impacts.

During 19 out of 21 days in June 1985, dissolved oxygen levels decreased to 5 mg/l at the USGS sampling station at CTH P, the downstream extreme of this segment. A similar situation occurred the next year. During a major storm event on July 25, 1985, dissolved oxygen dropped to 3 mg/l.(12) The BOD concentration of a stream water sample collected by USGS during this storm was 5.5 mg/l. On February 22, 1985, USGS collected a BOD sample at the CTH P automated monitoring site during a runoff event. At the time, rain fell on frozen ground with manure visible on fields and barnyards. The level of BOD in this sample was 16 mg/l. Department staff are concerned that this level of BOD in spring runoff could adversely impact the trout hatch in Black Earth Creek.(3)

Elevated stream temperatures, suspended solids load, and organic enrichment from Brewery Creek may account for the increased macrophyte growth and the appearance of sago pondweed and filamentous algae found downstream of CTH P.(12,13,15)

In summary, sedimentation, loss of habitat, increased temperature and decreased levels of dissolved oxygen are all factors which threaten the use classification of this stream segment. To alleviate these problems, the Water Resources objectives stated below have been identified.

<u>Water Resources Objectives</u>

A. <u>Headwaters to Stagecoach Road</u>

1. Prevent potential discharge of toxic substances to the stream.

2. Maintain integrity of recharge area of springs.

3. Reduce sediment and oxygen demanding substances to protect next stream segment downstream by 50%.

B. <u>Stagecoach Road to County Highway P</u>

1. Maintain a class I trout fishery (FALT (A) Class I) in this stream segment by:

Water Resources Objectives (cont.)

- increasing dissolved oxygen levels;
- lowering high water temperatures;
- reducing sedimentation; and
- decreasing organic loading to this stretch of stream.

2. Improve habitat to reduce macrophyte-caused dissolved oxygen sags and to reduce sedimentation.

3. Reduce sediment and oxygen demanding substances by 50% to protect next stream downstream segment.

Pollutants from Nonpoint Sources

Eroding Croplands (sediment and nutrients). Nearly all (greater than 95%) of the sediment reaching the headwaters of Black Earth Creek is from eroding croplands. Based on soil erosion estimates, Table 2 shows that about 82% is from croplands with very high erosion rates (greater than about 10-to-15 tons/acre/year) and about 6% is from croplands with high erosion rates (greater than about 7-to-10 tons/acre/year). Table 2 also shows that these very high/high erosion cropland fields comprise about 37% of the croplands. The location of these critical sites is shown on Figure 3. Overall, these critical sites comprise about 15% of the area of the subwatershed.

Eroding and Trampled Stream Banks (sediment and direct habitat impairment). Generally, there is little stream bank erosion in headwaters of Black Earth Creek. Two sites between Stagecoach Road and CTH P with moderate rates of erosion were identified. Both are about 20 feet in length. In addition, there are 10 to 12 sites with slight rates of erosion. Another site is trampled, causing the stream to widen. Overall, these and other sites eroding at a very low and unobservable rate represent a negligible sediment load to the stream when compared to the sediment from croplands. They do, however, have an impact on the immediately adjacent fish habitat due to the slumping of the banks.

TABLE 2. Cropland Soil Erosion in Black Earth Creek Headwaters to Brewery Creek Subwatershed.

Erosion Rate	Tons/year	%
> 10 tons/acre/yr.	52,391	82
7 to 10 tons/acre/yr.	4,031	6
4 to 7 tons/acre/yr.	2,236	4
< 4 tons/acre/yr.	4,949	8
Totals	63,607	100
Erosion Rate	**Acres**	**%**
> 10 tons/acre/yr.	1,448	29
7 to 10 tons/acre/yr.	372	8
4 to 7 tons/acre/yr.	306	6
< 4 tons/acre/yr.	2,833	57
Totals	4,959	100

Animal Lots (oxygen demand and nutrients). Manure from animal lots and winter spread fields are the most probable source of oxygen demanding substances. Table 3 shows the number of animal lots and pollutant loads by range of phosphorus load. The location of these lots is shown on Figure 3.

Winter Spread Manure (oxygen demand and nutrients). Winter spread manure was not analyzed. However, based on the erodibility of the soils and the steepness of slopes, it is likely a few of the eight livestock operations in this subwatershed are sources of manure to the stream from winter spread sites.

Cropped Organic Soils (nutrients). The U. S. Geological Survey monitored a farm on two dates in the spring of 1985. This farm is west of of Middleton's industrial park and has crops with organic soils. They found total phosphorus concentrations of over 1.0 mg/l with most of the phosphorus in the dissolved form

and total nitrogen concentrations of 4.6 mg/l. All of these concentrations are substantially higher than normal stream concentrations.

TABLE 3. Animal Lot Pollutant Loads for Black Earth Creek Headwaters to Brewery Creek Subwatershed.

Phosphorus Load Range	Operations	Lbs.*	%
> 20 lbs. phosphorus **	0	0	0
15-to-20 lbs. phosphorus	3	57	64
10-to-15 lbs. phosphorus	1	13	15
5-to-10 lbs. phosphorus	2	13	14
< 5 lbs. phosphorus	2	7	7
Total	8	90	100

* Pounds for a 10-year, 24-hour storm

** Phosphorus is used as an indicator of the amount of manure reaching streams. The amount of BOD or COD is proportional to the amount of phosphorus.

Construction Sites (sediment and nutrients). Construction in this subwatershed during 1986, 1987 and 1988 consisted of the reconstruction of State Highway 14, expansion of the Middleton Industrial Park and several individual houses. The Wisconsin Department of Transportation used erosion controls along much of the reconstruction project. Erosion controls were used on some sites, in the expansion of the Middleton Industrial Park.

In the next 5-to-10 years, it is anticipated the expansion of the Middleton Industrial Park will continue. Also, the Wisconsin Department of Transportation is proposing to expand State highway 14 to four lanes in this subwatershed.

Urban Lands (sediment and nutrients). A portion of the Middleton Industrial Park is located in the very eastern end of this subwatershed. During 1987 and the first half of 1988 this industrial park expanded rapidly. A large detention basin

controls the discharge of runoff from the industrial park. The amount of nutrients and sediment from these industrial lands is comparable to agricultural lands on a per acre basis. The amount of heavy metal and toxic substances being carried by runoff from the site, if any, is unknown.

Nonpoint Source Control Needs to meet the Water Resources Objectives

To achieve the water resources objectives identified for the headwaters of Black Earth Creek, the nonpoint sources must be controlled. Each type of source and its control need is briefly described and discussed.

1. Cropland Management Needs:

   Erosion on an estimated 1820 acres of cropland.

The cropland analysis estimated about 80 to 90% of the tons of erosion occurs on fields with very high or high erosion rates (greater than 10-to-15 tons/acre/year and 7-to-10 tons/acre/year). These very high/high erosion rates occur on about 1820 acres.

2. Stream Bank Management Needs:

   The two sites eroding at a moderate rate and the trampled site must be controlled.

Since the three sites are located within the class I trout fishery and are impairing the trout habitat, these sites need to be controlled to prevent further degradation of the habitat.

3. Animal Lot Management Needs:

   The amount of manure from animal lot runoff needs to be reduced on 6 of the 8 operations.

Based on the simulation of runoff controls, it is estimated that a 79% reduction can be achieved by reducing the amount of phosphorus on the 6 of 8 operations with estimated amounts of 5 or more pounds.

4. Manure Spreading Management Needs:

   Manure spreading management plans need to be prepared for the 8 livestock operations to minimize the amount of manure entering the stream.

Although the amount of manure and significant sites could not be identified, the existence of high oxygen demand levels during trout hatch periods warrants control of this type of nonpoint source.

5. Cropped Organic Soils Management Needs:

   For the site identified west of the Middleton Industrial Park, removing productiom from the land is desirable as urban development occurs on the surrounding area.

Given the higher-than-average concentrations of nutrients discharged from this site during baseflow periods, concern has been raised over the site. Given the very close proximity to the Middleton Industrial Park, the City of Middleton or other developers should set aside or retire this land from crop production. The restored wetland can buffer the runoff from the industrial park.

6. Construction Site Management Needs:

   Sediment and other pollutants from construction sites need to be controlled within the jurisdictions of Middleton, Dane County and Department of Transportation.

During the preparation of this plan, expansion of the Middleton Industrial Park began within the Black Earth Creek subwatershed. Expansion of the industrial park and growth of scattered commercial development along State Highway 14 will most likely continue within the watershed during the foreseeable future. Further expansion of the Madison metropolitan urban sewer service area may also occur, but no time period can be projected. Scattered, unsewered subdivision development is also likely to occur within this subdivision. With the very high rates of sediment delivery to the stream, construction sites will become a more significant source of pollutants. Construction site erosion control falls within the jurisdictions of the City of Middleton, Dane County and Wisconsin Department of Transportation.

In 1988, builders in Middleton's Industrial Park were not fully complying with Middleton's ordinance. Dane County's ordinance does not cover single family residential construction sites. The Department of Transportation used erosion controls to a significant degree on its highway construction sites in 1988.

7. Urban Lands Management Needs:

Development of commercial and industrial lands need to be designed and constructed to control pollutants and manage runoff.

Monitoring in Wisconsin and throughout the country has shown commercial and industrial lands as significant sources of heavy metals and possibly toxic substances. Design and installation of various controls such as a wet basin can substantially reduce the amount of pollutants leaving commercial and industrial sites.

Fishery Management and Other Resource Needs

1. Habitat Improvement Needs:

The stream habitat from the footbridge near STH 14 just east of Cross Plains downstream beyond CTH P needs improvement.

As stated above, this stream segment has problems caused by sediment and aquatic vegetation. The aquatic vegetation is causing dissolved oxygen levels to violate water quality standards. This segment is one of two stretches identified by fish managers as most in need of habitat improvement. The objective of the habitat improvements is to decrease the amount of sediment on the stream bed and decrease the aquatic vegetation density.

The Department should consider demonstrating and evaluating the planting of trees in selected locations to shade areas with dense aquatic vegetation growth.

Studies of aquatic vegetation conducted by University of Wisconsin graduate students found lower densities of vegetation in stream segments shaded by trees.

2. Land Acquisition Needs:

The lands adjoining the major spring area just east of Cross Plains need to be acquired for protecting these extremely important springs.

The springs just east of Cross Plains are the heart of the stream. Fish managers have identified for acquisition two parcels from Stagecoach Road down to CTH P. These two parcels rank the highest in priority for acquisition by purchase, rent or easement in the Black Earth Creek watershed.

See also the discussion of base flow protection in Chapter 5 of this plan.

BREWERY CREEK SUBWATERSHED - BC

Subwatershed Description

Brewery Creek Subwatershed is 7.7 square miles in size. It contains about half of the Village of Cross Plains including much of the "developable" portion of the village within the approved sewer service area. Brewery Creek (Master Waterbody ID # 1250200) is the main stream in the subwatershed. It is 2.7 miles long. As shown in Figure 4, the potential use of this stream varies between the lower 0.7 stream miles and the upper 2.0 stream miles. The shorter downstream section has the potential to support a valuable population of forage fish, intolerant forage fish, or intolerant macroinvertebrates (FAL(C)). Forage fish are needed as a food base for larger fish such as adult trout. While the upper 2.0 stream miles only has the potential to support populations of tolerant forage fish or macroinvertebrates (INT D). Neither segment of the stream is supporting its potential use.(17)

Most of the subwatershed is in rural land uses. The southern (downstream) end lies within the Village of Cross Plains. Overall the land use is:

agriculture	63%
woodlands	24%
wetlands	1%
incorporated (urban)	5%
other	7%

The category other includes scattered residential developments.

As shown in Figures 5, 6 and 7, the Village of Cross Plains is projected to grow; particularly in the Enchanted Valley portion of the subwatershed. Currently, much of the Enchanted Valley area is internally drained or poorly drained. As it is developed, it is expected that increased runoff and pollutant loading from the area will reach Brewery Creek.

Water Resources Conditions

Brewery Creek has been ditched and straightened. Low flow in the stream limits aquatic life. Presently, tolerant forage fish live in the stream which has little value for wildlife or recreation.(7) The stream is a significant transporter of sediment to Black Earth Creek.(12,11) Flooding and manure

runoff contribute to poor water quality in this stream.(12) Temperatures of 24.2 ^{o}C were measured in August 1987. During the major storm on July 25, 1985, the water sample collected by USGS at the automated monitoring site had a BOD concentration of 8.6 mg/l. Earlier that year on February 22, 1985, USGS also collected a BOD sample at the Brewery Creek automated monitoring site during a runoff event. At the time, rain fell on frozen ground with manure visible on fields and barnyards. The level of BOD in this sample was 38 mg/l. Department staff are concerned that this level of BOD in spring runoff could adversely impact the trout hatch in Black Earth Creek.

Water Resources Objectives

Reduce sediment and oxygen demanding substances to protect the stream segment downstream by 50%. Brewery Creek should be managed to limit negative impacts upon Black Earth Creek.

Pollutants from Nonpoint Sources

Eroding Croplands (sediment and nutrients). Nearly all (80-to-95%) of the sediment reaching Brewery Creek is from eroding croplands. Based on soil erosion estimates, Table 4 shows that about 82% is from croplands with very high erosion rates (greater than about 10-to-15 tons/acre/year) and about 7% is from croplands with high erosion rates (greater than about 7-to-10 tons/acre/year). Table 4 also shows that these very high/high erosion cropland fields comprise about 39% of the croplands. These critical sites are shown on Figure 4. Overall, they comprise about 25% of the area of the subwatershed.

Eroding and Trampled Stream Banks (sediment and direct habitat impairment). Generally there is little stream bank erosion on Brewery Creek.