

3. IMPLEMENTATION PLAN

INTRODUCTION

The Cottonwood River carries high sediment and phosphorus loads during the growing season. This is predominantly the result of rainfall-driven polluted runoff that occurs throughout most of the watershed. The lower reach is affected by bacteria, exceeding the fecal coliform standard, and is subject to a total maximum daily load study (TMDL) in the next few years. The usefulness and aesthetic qualities of the river are impaired, and conditions are unlikely to improve unless changes are made in land use and water management practices within the watershed. These changes can be accomplished through an implementation plan that reflects real problems occurring on the landscape, and clearly identifies solutions to those problems while developing and organizing sufficient resources to attain meaningful and effective solutions.

One challenge faced in trying to formulate a plan to enhance water quality in the Cottonwood River and its tributaries is the size of the watershed. At 1,310 mi², and 840,200 acres, the Cottonwood Watershed is one of the three largest watersheds in the Minnesota River Basin and nearly double the size of the adjacent Redwood River Watershed.¹ Because nonpoint source pollution is the principal determinant of water quality in the Cottonwood River, and nonpoint source pollution by definition is dispersed, the size of the watershed substantially increases the difficulty of achieving quick, measurable results. There is simply too much area to cover for the time and resources allowed.

Another challenge that is partly related to size is actively involving people in the lengthy process needed to clean up the River. Most watershed residents do not live near the Cottonwood River, nor do they use the river for recreational or other purposes. Yet, the nature of the problem is such that nearly everyone in the watershed, through their actions, affects the condition of the river. Moreover, water quality improvements will require efforts on behalf of large numbers of people within the watershed, the same people who do not use the river now and who do not understand how their actions are connected to its fate.

The implementation plan for the Cottonwood River Watershed acknowledges the complex nature of nonpoint source pollution and the central role played by watershed residents in achieving water quality improvements. It is based, in part, on experiences gained through the Redwood River Clean Water Project. The Redwood River Project emphasizes best management practices (BMPs) on agricultural land supported by an information and education program that uses a variety of techniques to achieve participation. Because the Cottonwood Watershed is very similar to the Redwood Watershed in terms of land use, topography, soils, and climate, it is likely that the successfully applied accelerated BMP program in the Redwood Watershed will also be successful in the Cottonwood Watershed. It is also reasonable to expect that techniques

¹ The Chippewa Watershed is 2,085 mi², the Blue Earth is 1,566 mi², and the Redwood Watershed is 703 mi².

used to increase participation rates in the Redwood Watershed will also work in the Cottonwood Watershed.

Finally, the Cottonwood River, like the Redwood River and other tributaries to the Minnesota River, has long been thought of primarily as a drainage system, a means for conveying excess water from the landscape, and has not been valued as a resource for its own sake or for other uses. One intent of the implementation plan is to change this perception by developing and promoting alternative uses of the Cottonwood River thereby exposing residents to a more complete understanding and appreciation of the river's value. This, in turn, may instill a greater sense of watershed community and commitment to the future protection and enhancement of the Cottonwood River.

GOALS AND OBJECTIVES

Goals and objectives for the Cottonwood River Watershed are based on sampling results, land use assessments, and judgements about reasonable expectations for rivers and streams in this region of the state. In setting goals and objectives, consideration is given to four important watershed characteristics. First, agriculture is the predominant land use in the watershed and improvements to water quality will necessarily require changes in agricultural practices. Second, pollutant transport in the watershed is primarily affected by uncontrolled runoff. Third, the Cottonwood River holds enormous potential for being a recreational resource, but past and present conditions prevent it from being used to its full potential. And, fourth, watershed residents through their involvement and actions hold the key to protecting and enhancing the Cottonwood River.

Ten-year goals of the Cottonwood River Restoration Project are:

1. To achieve the highest water quality attainable for ecoregion streams;
2. To have watershed residents take an active role in enhancing and protecting the Cottonwood River; and,
3. To develop the Cottonwood River as a major recreational resource within the Minnesota River Basin.

A number of objectives have been selected to help achieve these goals. Objectives are to:

- ❑ Make the Cottonwood River from Sanborn to Flandrau Park navigable and canoe accessible
- ❑ Increase game fish populations in the main stem from near Lamberton to Flandrau State Park
- ❑ Produce and construct trails, signage, kiosks and outdoor learning centers
- ❑ Establish, train, and support a group of volunteers to monitor watershed health

- ❑ Accelerate adoption of best management practices (BMPs) in high priority areas
- ❑ Help watershed residents understand the connection between their actions and water quality
- ❑ Strengthen cooperation between agencies and units of government that address water quality issues
- ❑ Collect and distribute credible information about water resources in the watershed
- ❑ Work with municipalities and unsewered communities to develop point source reduction plans
- ❑ Develop and implement plans to address total maximum daily load (TMDL) requirements

PRIORITY MANAGEMENT AREAS

Priority management areas represent portions of the watershed determined to contribute a significant share of the pollutant load to the Cottonwood River. Directing attention toward these areas will result in the greatest benefit at the least cost. Selection of these priority areas is based upon sampling results, watershed assessments² and inventories completed during the course of the diagnostic study.

Several tributaries originating on the Coteau des Prairies including the creeks Plum, Pell, Dutch Charley, Highwater, and Dry, are identified as delivering a disproportionate share of the sediment and phosphorus load to the Cottonwood River. For this reason, they represent one of the priority management areas of the watershed. Sleepy Eye Creek, though showing low sediment concentrations during the sampling period, carries a high nitrate nitrogen load, and is selected as a second priority area. The third priority management area within the watershed is the lower main stem of the Cottonwood River from county road 8 near Leavenworth to Flandrau State Park. These three priority management areas are depicted on Maps 3.01 – 3.03.

The Coteau Streams selected to represent one of the priority management areas cover approximately 396 mi² or nearly 254,000 acres. It is not practical to expect that best management practices (BMPs) will be applied equally throughout these minor watersheds, even though the entire area is viewed as being a contributor of nonpoint source pollution. To get maximum results, it will be necessary to treat only the most critical portions of the priority management area. This will require additional research in the form of water quality and watershed assessments.

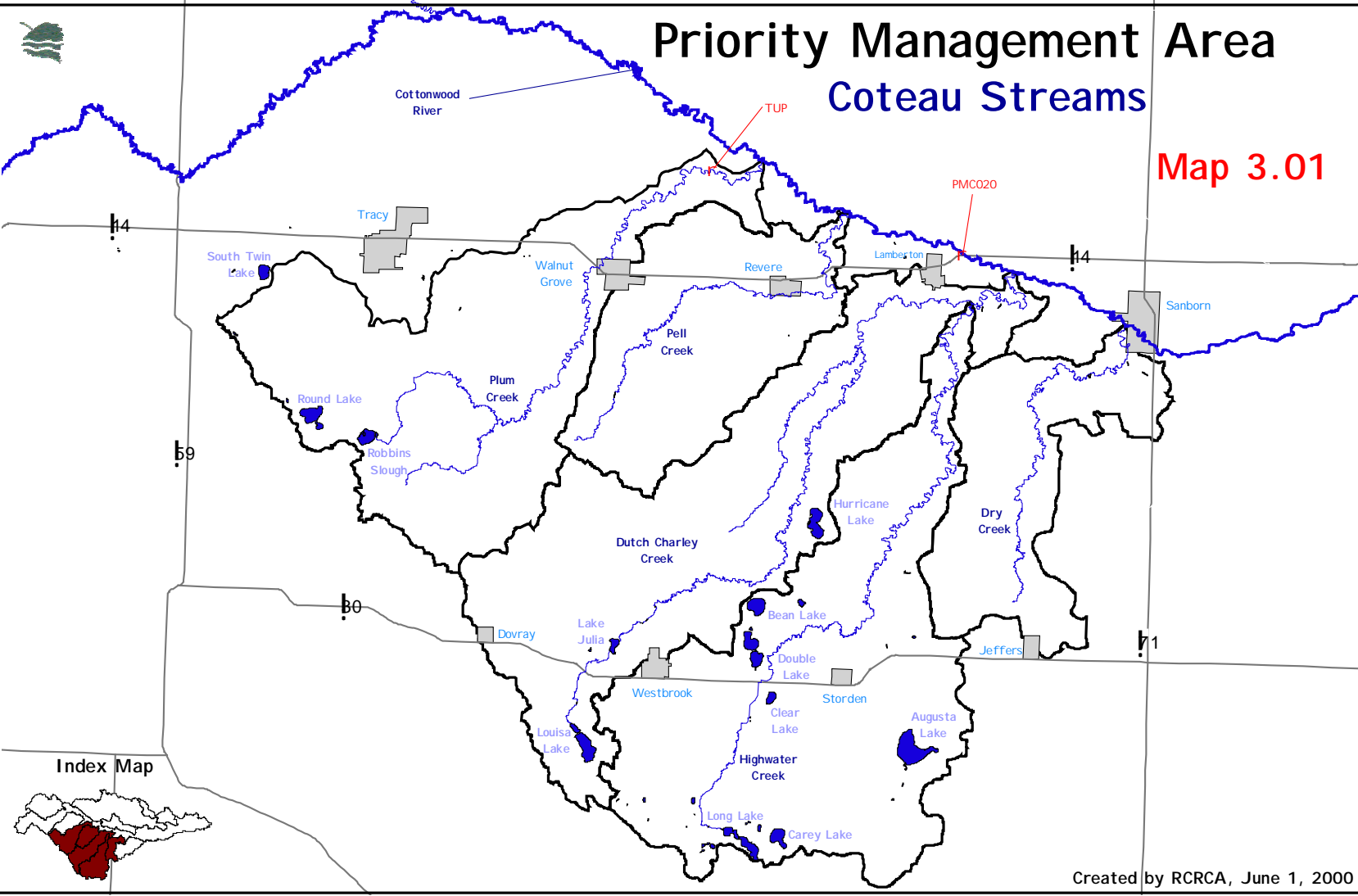
The diagnostic study began the process of refining the scope of areas in need of BMPs and the implementation phase will continue the process through several different approaches. First, additional water quality data will be collected through continuation of a monitoring program. Second, efforts are underway to complete a feedlot inventory within these watersheds. Third, TISWA and a tillage transect survey will be repeated in

² Information gathered through the tailored integrated stream and watershed assessment (TISWA) process forms the basis of these assessments.

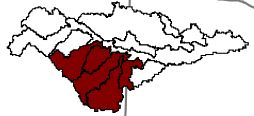


Priority Management Area Coteau Streams

Map 3.01



Index Map



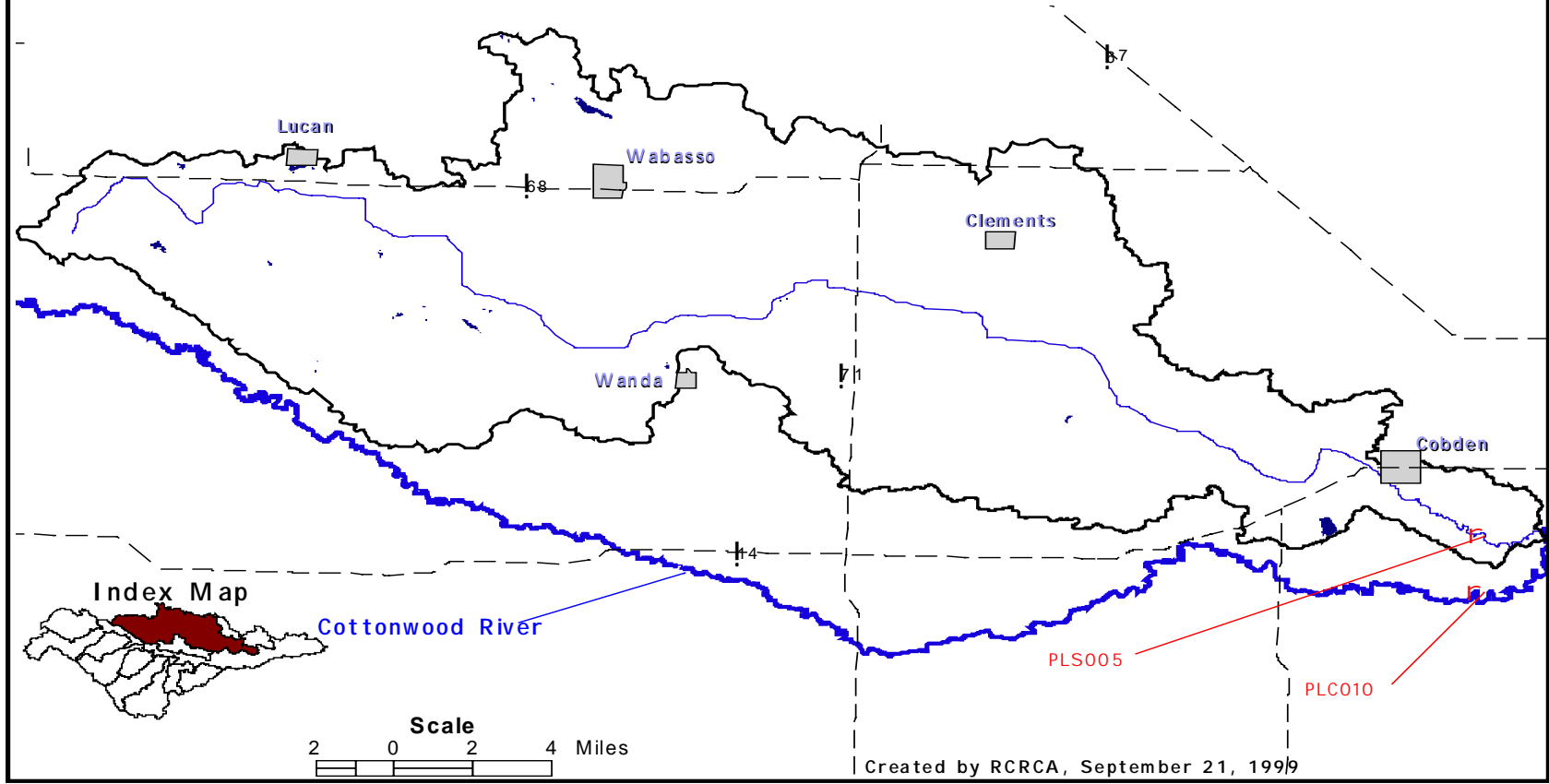
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Map 3.02

Priority Management Area

Sleepy Eye Creek Subwatershed

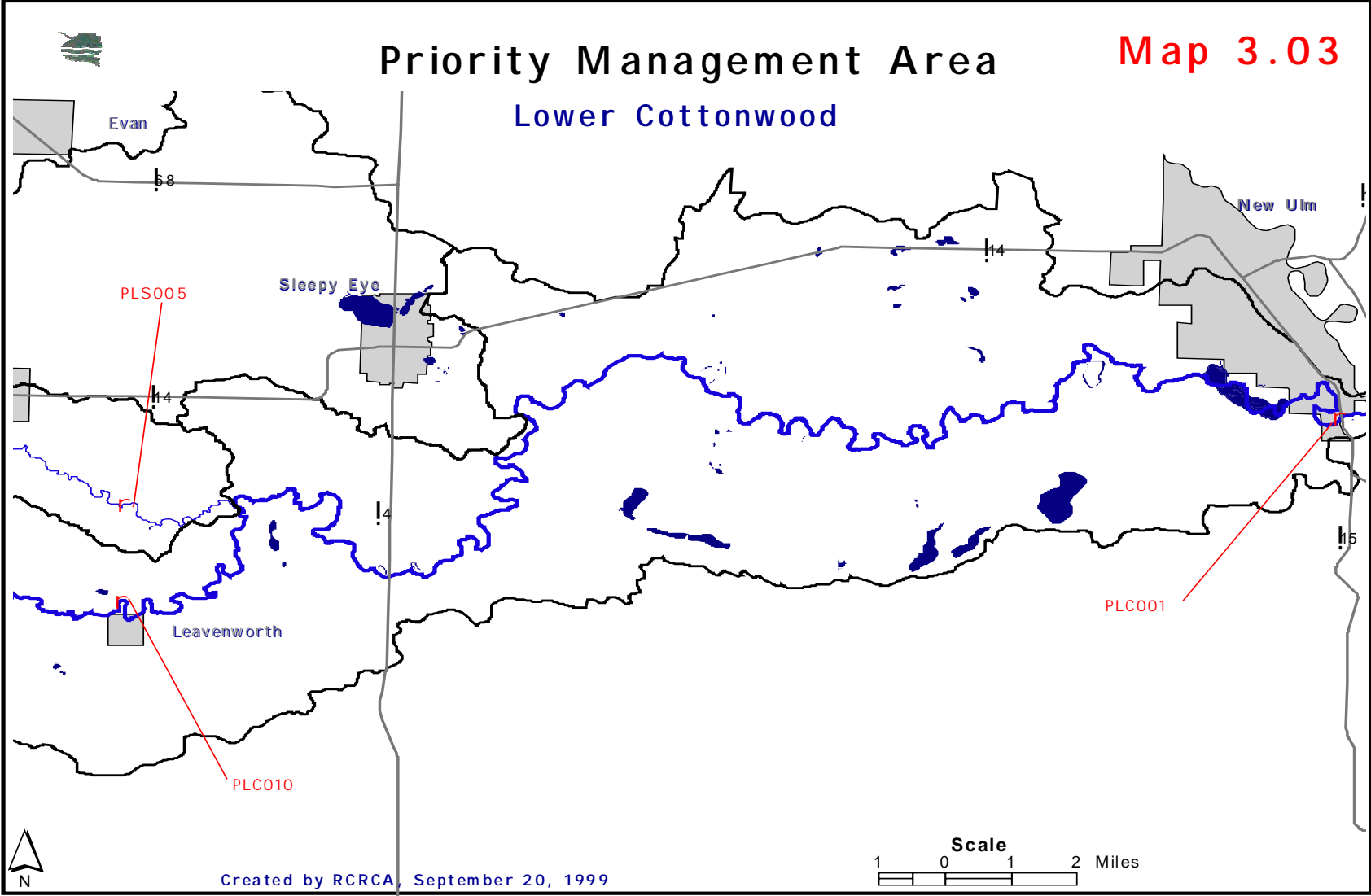


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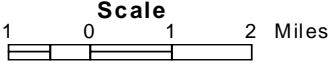
Priority Management Area

Lower Cottonwood

Map 3.03



Created by RCRCA, September 20, 1999



2000. And, finally, evaluations of the sediment and phosphorus reduction potential of BMPs for specific land areas will be completed prior to the approval and installation of the practices. This procedure will be immediately instituted for all BMPs that are started in 2000. In this way, water quality effectiveness of BMPs will be enhanced.

Nonpoint source pollution in Sleepy Eye Creek subwatershed appears to be related to nitrate losses from agricultural land devoted to row crops. Livestock and discharges from septic systems are also likely contributors. Sleepy Eye Creek is a relatively flat minor watershed with a low percentage of erodible soils. Sediment and phosphorus concentrations during the 1997-98 sampling seasons remained low, but nitrate+nitrite concentrations were frequently above 10 mg/L. Fertilization practices, and the manner in which nitrates are transported by the drainage system, are the two variables most in need of attention in this subwatershed. Additional research is needed to examine the frequency of buffer strips and tile intakes, presence and condition of septic systems, and the fertilization and tillage practices occurring in this minor watershed.

The lower reach of the Cottonwood River carries a very high sediment load as evidenced by 1997 sampling results. This reach represents a very important recreational opportunity, but its value as a fishery resource has been substantially compromised as a result of excessive sedimentation. A portion of the reach also violates the fecal coliform standard, making it unsuitable for swimming, another one of its designated uses.

Several isolated bank erosion sites have been documented in the reach, and are scheduled for repair as funds become available. These sites, and others, are undoubtedly contributing to the river's high sediment load. A more thorough investigation of bank erosion characteristics, assessments of overland runoff, and determinations of bacteria sources are needed to fully evaluate this reach, however. These actions are part of the implementation plan and will be completed in 2000.

Identification and Summary of Program Elements

Program Element 1: BMP/Resource Implementation

This element represents activities related to adoption or installation of best management practices (BMPs) including technical assistance for resource assessments, and practice selection, analysis, and design. Removal of log jams and associated streambank restoration practices are also contained in this program element as are urban BMPs. The acquisition and construction of trails, accesses, and outdoor learning stations are within this element as well.

Program Element 2: Monitoring

Contained in this program element is the establishment and maintenance of the watershed monitoring network, including collection and analysis of water quality and flow data. Other activities associated with this element are the tailored integrated stream and watershed assessment (TISWA) program, maintenance of the geographic information system (GIS) database, and resource inventories and assessments necessary to target implementation practices.

Program Element 3: Outreach

Outreach represents programs and actions that communicate project goals, objectives, and activities to outside audiences. Also included is recruitment and support of watershed assessment teams along with development and coordination of promotional events, displays, tours, and demonstrations.

Program Element 4: Evaluation

Included in this program element are attitude and opinion surveys of watershed residents, development and administration of a BMP tracking program, and periodic evaluations of major activities in all program elements.

Program Element 5: Administration

This program element includes all duties associated with fiscal management, reporting, supervision, and overall coordination of the Cottonwood River Restoration Project.

Best Management Practice (BMP) Alternatives and Analysis

Best management practices (BMPs) are defined as those practices, techniques, or measures for preventing or reducing nonpoint source pollution to a level compatible with water quality goals.³ These practices are often discussed in terms of systems, recognizing that individual BMPs have limited effectiveness, but combinations, or systems, can achieve significant nonpoint source reduction benefits.

Nutrient Management

Nutrient management involves careful management of all aspects of soil fertility, so that crop needs are met while minimizing losses to surface and groundwater supplies. This requires management of nutrients applied to the soil including commercial fertilizers and manure as well as in-place nutrients. Soil tests to determine existing nutrient levels are essential to nutrient management, and are necessary to determine the appropriate fertilizer requirements for a specific soil. The fertilizer application rate should be calculated by using soil test results and Minnesota Extension Service recommendations. The fertilizer application rate should consider the crop, soil type, previous crops, history of manure application, and method of fertilizer placement.

Nutrient management has been shown to have a very beneficial effect on water quality. Through use of proper rates, placement and timing of fertilizer application, loss of nitrogen and phosphorus can be reduced by 50% to 90%. It is easily the most effective way to reduce transport of soluble forms of nutrients to surface and groundwater. Sound nutrient management also reduces input costs, thereby increasing the profitability of crop production.

³ Descriptions and analyses of agricultural BMPs are taken from Minnesota Pollution Control Agency, [Agriculture and Water Quality: Best Management Practices for Minnesota](#), and U.S. Department of Agriculture, Natural Resources Conservation Service, [Conservation Choices](#).

Residue Management

Residue management is the practice of leaving last year's crop residue on the soil surface by limiting tillage. Tillage practices (conservation tillage) that leave at least 30% of the soil surface covered with crop residue are suitable to achieve adequate residue management. No-till, mulch till, and ridge till are three of the various techniques used to meet the 30% residue coverage rate.

Conservation tillage is effective for controlling soil erosion and helps control loss of nutrients that are attached to soil particles. Time, energy and labor savings from fewer tillage trips are related benefits of reduced tillage. These savings can offset the cost of tillage equipment needed to achieve adequate residue management. Residue management also helps maintain or develop good soil health, improve water infiltration and reduce evaporation from the soil surface while providing food and cover for wildlife.

The practice of residue management (>30% residue) does create additional challenges for the farmer. Factors such as crop sequence, soil texture and drainage, and climate must be considered. Under heavy residue conditions, well-drained soils are generally better suited to reduced tillage than poorly drained soils. Soil warming and drying can be delayed in the spring if high levels of residue are left on poorly drained soils.

Wetland Restoration

Wetland restoration or development can be achieved through use of small structures such as dikes to add water or regulate water levels in an existing wetland. Restoration can also be achieved by filling a surface drain or removing a subsurface drain. County or judicial ditches can also be modified to temporarily impound water. This practice is consistent with M.S. 103E, and can be accomplished in a way that does not impede drainage functions.

Wetlands are efficient sediment traps, preventing soil particles and attached pollutants from reaching lakes and streams. They also provide some removal of dissolved nutrients from runoff during the growing season. Wetlands provide habitat for waterfowl and other wildlife species and serve an important storage function in the watershed to help reduce peak streamflow.

Riparian Buffer Strips

Riparian buffers consist of trees and other vegetation located in areas adjacent to and upgradient from streams and ditches. This zone of vegetation is primarily designed to intercept surface runoff and remove nutrients, sediment, organic matter, pesticides and other pollutants prior to entry to surface waters. Riparian buffers also serve an important bank stabilization function, particularly when used in combination with in-stream restoration practices.

Sediment delivery reductions up to 80% have been reported on 4% slopes where buffers have been installed.

Water and Sediment Control Basins

Water and sediment control basins are earthen embankments constructed across depressional areas of concentrated runoff. They perform a function very similar to that of terraces. Drainage areas controlled by these structures should be less than 50 acres. In

many cases, a series of basins is needed to properly control erosion, and to be compatible with farm machinery.

This practice is very effective at preventing gully erosion, trapping sediment, and reducing downstream peak flows. They are capable of trapping up to 60% of total suspended solids contained in runoff. However, they are not effective at removing soluble pollutants.

Livestock Waste Management

Livestock waste management refers to storage facilities, but it also includes practices such as buffer strips and livestock exclusion, where appropriate. If manure is not handled properly, it is a source of bacteria, nutrients, ammonia and total suspended solids. The impact of feedlot runoff on surface waters depends on size and location, although feedlots distant from surface water can contribute pollution if runoff becomes channelized or reaches a ditch or tile. Generally, if a feedlot is large and close to a lake or stream, the impact is significant. If the feedlot is small and a long distance from a surface water body, the impact may be minimal.

A waste management system is a combination of practices used to temporarily store manure until it can be properly applied to cropland. Examples include waste storage ponds, waste storage structures, and solid waste storage areas. Storage ponds are earthen structures that usually require liquid manure handling equipment for agitation, hauling, and field application. Storage structures are fabricated containment areas such as a pit below a confinement building or an above-ground structure. These also require equipment to handle liquid manure. Solid storage areas are usually concrete slabs designed to store solids and allow liquids to run off. They require some type of runoff containment to prevent polluted runoff from leaving the site.

Waste management systems typically achieve pollutant reductions in the range of 50% to 75%. Systems that totally control runoff can eliminate all pollutant discharges. Careful consideration must be given to design and construction of these systems to prevent groundwater contamination. Even with proper construction, however, a certain amount of seepage is expected from earthen ponds. Waste management systems can be relatively complex and expensive and, therefore, are not an attractive alternative to many farmers.

Runoff from feedlots can be controlled with several practices that may or may not be used in conjunction with a waste management system. Diversions prevent clean water from flowing over the feedlot. Roof water can be collected and routed away from the feedlot. Filter strips are another effective way to treat feedlot runoff by allowing it to pass over an area of vegetation.

Another way to manage livestock waste in a non-feedlot situation is through exclusion. Livestock exclusion involves fencing off areas where grazing would cause erosion of streambanks or allow water quality to be lowered by livestock activity in the stream. This practice can achieve a 50% to 90% reduction of suspended solids and phosphorus within a stream reach.

Individual Sewage Treatment Systems (Septic Systems)

Septic systems are recognized as an acceptable means for treating wastewater. The system consists of a septic tank and drainfield. The septic tank provides a place for

large solids to settle and to be decomposed by microorganisms. The drainfield removes fine solids and destroys accompanying bacteria. Effluent from a septic tank contains solids, phosphorus, nitrogen, chloride, bacteria, viruses, and organic chemicals. For this reason, it is illegal to discharge a septic tank directly to a tile line or other surface water.

Pollutants from a properly sited, installed, and maintained septic system will be adequately treated within two to three feet below the drainfield. Soil characteristics are important considerations in the design and installation of septic systems. A poorly functioning septic system is a threat to the water quality of nearby streams, lakes, and groundwater. Routine maintenance is critical to prevent septic system failure. The tank should be inspected at least once every year, and, with ordinary use and care, the tank should be pumped every one to three years.

Grassed Waterways

A grassed waterway is a natural or constructed channel, usually broad and shallow, that is planted with grass to protect soil from erosion by concentrated storm flow. Runoff water that flows down the drainageway flows across the grass rather than eroding soil and forming a gully. An outlet is often installed at the base of the drainageway to stabilize the waterway and prevent a new gully from forming.

Grassed waterways are estimated to reduce sediment losses from the flow area by 60% to 80%. Although grassed waterways act as a filter to remove sediment from runoff, waterways should not be utilized primarily as a filter strip because siltation leads to reduced filtering capacity. Likewise, the watershed above a waterway should be treated to control erosion before construction to prevent the waterway from prematurely filling in with sediment. Vegetation may be difficult to establish in a waterway, so erosion control barriers or mulching may be needed during vegetative establishment.

Streambank Restoration

Streambank erosion is a continually occurring natural condition that can be greatly accelerated by human activity. Over time, natural streams tend to reach equilibrium so that erosion at one location is roughly balanced by deposition at another. Human alterations to hydrologic and streamflow patterns can, however, upset this balance and lead to severe consequences. Streambank failure, defined as the collapse or slippage of a large mass of bank material into the stream, is one example of what happens when this balance is upset.

Because of the complexity of physical processes affecting streams, there is not one single type of streambank failure, but many different types. Consequently, streambank protection or restoration practices must be tailored to the specific causes of the streambank problem. Through an understanding of the problem's cause and selection of the proper bank protection method, the likelihood of protecting an eroding streambank is significantly increased.

One of the most common techniques used for streambank protection is rock riprap. It is a very effective method when used properly, but it is also very expensive. Riprap consists of rock material placed on the bank surface at the location of the erosion problem, and serves to protect the bank from erosion by protecting it from the erosive forces of the stream. The rock should extend far enough up on the bank to where natural vegetation can provide adequate protection.

The most common method of riprap placement is dumping the rock material onto the streambank. Careful placement of the rock material is often necessary, however, to avoid separation of the large and small stones.

Bioengineering represents an attractive alternative to the use of rock riprap for streambank protection. This approach combines mechanical, biological, and ecological concepts to arrest and prevent shallow slope failures and erosion. Immediate soil reinforcement is achieved by specific plant arrangements at the site. In conjunction with the vegetative cover, structures (see Table 3.01) should also be used. Structures stabilize slopes during the critical time for seed germination and root growth. A well-established root zone will provide shear strength and resistance to sliding. Overall benefits of bioengineering practices include slope stabilization, improved infiltration, runoff filtration, excess moisture transpiration, ground temperature moderation, habitat improvement, and aesthetic enhancement.

Bioengineering techniques can be used to develop sustainable systems for slope or streambank protection. The combination of correct assessments of stream corridors along with bioengineering practices has proven to be cost effective and environmentally sensitive. Installations can be labor intensive, but less costly than conventional engineering solutions.

Table 3.01 lists major bioengineering practices and the problems for which they are most appropriate.



Logjam along the Cottonwood River.

Table 3.01: Appropriate Bioengineering Streambank Protection Measures⁴

<u>Erosion Process</u>	<u>Protection Measure</u>
Headcutting and general bed degradation	Bioengineering not recommended Grade control or bed armoring needed
Toe erosion and upper bank failure	Live cribwall Brushmattress Rock toe with vegetation Joint Plantings
Local bank scouring	Branchpacking Live cribwall Live fascine Joint planting Tree revetment Rock toe with vegetation
General scour of middle and upper bank	Brushmattress Live fascine Live stakes Joint plantings
Gully from overbank runoff	Divert runoff and repair area with Branchpacking Live fascine Live staking
Piping	Divert runoff and repair area With branchpacking Live staking

Terraces

A terrace is an earthen embankment that is constructed across a slope to intercept runoff. Terraces are best suited to uniform, gently to moderately sloping fields (2% to 12% slopes) that have erosion problems. There are two basic types of terraces. Storage terraces collect water and store it until it can infiltrate into the ground or be released through a stable outlet. Gradient terraces are designed as a channel to slow runoff water and carry it to a stable outlet like a grassed waterway.

Properly designed, installed, and maintained terraces can be very effective at reducing erosion and trapping sediment and nutrients. Studies of storage terraces show reductions of 95% for sediment, 84% for soluble nitrogen, 93% for attached nitrogen,

⁴ This table can be found in Gary Wells, USDA, Natural Resources Conservation Service, Bioengineering Techniques for Streambank Protection.

73% for soluble phosphorus, and 93% for attached phosphorus. Gradient terraces provide less infiltration, and therefore, less benefits.

Terraces are not recommended on fields with very stony, steep, or shallow soils, nor are they recommended on fields with very irregular topography and short slopes. They are also relatively expensive to install, and require a substantial amount of time to design and construct.

Contour Farming

Contour farming is farming with row patterns around the slopes rather than up and down the slopes. Ridges built by tilling and planting on the contour create hundreds of small dams that slow water flow and increase infiltration which reduces erosion by as much as 50%. No special equipment is necessary for this practice, but design can be enhanced by engineering supervision.

Diversion

A diversion is an earthen channel constructed across a slope to collect water and prevent damage to an area below. Diversions act much like a terrace, but their purpose is to direct or divert runoff water from an area. A diversion is often built at the base of a slope to divert runoff away from bottomlands. These structures may also be used to divert runoff from a feedlot or to collect and direct water to a pond.

On cropland, properly located diversions can reduce soil erosion by 30% to 60%. Used in conjunction with a waste management system, they are very effective at preventing unpolluted runoff from entering a feedlot.

Grade Control Structure

These structures involve pipe outlets or drop spillways and are used to allow water to drop to a lower elevation while protecting the soil from gully erosion or scouring. While they are expensive to design and construct, grade control structures can be a very necessary component of an overall management plan. They are often used at the outlet of a grassed waterway to stabilize the waterway outlet.

Sediment originating from unstable areas can be reduced from 75% to 90% with grade control structures, but they are only effective for very localized erosion control.

Pasture Management

Pasture management involves proper use and treatment of pasture so that the life of desirable forage species is prolonged, and the quality and quantity of forage is increased. Improving the quality of forage on pastures protects soil and minimizes runoff.

If the pasture has gully erosion problems, structural practices such as diversions, grassed waterways, or grade stabilization structures may be needed. Other pasture management techniques to consider include: rotational grazing, which involves short-term grazing followed by a rest period; seasonal grazing, where warm and cool season grasses are pastured in their particular season of growth; and liming and fertilizing, which provide proper soil fertility for forage production.

Rock Inlets

Surface, or open tile, inlets are believed to be a direct pathway for sediment and nutrients to reach surface water. Although they are a useful component of cropland drainage systems, they do not allow for adequate filtration of runoff.

A counter practice to surface inlets is that of rock inlets. There are several configurations of this practice, but most commonly, it requires a fabric-covered perforated tile placed in a trench and connected to the existing tile line.⁵ The trench is filled with varying sizes of rock to one foot above ground level. This system eliminates the above-ground tile inlet. Normally this trench is approximately twelve feet long by three feet wide and three feet deep. Runoff from the surrounding landscape is filtered through the trench rather than drained through a pipe as before. Preliminary research indicates that approximately one-half of the sediment delivered through surface inlets is delivered through rock inlets.

Because rock inlets do not substantially interfere with use of farm machinery, they are well received within the farming community. Crops can be planted over the inlets, but care should be taken around them when doing tillage. Maintenance needs are limited to removing and replacing the top twelve inches of rock after drainage efficiencies have decreased.

Urban Practices

In towns and cities, as in rural areas, what we do on the land is reflected in our water. When rain falls or snow melts, the runoff washes pollutants off streets, parking lots, lawns and construction sites. The water becomes polluted when it picks up grass clippings, leaves, pesticides, excess nutrients, motor oil and pet waste. Efficient drainage systems carry the polluted runoff to ditches, tributaries and rivers without any treatment. Although there is much less urban than rural area in the Cottonwood River Watershed, urban areas have more impenetrable surfaces that allow for faster and easier runoff. Pollutants found in urban runoff are similar to rural runoff and include sediment, nutrients, oxygen-demanding materials, and bacteria.

The following is a list of best management practices that will help reduce polluted runoff in urban areas.

Recycle oil

Used oil from cars and motors should be carefully removed and put into a leak-proof container. Every county has a hazardous waste removal day that the used oil can be disposed at to eliminate improper dumping.

Direct downspouts to lawns

Runoff from roofs that eliminate water quickly also wash pollutants into storm drains. When the water is directed onto a lawn, it irrigates the lawn and provides an opportunity for slowing the water down by soaking into the grass where a natural filtering process takes place.

⁵ The Southwest Research and Outreach Center has ongoing research which is assessing alternatives to surface tile inlets. As new information becomes available, it will be incorporated into the promotion and use of this practice.

Sweep paved areas to keep waste out of storm drains

Water in the form of runoff picks up contaminants from paved areas and carries them directly to a river or tributary. By keeping paved areas free of litter and chemicals, it is possible to eliminate some of the pollutant loading from runoff.

Keep cars tuned, repair leaks

Fluids from automobiles pollute water when they leak from the car and enter the river or tributary from a water source. It is possible to eliminate this by checking for leaks and keeping a schedule of tune-ups to insure a proper running car. Recycle auto fluids, such as oil, antifreeze, and transmission fluid.

Limit fertilizer and pesticide use, leave grass clippings on the lawn

Soil testing before applying fertilizer will provide the best use of chemicals with the least amount of extra that could runoff into the river or water source. Grass clippings left on the lawn are equal to one fertilizer application per year. When leaves or grass clippings are left on paved surfaces, they get washed into storm drains and are delivered directly to a water source. As they decay, nutrients are released, which provide food for unwanted growth in rivers, streams and lakes.

Clean up pet waste

Pet waste carries disease-causing bacteria. It should be thrown in the trash, flushed down the toilet or buried.

Dispose of toxic wastes properly

Properly dispose of car oil, antifreeze, thinners, solvents, paints, pesticides, and don't purchase more than what is necessary for the job. Do not wash brushes under running water in the sink. Use hazardous waste pick-ups to eliminate storing and possible leakage.

Wash cars on the lawn or at a car wash

To reduce the amount of runoff directly to a storm drain, wash the car on the lawn so waste water has an opportunity to slowly filter through soil and vegetation. Dirty water from a commercial car wash goes to a wastewater treatment plant where pollutants are removed.

Use construction site erosion control

Erosion control is important for public building as well as private building. Without erosion control measures, every acre under construction delivers about a dump truck and a half of soil into a nearby water source.

Related Resource Implementation

The character of the Cottonwood River has changed greatly over the years from the first pioneer settlements. Each year in both agricultural and urban settings, topsoil is lost to erosion resulting in damage to the river and other natural resources. Natural resources offer something for everyone in Minnesota. At this time, there are limited recreational opportunities along and on the Cottonwood River, yet every season holds the possibility of enjoying the river by local residents and visitors. Joseph N. Nicollet wrote in his 1838-1839 Journal, "We long to camp and turn toward the Cottonwood which is in

view to our left where it makes three or four bends, or capes, leaving charming little valleys between its course and the slope of the plateau that we are crossing. The SE wind blows very strongly, but the sky clears and the air is sweet from innumerable thickets of wild roses in full bloom that border the woods along the river.”

The Cottonwood River is one of only a few designated canoe routes in the Minnesota River Basin. At this time, however, it is impossible for canoes to travel the designated route due to logjams across the river. One seventeen mile stretch of the river from south of Essig to New Ulm has been maintained by the Minnesota Department of Natural Resources (DNR) to make it passable for canoes. People canoeing and fishing on the river use the cleared area on a regular basis. Further west, however, the river is completely blocked by seemingly endless logjams that make canoeing and fishing nearly impossible. As a designated canoe route, the river is expected to be available for its intended use, and DNR or another qualified group need to increase efforts to maintain the river farther to the west. If there is no way to use the resource, why protect it? Why should producers care? If the river isn't used as a river by local residents, it will continue to be viewed as a drainage ditch. Why clean up a ditch?

Logjam removal will help alleviate bank erosion as the logjams divert the water and provide the impetus for erosion. Bank erosion is a pronounced problem in the eastern part of the river valley, exactly where the canoeing is best. Removing logjams consists of using a DNR approved plan so fish and wildlife habitat is not degraded. This is accomplished by leaving some of the material in the channel. The designated logs are removed from the river, and secured or removed from the floodplain to prevent re-entry during flood stage.⁶

Fishing as indicated by our Diagnostic Study shows that there are a variety of fish in the river. Changes from the removal of the dam in 1995 at Flandrau State Park may influence future species. Time is needed for the habitat to return to a natural state. In 1999, preliminary findings from the DNR found that game fish were scarce but evident, while an abundance of nongame fish were found at each location. Fishing has been an activity enjoyed by many local residents. Changes such as logjam removal and improvement of water quality in the river need to be made for this opportunity to be continued and enhanced.

The Cottonwood River and its adjacent land area have a long history of people using it for hiking, canoeing and enjoying nature. Rivers and trails link towns and historic areas, as well as provide an economic gain for the region. Trails and canoe accesses offer recreation and outdoor activities for individuals, families, school groups, community groups and clubs as well as educational opportunities. The steps necessary for trail development are difficult and lengthy, however, the end result of people using and appreciating a beautiful resource outweigh the problems. Securing land for trails is accomplished through an agency such as Minnesota Department of Natural Resources

⁶ RCRCRA, working in conjunction with DNR, completed a successful logjam removal and bank stabilization program on the Cottonwood River in 1986-87. Using stabilization techniques pioneered by George Palmiter and removing only enough logjams to make the channel passable, the program improved flow conditions and stabilized numerous eroding banks in upper reaches of the river. Lack of ongoing maintenance, however, has reduced the effectiveness of these improvements so that today another similar initiative is needed.

(DNR), or through a local government unit such as a county. Development of a trail can begin after land is secured. Again, a trail will be designed with supervision by the DNR, as well as the landowner to guarantee appropriate habitat for wildlife and safety precautions for users. Canoe accesses will be developed using past models as well as considering the unique situation each access provides.

BMP Selection and Justification

Principal nonpoint source pollutants identified in the Cottonwood River Watershed are total suspended solids, phosphorus, and nitrate nitrogen. Land use practices and the highly developed hydrologic system in the watershed affect concentrations and delivery rates of these pollutants. Best management practices (BMPs) can play an important role in reducing the sediment and nutrient load in the Cottonwood River, particularly when they are concentrated within priority management areas and are chosen for their ability to address the main problems within these areas.

Although BMPs can help improve water quality in the Cottonwood River, there are limitations affecting their adoption and use. For example, some practices are expensive, requiring investments in equipment and materials, or loss of income producing cropland. Certain other practices require considerable technical assistance such as design or engineering assistance before they can be constructed. Some BMPs require a fundamental change in management style for landowners that may be difficult to undertake. And, finally, a common limitation with several BMPs is landowner acceptability related to cultural or social norms. Among landowners within geographic areas, some types of practices are more accepted than others. So, even though BMPs are a desirable means for attaining water quality improvements, how readily and extensively they are adopted is influenced by such factors as cost, ease of adoption, and social acceptability.

In recognition of the difficulties related to use of BMPs, public incentives have arisen to help reduce or offset costs that may be incurred by landowners. Cost-share, incentive payments, loans, and easement payments are methods used to transfer a major portion of the cost related to a BMP from the landowner to the general public. This is done mainly because most of the water quality benefits associated with the use of BMPs occur off-site or downstream, not at the site of their use. Public benefits in the form of cleaner water implies that the public ought to pay landowners to use practices that may have little direct benefit to the landowner.

Sometimes incentive payments, cost-share or other economic inducements are sufficient to achieve land use changes. Other times, these methods need to be supplemented with additional measures. Success of the Conservation Reserve Program (CRP), the Reinvest in Minnesota Program (RIM), and programs that cost-share seventy-five percent on certain structural BMPs suggests that economic incentives can be a necessary and very useful tool. For instance, it is doubtful that very many landowners would voluntarily relinquish cropland to protect water quality and improve wildlife habitat. Generous payment rates, however, have made this transition a popular choice. Similarly, erosion that does not affect productivity but does degrade downstream water quality is much more likely to receive landowner attention if someone else pays most of

the cost. Without cost-share, it would be easy to delay taking corrective action on a problem lacking direct consequences.

There are many instances, however, where economic incentives alone are ineffectual. In these cases, other measures are required if people are to be persuaded to use BMPs. As an example, regulatory controls can be used to increase participation. This approach is being used with some success in other watersheds to encourage landowners to upgrade septic systems and feedlots. It is an especially effective method when combined with economic incentives such as cost-share or low interest loans. Regulatory controls combined with economic incentives do not always result in compliance, however. Within the watershed, there are many septic systems and feedlots that remain out of compliance for reasons not easily defined or understood. Additional inspection and enforcement action may be needed, along with more attractive financial incentives, to effectively deal with septic and feedlot problems.

Education is another proven method for increasing BMP adoption rates. Research demonstrates that many landowners lack knowledge about land use effects on water quality, and about various practices that can be used to reduce pollution. Again, when combined with economic incentives, accurate information presented in an unbiased manner will influence people to make wise land use decisions.

Selection of appropriate BMPs to enhance water quality must therefore be based on recognition of factors limiting their use and factors that overcome or negate these limits. Technical solutions such as BMPs are only effective if people are willing to use and maintain them. Because this willingness is conditioned by many factors, some of which are poorly defined or unknown, selecting appropriate practices is a difficult task. For instance, widespread use of residue management (>30%) and strategic wetland restoration would go a long way toward improving water quality in the Cottonwood Watershed. Unfortunately, experience has shown both these practices are unpopular with large numbers of landowners. New techniques are therefore needed to help change attitudes in order for these less popular, but highly effective, BMPs to be more readily adopted. Repeated personal interaction with landowners is an example of a technique used successfully in several watershed projects to increase usage of all types of BMPs. To encourage use of BMPs in the priority management areas, a systematic program will be used that combines personal contacts, accurate information, land use controls, and financial incentives.

Following is a list, by priority management area, of BMPs selected to achieve water quality objectives. Selection is based both on the inherent ability of these practices to alleviate primary pollutant sources and acceptability of these practices to the local community.

Coteau Streams Dry, Dutch Charley, Highwater, Pell, and Plum Creeks

Total suspended solids (TSS) and total phosphorus (TP) are the major pollutants of concern within this priority management area. A thirty percent reduction in each is needed to achieve water quality goals for Coteau streams. Fecal coliform bacteria is another concern within this area, although additional data are needed to fully assess bacteria loadings.

Terraces

Terraces are well suited to the terrain of this portion of the watershed, and are particularly effective at trapping sediment from eroding fields in upper portions of the priority management area. They are also favored by area farmers as a useful erosion control and water quality BMP, and will be used in conjunction with other practices. The primary method for funding terraces is 75% cost-share provided through the state cost-share program.

Grassed Waterways

Grassed waterways are another effective erosion control BMP suited to the terrain of this priority management area. They have significant sediment reduction capability (60% to 80%) and are also popular with area farmers. Additionally, waterways can be used very successfully within an overall residue management system. Costs of grassed waterways will be covered through the state cost-share program.

Rock Inlets

Although the number of surface inlets within the priority management area is thought to be small, the sediment and nutrient reduction (50%) effect of this practice is substantial enough for it to be considered as part of the BMP package. This practice is eligible for state cost-share, so landowner expense to convert to rock inlets can be held to a minimum.

Livestock Waste Management

Livestock waste management practices are important methods of addressing nutrient concentrations in area streams. There are several feedlots within the management area that are potential pollutant sources. Efforts are underway to complete a level II feedlot inventory that will provide more accurate information about the condition of these lots. Storage facilities may be required for some, but equally important is promotion and use of filter strips, diversions, and other appropriate low-cost practices to manage feedlot runoff.

Livestock exclusion can also be used to protect water quality at several locations within this priority management area. Streambank protection will be an additional result of livestock exclusion, which will help alleviate sediment deposition from eroding banks.

Low interest loans and state cost-share will be used to meet costs associated with these practices.

Riparian Buffer Strips

Riparian zones in several portions of the priority management area have been stripped of permanent vegetation. Incentive payments through the Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP) to install buffer strips are extremely attractive, making this practice very acceptable to landowners. This acceptability, combined with an ability to filter nutrients and sediment and to provide wildlife habitat, make riparian buffer strips a particularly effective BMP for this area of the watershed.

Residue Management

Eroded topsoil is the primary source of the sediment and nutrient load transported by streams originating on the Coteau. Within these minor watersheds, practices that reduce cropland runoff, such as residue management, will provide the greatest water quality benefits.

Residue management, or conservation tillage, is a relatively low cost best management practice (BMP) that will be promoted in this priority management area. Depending on the amount of residue present, conservation tillage practices can reduce soil erosion up to 95% compared to intensive tillage. No-till planting systems provide the greatest protection, but as little as 30% residue cover can reduce erosion by about 65%.

Results of residue surveys between 1995 and 1998 show that only around one-half of the cropland in this portion of the watershed meet residue targets (corn >15%, soybeans >30%). There is a significant opportunity to expand the use of this practice and achieve substantial water quality benefits. Low interest loans will be used to increase participation rates.

Nutrient Management

Nutrient management is an important consideration when making the transition from conventional to conservation tillage. A common mistake is to use the same fertilizer program after making the transition. Nutrient management therefore will be promoted in combination with residue management.

The greatest benefit to be derived from nutrient management in this priority management area is a decrease in concentrations of soluble phosphorus and nitrates delivered to the Cottonwood River. Given the large number of acres that can be converted to conservation tillage systems, and the corresponding emphasis on nutrient management, considerable progress can be made to reduce suspended sediment, phosphorus, and nitrate concentrations in streams within the priority management area.

Septic Systems

Most septic systems in the priority area are thought to be poorly functioning, and contributing to the pollutant load. Elevated fecal coliform bacteria counts at tributary sampling stations during the study period give credibility to this belief.

System inspections and enforcement of local codes are necessary first steps in the process leading toward upgrades of malfunctioning septic systems. Replacement costs can be quite high, so low interest loans are needed to provide owners with an incentive to repair or replace failing systems. Unsewered communities may require special grants to bring systems into compliance.

Water and Sediment Control Basins

Water and sediment control basins are well suited for the rolling topography of this priority management area. This portion of the watershed contains a relatively high percentage of erodible soils, and water and sediment control basins are effective in preventing gully erosion, trapping sediment (40% to 60%), and reducing downstream peak flows. The state cost-share program will offset costs associated with this practice.

Urban Practices

There are eight towns located within this priority management area. Problems associated with pollutants in urban runoff include residents using unfiltered storm drains to dispose of hazardous materials such as used oil from cars and motors. Urban areas also have more impenetrable surfaces that allow faster and easier runoff of pollutants. Lawn fertilization and other homeowner BMPs will improve the discharge of untreated water to surface water. An outreach program will be used to increase awareness and participation rates.

Sleepy Eye Creek

The water quality goal for Sleepy Eye Creek is to achieve a thirty percent reduction in nitrate nitrogen (N-NO₂+NO₃) concentrations. Other concerns in this priority management area are total suspended solids (TSS) and total phosphorus (TP).

Residue Management

Less than one-third of the cropland in this minor watershed meet residue targets according to crop residue survey results. Although concentrations of total suspended solids (TSS) during the study period were relatively low, rainfall amounts and streamflow were also low during this time period. Intensive row crop agriculture, relying on conventional tillage and supported by a well-developed artificial drainage system containing a large number of surface inlets, suggests that the subwatershed may be a substantial contributor of TSS during years of greater rainfall and runoff. For this reason, residue management is selected as a major watershed BMP.

Nutrient Management

Nutrient management becomes an important BMP as conservation tillage becomes more prevalent in the watershed. High NO₂+NO₃ concentrations during the study period may indicate that nitrates are being lost through tile lines under current management practices, making nutrient management a very important BMP in this priority management area.

Rock Inlets

Replacing surface tile inlets with rock inlets will help reduce nitrate losses from the subwatershed. The combination of this practice and residue/nutrient management will provide an excellent system for reducing sediment and nutrient transport from Sleepy Eye Creek to the Cottonwood River.

Riparian Buffer Strips

According to DNR assessments, Sleepy Eye Creek, from river mile 5.8 to river mile 48.3, is entirely ditched. Aquatic habitats in this reach are extremely degraded, and virtually no game fish habitat is present. Deposition of sand in the lower portion of the creek has created a wide, shallow ditch.

Riparian buffer strips reduce sediment delivery rates up to 80%, and they create a zone between the cropland and the creek. Reestablishment of this riparian zone would greatly enhance the value of this resource. As in the other two priority management

areas, there are financial incentives through programs such as CREP and CRP to establish riparian buffer strips.

Individual Sewage Treatment Systems

Septic systems may have contributed to the elevated nitrate concentrations recorded during the study's sampling period. Many of the systems within the watershed are considered to be poorly functioning, and in need of replacement. Low interest loans will be used to upgrade failing systems including those within unsewered communities.

Wetland Restoration

Nearly all the original wetlands in Sleepy Eye Creek subwatershed have been drained. Only about 1.4% of this minor watershed 175,000 acres are presently classified as wetlands. There are considerable opportunities therefore to develop wetlands in this priority management area.

Wetlands are excellent areas for trapping sediment and preventing soil particles, with pollutants attached, from reaching streams and lakes. Water sampling results indicate high levels of nitrates in Sleepy Eye Creek. Concentrations may be reduced through wetland filtration. Map 2.12 shows soil types that are indicative of past wetlands and suitable for future wetland restoration.

Wildlife habitat is another important function of wetlands. Due to extensive ditching within the watershed, additional habitat would be a significant improvement. A number of programs including CRP, RIM and CREP provide easement payments to restore wetlands.

Urban Practices

Nutrient runoff is not only an agricultural problem, but an urban problem as well. Fertilizer runoff resulting from over or improper application can easily be transported to surface waters, and should be considered a contributor to the minor watershed's nutrient loading rate. Practices related to lawn care, hazardous waste disposal, and storm drain protection will be promoted within urban areas of this priority management area to help minimize pollutant loadings.

Lower Cottonwood Main Stem

Total suspended solids (TSS) and total phosphorus (TP) reductions of twenty-five percent are needed to achieve the water quality goal for this priority management area. Fecal coliform bacteria reductions are needed to return the lower reach to its designated swimming use.

Streambank Restoration

Initial assessments of this priority management area show severe streambank erosion at several locations. Streambank failure is contributing to the high sediment load in this reach of the river. There are opportunities to use several different bioengineering techniques to help alleviate the problem. These techniques are less costly than traditional approaches, yet equally effective, and therefore more likely to be used. They also provide additional fishery benefits not associated with traditional methods.

Riparian Buffer Strips

Buffer strips are an integral part of a streambank restoration program. Loss of vegetative cover has contributed to bank erosion at several locations along this reach of the river. Financial incentives through CRP and CREP make this best management practice (BMP) very attractive.

Water and Sediment Control Basins

Within this priority management area, deep gullies from excessive runoff can be easily observed along the main corridor of the river. This gullying action washes sediment and attached nutrients down the bank into the water, contributing to the high loadings that have been documented in this lower reach of the Cottonwood River. Water and sediment control basins, when placed appropriately on the land, are effective erosion control structures, reducing suspended solids in runoff by 40% to 60%. State cost-share will pay up to 75% of the cost for this BMP.

Terraces

It has been documented that within this priority management area, there is a significant increase in overland flow between the sampling station PLC010 at Leavenworth, and the station at New Ulm, PLC001. This increased flow can be deterred by conservation practices such as terraces. Terraces, when designed and located effectively, can be very efficient at intercepting runoff from cropland. Combining this practice with other BMPs can lead to cropland that is productive, yet protective of the watershed environment. State cost-share is the primary method for financing this practice.

Grassed Waterways

Another effective BMP for sediment reduction is grassed waterways. It has been estimated that the correct placement of this erosion control structure can reduce sediment losses by 60% to 80%. Within this priority management area, waterways can be used with other BMPs, such as terraces, to help rectify high pollutant loadings, especially sediment. Costs associated with this practice will be funded through state cost-share, and other farm programs such as EQIP (Environmental Quality Incentive Program).

Wetland Restoration

With the high sediment loadings that have been documented in this priority management area, BMPs that retain water on the landscape and reduce sediment transport are needed. Wetland restoration has been shown to reduce sediment runoff from 80% to 100%. Wetlands also can achieve a 10% to 90% reduction in nutrient (phosphorus and nitrogen) runoff, and provide the added benefit of habitat for wildlife species and waterfowl. Most likely sources of funding are CRP, RIM and the U.S. Fish and Wildlife Service.

Individual Sewage Treatment Systems

Bacteria in the lower segment of this priority management area is a concern. It has become a limitation on the use of the river. Failing septic systems are a likely

contributor to the bacteria load. Low interest loans will be used to upgrade these systems.

Urban Practices

As shown in the other priority management areas, water quality is affected by more than just runoff from agricultural land. The cities of New Ulm, Sleepy Eye, and Leavenworth are located in this priority management area, and land use activities within these communities need to be considered. Lawn fertilization practices, waste disposal techniques, and storm water runoff are important factors affecting the Cottonwood River. Throughout this priority management area, outreach programs will be developed and used that emphasize community and personal responsibility for protecting water quality.

Table 3.02 indicates the relationship between best management practices (BMPs) and surface water conditions related to four categories: sediment reduction, nutrient reduction, flow stability, and fishery habitat. As shown on the table, most BMPs offer benefits in more than one category. Several show benefits in all four. Table 3.03 lists the BMP location within each priority management area.

Table 3.02: Benefits Associated with BMPs

BMPs	Sediment Reduction	Nutrient Reduction	Flow Stability	Fishery Habitat
Nutrient Management		x		x
Residue Management	x	x	x	x
Streambank Restoration	x	x	x	x
Grassed Waterways	x	x		x
Terraces	x	x	x	
Grade Stabilization Structures	x		x	
Pasture Management/Livestock Exclusion	x	x		x
Agricultural Waste Management Systems		x		x
Wetland Development/Restoration	x	x	x	x
Riparian Buffer Strips	x	x		x
Water and Sediment Control Basins	x	x	x	x
Multi-Purpose Dams	x	x	x	x
Filter Strips	x			x
Onsite Sewage Systems		x		x
Rock Inlets (intake replacement)	x	x	x	x
Urban Practices	x	x	x	x

Table 3.03: Priority Area BMP Reference

BMPs	Coteau Streams	Sleepy Eye Creek	Lower Cottonwood
Nutrient Management	x	x	
Residue Management	x	x	
Grassed Waterways	x		x
Terraces	x		x
Livestock Waste Management	x		
Wetland Development/Restoration		x	x
Riparian Buffer Strips	x	x	x
Water and Sediment Control Basins	x		x
Multi-Purpose Dams	x		
Filter Strips	x		
Onsite Sewage Systems	x	x	x
Rock Inlets (intake replacement)	x	x	
Urban Practices	x	x	x
Streambank Restoration			x

Evaluation

Evaluation is considered to be a major component of the implementation plan. Its purpose is to help us understand how effective our programs and actions are at achieving Project goals. In order to do this, it is necessary to use several evaluation methods or tools that are designed to measure different variables from different perspectives. To evaluate the project, sampling data will be collected to measure changes in water quality, statistics will be kept on land use changes, attitudes of watershed residents will be assessed, and specific implementation programs will be periodically reviewed and assessed. This comprehensive approach will provide a variety of assessments about project effectiveness in terms of water quality impacts, land use changes, citizen attitudes, and program delivery. Information gathered will be used as a guide for future program adjustments.

Water Quality Monitoring

The monitoring program is designed to be a continuation of water quality data collection procedures initiated during the diagnostic study phase of the Cottonwood River Restoration Project. Information gathered through the program will improve loading estimate accuracy, and will also help to assess water quality trends within the watershed. Three adjustments will be made to the monitoring network used in 1999. First, sampling station PLC001 (New Ulm), which was discontinued after the 1997 sampling season, will be reestablished. Additional data collection at this station is needed to help understand sediment loading in the lower portion of the river. Another adjustment is the addition of a sampling station on the main stem near Lamberton. The location of this site coincides with the early flood warning monitoring station maintained by the Department of Natural

Resources and U.S. Geological Survey.⁷ The third change is to discontinue the Highwater/Dutch Charley monitoring station due to scheduled bridge replacement at the established site. Sampling stations PLC010 (Leavenworth), PLS005 (Sleepy Eye Creek), and TUP (Plum Creek) will be retained. See Map 3.04.

Monthly base flow samples will be collected at each station between May and September. At least two storm events equal to a five-year frequency will be sampled at each location. The water analysis will be a continuation of the monitoring performed during the diagnostic study.

Laboratory testing parameters utilized for the monitoring plan will include total suspended solids (TSS), total phosphorous (TP), soluble phosphorous (P-PO₄), and nitrate nitrogen (N-NO₂+NO₃). Fecal grab samples will be collected five times per month between May and September as part of the total maximum daily load (TMDL) process for the lower reach of the Cottonwood River.

Field testing parameters utilized for the monitoring plan will include dissolved oxygen, specific conductance, water temperature, pH, and water level measurements.

Program Evaluation

Several evaluation methods, in addition to the monitoring program discussed above, are necessary to measure Project success. Methods used in the implementation plan have been selected to evaluate different components and outcomes of the plan in different ways.

A best management practice (BMP) tracking system will be used to measure BMP adoption rates within priority management areas. Information contained in this system will include records of initial contacts with landowners or operators; the status of each BMP from initial sign-up to construction; and the potential sediment and nutrient reduction obtained as a result of the BMP. This information will be entered into the watershed GIS system maintained by RCRC.

Annual tillage transect surveys will be conducted by Soil and Water Conservation District (SWCD) staff. This information will provide one indicator of residue management trends within the watershed.

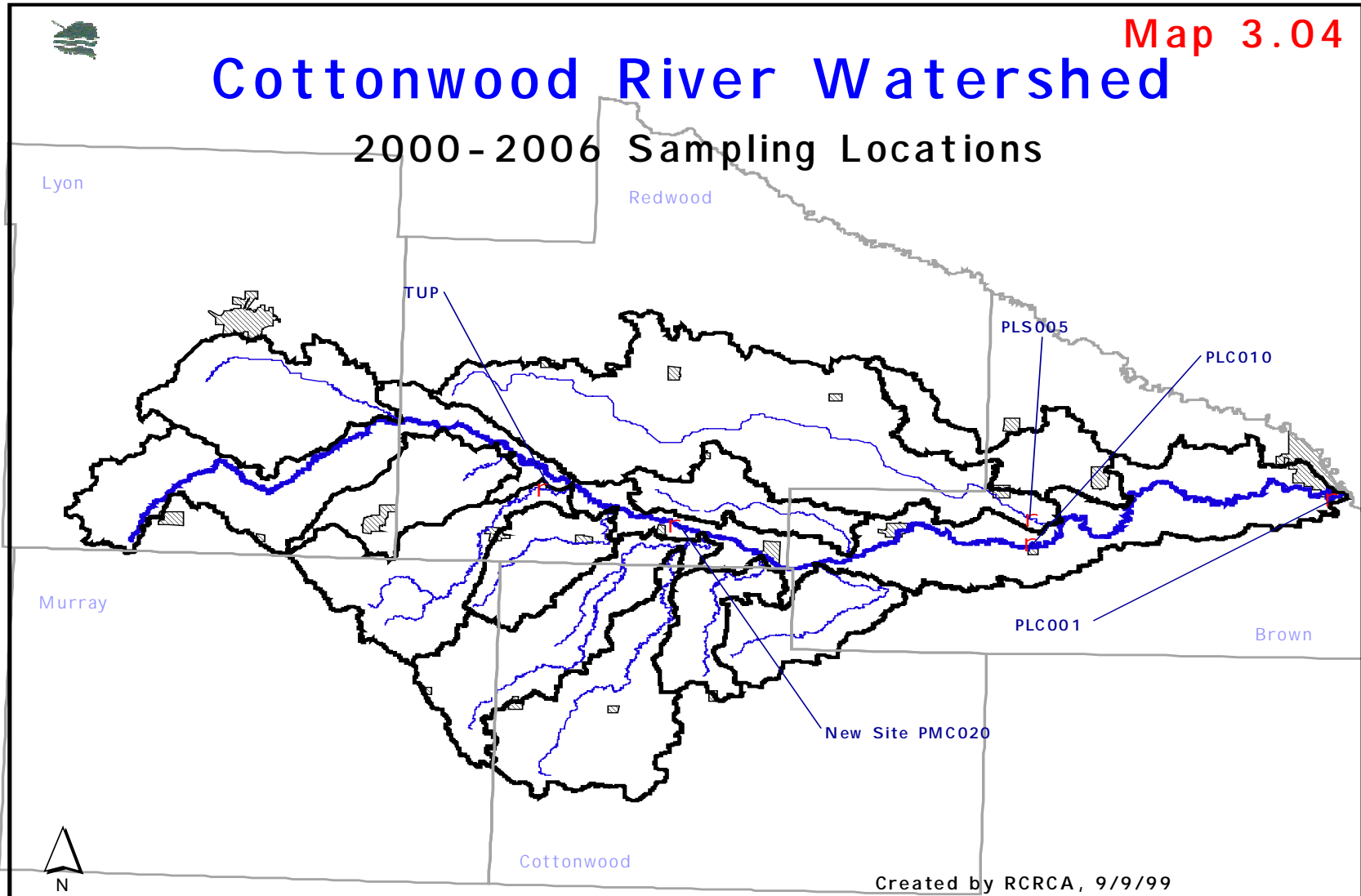
A questionnaire will be administered to a random sample of watershed residents at the onset of the implementation program. This survey will measure attitudes and opinions about the Cottonwood River, and identify issues of greatest concern to watershed residents. A follow-up questionnaire will be administered three to four years later to measure shifts in attitudes, opinions, and perceptions about the Cottonwood River.

Program evaluation tools will be developed to evaluate other key activities within each program element of the implementation plan. For example, an evaluation of watershed assessment teams will be undertaken to determine how effective they are at meeting their intended purpose. Events and tours will be evaluated shortly after their

⁶² This option eliminates the need for a Telog or CR10 flow monitoring device. A final decision on this site will depend on improvements in the dependability and accessibility of data generated by the DNR/USGS monitoring device.

Cottonwood River Watershed

2000-2006 Sampling Locations



completion, and evaluations will be made of investments in each media area. Program evaluations will be ongoing and will help guide decisions throughout the course of the Project.

Roles and Responsibilities of Project Participants

Considerable expertise and resources are available in the watershed to carry out major portions of the implementation plan. Participating local, state, and federal agencies administer nearly all of the programs necessary to accomplish project goals and objectives. This includes programs and funding to design and install best management practices (BMPs), collect and analyze water quality data, perform research on BMP alternatives, and inform watershed residents of project activities. Admittedly, some program and work plan activities are better funded than others, and some functions are more easily accomplished than others given financial, social, and political constraints. It is very clear, however, that program availability is not the limiting factor in protecting the Cottonwood River. Rather, it is focusing programs on critical watershed problems and encouraging people to participate that will lead to a successful Cottonwood River Restoration Project.

A central theme of successful watershed-based nonpoint source projects is a unified approach to achieve mutually agreed upon goals. The challenge is to bring together the whole range of programs and agencies and focus them on the intended outcome. The way this can be achieved is for all participants to clearly understand their own and each other's obligation to the Project, and to be held accountable for carrying out this obligation.

Roles and responsibilities of organizations, agencies, and groups involved in the Cottonwood River Restoration Project are briefly summarized below. To some extent, responsibilities will remain flexible. For example, program, budget, and other changes in the next six years may alter the structure and capacity of one or more participants. This would necessitate changed roles and responsibilities.

Project participants will be represented on an advisory committee that will meet quarterly. Major roles of the committee will be to sustain communication among participants, investigate new opportunities for improving Project success, and assessing results. Other representatives besides those listed may be added to the committee as the Cottonwood River Restoration Project develops.

Redwood-Cottonwood Rivers Control Area (RCRCA)

Responsible for overall program administration and fiscal management. Responsibilities extend to supervision of project staff and coordination of all program elements.

Soil and Water Conservation Districts (SWCDs)

Responsible for technical assistance in the design and installation of BMPs and for developing and carrying out a tracking system to help evaluate the effectiveness of BMPs. Also responsible for conducting an annual tillage survey; sustaining work on CREP, CRP and RIM; watershed assessments and inventories; and distributing project-related information.

Counties (Brown, Cottonwood, Lyon, Murray, Redwood)

Counties will provide local project matching funds. County water plan implementation groups will assist with outreach activities. County staff will assist in processing applications for low interest loans and take responsibility for design and inspection of septic systems.

Natural Resources Conservation Service (NRCS)

The NRCS will provide final BMP technical review through services of a staff engineer. They will also assist with annual planning activities by participating on an inter-agency advisory committee. Vehicles and other equipment will also be provided through the NRCS.

Farm Service Agency (FSA)

The principal responsibility of FSA is working with the implementation team to secure BMP cost-share funds. Processing BMP applications for CRP, EQIP or CREP is another important responsibility of FSA.

Minnesota Department of Natural Resources (DNR)

DNR staff will be part of the inter-agency advisory committee team, and will assist in project evaluation activities. The DNR also has permitting authority over in-stream restoration work and will be involved in assessments and acquisition of property devoted to trails and accesses. They may also provide limited equipment needed to perform streambank restoration work.

Minnesota Pollution Control Agency (MPCA)

Staff of MPCA will be part of the inter-agency advisory committee and will continue to offer guidance on project implementation.

Board of Water and Soil Resources (BWSR)

Responsible for working with SWCD staff to ensure efficient completion of cost-share agreements. Staff will also participate on the inter-agency advisory team.

Minnesota Extension Service (MES)

The Extension Service will lend expertise, research information, and assistance with the information and outreach program.

Southwest Research and Outreach Center (SW-ROC)

Staff will participate in the inter-agency advisory committee, offer technical assistance, and assist with the Outreach Program.

Area II Minnesota River Basin Projects, Inc. (Area II)

Provide automated sampling equipment to be used for the monitoring network and technical and financial assistance for projects to reduce flood damages

BMP Operation and Maintenance Plan

Nearly all best management practices (BMPs) recommended in the implementation plan are subject to ten-year operation and maintenance requirements. This is a contractual agreement between the funding source (state or federal) and the landowner. Failure to comply results in repayment of a portion of the funds obtained to install the practice.

The implementation plan lists removal of logjams as a resource implementation practice. This practice currently is not subject to an operation and maintenance plan. Consequently, prior to this type of work being done, owners of land adjacent to the work site will be required to sign an agreement with the appropriate unit of government⁸ detailing the landowner's future obligations. These obligations may include: 1) responsibility to remove subsequent obstructions from the work site area, or 2) agreement to notify RCRCA or the county within which the land is located when new obstructions become evident. The agreement will be for a period of ten years.

Streambank stabilization, under certain circumstances, can be accomplished with use of state or federal cost-share funds. In these cases, the practice would be subject to the same operation and maintenance provisions as any other cost-shared BMP. Some stabilization techniques proposed for the Cottonwood River, however, may not be eligible for state or federal cost-share, and will require the development of an alternative operation and maintenance plan. The Department of Natural Resources (DNR) will be consulted and asked to assist in development of an appropriate operation and maintenance plan that can be applied under these conditions.

Other resource implementation practices including trails and canoe accesses will be subject to operation and maintenance plans as determined by the state of Minnesota and the county within which they are located. It is expected that all trails and accesses will be the property of the county or the state of Minnesota.

Information and Outreach Program

Education provides awareness and knowledge, which are both key agents of change. A clear program directed to involve stakeholders encourages ownership, change and ultimately sustainability of the programs. For change to take place, research has shown a minimum of nine contacts. Contacts could be a variety of elements such as personal visits, newsletters, radio programs or presentations to existing groups.

Objectives for the Cottonwood River outreach program are: 1) to supply watershed residents with opportunities and information to understand the human impact on the watershed; 2) coordinate and support water quality interest groups through dialogue, interactive projects and written materials; 3) build capacity for sustainable watershed programs; 4) lend support to all program elements.

The Outreach Program will serve as a unifying component to achieve the ten identified objectives for the Cottonwood River Restoration Project. This program

⁸ This unit of government may be the county, township, or soil and water conservation district depending on circumstances and interests.

element will identify communication, technical and educational needs of watershed residents, community groups and professional groups. After identification, services, materials and products will be provided that directly correlate with the three goals of the Cottonwood River Restoration Project. Recognizing that boundaries are points of contact and not definitions of limits, RCRCA will work with existing Soil and Water Conservation Districts, Natural Resources Conservation Service, Minnesota Pollution Control Agency, Board of Water and Soil Resources, Minnesota Extension Service, Southwest Research and Outreach Center, and Minnesota Department of Natural Resources to develop an informational network for enhancing land use changes that work to improve water quality.

The outreach program activities will be a deliberate effort to encourage watershed residents to become committed to the Cottonwood River and the restoration process. Watershed residents will encounter a variety of information sources and opportunities from different disciplines that will enable them to become involved from a more personal perspective. Using different modalities, a program will be designed to encourage watershed residents to participate. It is generally recognized that we retain 90% of what we do, suggesting that an interactive design will be the most appropriate. Our intent is to encourage ownership and a greater capacity for protecting the Cottonwood River by watershed residents.



Citizens gather in Sleepy Eye to discuss the health of the Cottonwood River Watershed, July 1999

Media

Background and current information will be distributed through a mix of media sources including but not exclusive to radio, newsletters and news releases. Working with partners and specified experts, we will provide information to watershed residents and special interest groups that will encourage directed awareness to the issues surrounding the Cottonwood River Watershed. Moveable and reusable items such as displays will be developed to be interactive, and to provide a wide audience with the information they need to become familiar with the watershed project.

Forums and Specialty Groups

Knowing that people act on the basis of their perceptions – not necessarily on facts, opportunities will be provided for people to learn from experts in the area through forums and interest groups. Interaction must begin where the people are, so, our efforts will be targeted around existing groups while forming new groups around interests, occupations or another determined merit. The newly formed groups will be centered on the restoration of the Cottonwood River, while existing groups will be platforms for information sharing and engaging people in new groups and the Cottonwood River Restoration efforts. Groups of watershed residents will be provided with opportunities to further their interests as well as develop new interests through RCRCA accommodating and facilitating the process with organized activities such as canoe tours, brown bag lunch forums, town forums and watershed monitoring.

Materials

As the needs and interests of watershed residents become identified, materials for distribution and training will be developed and used. The development and use of materials will be a cooperative effort between RCRCA, partners and professionals in the field. Specific materials will be developed as needed for program elements. One useful tool will be to develop maps of the watershed and the river. Maps can be used to encourage recreation as well as interaction with the river and will be developed for defined activities and projects. After projects have been implemented, maps will allow residents to self-tour the improvements and the recreation possibilities. Studies have determined that showing people examples and allowing them to become involved with the example is necessary to change attitudes and heighten awareness.

Publications

Timely, specialty publications describing key issues within specific areas of the watershed using our own research to provide watershed residents with facts about local water quality conditions will be produced. Publications will be produced at least four times during the year and written for a defined audience about a specific topic. Topics may include issues identified within the program elements, or, of interest and concern to watershed residents. Audience for publications may include landowners, absent landowners, agri-business professionals, production agriculture, town residents or interest

groups. They may show accomplishments as well as problems. Due to the timely nature of this type of publication, production dates and distribution will be dependent on issues, audience and calendar. Publications will provide local examples of water quality practices along with visibility, project identity and generate awareness of water quality problems and solutions. A directory of water quality services and agencies will be developed and distributed to help watershed residents understand connections and use the resources available to them within the Cottonwood River Watershed.

Legal Authorities and Permits Required for Completion of Project

Redwood-Cottonwood Rivers Control Area (RCRCA), the project sponsor, is a joint powers organization established pursuant to Minnesota Statutes 471.59. Counties belonging to RCRCA, including Brown, Cottonwood, Murray, Lyon and Redwood, represent the entire Cottonwood River Watershed and vested in these counties are all necessary authorities related to taxation and ordinance adoption and enforcement.

Permits from the Department of Natural Resources (DNR) and, in some cases, the U.S. Army Corps of Engineers (COE), will be required to remove channel obstructions and to undertake certain streambank stabilization procedures. Redwood-Cottonwood Rivers Control Area (RCRCA) or the appropriate county will apply for these permits as needed.

Permits from the Minnesota Pollution Control Agency (MPCA) will be required prior to construction of agricultural waste management systems. These permits, however, are the responsibility of the feedlot owner.

Trails and canoe accesses may be subject to permit requirements of the local jurisdiction and the state of Minnesota. These will be obtained by the appropriate local unit of government.

Permit	County	Responsible Agency		
		DNR	MPCA	COE
Floodplain/Shoreland Protected Waters	X	X		
Section 404				X
Septic Systems	X			
Waste Management Systems Section 401	X		X	

Project Staffing

The Cottonwood River Restoration Project represents an ambitious attempt to increase both the level and scope of water quality protection activities occurring within the Cottonwood Watershed. It is not reasonable to expect this increase to occur under current staffing conditions. Present staff capacities of agencies and organizations

working in the watershed are inadequate to meet additional demands of the implementation plan. To make the Project successful, several additional key staff positions are needed.

Watershed Technician (2.5)

This position is responsible for investigating resource problems and opportunities within priority management areas and recommending appropriate actions to be taken. Much of this work is an extension and refinement of outcomes from the diagnostic study. Within priority management areas, additional detail is needed to define type and location of best management practices (BMP) that will provide the most efficient water quality benefits. This can only be accomplished through direct and systematic field observations and discussions with landowners.

Water Quality Technician (.5)

This position has responsibility for the water quality monitoring program and for developing and administering several databases related to sampling, inventories, and watershed assessments. The importance of these duties relates to the need for credible scientific data about water quality trends and for clear assessments of how project activities affect water quality.

Watershed Coordinator (.5)

Management and coordination of outreach activities is essential to maintain a consistent and uniform message. Contained in this position are duties that relate to the formulation of materials and methods that convey Project goals, objectives, and accomplishments to a wide array of audiences.

Milestone Schedule

PROGRAM ELEMENT	PROJECT YEAR					
	1	2	3	4	5	6
BMP/Resource Implementation						
(1,2,3,4) Technical assistance	X	X	X	X	X	X
(1,2,6) Stream maintenance		X	X	X	X	X
(1,2,4,6) Bank restoration		X	X	X	X	X
(1,2,3,4) BMP installation		X	X	X	X	X
Monitoring						
(1,7,11) Water quality monitoring	X	X	X	X	X	X
(1) TISWA	X	X	X	X	X	X
(1) GIS	X	X	X	X	X	X
(1,2,4,8) Resource inventories	X	X	X	X	X	X
Outreach						
(1) Media	X	X	X	X	X	X
(1,2,3,9,10) Forums and Groups			X	X	X	X
(1) Print materials	X	X	X	X	X	X
(1) Publications	X	X	X	X	X	X
Evaluation						
(1,9) Surveys	X		X			X
(1,2,4) BMP tracking		X	X	X	X	X
(1) Program evaluations		X		X		X
Administration						
(1) Project management	X	X	X	X	X	X
(1) Professional services	X		X			
(1) Reports	X	X	X	X	X	X
(1) Interagency Committee	X	X	X	X	X	X

- 1 RCRCRA
- 2 SWCDs
- 3 Counties
- 4 NRCS
- 5 FSA
- 6 DNR
- 7 MPCA
- 8 BWSR

- 9 MES
- 10 SW-ROC
- 11 Area

