.

-Create openings in forestland no larger than 40 acres.
-Promote forage production on summer and winter ranges.
-Control motorized access during fall and winter to lower big game mortality rates and disturbance on winter ranges.
-Reduce noxious weeds.

Furbearers:

Common furbearers include coyote, skunk, fox, badger, mink, porcupine, weasel, ermine, bobcat, beaver and muskrat. Many of these species are dependent on the quality and quantity of riparian and wetland areas in the watershed.

Historically beaver has played a major role in the development of the meadows associated with Cottonwood Creek and its tributaries. Over the last 50 years beaver has not played a significant role in sustaining the functions and values of the riparian/wetland areas in the watershed. The removal of beaver and their habitat has reduced the historical functions and values of Cottonwood Creek. Activities enhancing habitat for furbearers need to focus on riparian and wetland areas. Restoration of riparian and wetland areas focusing on the regeneration of woody plant communities along Cottonwood Creek and associated tributaries will enhance habitat for furbearers.

Non-game Species:

Reptile and amphibian species include tiger salamander, western toad, Woodhouse's toad, sagebrush lizard, short-horned lizard, western skink, rubber boa, racer, gopher snake, common garter snake, western garter snake and great basin rattlesnake. Springs, wetlands and riparian areas play a major role in the life history for these animals. Protecting and enhancing springs, wetlands, and riparian areas will directly benefit these species.

Non-game avian wildlife include belted kingfisher, marsh wren, raven, crow, sage thrasher, western bluebird, warbler species, red-winged blackbird, yellow headed blackbird, American goldfinch and vesper sparrow. Many of these species are migratory in nature spending the breeding season in the Cottonwood Creek watershed. The majority are tied to riparian areas for part or all of their habitat needs. Many of the remaining riparian areas are lacking the woody component in the plant community.

Activities that focus on restoring and/or enhancing woody shrubs and trees in riparian areas will address the most limiting habitat factors.

Riparian areas are utilized by many game and nongame species which reside or migrate through the watershed. Many riparian areas on Cottonwood Creek and its tributaries are lacking woody vegetation in the plant community. Historically these riparian areas supported a diverse plant community of herbaceous and woody vegetation. With the change of management in the watershed to an agricultural and recreational land base, many riparian areas have gradually changed to a herbaceous plant community dominated by reed canarygrass and isolated woody vegetation. Practices improving or enhancing diverse multi-level riparian habitats will have the most direct benefit to all terrestrial wildlife.

Aquatic Wildlife- Aquatic resources are tied to Cottonwood Creek and it's tributaries. The major tributaries include Magpie, Coyote, Star Mill and Pickle Canyon Creeks.

Fish species present include rainbow/steelhead trout, speckled dace, piute sculpin, northern sqawfish, chiselmouth, redside shiner and bridqelip sucker.

Historically Cottonwood Creek supported populations of rainbow/steelhead, cutthroat trout, and chinook salmon as the main gamefish. Land use changes and current management inside and outside the watershed have significantly changed the habitat suitability of the creek eliminating cutthroat trout and reducing rainbow/steelhead trout populations.

Cottonwood Creek is considered extremely important to rainbow/steelhead populations in the Clearwater drainage by the Nez Perce Tribe and Idaho Department of Fish and Game (IDFG).

The 1996/1997 floods in northern Idaho impacted aquatic habitat in Cottonwood Creek and its tributaries. High stream flows scoured the floodplain and stream channel and created new channels. Depositional areas also occurred. The amount of gravel and cobble movement through the system impacted the eggs, young and adults of all fish species inhabiting Cottonwood Creek. The old habitat (pools/riffles/runs) in some areas was replaced with new pools, riffles and runs.

Habitat surveys were completed by the Nez Perce Tribe and IDFG over the past 15 years. The historical habitat evaluations identified low summer flows, extreme fluctuation in annual stream flow, high summer stream temperatures and lack of instream cover as limiting factors for aquatic resources in Cottonwood Creek (Kucera, Johnson and Bear 1983).

In general, prior to the flood, the middle reach of Cottonwood Creek had moderate riparian development providing about 30 percent shading (Kucera, Johnson and Bear 1983). Habitat parameter scores were low. High summer stream temperatures, lack of instream cover, and extreme water fluctuations all were considered limiting factors influencing fish populations. The lower reaches of the creek has areas of sparse riparian vegetation leading to high summer stream temperatures, lack of instream and overhead cover, unstable streambanks and high fine sediment in spawning gravels.

In March of 1996 a team of biologists evaluated three stream sections of the stream; lower, middle and upper. Parameters evaluated include stream shading, pools, riffles, runs, undercut banks, vegetative overhang, bank stability and stream width and depth.

Many riparian areas were changed and new multiple channels were created by the 1996 flood. The stream at this time has pools, riffles and runs similar to historic conditions. The 1996 floods rearranged the pools and riffles however the integrity of these habitat parameters still exist. The parameters associated with cover (undercut banks, overhanging vegetation and stream shading) were reduced by the 1996 flood event.

The majority of stream changes from the 1996 flood event occurred in the lower stream reaches. Based on the 1996 survey, lower stream reach habitat quality is impacted by;

-poor stream canopy cover
-poor stream cover (undercut banks/overhanging vegetation)
-lack of LOD (large organic debris)
-pools/riffles/runs similar to historic conditions

The conditions exhibited in the lower reach led to elevated water temperatures and a lack of instream cover for the fishery.

The middle reach exhibited the best available habitat in Cottonwood Creek. The 1996 flood altered much of the stream channel and riparian vegetation. Habitat conditions found during the 1996 survey included:

-increase of instream LOD
-poor stream cover (undercut banks/overhanging vegetation)
-pools/riffles/runs similar to historic conditions
-fair/good stream canopy cover

The addition of LOD as a result of the 1996 flood will enhance the fishery habitat through this reach. Stream cover from undercut banks and overhanging vegetation will take many years to return. Historically these parameters developed with the help of beavers and a fully functioning floodplain. The elimination of beavers and development in the floodplain has greatly increased the time needed to restore these habitat parameters throughout Cottonwood Creek.

The upper reach was determined to extend through the canyon areas approximately 8 to 10 miles up from the mouth of Cottonwood Creek. Narrow canyon reaches did not exhibit significant changes in habitat conditions related to the flood. The narrow canyon reaches provided significant stream cover (overhead and instream). Areas where a wide floodplain existed exhibited significant impacts related to the 1996 flood as follows:

-poor stream canopy cover
-poor stream cover (undercut banks/overhanging vegetation)
-pools/riffles/runs similar to historic conditions
-lack of LOD (large organic debris)

The lack of canopy cover results in high water temperature in the summer. The lack of stream cover (overhead and instream) limits the cold water fishery.

<u>Recommendations For Habitat Enhancement</u>

-Enhance woody riparian regeneration through a combination of direct plantings, natural regeneration, livestock management and exclusion.
-Leave LOD instream where possible (if no eminent danger to life or property exists).
-Install BMPs in upland areas (agricultural, forest, range, roads, urban) to reduce sediment delivery to the stream.
-Install BMPs in upland areas to extend stream flows throughout the year.
-Leave new channels (where appropriate) created by the 1996 flood.
-When bank stabilization is warranted, utilize practices that include bioengineering technology over riprap.
-Complete instream work before spawning rainbow/steelhead activities occur.

The 1996 flood created a new opportunity for fisheries in Cottonwood Creek. Sediments were flushed from the system in many areas creating new or enhanced spawning and rearing areas. Many pools were created with the scouring action of the flood waters. LOD was deposited in the channel which provided needed instream cover lacking in the past. With an emphasis on riparian management and upland conservation work the stream over time can be rebuilt into a significant fishery resource.

Threatened and Endangered species

Threatened and endangered species were identified in the watershed using the Idaho Conservation Data Center's computer data base. The following list identifies threatened, endangered, candidate, or species of concern in the watershed:

Table 7. Threatened and Endangered Species within the Watershed

Species	Listing	Occurrence
Bald Eagle	Threatened	wintering
Jessica's Aster	Species of Concern	disturbed-ponderosa sites
Palouse Goldenweed	Species of Concern	watershed
Fall Chinook Salmon	Threatened	Clearwater River
Steelhead Salmon	Threatened	Cottonwood Creek
Gray Wolf	Endangered	Nez Perce County

Bald Eagle - *Haliaeetus leucocephalus*

The bald eagle winters in the area, roosting in trees located near rivers, lakes and streams. The bald eagle winters along the Clearwater River to the S.F. Clearwater River. Wintering eagles utilize tall trees to roost and view the waters of the Clearwater River and it's tributaries. Occasional eagles are sighted along Cottonwood Creek hunting for available prey during the winter months. The abundance of fish in Cottonwood Creek offers an excellent prey base for wintering bald eagles. Land development and poor land management practices impacting aquatic habitat and water quality, have resulted in a reduced aquatic prey base and a reduced number of roosting sites for the eagle.

Jessica's Aster - *Aster jessicae*

Jessica's aster is a species of concern in the watershed. Jessica's aster is found in dry-mesic areas with a slope percentage ranging from 0% to 8% slope. The species is found along streambanks and open places. Habitat type for this plant is Ponderosa Pine / Common Snowberry. It has also been found in Idaho Fescue Rose communities. Plant species commonly found in the same area include: *Dactylus glomerata* - Orchard grass, *Hypericum perforatum* - St. John's wort, *Phleum pratense* - Timothy, *Lactuca serriola* - Prickly lettuce , *Amelanchier alnifolia* - Western serviceberry, and *Achillea millefolium* - Yarrow. The plant has simple leaves, blue to violet colored rays with a yellow center.

Palouse Goldenweed - *Haplopappus liatriformis*

Palouse goldenweed is a species of concern in the watershed. Goldenweed inhabits dry-mesic areas, upper slopes, western aspects, 8 - 15% slopes in open light. The plant is found in the Rose/Balsamroot community. Other plants that are found in the area include: *Potentilla glandulosa* - Cinquefoil, *Dactylus glomerata* - Orchard grass, *Balsmorhiza sagittata* - Arrowleaf balsamroot, *Phlox speciosus* - Wild Sweet William, and *Festuca idahoensis* - Idaho Fescue.

Fall Chinook Salmon - *Oncorhynchus tsawltsha*

Chinook salmon are a threatened species in the Clearwater River. Sediment and high stream temperatures from the Cottonwood Creek watershed may impact Chinook habitat in the Clearwater River. Chinook are an anadromous species. The fish develop for 1-2 years in freshwater streams, migrate to the ocean for 1-2 years, then swim back upstream to their birthwater to spawn. After spawning, the adult fish die within a week or two. Chinook use a variety of freshwater habitats, but are more likely to spawn in larger main stream rivers than other salmonid species. Decreased water quality, habitat degradation, and migration barriers have heavily impacted the Chinook populations in the region.

West Coast Steelhead - *Oncorhynchus mykiss*

Steelhead are a threatened species within the watershed. Steelhead are an anadromous species. The fish develop for 1-2 years in freshwater streams, migrate to the ocean for 1-2 years, then swim back upstream to their birthwater to spawn. Steelhead do not usually die after spawning. Steelhead depend more on freshwater environment than most salmonids. They rely heavily on smaller rivers and streams as nursery areas, and tend to penetrate farther into headwater areas. Decreased water quality, habitat degradation, and migration barriers have heavily impacted the Steelhead populations in the region.

Gray Wolf - *Canis lupis*

Gray wolf is listed as an endangered species in Nez Perce county. Wolves normally prefer secluded, wooded areas. However, a pack's hunting range will likely cover a variety of habitat types. Wolves are highly social, normally living in packs of 2-8+. Packs cooperatively hunt a variety of big game including deer, elk, caribou, and moose. Wolves feed on small mammals to a lesser extent.

Riparian Areas

The riparian resources vary from narrow, shrub dominated riparian areas in the steeper V-shaped valleys to broader, tree dominated riparian zones in the flatter U-shaped valleys. Common riparian shrubs include willow species, alder, and black hawthorn. Common riparian trees include cottonwood and alder. The lower half of Cottonwood Creek is dominated by trees and shrubs over a relatively wide accessible floodplain. The upper half is primarily a narrow, rocky canyon with a correspondingly narrow riparian area dominated by shrubs. Tributaries entering from the west are short, steep, and dominated by shrub thickets. Tributaries entering from the east are longer and less steep and dominated by similar shrub thickets. Cottonwood Creek and most of its tributaries originate on cropland.

A comparatively high density of shrubs, trees, or both can indicate good riparian condition, or a properly functioning riparian area. Together, these woody plants perform important functions such as maintaining streambank stability and trapping sediment and debris. They also shade the stream and provide hiding cover for fish. Poor condition riparian zones function below their potential and are identified by few, if any, woody plants. The land use practices impairing the establishment and growth of woody riparian plants include the direct removal of riparian vegetation for pasture or farming, unrestricted livestock grazing, logging, and stream channelization.

In March of 1996 a reconnaissance level riparian area inventory was completed using 1992 color aerial photographs combined with ground surveys. Stream segments with less than 50 percent shrub/tree cover (streambank canopy cover) were considered inadequate while segments with more than 50% cover were considered adequate. This information was then loaded into the Nez Perce Tribe's Geographic Information System. Results indicate that of the 48.7 stream-miles inventoried, 16.9 miles (35%) are adequate while 31.8 miles (65%) are inadequate. With almost no shade, these streams are a likely source of higher stream temperatures and poor aquatic habitat. The feasibility of planting shrubs, such as willow and alder, should be evaluated.

The land use practices which degrade riparian areas include:

- Poor timber harvest practices
- Inadequate winter crop residue
- Unrestricted livestock grazing
- Removal of riparian vegetation

Timber harvest Best Management Practices (BMPs) should be adopted with an emphasis on minimizing the loss of trees and shrubs along streams. New roads should avoid riparian corridors where possible and old roads should be closed and stabilized.

Cropland BMPs should focus on maximizing winter crop residue. Structural practices, such as grassed waterways, sediment basins, and water and sediment control basins should also be encouraged. In addition to reducing erosion, these conservation practices trap sediment/ nutrients and increase infiltration.

Pasture and rangeland BMPs, such as cross-fencing and rotational grazing, should be encouraged. Season-long grazing should be strongly discouraged, especially if riparian areas are within the pasture. Providing riparian areas with adequate rest periods during the growing season will help restore riparian vegetation.

Finally, the direct removal of riparian vegetation should be strongly discouraged. Recent flooding has resulted in increased channelization activity. Extensive experience with channelization has shown it to be detrimental downstream since the stream's velocity and bedload increase significantly in straightened sections.

Urban \ Suburban Land

There are no major urban areas within the Cottonwood Creek Watershed. The total watershed population is 201 persons, occupying 84 residences. The unincorporated community of Gifford (population 61) occupies approximately 58 acres, comprised chiefly of 26 residences and a community center. Gifford lies about 4 miles northeast of the headwaters of Cottonwood Creek.

It is anticipated that future rural homesite development will increase along the lower portion of Cottonwood Creek. Further development could be expected for about 7 miles upstream paralleling a paved county road. There could also be increased development along the lower reaches of Magpie Creek which empties into Cottonwood Creek about 2.5 miles upstream from the Clearwater River. These projections are based on local knowledge of trends by the Nez Perce County Planner. Moreover, slightly more than 30 percent of the watershed's total population already exists in these areas. This potential development could include some upland area but is more likely to occur on bottomland riparian areas.

It is not likely that significant increases in homesite development would occur watershed-wide because of limited road access, groundwater availability, and steep terrain. The gently rolling areas of the watershed will probably remain in agricultural production.

The only known planned developments include a total of about 19 five acre lots near the mouth of Cottonwood Creek and 6 five acre lots at the confluence of Magpie and Cottonwood Creeks.

Presently, permits are required for all commercial uses in rural areas. The Nez Perce County Planning and Zoning Commission reviews special use permit applications for potential impacts on surrounding property and the environment and may condition these uses to mitigate adverse impacts. The Commission should be encouraged to explore options to limit further development in designated flood prone areas. The adverse impact of floodplain development along Cottonwood Creek was dramatically illustrated in February 1996 when high winter rainfall melted heavy low elevation snowpack causing significant flooding of Clearwater River Basin tributaries, including Cottonwood Creek.

It is unknown at this time what the cumulative effects are from urban development in the watershed, i.e., septic tank absorption fields, runoff from building and home sites, stored chemicals, etc.

Wetlands

Wetlands in the drainage are typically associated with Bridgewater-Joseph and Wilkins silt loam soil types. These soils share similar features:

- Hydric due to saturation.
- Naturally supports woody vegetation.
- Seasonally ponded or flooded.

A wetlands inventory of the Cottonwood Creek watershed was conducted using the climate, soil and vegetation information collected during the Lewis - Nez Perce Soil survey. A field tour of the watershed was made on March 5, 1996 to complement this recorded data. Hydric soils were taken as the key indicator of wetland status. A total of 133 acres of hydric soils were identified.

The Bridgewater-Joseph complex and Wilkins silt loam soils are described in Appendix B as units 1 and 2 respectively.

The Bridgewater-Joseph complex is located along the floodplain of Cottonwood Creek. Only the Joseph soil is hydric. It represents 35 percent of the map unit or 109 acres. Joseph is hydric due to frequent flooding during the early part of the growing season. The natural condition of the soil is wooded with a plant community of cottonwood, alder and wildrye. Current uses of the soil are pasture, hayland and some range.

The Wilkins silt loam is found in the drainageways and on floodplains of the loess covered basalt plateau. The map unit itself is not hydric but does contain a 2 percent hydric inclusion. This inclusion represents about 24 acres. The included soil is hydric due to saturation, flooding and ponding during the early part of the growing season. The natural condition of this soil is wooded with a plant community of willow, alder, cattail, sedges and rushes. Current uses of the soil are cropland, pasture and hayland.

Table 8. Wetland Map Units

Soil	Bridgewater-Joseph	Wilkins
Total Acres	311	1,180
Wetland Acres	109	24
Landscape	floodplain on canyon floor	drainage ways and flood plains on basalt plateau
Current Use	pasture or hayland	cropland, pasture and hayland

The Cottonwood Creek watershed has wetlands associated with the creek itself, riparian areas and associated tributaries. No USFWS wetland inventories have been completed in the watershed. The Nez Perce Tribe is compiling an on-going wetland inventory. At this time the inventory is not completed.

Hydric soils typically indicate that conditions exist that constitute a wetland. Hydrophytic vegetation associated with the wetlands include willows, sedges, rush, and alder.

Many wetlands have been impacted by past and present land management activities. Subsurface drain tile, ditching and woody vegetation removal have been the typical conversion activities in the watershed. Riparian/wetland areas and associated streambanks have become unstable delivering sediment to the stream system. Lack of woody vegetation in these areas is critical for terrestrial and aquatic resources.

Practices that will reduce impacts to wetland areas from recreational activities, livestock and cropping will positively impact wetland habitat conditions in the watershed.

Programs like Wetland Reserve Program, USFW Partners Program, IDFG Habitat Incentives Program can help in protecting and restoring wetland areas.

Cultural Resources

Prehistoric and historic cultural resources have been identified in the watershed. Historic resources in the watershed include buildings used by early settlers in the late 1800's. Native Americans utilized the watershed for it's abundance of large and small game, fisheries and abundant plant resources.

Practices that are considered land disturbing may impact cultural resources. Consideration for cultural resources should be completed during site specific on-farm planning.

Livestock

The SWCD inventoried the livestock feeding operations in March of 1998. Forty-six livestock operations (652 animals) were located within the watershed boundary. The livestock species included mature cattle (82.5%), yearling cattle (5%), horses (11%), swine (1%), and sheep (0.5%). The majority of livestock operations had 1-5 animals (41%), with ranges of 6-10 (11%), 11-20 (26%), 21-40 (20%) and 81-100 (2%).

The inventory and analysis ranked this watershed as a high risk for water quality pollution from livestock sources. The high risk category is based on;

1) 68% of the operations have direct access to water sources
2) Soil leaching potential is high on 54% of the operations

<u>Data Collection:</u>

Surface Water Quality

Water quality conditions include traditional chemical constituents as well as biological and physical conditions. These are extremely important to the beneficial uses that the water resource supports. Biological and physical data have been collected in past studies and will be described to a limited degree in this section.

The current beneficial uses and status for Cottonwood Creek (PNRS # 1160, headwaters to Clearwater River) include Agricultural Water Supply (Supported), and Primary and Secondary Contact Recreation (Supported), Wildlife Habitat (Not Evaluated) and Aesthetics (Not Evaluated) (IDHW-DEQ, 1992). Although Cold Water Biota and Salmonid Spawning beneficial uses are not listed, based on past studies conducted by the Nez Perce Tribe, these uses should also be included for this stream segment. The Nez Perce Tribe rated a portion of this steam as second among fifteen reservation sampling stations for over-yearling steelhead trout population densities (Kucera et al., 1983). Because a beneficial use attainability assessment has not been completed on this stream segment, it should be conducted to determine the current status and attainability.

Water quality within the Cottonwood Creek Watershed is currently being impacted by non-irrigated cropland, rangeland, animal holding/feeding areas, forestland, road construction and maintenance, removal of riparian vegetation, flow modification, and channelization. In addition, land development (housing sites, bridged roadways etc.) within the floodplain and associated streambank modification/destabilization activities that have been initiated because of flood recovery have greatly impacted the natural integrity of the stream system.

Four known studies have been conducted on Cottonwood Creek. These studies include Bjornn et al., 1977, Kucera et al., 1983, Kucera and Johnson, 1986 and unpublished data for 1995. Based on the data that has been collected from these studies, water quality conditions can be described as follows:

Sediment:

Suspended sediment concentrations are highest during peak runoff events with much of the sediment being transported completely through the system into the Clearwater River System. No total suspended solids samples were collected, however, cobble embeddedness was measured at three sample stations. Spawning gravels were identified as being in sufficient quantity and quality with 10%, 15%, and 35% fines intermixed in the middle (stream mile 8), middle lower (stream mile 4) and lower (stream mile 2), respectively (Kucera et al., 1983). The primary sources of sediment include streambanks and cropland in the upper watershed.

Nitrogen:

Nitrate nitrogen concentrations in Cottonwood Creek were 3.1 mg/L on September 16, 1976 at the mouth (Bjornn et al., 1977). Sampling in 1982 showed 0.45, 0.66, and 1.21 mg/L, at the lower middle station, middle station and lower station, respectively (Kucera et al., 1983); and 0.39 for August 4, 1983 and 0.072 for September 14, 1984 at the mouth (Kucera and Johnson, 1986). Nitrate nitrogen concentrations ranged from 0.072 to 3.1 mg/L. Generally nitrate concentrations were found above the concentration of 0.3 mg/L which is the upper limit recommended to prevent accelerated eutrophication. Potential sources of nitrogen include sources directly adjacent to the stream (livestock, wildlife and human), as well as upland sources from cropland areas.

Phosphorus:

Ortho phosphate concentrations range from 0.05 to 0.11 mg/L. Phosphate concentrations during 1982 were found to be lowest upstream (0.05 mg/L) with a gradual increase downstream (0.11 mg/L). Generally, phosphate concentrations were within the recommended concentration of 0.10 mg/L for water bodies that do not directly enter a lake or reservoir. Potential sources of phosphorus include sources directly adjacent to the stream (livestock, wildlife and human), as well as upland sources from cropland areas (dissolved and sediment attached).

Pathogens:

Samples for fecal coliform were collected in 1976 at the mouth of Cottonwood Creek. Samples collected during April (2400 #/100ml) and July (4300 #/100 ml) were above the water quality standard of 500 and 800 #/100 ml for primary and secondary contact recreation, respectively. Sources of fecal contamination include wildlife, livestock and septic tanks located directly adjacent to the stream.

Temperature:

Stream temperatures ranged from 1.65°C in December 1994 to 26.7°C in July 1982. Stream temperatures were below the water quality standard of 22°C for cold water biota for all months except for occasional elevated temperatures during June, July and August. Stream temperatures, however, were often found above the water quality standard of 13°C necessary to support salmonid spawning during periods of spawning and incubation (April and May). Elevated stream temperatures are attributed to lack of riparian vegetation and low flow conditions. Data collected by the Nez Perce Tribe found the most significant steelhead trout populations in the lower middle sample section near stream mile four. Much of this was attributed to spring discharges just upstream of the sample site and improved overhead canopy cover.

Dissolved Oxygen:

Dissolved oxygen (DO) concentrations during 1994-1995 ranged from 5.13 to 10.57 mg/L. Since dissolved oxygen concentrations are inversely proportional to temperature, the lowest DO concentrations were found in the summer during periods of elevated stream temperatures. Generally, DO concentrations were found well above the state water quality standard of 6.0 mg/L, however, during periods of critical low flows and elevated stream temperatures, DO concentrations were found below 6.0 mg/L. Dissolved oxygen concentrations are also affected by excess nutrient concentrations, especially organic materials which create a high oxygen demand. It is likely that the animal holding/feeding operations directly along the creek are contributing nutrients and organics. During low flow periods, nutrient concentrations accelerate eutrophication subsequently reducing DO concentrations such that viable fish populations become limited.

Based on the data collected to date, Cottonwood Creek supports a viable population of steelhead trout and therefore should be listed for Salmonid Spawning and Cold Water Biota beneficial uses. The most likely status is that these uses are only partially supported, and a habitat use and attainability survey should be completed to confirm both the beneficial uses and the current status.

Sediment within the stream system is probably impacting spawning gravels at least to some degree in certain sections. However, spawning gravels were noted in sufficient quantity and quality throughout the system. Nitrate nitrogen and phosphate phosphorus concentrations were occasionally found above recommended concentrations, but do not appear to be limiting water quality conditions or the beneficial uses. Pathogens, stream temperature and occasionally dissolved oxygen concentrations were found to be in violation of the Idaho Water Quality Standards and are limiting water quality and the associated beneficial uses.

Groundwater

Cottonwood Creek is a basalt aquifer located within the Clearwater Uplands and Plateau aquifer[6]. Major sources of recharge to basalt aquifers include infiltration of precipitation and seepage from streams and rivers. Numerous basalt flows and thin interbeds of sediments and/or pyroclastic volcanic rocks characterize basalt aquifers. Water yielding zones in these aquifers are usually located between the basalt flows. Potential contamination sources to the watershed's groundwater include agricultural chemical applications, storage, waste disposal, accidental spills, and handling. Other sources may include underground and above-ground storage tanks, confined animal feeding operations, urban uses, and abandoned wells.

Agricultural chemicals are utilized in the watershed on all cropland acres. According to the Big Canyon Creek Plant Protection Products Survey (Rasmussen et al, 1995) most products utilized pose little risk to groundwater. However, an analysis should be completed based on the products utilized in the Cottonwood Creek watershed. In addition, only one commercial agricultural chemical dealer is located within the watershed. The Western Farm Service facility is located adjacent to Star Mill Creek. Many farm operators store agricultural products at their farm sites. No inventory exists to qualify or quantify the type or amounts of products stored on farms.

Petroleum product point source contamination may come from above ground or underground storage tanks. The April 12, 1995 listing of registered underground storage tanks for the state of Idaho includes the Western Farm Service facility near Star Mill Creek[7]. No other underground storage tanks are registered within the watershed. Most farm tanks are less than 1,100 gallons and are therefore not listed on the register. No information was obtained to quantify the number of above ground or nonregistered underground storage tanks. The major concern from these storage tanks is the impact on groundwater from benzene pollution. The current water quality standard is 5 parts per billion (ppb) benzene for drinking water quality[8]. Because some of the soils within the watershed have perched water tables this type of pollution may be a concern.

Well location and depth information can be obtained from the Idaho Department of Water Resources. The Idaho Department of Health and Welfare does not have any records of reported drinking well water contamination from any pollution sources in the Cottonwood Creek watershed[9]. In addition, a 1993 wellhead survey for nitrates completed in the Big Canyon Creek watershed concluded that nitrates were not a concern for drinking water within that watershed[10]. Another source of data may be the Idaho Farm Bureau.

Qualitative evaluations and limited water quality monitoring indicates the following pollutants impair the water quality of Cottonwood Creek and its tributaries:

- Thermal modification
- Nutrients
- Sediment

Thermal modifications within the watershed are caused by the loss of shading riparian vegetation and low stream flows. The majority of excess nutrients, primarily nitrogen and phosphorus compounds, probably originate from croplands that receive supplemental fertilizers. Improperly installed and maintained septic systems may also contribute. Excess sediment is most likely coming from croplands and to a lesser extent, roads and streambanks. Because of the extensive 1996 flood damage, the streambank erosion and sediment delivery rates were not calculated.

Low summer flows, especially severe in drought years, exacerbate the adverse effects of

[6]Data from Protecting Groundwater Quality in Idaho (The Idaho Groundwater Quality Council).

[7]Only underground storage tanks over 1,100 gallons are required to be registered. The list is available from DEQ.

[8]Information from EPA.

[9]Data obtained by phone interview (June 1995).

pollutants. These low flows can be attributed to the reduction of vegetative cover since the watershed was first settled. As farming, logging, and road building reduced the native vegetative cover, an increasingly larger percentage of precipitation began leaving the watershed as runoff while less infiltrated the soil. When multiplied by thousands of acres, a small reduction in the rate of water infiltration can result in a significant reduction in subsurface water flow. Since subsurface flows are the source of summer stream flows, any reduction in subsurface flows will result in reduced stream flows.

Erosion/Sedimentation

Landslides occur in the watershed area. These are natural occurrences in the layered basalt topography. In a basalt topography, a combination of downcutting and undercutting by streamflow typically forms steep-sided canyons followed by slumping and block-failure slides. In addition, the silty loess soils in the uplands tend to be high in water-holding capacity. When this is combined with the presence of fragipans, the soils on steeper slopes are subject to sliding and surface slumping. The Cottonwood Creek watershed naturally contains all of these features, so when wet conditions occur and soils become saturated, the incidence of slumping and landsliding increases. When the climate is relatively dry, there are fewer slides.

General sediment delivery ratios (SDRs) for use in the Preliminary Investigation report preparation can be compared to SDRs used for planning purposes in the adjacent watershed of Big Canyon Creek. The cropland areas in Cottonwood Creek are somewhat steeper and the overall watershed size is smaller than Big Canyon, contributing to higher SDR values from the Cottonwood Creek drainage.

Cropland in the watershed was separated into two divisions for the PI based on slopes. About 40 percent of the cropland in the watershed is on 0 to 15 percent slopes, with the remaining 60 percent on slopes greater than 15 percent. The flatter cropland is typically on the plateau areas in the upper reaches of the watershed area. These areas exhibit some internal drainage and numerous small ponds which increase sediment deposition potential. The greater than 15 percent slope cropland is along the drainages and main canyon areas and delivers sediment directly to the perennial watercourses in the watershed. This increases sediment delivery from these lands.

Pastureland is in the floodplain immediately adjacent to the main stream channel. Range is typically on steeper south-facing slopes along the drainages. Forestland is on steeper north-facing slopes along the drainages and in upper sections of the watershed.

Table 9. General Sediment Delivery Rates for PI Planning

Land Unit	SDR	
Cropland	0- 15%	[10% slope]
Cropland	> 15%	[35% slope]
Pasture	60%	
Range	35%	
Forestland (roads)	40%	

Fluvial Geomorphology/Geohydrology

Overall impressions about the general geohydrology of the Cottonwood Creek watershed were based solely on observations during the 1996 field inventory and experience of past watershed studies in the region.

Cottonwood Creek responded to the 1996 Flood event by channel incision in some sections and bedload deposition in others. A large percentage of the total stream miles still have floodplain access. The majority of floodplain problems include bridges and culverts sized insufficiently to pass large flows, homesteads located directly in the floodplain.

When the water volume and velocity in the channels became greater than either the vegetation or rock armor could withstand, the banks and channel bottom began to erode. The erosion caused bedload in the channels to increase to a point where the stream could no longer move material through, and the bedload was subsequently deposited. This resulted in restricted channel capacities and contributed to even more erosion downstream. This is because after a bedload is deposited, the water has more energy which is capable of eroding additional material than if the energy is still being used to push the bedload.

Cottonwood Creek historic runoff events were estimated using TR-55, a hydrological model developed by USDA-NRCS. The estimated peak discharge for a 25-year runoff event is 4,200 cfs, compared to an estimated 6,800 cfs for a 100-year runoff event.

Peak discharge estimates for the February 1996 flood were completed by measuring the high water mark cross sectional area at two bridges near the mouth of the watershed. Manning's equation was used to estimate the peak flow at 2,500-4,500 cfs. Based on TR-55 analysis, this flood approximates a 20-30 year runoff event. The United States Geological Survey (USGS) estimated the peak flow at Lapwai Creek for this same period at 3,800 cfs, which corresponds to a 50-year runoff event. Lapwai watershed is approximately three times larger than Cottonwood Creek watershed.

The following are potential sources of technical and financial assistance for planning and implementation which the sponsors would be eligible to pursue in addressing their water quality improvement objectives, while others are oriented towards working with groups of individuals on a project action basis.

NRCS Assistance to Conservation Districts-Public Law 46

Under the authorities of this program, the USDA Natural Resources Conservation Service, through local Soil Conservation Districts, assists both individuals and groups in the planning and application of needed soil and water conservation practices on private land. The amount and timing of technical assistance is determined and prioritized by the local NRCS Field Office and Soil Conservation District. This assistance is typically referred to as the Conservation Operations Program (CO-01).

Resource Conservation and Rangeland Development Program (RCRDP)

Loan Program- This is a program administered by the Idaho Soil Conservation Commission which provides long-term low-interest loans to farmers and ranchers for conservation improvements. Eligible programs include the installation of permanent conservation practices for the treatment of all land uses, riparian protection, and water quality improvements.

Grant Program- This is a program administered by the Idaho Soil Conservation Commission which provides grants to finance demonstration projects for improving rangeland and riparian areas. Grants are available to individuals, partnerships, associations, trusts, private corporations, and certain other private legal entities recognized by law through filing an application with the local Soil Conservation District. A grant cannot exceed $10,000 and the grantee must match or exceed the grant either in dollars, materials, or labor and/or equipment.

Watershed Protection and Flood Prevention Act- Public Law 83-566

The PL-566 program, administered by the USDA Natural Resources Conservation Service provides both technical and financial assistance for the protection of watershed areas. Both financial and technical assistance are available to qualified sponsors for the following purposes: flood prevention, agricultural water management, public fish and wildlife development, public recreation development, ground water recharge, water quality management, conservation and proper utilization of land, and municipal and industrial water supply.

Idaho Agricultural Water Quality Program (WQPA)

The Idaho Agricultural Water Quality Program provides technical and financial assistance to private landowners and operators having control of agricultural lands designated as critical areas or sources of non-point source pollution in an approved project area. The program is administered by the Idaho Soil Conservation Commission. Grants made to selected Soil Conservation Districts provide funding for technical assistance, informational activities, projects administration, and cost-sharing for the installation of Best Management Practices (BMPs).

Habitat Improvement Program (HIP)

The Habitat Improvement Program, administered by the Idaho Department of Fish and Game, provides cost-sharing, primarily to private landowners, for the development and improvement of wildlife habitat for both upland game birds and waterfowl.

Stewardship Incentive Program (SIP)

The Stewardship Incentive Program, administered by the Idaho Department of Lands, provides cost-sharing to non-industrial private landowners and operators. Under the SIP program, benefits or enhanced management, may include, habitat for fish and wildlife, aesthetics, recreational opportunities, increased timber supplies and other products, and erosion control measures.

Department of Army-Corps of Engineers Programs

Section 14 - This is a program which provides funding for the protection of public facilities including schools, roads, bridges, and water treatment facilities. Funds can be used for treatment alternatives such as streambank erosion control is significant.

Section 205 - Under this program, financial and technical assistance is available to qualified sponsors for the following purposes: flood control, power, water supply, recreation, and water quality control.

Section 1135 - This program provides funding for environmental restoration projects. The primary program purpose is for fish and wildlife restoration.

Partners for Wildlife

This is a program administered by the U.S. Fish and Wildlife Service (USFWS) which offers both financial and technical assistance to restore and protect fish and wildlife habitat on private lands through alliances between the USFWS, other organizations, and individuals, while leaving the land in private ownership.

Clean Water Act (section 319)

Section 319 funding is used to assist in implementing Environmental Protection Agency (EPA) approved state non-point source management programs. Section 319 project funding is intended to prevent or solve specific water quality problems on a comprehensive watershed basis. Section 319 funding maybe used for the purpose of: protection or restoration of riparian areas, protection or restoration of wellhead protection areas, protection or restoration of wetlands, and protection of coastal areas.

Bonneville Power Admistration

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 created the Northwest Power Planning Council and gave the Bonneville Power Administration the authority and responsibility to use its legal and financial resources to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries. The BPA provides funding in part, for the Council and its programs.

Conclusions

Qualitative evaluations and limited water quality monitoring indicate the following pollutants impair the water quality of Cottonwood Creek and its tributaries:

- Thermal modification
- Nutrients
- Sediment

Thermal modifications within the watershed are caused by the loss of shading from riparian vegetation and low stream flows. The majority of excess nutrients, primarily nitrogen and phosphorus compounds, probably originate from croplands that receive supplemental fertilizers. Improperly installed and maintained septic systems may also contribute. Excess sediment is most likely coming from croplands and to a lesser extent, roads and streambanks. Because of the extensive 1996 flood damage, the streambank erosion and sediment delivery rates were not calculated.

Low summer flows, especially severe in drought years, exacerbate the adverse effects of pollutants. These low flows can be attributed to the reduction of vegetative cover since the watershed was first settled. As farming, logging, and road building reduced the native vegetative cover, an increasingly larger percentage of precipitation began leaving the watershed as runoff while less infiltrated the soil. When multiplied by thousands of acres, a small reduction in the rate of soil infiltration can result in a significant reduction in subsurface water flow. Since subsurface flows are the source of summer stream flows, any reduction in subsurface flows will result in reduced stream flows.

The land use practices which degrade riparian areas are:

1) Poor timber harvest practices
2) Inadequate winter crop residue
3) Unrestricted livestock grazing
4) Removal of riparian vegetation

Timber harvest Best Management Practices should be adopted with an emphasis on minimizing the loss of trees and shrubs that shade streams. New roads should avoid riparian corridors where possible and old roads should be closed and stabilized.

Cropland Best Management Practices should focus on maximizing winter crop residue. Structural practices, such as grassed waterways, sediment basins, and water and sediment control basins should also be encouraged. In addition to reducing erosion, these conservation practices trap sediment and nutrients and increase infiltration.

Pasture and rangeland Best Management Practices, such as cross-fencing and rotation grazing, should be encouraged. Season-long grazing should be strongly discouraged, especially if riparian areas are within the pasture. Providing riparian areas with adequate rest periods during the growing season will help restore riparian vegetation.

Finally, the direct removal of riparian vegetation should be strongly discouraged. Recent flooding has resulted in increased stream channelization. Extensive experience with channelization has shown it to be detrimental to downstream areas, since the stream's velocity and bedload increase significantly in straightened sections.

The Major point and non-point pollution sources that are threatening or impairing the beneficial uses include:

Pollutant	**Source**
Excess sediment	agriculture, forestry, roads, urban development
Excess nutrients	agriculture, forestry, roads, urban development
Elevated water temperature	agriculture, forestry, roads, urban development
Habitat quality degradation	agriculture, forestry, roads, urban development

Recommendations

Based on the information obtained in this report the PI team recommends that further project action be taken. The development of a detailed watershed plan could be used to pursue implementation of BMPs to improve the identified resource concerns. The development of treatment units and costs are items needed to complete a watershed plan.

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Figure 4. Genearl Soil Map

GENERAL SOIL MAP GROUPS

The soil map units in this watershed have been combined into nine major soil groups. These groupings were based on landform, slope class, soil depth, drainage class, erosion hazard, and the potential pesticide loss due to leaching and surface loss. These soil groups provide similar management limitations for the land manager to make land use decisions.

SOIL GROUP 1: BRIDGEWATER-JOSEPH COMPLEX, 1 TO 3 PERCENT SLOPES

Nearly level, very deep, moderately well to well drained soils formed in alluvium on flood plains.

The major map unit of this group is Bridgewater-Joseph complex, 1 to 3 percent slopes (85 percent) with minor inclusions of Tombeall and Lapwai soils. Soils in this group have seasonal soil wetness or are subject to occasional or frequent flooding. Water erosion hazard is slight. Pesticide leaching loss potential is moderate (Bridgewater) to severe (Joseph).

The Bridgewater soils are very deep and well drained. They are formed in mixed alluvium predominantly of the gravel and cobble class. They occur in stream floodplains. Surface texture is extremely gravelly sandy loam. Depth to bedrock is more than 60 inches. Permeability is moderate in the upper part and very rapid in the lower part and available water holding capacity is very low. Natural potential plant community is common snowberry/bluebunch wheatgrass.

The Joseph soils are very deep and moderately well drained. They are formed in mixed alluvium predominantly of the cobble class. They occur in lower positions of stream floodplains. Surface texture is extremely cobbly loamy coarse sand. Depth to bedrock is more than 60 inches. Permeability is very rapid and available water holding capacity is very low. Natural potential plant community is alder/wildrye.

SOIL GROUP 2: WILKINS SILT LOAM, 0 TO 5 PERCENT SLOPES

Nearly level to gently sloping, very deep, somewhat poorly drained soils formed in drainageways on plateaus.

The major map unit of this group is Wilkins silt loam, 0 to 5 percent slopes (85 percent) with minor inclusions of Setters, Westlake, and Taney soils. Wilkins has seasonal wetness and is subject to occasional flooding. Water erosion hazard is slight. Pesticide leaching loss potential is severe.

Wilkins soils are very deep and somewhat poorly drained. They are formed in loess and alluvium in drainageways on plateaus. Surface texture is silt loam and depth to bedrock is greater than 60 inches. Permeability is very slow and the available water capacity is high. A seasonally perched water table from 15 to 20 inches occurs form February to May. Occasional flooding occurs from March to May. Water erosion hazard is slight.

SOIL GROUP 3: NAFF-PALOUSE, 2 TO 10 PERCENT SLOPES

Gently sloping to strongly sloping, very deep, well drained soils formed on loess hills on plateaus.

The major map unit in this group is Naff-Palouse complex, 2 to 8 percent slopes (88%). Other units included are: Uhlig silt loam, 2 to 8 percent slopes (2.5%), Vollmer silt loam, 3 to 10 percent slopes (2.5%) and Naff-Waha complex 3 to 12 percent slopes (7%). Pesticide leaching loss potential is moderate.

The Naff soils are very deep and well drained. They formed in loess on convex and/or south to west facing slopes. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is high. The water erosion hazard is moderate.

The Palouse soils are very deep and well drained. They formed in loess on concave and/or north to east facing slopes. Surface texture is silt loam. Permeability is moderate. The available water capacity is high. The water erosion hazard is moderate.

SOIL GROUP 4: NAFF-PALOUSE-THATUNA, 8 TO 25 PERCENT SLOPES

Strongly sloping to moderately steep, very deep, moderately well to well drained soils formed on loess hills on plateaus.

The major map unit in this group is Naff-Palouse complex 8 to 20 percent slopes (70%). Other units included are: Uhlig silt loam, 8 to 20 percent slopes (13%), Thatuna-Naff complex, 10 to 25 percent slopes (14%) and Naff-Waha complex 12 to 25 percent slopes (3%). Pesticide leaching loss potential is moderate. Pesticide runoff loss potential is moderate.

The Naff soils are very deep and well drained. They formed in loess on south to west facing slopes. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is high. The water erosion hazard is severe.

The Palouse soils are very deep and well drained. They formed in loess on concave north to east facing slopes. Surface texture is silt loam. Permeability is moderate. The available water capacity is high. The water erosion hazard is severe.

The Thatuna soils are very deep and moderately well drained. They formed in loess on smooth to concave slopes. Surface texture is silt loam. Permeability is slow due to an abrupt silty clay loam subsoil at 29 to 40 inches depth. The available water capacity is high. The water erosion hazard is very severe. A seasonal perched water table occurs at 24 to 36 inches depth from February to April.

SOIL GROUP 5: NAFF-WAHA, 25 TO 40 PERCENT SLOPES

Moderately steep and steep, moderately deep to very deep, well drained soils formed on hills on plateaus.

The major map unit in this group is Naff-Waha complex, 25 to 40 percent slopes (82%). Other units included are: Uhlig silt loam, 20 to 35 percent slopes (13%) and Thatuna-Naff complex, 25 to 40 percent slopes (5%). Pesticide leaching loss potential is slight. Pesticide runoff loss potential is severe.

The Naff soils are very deep and well drained. They formed in loess on hills. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is high. The water erosion hazard is very severe.

The Waha soils are moderately deep and well drained. They formed in loess and basalt on south and west facing slopes. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is moderate. The water erosion hazard is very severe.

SOIL GROUP 6: SOUTHWICK-DRISCOLL-LARKIN, 2 TO 12 PERCENT SLOPES

Gently sloping to strongly sloping, very deep, moderately well to well drained soils formed on loess hills on plateaus.

The major map unit in this group is Southwick-Driscoll complex, 3 to 12 percent slopes (51%). Other units included are: Taney-Setters complex, 3 to 8 percent slopes (29%) and Driscoll-Larkin complex, 2 to 10 percent slopes (20%). There is less than one percent Joel-Setters complex, 2 to 10 percent slopes. Pesticide leaching loss potential is severe. Pesticide runoff loss potential is moderate.

The Southwick soils are very deep and moderately well drained. They formed in loess on smooth and concave slopes. Surface texture is silt loam. Permeability is moderate in the upper part and very slow in the lower part of the soil. The available water capacity is high. The subsoil is a dense silty clay loam that restricts roots and water movement at 29 to 36 inches depth. The water erosion hazard is moderate. A seasonal perched water table occurs at 20 to 36 inches depth from February to April.

The Driscoll soils are very deep and moderately well drained. They formed in loess on summits and shoulders of hills. Surface texture is silt loam. Permeability is slow. The available water capacity is high. There is an abrupt silty clay loam subsoil at 18 to 36 inches depth that restricts roots and water movement. The water erosion hazard is moderate. A seasonal perched water table occurs at 15 to 30 inches depth from January to April.

The Larkin soils are very deep and well drained. They formed in loess on hills. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is high. The water erosion hazard is moderate.

SOIL GROUP 7: SOUTHWICK-DRISCOLL-LARKIN, 8 TO 25 PERCENT SLOPES

Strongly sloping to moderately steep, very deep moderately well to well drained soils formed on loess hills on plateaus.

The major map unit in this group is Larkin-Driscoll complex, 10 to 20 percent slopes (37%). Other units included are: Southwick-Driscoll complex, 12 to 25 percent slopes (21%), Southwick-Bluesprin complex, 10 to 35 percent slopes (14%), Taney-Setters complex, 8 to 20 percent slopes (10%), Taney-Joel complex, 10 to 20 percent slopes (8%) and Southwick-Larkin complex, 12 to 25 percent slopes (3%). The remaining 7 percent of the group is composed of a mixture of Meland, Keuterville, Carlinton and Cavendish map units. Pesticide leaching loss potential is severe. Pesticide runoff loss potential is severe.

The Southwick soils are very deep and moderately well drained. They formed in loess on smooth and concave slopes. Surface texture is silt loam. Permeability is moderate in the upper part and very slow in the lower part of the soil. The available water capacity is high. The subsoil is a dense silty clay loam that restricts roots and water movement at 29 to 36 inches depth. The water erosion hazard is very severe. A seasonal perched water table occurs at 20 to 36 inches depth from February to April.

The Driscoll soils are very deep and moderately well drained. They formed in loess on summits and shoulders of hills. Surface texture is silt loam. Permeability is slow. The available water capacity is high. There is an abrupt silty clay loam subsoil at 18 to 36 inches depth that restricts roots and water movement. The water erosion hazard is severe. A seasonal perched water table occurs at 15 to 30 inches depth from January to April.

The Larkin soils are very deep and well drained. They formed in loess on hills. Surface texture is silt loam. Permeability is moderately slow. The available water capacity is high. The water erosion hazard is severe.

SOIL GROUP 8: KETTENBACH-KEUTERVILLE-GWIN, 35 TO 75 PERCENT SLOPES

Steep to very steep, shallow to very deep, well drained soils formed in loess and basalt colluvium and residuum.

The major map unit in this group is Kettenbach-Keuterville association, 35 to 75 percent slopes (47 percent) with a large percentage of Kettenbach-Gwin complex, 35 to 75 percent slopes (40 percent). Within this group there are inclusions of Hooverton, Linville, and Rock outcrop. Water erosion hazard is very severe. Pesticide leaching loss potential is slight and pesticide surface loss potential is severe. The major land use for these soil types is rangeland with marginal woodlands.

The Kettenbach soils are moderately deep and well drained. They are formed in a thin mantle of loess over basalt colluvium and residuum. Kettenbach soils are on concave south and west-facing canyon side slopes. Surface texture is stony silt loam. Depth to bedrock is 20 to 40 inches. Permeability is moderately slow and available water holding capacity is low. Water erosion hazard is very severe. Natural potential plant community is bluebunch wheatgrass/arrowleaf balsamroot.

The Keuterville soils are very deep and well drained. They are formed in loess and material weathered from basalt. Keuterville soils are on north and east-facing warmer lower elevation canyon side slopes. Surface texture is gravelly silt loam. Depth to bedrock is greater than 60 inches. Permeability is moderately slow and available water holding capacity is moderate. Water erosion hazard is very severe. Natural potential plant community is Ponderosa pine/common snowberry.

The Gwin soils are shallow and well drained. They are formed in loess and basalt colluvium. Gwin soils are on convex south and west-facing canyon side slopes. Surface texture is stony silt loam. Depth to bedrock is 10 to 20 inches. Permeability is moderately slow and available water holding capacity is very low. Water erosion hazard is very severe. Natural potential plant community is Bluebunch wheatgrass/Sandberg bluegrass.

SOIL GROUP 9: KLICKSON-JACKET-KEUTERVILLE, 20 TO 90 PERCENT SLOPES

Steep to very steep, very deep, well-drained soils formed in loess and material weathered from basalt on canyons.

The major map unit in this group is Klickson-Hooverton association, 35 to 90 percent slopes (28 percent) with a large percentage of Klickson silt loam, 35 to 90 percent slopes (20 percent), Jacket-Larkin complex, 20 to 50 percent slopes (27 percent), Keuterville gravelly silt loam, 25 to 50 percent slopes (7 percent), Kueterville-Rock outcrop complex, 35 to 90 percent slopes (5 percent), and minor inclusions of Taney, Joel, and Uptmor soils. Water erosion hazard is severe to very severe. Pesticide leaching loss potential is slight and pesticide surface loss potential is severe. The major land use for these soil types is rangelands with marginal woodlands.

The Klickson soils are very deep and well drained. They are formed in loess and material weathered from basalt. Klickson soils are on very steep north-facing canyon side slopes. Surface texture is silt loam. Depth to bedrock is greater than 60 inches. Permeability is moderately slow and available water holding capacity is moderate. Water erosion hazard is very severe. Natural potential plant community is Douglas-fir/mallow ninebark.

The Jacket soils are very deep and well drained. They are formed in loess and material weathered from basalt. Jacket soils are on canyon benches and shoulder slopes. Surface texture is silt loam. Depth to bedrock is greater than 60 inches. Permeability is slow and available water holding capacity is high. Water erosion hazard is very severe. Natural potential plant community is Ponderosa pine/common snowberry.

The Keuterville soils are very deep and well drained. They are formed in loess and material weathered from basalt. Keuterville soils are on south and west-facing canyon side slopes. Surface texture is gravelly silt loam. Depth to bedrock is greater than 60 inches. Permeability is moderately slow and available water holding capacity is moderate. Water erosion hazard is severe to very severe. Natural potential plant community is Ponderosa pine/common snowberry.

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