Maquoketa River Watershed Above Lake Delhi Dam Comprehensive Plan

Assessment and Management Strategies

This document was prepared by:
The Water Quality in the Watershed above Lake Delhi Project through the Limestone Bluffs RC&D, Inc. with assistance from the Delaware SWCD.

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Section I. Introduction

The drainage area of the Watershed above the Lake Delhi Dam (WALDD) on the Maquoketa River includes approximately 223,716 acres in 4 Eastern Iowa counties- Delaware, Buchanan, Fayette, and Clayton. The WALDD is part of the larger Maquoketa River Watershed, an 8 digit HUC-07060006 watershed that covers 1,198,750 acres and is listed by the Iowa Unified Watershed Assessment as a priority 1 Watershed. The Maquoketa River is one of 11 tributaries to the Mississippi River being monitored by the Long-Term Resource Monitoring Program Field Station at Bellevue, Iowa. Data at this station indicates that the Maquoketa River delivers higher levels of suspended solids and crop nutrients than other tributaries. The cumulative effect of the discharge from these tributaries has been the Zone of Hypoxia in the Gulf of Mexico below the mouth of the Mississippi, an area of nutrient concentration affecting fisheries and associated industries. The expansion of this hypoxia zone has led to calls for changes within the sub-watersheds of the Mississippi suspected of contributing to the condition.

The Maquoketa River Alliance has existed since 1996 to collect, coordinate, and distribute information for the protection and betterment of water quality in the Maquoketa River watershed. The process of comprehensive planning for the Maquoketa River has led to the identification of sub-watersheds for further assessment and the development of plans specific to these local watersheds. The WALDD was listed as a priority within the Maquoketa Watershed as a sub-watershed contributing to water quality impairments in the following ways:

- 303 (d) List of Impaired waters: The WALDD contains one body of water on the 2004 List of Impaired Water. This is Lake Backbone in Section 15 & 16 of Richland Township in Delaware County, a recreational lake created on the Upper Maquoketa River in the 1930's as a WWW project. This lake is impaired by bacteria and nutrients from mostly agricultural runoff from 76,000+ acres in Buchanan, Clayton, Fayette, and Delaware counties. Lake Backbone lies above Lake Delhi.
- Bacteria Levels: Coordinated sampling done on Lake Delhi, and on the Maquoketa River and several of its tributaries has found fecal coliform bacteria levels as high as 29,000 cfu /100 ml, with averages on all sites sampled averaging multiple times greater than the 235 cfu/ ml limit for human contact.
- Sediment: Sediment has been identified as a major impairment to Lake Delhi, with approximately 9,271 tons per year entering the Lake from the Maquoketa River. The Lake Delhi Recreation Association has invested nearly $1.5 million in dredging done in 2004-2005.
- Fisheries: Iowa DNR Fisheries' studies indicate that the Maquoketa River and its tributaries are not supporting the diversity or quality of fish

populations due to high levels of sediment, bacteria, and nutrients. Efforts are being made to improve the recreational qualities on this stretch of the Maquoketa.

Section II. Sub-watersheds

The 223,393 acres of the Watershed above Lake Delhi Dam (WALDD) can be divided into 9 sub-watersheds. These are:

-Upper Maquoketa, with 40,133 acres
-South Fork, with 36,431 acres
-Coffins Creek, with 35,587 acres
-Honey Creek, with 18,097 acres
-Lindsey Creek (which empties into Honey Creek), with 12,712 acres
-Spring Branch, with 11,959 acres
-Sand Creek, with 15,867 acres
-the area between Lake Backbone Dam and the confluence of Coffins Creek draining directly to the Maquoketa, with 30,151 acres
-the area below Coffins Creek and above Delhi Dam draining directly to the Maquoketa or Lake Delhi, with 22,456 acres.

Section III. About the Watershed above Lake Delhi Dam

Physical Location

The WALDD includes an area of approximately 223,400 acres in the 4 northeast Iowa counties of Delaware, Buchanan, Fayette, and Clayton, and comprises 18.6% of the larger Maquoketa River Watershed. The Maquoketa River Watershed is a HUC-8 watershed that covers 1,198,754 acres and drains into the Mississippi River near Bellevue, Iowa.

Population / Demographics

The WALDD is populated by over 10,000 people according to 2000 US Census figures. There are 7 incorporated communities in the WALDD, with Manchester being the largest with 5,257 people. The others are Masonville, pop. 104; Lamont, pop. 503; Dundee, pop. 176; Arlington, pop.490 (which lies only partially in the watershed); Strawberry Point, pop. 1,386 (also partially in) ; and Edgewood, pop. 923 (also partially in the watershed). The cluster community along Lake Delhi has made attempts to incorporate in order to gain financial assistance for its need for repeated dredging to keep the lake viable. Approximately 900 people live here on a seasonal basis, with growth occurring. The lower end of the WALDD lies in the most densely populated portion of Delaware County, as shown in Figure 1 below.

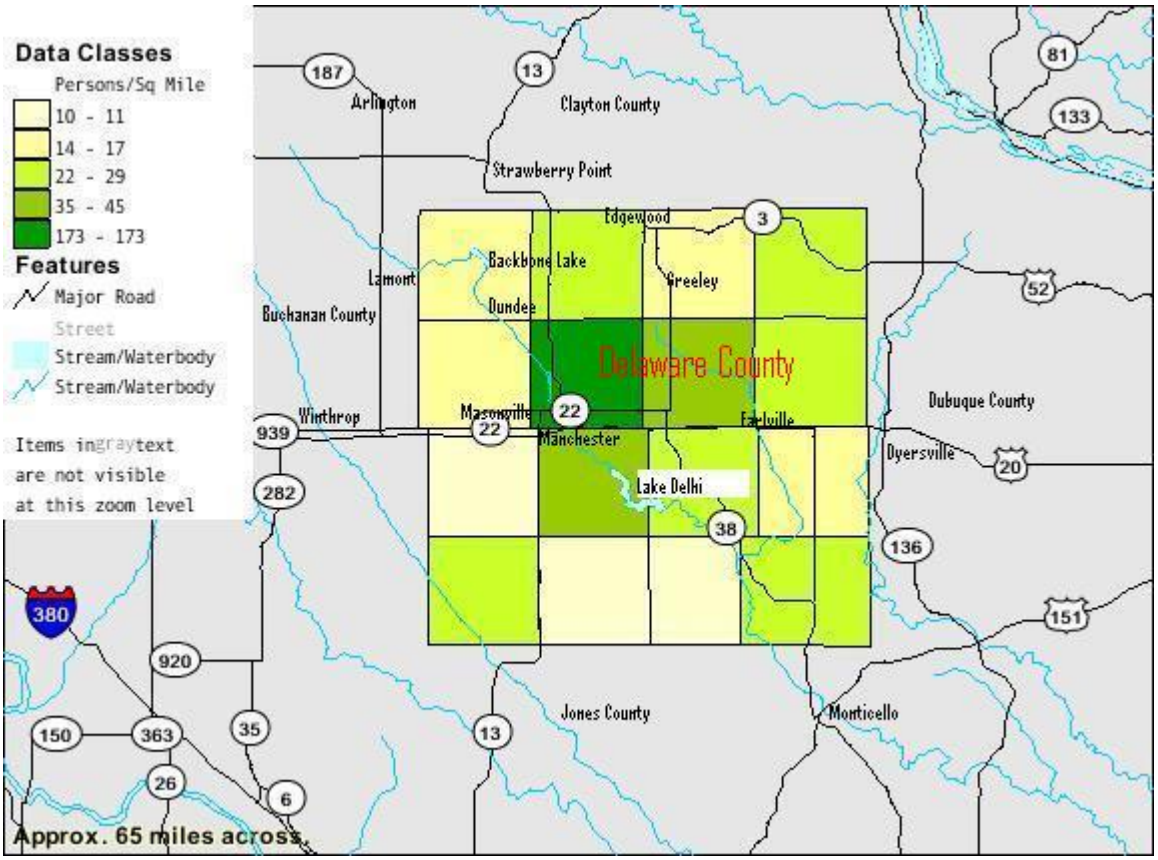


Figure 1- Population Density Map of Delaware County

Transportation

The WALDD is covered by hundreds of miles of roads, including hard surface and gravel. The main roads include the four-lane highway US 20, which travels east and west on the south edge of Manchester; Hwy D-22 (old Hwy 20), and Hwy 3, both two lane state highways running east-to-west; Hwy 13, a two-lane state highway running north-to-south through Manchester; and W-69 and 187, two county blacktop roads running north-south on the west side of the watershed.

Climate

Manchester, the largest population center of the watershed, has an annual mean temperature of 48 degrees. Temperatures can range from 100 degrees or more with high humidity possible, or even likely; in contrast, temperatures to 35 degrees below zero have been registered in the coldest winters. Average rainfall throughout the watershed ranges from 32 to 36 inches per year. The past several years have been relatively dry, after enduring a period of wet years featuring heavy rains in 2002 and 2004. The average annual snowfall in Manchester is approximately 38 inches.

Hydrology

The WALDD contains 149.7 miles of streams and rivers characterized by the Stralhers Stream Order survey of Iowa. The Stralhers system classifies rivers and streams on a scale from 1 to 7 as smaller flows merge to form more complex waterways. The highest classified stream in the WALDD is a 5th order stream, that being the portion of the Maquoketa from below its confluence with Sand Hagen Creek below Dundee and on to the Delhi Dam, a total of 9 miles. An overwhelming majority are Order 1, at 96 miles; Order 2 totals 25 miles; Order 3 equals 16 miles; and Order 4 adds up to 4 miles.

The entire stretch from Backbone to Lake Delhi is on the 2002 list of Protected Waters, as are the lower ends of Coffins Creek, Sand Creek, Fenchel Creek, Spring Branch, and substantial portions of South Fork and the Upper Maquoketa. This designation requires a state permit to perform any stream alteration.

Soils

Soils in the WALDD are dominated by those of the **Kenyon-Clyde-Floyd Association**. 44,336 acres (19.8 %) of the area soils are classified as **Clyde-Floyd** because they are so intermingled; 9822 acres (4.4%) are **Clyde** and 7970 (3.6%) are **Floyd**. **Kenyon** soils total 37,714 acres, or 16.9% of the land mass. **Bassett**, **Fayette**, and **Olin** are the only other soils to total over 3% of the drainage area above the Delhi dam. Another 7 soil types have been identified on 1.7% or more of the area, and an additional 11 types are found on 0.7% or more acres of the watershed. Numerous soils make up the remaining 18% of the total 223,716 acres surveyed.

The major soils are prairie-derived soils. The native vegetation for **Clyde** soils was water-tolerant grasses common to the poorly drained, moderately permeable upland drainage ways where they are found. The **Floyd** series formed in loamy sediments and in the underlying glacial till of the somewhat poorly drained and moderately permeable soils of upland drainage ways. Because of the intermingled nature of these soils, the two cannot be separated much of the time, so the vast majority of these soils are classified as **Clyde-Floyd**, or 391B. Slopes range from 0 to 4%.

The **Kenyon** series consists of moderately well drained, moderately permeable soils. These soils are on convex ridge tops and side slopes in the uplands. They too were formed on areas with prairie grass vegetation. The **Olin** series of well drained soils on upland side slopes and interfluves also derived from prairie grass vegetation. The **Fayette** soils- well drained, moderately permeable soils on upland ridge tops and side slopes- formed in loess with native vegetation of deciduous trees. Slopes range from 2 to 40%. The **Bassett** soils, the other type to total over 3%, consist of moderately well

drained, moderately permeable soils on convex upland ridges and side slopes. These soils formed in loamy sediments and underlying glacial till in a mixed environment of prairie grasses and deciduous trees. Slopes range from 2 to 9%.

Below is a summary of soils in the watershed.

Delhi Watershed Dominant Soil Types

Soil Type	Acres	% of Total
Clyde-Floyd Complex	62,128.00	27.8%
Kenyon	37,714.00	16.9%
Bassett	9,708.00	4.3%
Fayette	7,360.00	3.3%
Olin	7,350.00	3.3%
Nordness	5,717.00	2.6%
Saude	5,596.00	2.5%
Rockton	4,297.00	1.9%
Spillville-Coland	4,190.00	1.9%
Marshan	4,186.00	1.9%
Cresco	4,133.00	1.8%
Sparta	3,692.00	1.7%
Chelsea	3,206.00	1.4%
Flagler	2,963.00	1.3%
Lilah	2,906.00	1.3%
Dickinson	2,882.00	1.3%
Readlyn	2,823.00	1.3%
Schley	2,707.00	1.2%
Downs	2,498.00	1.1%
Burkhardt-Saude	2,002.00	0.9%
Protivin	2,001.00	0.9%
Colo-Ely	1,629.00	0.7%
Cresken	1,529.00	0.7%
Other various soils	40,499.00	18.0%
Total	**223,716.00**	100.0%

Geology

The entire WALDD lies in an area characterized by geologic layers created during the Silurian period of the Paleozoic Era. The carbonate bedrock present in the Silurian strata was likely formed between 443 and 417 million years ago when this area lay beneath a warm, shallow tropical sea that covered much of North America. There are three main Silurian formations present in the WALDD; the Wapsipinicon Formation, the Alexandrian Series, and the Niagaran Series, which is by far the predominant one.

The geology of the Maquoketa River as it flows through Delaware County, has notable karst features. Springs, seeps, sinkholes and losing streams can be found in this watershed. These karst features allow for the quick transfer from surface water to ground water.

Fisheries

The Fisheries aspect of this watershed needs to be discussed as three separate units- the Lake, the main stem of the Maquoketa, and the tributaries. Fishing on Lake Delhi had been declining for years due to the steady deposition of sediment from the 223,000 acre drainage area. Over 9,000 tons of sediment is estimated to enter the 450 acre Lake Delhi impoundment area annually. During 2001 and 2002, the USGS with the cooperation of the Lake Delhi Association and the Iowa Waste Reduction Center of the University of Northern Iowa, conducted a bathymetric study of the entire lake. The results indicated heaviest sedimentation at the upper end of the lake, as expected, with water depths of less than 1 foot common. Deeper waters were found as the process worked downstream, with the greatest depth of 26 feet found just above the dam. The Lake Delhi Recreation Association has since invested nearly $1.5 million in dredging in the 2004-2005 period. This operation is estimated to have removed enough sediment to achieve a common depth of 5 feet. Since the dredging, observations from local fishermen indicate much improved fish catches. The desire now is to maintain this water depth despite the large drainage area above the Lake.

Despite this challenging lack of a clean substrate system because of sediment moving down the watershed, game fish are present in sufficient numbers on the Maquoketa to draw anglers, and the local community is motivated to develop their river resource to a greater degree. To this end, the Maquoketa River has been monitored by DNR Fisheries-Manchester Unit and by the Water Monitoring and Assessment Section of Iowa DNR.

The monitoring process produces data that allows comparison to reference streams in the same ecoregion. Fish Index Biotic Integrity (FIBI) scores for a given stream are then used to compare how well it measures up to reference streams in the same ecoregion. Reference sites represent contemporary stream conditions that are least disturbed by human activities. These reference sites showcase desirable, natural qualities that are attainable among other streams in its ecoregion, which in this case is the Iowan Surface.

The wadeable portions of the Maquoketa and its tributaries are scored according to the FIBI system and the Benthic Macroinvertebrate Index of Biotic Integrity (BMIBI) system. FIBI is a nationally derived system, which has been modified regionally to better reflect local conditions. The FIBI scores a stream according to the variety of fish, ratio of tolerant to intolerant species, and abundance of game fish. The 12 factors are listed on the next page.

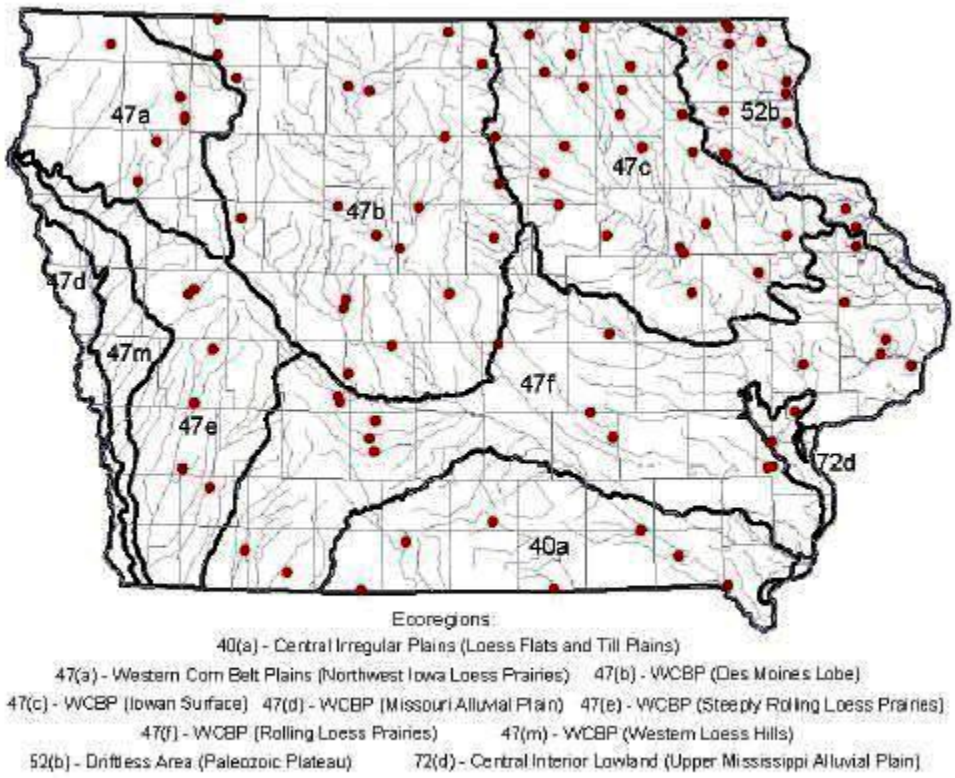


Figure 1-1. Iowa ecoregions and wadeable stream reference sites: 1994–2000.

Table 1-1. Data metrics of the Benthic Macroinvertebrate Index of Biotic Integrity (BMIBI) and the Fish Index of Biotic Integrity (FIBI).

Benthic Macroinvertebrate Index of Biotic Integrity (BMIBI)	Fish Index of Biotic Integrity (FIBI)
1. MH*-taxa richness	1. # native fish species
2. SH*-taxa richness	2. # sucker species
3. MH-EPT richness	3. # sensitive species
4. SH-EPT richness	4. # benthic invertivore species
5. MH-sensitive taxa	5. % 3-dominant fish species
6. % 3-dominant taxa (SH)	6. % benthic invertivores
7. Biotic index (SH)	7. % omnivores
8. % EPT (SH)	8. % top carnivores
9. % Chironomidae (SH)	9. % simple lithophil spawners
10. % Ephemeroptera (SH)	10. fish assemblage tolerance index
11. % Scrapers (SH)	11. adjusted catch per unit effort
12. % Dom. functional feeding group (SH)	12. % fish with DELTs

* MH, Multi-habitat sample; SH, Standard-habitat sample.

The BMIBI and the FIBI both correlate very strongly with several physical habitat and water quality variables, including bank stability, the % of fine sediment present in the stream, total phosphorous, and total suspended solids. This monitoring will quantitatively measure the improvements to the water quality as progress is made to reduce soil erosion from farm fields and repairing/protecting vulnerable stream banks on the river and associated streams. These efforts will improve the habitat for the fish population and its supporting food supply.

In order to be classified as supporting the levels of fish diversity or quality expected for streams in the Iowan Surface ecoregion, a non-riffle stream like the Maquoketa needs to meet or exceed the 25th percentile, or Biological Impairment Criteria (BIC), which equals 44.1 at this time. Two samples taken south of Lindsey Bridge in sections 1 and 12 of Coffins Grove Township in July, 2001 scored 45 and 47, just over the BIC. More recent sampling in the Manchester area in September, 2002 indicated a score of 59, which would also indicate the stream is supporting

Ecoregion	# sites	FIBI mean	FIBI min	FIBI 25th (BIC)	FIBI median	FIBI 75th	FIBI max
47c riffle	8	73.1	58.5	**64.9**	76.6	78.9	83
47c non-riffle	12	55.9	38	**44.1**		69.1	

Ecoregion	# sites	BMIBI mean	BMIBI min	BMIBI 25th	BMIBI median	BMIBI 75th	BMIBI max
47c art subs	9	58.7	47.0	**52.3**	59.5	65.2	70.5
47c hess/surber	13	73.3	62.0	**70.3**	72.6	78.0	81.5

expected levels for this area. The site at Manchester even exceeds the median score of 54.3 for this area. Another sample taken in September 2006, as an inventory before a planned stream bank repair and boat access project is installed immediately below Manchester, indicated 25% of the fish numbers found were classified as game fish.

However, the BMIBI for this stretch is only 57, which falls below the expected 25th percentile score of 70.3, which has led to the designation that this segment of the Maquoketa is only “partially supporting “ its expected aquatic life uses. What this designation is saying in effect is that the less-than-expected food population of macro invertebrates is curtailing the expected fish population. Taking the steps necessary to achieve cleaner water on the Maquoketa River is expected to help fish populations expand by improving both reproductive conditions and the food supply required to support that expanded population.

Fish sampling done over many years by Iowa DNR on the Maquoketa has found sunfish of the green and orange spotted varieties, bluegill, largemouth bass,

smallmouth bass, white bass, yellow bass, northern rock bass, white and black crappie, channel catfish walleye. This sampling has been done on five primary areas on the Maquoketa: the Backbone Park area, below the Lindsey Bridge, in the Manchester area, below the confluence with Sand Creek, and below the confluence with Spring Branch. Trout stocking also occurs in the Upper Maquoketa area.

Segmentation is a major challenge to this portion of the Maquoketa River. The river is cut into segments by the Quaker Mill dam above Manchester, the Fareway dam in Manchester, and the dam at the lower end of Lake Delhi. This prevents the migration of fish between the dam segments which particularly affects smallmouth bass, a species that tends to migrate significant distances. This situation causes the local fish population to be very susceptible to local reproductive conditions, either on the Maquoketa itself or on tributaries that may act as nursery streams to the main river. In this instance, two streams could possibly perform the nursery stream function - Sand Creek for the area below Manchester and above Lake Delhi, and Coffins Creek for the section between the Quaker Mill and Fareway dams. Spring Branch, although a high quality stream is not able to fill this need because of its cold water classification.

The various tributaries all have different characteristics that affect their ability to support fish populations. Spring Branch is a cold water stream that joins the river just above Lake Delhi. The Baileys Ford Park at its confluence with the Maquoketa River is stocked periodically with trout. Sampling done at points on Spring Branch above the park has also found rainbow, brown, and brook trout as well. Stream Visual Assessment Protocol (SVAP) scores on this stream are in the excellent range.

Sand Creek is a warm water stream which joins the river about a mile below U.S. Highway 20. A DNR assessment done in 1987 discovered springs bubbling up in rock outcropping in the streambed. This stream contains some pool and riffle segments and displays very clear water flows. Fish inventories have noted abundant numbers of fish, including smallmouth, largemouth, and northern rock bass. This stream is seen by DNR Fisheries as worthy of attempts to improve its role as a spawning and nursery stream to increase the fish population on the Maquoketa from Lake Delhi up to the Fareway Dam in Manchester. This would be done by repairing areas of stream bank, improving habitat in key areas, increasing the amount of conservation cover in the riparian zone, and working with area farmers to cut sediment and nutrients from reaching the stream.

Coffins Creek is another warm water tributary with fishery potential. It joins the Maquoketa on the west side of Manchester below Quaker Mill Dam. This stream has been sampled extensively over the past 20 years, resulting in catches of green sunfish, smallmouth and northern rock bass, bluegill, and golden redhorse. FIBI scores below the Coffins Creek Park have achieved 63, well above the BIC of 44.1 required to be rated as “adequately supporting expected levels of fish

quality and diversity". This score of 63 is also above the median score for this ecoregion, and approaches the 75th percentile ranking as well. The lower end of this watershed is the site of many country acreages, with many of these landowners choosing to maintain, expand or install woodland, wetland or grassland areas for wildlife benefits. By attempting the same methods as intended for Sand Creek, it could better serve as a feeder stream for the Maquoketa, and between the Fareway Dam in Manchester and the Quaker Mill Dam above Manchester.

Honey Creek enters the Maquoketa from the east, just above Coffins and also below Quaker Mill Dam. This warm water stream drains a large area which is very heavily farmed, including what is considered the greatest livestock numbers of the Lake Delhi watershed. The limited amount of fish sampling done here has produced non-existent game fish numbers. Much of Honey Creek's stream corridor is pastured at varying degrees of intensity. Lindsey Creek is a sub-watershed of Honey Creek with very similar characteristics.

Fenchel Creek drains a small area of less than 7200 acres from Strawberry Point and below. It joins the Maquoketa within Backbone State Park. It begins as a warm water stream. Improvements have been made to the wastewater treatment system of Strawberry Point, which previously had a history of improper discharges to Fenchel Creek. DNR personnel determined in 2003 that Fenchel Creek is a losing stream since water goes underground at one location. Below this point, Richmond Springs, continuously flowing ground water seepage, joins the stream, beginning a cold water designation for Fenchel Creek.

The South Fork of the Maquoketa River drains over 36,000 acres before joining the Maquoketa from the west in the southwest area of Backbone Park. It is classified as a warm water stream. This stream corridor is heavily grazed with cattle found in and along the stream, and displays heavy stream bank compaction and erosion. Lamont Creek is a smaller stream that joins the South Fork near its lower end. In 2006, a DNR study found that the sewage treatment system of the community of Lamont had been operated improperly for many years. Corrections were made, which will likely decrease bacteria levels in this watershed.

The Upper Maquoketa has its origins in Fayette County, flowing through Clayton County, where it picks up spring flows from Joy Springs, and then flows into Delaware County through Backbone Park, where it is also supplied by Richmond Springs, via Fenchel Creek. It supports a trout population which is stocked on an annual basis with fingerling browns and rainbows, and on a bi-weekly schedule between April and October with brown, rainbow, and brook trout.

Below the confluence with the South Fork, the warm water designation of the Maquoketa River begins. There have been no reports of fish kills on this segment of the Maquoketa River, or its tributaries.

Flooding

For the past several years the city of Manchester has experienced increased growth and development. One area is the northeast corner of the City that drains to an area called Dry Run. A second area identified as Prairie Creek is at the northwest corner of the city. Both of these areas have increased the amount of run off water and frequency of flooding to city residents within these drainageways.

The Maquoketa River bisects Manchester from North to South. At times of high water, flooding has been a problem for downtown businesses and residents within the river's floodplain. In recent years this has occurred in 1999, 2002, 2004 and 4 times in 2008. Recently other portions of the city have experienced water problems that have not occurred in the past. Increased water and run off management will also reduce run off and potential contaminants from entering the Maquoketa River. Based on a review by Gibbs Engineering in 2004, they identified the agricultural portions of these watersheds as major contributors of run off to the city.

The city would like to be pro-active to this increasing concern and start by reducing peak run off and discharge within the city limits. At this time, there is no financial assistance for implementing Storm Water BMP's in the Manchester city limits. The Delaware SWCD has requested and received approval to use REAP funds for the city of Manchester and the adjoining developments or expansions that are adjacent to the city limits to implement BMP's for storm water reduction. Examples of the BMP's are: rain gardens, bio swales, pervious concrete, storm water basins, wetlands, streambank stabilization, and others. Practices that provide storm water detention will receive priority of ranking or available REAP funds. This project will first inform the local people of the project. Second it will demonstrate various BMP's and third, it will address the need of BMP's in the agricultural portions of the associated watersheds.

The city has also adopted a new storm water management ordinance for any new construction within the city.

Impaired Waters

The only portion of this watershed on the 2004 303(d) List of Impaired Waters is the Lake Backbone area for its high bacterial levels that affect its use for recreational purposes. This lake is used for swimming and fishing purposes, and is monitored frequently from April until the end of the summer season. It is frequently posted as unfit for human contact when bacterial levels rise to unacceptable levels. This is most likely due to livestock waste from farms above the Lake and grazing cattle that are allowed access to the stream immediately

above Backbone Lake, but as mentioned earlier, a 2006 DNR study also implicated improper operation of the sewer system of Lamont as a source, and the community of Strawberry Point has also had controlled releases because of lack of capacity. These have been addressed, and should help to alleviate the condition.

Wastewater Treatment

The six rural communities in the Lake Delhi drainage area- Dundee, Edgewood, Greeley, Lamont, Masonville, and Strawberry Point- all use waste stabilization lagoons to treat their community waste. These are all functioning properly at this time.

The City of Manchester, population 5,257, is proceeding with plans to upgrade their wastewater treatment facilities. Their current plant was constructed in 1952, and was last upgraded in 1982. These plants typically have a useful life of 20 years. The $7.5 million improvements will decrease the BOD of the water discharged from the system.

Lake Delhi has a history of elevated bacterial levels. Some of this is due to inflows from the Maquoketa River upstream, as water sampling has shown high bacterial levels throughout the river system. However, a major cause is likely the numerous private septic systems serving the residences that have been built around the Lake since it became a recreational destination. Homes built since 1992 in Delaware County have had to meet regulations. It is the systems that existed before then that contribute more than proportionally to the bacterial problem on the lake. Plans at this time are to develop cluster septic systems, each treating the waste from a handful of residences, as an alternative to a cost-prohibitive association-wide system.

Section IV: Goals and Objectives

The overall goal of this project was to develop a community-based comprehensive watershed management plan for the watershed above Lake Delhi. This comprehensive plan will provide the needed planning information to enable stakeholders to access financial resources to implement water quality protection practices. The following objectives and activities were identified for the project and have been implemented to accomplish this goal.

Objective 1: Complete a comprehensive assessment of the watershed above Lake Delhi to identify priority areas for future project development.

Activity A

- Sampling points were strategically selected in the watershed to quantify nutrient, bacteria and sediment loading. A map showing the location of these sampling points within the overall watershed and within the sub-watersheds is located on page 16.

Activity B

- Bar graphs summarizing the data are located within the narrative of this report for each of the priority sub-watersheds.

Activity C

- A complete stream corridor assessment was completed with the corridor assessment located on pages 36 - 40 in the appendix.

.**Activity D**

- The priority sub-watersheds were identified. They are Sand Creek, Coffins Creek, Honey Creek and Lindsey Creek. A detailed description of each of these sub-watersheds will be provided in this report.

Objective 2: Complete a detailed "field by field" assessment in priority sub-watersheds and identify and demonstrate strategies to reduce sediment, nutrient and bacteria impairments. The assessments were completed based on 160 acre randomly selected sites. Refer to page 41 in the appendix.

Activity A

- Assessments were completed using the Iowa DNR notebook computer.

Activity B

- Stakeholder surveys were conducted to determine acceptance of implementing water quality practices. The summary of responses is detailed in the narrative for each of the priority sub-watersheds. A copy of each survey is on pages 43 & 52 in the appendix.

Activity C

- Best management practices have also been identified in the report. They are identified as structural and cultural practices with the benefits elaborated for each.

Activity D

- This will be implemented as each sub-watershed is implemented. During the summer of 2008 a stream bank stabilization demonstration was completed on the Maquoketa River within the Manchester city limits. No sign or field day has been held yet but it is planned to construct a sign and hold a field day for the public.

Activity E

- The open lot evaluations were completed. The summary of this evaluation is located on page 25 & 26.

Objective 3: Implement a model designed to measure the impacts of Best Management Practices.

Activity A

- Sediment delivery was calculated using technology developed by Iowa DNR and Iowa DSC. Maps showing the calculated sediment delivery are located on pages 53 & 54 in the appendix.

Activity B

- Land cover changes will be updated for each sub-watershed as deemed appropriate based upon how soon the project applications will be submitted for each sub-watershed.

Objective 4: Assess the impacts of storm and waste water from cluster developments and communities and identify potential solutions.

Activity A

- The various cities were contacted to determine any problems and/or actions taken to correct the potential problems. A brief explanation for each is in the report narrative.

Objective 5: Establish sub-watershed stakeholder groups to set priorities for future implementation.

Activity A

- Representatives were contacted and have been utilized for assistance in establishing financial support for the stream bank stabilization demonstration project as well as expert input on a variety of subjects associated with this project.

Activity B

- Stakeholder meetings were held to disseminate water quality assessment data to the stakeholders and identify actions for water quality project implementation.
- A stakeholder meeting was held to review the final report of the comprehensive plan. The general consensus of the attendees was that Honey/Lindsey Creek was more critical than Coffins Creek. The attending stakeholders all would like to see the SWCD pursue funding for a water quality project in Honey/Lindsey Creek initially with efforts made toward Coffins Creek later.

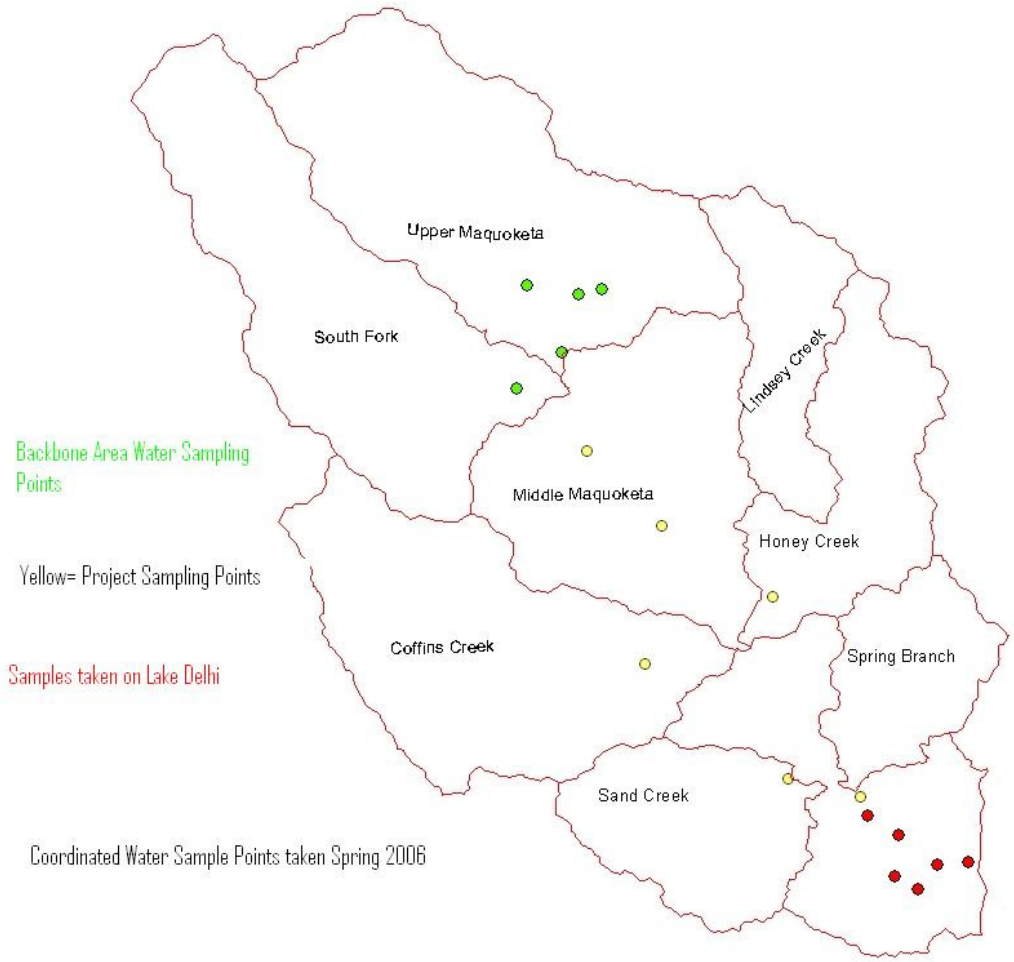
Section V: Research Results

Water Sampling

The Maquoketa River flows through 9 counties in northeast Iowa and empties into the Mississippi River in Jackson County. The WALDD takes water from portions of 4 of these counties, namely Buchanan, Fayette, Clayton, and Delaware. Portions of the Maquoketa River that flow through Delaware County were monitored. The goal in monitoring the Maquoketa River in Delaware County was to identify areas of the watershed that have the highest

concentration of bacteria, nutrients, and sediment and also to establish a baseline from which to evaluate the success of future projects in the sub-watershed.

The water sampling done in the watershed was the result of several interested parties. There were three areas identified for sampling. They are: 1) Backbone Beach and Watershed because of its designation as a "vulnerable beach". It is a swimmable beach at a State Park with a history of high bacteria levels and is regularly monitored by Iowa DNR. 2) Stream corridor between Backbone State Park and Lake Delhi and 3) Lake Delhi itself. The water samples were collected on the same days under similar conditions using the same sampling protocol. Below is a map showing the locations of the sampling points within the watershed.



Backbone Beach and Watershed

Backbone beach is considered a “vulnerable” beach, meaning that it has a history of having high bacteria levels during the swimming season. Backbone Lake, which is designated for swimming and warm water fishing uses, i.e. Class A, is on the State of Iowa “impaired water list” because it does not meet the State of Iowa water quality standards for *E. coli.*

Nine sites were sampled at the Backbone Lake beach. These sites were located along three transects that ran perpendicular from the beach shore with 3 sample sites along each transect. The 3 sample sites were located at ankle, knee and chest depth along each transect.

Five sites (sites in green on above map) were sampled in the Backbone Lake Watershed which is approximately 76,544 acres. They are:

1.) Maquoketa River with approximately 21,120 acres.

2.) Fenchel Creek – 7,168 acres which is mostly agricultural land with some livestock. It also receives controlled wastewater from the community of Strawberry Point. Fenchel Creek is also determined to be a losing stream.

3.) Richmond Springs is a continuously flowing ground water spring. A cold water designation for Fenchel Creek begins at the mouth of Richmond Springs. Richmond Springs was sampled before it entered Fenchel Creek.

4.) The “Maquoketa near Picnic Area” site was on the main channel of the Maquoketa River, located downstream of where Fenchel Creek empties into the Maquoketa River, near a picnic area in Backbone State Park.

5.) The South Fork (of the Maquoketa River) drains an area of approximately 36,416 acre area. The City of Lamont discharges their wastewater from a controlled discharge lagoon into the Lamont. The monitoring site on the South Fork (South Fork 19) was located downstream of where the Lamont Creek enters the South Fork and upstream of the mouth of the South Fork.

Maquoketa River between Backbone State Park and Lake Delhi

Three sites were monitored on the main channel of the Maquoketa River and 3 sub-watershed sites at points above their confluence with the Maquoketa. (sites in yellow on above map) The “Maquoketa below Backbone” site was located on the main channel of the Maquoketa River, downstream of Backbone State Park at the bridge west of Dundee. The “Mid Maquoketa” site was also located on the main channel at the Lindsey Bridge over the Maquoketa River and was approximately half the distance between the south border of Backbone State Park and the city of Manchester. The “Lower Maquoketa above Lake” site was sampled at the Baileys Ford Bridge at the north end of Lake Delhi. This site is

located downstream of the City of Manchester, which discharges the treated wastewater into the Maquoketa River.

The three sub-watersheds that were monitored included: Honey Creek, Coffins Creek and Sand Creek. Honey Creek drains approximately 30,900 acres of land, which is 80% cropland. This drainage area includes Lindsey Creek, a smaller sub-watershed of 12,700 predominantly agricultural acres. The "Honey Creek Outlet" site was located on the downstream end of Honey Creek at the bridge on 180th Ave, or old Highway 13. Coffins Creek drains approximately 35,600 acres of land, which is 90% cropland. The "Coffins Creek" site was located at the bridge on 145th Ave, or County Road W69, just below the Coffins Grove Park. Sand Creek drains approximately 16,045 acres, which is also over 90% cropland. The "Sand Creek Outlet" site was located less than 0.5 mi. from its mouth.

Lake Delhi

Lake Delhi has a drainage area of 223,000+ acres. Lake Delhi (also known as "Hartwick Lake" for the town that was flooded in its construction) is a heavily recreated lake within the main channel of the Maquoketa River. A low-head dam at the south end of Lake Delhi slows the river flow rate and maintains a minimum water level throughout the lake. There are approximately 875 residences surrounding Lake Delhi, approximately 1/3 of which are occupied year round. The remaining 2/3 residences are only occupied during weekends and summer months. There is no community sewer system for the residences surrounding Lake Delhi. Public and private lake access is available at the lake. From Memorial Day through Labor Day of each year the lake is heavily recreated by boaters, fisherman, swimmers, water skiers and jet skiers.

Six sites were monitored at Lake Delhi (Figure 4). The sample site for Fink's Creek was located at the edge of the mouth of the stream, as it enters Lake Delhi. The sample site for "Croskey's" was located about one-third of the total width of Lake Delhi from the west shore. Freddy's Beach was sampled within the area considered to be swimmable, for the private beach. The sample site for Turtle Creek was located at the mouth of the stream, before it enters Lake Delhi. Camp O' Delhi was sampled in the swimmable area of this privately-run beach. Lost Beach was sampled downstream of the beach area, at the mouth of a small drainage ditch.

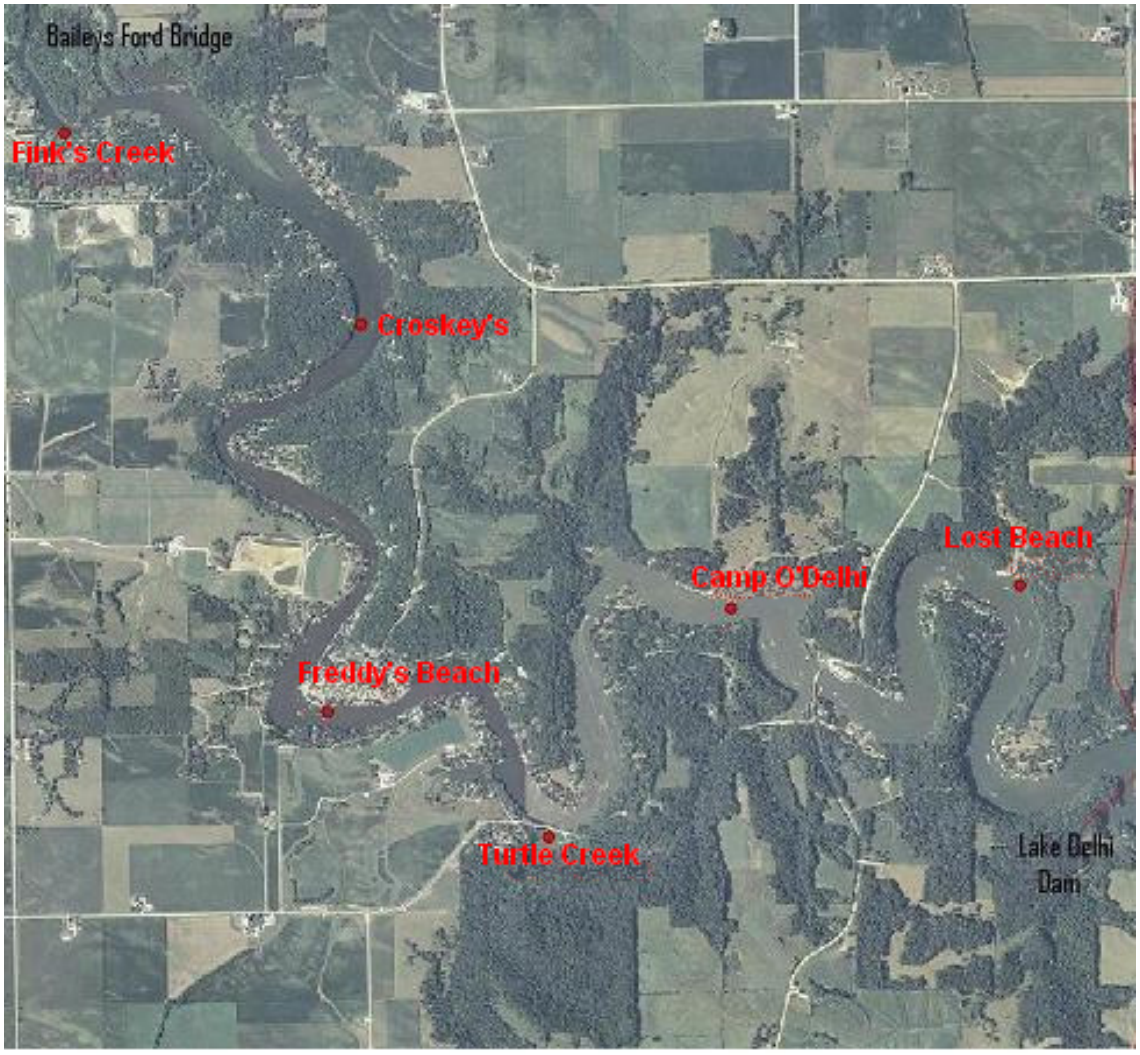


Figure 4

Lab analysis for the samples was performed by the University of Iowa Hygienic Lab (UHL), an Environmental Protection Agency (EPA) certified lab. Due to cost restraints, field test kits were used at some locations in place of lab analysis. In an effort to study the difference in results between the field test kits and the lab results, both methods were used for sites on the Maquoketa River between Backbone State Park and Lake Delhi.

Sampling was conducted from April 3rd through June 5th, 2006. The beach at Backbone State Park was sampled from 7:30 to 8:15 a.m. The Backbone watershed was sampled from 8:30 to 10:30 a.m. The Maquoketa River between Backbone State Park and Lake Delhi was sampled between 10:30 a.m. and 2:00 p.m. Lake Delhi was sampled between 10:15 a.m. and 2:30 p.m.

The sampling was conducted 6 times or more at all sites. Based on the rainfall and flow data that was collected between April 1st and June 7th, the following sampling dates were considered rainfall sampling events: April 3rd and 18th, and May 1st and 31st. The other two sampling events, May 15th and June 5th, were considered dry sampling events. The sites on the Maquoketa and the 3 sub-watersheds were also sampled on June 12th after a substantial rainfall.

Nitrogen, phosphorus, and chloride were monitored. Bacteria were monitored by testing for *E. coli*. Dissolved oxygen, temperature, pH and turbidity measurements were taken on site.

Inventory of Pollutants

Bacteria

Sampling Parameters

The Iowa Department of Natural Resources has adopted a one-time standard of 235 colonies/100 mL of *E. coli* as the maximum allowable concentration of bacteria in water designated for swimming (Class A1 streams and beaches). At each site, a water sample was taken for *E. coli* analysis, preserved and sent to the UHL, for analysis.

Sampling Results

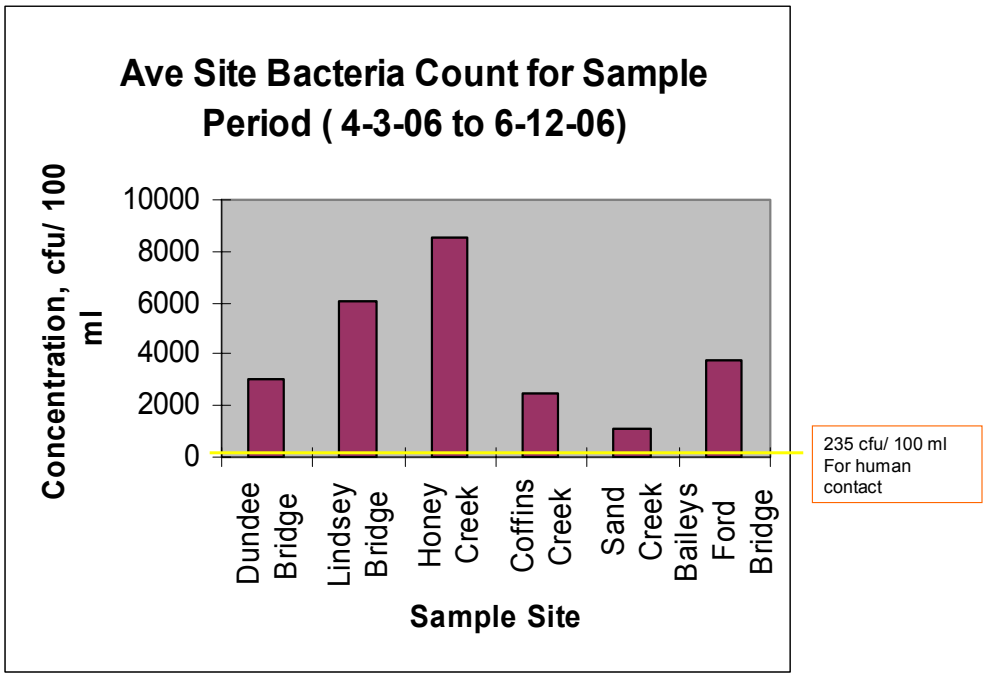
At every site that was sampled for this study, the average concentration of *E. coli* was higher during rainfall sampling events than dry sampling events. This indicates that non-point sources of pollution are entering all of the water bodies studied. Fenchel Creek and Honey Creek had the highest *E. coli* levels during rainfall events (19393 and 29000 colonies/100 mL, respectively). These two sites also had the highest *E. coli* average during dry events. This indicates inputs of both point and non-point sources of pollution in the watersheds of these two streams. Honey Creek had the highest overall average E. coli count for the sampling period.

Most sites within Class A1 waters (Backbone Beach, Lake Delhi and the Maquoketa River within Backbone State Park), went above the one-time State of Iowa Standard for bacteria during all of the rainfall sampling events. All nine sites at Backbone Beach went above the one-time bacteria standard during all of the rainfall sampling events. During dry sampling events, Backbone beach water averaged 68 colonies/100 mL. The Maquoketa River near Picnic Area site (within Backbone State Park, downstream of Richmond Springs and Fenchel Creek) went above the one-time state standard for bacteria during all of the rainfall sampling events. This site averaged 12,748 colonies/100 mL during rainfall event sampling.

The monitoring site on the South Fork (of the Maquoketa River) had an average *E. coli* concentration of 1000 colonies/100 mL during rainfall sampling events and 345 colonies/100 mL during dry sampling events. This indicates there are both point and non-point sources of human and/or animal waste entering the South Fork. During every sampling event, cattle were observed near or in the stream, directly upstream of the South Fork site. Noticeable stream bank erosion and compaction was also noticed at this site.

The Lake Delhi sites all went above the one-time standard for bacteria during rainfall sampling events. Lost Beach had the lowest average for all samples taken, while the Finks Creek and Croskeys had the highest averages. Fink's Creek, a small tributary of Lake Delhi, had the highest concentration of *E. coli* during rainfall events, of all the Lake Delhi sites. This indicates human and/or animal waste is entering Fink's Creek during rainfall events. There is at least one known livestock operation upstream of the Fink's Creek site.

The lowest average for E. coli concentration during rainfall events occurred at Lost Beach (252 colonies/100mL) on Lake Delhi and Richmond Springs (148 colonies/100 mL) above Backbone Lake. During a heavy rainfall event on May 31, Richmond Springs had its highest spike with an E. coli level of 510 colonies/100 mL.



Nutrients

Sampling Parameters

Three forms of nitrogen were monitored: ammonia, total Kjeldahl nitrogen (TKN), and nitrate + nitrite (N+N). Ammonia is the inorganic, dissolved form of nitrogen in water. It is a product of the decomposition of organic matter and indicates there is a nearby source of human or animal waste or fertilizer. Ammonia was sampled with the HACH Ammonia Nitrogen Test Kit at most of the monitoring sites. Ammonia was also lab analyzed by the UHL at the Maquoketa River between Backbone State Park and Lake Delhi sites.

The State of Iowa water quality standard for ammonia in Class B surface waters is dependent upon pH.

TKN is the organic form of nitrogen. It is a product of the decomposition of ammonia and is measured by the Kjeldahl Method. Sources for TKN include human and animal waste, and decaying and live organic matter. TKN was sampled consistently at the Maquoketa River above Lake Delhi site and the Lake Delhi sites.

N+N is the oxidized, inorganic form of nitrogen in water. It is necessary for plant growth, but excessive amounts cause nutrient enrichment. Sources for N+N include soils, human and animal waste, decomposing plants, and fertilizer. N+N concentration was monitored by two methods. Field HACH test strips were used at all sites. Lab analysis was conducted for sites between Backbone State Park and Lake Delhi.

The State of Iowa has not adopted water quality standards for TKN or N+N for class B surface waters. The EPA's recommended standard for TKN is 0.65 mg/L or less. The EPA's recommended standard for N+N is 1.965 mg/L or less.

Phosphorus in the form of total phosphate (TP) was monitored. TP is the dissolved and particulate form of phosphorus in water. It is a necessary and limiting nutrient for plant growth. Excess amounts can cause nutrient enrichment. The sources of total phosphate are soils and bedrock, human and animal waste, detergents, decomposing plants and fertilizer. Currently, the state of Iowa has not adopted water quality standards for TP for class A and B surface waters. Its presence is generally established as a sign of soil erosion reaching the stream.

Sampling results

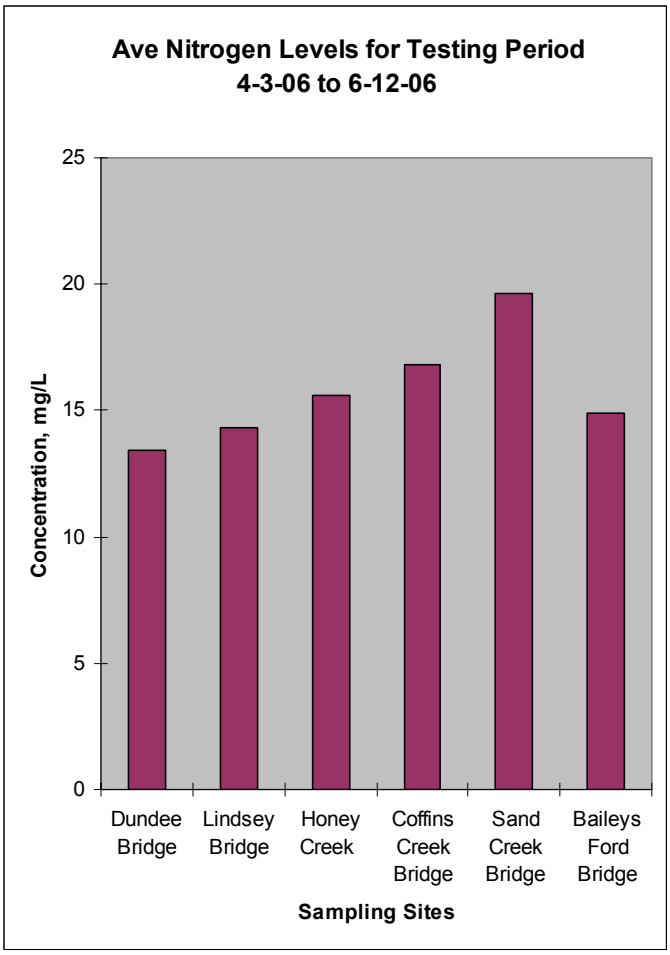
As previously stated, due to cost restraints, field test kits were used at some locations in place of lab analysis. Ammonia results from the HACH field kit were not comparable to the lab test results (R^2=0.0). Of the 42 side-by-side field and

lab tests for ammonia concentration that were run, none of the field kits yielded a positive ammonia result, while 14 of lab tests yielded a positive ammonia result. The ammonia results from the HACH Ammonia Nitrogen Test Kits were not considered when analyzing the ammonia results, only lab results were considered.

Ammonia was detected frequently during the early spring sampling events at relatively low levels. The highest concentration of ammonia was detected at the Honey Creek outlet site (0.5 mg/L) on April 3rd, 2006, following a rainfall event. None of the positive ammonia detections were above the State of Iowa water quality standards for Class B streams with early aquatic life (IAC, 2003

TKN ranged from non-detectable to 2.5 mg/L at the sites where it was monitored. TKN was monitored on all sample dates on the Lake sites and at the Baileys Ford site above the Lake's beginning point. The other sites on the Maquoketa were each checked twice during the sample period, all after the same rain events. The EPA recommendation for TKN concentration is $\leq$0.65 mg/L. The average TKN concentration was higher than this recommended concentration at all sites during both rainfall and dry sampling events. Freddy's Beach had the highest average TKN concentration during both rainfall and dry sampling events (1.3 and 1.2 mg/L, respectively), with a high of 2.5 and a low of 0.4. All but one of the lake sites had high readings approaching 1.8, and of the 36 samples taken during the sample period, >80% were above the EPA's suggested 0.65.

N+N typically has higher concentrations in Iowa streams during the spring of each year, due to fertilizer application. The EPA recommendation for N+N is $\leq$1.965 mg/L. Every site that was analyzed for N+N by the UHL had a N+N concentration above the EPA recommendation. Values for N+N ranged between 7.2 and 25 mg/L, with an average value of 15.8 mg/L for the six sample sites between Backbone Lake and Lake Delhi. Average N+N concentrations during rainfall sampling events were higher than during dry sampling events.



TP results from the field kit were comparable to the lab test results (R^2=0.5). Thirty-five side-by-side field and lab tests for TP were run. Field test kit results for TP tended to overestimate the amount of TP concentration when compared to the lab result for the same samples.

TP was near the EPA's recommended standard (≤0.12 mg/L) at most sites. The average TP level at all sites ranged from 0.10 to 0.22 mg/L. The Lower Maquoketa above Lake Delhi site had the highest average TP concentration (0.22 mg/L), as detected by the UHL analysis.

Sediment Delivery

As part of this project, three of the sub-watersheds in this drainage area were selected for a field-by-field assessment. This entailed observing land use on all acres, projected crop rotations used on all farmed acres, tillage systems used on these acres, crop residue levels left on these fields, and conservation practices (grassed waterways, contouring, terraces, ponds) that are being applied on these acres. These observations, collected in the fall/winter of 2006-2007, were then

entered into the Revised Universal Soil Loss Equation, known as RUSLE, to arrive at soil loss estimates from each watershed. These figures are used to generate total projected soil losses from watersheds on a total and per acre tonnage basis, which allows for comparison between watersheds.

A review of the figures from these 3 watersheds shows a distinct difference among them. Coffins Creek, with its flatter slopes and greater number of acres observed to be employing conservation tillage of various levels, was estimated to deliver 0.13 tons of soil/acre annually to the stream. By comparison, Honey Creek delivered twice that at a rate of 0.26 tons/acre, still a relatively low rate due to a high proportion of flatter soils even though they are tilled more intensively than is Coffins because this watershed has more animal waste to incorporate. Lindsey Creek, which as a sub-watershed of Honey Creek is on steeper slopes, is estimated by these observations to produce 2.6 tons/acre of soil loss annually. These maps can be viewed on pages 55 - 57 in the appendix materials.

These assessments will be used to prioritize one-on-one contacts in the watersheds and to help determine the BMP's best suited to reducing the sediment delivery to the stream and ultimately improve the water quality.

Stream Visual Assessment Protocol

As part of this project, stream segments that fell within randomly chosen, 160 acre tracts throughout the watershed were scored using the Stream Visual Assessment (SVAP) protocol. The is meant to provide a basic measure of stream health by evaluating physical characteristics of the immediate stream corridor, water appearance, habitat for fish and macro invertebrates, and the presence or lack of high quality, intolerant macro invertebrates that serve as a food source for fish populations.

Thirteen sites were scored using the SVAP methodology. Of these, 3 scored over 9.0 points to place them in the excellent category. One of these was on Spring Branch, the cold water trout stream. Another was on the Maquoketa River, below a riffled area near the Lindsey Bridge. The third was a well vegetated area on Lamont Creek, across the road from the truck stop at Lamont.

Two more sites scored between 7.5 and 8.9 points, placing them in the good category. Five sites landed in the fair category, between 6.1 and 7.4. The remaining 3 sites scored less than 6.0 for a poor rating. Eight total sites (61%) fell into the poor and fair categories.

Open lot Evaluations

A drive-by evaluation was completed to identify livestock operations in each watershed as well as evaluate the potential runoff of manure from open lots. A

copy of the evaluation form is included in the appendix on page 42. A misleading aspect of this evaluation is that it does not account for the number, the type, the size of livestock or how long the open lot is occupied. The other concern not addressed is the method, rate, and timing of manure application to the fields. Based on a lack of that information, the results are somewhat misleading in that the potential problem doesn't look much different from one watershed to another. Personal observation of the two watersheds leads one to consider Honey Creek/Lindsey Creek to have the greatest potential problem with manure runoff based on the number, type, and size of the livestock operations. Following are the results of the evaluation by watershed:

Coffins Creek

- Number of livestock operations - 43
- Number of open lots - 23 or 53%
- Likely maximum score - 215
- Range of scores - 60 to185
- Average score - 138

Honey Creek/Lindsey Creek

- Number of livestock operations – 52
- Number of open lots - 22 or 42%
- Likely maximum score - 215
- Range of scores - 40 to 205
- Average score - 136

The higher the score, the greater is the potential of an adverse impact to water quality.

Stakeholder Surveys

As part of this project, a survey was sent out to landowners and operators in two of the selected priority sub-watersheds within this drainage area above Lake Delhi. One of these was Coffins Creek, to the west and north of Manchester. The other was Honey Creek, to the north and east of Manchester. Honey Creek also includes Lindsey Creek which is a sub-watershed that lies within the Honey Creek watershed area. This survey was sent to gather information from local residents on sources of information that they use concerning soil and water conservation, the value of the information received from these sources, their attitudes about environmental practices that can be used, and their opinions about water quality in their local area and factors affecting water quality. The same survey was sent to both watersheds, with one exception. Residents of Coffins Creek were also asked - Is it worth the effort to improve water quality here for the potential economic benefits of having a stream capable of serving as a fishery in its own right or as a feeder stream to the Maquoketa River? This question was not asked of Honey Creek since it does not have a record of supporting game fish as does Coffins Creek. The survey responses from Coffins

Creek represented 24% of the residence in the watershed and 49% of the land area of the watershed. The responses from Lindley/Honey Creek were 21% and 43% respectively. Of the responses in Coffins Creek, 91% was cropland and in Lindley/Honey Creek the responses represented 82% cropland. Following is a brief summary of results from each watershed. The tabulated results of each watershed can be found on pages 53 and 54 in the appendix.

Coffins Creek

1. Sources and Value of Conservation Information
Residents said the USDA Service Center- NRCS and FSA- was their number one source of information when making decisions concerning farm conservation decisions, and the information received was considered helpful or very helpful by 94% of respondents. Soil and Water Conservation District Commissioners ranked second and Farm magazines ranked third.

Based on these responses it will be important to focus at least initially on one-on-one contacts with stakeholders. Once a rapport is established, then other sources of information and education efforts should be effective.

2. Effectiveness of practices
Better crop fertilizer management ranked first. Applying manure based on analyzed nutrient content and soil testing ranked second and better tillage systems came in third.

3. Factors related to adoption of practices
The majority of BMPs currently being used were represented by cultural practices vs. structural practices. Of the identified BMPs, the top 3 are grassed waterways, nutrient management, and various types of reduced tillage. The vast majority of soybeans are planted using no tillage. No-tilling of corn into bean stubble has been tried by over 50% of respondents. No-till corn after corn has been tried by a very few with producers wanting more information on the practice before they risk yields and profits.

Nearly all respondents in Coffins Creek utilize Variable Rate Technology (VRT) when applying crop fertilizer.

Based on the soil loss assessments and responses for this category of the survey, it is most likely the sediment delivery rates can be controlled or reduced primarily by cultural practices therefore reducing the level of cost share assistance needed to implement BMP's.

4. Attitudes about Water Quality Issues
77% of Coffins Creek producers agreed or strongly agreed that water contamination is an important environmental problem, with 27% strongly agreeing. 40% of Coffins Creek responses thought agricultural fertilizers were a

significant contributor. 69% of the stakeholders worry about the purity of their drinking water.

The survey also asked producers who should be responsible for ensuring clean streams in their watershed area. 69% of respondents in Coffins Creek think the landowners are primarily responsible, 56% think recreational users should be responsible, 48% think it is the task of local governmental units and ag businesses, and 44% believe tenants and state government should be responsible.

Because of the attributes of their stream on its own and its relationship with its segment of the Maquoketa, residents of Coffins Creek were asked whether working to improve water quality and thus its fishing and recreational potential as a means of economic development for the Masonville/Manchester was worth pursuing. 82% felt that it was a worthy goal to improve the water quality fishery aspect of Coffins Creek.

Honey Creek/Lindsey Creek

1. Sources and Value of Conservation Information

Residents said the USDA Service Center- NRCS and FSA- was their number one source of information when making decisions concerning farm conservation decisions, and the information received was considered helpful or very helpful by 94% of respondents. Farm magazines and publications ranked second and a farm neighbor ranked third.

Based on these responses it will be important to focus at least initially on one-on-one contacts with stakeholders. Once a rapport is established, then other sources of information and education efforts should be effective.

2. Effectiveness of practices

Better erosion control management ranked first. Better crop fertilizer management ranked second and applying manure based on analyzed nutrient content and soil testing came in third.

3. Factors related to adoption of practices

The majority of BMPs currently being used were represented by cultural practices vs. structural practices. Of the identified BMPs, the top 3 are grassed waterways, nutrient management, and various types of reduced tillage. 50% of the soybeans are planted using no tillage. The respondents expressed concern about not having the proper equipment or concern that this practice would hurt their profits and yields. No-tilling of corn into bean stubble or corn after corn has been tried by very few with producers wanting more information before they risk yields and profits.

Approximately 50% of the respondents reported utilizing Variable Rate Technology (VRT) when applying crop fertilizer.

Based on the responses, it will likely require a higher cost share rate to motivate stakeholders to accept and implement structural practices vs. cultural practices. The soil loss assessments can be used to prioritize and possibly rank the applications for structural practices. This would focus the efforts, BMP's and cost share in the areas with the greatest potential for sediment delivery.

4. Attitudes about Water Quality Issues
60% of Honey Creek producers agreed or strongly agreed that water contamination is an important environmental problem, with 9% strongly agreeing. 25% of Honey Creek responses thought agricultural fertilizers were a significant contributor. 69% of the stakeholders worry about the purity of their drinking water.

The survey also asked producers who should be responsible for ensuring clean streams in their watershed area. 59% of respondents in Honey Creek think the landowners are primarily responsible, 50% think recreational users should be responsible, 41% think it is the task of local governmental units and 38% think ag businesses should be accountable, and 24% believe the federal government should be responsible.

Section VI: Solutions & Management Strategies

Goals
The overall goal of this Comprehensive Plan for the Watershed above Lake Delhi Dam is to gather information which can be accessed to aid in the development of watershed improvement project proposals for funding consideration. The assessment segment of this plan provides an overall view of the water quality problems and attributes of each of the primary sub-watersheds. The management strategies formulate a plan of action for future activities in each sub-watershed. These sub-watersheds are Sand Creek, Coffins Creek and Honey/Lindsey Creek.

The comprehensive plan was developed using existing data, new data from sampling done in conjunction with this project, and input from watershed stakeholders. Agriculture and farming are a very important part of the economy of this area. The potential for increased corn production and an increase in swine finishing units along with the number of cattle being fed could increase the potential for more sediment, nutrient, and bacterial run-off into area streams.

Water sampling done at multiple points in the watershed shows current levels of these compounds are at levels that challenge the ability of area streams to support and expand the population of game fish.

The development of this comprehensive plan involved conducting an inventory and evaluation, formulating and evaluating alternatives and determining public acceptance/community desire for watershed changes.

Based on the water quality issues identified by this project and the concerns within each watershed, the stakeholders have determined that a water quality project application should be submitted for 3 sub-watersheds. Based on the studies conducted, Honey/Lindsey Creek ranked highest in phosphate, bacteria, soil loss, livestock numbers and sediment delivery and second highest in nitrogen levels. Since prior efforts occurred in Sand Creek, it is proposed that Sand Creek, Honey/Lindsey Creek and Coffins Creek will be submitted in the order listed.

Section VII: Assessment and Recommendations for Future Projects

Sand Creek

This sub-watershed has already had an application submitted and approved for a project.

Honey/Lindsey Creek

Inventory and Evaluation

- Drainage area is 30,809 acres
- 52 livestock operations
- Total sediment delivery is 4,704 tons per year
- Average sediment delivery is .26 tons/ac/yr
- Average Nitrogen levels in the stream are 15.57 mg/L
- Average Phosphate levels in the stream are .39 mg/L
- Average bacteria count in the stream is 8539 cfu/100ml

Goals and Objectives

I. Decrease soil erosion and sediment delivery
   A. Implement best management practices
      1. Structural Practices
         a. Terraces
         b. Water & Sediment Control Basins
         c. Grassed Waterways

d. Wetland Creation
e. Ponds
f. Stream bank Stabilization

2. Cultural Practices
   a. No-till farming
   b. Residue management
   c. Contour buffer strips
   d. Filter Strips and Riparian Buffers
   e. Contour farming and Field Borders
   f. Crop Rotations
   g. Nutrient Management
   h. Land use changes
   i. Livestock exclusion from stream corridors

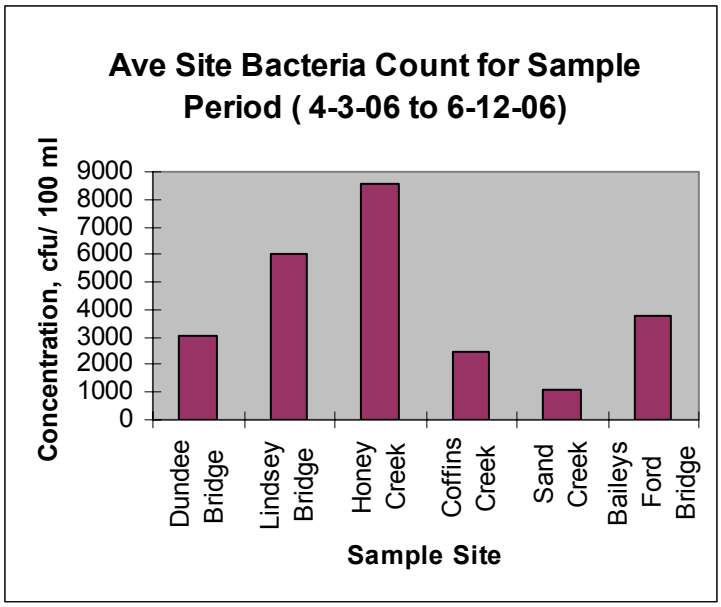
II. Implement Information and Education Efforts
   A. One-on-one personal contacts
   B. News letters
   C. News releases
   D. Demonstrations
   E. Field days
   F. Stakeholder meetings

Coffins Creek

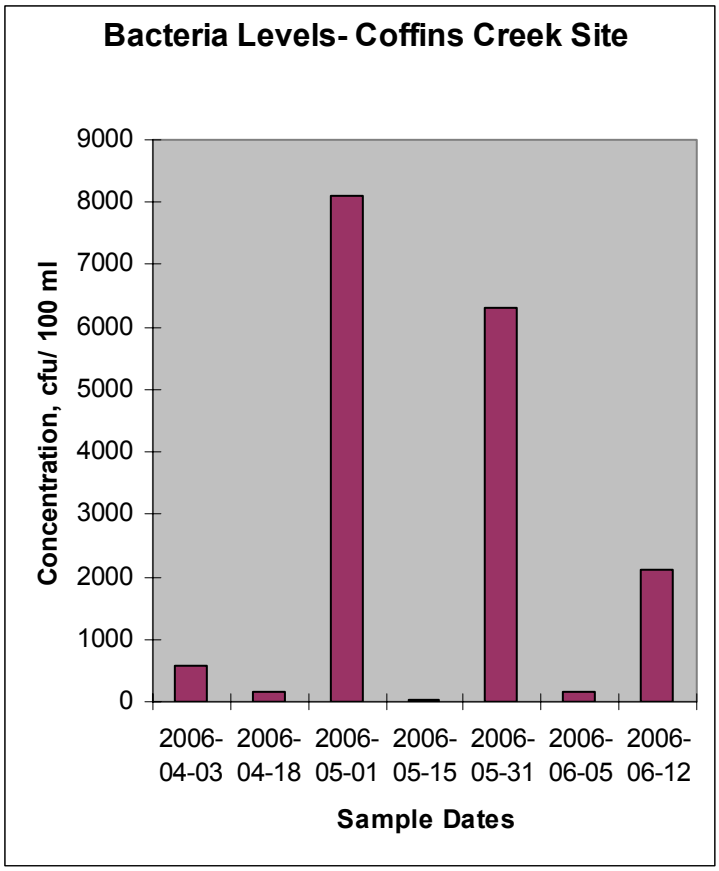
Inventory and Evaluation

- Drainage area is 35,587 acres
- Number of livestock operations is 43
- Total sediment delivery is 4,685 tons per year
- Average sediment delivery is .13 tons/ac/yr
- Average Nitrogen levels in the stream are 16.8 mg/L
- Average Phosphate levels in the stream are .11 mg/L
- Average bacteria count is 2490 cfu/100 ml
- Bacteria count is relatively low with a potential for fisheries
- Fish samples have shown the presence of smallmouth bass
- Stakeholder survey showed an overwhelming number of respondent favored improving the stream as a means of economic development for the Manchester/Masonville area

The following graph shows the bacterial counts for Honey/Lindsey Creek and Coffins Creek relative to other sites in the Delhi watershed, according to 7 samples taken in the spring of 2006.



DNR Fisheries has frequently sampled Coffins Creek over the past 20+ years; their samples have consistently shown the presence of smallmouth bass at low levels. Water sampling done in 2006 indicated the second lowest bacterial levels of this watershed. The graph below shows that the two highest spikes in E. coli levels were at levels lower than the overall period average for two of the other sample sites, as shown in the previous graph. With the exception of the rain event spikes, bacterial levels for this stream are quite low. This low level of bacterial contamination would be a major plus in survivability of an increased fish population if habitat improvements were to be made in Coffins Creek.



Goals and Objectives

1. Decrease soil erosion and sediment delivery
    A. Implement Best Management Practices
        1. Structural Practices
            a. Terraces
            b. Water and Sediment Control Basins
            c. Grassed Waterways
            d. Wetland creation
            e. Ponds
        2. Cultural Practices
            a. No-till farming
            b. Residue Management
            c. Contour Buffer Strips
            d. Filter Strips and Riparian Buffers
            e. Contour Farming and Field Borders
            f. Crop Rotations
            g. Nutrient Management
            h. Land use changes such as more forages and/or trees
2. Implement Information and Education Efforts
    A. One-on-one personal contacts
    B. News letters

C. News releases
D. Demonstrations
E. Field days
F. Stakeholder meetings

3. Enhance the potential for improved fisheries
    A. Implement goal 1
    B. Identify and control eroding stream banks
    C. Install fish hides at eroding stream banks
    D. DNR fisheries conduct a more detailed assessment to determine key sites for habitat development and stream bank repairs

Fisheries Enhancement

Another priority area of the watershed is to work on the main channel of the Maquoketa River to improve the fishery potential. This will call for actions of 3 types on the main channel of the Maquoketa River and on key tributaries: 1. Repair of key eroded stream bank sites to reduce sediment delivery to identified important game fish reproductive areas; 2. Enhancement of fish habitat as a part of the stream bank reparations and/or by addition of riparian vegetation; and 3. Improving water quality in general by reducing the delivery of sediment, bacteria, and nutrients to the streams and, ultimately, the river. The sites will be prioritized based upon the extent of erosion and quantity of sediment being delivered to the stream. It is estimated that 1-3 feet of bank is lost each year from the eroding stream banks. If all banks are eroding at the same rate, then priorities will be based upon the height and length of each eroding area. In time, a more accurate determination can eventually be made by actually measuring the advancement of bank erosion at each of the identified sites and prioritizing them accordingly.

The RASCAL assessment (*Objective 1 Activity C*) of the main stem of the Maquoketa River from the Backbone Dam down to the Baileys Ford access identified 58 sites of stream bank erosion that were deemed significant. These are part of a GIS record with estimated lengths and heights. These sites can then be ranked according to the amount of sediment delivery. This summary of sediment delivery on a per site basis can then be referenced as to its proximity to key potential fish breeding areas to allow for ranking of sites so that those sites most likely to improve fish populations are targeted first. The RASCAL assessment inventoried habitat along this stretch of the Maquoketa, noting areas with no habitat, areas with less than 30% habitat, and areas containing 30-60% habitat. A more detailed review of these areas containing habitat will need to be done by DNR Fisheries personnel to determine those sites best suited for reproductive habitat improvement.

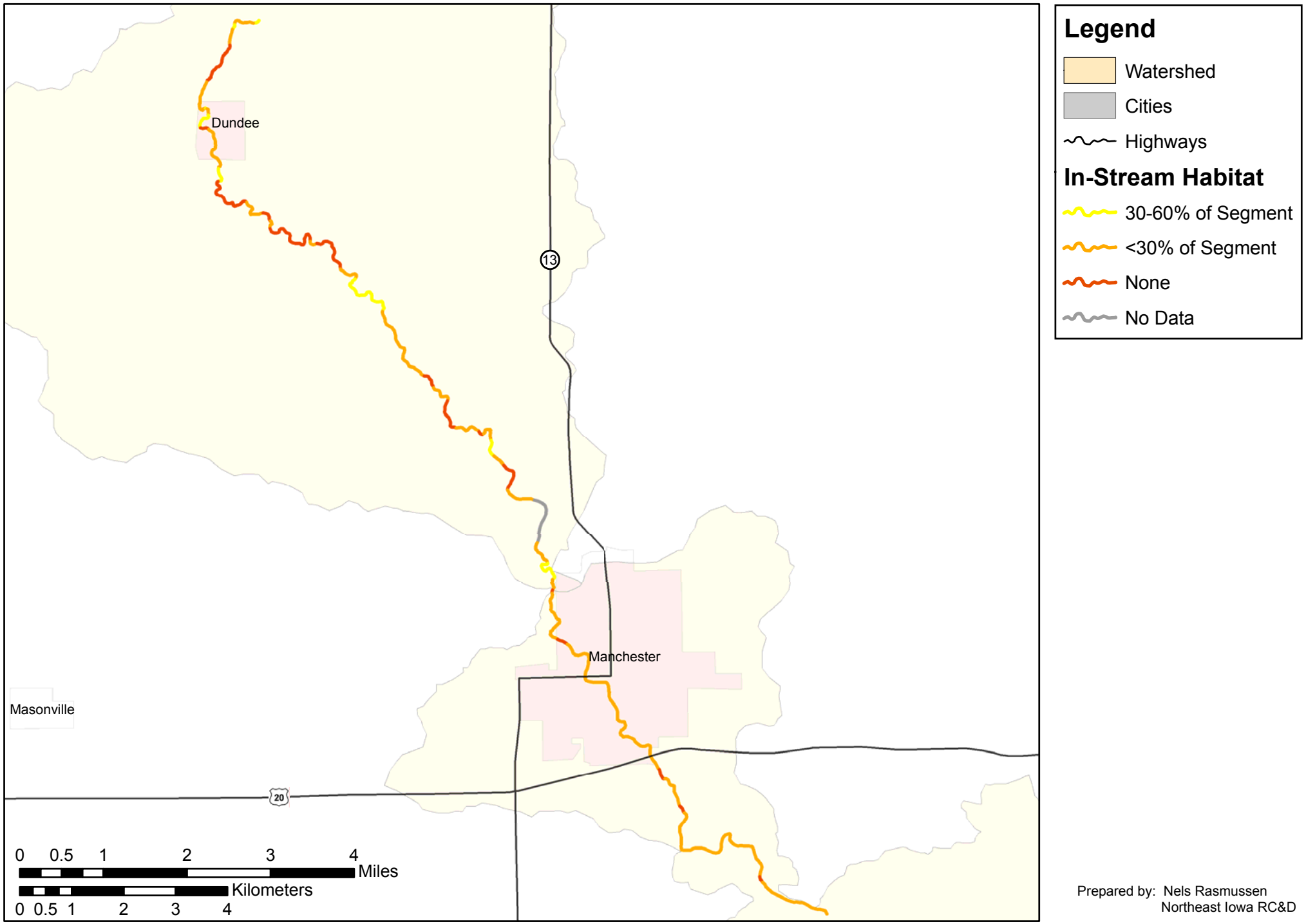
This approach will also need to be applied to other key tributaries that appear to offer potential as nursery streams for the Maquoketa.

The general improvement of water quality in these key tributaries, and consequently on the main reach of the Maquoketa River, would also play a major role in improving fish populations since it also makes the river a better overall recreational outlet for local citizens or visiting tourists. This would help by providing conditions that sustain a plentiful food supply of macro-invertebrates that can in turn feed a growing fish population and by providing water quality conducive to survivability of young fish that are susceptible to E. coli, nitrate, and sediment surges. This will require application of various conservation practices across the watershed landscape or practices targeted to specific critical sites.

Section VIII: Appendix

Maquoketa River In-Stream Assessment

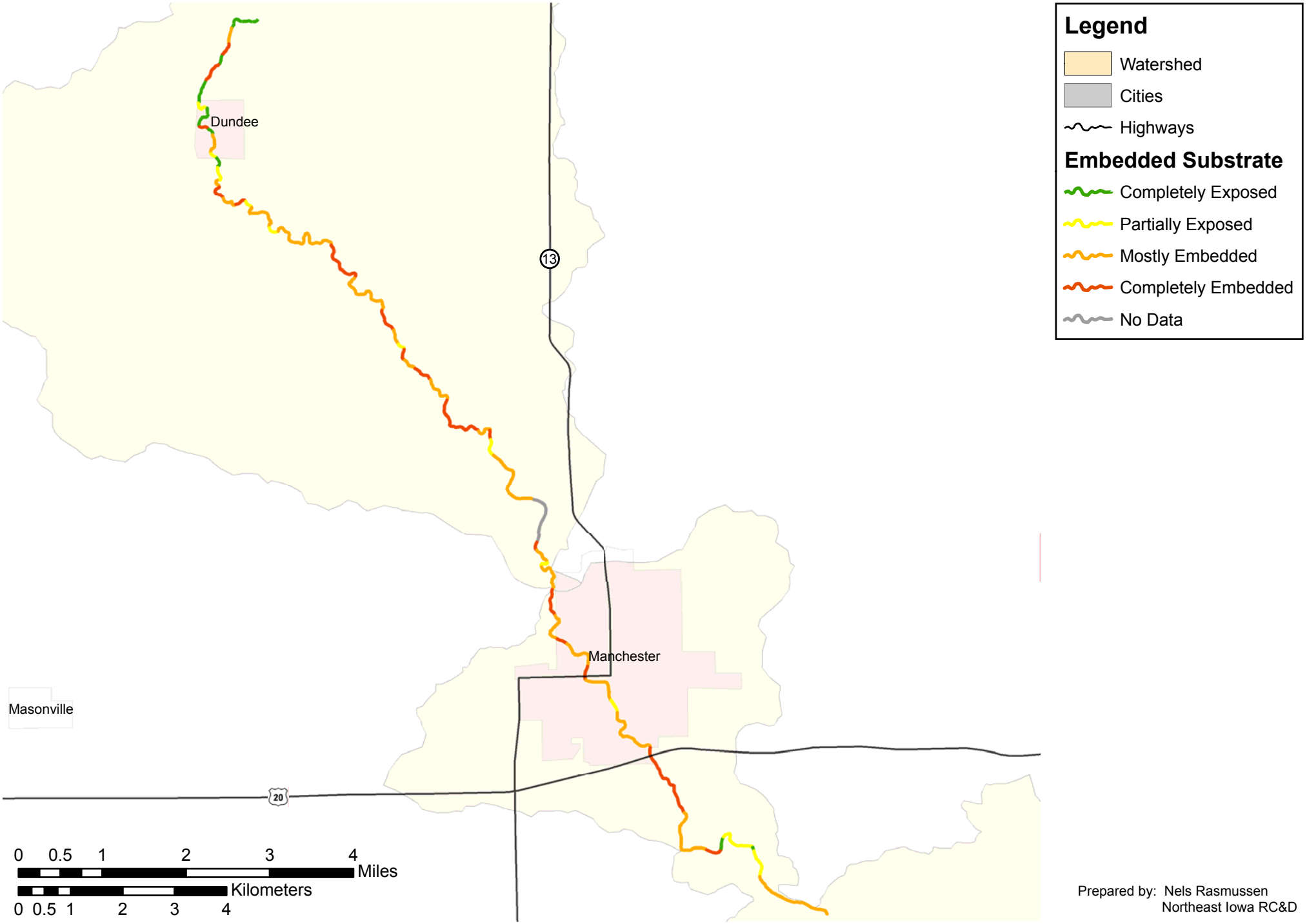
In-Stream Habitat



Prepared by: Nels Rasmussen
Northeast Iowa RC&D

Maquoketa River In-Stream Assessment

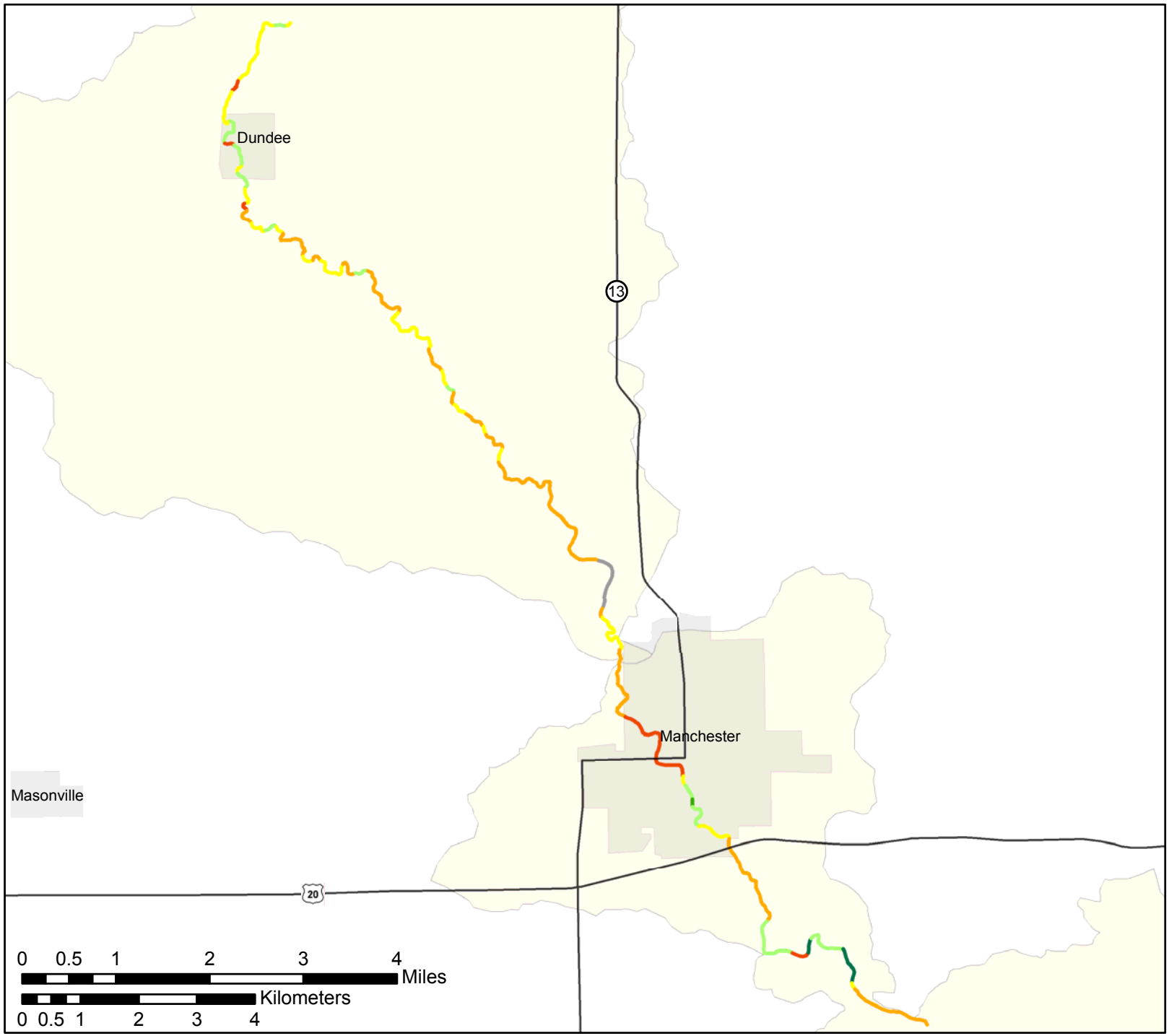
Embedded Substrate



Prepared by: Nels Rasmussen
Northeast Iowa RC&D

Maquoketa River In-Stream Assessment

Substrate



Legend

- Watershed
- Cities
- Highways

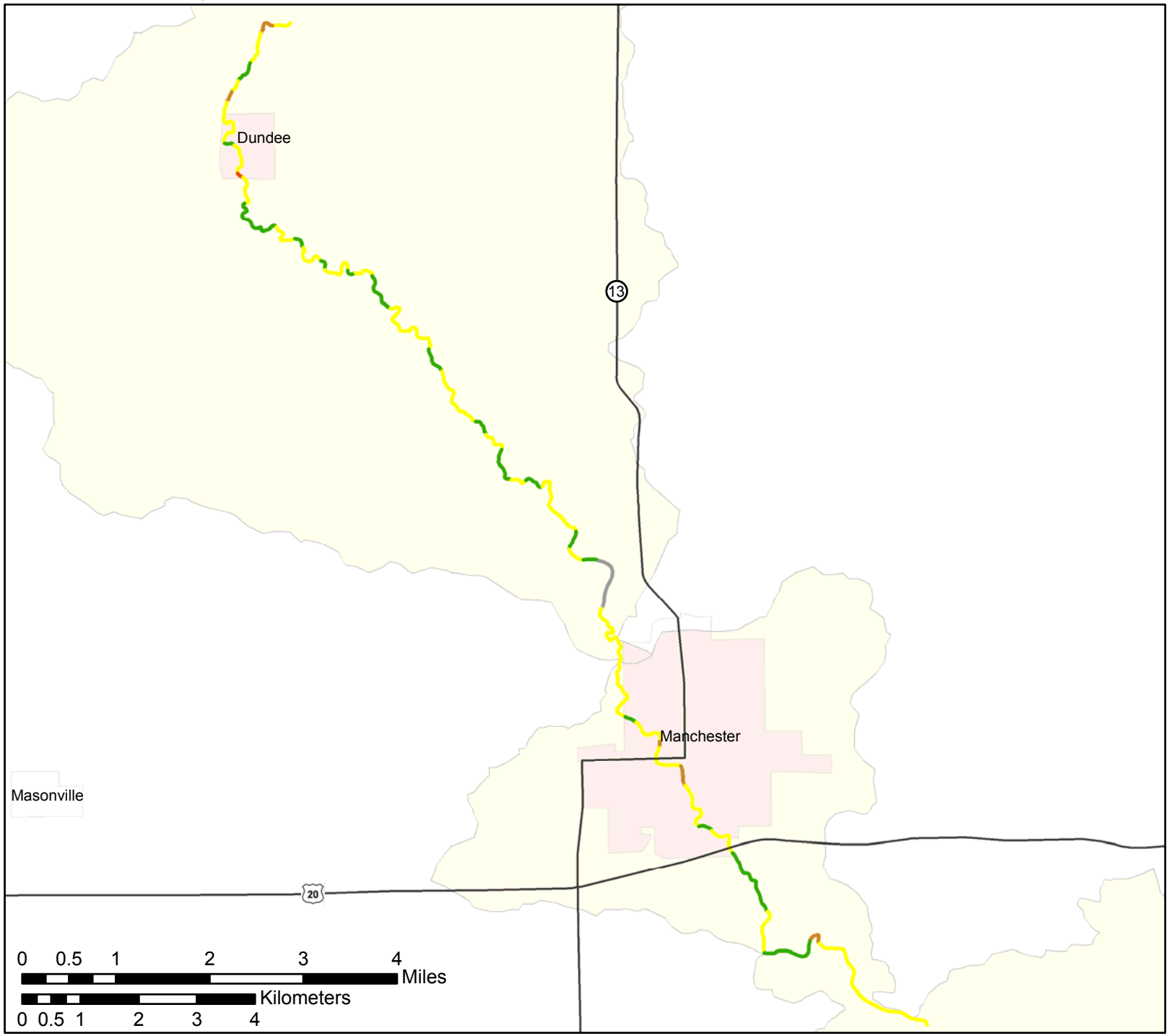
Substrate

- Bedrock
- Boulder
- Cobble
- Gravel
- Sand
- Silt/Mu
- No Data

Prepared by: Nels Rasmussen
Northeast Iowa RC&D

Maquoketa River In-Stream Assessment

Pool Frequency



Legend

- Watershed
- Cities
- Highways

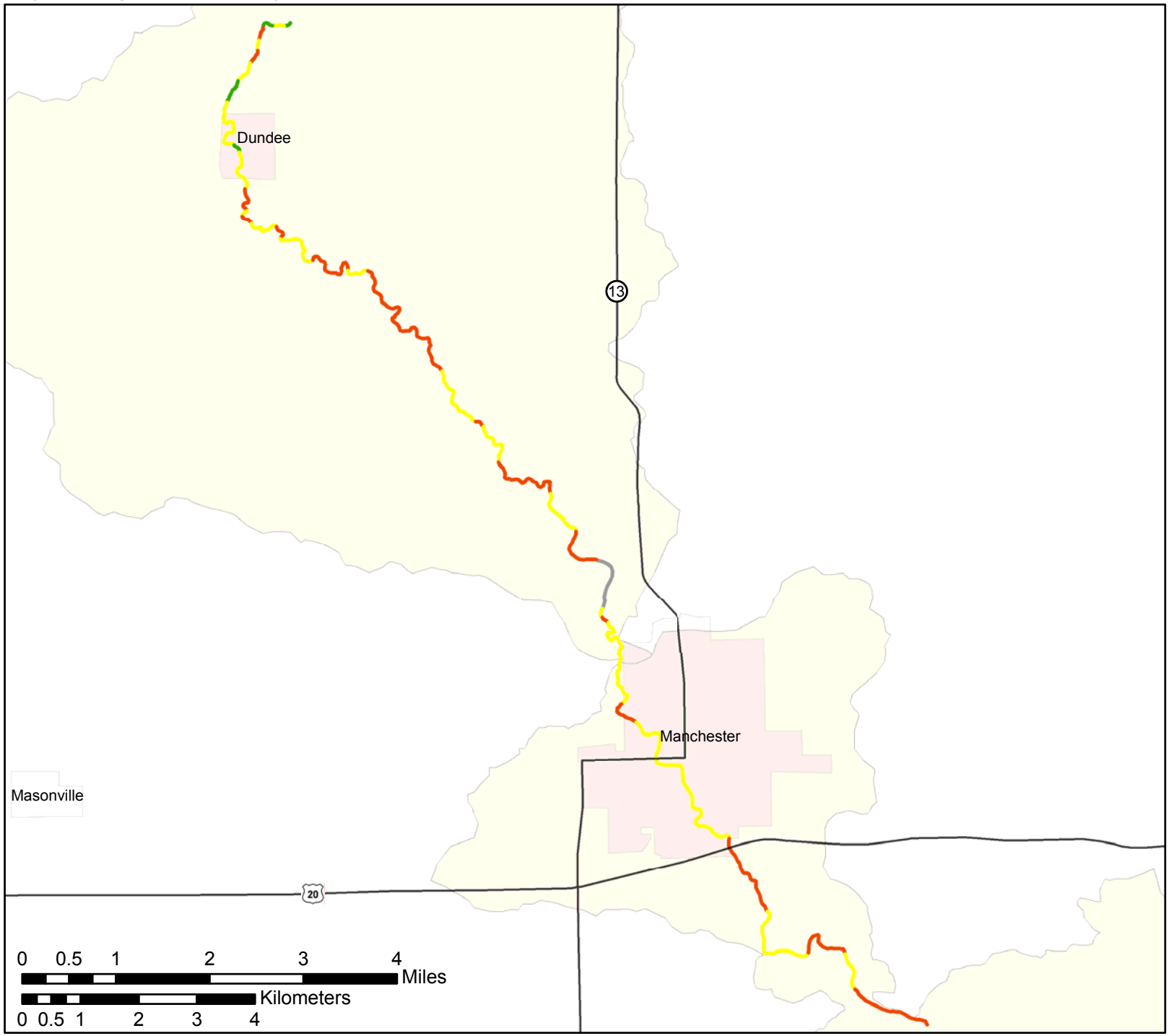
Pool Frequency

- None
- < 1 Pool Every 250
- > 1 Pool Every 250
- Frequent Pools
- No Data

Prepared by: Nels Rasmussen
Northeast Iowa RC&D

Maquoketa River In-Stream Assessment

Hydrologic Variability



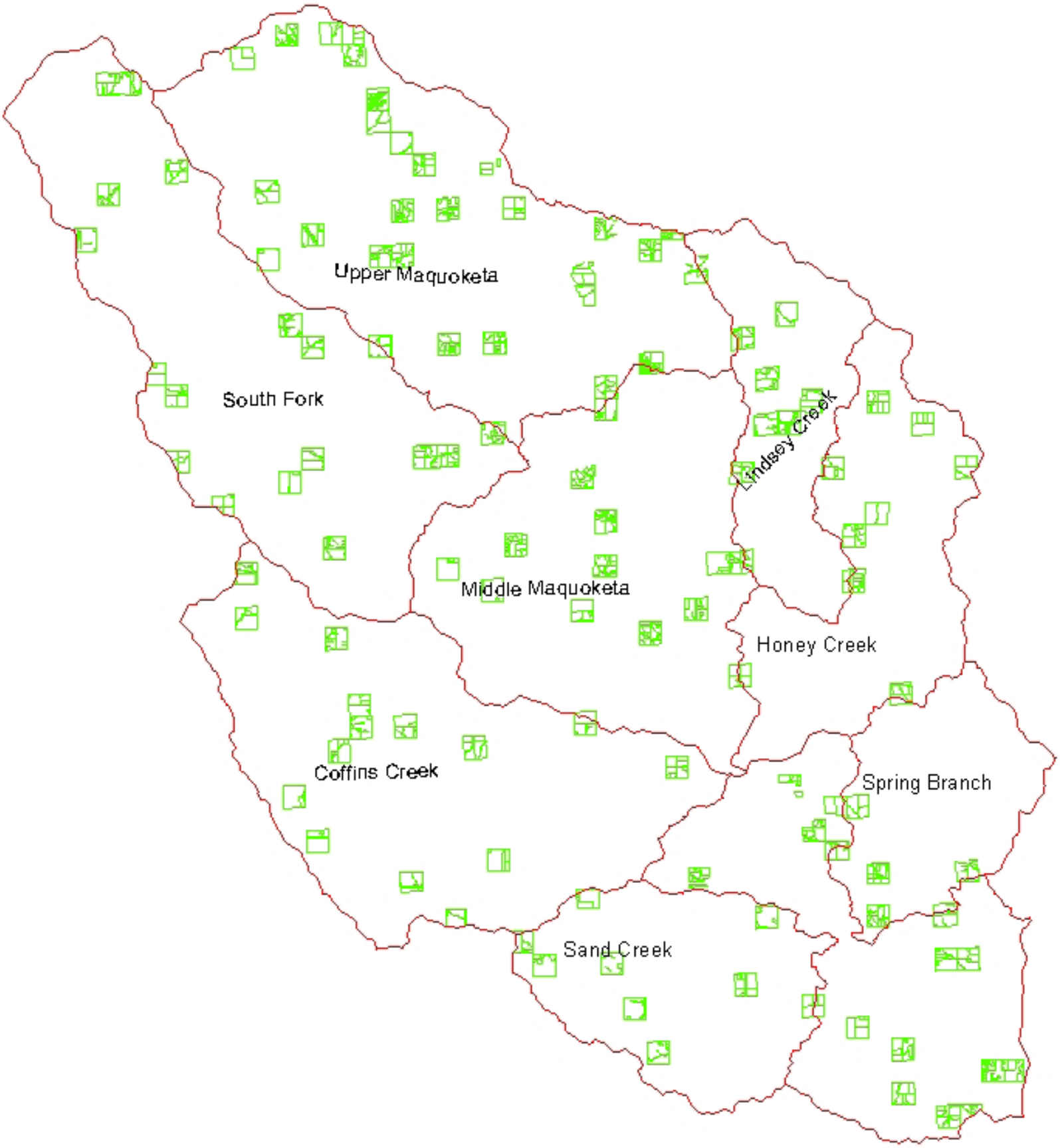
Legend

- Watershed
- Cities
- Highways

Hydrolic Variability

- Pool & Riffle
- Somewhat Variable
- Straight Uniform Depth & Width
- No Data

Prepared by: Nels Rasmussen
Northeast Iowa RC&D


Upper Maquoketa
South Fork
Lindsey Creek
Middle Maquoketa
Honey Creek
Coffins Creek
Spring Branch
Sand Creek

Watershed Open Feedlot Evaluation

Owner Name_____ Date_____

Address_____

Telephone_____

Facility Location (legal description)_____

Total sq. ft. of yard space_____ **Points assessed**_____
10 Points assessed per 50,000 sq. ft. of yard space

Distance to Surface Water_____ **Points assessed**_____
0-100 ft.-40 Points
100-500 ft.-20 Points
> 500 ft.-10 Points

Topography **Points assessed**_____
> 4%-40 Points
1-4%-20 Points
Flat-10 Points

Conduits to Surface Water from yard to surface water **Points assessed**_____
No conservation measures-50 Points
Grass waterway or filter strip with channels-30 Points
Tile inlet in waterway or filter strip-20 Points
Functioning waterway or filter strip-10 Points

Yard manure containment **Points assessed**_____
No containment in feedlot-50 Points
Cement wall containment with weep holes, gaps, etc.-20 Points
Picket fence with adequate filter strip-10 Points
Cement wall containment with no obvious breaches-10 Points

Drainage area of feedlot including clean water entering feedlot **Points assessed**_____
Points per acre-5

Manure storage? Y/N

Additional comments:_____

Grazing or Feedlot

Watershed Above Lake Delhi Dam Project
Delaware SWCD
200 South 12th St
Manchester, IA 52057

Watershed Above Lake Delhi Dam

February 9, 2007

Dear Watershed Landowner/ Operator:

A project is under way to gain information about the area draining into the Maquoketa River above the Lake Delhi Dam. This is a watershed of over 223,000 acres which can be further reduced to sub-watersheds, according to streams which feed into the Maquoketa. You are being sent this questionnaire as a resident, landowner, or farm operator in the Honey Creek sub-watershed of 30,700 acres. This includes the land area from Edgewood to the confluence of Honey Creek with the Maquoketa River, just south of the Quaker Mill Dam in northwest Manchester.

We are interested in your attitudes about conservation practices, and in the tools and sources of information that you use as you manage your farmland, or operate your farming operation. If you don't feel you can answer some of the questions, please contact your tenant or co-owner to see if he/she received a survey- perhaps he/she could complete it and return it to us. Your answers will be kept confidential, but the composite results will help us assess the needs of the area, and perhaps enable us to access the resources to address these needs. Any written comments are also very welcome.

We have included several questions about the growing ethanol industry, which will have a definite influence on area farming operations in the future. This enterprise offers great promise, but also could present great challenges to soil and water quality preservation efforts. Your ideas, opinions, and concerns are of great interest to us. Thank you for a speedy response.

Sincerely,

Wayne Brunsman

Wayne Brunsman
Project Coordinator
Delaware County Soil & Water Conservation District

Unless otherwise directed, please circle the number that corresponds to your response.

WATERSHED ATTITUDES ON CONSERVATION ISSUES, AND SOURCES OF INFORMATION

Honey Creek Watershed

1. When making farm conservation decisions in the last two years, have you received or used information from the following sources?

	Received information		Used information	
	Yes	No	Yes	No
Soil Conservation District Commissioners	1	2	1	2
Natural Resources Conservation Service (NRCS)	1	2	1	2
Farm Service Agency (FSA)	1	2	1	2
Independent crop consultant	1	2	1	2
Farm supply dealer field specialist	1	2	1	2
ISU Extension Services	1	2	1	2
Family member	1	2	1	2
A farming neighbor	1	2	1	2
Department of Natural Resources (DNR)	1	2	1	2
Farm magazines and publications	1	2	1	2
Internet	1	2	1	2
Field days	1	2	1	2

2. How effective do you feel the following management practices would be in improving water quality in your watershed?

	Not Effective	Somewhat Effective	Very Effective
a. Better crop fertilizer management	1	2	3
b. Applying manure based on the nutrient content and soil test results ……	1	2	3
c. Marketing of alternative crops (hay, organic, switchgrass, cattle, etc.)	1	2	3
d. Better farm record keeping systems	1	2	3
e. Better tillage system management	1	2	3
f. Better erosion control management	1	2	3
g. Pasture renovation	1	2	3
h. Timber stand improvement	1	2	3
i. Other (specify)	1	2	3

3. What factors *limit* adopting or expanding the following practices on your farm? *(For each practice check all reasons that apply.)*

	Currently use	Will hurt my yields/profits	Need more information or training	It doesn't fit with my equipment	The practice is too expensive	Takes too much time to plan and implement
Terraces/ Sediment Control Structures….. …..	❒	❒	❒	❒	❒	❒
Contour farming…….	❒	❒	❒	❒	❒	❒
No-till beans after corn…..	❒	❒	❒	❒	❒	❒
No-till corn after beans…..	❒	❒	❒	❒	❒	❒
No-till corn after corn…..	❒	❒	❒	❒	❒	❒
Grassed filter strips along Streams…….	❒	❒	❒	❒	❒	❒
Hay production……...	❒	❒	❒	❒	❒	❒
Contour buffer strips on side hills…….	❒	❒	❒	❒	❒	❒
High residue Planting…….	❒	❒	❒	❒	❒	❒
Applying fertilizer based on soil test results using Variable Rate Technology	❒	❒	❒	❒	❒	❒
Contour strip farming……	❒	❒	❒	❒	❒	❒
Applying commercial nitrogen based on soil or stalk test results	❒	❒	❒	❒	❒	❒
Pasture renovation……	❒	❒	❒	❒	❒	❒
Timber stand improvement……...	❒	❒	❒	❒	❒	❒

4. How many acres do you farm?

Acres

Own ..... _____

Rent ..... _____

Total..... _____

Please indicate who makes the management decisions on the ground you rent ?

_____

5. Of the land you farmed last year, how many acres were:

	Acres
Corn	_____
Soybeans	_____
Alfalfa hay	_____
Grass hay or improved pasture	_____
Permanent unimproved pasture	_____
Oats or other small grains.....	_____
CRP / Timber	_____ / _____

6. We have identified the conservation practices below as being effective at improving the water quality in our local watersheds. How interested are you in adopting the following to your farming operation?

	Not at all interested	Somewhat interested	Very interested	Already adopted
a. Install waterways	1	2	3	4
b. Better management of nitrogen and phosphorous fertilizer usage ...	1	2	3	4
c. Switch to hay or cow-calf production on marginal ground.....	1	2	3	4
d. Install ponds or grade stabilizationstructures…….	1	2	3	4
e. Change tillage systems	1	2	3	4
f. Adopt better soil erosion control methods.....	1	2	3	4
g. Renovate pastures	1	2	3	4
h. Install a livestock waste system	1	2	3	4
i. Install terraces…….	1	2	3	4
j. Adapt rotational grazing……..	1	2	3	4
Would you incorporate any of these practices if 50% cost share was provided?	**Yes**	**No**		
…if 75% cost share was provided?	**Yes**	**No**		

7. Do you currently use the following information technologies in your farming operation?

	Yes	No
a. Digital/Cellular phone	1	2
b. E-mail	1	2
c. Internet / e-commerce	1	2
d. Personal computer	1	2
e. Yield monitor on harvest equipment.....	1	2
f. VRT (Variable Rate fertilizer application based on grid sampling & soil types)	1	2
g. Yield mapping.....	1	2
h. GPS (Global Positioning System).....	1	2
i. Mapping of planting and/or fertilizer application……..	1	2

8. In the past year, what sources of information have you used to assist you in making decisions for your farming operation? ***(Check all that apply in Column A, then indicate how helpful the information was).***

Column A (√ if used)		Column B: Not Helpful	Somewhat Helpful	Very Helpful
❒	a. Informational meetings.....	1	2	3
❒	b. Informal discussions w/ neighbors..	1	2	3
❒	c. Dealer field days	1	2	3
❒	d. Internet information sites, web pages	1	2	3
❒	e. Demonstration projects	1	2	3
❒	f. NRCS personnel……..	1	2	3
❒	g. Newspaper articles…….	1	2	3
❒	h. Newsletters	1	2	3
❒	i. Farm Magazines	1	2	3

9. If you raise livestock, please indicate what type of livestock you raise?

Type of livestock

_____

_____

_____

10. Which type of production system do you use to produce your livestock?

Large, modern confinement system 1
An older confinement system 2
A traditional or open production system (hoop houses, A-frames, etc.) 3
Open confinement system…… 4
Open Grazing……. 5

If you have livestock, do they have unrestricted access to any streams, rivers or lakes? **Yes** or **No**

Would you consider fencing livestock from the stream if alternative water sources were provided? **Yes** **No**

The state has a new low interest loan program for farmers interested in adopting conservation practices. This program would allow you to borrow your share of the money needed to implement conservation practices. If this was available to you, would you be interested in learning more about this program or signing up? **Yes** **No**

Do you believe at this time, the water quality of Iowa's streams, rivers and lakes is getting better or worse?

_____ better _____ worse

11. Please indicate your level of agreement or disagreement with the following statements.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
a. Water contamination is an important environmental problem in our watershed	1	2	3	4	5
b. Agriculture fertilizers have significantly contaminated water in our watershed	1	2	3	4	5
c. I worry about the purity of my drinking water.....	1	2	3	4	5
d. Ethanol will be a great boost to the farm economy of this watershed…….	1	2	3	4	5
e. The boom in ethanol production will lead to greater soil loss within the state by causing changes in crop patterns…..	1	2	3	4	5
f. Poor water quality affects economic development in this region of Iowa.....	1	2	3	4	5
g. If ethanol production from corn stalks becomes practical, more regulation will be needed to prevent greater soil loss……	1	2	3	4	5
h. I am interested in attending a community meeting concerning how to protect water quality locally	1	2	3	4	5
i. I know what steps to take to better conserve soil and water on my land	1	2	3	4	5
j. Ethanol companies should be required to limit corn stalks harvested per acre to leave sufficient residue to prevent the depletion of our soil resources……	1	2	3	4	5
k. I would be willing to work with others to develop and implement strategies that protect our watershed.....	1	2	3	4	5

12.What is your age? _____ Years (This question is optional)

13. If you are 55 years or older, what are your plans for the farm once you retire?

Pass the farm on to a family member .....1_____
Rent the land to another farmer .....2_____
Have the land custom farmed .....3_____
Sell the farm.....4_____
No plans.....5_____
Other (specify) _____

14. If you use a private septic, approximately how old is your system?

_____ less than 10 years old
_____ between 10 and 25 years old
_____ greater than 25 years old

15. Are you aware that there is a low interest loan program available in which you can borrow up to $10,000 at 3% interest for 10 years to update your septic system? If this was available to you, would you be interested in learning more about this program or signing up?

Yes____ **No_____**

16. If you have a private well for drinking water, how long has it been since you've had it tested by a certified lab for pollutants?

_____ less than 2 years ago
_____ between 2 and 7 years ago
_____ more than 7 years ago

17. If you've had your well tested within the last five years, what were the results:

_____ Everything was fine
_____ High in bacteria
_____ High in nitrates

18. Who do you believe should be responsible for ensuring a clean Honey Creek?

____ Federal Govt ___ State Govt _____Local Govt _____ Land Owners ____ Ag Business
_____ Land Renters/Tenants _____ Recreational Users

Thank you for taking the time to participate in this survey. Your individual responses will be kept in the strictest of confidence. However we will prepare a summary based upon the collective responses to this survey, the results of which may be made available to the public.

Feel free to use the space below to add any comments:

Name: (This is completely optional) _____

Original

Watershed Above Lake Delhi Dam Project
Delaware SWCD
200 South 12th St
Manchester, IA 52057

Watershed Above Lake Delhi Dam

February 12, 2007

Dear Watershed Landowner/ Operator:

A project is under way to gain information about the area draining into the Maquoketa River above the Lake Delhi Dam. This is a watershed of over 223,000 acres which can be further reduced to sub-watersheds, according to streams which feed into the Maquoketa. You are being sent this questionnaire as a resident, landowner, or farm operator in the Coffins Creek sub-watershed of 35,587 acres. This includes the land area from several miles south of Lamont, and along both sides of Hwy 187 down through the Masonville area, and eastward from there to its confluence with the Maquoketa River just south of the Quaker Mill Dam in northwest Manchester.

We are interested in your attitudes about conservation practices, and in the tools and sources of information that you use as you manage your farmland, or operate your farming operation. If you don't feel you can answer some of the questions, please contact your tenant or co-owner to see if he/she received a survey- perhaps he/she could complete it and return it to us. Your answers will be kept confidential, but the composite results will help us assess the needs of the area, and perhaps enable us to access the resources to address these needs. Any written comments are also very welcome.

We have included several questions about the growing ethanol industry, which will have a definite influence on area farming operations in the future. This enterprise offers great promise, but also could present great challenges to soil and water quality preservation efforts. Your ideas, opinions, and concerns are of great interest to us. Thank you for a speedy response.

Sincerely,

Wayne Brunsman

Wayne Brunsman
Project Coordinator
Delaware County Soil & Water Conservation District

Unless otherwise directed, please circle the number that corresponds to your response.

WATERSHED ATTITUDES ON CONSERVATION ISSUES, AND SOURCES OF INFORMATION

Coffins Creek Watershed

1. When making farm conservation decisions in the last two years, have you received or used information from the following sources?

	Received information		Used information	
	Yes	No	Yes	No
Soil Conservation District Commissioners	1	2	1	2
Natural Resources Conservation Service (NRCS)	1	2	1	2
Farm Service Agency (FSA)	1	2	1	2
Independent crop consultant	1	2	1	2
Farm supply dealer field specialist	1	2	1	2
ISU Extension Services	1	2	1	2
Family member	1	2	1	2
A farming neighbor	1	2	1	2
Department of Natural Resources (DNR)	1	2	1	2
Farm magazines and publications	1	2	1	2
Internet	1	2	1	2
Field days	1	2	1	2

2. How effective do you feel the following management practices would be in improving water quality in your watershed?

	Not Effective	Somewhat Effective	Very Effective
a. Better crop fertilizer management	1	2	3
b. Applying manure based on the nutrient content and soil test results ……	1	2	3
c. Marketing of alternative crops (hay, organic, switchgrass, cattle, etc.)	1	2	3
d. Better farm record keeping systems	1	2	3
e. Better tillage system management	1	2	3
f. Better erosion control management	1	2	3
g. Pasture renovation	1	2	3
h. Timber stand improvement	1	2	3
i. Other (specify)	1	2	3

3. What factors *limit* adopting or expanding the following practices on your farm? *(For each practice check all reasons that apply.)*

	Currently use	Will hurt my yields/profits	Need more information or training	It doesn't fit with my equipment	The practice is too expensive	Takes too much time to plan and implement
Terraces/ Sediment Control Structures….. …..	❒	❒	❒	❒	❒	❒
Contour farming…….	❒	❒	❒	❒	❒	❒
No-till beans after corn…..	❒	❒	❒	❒	❒	❒
No-till corn after beans…..	❒	❒	❒	❒	❒	❒
No-till corn after corn…..	❒	❒	❒	❒	❒	❒
Grassed filter strips along Streams……	❒	❒	❒	❒	❒	❒
Hay production……...	❒	❒	❒	❒	❒	❒
Contour buffer strips on side hills…….	❒	❒	❒	❒	❒	❒
High residue Planting…….	❒	❒	❒	❒	❒	❒
Applying fertilizer based on soil test results using Variable Rate Technology	❒	❒	❒	❒	❒	❒
Contour strip farming……	❒	❒	❒	❒	❒	❒
Applying commercial nitrogen based on soil or stalk test results	❒	❒	❒	❒	❒	❒
Pasture renovation……	❒	❒	❒	❒	❒	❒
Timber stand improvement……...	❒	❒	❒	❒	❒	❒

4. How many acres do you farm?

Acres

Own ..... _____

Rent ..... _____

Total..... _____

Please indicate who makes the management decisions on the ground you rent ?

_____

5. Of the land you farmed last year, how many acres were:

	Acres
Corn	
Soybeans	
Alfalfa hay	
Grass hay or improved pasture	
Permanent unimproved pasture	
Oats or other small grains.....	
CRP / Timber	/

6. We have identified the conservation practices below as being effective at improving the water quality in our local watersheds. How interested are you in adopting the following to your farming operation?

	Not at all interested	Somewhat interested	Very interested	Already adopted
a. Install waterways	1	2	3	4
b. Better management of nitrogen and phosphorous fertilizer usage ...	1	2	3	4
c. Switch to hay or cow-calf production on marginal ground.....	1	2	3	4
d. Install ponds or grade stabilizationstructures…….	1	2	3	4
e. Change tillage systems	1	2	3	4
f. Adopt better soil erosion control methods.....	1	2	3	4
g. Renovate pastures	1	2	3	4
h. Install a livestock waste system	1	2	3	4
i. Install terraces…….	1	2	3	4
j. Adapt rotational grazing……..	1	2	3	4
Would you incorporate any of these practices if 50% cost share was provided?	**Yes**	**No**		
…if 75% cost share was provided?	**Yes**	**No**		

7. Do you currently use the following information technologies in your farming operation?

	Yes	No
a. Digital/Cellular phone	1	2
b. E-mail	1	2
c. Internet / e-commerce	1	2
d. Personal computer	1	2
e. Yield monitor on harvest equipment.....	1	2
f. VRT (Variable Rate fertilizer application based on grid sampling & soil types)	1	2
g. Yield mapping.....	1	2
h. GPS (Global Positioning System).....	1	2
i. Mapping of planting and/or fertilizer application……..	1	2

8. In the past year, what sources of information have you used to assist you in making decisions for your farming operation? ***(Check all that apply in Column A, then indicate how helpful the information was).***

Column A (√ if used)		Column B Not Helpful	Somewhat Helpful	Very Helpful
❒	a. Informational meetings.....	1	2	3
❒	b. Informal discussions w/ neighbors..	1	2	3
❒	c. Dealer field days	1	2	3
❒	d. Internet information sites, web pages	1	2	3
❒	e. Demonstration projects	1	2	3
❒	f. NRCS personnel……..	1	2	3
❒	g. Newspaper articles…….	1	2	3
❒	h. Newsletters	1	2	3
❒	i. Farm Magazines	1	2	3

9. If you raise livestock, please indicate what type of livestock you raise?

Type of livestock

_____

_____

_____

10. Which type of production system do you use to produce your livestock?

Large, modern confinement system 1
An older confinement system 2
A traditional or open production system (hoop houses, A-frames, etc.) 3
Open confinement system…… 4
Open Grazing……. 5

If you have livestock, do they have unrestricted access to any streams, rivers or lakes? **Yes** or **No**

Would you consider fencing livestock from the stream if alternative water sources were provided? **Yes** **No**

The state has a new low interest loan program for farmers interested in adopting conservation practices. This program would allow you to borrow your share of the money needed to implement conservation practices. If this was available to you, would you be interested in learning more about this program or signing up? **Yes** **No**

Do you believe at this time, the water quality of Iowa's streams, rivers and lakes is getting better or worse?

_____ better _____ worse

11. Please indicate your level of agreement or disagreement with the following statements.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
a. Water contamination is an important environmental problem in our watershed	1	2	3	4	5
b. Agriculture fertilizers have significantly contaminated water in our watershed	1	2	3	4	5
c. I worry about the purity of my drinking water.....	1	2	3	4	5
d. Ethanol will be a great boost to the farm economy of this watershed…….	1	2	3	4	5
e. The boom in ethanol production will lead to greater soil loss within the state by causing changes in crop patterns…..	1	2	3	4	5
f. Poor water quality affects economic development in this region of Iowa.....	1	2	3	4	5
g. If ethanol production from corn stalks becomes practical, more regulation will be needed to prevent greater soil loss……	1	2	3	4	5
h. I am interested in attending a community meeting concerning how to protect water quality locally	1	2	3	4	5
i. I know what steps to take to better conserve soil and water on my land	1	2	3	4	5
j. Ethanol companies should be required to limit corn stalks harvested per acre to leave sufficient residue to prevent the depletion of our soil resources……	1	2	3	4	5
k. I would be willing to work with others to develop and implement strategies that protect our watershed.....	1	2	3	4	5

12.What is your age? _____Years (This question is optional)

13. If you are 55 years or older, what are your plans for the farm once you retire?

Pass the farm on to a family member .....1_____
Rent the land to another farmer .....2_____
Have the land custom farmed .....3_____
Sell the farm.....4_____
No plans.....5_____
Other (specify) _____

14. If you use a private septic, approximately how old is your system?

_____ less than 10 years old
_____ between 10 and 25 years old
_____ greater than 25 years old

15. Are you aware that there is a low interest loan program available in which you can borrow up to $10,000 at 3% interest for 10 years to update your septic system? If this was available to you, would you be interested in learning more about this program or signing up?

Yes____ **No_____**

16. If you have a private well for drinking water, how long has it been since you've had it tested by a certified lab for pollutants?

_____ less than 2 years ago
_____ between 2 and 7 years ago
_____ more than 7 years ago

17. If you've had your well tested within the last five years, what were the results:

_____ Everything was fine
_____ High in bacteria
_____ High in nitrates

18. Who do you believe should be responsible for ensuring a clean Coffins Creek?

____ Federal Govt _____ State Govt _____ Local Govt ____ Land Owners
_____ Recreational users _____ Ag Business ____ Renters/Tenants

19. The lower end of Coffins Creek shows promise as a fishery on its own, and/or as a feeder stream for game fish in the Maquoketa River. Do you feel that working to improve water quality to achieve this goal is worth pursuing for its economic development value for the Masonville / Manchester area?

_____ Yes _____ No

Thank you for taking the time to participate in this survey. Your individual responses will be kept in the strictest of confidence. However we will prepare a summary based upon the collective responses to this survey, the results of which may be made available to the public.

Feel free to use the space below to add any comments:

Name: (This is entirely optional) _____

Watershed Survey Results	Received Information		Used Information	
Source of Information	Yes	No	Yes	No
Soil Commissioners	10	16	6	17
NRCS Staff	20	8	16	9
FSA Staff	21	7	16	8
Independent Crop Consultant	5	21	5	17
Farm Supply dealer/field rep	8	17	9	11
ISU Extension	5	20	2	16
Family member	9	17	8	12
Farming neighbor	13	13	11	10
DNR staff	7	20	4	16
Farm magazines/publications	18	10	12	13
Internet	3	22	2	17
Field Days	6	18	4	14

Effectiveness of Mgt Practices	Not Effective	Somewhat Effective	Very Effective
a. Better Crop Fertilizer Mgt	2	22	11
b. Manure Mgt based on nutrient content & soil test results	5	14	16
c. Marketing alternative crops: hay, organic, switchgrass,cattle,etc.	8	20	6
d. Better Farm Record Systems	12	17	5
e. Better Tillage System Mgt	3	22	8
f. Better Erosion Control Mgt	1	18	16
g. Pasture Renovation	8	22	6
h. Timber stand Improvement	2		

Limiting Factors to Practice Adoption	Currently Use	Will hurt Yields/Profit	Need More Information	Does Not Fit Equip	Practice Is Too Expensive	Too much Time To Implement
Terraces/ Sediment Control Structures	2	8	9	7	13	4
Contour Farming	7	3	9	8	2	5
No-till Beans After Corn	10	6	3	7		1
No-till Corn After Beans	8	9	4	7		
No-till Corn After Corn	4	16	6	11		1
Grass Filter Strips	19	1	3		1	
Hay Production	20	5		4		
Contour Buffer Strips	5	8	9	3	5	1
High Residue Planting	18	5	4	6		
Variable Rate Fert Application	17		6	8	6	
Contour Strip Farming	4	3	10	5	1	1
Soil/Stalk Test Based Nitrogen Application	14		13	2	2	2
Pasture Renovation	5	4	8	2		
Timber Stand Improvement	3	3	11	4	2	

Interest In Adopting Practices	No Interest	Somewhat Interested	Very Interested	Already Adopted
a. Install Waterways	1	4	5	27
b. Better N & P Fertilizer Mgt	3	9	10	12
c. Use Hay or Cow-calf on Marginal	10	9		10
d. Install Ponds or Grade Stabes	15	10		3
e. Change Tillage systems	14	14	1	3
f. Better Erosion Control Methods	4	19	3	6
g. Renovate Pastures	15	9	2	3
h. Install Livestock Waste System	16	5	3	3
i. Install terrraces	19	4		5
j. Adapt Rotational Grazing	14	2		1

Technologies Used In Farm Operation	Yes	No
a. Cellular Phone	28	5
b. E-mail	18	14
c. Internet/ e-commerce	18	13
d. Personal computer	22	12
e. Harvest Yield Monitor	10	19
f. VRT Fert Application	16	16
g. Yield Mapping	9	23
h. GPS	8	23
i. Mapping Planting/ Fert Appl.	11	17

Rate Sources of Information For Farm	Not Helpful	Somewhat Helpful	Very Helpful
Informational Meetings		12	3
Informal Discussions w/ Neighbors	2	14	3
Dealer field days		11	3
Internet Web Sites	3	9	2
Demonstration Projects	2	4	1
NRCS Personnel	1	5	7
Newspaper Articles	2	14	1
Newsletters	1	16	1
Farm Magazines	1	22	2

Type Of Livestock Raised	Hogs	Fat Cattle	Dairy	Cow-Calf
	10	7	4	5

Do Your Livestock Have Unrestricted Access to Stream, River, or Lake?	Yes	No
	5	17

Would You Consider Fencing Livestock From the Stream if Water Source was Provided?	Yes	No
	6	8

Interested In Low Interest Loan to Implement Conservation Practices?	Yes	No
	17	7

Is Water Quality In Iowa's Streams, Rivers, and Lakes Improving or Not?	Better	Worse	Undecided
	22	9	2

Attitudes About watershed Issues	Strongly Disagree	Disagree	Can't Decide	Agree	Strongly Agree
Water contamination is an important environmental problem in our watershed	1	2	10	18	3

Watershed Survey Results	Received Information		Used Information	
Source of Information	Yes	No	Yes	No
Soil Commissioners	19	6	17	5
NRCS Staff	22	7	20	4
FSA Staff	25	4	20	1
Independent Crop Consultant	6	16	5	12
Farm Supply dealer/field rep	14	10	12	7
ISU Extension	14	11	11	8
Family member	11	11	10	8
Farming neighbor	11	11	10	8
DNR staff	13	9	7	8
Farm magazines/publications	21	5	16	5
Internet	14	10	12	9
Field Days	15	7	13	6

Effectiveness of Mgt Practices	Not Effective	Somewhat Effective	Very Effective
a. Better Crop Fertilizer Mgt	1	12	18
b. Manure Mgt based on nutrient content & soil test results	1	8	22
c. Marketing alternative crops: hay, organic, switchgrass,cattle,etc.	6	17	8
d. Better Farm Record Systems	4	17	7
e. Better Tillage System Mgt	1	13	16
f. Better Erosion Control Mgt	2	8	22
g. Pasture Renovation	5	18	7
h. Timber stand Improvement	4	16	8

Limiting Factors to Practice Adoption	Currently Use	Will hurt Yields/Profit	Need More Information	Does Not Fit Equip	Practice Is Too Expensive	Too much Time To Implement
Terraces/ Sediment Control Structures	9	1	6	7	9	5
Contour Farming	8	1	6	6	1	2
No-till Beans After Corn	22	4	4	4		
No-till Corn After Beans	15	7	6	4		
No-till Corn After Corn	5	8	9	5	1	
Grass Filter Strips	22	1	3	1		
Hay Production	13	5	1	7		2
Contour Buffer Strips	6	1	8	4		
High Residue Planting	16		4	4		
Variable Rate Fert Application	22	1	7	1	1	1
Contour Strip Farming	0	1	8	8		3
Soil/Stalk Test Based Nitrogen Application	17	2	9			3
Pasture Renovation	4		5	4		
Timber Stand Improvement			7	3	1	

Interest In Adopting Practices	No Interest	Somewhat Interested	Very Interested	Already Adopted
a. Install Waterways		3	8	22
b. Better N & P Fertilizer Mgt		3	13	16
c. Use Hay or Cow-calf on Marginal	17	5	5	5
d. Install Ponds or Grade Stabes	14	7	6	6
e. Change Tillage systems	5	9	5	14
f. Better Erosion Control Methods	2	7	10	10
g. Renovate Pastures	17	3	6	2
h. Install Livestock Waste System	18	5	2	3
i. Install terraces	22	2	2	5
j. Adapt Rotational Grazing	16	4	2	1

Technologies Used In Farm Operation	Yes	No
a. Cellular Phone	27	4
b. E-mail	22	7
c. Internet/ e-commerce	22	6
d. Personal computer	27	1
e. Harvest Yield Monitor	18	13
f. VRT Fert Application	16	12
g. Yield Mapping	10	18
h. GPS	7	21
i. Mapping Planting/ Fert Appl.	18	9

Rate Sources of Information For Farm	Not Helpful	Somewhat Helpful	Very Helpful
Informational Meetings		13	8
Informal Discussions w/ Neighbors	1	18	4
Dealer field days	3	12	4
Internet Web Sites	1	13	5
Demonstration Projects	1	8	8
NRCS Personnel	1	9	13
Newspaper Articles	2	14	9
Newsletters		20	3
Farm Magazines	1	17	8

Type Of Livestock Raised	Hogs	Fat Cattle	Dairy	Cow-Calf
	8	5	1	4

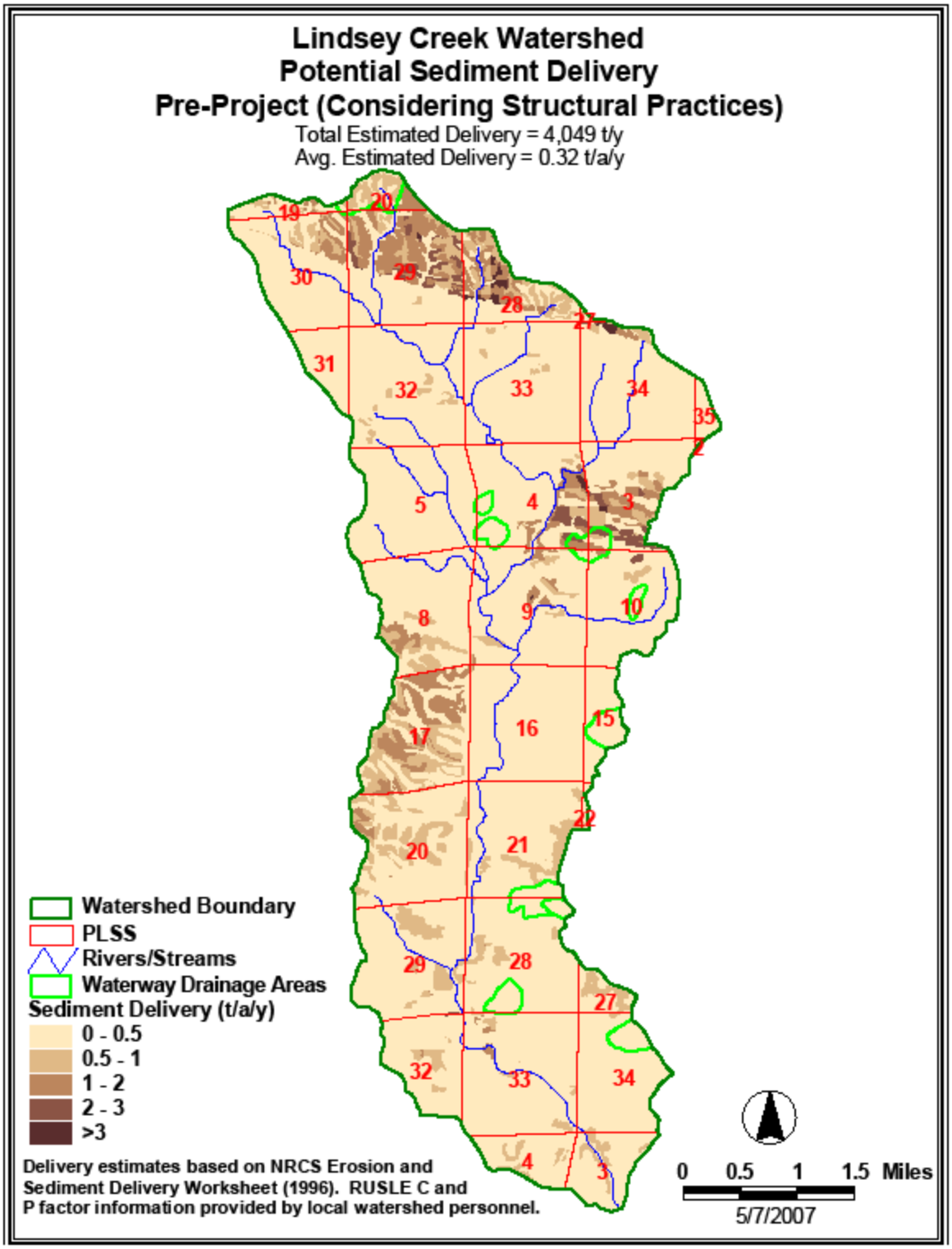
Do Your Livestock Have Unrestricted Access to Stream, River, or Lake?	Yes	No
	4	12

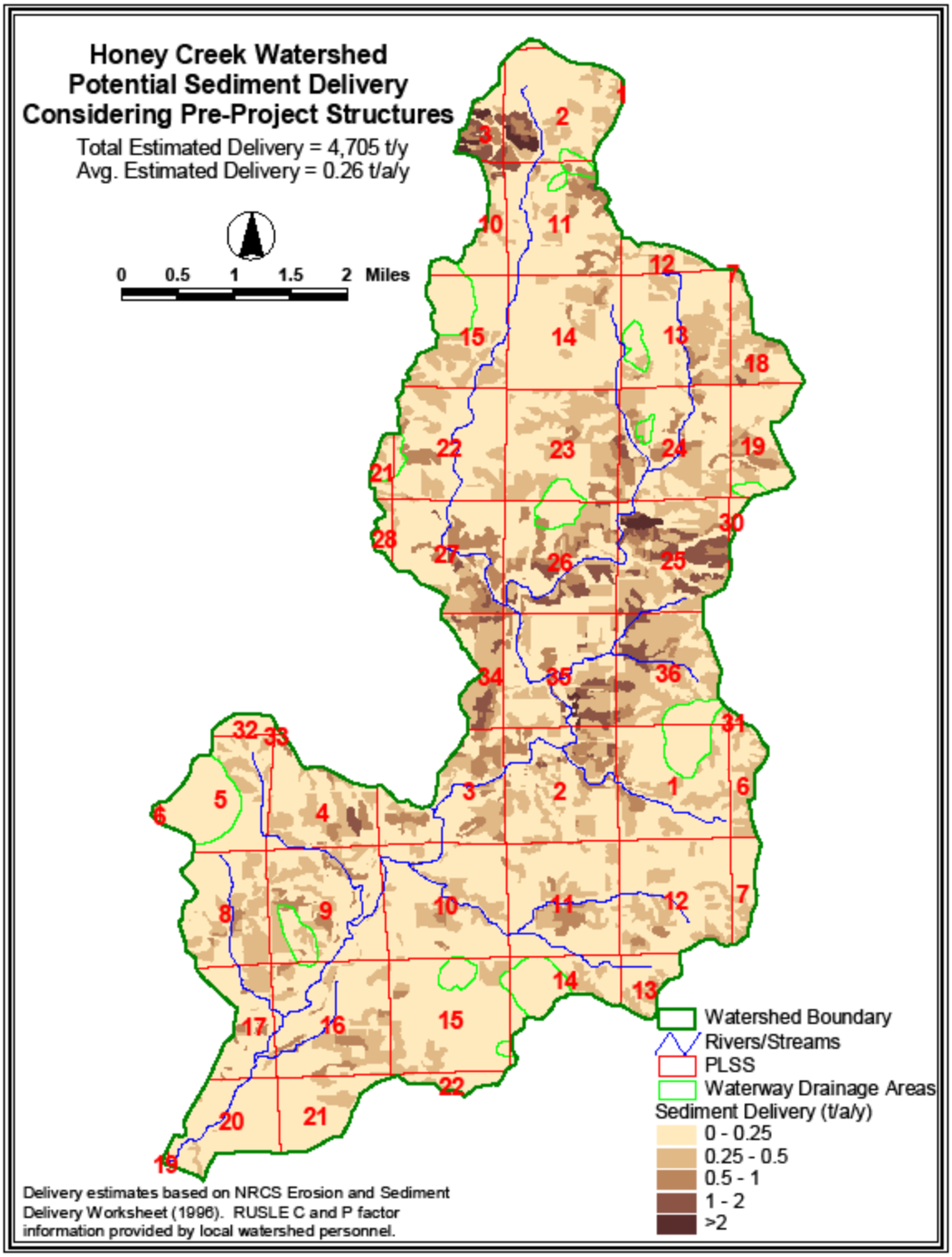
Would You Consider Fencing Livestock From the Stream if Water Source was Provided?	Yes	No
	8	3

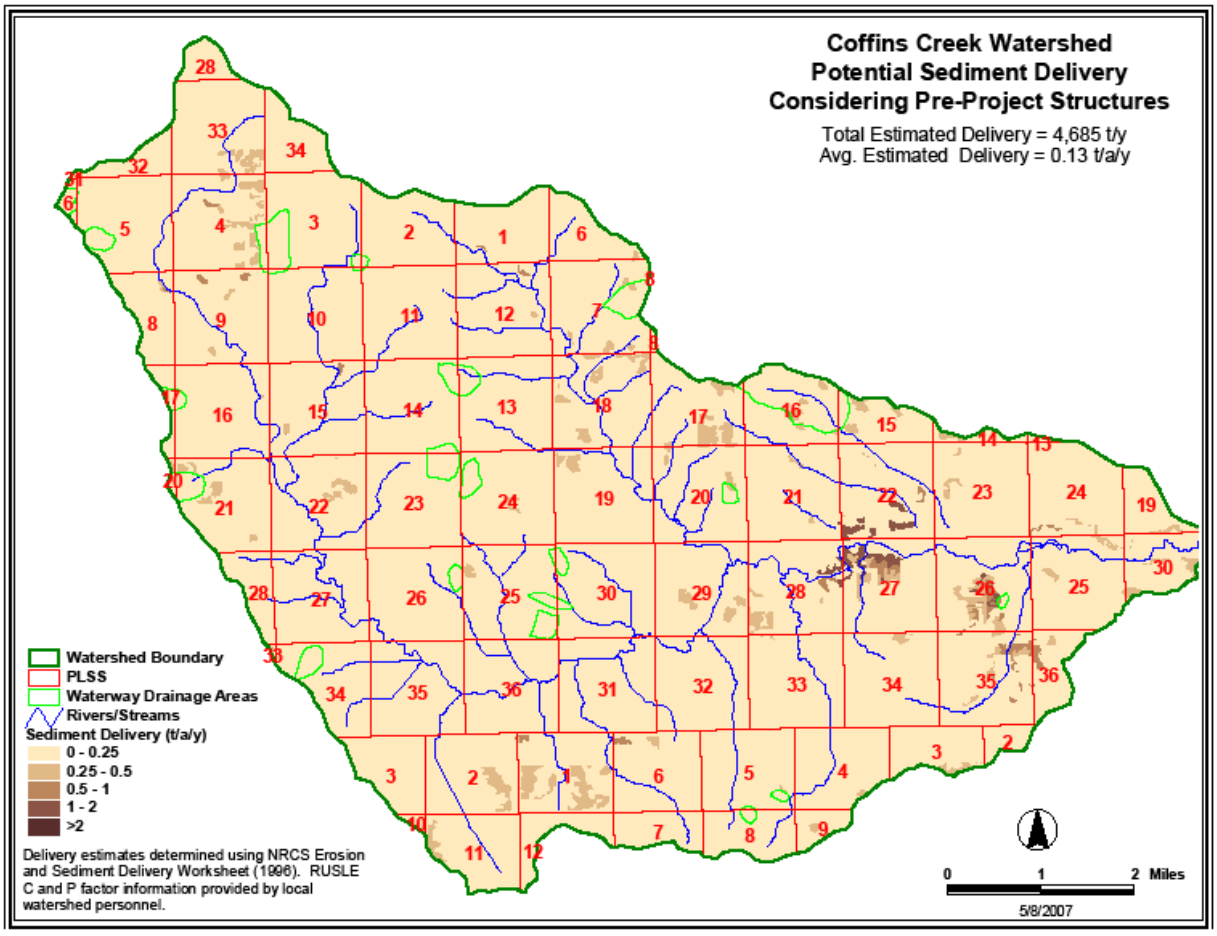
Interested In Low Interest Loan to Implement Conservation Practices?	Yes	No
	10	7

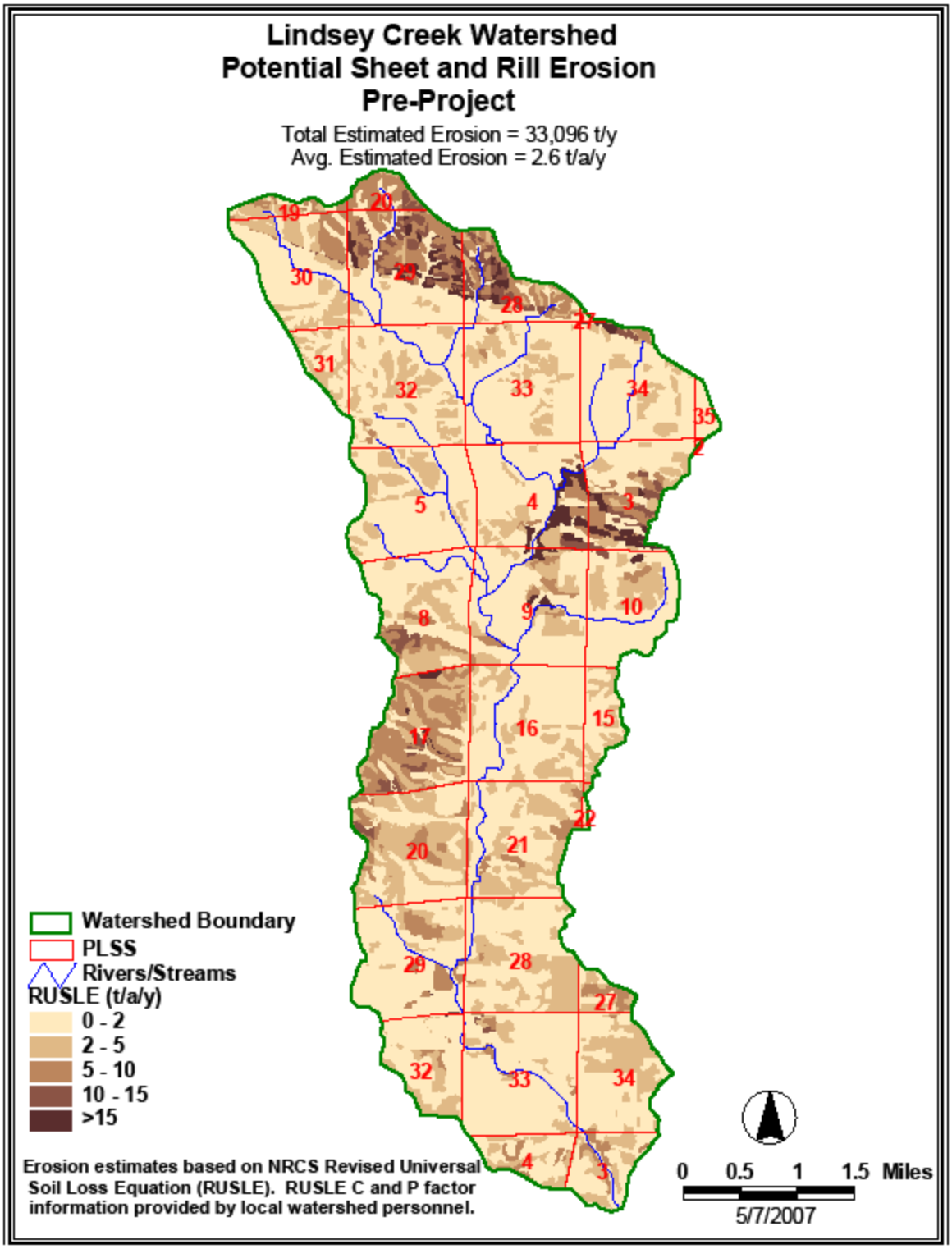
Is Water Quality In Iowa's Streams, Rivers, and Lakes Improving or Not?	Better	Worse	Undecided
	21	4	1

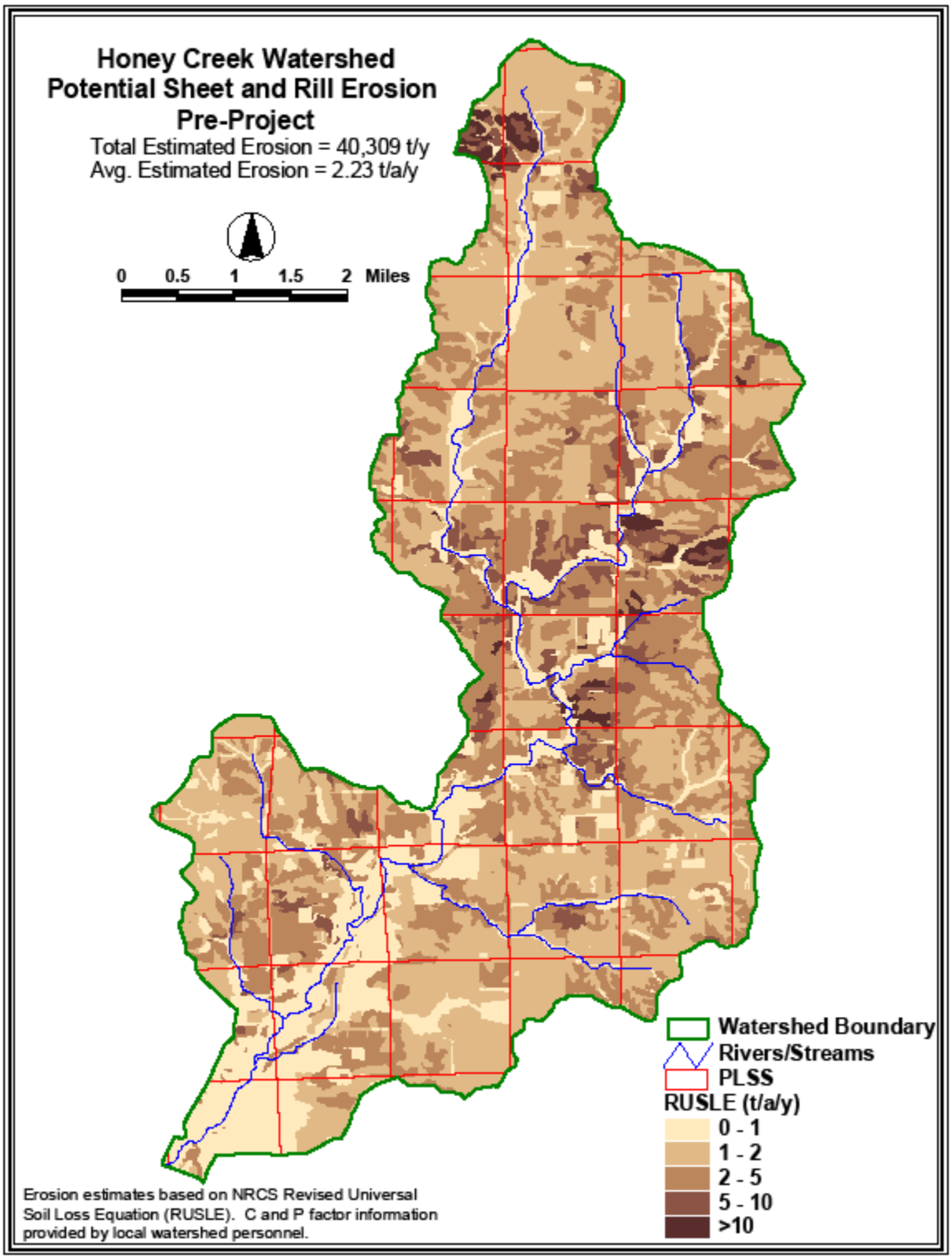
Attitudes About watershed Issues	Strongly Disagree	Disagree	Can't Decide	Agree	Strongly Agree
Water contamination is an important environmental problem in our watershed		2	5	14	8

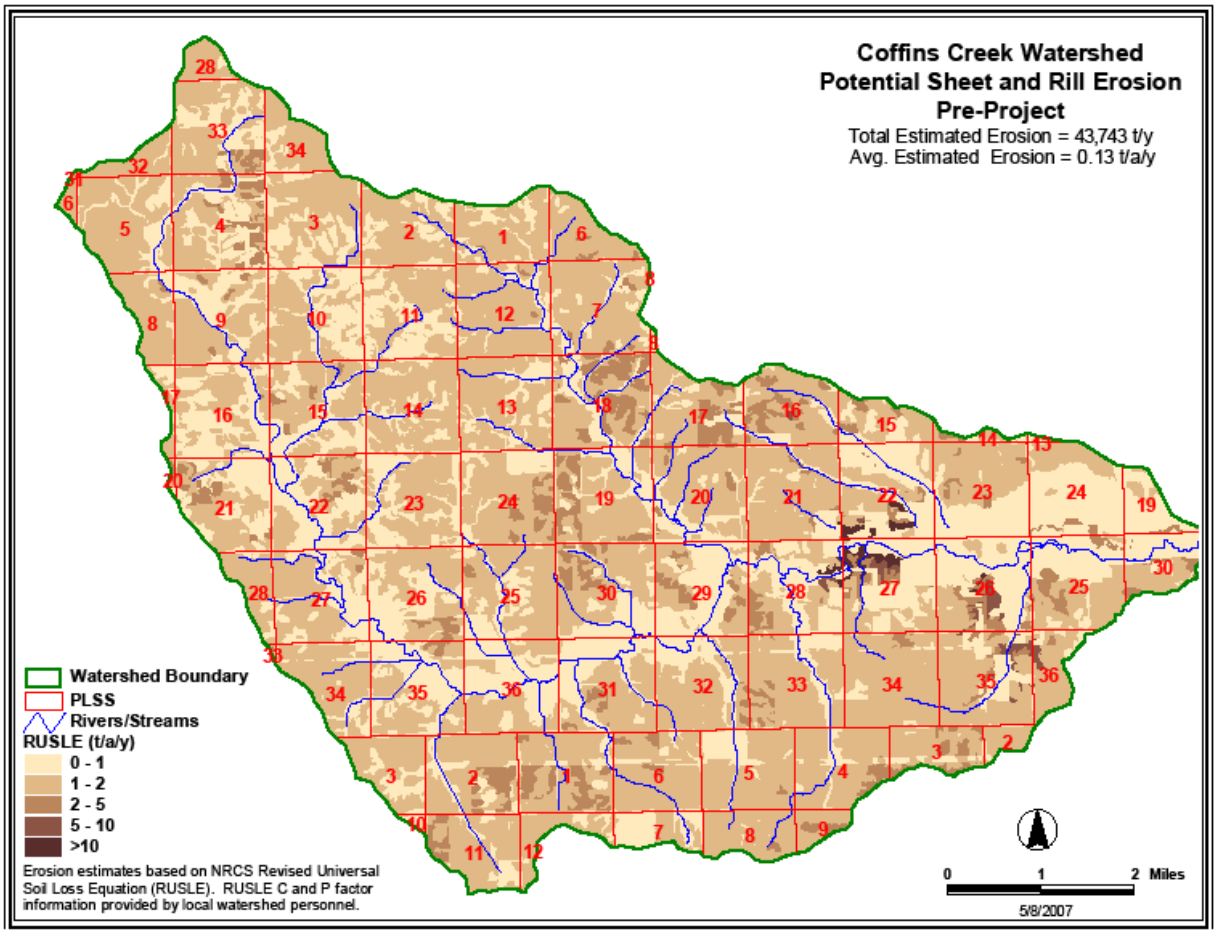

Lindsey Creek Watershed
Potential Sediment Delivery
Pre-Project (Considering Structural Practices)
Total Estimated Delivery = 4,049 t/y
Avg. Estimated Delivery = 0.32 t/a/y
Watershed Boundary
PLSS
Rivers/Streams
Waterway Drainage Areas
Sediment Delivery (t/a/y)
0 - 0.5
0.5 - 1
1 - 2
2 - 3
>3
Delivery estimates based on NRCS Erosion and Sediment Delivery Worksheet (1996). RUSLE C and P factor information provided by local watershed personnel.
0 0.5 1 1.5 Miles
5/7/2007


Honey Creek Watershed
Potential Sediment Delivery
Considering Pre-Project Structures
Total Estimated Delivery = 4,705 t/y
Avg. Estimated Delivery = 0.26 t/a/y
0 0.5 1 1.5 2 Miles
Watershed Boundary
Rivers/Streams
PLSS
Waterway Drainage Areas
Sediment Delivery (t/a/y)
0 - 0.25
0.25 - 0.5
0.5 - 1
1 - 2
>2
Delivery estimates based on NRCS Erosion and Sediment Delivery Worksheet (1996). RUSLE C and P factor information provided by local watershed personnel.


Coffins Creek Watershed
Potential Sediment Delivery
Considering Pre-Project Structures
Total Estimated Delivery = 4,685 t/y
Avg. Estimated Delivery = 0.13 t/a/y
Watershed Boundary
PLSS
Waterway Drainage Areas
Rivers/Streams
Sediment Delivery (t/a/y)
0 - 0.25
0.25 - 0.5
0.5 - 1
1 - 2
>2
Delivery estimates determined using NRCS Erosion and Sediment Delivery Worksheet (1996). RUSLE C and P factor information provided by local watershed personnel.
0 1 2 Miles
5/8/2007


Lindsey Creek Watershed
Potential Sheet and Rill Erosion
Pre-Project
Total Estimated Erosion = 33,096 t/y
Avg. Estimated Erosion = 2.6 t/a/y
Watershed Boundary
PLSS
Rivers/Streams
RUSLE (t/a/y)
0 - 2
2 - 5
5 - 10
10 - 15
>15
Erosion estimates based on NRCS Revised Universal Soil Loss Equation (RUSLE). RUSLE C and P factor information provided by local watershed personnel.
0 0.5 1 1.5 Miles
5/7/2007


Honey Creek Watershed
Potential Sheet and Rill Erosion
Pre-Project
Total Estimated Erosion = 40,309 t/y
Avg. Estimated Erosion = 2.23 t/a/y
0 0.5 1 1.5 2 Miles
Watershed Boundary
Rivers/Streams
PLSS
RUSLE (t/a/y)
0 - 1
1 - 2
2 - 5
5 - 10
>10
Erosion estimates based on NRCS Revised Universal Soil Loss Equation (RUSLE). C and P factor information provided by local watershed personnel.


Coffins Creek Watershed
Potential Sheet and Rill Erosion
Pre-Project
Total Estimated Erosion = 43,743 t/y
Avg. Estimated Erosion = 0.13 t/a/y
Watershed Boundary
PLSS
Rivers/Streams
RUSLE (t/a/y)
0 - 1
1 - 2
2 - 5
5 - 10
>10
Erosion estimates based on NRCS Revised Universal Soil Loss Equation (RUSLE). RUSLE C and P factor information provided by local watershed personnel.
0 1 2 Miles
5/8/2007