UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Ms. Lori McDaniel
Water Quality Bureau Chief
Iowa Department of Natural Resources
Wallace Building
Wallace State Office Building E. 9th St.
Des Moines, Iowa 50319

RE: Correction to Approval Letter of Total Maximum Daily Load document for the Iowa River Basin.

Dear Ms. McDaniels:

This is a correction to a letter sent by the U.S. Environmental Protection Agency, Region 7 on March 9, 2018. The letter approved a Total Maximum Daily Load document that contained TMDLs for Pathogen Indictors (*Escherichia coli*). In an audit of older TMDLs, the EPA discovered that the following water body pollutant pairs were included as protection TMDLs (pursuant to Section 303(d)3) in the approval letter instead of TMDLs for an impaired water body.

The approval letter stated for the two water bodies below, "Although these water bodies are not listed as impaired on the 2016 Iowa Section 303(d) List, the Iowa Department of Natural Resources included the water bodies in the TMDL document for protection. The TMDLs for these water bodies were not reviewed for approval by the EPA but are recognized under Section 303(d)3."

The approval letter erroneously stated that those water bodies were submitted as protection TMDLs and were not included on the 2016 Iowa Section 303(d) List by the IDNR.

Water Body Name	WBIDs	Causes
Unnamed Trib to Tipton Creek	IA 02-IOW-6364	*E. coli*
East Branch Iowa River	IA-02-IOW-769	*E. coli*

These water bodies were, in fact, listed on the 2016 Iowa Section 303(d) List by the IDNR. The IDNR included these water bodies as TMDLs, and should have been included in the EPA's 2018 approval. These water bodies were further reviewed by the EPA during the audit and the EPA concludes IDNR's 2016 submission fulfilled the Clean Water Act statutory requirement to develop TMDLs for impairments listed on a state's §303(d) list. By this letter, the EPA approves these TMDLs and corrects the record. The TMDL Decision Document enclosed with the 2018 approval letter adequately summarizes the rationale for the EPA's approval.

If your staff have any questions about this correction, please direct them to Jennifer Kissel at 913-551-7982.

Sincerely,

JEFFERY ROBICHAUD

Digitally signed by JEFFERY ROBICHAUD
Date: 2021.03.23 16:38:03 -05'00'

Jeffery Robichaud
Director
Water Division

cc: Mr. Jeff Berckes, Iowa DNR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

MAR 0 9 2018

Mr. Chuck Gipp
Director
Iowa Department of Natural Resources
Henry A. Wallace Building
502 East 9th Street
Des Moines, Iowa 50319

Dear Mr. Gipp:

RE: Approval of Total Maximum Daily Load document for the Iowa River Basin

This letter responds to the submission from the Iowa Department of Natural Resources, originally received by the U.S. Environmental Protection Agency, Region 7 on December 8, 2017, for a Total Maximum Daily Load document which contained TMDLs for Pathogen Indicators (*Escherichia coli*). The water bodies listed below were identified on the 2016 Iowa Section 303(d) List as impaired by *E. coli*. This submission fulfills the Clean Water Act statutory requirement to develop TMDLs for impairments listed on a state's CWA § 303(d) List. The specific impairment (water body segment and causes) are:

Water Body Name	**WBIDs**	**Causes**
Iowa River	IA 02-IOW-621	*E. Coli*
Iowa River	IA 02-IOW-622	*E. Coli*
Iowa River	IA 02-IOW-623	*E. Coli*
Iowa River	IA 02-IOW-624	*E. Coli*
Iowa River	IA 02-IOW-627	*E. Coli*
English River	IA 02-IOW-671	*E. Coli*
Old Mans Creek	IA 02-IOW-686	*E. Coli*
Muddy Creek	IA 02-IOW-2043	*E. Coli*
Unnamed Trib to Muddy Cr	IA 02-IOW-6588	*E. Coli*
Iowa River	IA 02-IOW-633	*E. Coli*
Iowa River	IA 02-IOW-641	*E. Coli*
Iowa River	IA 02-IOW-642	*E. Coli*
Price Creek	IA 02-IOW-699	*E. Coli*
Price Creek	IA 02-IOW-6377	*E. Coli*
Willow Creek	IA 02-IOW-6586	*E. Coli*
Unnamed Trib to Willow Cr	IA 02-IOW-6587	*E. Coli*
Little Bear Creek	IA 02-IOW-705	*E. Coli*
Little Bear Creek	IA 02-IOW-706	*E. Coli*

Little Bear Creek	IA 02-IOW-6563	*E. Coli*
Walnut Creek	IA 02-IOW-709	*E. Coli*
Walnut Creek	IA 02-IOW-1916	*E. Coli*
Unnamed Trib to Walnut Cr	IA 02-IOW-6317	*E. Coli*
Unnamed Trib to Walnut Cr	IA 02-IOW-6318	*E. Coli*
Unnamed Trib to Walnut Cr	IA 02-IOW-6590	*E. Coli*
Bennett Creek	IA 02-IOW-6263	*E. Coli*
Raven Creek	IA 02-IOW-723	*E. Coli*
Deer Creek	IA 02-IOW-6538	*E. Coli*
East Trib to Union Grove Lake	IA 02-IOW-6539	*E. Coli*
Iowa River	IA 02-IOW-646	*E. Coli*
Iowa River	IA 02-IOW-651	*E. Coli*
South Fork Iowa River	IA 02-IOW-746	*E. Coli*
South Fork Iowa River	IA 02-IOW-749	*E. Coli*
South Fork Iowa River	IA 02-IOW-750	*E. Coli*
South Fork Iowa River	IA 02-IOW-751	*E. Coli*
South Fork Iowa River	IA 02-IOW-752	*E. Coli*
Beaver Creek	IA 02-IOW-753	*E. Coli*
Beaver Creek	IA 02-IOW-6362	*E. Coli*
South Beaver Creek	IA 02-IOW-6363	*E. Coli*
Tipton Creek	IA 02-IOW-754	*E. Coli*
Tipton Creek	IA 02-IOW-755	*E. Coli*
Unnamed Trib to Tipton Creek	IA 02-IOW-6364*	*E. Coli*
East Branch Iowa River	IA 02-IOW-769*	*E. Coli*
East Branch Iowa River	IA 02-IOW-771	*E. Coli*
Drainage Ditch 13	IA 02-IOW-6550	*E. Coli*
Drainage Ditch 81	IA 02-IOW-6551	*E. Coli*
Gails Creek	IA 02-IOW-774	*E. Coli*
Unnamed Trib to E Br Iowa R	IA 02-IOW-6559	*E. Coli*

*Although *these water bodies are not listed as impaired on the 2016 Iowa Section 303(d) List, IDNR included the water bodies in the TMDL document for protection. The TMDLS for these water bodies were not reviewed for approval by the EPA but are recognized under Section 303(d)3.*

The EPA has completed its review of the TMDL document with supporting documentation and information. By this letter, the EPA approves the TMDLs submitted under CWA § 303(d) and acknowledges the additional water bodies included for the purpose of developing information under CWA § 303(d)(3). Enclosed with this letter is the Region 7 TMDL Decision Document which summarizes the rationale for the EPA's approval of the TMDL document. The EPA believes the separate elements of the TMDLs described in the enclosed document adequately address the pollutants of concern, taking into consideration seasonal variation and a margin of safety.

Although the EPA does not review for approval, the monitoring or implementation plans submitted by the state, the EPA acknowledges the state's efforts. The EPA understands that the state may use the monitoring plan to gauge the effectiveness of the TMDLs and determine if future revisions are necessary or appropriate to meet applicable water quality standards. The EPA recognizes that technical guidance and support are critical to determining the feasibility of achieving the goals outlined in this TMDL

document. Therefore, the implementation plan in this TMDL document provides information regarding implementation efforts to achieve the loading reductions identified.

The EPA appreciates the thoughtful effort that the IDNR has put into this TMDL document. We will continue to cooperate with and assist, as appropriate, in future efforts by the IDNR to develop TMDLs.

Sincerely,

Karen A. Flournoy
Director
Water, Wetlands and Pesticides Division

Enclosure

cc: Mr. William Ehm, Administrator, Division of Environmental Services, IDNR
Mr. Allen Bonini, Supervisor, Watershed Improvement Program, IDNR

December 4, 2017

Bruce Perkins
U.S. EPA, Region VII
11201 Renner Blvd.
Lenexa, KS 66219

Subject: Submittal of Iowa River Basin Bacteria TMDL for EPA approval

Dear Mr. Perkins:

The Final Iowa River Basin Bacteria Total Maximum Daily Load document completed by the Iowa Department of Natural Resources is enclosed. The document includes 10 main stem segments and 37 tributary segments (47 total) in the basin. These stream segments were recently included on Iowa's 2016 303(d) list. Included are:

Upper Iowa HUC-8 watershed (19 total):

- Iowa River main stem segments (2) – 0070_3 and 0080_2
- South Fork Iowa River segments (5) – 0270_0, 0280_3, 0280_4, 0280_5, and 0282_0
- Beaver Creek segments (2) – 0290_0 and 0295_0
- South Beaver Creek – 0297_0
- Tipton Creek segments (2) – 0300_1 and 0300_2
- Unnamed Tributary to Tipton Creek – 0302_0
- East Branch Iowa River segments (2) – 0380_1 and 0380_3
- Drainage Ditch 13 – 0381_0
- Drainage Ditch 81 – 0382_0
- Galls Creek – 0390_0
- Unnamed Tributary to East Branch Iowa River – 0395_0

Middle Iowa HUC-8 watershed (19 total):

- Iowa River main stem segments (3) – 0050_1, 0060_4, and 0060_5
- Price Creek segments (2) – 0175_2 and 0176_0
- Willow Creek – 0177_0
- Unnamed Tributary to Willow Creek – 0179_0
- Little Bear Creek segments (3) – 0185_1, 0185_2, and 0500_0
- Walnut Creek segments (2) – 0187_2 and 0188_0
- Unnamed Tributary to Walnut Creek segments (3) – 0189_0, 0191_0, 0510_0
- Bennett Creek – 0213_0
- Raven Creek – 0215_0
- Deer Creek – 0225_0
- East Tributary to Union Grove Lake – 0226_0

Lower Iowa HUC-8 watershed (9 total):

- Iowa River main stem segments (5) – 0010_1, 0010_2, 0010_3, 0020_1, and 0030_1
- English River – 0100_1
- Old Man's Creek – 0150_2
- Muddy Creek – 0162_0
- Unnamed Tributary to Muddy Creek – 0166_0

The draft TMDL was posted on the Iowa Department of Natural Resources website on September 7, 2017 and comments were accepted from September 7, 2017 to October 23, 2017. Three public meetings were held, one in each HUC-8 watershed, as follows:

- September 20, Eldora Public Library, 1202 10th St., Eldora (Upper Iowa)
- September 26, Marshalltown Public Library, 105 W. Boone St., Marshalltown (Middle Iowa)
- October 4, Coralville Public Library, Schwab Auditorium, 1401 5th St., Coralville (Lower Iowa)

Please accept this document for approval as the completed Iowa River Basin Bacteria TMDL.

Sincerely,

Allen P. Bonini, Supervisor
Watershed Improvement Section

Enclosure

Water Quality Improvement Plan
for the
Iowa River Basin

Benton, Cerro Gordo, Des Moines, Franklin, Grundy, Hamilton, Hancock, Hardin, Henry, Iowa, Jasper, Johnson, Keokuk, Linn, Louisa, Mahaska, Marshall, Muscatine, Poweshiek, Story, Tama, Washington, Winnebago, and Wright Counties, Iowa

Total Maximum Daily Loads for:
Pathogen Indicators (*E. coli*)

Prepared by:
James A. Hallmark, P.E.

clean water starts with you.
IOWA DNR WATERSHED IMPROVEMENT

Iowa Department of Natural Resources
Watershed Improvement Section
2017

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List of Abbreviations

Units of measure:

ac	acre	M	meter
cfs	cubic feet per second	mg	milligram
cfu	colony-forming unit	Mg	megagram (= 1 mt)
cm	centimeter	mi	mile
cms	cubic meters per second	mL	milliliter
d	day	mo	month
g	gram	mt	metric ton (= 1 Mg)
ha	hectare	orgs	E. *coli* organisms
hm	hectometer	ppm	parts per million
hr	hour	ppb	parts per billion
in	inch	s	second
kg	kilogram	t	ton (English)
km	kilometer	yd	yard
L	liter	yr	year
lb	pound		

Other abbreviations:

AFO	animal feeding operation
BMP	best management practice
Chl-a	chlorophyll a
E. coli	Escherichia coli
GM	geometric mean (pertains to WQS for E. coli, = 126 orgs/100 mL)
LDC	load duration curve
N	nitrogen
ortho-P	ortho-phosphate
P	phosphorus
SSM	single-sample max (pertains to WQS for E. coli, = 235 orgs/100 mL)
TN	total nitrogen
TP	total phosphorus
WQS	water quality standard

General Report Summary

What is the purpose of this report?
This Water Quality Improvement Plan serves multiple purposes. First, it is a resource for increased understanding of watershed and water quality conditions in the Iowa River Basin. Second, it satisfies the Federal Clean Water Act requirement to develop a Total Maximum Daily Load (TMDL) for waterbodies on the federal 303(d) impaired waters list. Third, it provides a foundation for locally-driven water quality improvements for streams in the Iowa River Basin in an effort to improve water quality. Fourth, it may be useful for obtaining financial assistance to implement projects to remove waterbodies in the Iowa River Basin from the federal 303(d) impaired waters list.

What's wrong with the Iowa River and its tributaries?
Ten segments of the Iowa River and 36 other stream segments in the Iowa River basin are not supporting the primary contact recreation (Class A1) use due to high levels of indicator bacteria called Escherichia coli (*E. coli*). Primary contact recreation includes activities that involve direct contact with the water such as swimming and wading. High *E. coli* levels in a waterbody can indicate the likelihood of the presence of potentially harmful bacteria and viruses (also called pathogens). Humans can become ill if they come into contact with and/or ingest water that contains pathogens; however, it is important to note that not all forms of *E. coli* (the indicator bacteria) are pathogens.

What is causing the problem?
E. coli and harmful pathogens found in a lake or stream can originate from point or nonpoint sources of pollution, or a combination of both. Point sources of pollution are easily identified sources that enter a stream or lake at a distinct location, such as a wastewater treatment plant discharge. Nonpoint sources of pollution are discharged in a more indirect and diffuse manner, and are often more difficult to locate and quantify. Nonpoint source pollution is usually carried with rainfall or snowmelt over the land surface and into a nearby lake or stream, although in some locations in the Iowa River basin, subsurface drainage tiles also transport nonpoint source pollution to surface water.

Both point and nonpoint sources of pollution contribute *E. coli* to surface water in the watershed. Permitted point sources in the Iowa River basin include municipal separate storm sewer systems (MS4s) and municipal wastewater treatment facilities (WWTFs). Onsite wastewater treatment systems (often called septic systems), are not point sources unless they are designed to discharge and do so under an NPDES permit. Nonpoint sources result from livestock, pets, wildlife, and humans that live, work, and play in and around the stream. Specific examples of nonpoint sources of bacteria include cattle with direct access to streams, manure applied to row crops, most onsite wastewater systems, and natural or background sources such as wildlife. Other sources may exist that are difficult to detect and document, such as resuspension of bacteria from the stream bed, or growth of bacteria within the storm sewer system.

What can be done to improve the Iowa River and its tributaries?
To improve the water quality in the Iowa River Basin so that primary contact and children's recreation are fully supported, the amount of bacteria entering the stream must be reduced. Accomplishing this will require a combination of land, animal, stormwater, and wastewater management practices. In rural areas of the basin, efforts should focus on eliminating livestock access to streams, increasing manure storage capacity, strategic manure application that considers location, timing, and method of application, and improving failing onsite wastewater treatment systems to meet state standards.

Urban activities should include the following management practices either separately or in combination: adoption of stormwater BMPs geared specifically to bacteria reduction, runoff volume reduction, elimination of sanitary sewer overflows (SSOs) and possible illicit sanitary sewer connections, strategic management of wastewater facility discharges (adjustment of discharge timing, disinfection, etc.), and public outreach and educational programs that encourage pet owners to pick up pet waste.

Who is responsible for a cleaner Iowa River Basin?
Everyone who lives, works, or plays in the watershed has a role in water quality improvement. Because there are several municipal point sources in the watershed, the cities must meet wasteload allocations (WLAs) that will be incorporated into their National Pollutant Discharge Elimination System (NPDES) permits. Voluntary management of land and animals by private landowners and citizens will also be required to see positive results.

Improving water quality in the impaired streams within the basin will require a collaborative effort of citizens and agencies with a genuine interest in protecting the stream now and in the future.

Does a TMDL guarantee water quality improvement?
The Iowa Department of Natural Resources (DNR) recognizes that technical guidance and support are critical to achieving the goals outlined in this Water Quality Improvement Plan (WQIP). The TMDL itself is only a document, and without implementation, will not improve water quality. Therefore, a basic implementation plan is included for use by local agencies, watershed managers, and citizens for decision-making support and planning purposes. This implementation plan should be used as a guide or foundation for detailed and comprehensive planning by local stakeholders, and must be tailored to fit the needs of each impaired stream / river segment in the basin.

Reducing pollutants from unregulated nonpoint sources requires voluntary implementation of best management practices. Many practices have benefits to sustained productivity of the land as well as water quality. Quantifying the value of sustainability and other ecosystem services is difficult and those benefits are not commonly recognized. Consequently, wide-spread adoption of voluntary conservation practices is often difficult to achieve. A coordinated watershed improvement effort for each individual stream could address some of these barriers by providing financial assistance, technical resources, and information outreach to landowners to encourage and facilitate adoption of conservation practices.

Required Elements of the TMDL

This Water Quality Improvement Plan has been prepared in compliance with the current regulations for TMDL development that were promulgated in 1992 as 40 CFR Part 130.7 in compliance with the Clean Water Act. These regulations and consequent TMDL development are summarized below in Table 1-1.

Table 1-1. Required TMDL Elements.

Name of the impaired or threatened waterbodies for which the TMDLs are being established. (Prefix for all stream segments is IA 02-IOW-):	Lower Iowa HUC-8 Watershed • Iowa River: 0010_1 0010_2 0010_3 0020_1 0030_1 • English River: 0100_1 • Old Mans Creek: 0150_2 • Muddy Creek: 0162_0 • Unnamed Trib to Muddy Creek: 0166_0	Middle Iowa HUC-8 Watershed • Iowa River: 0050_1 0060_4 0060_5 • Price Creek: 0175_2 0176_0 • Willow Creek: 0177_0 • Unnamed Trib to Willow Creek: 0179_0 • Little Bear Creek: 0185_1 0185_2 0500_0 • Walnut Creek: 0187_2 0188_0 • Unnamed Trib to Walnut Creek: 0189_0 0191_0 0510_0 • Bennett Creek: 0213_0 • Raven Creek: 0215_0 • Deer Creek: 0225_0 • East Trib to Union Grove Lake: 0226_0	Upper Iowa HUC-8 Watershed • Iowa River: 0070_3 0080_2 • South Fork Iowa River: 0270_0 0280_3 0280_4 0280_5 0282_0 • Beaver Creek: 0290_0 0295_0 • South Beaver Creek: 0297_0 • Tipton Creek: 0300_1 0300_2 • Unnamed Trib to Tipton Creek: 0302_0 • East Branch Iowa River: 0380_1 0380_3 • Drainage Ditch 13: 0381_0 • Drainage Ditch 81: 0382_0 • Galls Creek: 0390_0 • Unnamed Trib to East Branch Iowa River: 0395_0
Surface water classification and designated uses:		Class A1, primary contact recreation →All segments above Class B(WW), warm water aquatic life →All segments above Class HH, human health, fish consumption →Iowa River main stem segments only	
Impaired beneficial uses:		Class A1, primary contact recreation (March 15 to November 15)	
TMDL priority level:		Tier III	

Identification of the pollutants and applicable Water Quality Standards (WQS):	Pathogen Indicator, *E. coli*. Primary contact recreational (Class A1) use is not supported due to violation of the *E. coli* Water Quality Standard criteria of 126 organisms/100 mL for the geometric mean. These standards only apply during the recreational season of March 15 – November 15.
Quantification of the pollutant loads that may be present in the waterbody and still allow attainment and maintenance of water quality standards:	The target for the Iowa River segments and its tributaries is a geometric mean of 126 *E. coli* organisms/100 mL. The odd numbered tables between Table 4-9 through Table 4-23; Table 5-9 through Table 5-45; and Table 6-9 through Table 6-45 lists the existing loads and departures from capacity for the impaired segments.
Quantification of the amount or degree by which the current pollutant loads in the waterbody, including the pollutants from upstream sources that are being accounted for as background loading, deviate from the pollutant loads needed to attain and maintain water quality standards:	The *E. coli* load departure from capacity has been calculated for five flow recurrence intervals for each impaired segment in the basin for the GM. The odd numbered tables between Table 4-9 through Table 4-23; Table 5-9 through Table 5-45; and Table 6-9 through Table 6-45 lists the existing loads and departures from capacity for the impaired segments.
Identification of pollution sources:	Point sources of bacteria include municipal separate storm sewer systems (MS4s), wastewater treatment facilities (WWTFs), onsite wastewater systems operating under NPDES permits, and sanitary sewer overflows (SSOs). Nonpoint sources of pollution include cattle with direct access to streams, manure application to row crops, failing onsite wastewater treatment systems, and wildlife.
Wasteload allocations (WLA) for pollutants from point sources:	Pathogen Indicator, *E. coli*. The wasteload allocations (WLA) for point sources for each segment are listed in the even numbered tables between Table 4-10 through Table 4-24; Table 5-10 through Table 5-46; and Table 6-10 through Table 6-46 as well as Table 4-25, Table 5-47, and Table 6-47. Individual WLA for each point source is listed in the tables in Appendices C, D, & E
Load allocations for pollutants from nonpoint sources (NPS):	Pathogen Indicator, *E. coli*. The load allocations for nonpoint sources for each segment are listed in the even numbered tables between Table 4-10 through Table 4-24; Table 5-10 through Table 5-46; and Table 6-10 through Table 6-46 as well as Table 4-25, Table 5-47, and Table 6-47.
Margin of safety (MOS):	Pathogen Indicator, *E. coli*. An explicit MOS of 10% is utilized in the TMDL for all impaired reaches. Additionally, targeting the GM in each flow condition, rather than only the overall GM, provides an implicit MOS by requiring WQS compliance across flow conditions.
Consideration of seasonal variation:	Pathogen Indicator, *E. coli*. These TMDLs were developed based on the Iowa WQS primary contact recreation season that runs from March 15 to November 15. Allocations are developed for a range of flow conditions, which help account for wet and dry periods within the recreation season.

Reasonable assurance that load and wasteload allocations will be met:	For nonpoint sources, reasonable assurance is provided by: (1) planned implementation activities that address the pollutant of concern, (2) local stakeholders working towards implementation of appropriate BMPs, (3) detailed requirements for watershed planning to ensure that 319 applications meet EPA requirements, and (4) available monetary support for nonpoint source pollution reduction. See Section 3.4 for more detailed discussion of reasonable assurance. For point sources, reasonable assurance is provided through NPDES permits.
Allowance for reasonably foreseeable increases in pollutant loads:	Foreseeable increases in pollutant loads are accommodated by the inclusion of reserve WLAs for unsewered communities. In addition, any new or expanded dischargers will be expected to meet the same end-of-pipe criteria (GM of 126 orgs/100 mL) as dischargers for which WLAs were calculated and included in this TMDL.
Implementation plan:	A general implementation plan is outlined in Section 7 to guide local citizens, government, and water quality groups in the development of more detailed plans for individual streams within the Iowa River Basin. *E. coli* reduction will be accomplished through a combination of land use, livestock / manure, stormwater, and wastewater management strategies.

1. Introduction

The Federal Clean Water Act requires states to assess their waterbodies every even numbered year and incorporate these assessments into the 305(b) Water Quality Assessment Report. Assessed lakes and streams that do not meet the Iowa Water Quality Standards (WQS) criteria are placed on the 303(d) Impaired Waters List. Subsequently, a Total Maximum Daily Load (TMDL) for each pollutant must be calculated and a Water Quality Improvement Plan written for each impaired water body.

A TMDL is a calculation of the maximum amount of pollution that a waterbody can tolerate without exceeding WQS and impairing the waterbody's designated uses. The TMDL calculation is represented by the following general equation:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

Where: TMDL = total maximum daily load
LC = loading capacity
ΣWLA = sum of wasteload allocations (point sources)
ΣLA = sum of load allocations (nonpoint sources)
MOS = margin of safety (to account for uncertainty)

One purpose of this Water Quality Improvement Plan (WQIP) for the Iowa River basin is to provide the TMDL for E. coli and satisfy the requirements of the Clean Water Act. The second purpose of the plan is to provide local stakeholders and watershed managers with a tool to promote awareness of water quality issues, assist the development of funding applications and a comprehensive watershed management plan, and guide water quality improvement efforts.

This WQIP includes an assessment of the existing *E. coli* loads to each of the impaired segments in the basin and a determination of how much *E. coli* each stream can tolerate and still provide for primary contact recreational use. The WQIP also includes descriptions of potential solutions to the impairments. This group of solutions is presented as a toolbox of best management practices (BMPs) for reducing *E. coli* concentrations in the Iowa River Basin, with the ultimate goal of meeting water quality standards and supporting designated uses. These BMPs are outlined in the general implementation plan in Section 7.2.

The WQIP will be of little value to real water quality improvement unless watershed improvement activities and BMPs are implemented. This will require the active engagement of local stakeholders and the collaboration of several state and local agencies.

Implementation of BMPs should be integrated with collection of water quality data as part of the ongoing monitoring plan, evaluation of collected data, and modification of the implementation plan (if necessary). Monitoring is a crucial element to assess the attainment of WQS and designated uses, to determine if water quality is improving, degrading, or unchanged, and to assess the effectiveness of implementation activities and the possible need for additional BMPs. A water quality monitoring plan designed to help assess water quality improvement and BMP effectiveness is provided in Section 8.1.

2. Description of the Iowa River Basin

The Iowa River Basin consists of three 8 Digit Hydraulic Unit (HUC-8) watersheds: the Lower Iowa (HUC-8, 07080209), the Middle Iowa (HUC-8, 07080208), and the Upper Iowa (HUC-8, 07080207) with areas of 1,686 square miles (mi^2), 1,657 mi^2, and 1,456 mi^2, respectively. The Upper Iowa watershed in this WQIP should not be confused with the Upper Iowa River Basin located in northeast Iowa. Due to the size of the Iowa River basin, each HUC-8 watershed will be reviewed and discussed separately in this report. Figure 2-1 shows the Iowa River with the three HUC-8 watersheds.

Elevations in the watershed range from a maximum of 1,360 feet North American Vertical Datum 1988 (NAVD 88) in Hancock County to a minimum of 534 feet NAVD 88 at the confluence with the Mississippi River in Louisa County.

The East and West Branches form the headwaters of the Iowa River in Hancock County. Both headwater branches are approximately 39 miles long and converge on the north side of the City of Belmond, in Wright County, to form the main stem of the Iowa River. From the City of Belmond the Iowa River runs approximately 325 miles southeasterly through Wright, Franklin, Hardin, Marshall, Tama, Benton, Iowa, Johnson, Washington and Louisa Counties and discharges to the Mississippi River just downstream of the Lock and Dam No. 17. The Iowa River passes through or is adjacent to several cities including Iowa Falls, Marshalltown, Coralville, and Iowa City.

At the confluence of the Mississippi River, the Iowa River basin has a total drainage area of approximately 12,600 square miles, which includes approximately 7,819 square miles from the Cedar River basin. The mouth of the Cedar River is located approximately 30 miles upstream from the mouth of the Iowa River in Louisa County, between Columbus Junction and Fredonia, Iowa.

The hydrology and hydraulics of the Iowa River have been altered since the settlement of Iowa in the mid 1800's due to changes in land use, urban development, and development along the river. Changes in land use from prairie to row crops has increased runoff, and lands that were too wet to cultivate crops were drained to allow for farming.

Twelve low head dams have been constructed on the Iowa River to pond water or divert water to a millrace (Linhart SM, and DA Eash. 2010). The most significant dam on the Iowa River is the Coralville Dam in Johnson County, which impounds the Iowa River and creates Coralville Reservoir. The reservoir was constructed by the U.S. Army Corps of Engineers in 1958 to reduce flooding on the Mississippi River. (USACE, January 2013).

Other significant developments along the river include the construction of flood control works, agricultural levees, bridges, and straightening of short segments of the river. Flood control works include levees and flood walls that are typically located in urban developed areas and are constructed to protect to the 100-year storm event. Agricultural levees are constructed along the river to protect farmland from flooding. Since 1930 there has been minimal straightening of the river outside of activity associated with bridge construction.

Water resources data on the Iowa River and its tributaries are monitored by a series of gages managed by the U.S. Geological Survey (USGS). Since the early 1900's the USGS has maintained 35 stream gages in this watershed. Only 24 of these stream gages are currently active. Monitoring locations have been established that collect surface water data such as gage height (stage) and streamflow (discharge). At some gage sites, water quality data are also available that includes information about temperature, pH, nutrients, pesticides, volatile organic compounds, or other compounds of interest.

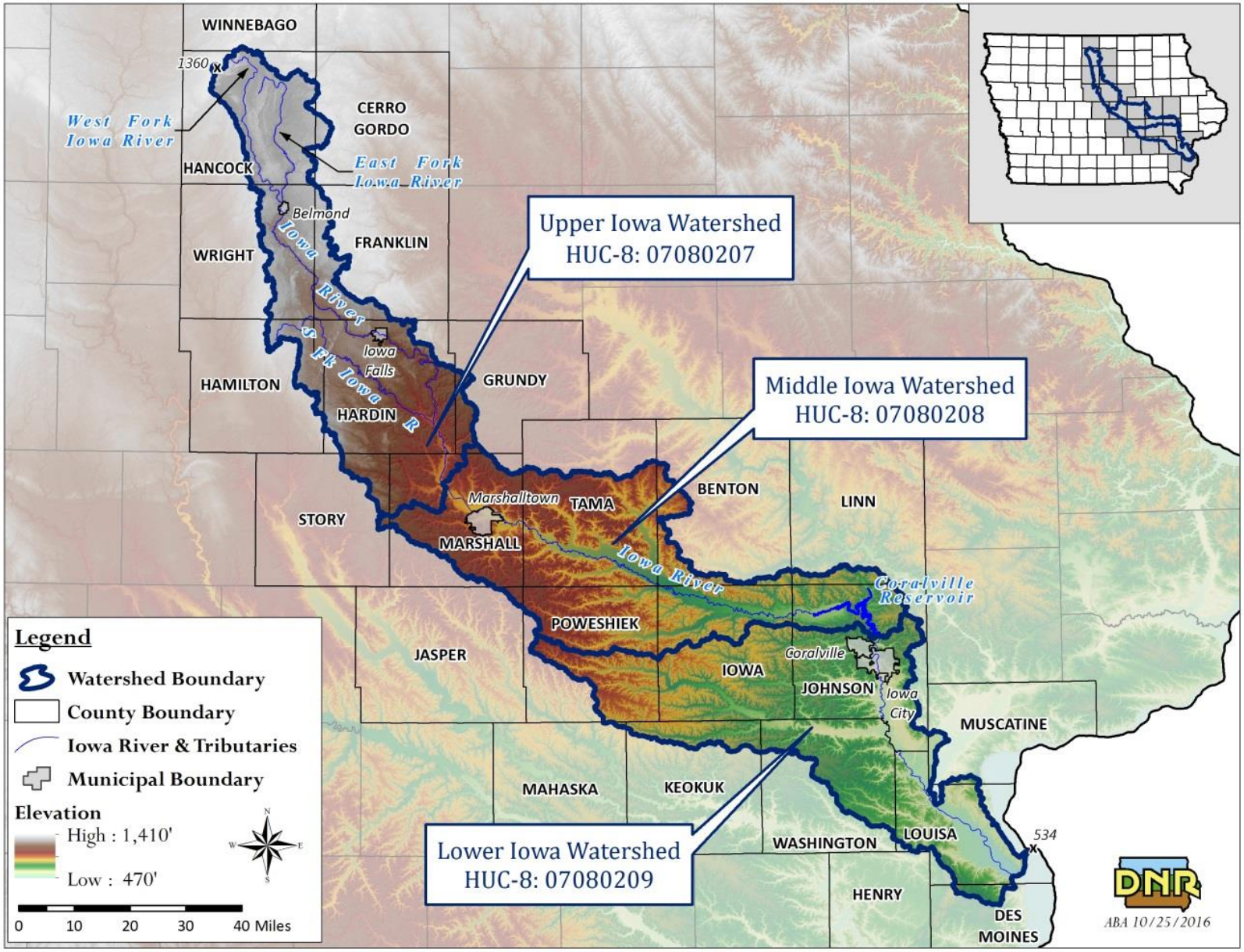

Figure 2-1. Iowa River Basin.

3. General Stream and Environmental Information

3.1. Problem Identification

47 stream segments in the Iowa River Basin do not meet water quality standards (WQS) and are not fully supporting Class A1 (primary contact recreation) uses due to the presence of high levels of an indicator bacteria called *Escherichia coli* (*E. coli*). High *E. coli* levels in a waterbody can indicate the presence of potentially harmful bacteria and viruses (also called pathogens). Under Iowa Administrative Code (567 Iowa Administrative Code, Chapter 61, (IAC)), streams are impaired for *E. coli* if the geometric mean (GM) of all samples exceeds 126 orgs/100 mL of water. This standard is only applicable during the recreation season, defined as March 15 through November 15.

General Description of the Pollutants

Fecal material from warm-blooded animals contains many microorganisms. Some of these microorganisms can cause illness or disease if ingested by humans. The term pathogen refers to a disease-causing microorganism, and can include bacteria, viruses, and other microscopic organisms. Humans can become ill if they come into contact with and/or ingest water that contains pathogens.

It is not practical to test water for every possible pathogen that may be present – there are simply too many different kinds of pathogens. Instead, water quality assessments typically test for an organism such as total coliform, fecal coliform, or *E. coli* to indicate the presence of pathogens from fecal material. *E. coli* is a type of fecal coliform, and its presence theoretically correlates with illnesses that result from human exposure to water that is contaminated with fecal material (Mishra et al, 2008). It should be noted that not all types of *E. coli* cause human illness; however, the presence of *E. coli* indicates the likelihood that pathogens are present. For the purposes of this TMDL, *E. coli* is used as the indicator bacteria. The two primary reasons for using *E. coli* are: (1) the EPA currently considers *E. coli* to be the preferred bacterial indicator, and (2) Iowa's WQS are written for *E. coli*.

Problem Statement

Water quality assessments indicate that primary contact recreation is either "not supported" or only "partially supported" in these segments due to high levels of indicator bacteria (*E. coli*) that violate the state's WQS. The significance of the impairments noted in the assessments is that desirable recreational activities, such as swimming and wading, are not supported by existing water quality in the impaired segments. As a result of these findings, the Federal Clean Water Act requires that TDMLs for *E. coli* be developed for all the impaired segments.

Stream Segment Designations and Descriptions

In February 2008, changes to Iowa's surface water classifications were approved by the EPA and all segments were presumed to be Class A1, primary contact recreation until a use attainability assessment could be completed and approved by the EPA. Stream designations are defined and classified for protection of beneficial uses in the Iowa Administrative Code (IAC) 567-61.3(1).

Beneficial uses as defined in the IAC 567-61.3(1) are cited below.

- 567-61.3(1)(b)(1) Primary contact recreational use (Class "A1"). Water in which recreational or other uses may result in prolonged and direct contact with the water, involving considerable risk of ingesting water in quantities sufficient to pose a health hazard. Such activities would include, but not be limited to, swimming, diving, water skiing, and water contact recreation canoeing.
- 567-61.3(1)(b)(6) Warm water-Type 1 (Class "B(WW-1)"). Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native nongame fish and invertebrate species. These waters generally include border rivers, large interior rivers, and the lower segments of medium-size tributary streams.
- 567-61.3(1)(b)(10). Human health (Class "HH"). Waters in which fish are routinely harvested for human consumption or waters both designated as a drinking water supply and in which fish are routinely harvested for human consumption.

Stream segment designations and descriptions for individual impaired stream segments will be discussed in the respective sections of this report.

Data Sources and Monitoring Sites
The primary sources of water quality data used in the development of this WQIP are water quality data collected by the Iowa DNR and the USGS National Water-Quality Assessment (NAWQA) Program. An additional source of water quality data solely used in the Upper Iowa Watershed is the National Laboratory for Agriculture and the Environment (NLAE). These data consist primarily of grab samples collected by the agencies between 1997 and 2012. When available, additional water quality data through 2015 was utilized. The following list summarizes sources of additional data used for this WQIP:

- Stream data collected by Iowa DNR Watershed Improvement Section staff for the purpose of TMDL development.
- Stream data collected by USACE, Kansas City District, as part of its reservoir monitoring program.
- Streamflow data collected by the USGS at multiple surface water gaging stations.
- Precipitation data from the National Weather Service Cooperative Observer Program (NWS COOP) (IEM, 2015).
- 10-m Digital Elevation Model (DEM) available from DNR GIS library.
- SSURGO soils data maintained by United States Department of Agriculture –Natural Resource Conservation Service (USDA-NRCS).
- U.S. Department of Agriculture National Agricultural Statistics Service Cropland Data Layer (USDA CDL) reflecting 2014 conditions.
- Aerial images (various years) collected and maintained by DNR.
- Water Quality data collected by the USDA's Agricultural Research Service National Laboratory for Agriculture and the Environment (NLAE).

3.2. TMDL Target

Selection of Environmental Conditions
The critical period for the impairment occurs in the recreational season of March 15 to November 15.

Pollutant Loading Capacity
Attainment of the WQS to fully support primary contact recreation requires that the GM for *E. coli* concentrations be no greater than 126 orgs/100 mL and the single sample maximum (SSM) be not greater than 235 orgs/100 mL (Iowa Administrative Code 567, Chapter 61, Water Quality Standards for Class A1 uses). The methods used to develop the *E. coli* TMDLs for the Iowa River Basin are based on the assumption that compliance with the SSM will coincide with attainment of the GM targets set forth in this TMDL. Therefore, the loading capacity of each TMDL segment is the maximum number of *E. coli* organisms that can be in the stream while meeting the GM criterion of 126 orgs/100 mL.

Decision Criteria for WQS Attainment
Load duration curves (LDCs) constructed using mean daily flows and the GM criterion were used to quantify the loading capacity of each impaired segment, in terms of load (orgs/day), across a range of flow conditions. Points above the red GM curve in Figure 3-1 represent violations of the WQS, whereas points below the curves comply with WQS.

WQS will be attained in the impaired stream segments when the monitored *E. coli* concentration meets the GM criterion of 126 orgs/100 mL during the recreational season of March 15 – November 15.

3.3. Pollution Source Assessment

Existing Loads
E. coli loads were estimated by multiplying observed concentrations (orgs/100 mL) by the mean daily flow (cfs) on the day the sample was collected (including a unit's conversion). Using the load duration curve (LDC) approach, these measured loads are plotted against the flow duration interval, which allows loads to be grouped into the same flow conditions loading capacity. Figure 3-1 is a load duration curve for the Iowa River segment IA 02-IOW-0010_1 and is

presented here as an example of the format of the LDC used throughout this WQIP and illustrates both observed loads and the flow-variable loading capacity, which is based on the WQS of 126 orgs/100 mL for the GM concentration.

Each blue diamonds (◆) in Figure 3-1 represents an observed E. coli concentration and flow, and hence corresponding load. Green-shaded diamonds (◆) indicate samples that were collected in early spring (March to May), orange shading (◆) represents samples collected in the summer (June to September), and gray shading (◆) indicates samples that were collected in the late fall (October to November).

Data points with a red X (×) indicate where E. coli concentrations exceeded the quantitative limits of the analysis. Typically this value was 24,000 orgs/100mL, however in some cases the limit was 2419.6 orgs/100 mL.

Data points with a tan cross (+) indicates samples that had E. coli concentrations below the reporting thresholds. Typically this value was 10 orgs/100 mL, however is some cases the limit was 1 org/100 mL.

Data points with a blue X (×) indicate where E. coli concentrations were estimated by the agency collecting the data.

LDCs for each stream segment show the observed GM loading (green, dotted lines) for each flow condition and the target GM loading (red, dashed line). The difference between these two is the departure from the loading capacity.

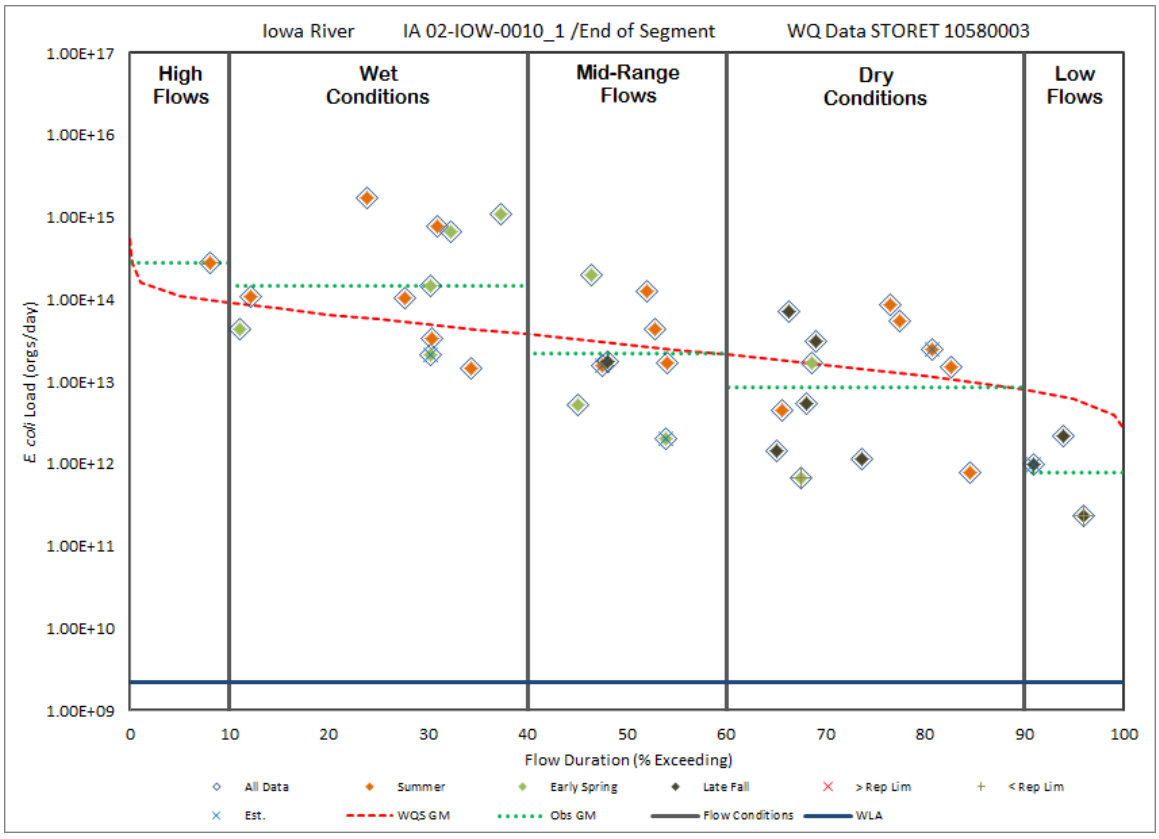

Figure 3-1. Load Duration Curve for Iowa River Segment IA 02-IOW-0010_1.

Potential Sources

Figure 3-2 shows some potential *E. coli* contributing sources by flow condition. Each box represents a potential source and overlaps the flow conditions in which it is most likely to contribute to the impairment. The boxes are color coded with red shading indicating the condition in which the source has a greater impact to water quality and green shading indicates the condition in which the source has a lower impact to water quality.

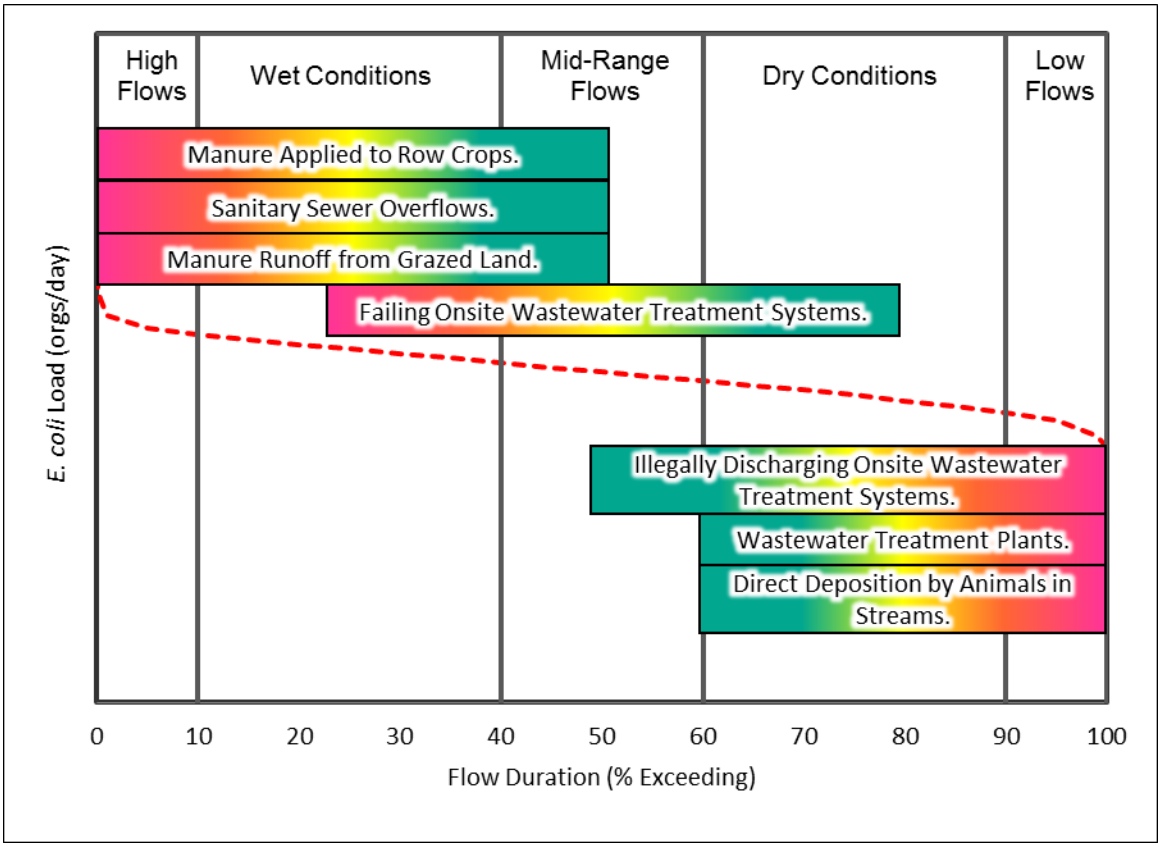

Figure 3-2. Potential E. coli Sources by Flow Condition.

3.4. Reasonable Assurance

Under current EPA guidance, TMDLs that allocate loads to both point sources (WLAs) and nonpoint sources (LAs) must demonstrate reasonable assurance that required load reductions will be implemented. For point sources, reasonable assurance is provided through NPDES permits. Permits include operation requirements and compliance schedules that are developed based on water quality protection. For nonpoint sources, allocations and proposed implementation activities must satisfy four criteria:

- They must apply to the pollutant of concern
- They will be implemented expeditiously
- They will be accomplished through effective programs
- They will be supported by adequate water quality funding

Nonpoint source measures developed in the Iowa River Basin TMDL satisfy all four criteria. First, LAs and implementation activities described in Section 7 of the report apply directly to *E. coli*. Attainment of designated uses and existing water quality are measured using these indicator bacteria. Second, there are several active watershed groups already pursuing detailed watershed planning and implementation activities in the Iowa River Basin. Third, Iowa DNR has set forth detailed requirements for watershed planning and implementation to ensure that watershed management plans and Section 319 applications meet EPA requirements and include: approximate timelines for implementation activities, ongoing monitoring to track progress towards water quality improvement, a phased and prioritized schedule of activities, and target the impairment appropriately. Finally, ongoing monetary support is available for implementation in a variety of forms, including Section 319 grants, as well as other federal, state, and local resources.

4. TMDLs for the Lower Iowa Watershed

4.1. Watershed/Waterbody Description

The Lower Iowa watershed (HUC-8 ID: 07080209) has a drainage area of 1,686 mi^2, comprising 35 percent of the Iowa River Basin. Eleven HUC-10 watersheds covering all or portions of Johnson, Iowa, Poweshiek, Keokuk, Washington, Muscatine, Louisa, and Des Moines Counties, are within the Lower Iowa. Elevations in the watershed range from 529 feet NAVD 88 at the confluence of the Mississippi and Iowa Rivers to 1,019 feet NAVD 88 at the northwest boundary of the watershed in Poweshiek County.

The division between the Lower and Middle Iowa watersheds occurs at the Coralville Reservoir Dam located in Johnson County, approximately 3 miles north of the Iowa City corporate limits. From this point the Iowa River runs approximately 83 miles in a South-Southeasterly direction passing through Johnson, Washington, and Louisa counties before discharging to the Mississippi River. It flows through several incorporated areas including Iowa City, Coralville, Riverside, Columbus Junction, and Wapello. In addition, the Iowa River flows through several parks owned and operated by City and County entities that provide recreational opportunities to the local population. The river also flows through several wildlife management areas (WMA) including Indian Slough, Millrace Flats, Wapello Bottoms, and the Port Louisa National Wildlife Refuge. The Iowa River provides recreation, aquatic and riparian wildlife habitat, aesthetic qualities, and storm drainage.

Tributaries to the Iowa River with a drainage area over 30 mi^2 includes Short Creek, Buck Creek, Cedar River, Indian Creek, Rapid Creek, Goose Creek, Otter Creek, Clear Creek, Long Creek, Old Mans Creek and the English River. Many smaller streams also drain to the Iowa River in the Lower Iowa HUC-8 watershed, including Prairie Creek, Richey Creek, Honey Creek, Snyder Creek, Smith Creek, Davis Creek, and other smaller named and unnamed tributaries. A map of the Lower Iowa HUC-8 watershed is shown in Figure 4-1 and general watershed and river information is provide in Table 4-1.

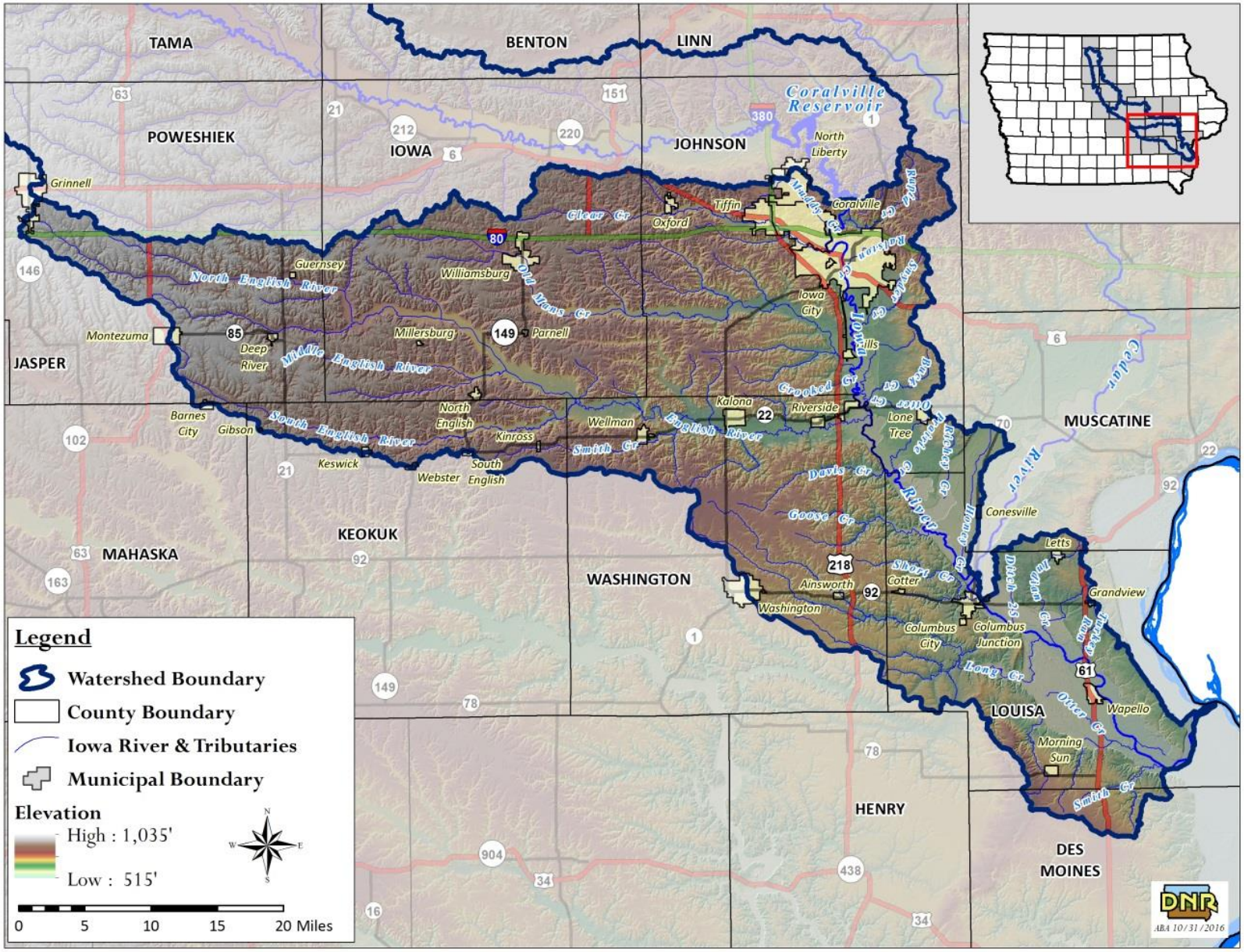

Figure 4-1. The Lower Iowa Watershed.

Table 4-1. Iowa River and Lower Iowa Watershed Information.

Waterbody	Iowa River
8 Digit Hydrologic Unit Code (HUC)	07080209
8 Digit HUC Name	Lower Iowa
Location	Beginning in the NE ¼ of Sec 22, T80N, R06W; running in a south-southeast direction for 83 miles and discharging into the Mississippi River.
Designated Uses	A1 – primary contact recreation B(WW-1) – aquatic life (warm water) HH – human health/fish consumption
Tributaries	Buck Creek, Cedar River, (addressed in a separate TMDL), Clear Creek, Crooked Creek, Davis Creek, Diggins Slough, Ditch No 25, English River, Goose Creek, Honey Creek, Indian Creek, Long Creek, Muddy Creek, Old Man's Creek, Otter Creek, Prairie Creek, Ralston Creek, Rapid Creek, Richey Creek, Short Creek, Smith Creek, Snyder Creek, Turkey Run, and several unnamed tributaries.
HUC – Length	81 Miles
Up Stream	Iowa River, Middle Iowa, HUC-8, 07080208
Receiving Waterbody	Mississippi River

Landforms

The Lower Iowa watershed is made up of four landforms: Southern Iowa Drift Plain, Mississippi River Alluvial Plain, Iowan Surface, and Iowa-Cedar Lowland. The Southern Iowa Drift Plan and the Iowa-Cedar Lowland landforms make up approximately 99% of the watershed.

The Southern Iowa Drift Plain makes up 88% of the landform area in the watershed. This landscape consists of rolling hills of Wisconsin-age loess on Illinoian till. Numerous rills, creeks, and rivers branch out across the landscape shaping the old glacial deposits into steeply rolling hills and valleys (Prior, 1991).

The Iowa-Cedar Lowland makes up 11% of the landform area in the watershed. This landform encompasses the area at the lower end of the Iowa River and at the confluence of the Cedar River and was formerly part of the Alluvial Plains but was separated out due to its uniqueness. The landscape is characterized by an extensive modern floodplain composed of thick alluvial deposits with adjacent older terraces and benches that are mantled by eolian sand dunes and wind-blown loess. (Prior, Kohrt, and Quade, 2009).

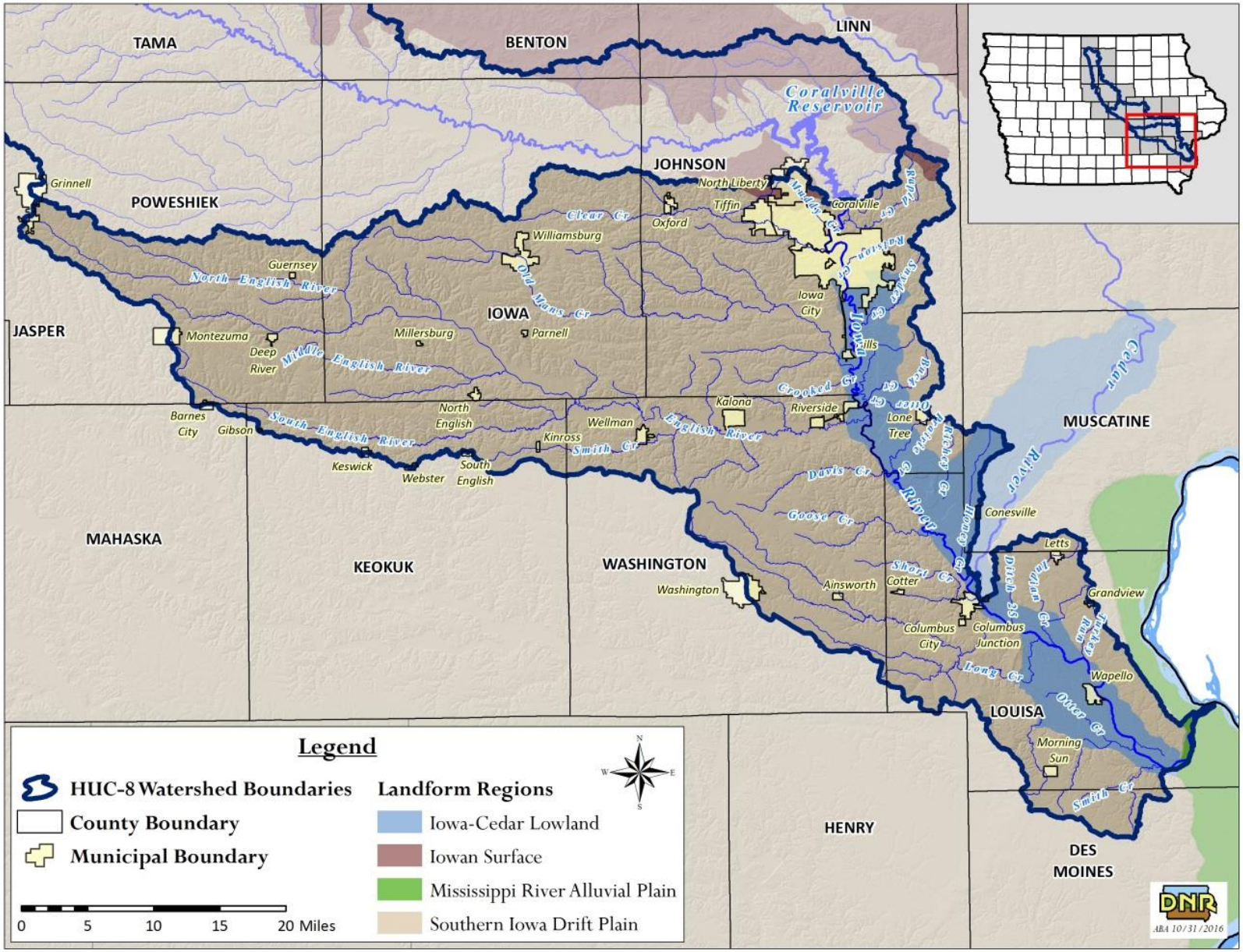

Figure 4-2. Lower Iowa Watershed Landforms.

Hydrology

Based on USGS National Hydrography Dataset (NHD) High Resolution (https://nhd.usgs.gov/data.html), the Lower Iowa watershed includes approximately 3,705 miles of streams, with the Iowa River having a total stream length of approximately 81 miles. Discharge rates in the Iowa River downstream of the Coralville Reservoir are partially regulated at the outlet of the reservoir by the U.S. Army Corps of Engineers. During low flow periods water will be discharged from the reservoir to maintain a minimum downstream discharge rate of 150 cubic feet per second (cfs). (USACE, January 2013). The reservoir was completed in 1958 and was constructed for the main purpose of flood control on the Mississippi River.

The USGS currently maintains 12 surface water gaging stations in this watershed. These gaging stations are used to collect stream data such as gage height, discharge rate, and in some cases water quality data. Table 4-2 lists the USGS stream gage information for the active gages used in this WQIP.

Table 4-2. Selected USGS Stream Gages in the Lower Iowa Watershed.

Station Number	Station Name	Latitude	Longitude	Stream	Drainage Area (mi^2)
05465500	Iowa River at Wapello, IA	41°10’41”	91°10’55”	Iowa River	12,500
05455500	English River at Kalona, IA	41°28’11”	91°42’52”	English River	574
05455100	Old Man’s Creek near Iowa City, IA	41°36’23”	91°36’56”	Old Man’s Creek	201
05454300	Clear Creek near Coralville, IA	41°40’36”	91°35’55”	Clear Creek	98.1

From 1997 to 2014, rainfall across the watershed ranges from 37-40 inches (Table 4-3), with some variation across location and years (Figure 4-4).

Table 4-3. Weather Station Information for Grinnell, Iowa City, Mount Pleasant, Iowa.

IEM Station ID	IA3473	IA4101	IA5796
Station Name	Grinnell-3-SW	Iowa City	Mt. Pleasant
Latitude	41.72	41.65	40.95
Longitude	-92.73	-91.53	-91.55
Miles from Watershed	0.27	N/A	16.0
Average Annual Precipitation (1997-2014)	37.0 inches	37.4 inches	39.6 inches

Source: https://mesonet.agron.iastate.edu/climodat and https://mesonet.agron.iastate.edu/sites/locate.php?network=IACLIMATE

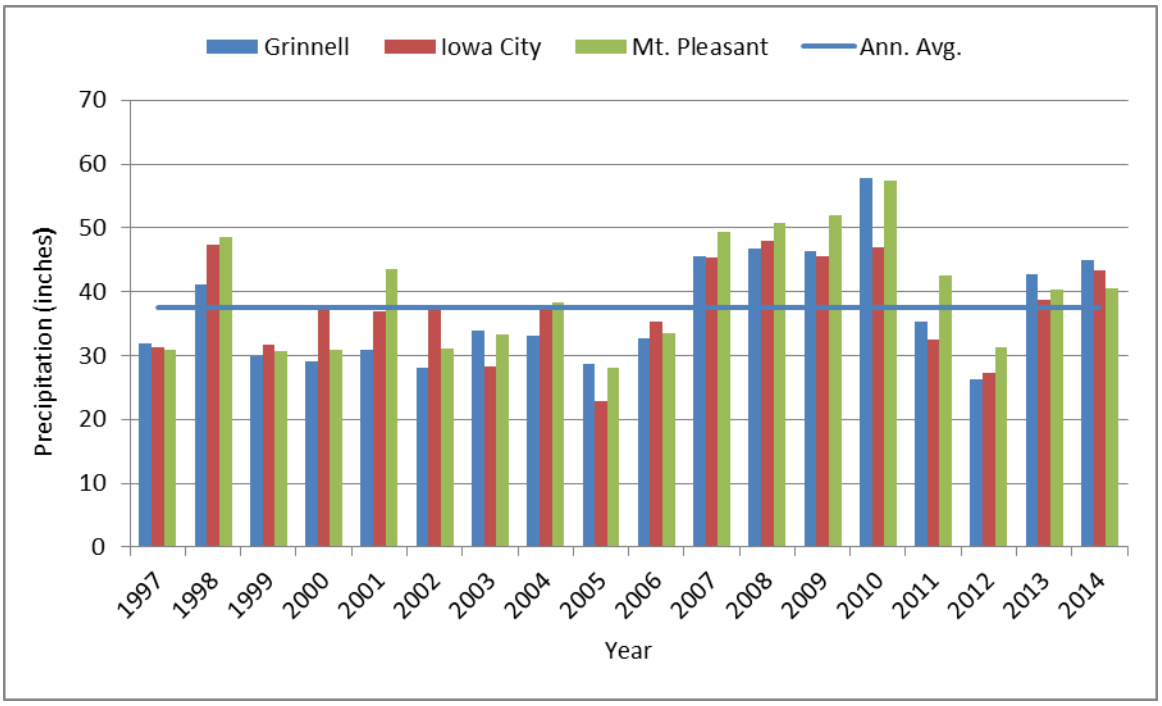

Figure 4-3. Annual Precipitation Grinnell, Iowa City, and Mt. Pleasant, Iowa.

Land Use

The land use coverage comes from the 2014 USDA Cropland Data Layer (USDA, National Agricultural Statistics Service). The two predominate land uses are row crops and grassland, with row crops making up 57% and grassland comprising 23.1% of the watershed (Table 4-4). Row crops consist of corn, and soybeans, with less than 0.1% being other crops. The nine land uses shown in Table 4-4 were aggregated from the fourteen land uses in the cropland data layer as shown in the description column. Figure 4-5 shows the distribution of the various land uses throughout the Lower Iowa watershed in a pie-chart

Table 4-4. Lower Iowa Watershed Land Uses.

Land Use	Description	Area (AC)	Percent of total
Water/Wetland	Water and Wetlands	13,677	1.3%
Forested	Bottomland, Coniferous, Deciduous	88,580	8.2%
Grassland	Ungrazed, Grazed, & CRP-	249,566	23.1%
Alfalfa/Hay	Perennial Hay Crop-	22,676	2.1%
Row crop	Corn, Soybeans, & other	614,662	57.0%
Roads	Roads Lightly Developed Urban	53,246	4.9%
Urban	Intensively Developed Urban	10,463	1.0%
Residential	Residential/Moderately Developed	25,603	2.4%
Barren	-	567	0.1%
Total		**1,079,040**	**100%**

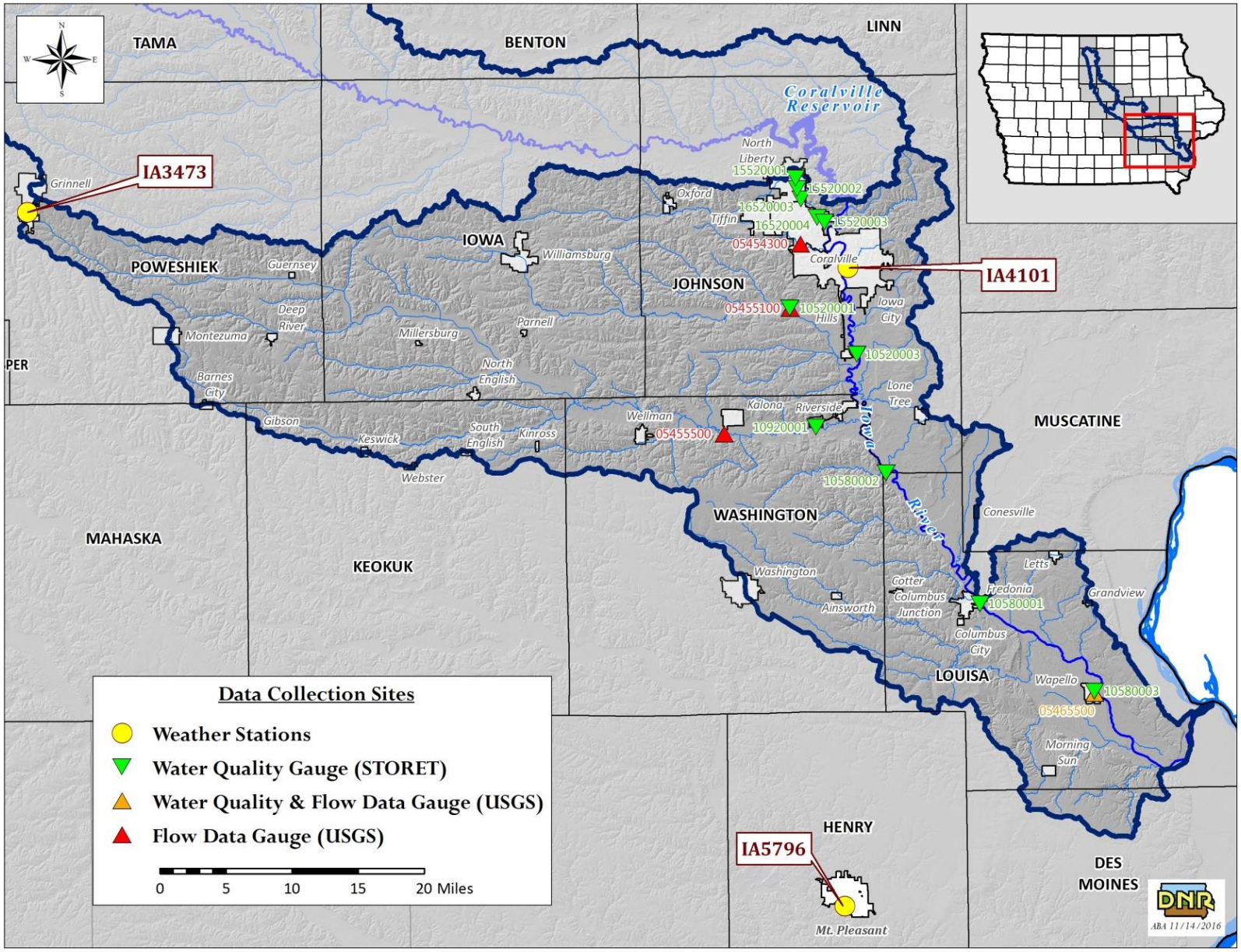

Figure 4-4. Lower Iowa Watershed Data Collection Points.

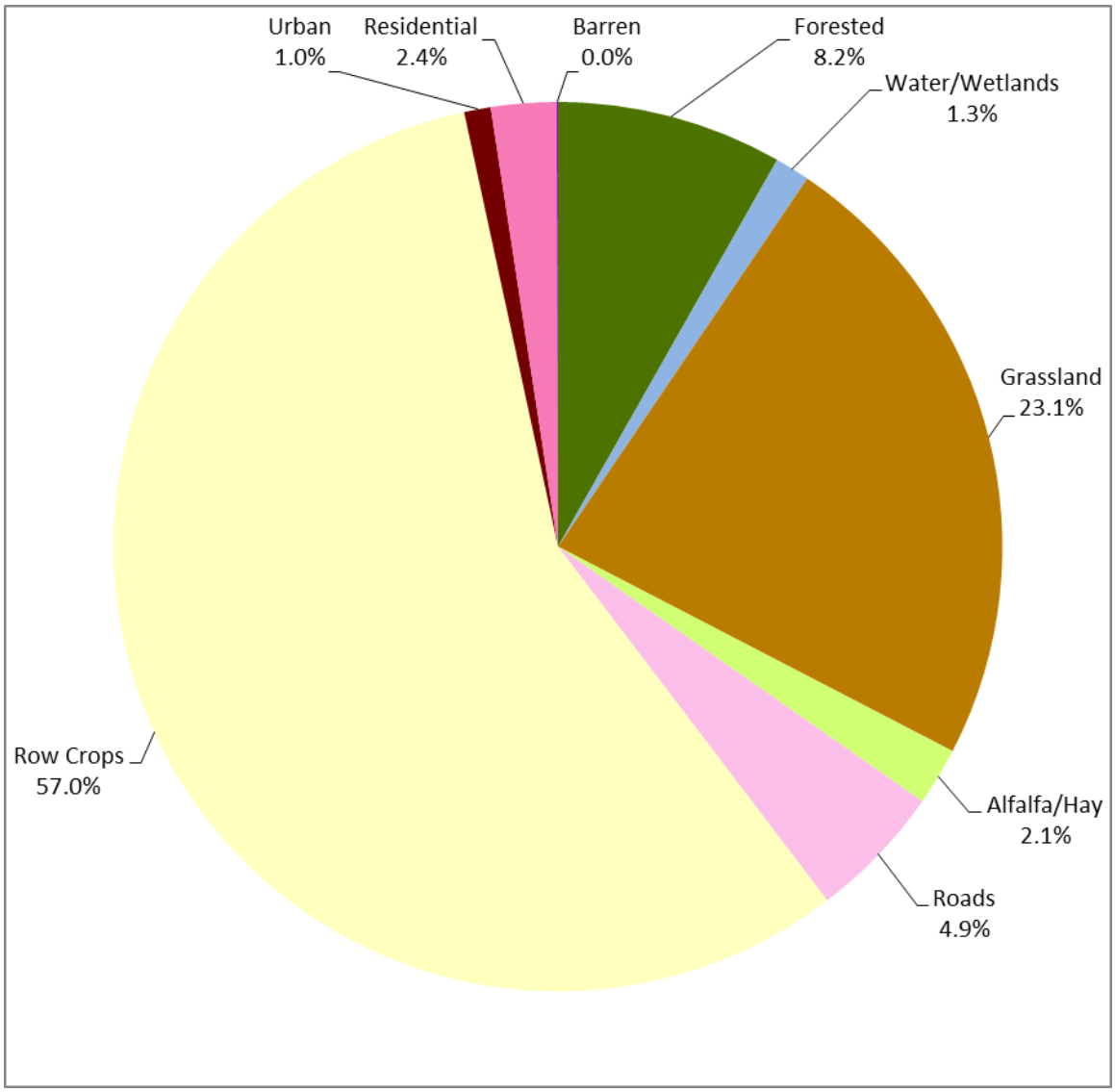

Figure 4-5. Land Use Composition of the Lower Iowa Watershed.

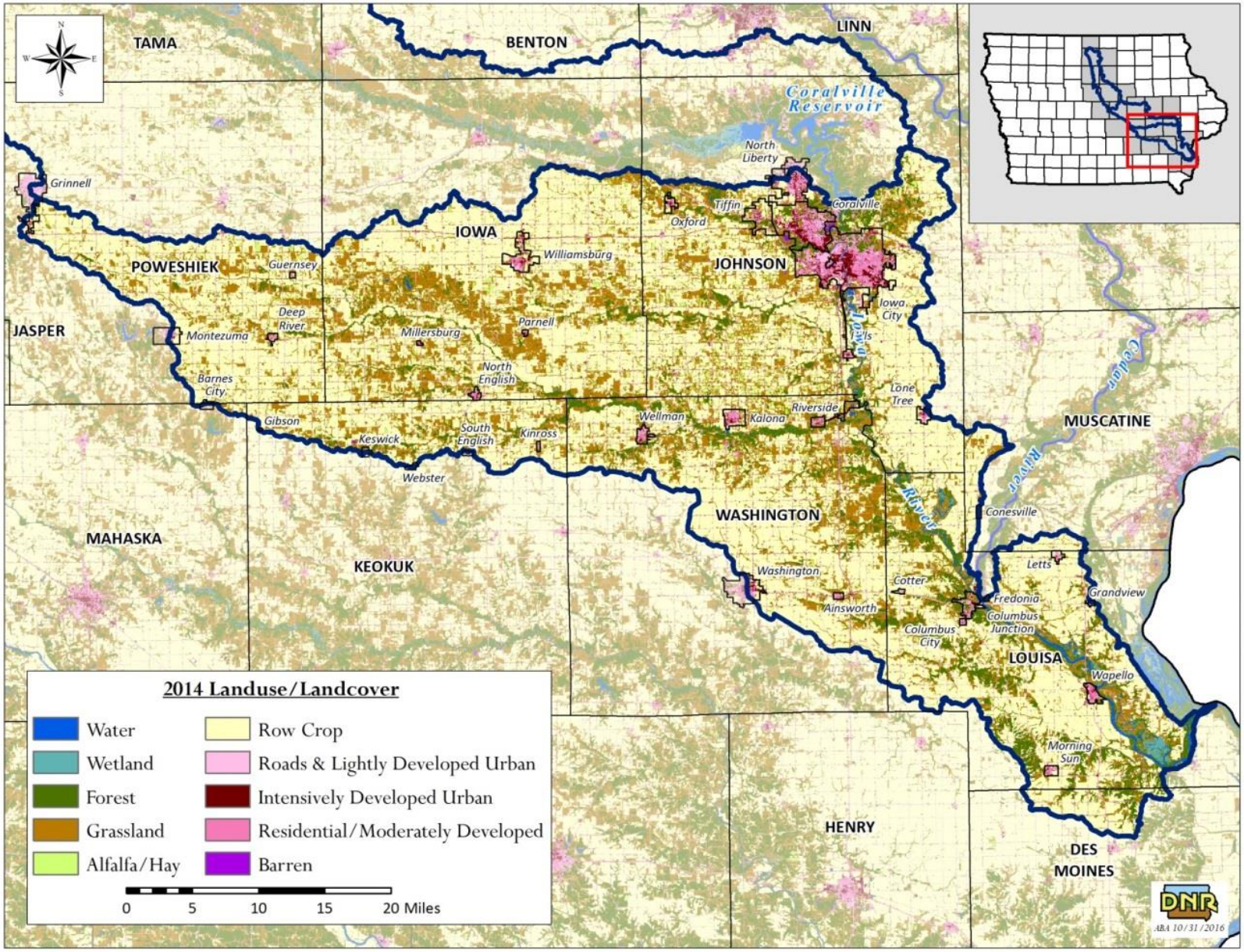

Figure 4-6. Land Use Map of the Lower Iowa Watershed.

Soils

From data obtained from the NRCS, there are 209 different soils types in this watershed. No soil type makes up a majority in the area. The top two soil types in the watershed are the Otley-silty clay loam and the Ladoga silt loam, which makes up 19.7% of the soil types in the watershed. Of the seven hydrologic soil types, hydraulic soil type B makes up the majority of the soils in the watershed at 64.5%. A summary of the hydraulic soil types is shown in Table 4-5.

4.2. Stream Segment Designations and Descriptions

Nine stream segments in the Lower Iowa watershed do not meet water quality standards (WQS) and are not fully supporting Class A1 (primary contact recreation) uses due to the presence of high levels of an indicator bacteria called *Escherichia coli* (*E. coli*). Figure 4-7 shows graphically the stream segments in the Lower Iowa watershed with a bacteria impairment addressed covered in this WQIP. Table 4-6 is a summary of the impaired stream segments, segment identifications, location description, segment length, and designated uses.

Cedar River Basin

The Cedar River discharges to the Iowa River approximately 30 miles upstream of the mouth of the Iowa River, in Louisa County between the communities of Columbus Junction and Fredonia, Iowa. Consequently, the Cedar River basin is part of the Lower Iowa watershed impacting the water quality of those segments below its confluence with the Iowa River.

A TMDL for indicator bacteria impairments for nine segments of Cedar River was prepared and approved by EPA in February 2010. However, one segment of the Cedar River (IA 02-CED-0010_0) had not been impaired due to indicator bacteria prior to that time but was added to the 303(d) list in 2010. Therefore, this segment was not included in the EPA TMDL.

This WQIP addresses the Iowa River basin only therefore, it is assumed that this single impaired segment meets water quality standards therefore, a TMDL for this segment will not be addressed in this WQIP but will be addressed in a future one.

Table 4-5. Hydrologic Soil Groups in the Lower Iowa Watershed.

Soil Group	Watershed Area (%)	Description
A	3.8	Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
B	64.5	Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
C	13.2	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
D	0.90	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification.
Unclassified	1.3	
Dual Hydrologic Soil Groups		
A/D	0.0	Groups A/D, B/D, and C/D are dual hydrologic soil group. Some soils are placed in group D due to the depth of the water table within 24 inches of the surface even though the soils exhibit favorable properties for water transmission. If these soils can be drained they are classified dual hydrologic soils. The first letter applies to the drained condition and the second to the undrained condition.
B/D	11.6	
C/D	4.7	

Source: USDA-NRCS, 2009, Part 630 Hydrology, National Engineering Handbook, Chapter 7

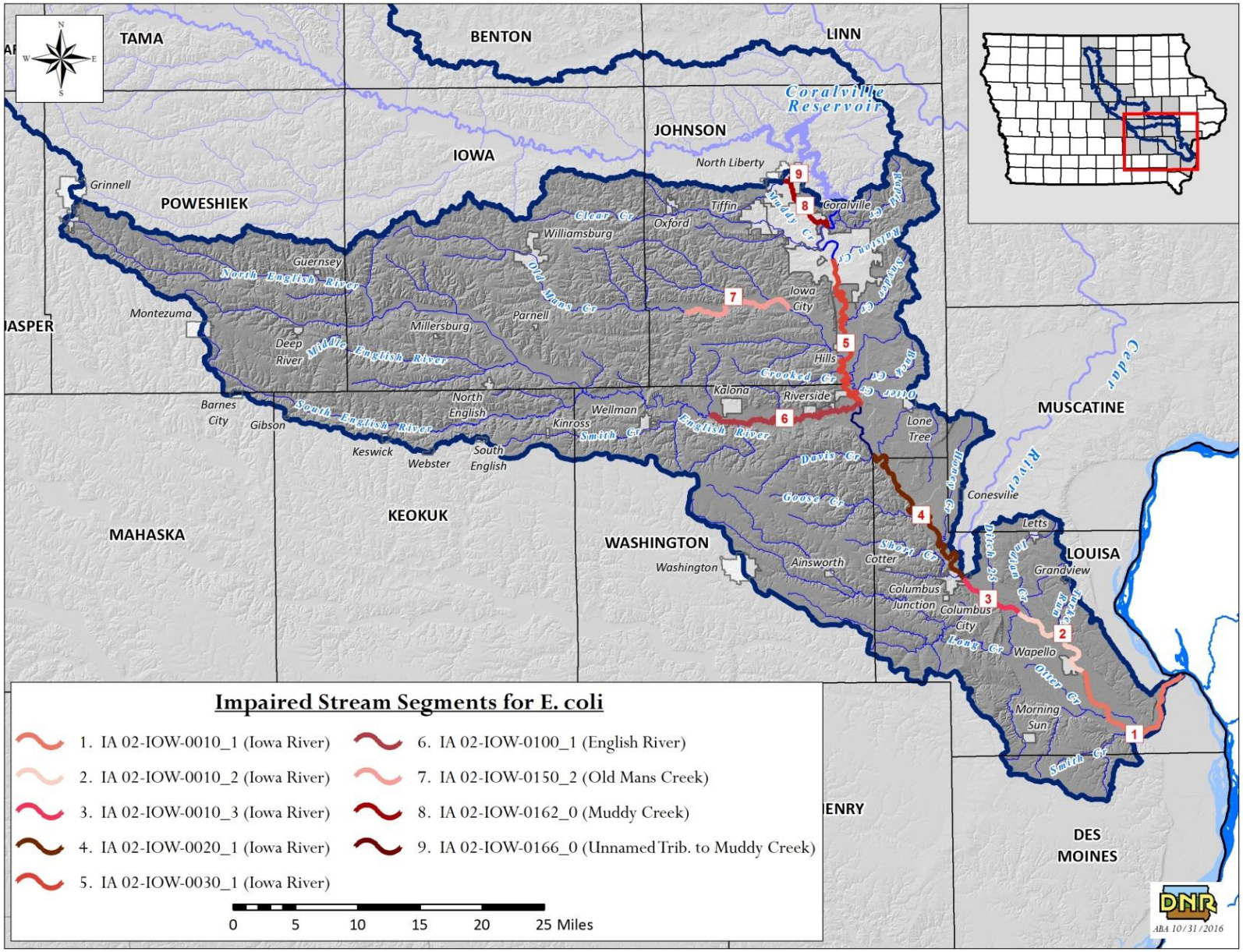

Figure 4-7. Lower Iowa Watershed Impaired Stream Segments for *E. coli*.

Table 4-6. Lower Iowa Watershed Impaired Stream Segments and Designated Uses.

Stream Name	Legacy ID[(1)]	Segment ID[(2)]	Location Description	Length (mi.)	Designated Uses
Iowa River	0010_1	621	mouth (Louisa Co.) to S. corporate limit of Wapello (S35, T74N, R3W, Louisa Co.)	14.8	A1 – primary contact B(WW-1) HH
Iowa River	0010_2	622	from south corporate limit of Wapello (S35, T74N, R3W, Louisa Co.) to Long Cr (S1, T74N, R4W, Louisa Co.)	8.5	A1 – primary contact B(WW-1) HH
Iowa River	0010_3	623	from confluence with Long Cr. (S1, T74N, R4W, Louisa Co.) to confluence with Cedar R in S20, T75, R4W, Louisa Co.	5.4	A1 – primary contact B(WW-1) HH
Iowa River	0020_1	624	confluence with Cedar R. to Johnson-Washington Co. line	17.7	A1 – primary contact B(WW-1) HH
Iowa River	0030_1	627	from confluence with English R. (Washington Co.) to Burlington Street Dam in Iowa City (Johnson Co.)	19.5	A1 – primary contact B(WW-1) HH
English River	0100_1	671	mouth (S12, T77N, R6W, Washington Co.) to confluence with Ramsey Cr. in S14, T77N, R8W, Washington Co.	18.9	A1 – primary contact B(WW-1) HH
Old Mans Creek	0150_2	686	from confluence with unnamed tributary (N line S1 T78N R7W Johnson Co.) to confluence with unnamed tributary in NE 1/4 S4 T78N R8W Johnson Co.	11.5	A1 – primary contact B(WW-2)
Muddy Creek	0162_0	2043	from mouth (S33 T80N R6W Johnson Co.) to headwaters in SW 1/4 S12 T80N R7W Johnson Co.	6.5	A1 – primary contact B(WW-1)
Unnamed Trib. to Muddy Cr.	0166_0	6588	from mouth to headwaters (T80N R7W Sec12 Johnson Co.)	0.54	A1 – primary contact B(WW-1)
Iowa River[(3)]	0030_2	628	from Burlington St. dam in Iowa City (Johnson Co.) to Coralville Reservoir dam (Johnson Co.)	8.8	A1 – primary contact B(WW-1) C and HH
Cedar River[(4)]	IA 02-CED-0010_0	IA 02-CED-449	Mouth (S20, T75N, R4W, Louisa Co.) to confluence with Sugar Cr. In S17, T78N, R2W, Muscatine Co.	28.6	A1 – primary contact B(WW-1) C and HH

(1) Prefix for Legacy ID is IA 02-IOW (Legacy ID: IA 02-IOW-0010_1), except where noted.
(2) Prefix for Segment ID is IA 02-IOW (Segment ID: IA 02-IOW-621), except where noted.
(3) A TMDL for this segment was completed in 2007. (Iowa DNR, 2007).
(4) A TMDL for indicator bacteria impairments for the Cedar River was prepared and approved by EPA in February 2010. This segment was not included in the approved EPA TMDL. It is assumed that this segment meets water quality standards consequently, a TMDL for this segment will not be addressed in this WQIP but will be addressed in a separate one.

Data Sources and Monitoring Sites

Table 4-2 (in Section 4.1) lists the USGS Gaging Stations used and Table 4-7 lists water quality monitoring locations. STORET sites refer to data collected by Iowa DNR personnel for the STOrage and RETrieval sponsored by the US EPA.

Table 4-7. WQ Data Monitoring Sites of the Lower Iowa Watershed.

Site Name	ID	Longitude	Latitude
English River at Riverside	STORET 10920001	91° 34’ 49”	41° 28’ 32”
Iowa River at Columbus Junction	STORET 10580001	91° 20’ 44”	41° 16’ 44”
Iowa River Downstream of Iowa City	STORET 10520003	91° 31’ 08”	41° 33’ 17”
Iowa River near Lone Tree	STORET 10580002	91° 28’ 45”	41° 25’ 26”
Iowa River near Wapello	STORET 10580003	91° 10’ 56”	41° 10’ 49”
Muddy Creek - MCR1	STORET 16520003	91° 35’ 47”	41° 43’ 33”
Muddy Creek - MCR2	STORET 16520004	91° 34’ 23”	41° 42’ 19”
Muddy Creek at 1st Ave (MC3)	STORET 15520003	91° 33’ 46”	41° 42’ 01”
Muddy Creek at Golf View Dr (MCB)	STORET 15520002	91° 36’ 07”	41° 44’ 15”
Unnamed Creek at West Cherry St (MCA)	STORET 15520001	91° 36’ 15”	41° 44’ 57”
Old Mans Creek near Iowa City	STORET 10520001	91° 36’ 56”	41° 36’ 23”
Iowa River at Wapello	USGS 05465500	91° 10’ 55”	41° 10’ 41”

Interpreting Data

Analysis of the data shows consistently high *E. coli* levels that exceed the criterion set for in Iowa’s WQS for primary contact recreation. Significant reductions in *E. coli* loading will be required to comply with the standards and fully support the designated recreational use in the impaired segments.

Identification of pollutant sources

There are a variety of *E. coli* sources in the Lower Iowa watershed. These sources can be divided into two categories, point and non-point sources. Point sources include municipal separate storm sewer systems (MS4s), municipal and industrial wastewater treatment facilities (WWTFs), sanitary sewer overflows (SSOs), onsite wastewater systems with permitted discharges, and animal feeding operations (AFOs) regulated as concentrated animal feeding operations (CAFOs). Nonpoint sources include wildlife, manure application to row crops, grazing livestock and small feeding operations, direct deposition by livestock in streams, and non-permitted (i.e., non-discharging) onsite wastewater systems.

Load duration curves (LDCs) were used in the development of *E. coli* TMDLs for impaired stream segments in the Iowa River Basin (Section 4.3). The use of LDCs is helpful for understanding the importance that hydrology plays on pollutant loading. Information illustrated in LDCs provides a basic understanding of the importance of potential pollutant sources, although the approach does not offer explicit calculation of source-specific pollutant loads. However, when analyzed in conjunction with a detailed inventory of sources, LDCs can provide a quantitative means of comparing the relative importance of specific pollutant sources.

Point Sources

There are a total of 73 active or pending NPDES permits in this watershed. This includes 26 municipal system permits, 24 semi-public permits, ten (10) industrial permits, five (5) stormwater permits, four (4) operation permits, and four (4) municipal water treatment permits. Operation permits do not discharge to surface water and industrial facilities and municipal water treatment plants are not expected to have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources with the exception of those facilities that have an *E. coli* limit in their NPDES permit. An inventory of the facilities not considered in this WQIP is located in Appendix C.3. Other point sources in the watershed include private sewage disposal systems covered under General Permit #4. Systems covered by this general permit must meet specified requirements, which include a population equivalent of less than 15 persons. Figure 4-8 shows the locations of NPDES permitted wastewater facilities, concentrated animal feeding operations, unsewered

communities, and private facilities that discharge under an NPDES General Permit #4. A full inventory of dischargers and their respective WLAs is provided in Appendix C.

Nonpoint Sources

The nonpoint sources of pathogen indicators include contributors that do not have localized points of release into a stream. In the watershed these sources are:

- Grazing animals
- Direct deposition of manure in streams
- Land application and subsequent runoff of manure
- Developed / urban area runoff
- Wildlife
- Faulty septic tank systems

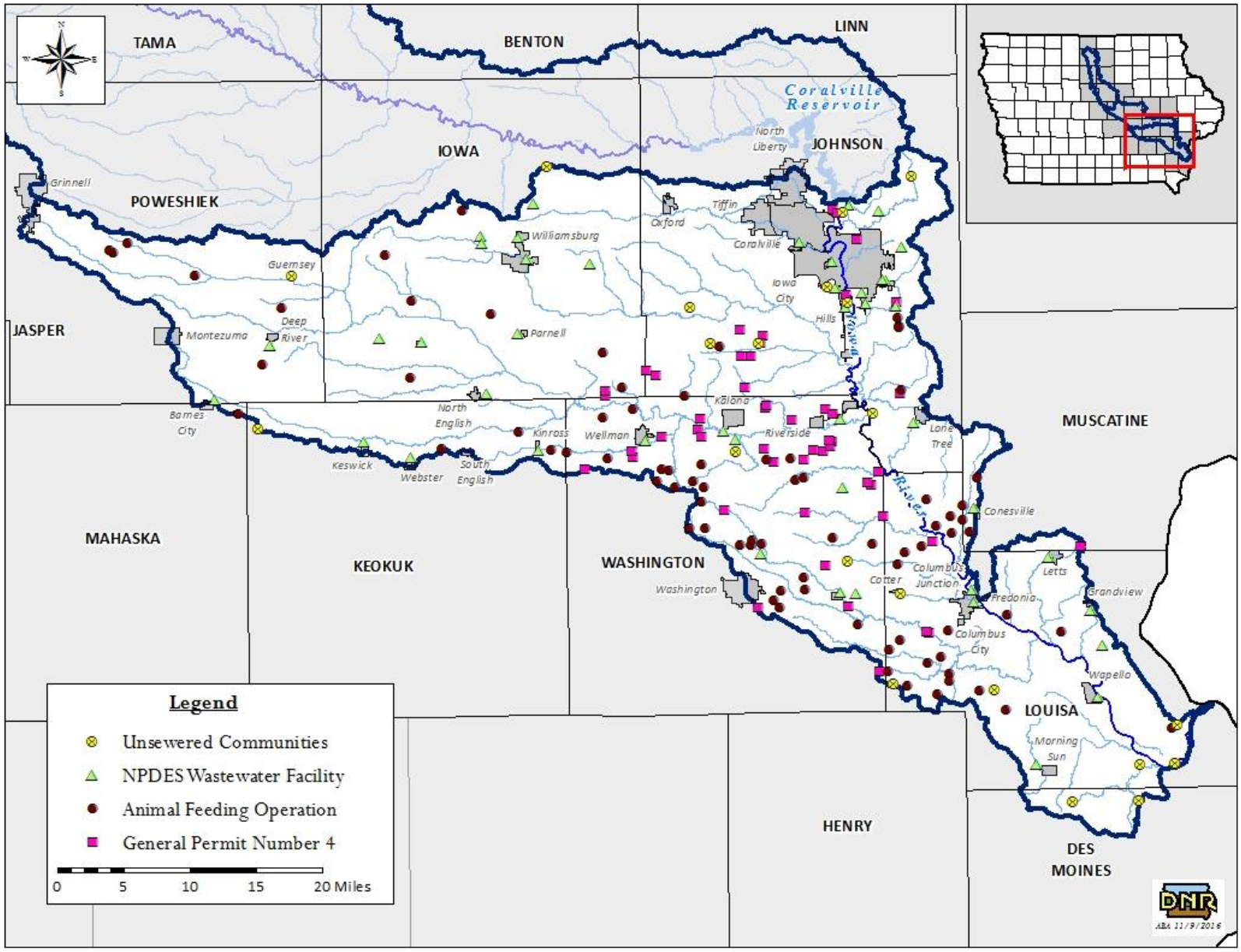

Figure 4-8. Point Source Location Map for the Lower Iowa Watershed.

4.3. Pollution Source Assessment

Departure from Load Capacity

The LDCs, observed loads, and observed GM loads for each flow condition are plotted in Figure 4-11 through Figure 4-17. This methodology enables calculation of a TMDL target at the midpoint of each flow condition for each impaired segment, as provided in Table 4-9 through Table 4-26.

Allowance for Increases in Pollutant Loads

There are a total of 21 unsewered communities in the Lower Iowa watershed. A reserve wasteload allocation (WLA) was calculated for each community and applied to the aggregate WLA for the associated segment. Table C-11, in Appendix C.2 lists all the unsewered communities in the Lower Iowa watershed. Any new or expanded dischargers will be expected to meet the same end-of-pipe criteria (GM of 126 orgs/100 mL) as dischargers for which WLAs were calculated and included in this TMDL

4.4. Pollutant Allocations

Wasteload Allocations (WLA)

A WLA was calculated for each wastewater treatment facility (WWTF), MS4 community, and an aggregate reserve WLA for unsewered communities in the watershed. Table 4-8 shows the aggregate WLA summary by facility type for the Lower Iowa watershed. Individual WLAs for each discharger are included in Appendix C.

Table 4-8. WLA Summary by Facility Type for the Lower Iowa Watershed.

Facility Type	Number of Facilities	Flow (MGD)(1)	GM Conc (orgs/100 mL)	GM Load (orgs/day)
WWTF	43	51.20	126	2.44E+11
Unsewered	21	0.10	126	4.77E+08
CAFO	79	--	0	0.00E+00
GP #4	51	--	126	--
Stormwater	1	--	126	2.30E+09
Totals	**195**	**51.30**	**126**	**2.47E+11**

(1) Flows used to calculate the wasteload allocation. See Appendix C.

Load Allocation (LA)

Nonpoint sources result from livestock, pets, wildlife, and humans that live, work, and play in and around the stream. Specific examples of potential nonpoint sources of bacteria include animals directly depositing into streams, manure applied to row crops, manure runoff from grazed land, non-permitted onsite wastewater systems, and natural sources such as wildlife.

Margin of Safety

An explicit margin of safety (MOS) of 10 percent is applied to the calculation of loading capacities in this TMDL. Additionally, targeting the GM in each flow condition, rather than only the overall GM, provides an implicit MOS by requiring WQS compliance across flow conditions.

Load Duration Curve

Figure 4-9 through Figure 4-17 show load durations for the impaired stream segments in this watershed. Table 4-9 through Table 4-25 are the existing load estimates and the TMDL summary for each impaired segment.

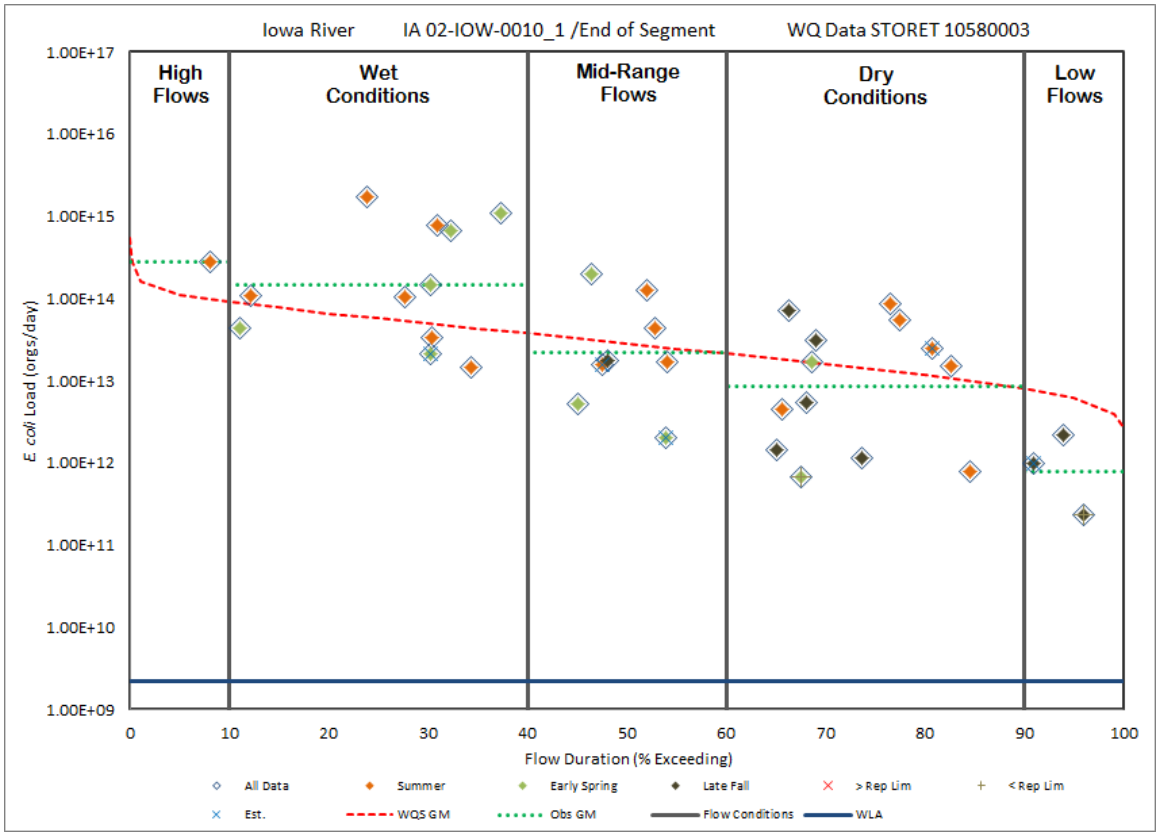

Figure 4-9. Load Duration Curve, Iowa River, Segment IA 02-IOW-0010_1.

Table 4-9. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0010_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.82E+14	1.49E+14	2.19E+13	8.66E+12	7.97E+11
GM Departure (% Reduction)	1.72E+14 (60.9)	9.16E+13 (61.5)	-6.47E+12 (0)	-5.17E+12 (0)	-5.50E+12 (0)
Midpoint Flow (cfs)	35,777.2	18,596.1	9,202.0	4,484.8	2,041.5

Table 4-10. TMDL Summary for Iowa River, Segment IA 02-IOW-0010_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.10E+14	5.73E+13	2.84E+13	1.38E+13	6.29E+12
WLA (orgs/day)	2.21E+09	2.21E+09	2.21E+09	2.21E+09	2.21E+09
LA (orgs/day)	9.93E+13	5.16E+13	2.55E+13	1.24E+13	5.66E+12
MOS (orgs/day)	1.10E+13	5.73E+12	2.84E+12	1.38E+12	6.29E+11

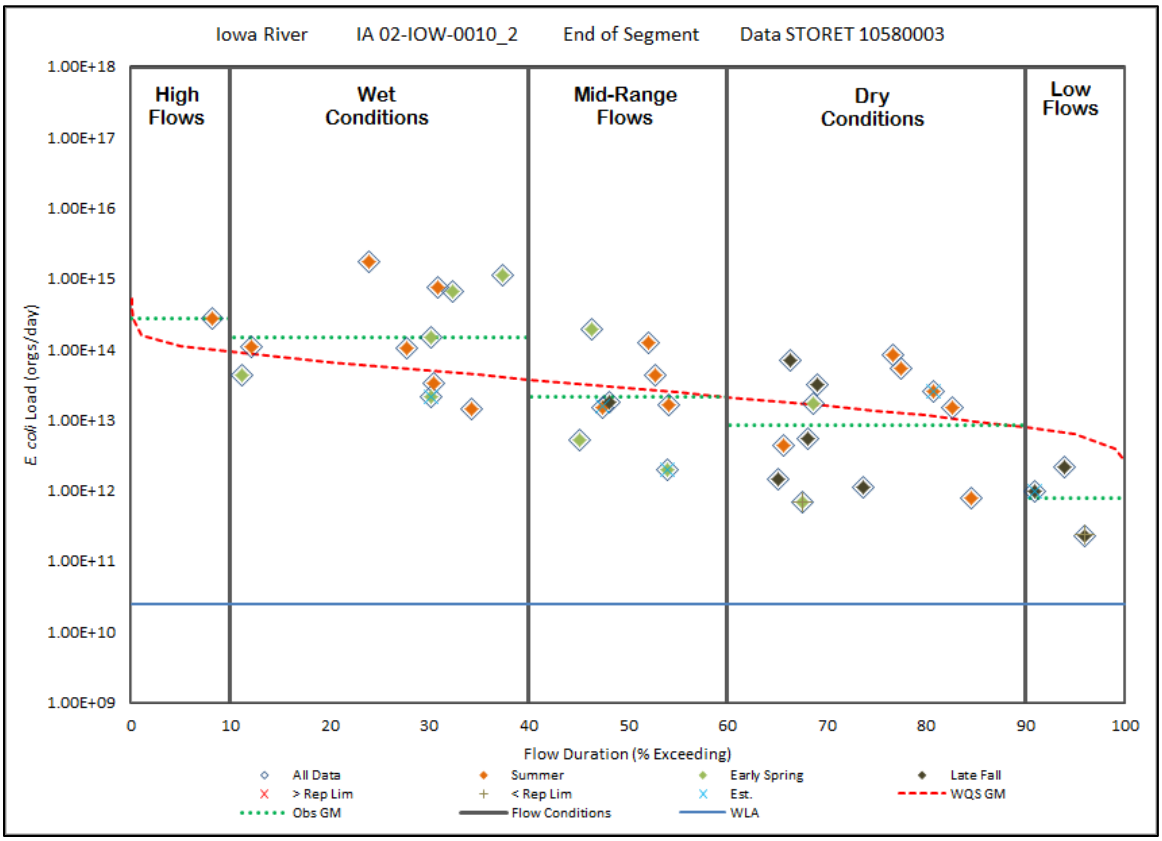

Figure 4-10. Load Duration Curve, Iowa River, Segment IA 02-IOW-0010_2.

Table 4-11. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0010_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.79E+14	1.47E+14	2.17E+13	8.56E+12	7.89E+11
GM Departure	1.70E+14	9.06E+13	-6.40E+12	-5.12E+12	-5.44E+12
(% Reduction)	(60.9)	(61.5)	(0)	(0)	(0)
Midpoint Flow (cfs)	35,400.0	18,400.0	9,105.0	4,437.5	2,020.0

Table 4-12. TMDL Summary for Iowa River, Segment IA 02-IOW-0010_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.09E+14	5.67E+13	2.81E+13	1.37E+13	6.23E+12
WLA (orgs/day)	2.52E+10	2.52E+10	2.52E+10	2.52E+10	2.52E+10
LA (orgs/day)	9.82E+13	5.10E+13	2.52E+13	1.23E+13	5.58E+12
MOS (orgs/day)	1.09E+13	5.67E+12	2.81E+12	1.37E+12	6.23E+11

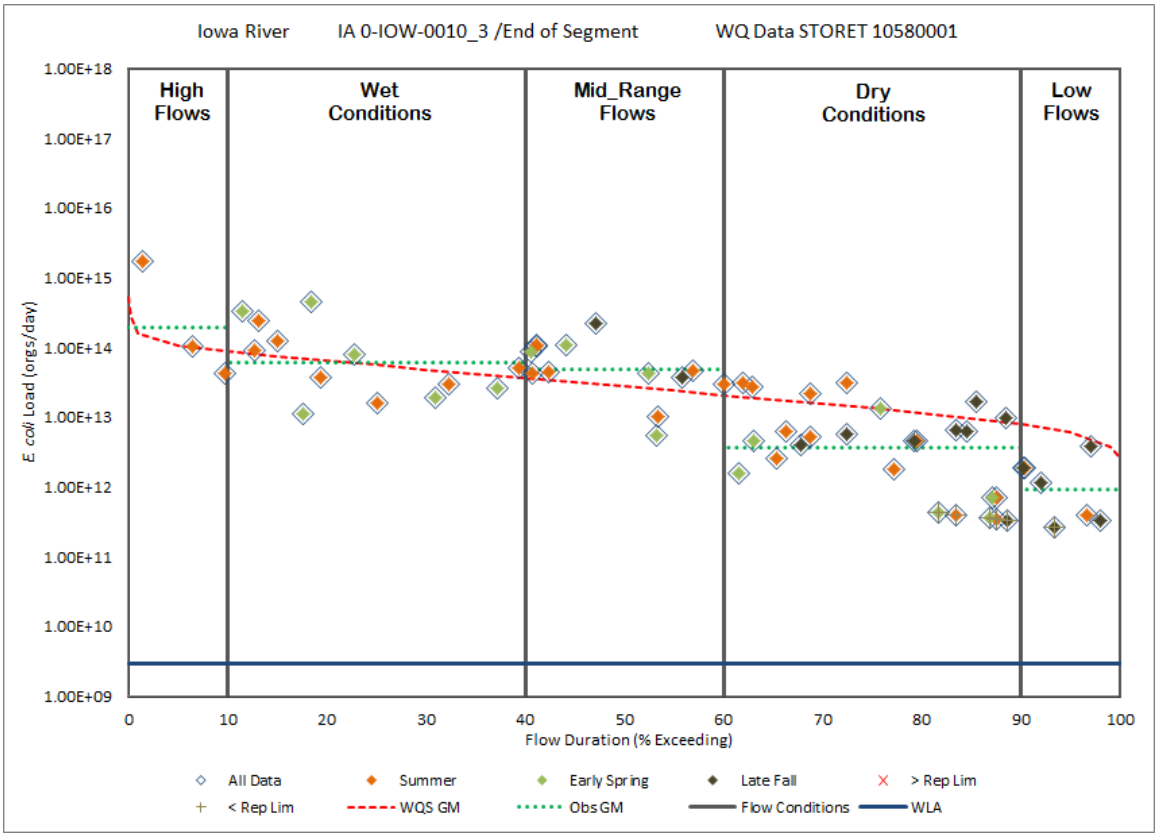

Figure 4-11. Load Duration Curve, Iowa River, Segment IA 02-IOW-0010_3.

Table 4-13. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0010_3.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.97E+14	6.14E+13	4.89E+13	3.75E+12	9.13E+11
GM Departure (% Reduction)	8.95E+13 (45.3)	5.27E+12 (8.6)	2.11E+13 (43.2)	-9.79E+12 (0)	-5.25E+12 (0)
Midpoint Flow (cfs)	35,022.8	18,203.9	9,008.0	4,390.2	1,998.5

Table 4-14. TMDL Summary for Iowa River, Segment IA 02-IOW-0010_3.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.08E+14	5.61E+13	2.78E+13	1.35E+13	6.16E+12
WLA (orgs/day)	2.96E+09	2.96E+09	2.96E+09	2.96E+09	2.96E+09
LA (orgs/day)	9.72E+13	5.05E+13	2.50E+13	1.22E+13	5.54E+12
MOS (orgs/day)	1.08E+13	5.61E+12	2.78E+12	1.35E+12	6.16E+11

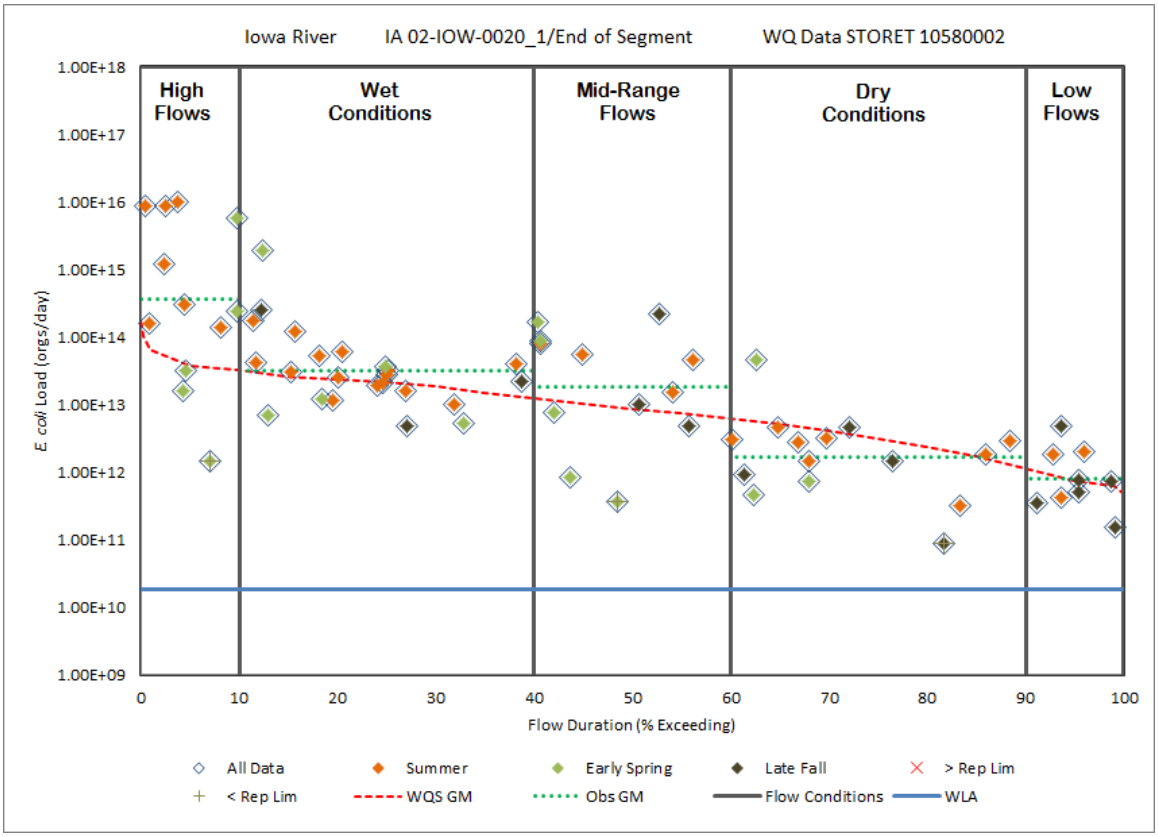

Figure 4-12. Load Duration Curve, Iowa River, Segment IA 02-IOW-0020_1.

Table 4-15. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0020_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	3.67E+14	3.22E+13	1.80E+13	1.67E+12	7.85E+11
GM Departure (% Reduction)	3.29E+14 (89.6)	1.09E+13 (33.7)	9.38E+12 (52.1)	-1.45E+12 (0)	4.34E+10 (5.5)
Midpoint Flow (cfs)	12,329.0	6,936.0	2,792.0	1,014.1	240.5

Table 4-16. TMDL Summary for Iowa River, Segment IA 02-IOW-0020_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.80E+13	2.14E+13	8.61E+12	3.13E+12	7.41E+11
WLA (orgs/day)	1.87E+10	1.87E+10	1.87E+10	1.87E+10	1.87E+10
LA (orgs/day)	3.42E+13	1.92E+13	7.73E+12	2.79E+12	6.49E+11
MOS (orgs/day)	3.80E+12	2.14E+12	8.61E+11	3.13E+11	7.41E+10

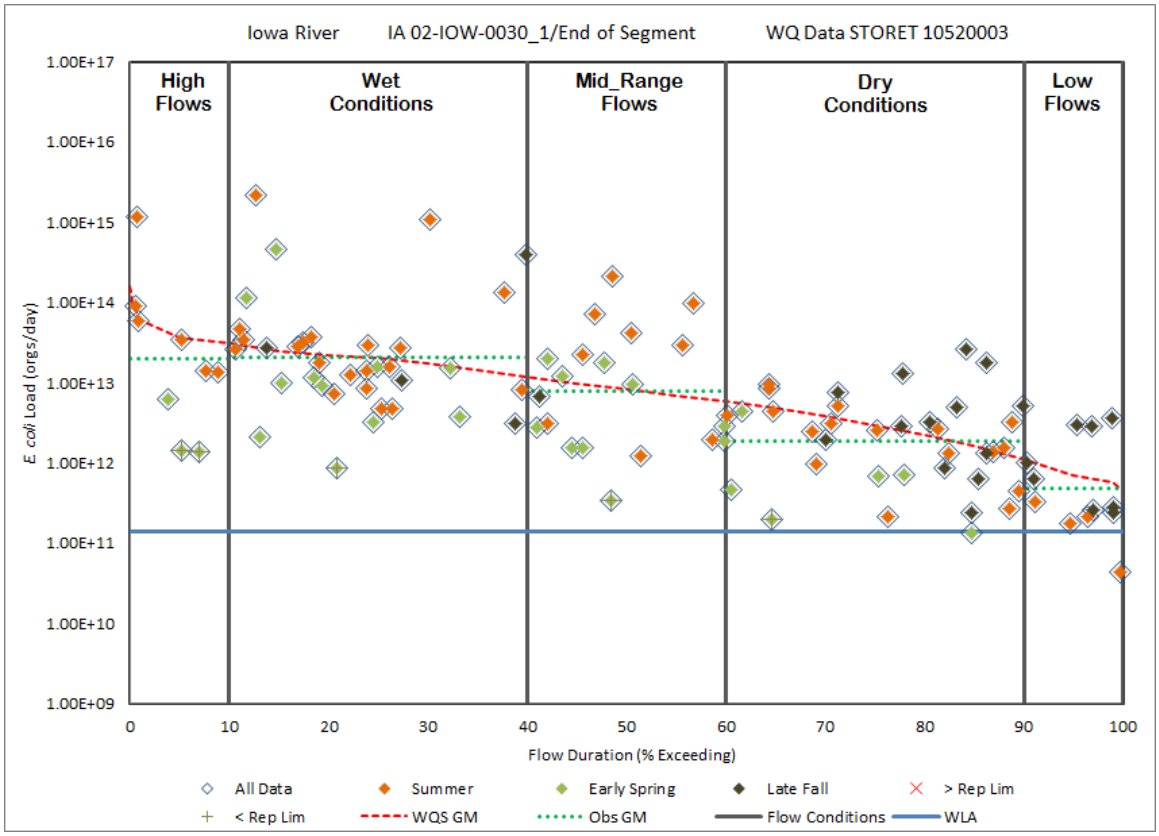

Figure 4-13. Load Duration Curve, Iowa River, Segment IA 02-IOW-0030_1.

Table 4-17. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0030_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.01E+13	2.12E+13	8.00E+12	1.89E+12	4.92E+11
GM Departure % (Reduction)	-1.64E+13 (0)	6.78E+11 (3.2)	-2.55E+11 (0)	-1.11E+12 (0)	-2.19E+11 (0)
Midpoint Flow (cfs)	11,825.4	6,652.7	2,677.9	972.7	230.7

Table 4-18. TMDL Summary for Iowa River, Segment IA 02-IOW-0030_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.65E+13	2.05E+13	8.26E+12	3.00E+12	7.11E+11
WLA (orgs/day)	1.40E+11	1.40E+11	1.40E+11	1.40E+11	1.40E+11
LA (orgs/day)	3.27E+13	1.83E+13	7.29E+12	2.56E+12	5.00E+11
MOS (orgs/day)	3.65E+12	2.05E+12	8.26E+11	3.00E+11	7.11E+10

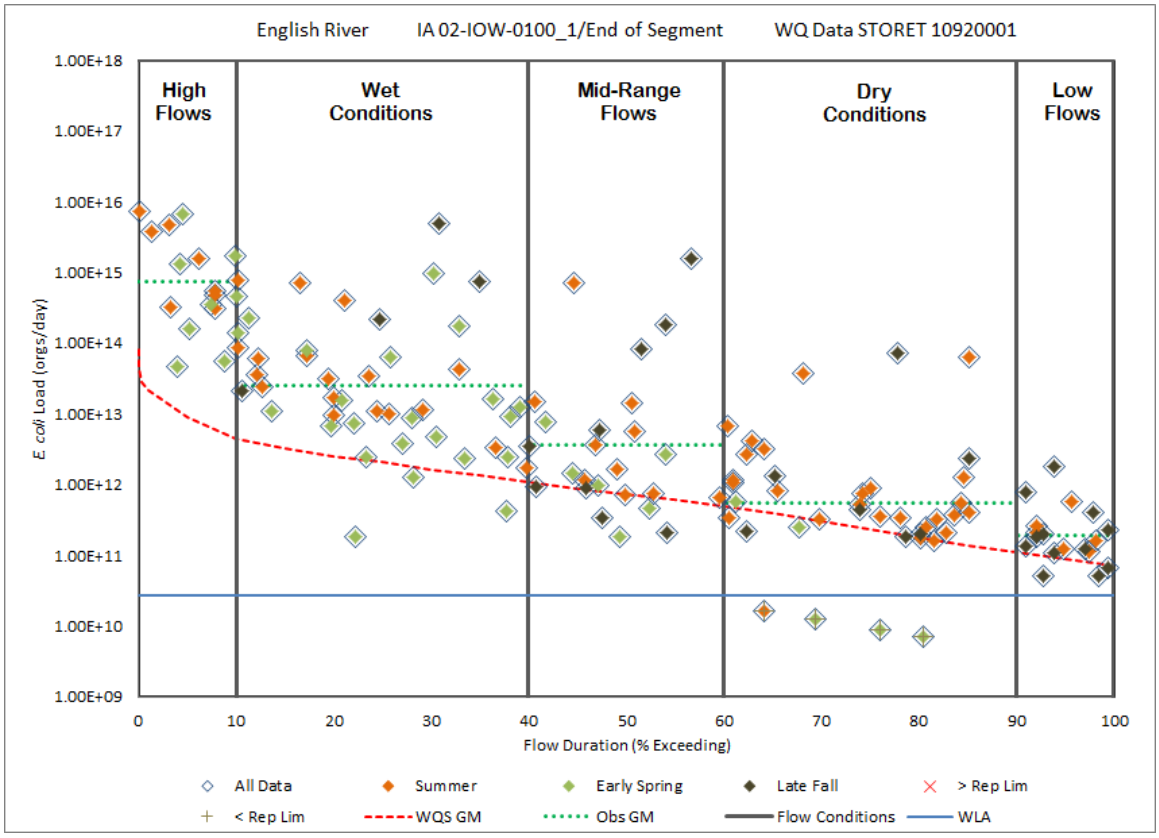

Figure 4-14. Load Duration Curve, English River, Segment IA 02-IOW-0100_1.

Table 4-19. Existing Load Estimates for English River, Segment IA 02-IOW-0100_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	7.46E+14	2.58E+13	3.71E+12	5.59E+11	1.92E+11
GM Departure (% Reduction)	7.37E+14 (98.8)	2.37E+13 (92.0)	2.97E+12 (80.0)	3.24E+11 (58.0)	1.02E+11 (52.8)
Midpoint Flow (cfs)[1]	2,875.5	672.9	241.0	76.2	29.5

(1) See Appendix F for flow estimates.

Table 4-20. TMDL Summary for English River, Segment IA 02-IOW-0100_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	8.86E+12	2.07E+12	7.43E+11	2.35E+11	9.08E+10
WLA (orgs/day)	5.30E+10	5.30E+10	5.30E+10	5.30E+10	5.30E+10
LA (orgs/day)	7.92E+12	1.81E+12	6.16E+11	1.58E+11	2.87E+10
MOS (orgs/day)	8.86E+11	2.07E+11	7.43E+10	2.35E+10	9.08E+09

Figure 4-15. Load Duration Curve, Old Mans Creek, Segment IA 02-IOW-0150_2.

Table 4-21. Existing Load Estimates for Old Mans Creek, Segment IA 02-IOW-0150_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	3.35E+14	5.57E+12	1.10E+12	2.28E+11	2.19E+10
GM Departure (% Reduction)	3.33E+14 (99.3)	4.96E+12 (89.0)	8.36E+11 (76.2)	1.44E+11 (63.2)	9.14E+09 (41.7)
Midpoint Flow (cfs)	705.9	199.0	84.8	27.3	4.1

Table 4-22. TMDL Summary for Old Mans Creek, Segment IA 02-IOW-0150_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.18E+12	6.13E+11	2.62E+11	8.41E+10	1.28E+10
WLA (orgs/day)	4.58E+09	4.58E+09	4.58E+09	4.58E+09	4.58E+09
LA (orgs/day)	1.95E+12	5.47E+11	2.31E+11	7.11E+10	6.90E+09
MOS (orgs/day)	2.18E+11	6.13E+10	2.62E+10	8.41E+09	1.28E+09

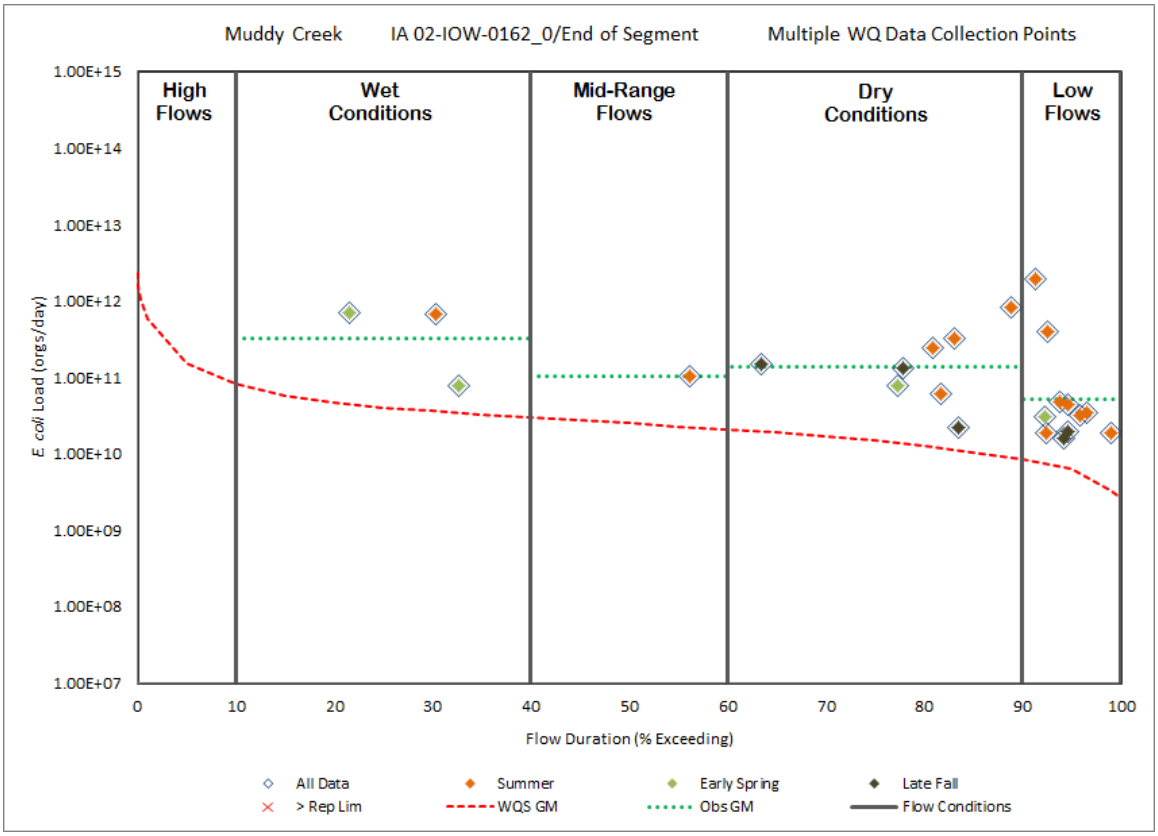

Figure 4-16. Load Duration Curve, Muddy Creek, Segment IA 02-IOW-0162_0.

Table 4-23. Existing Load Estimates for Muddy Creek, Segment IA 02-IOW-0162_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	N/A	3.29E+11	1.04E+11	1.39E+11	5.12E+10
GM Departure (% Reduction)	N/A (N/A)	2.89E+11 (87.7)	7.89E+10 (75.7)	1.24E+11 (89.2)	4.49E+10 (87.6)
Midpoint Flow (cfs)	49.5	13.1	8.2	4.9	2.1

Table 4-24. TMDL Summary for Muddy Creek, Segment IA 02-IOW-0162_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.52E+11	4.05E+10	2.54E+10	1.50E+10	6.32E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.37E+11	3.65E+10	2.28E+10	1.35E+10	5.69E+09
MOS (orgs/day)	1.52E+10	4.05E+09	2.54E+09	1.50E+09	6.32E+08

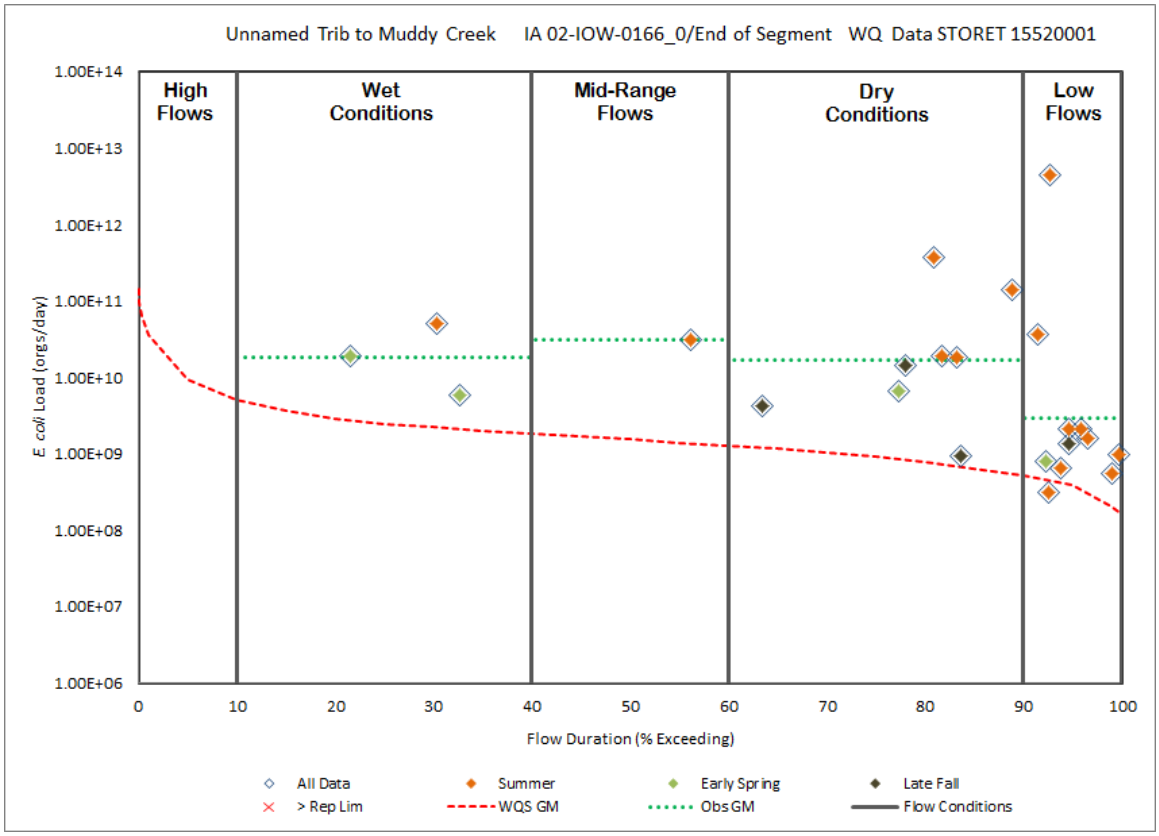

Figure 4-17. Load Duration Curve, Unnamed Tributary to Muddy Creek, Segment IA 02-IOW-0166_0.

Table 4-25. Existing Load Estimates for Unnamed Tributary to Muddy Creek, Segment IA 02-IOW-0166_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	N/A	1.81E+10	3.07E+10	1.71E+10	2.95E+09
GM Departure (% Reduction)	N/A (N/A)	1.56E+10 (86.3)	2.91E+10 (94.9)	1.61E+10 (94.6)	2.56E+09 (86.8)
Midpoint Flow (cfs)	3.1	0.8	0.5	0.3	0.1

Table 4-26. TMDL Summary for Unnamed Tributary to Muddy Creek, Segment IA 02-IOW-0166_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	9.42E+09	2.49E+09	1.56E+09	9.23E+08	3.88E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	8.48E+09	2.24E+09	1.40E+09	8.30E+08	3.49E+08
MOS (orgs/day)	9.42E+08	2.49E+08	1.56E+08	9.23E+07	3.88E+07

4.5. TMDL Summary

This TMDL is based on meeting the water quality criteria for primary contact and children's recreation in the Lower Iowa River watershed, HUC-8. Although the WQS are based on *E. coli* concentration, the TMDL is also expressed as a load, in light of the November 2006 EPA memorandum. The following equation represents the total maximum daily load (TMDL) and its components:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

Where: TMDL = total maximum daily load
LC = loading capacity
ΣWLA = sum of wasteload allocations (point sources)
ΣLA = sum of load allocations (nonpoint sources)
MOS = margin of safety (to account for uncertainty)

Once the loading capacity, waste load allocations, load allocations, and margin of safety are determined for the Lower Iowa River watershed, the general equation above can be expressed for each segment and flow condition for *E. coli* as the allowable daily load.

Table 4-27. TMDL Summary by Segment for the Lower Iowa HUC-8 Watershed.

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Iowa River, IA 02-IOW-0010_1				
High Flow	1.10E+14	2.21E+09	9.93E+13	1.10E+13
Moist	5.73E+13	2.21E+09	5.16E+13	5.73E+12
Mid-Range	2.84E+13	2.21E+09	2.55E+13	2.84E+12
Dry	1.38E+13	2.21E+09	1.24E+13	1.38E+12
Low Flow	6.29E+12	2.21E+09	5.66E+12	6.29E+11
Iowa River, IA 02-IOW-0010_2				
High Flow	1.09E+14	2.52E+10	9.82E+13	1.09E+13
Moist	5.67E+13	2.52E+10	5.10E+13	5.67E+12
Mid-Range	2.81E+13	2.52E+10	2.52E+13	2.81E+12
Dry	1.37E+13	2.52E+10	1.23E+13	1.37E+12
Low Flow	6.23E+12	2.52E+10	5.58E+12	6.23E+11
Iowa River, IA 02-IOW-0010_3				
High Flow	1.08E+14	2.96E+09	9.72E+13	1.08E+13
Moist	5.61E+13	2.96E+09	5.05E+13	5.61E+12
Mid-Range	2.78E+13	2.96E+09	2.50E+13	2.78E+12
Dry	1.35E+13	2.96E+09	1.22E+13	1.35E+12
Low Flow	6.16E+12	2.96E+09	5.54E+12	6.16E+11
Iowa River, IA 02-IOW-0020_1				
High Flow	3.80E+13	1.87E+10	3.42E+13	3.80E+12
Moist	2.14E+13	1.87E+10	1.92E+13	2.14E+12
Mid-Range	8.61E+12	1.87E+10	7.73E+12	8.61E+11
Dry	3.13E+12	1.87E+10	2.79E+12	3.13E+11
Low Flow	7.41E+11	1.87E+10	6.49E+11	7.41E+10

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Iowa River, IA 02-IOW-0030_1				
High Flow	3.65E+13	1.40E+11	3.27E+13	3.65E+12
Moist	2.05E+13	1.40E+11	1.83E+13	2.05E+12
Mid-Range	8.26E+12	1.40E+11	7.29E+12	8.26E+11
Dry	3.00E+12	1.40E+11	2.56E+12	3.00E+11
Low Flow	7.11E+11	1.40E+11	5.00E+11	7.11E+10
English River, IA 02-IOW-0100_1				
High Flow	8.86E+12	5.30E+10	7.92E+12	8.86E+11
Moist	2.07E+12	5.30E+10	1.81E+12	2.07E+11
Mid-Range	7.43E+11	5.30E+10	6.16E+11	7.43E+10
Dry	2.35E+11	5.30E+10	1.58E+11	2.35E+10
Low Flow	9.08E+10	5.30E+10	2.87E+10	9.08E+09
Old Mans Creek, IA 02-IOW-0150_2				
High Flow	2.18E+12	4.58E+09	1.95E+12	2.18E+11
Moist	6.13E+11	4.58E+09	5.47E+11	6.13E+10
Mid-Range	2.62E+11	4.58E+09	2.31E+11	2.62E+10
Dry	8.41E+10	4.58E+09	7.11E+10	8.41E+09
Low Flow	1.28E+10	4.58E+09	6.90E+09	1.28E+09
Muddy Creek, IA 02-IOW-0162_0				
High Flow	1.52E+11	0.00E+00	1.37E+11	1.52E+10
Moist	4.05E+10	0.00E+00	3.65E+10	4.05E+09
Mid-Range	2.54E+10	0.00E+00	2.28E+10	2.54E+09
Dry	1.50E+10	0.00E+00	1.35E+10	1.50E+09
Low Flow	6.32E+09	0.00E+00	5.69E+09	6.32E+08
Unnamed Tributary to Muddy Creek, IA 02-IOW-0166_0				
High Flow	9.42E+09	0.00E+00	8.48E+09	9.42E+08
Moist	2.49E+09	0.00E+00	2.24E+09	2.49E+08
Mid-Range	1.56E+09	0.00E+00	1.40E+09	1.56E+08
Dry	9.23E+08	0.00E+00	8.30E+08	9.23E+07
Low Flow	3.88E+08	0.00E+00	3.49E+08	3.88E+07

5. TMDLs for the Middle Iowa HUC-8 Watershed

5.1. Watershed/Waterbody Description

The Middle Iowa watershed (HUC-8 ID: 07080208) has a drainage area of 1,657 mi^2, comprising 35 percent of the Iowa River Basin. Ten HUC-10 watersheds covering portions of Benton, Grundy, Iowa, Jasper, Johnson, Linn, Marshall, Poweshiek, Story, and Tama Counties, are within the Middle Iowa watershed.

Based on LiDAR data collected in 2009, elevations in the watershed range from 677 feet NAVD 88 to 1,151 feet NAVD 88. The low point is located on land that is operated as a quarry, located in the northwest corner of Johnson County. The high point is located at the western end of the watershed along the western border of Marshall County.

Water exits the Middle Iowa watershed at the outlet works of the Coralville Dam. The dam has a crest elevation of 742.9 feet NAVD 88 and is 100 feet tall. The water surface elevation of Coralville Reservoir varies seasonally and is controlled by the Army Corps of Engineers, Rock Island District. Seasonal pool elevations are: spring, 682.9 feet NAVD 88; summer, 678.9 feet NAVD 88; and fall, 685.9 feet NAVD 88.

The division between the Lower and Middle Iowa HUC-8 watersheds is at the Coralville Reservoir Dam located in Johnson County, approximately 3 miles north of the Iowa City corporate limits. The division between the Middle and Upper Iowa HUC-8 watersheds is in the NW ¼ of Section 2, Township 84 North, Range 19 West, Marshall County, and approximately 7 miles northwest of the City of Marshalltown corporate limits.

From the upper reach in the Middle Iowa HUC-8 watershed, the Iowa River runs approximately 148 miles in a southeasterly direction passing through Benton, Iowa, Johnson, Marshall, and Tama counties before discharging to the Lower Iowa HUC-8 watershed through the Coralville Dam outlet works. It flows through or adjacent to several incorporated areas including, Chelsea, Marengo, Marshalltown, Montour, North Liberty, and Tama. In addition, the Iowa River flows through several parks owned and operated by City, County, and Federal entities that provide recreational opportunities to the local population, the largest of these being Coralville Reservoir and ancillary facilities. The river also flows through several wildlife management areas (WMA), the largest of these being the Hawkeye WMA. The Iowa River provides recreation, aquatic and riparian wildlife habitat, aesthetic qualities, and storm drainage.

Tributaries to the Iowa River with a drainage area over 30 mi^2 includes: Honey Creek, Burnett Creek, Price Creek, Hoosier Creek, Otter Creek, Asher Creek, Richland Creek, Linn Creek, Walnut Creek, Timber Creek, Big Bear Creek, and Salt Creek. Many smaller streams also drain to the Iowa River in the Middle Iowa HUC-8 watershed, including Davisons Creek, Plum Creek, Coon Creek, Rock Creek, Deer Creek, Sugar Creek, Hilton Creek, Buckeye Creek, Raven Creek, Knapp Creek, and other small named and unnamed tributaries. A map of the Middle Iowa HUC-8 watershed is shown in Figure 5-1 and general river and watershed information is provide in Table 5-1.

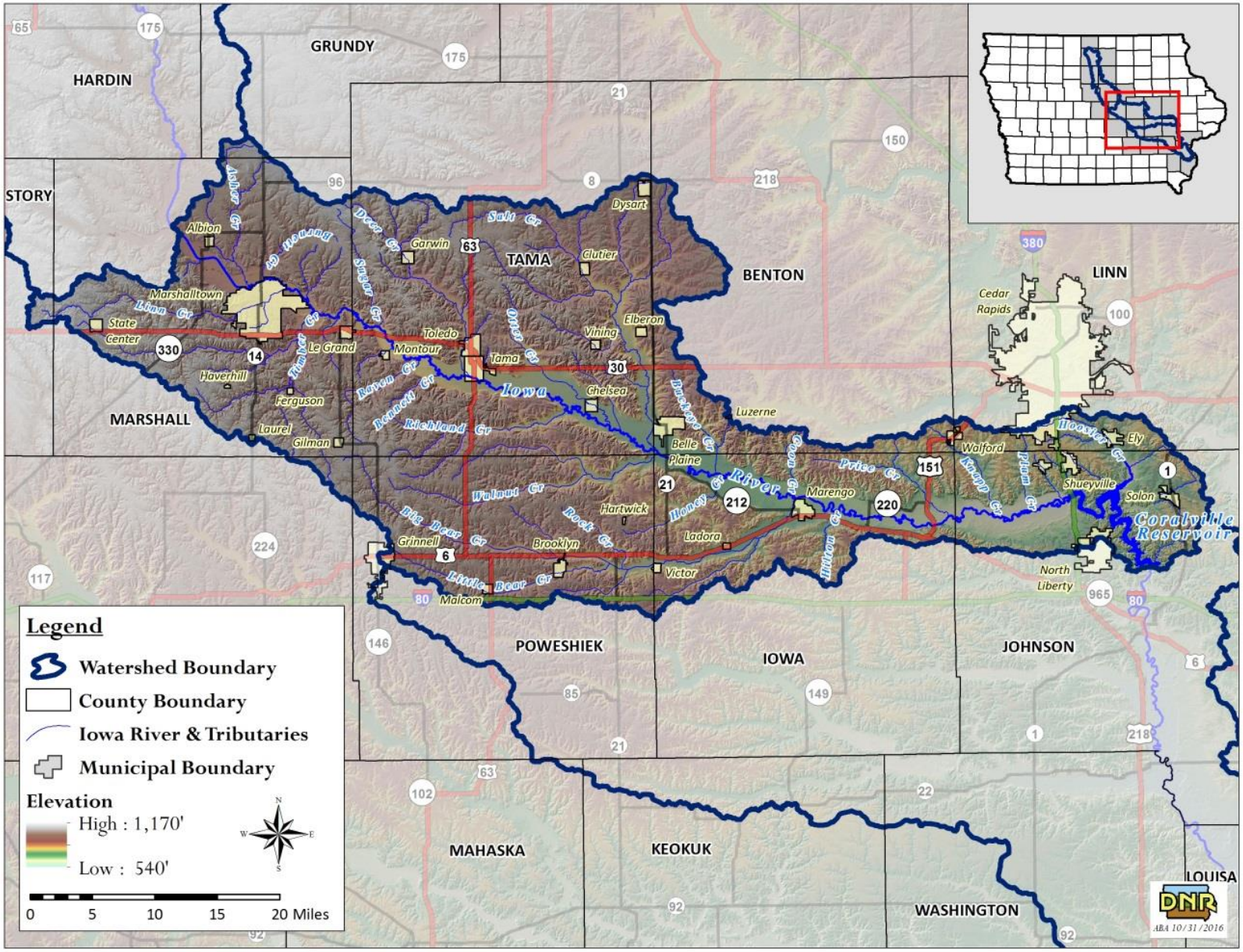

Figure 5-1. The Middle Iowa Watershed.

Table 5-1. Iowa River and Middle Iowa Watershed Information.

Waterbody	Iowa River
8 Digit Hydrologic Unit Code (HUC)	07080208
8 Digit HUC Name	Middle Iowa
Location	Beginning in the NW ¼ of NW ¼ of Sec 2, T84N, R19W; running in a southeasterly direction for 148 to the boundary between the Middle Iowa and Lower Iowa HUC9 watersheds.
Designated Uses	A1 – primary contact recreation B(WW-1) – aquatic life (warm water) HH – human health/fish consumption
Tributaries	Asher Creek, Bennett Creek, Big Bear Creek, Buckeye Creek, Burnett Creek, Coon Creek, Davisons Creek, Deer Creek, Hilton Creek, Honey Creek, Hoosier Creek, Indian Creek, Knapp Creek, Linn Creek, McAllister Creek, Mud Creek, Otter Creek, Plague Mine Creek, Plum Creek, Price Creek, Raven Creek, Richland Creek, Rock Creek, Salt Creek, Sugar Creek, Timber Creek, Turkey Creek, Walnut Creek, West Hoosier Creek, and several unnamed tributaries.
HUC – Length	138 Miles
Up Stream	Iowa River, Upper Iowa, HUC-8, 07080207
Receiving Waterbody	Iowa River, Lower Iowa HUC-8, 07080209

Landforms

The Middle Iowa watershed is made up of three landforms: Southern Iowa Drift Plain (72%), Iowan Surface (28%) and the Des Moines Lobe (<1%). The Southern Iowa Drift Plain landscape consists of rolling hills of Wisconsin-age loess on Illinoisan till. Numerous rills, creeks, and rivers branch out across the landscape shaping the old glacial deposits into steeply rolling hills and valleys (Prior, 1991). The Iowan Surface of northeastern Iowa is dominated by gently rolling terrain. Glacial boulders lie scattered across the landscape, and northwest to southeast trending loess-mantled hills (paha) stand above the surrounding plain. (Prior, Kohrt, and Quade, 2009).

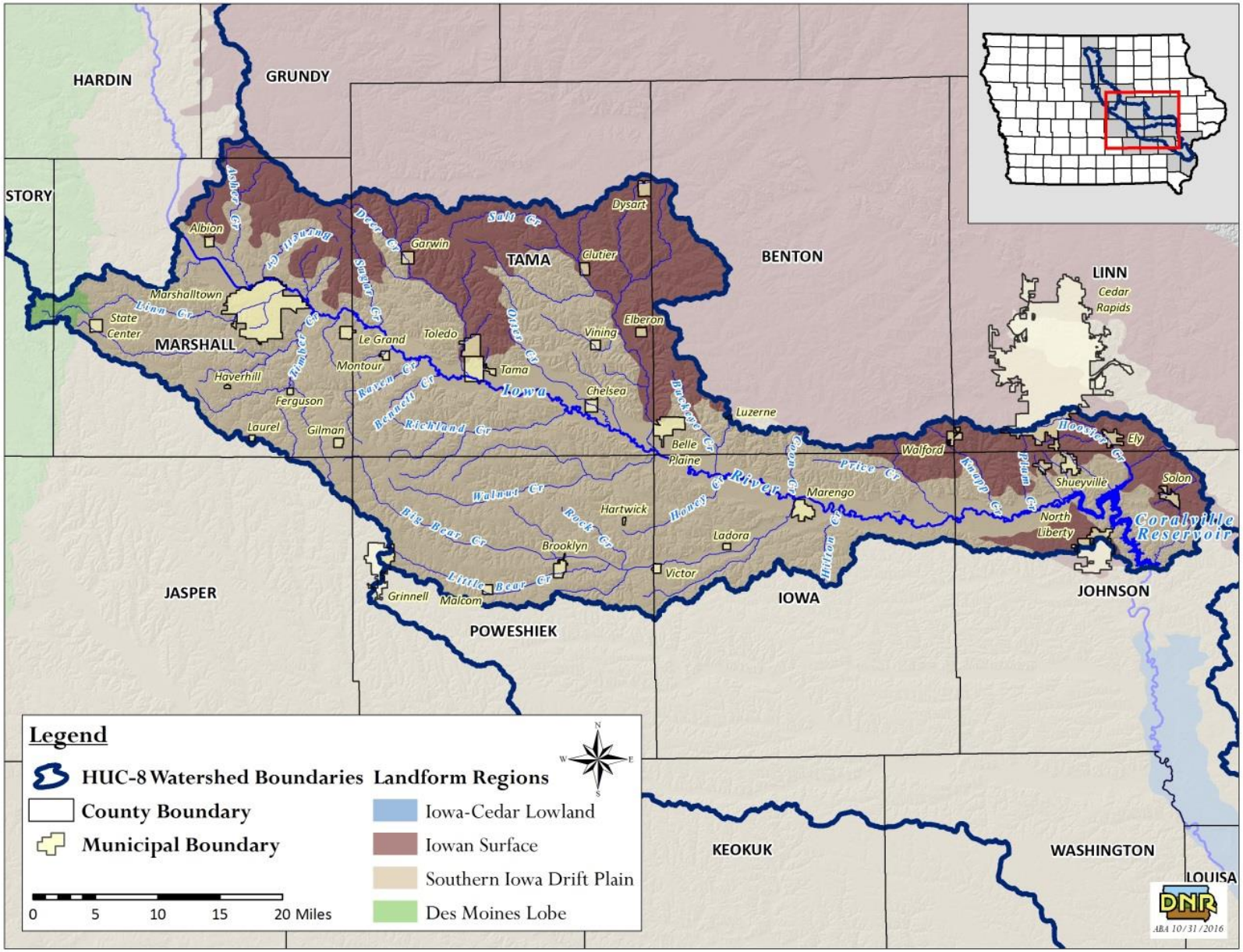

Figure 5-2. Middle Iowa Watershed Landforms.

Hydrology

Based on the USGS National Hydrography Database (NHD), the Middle Iowa watershed includes approximately 3,830 miles of streams, with the Iowa River having a total stream length of approximately 138 miles. The Iowa River is impounded by the Coralville Dam, which forms Coralville Reservoir. At normal pool elevation, the reservoir stores 28,100 acre-feet of water, covers an area of 5,430 acres and is 23 miles long. Pool elevations vary depending on the time of season as discussed previously and the amount of influent to the reservoir. Discharge rates in the Iowa River downstream of the Coralville Reservoir are partially regulated at the outlet of the reservoir by the U.S. Army Corps of Engineers. During low flow periods water will be discharged from the reservoir to maintain a minimum downstream discharge rate of 150 cubic feet per second (cfs). (Iowa River Iowa Reservoirs Dam Safety Floodplain Management Study). The reservoir was completed in 1958 and was constructed for the main purpose of flood control on the Mississippi River.

The USGS currently maintains 12 surface water gaging stations in this watershed. These gaging stations are used to collect stream data such as gage height, discharge rate, and in some cases water quality data. Table 5-2 lists the USGS stream gage information for the active gages used in this WQIP.

Table 5-2. Selected USGS Stream Gages in the Middle Iowa Watershed.

Station Number	Station Name	Latitude	Longitude	Stream	Drainage Area (mi^2)
05451500	Iowa River at Marshalltown, IA	42°03’57”	92°54’27”	Iowa River	1,532
05451700	Timber Creek nr Marshalltown, IA	42°00’32”	92°51’08”	Timber Creek	118
05451900	Richland Creek near Haven, IA	41°53’58”	92°28’27”	Richland Creek	56.1
05452000	Salt Creek near Elberon, IA	41°57’51”	92°18’47”	Salt Creek	201
05452200	Walnut Creek near Hartwick, IA	41°50’06”	92°23’10”	Walnut Creek	70.9
05453000	Big Bear Creek at Ladora, IA	41°44’58”	92°10’55”	Big Bear Creek	189

From 1997 to 2014, rainfall across the watershed ranged from 33 to 38 inches (Table 5-3), with some variation across location and years (Figure 5-4).

Table 5-3. Weather Station Information for Belle-Plaine, Iowa City, Marshalltown, and Toledo, Iowa.

IEM Station ID	IA0600	IA4101	IA5198	IA8296
Station Name	Belle-Plaine	Iowa City	Marshalltown	Toledo
Latitude	41° 52’ 48”	41° 39’ 00”	42° 04’ 12”	41° 58’ 48”
Longitude	92° 16’ 12”	91° 31’ 48”	92° 55’ 48”	92° 34’ 48”
Miles from Watershed	N/A	4.95	N/A	N/A
Average Annual Precipitation (1997-2014)	35.0 inches	37.4 inches	36.5 inches	33.5 inches

Source: https://mesonet.agron.iastate.edu/climodat and https://mesonet.agron.iastate.edu/sites/locate.php?network=IACLIMATE

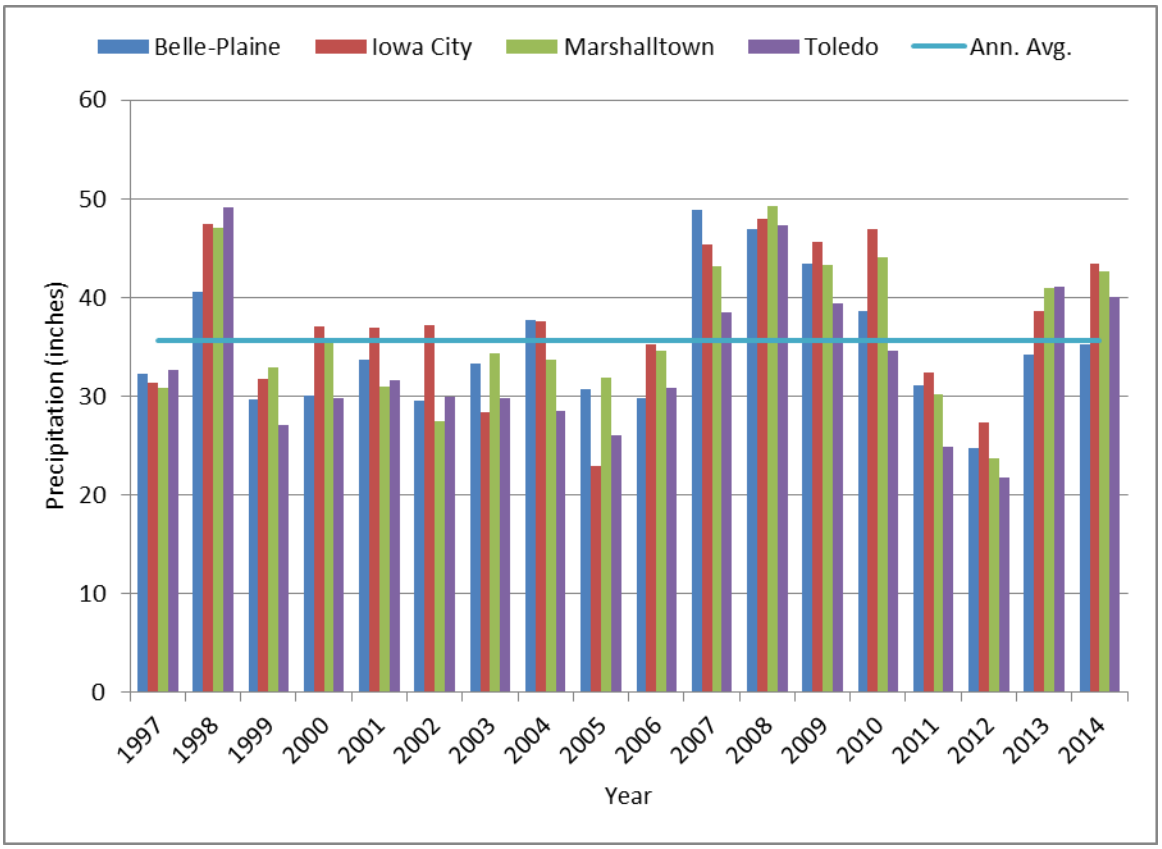

Figure 5-3. Annual Precipitation Belle-Plaine, Iowa City, Marshalltown, and Toledo, Iowa.

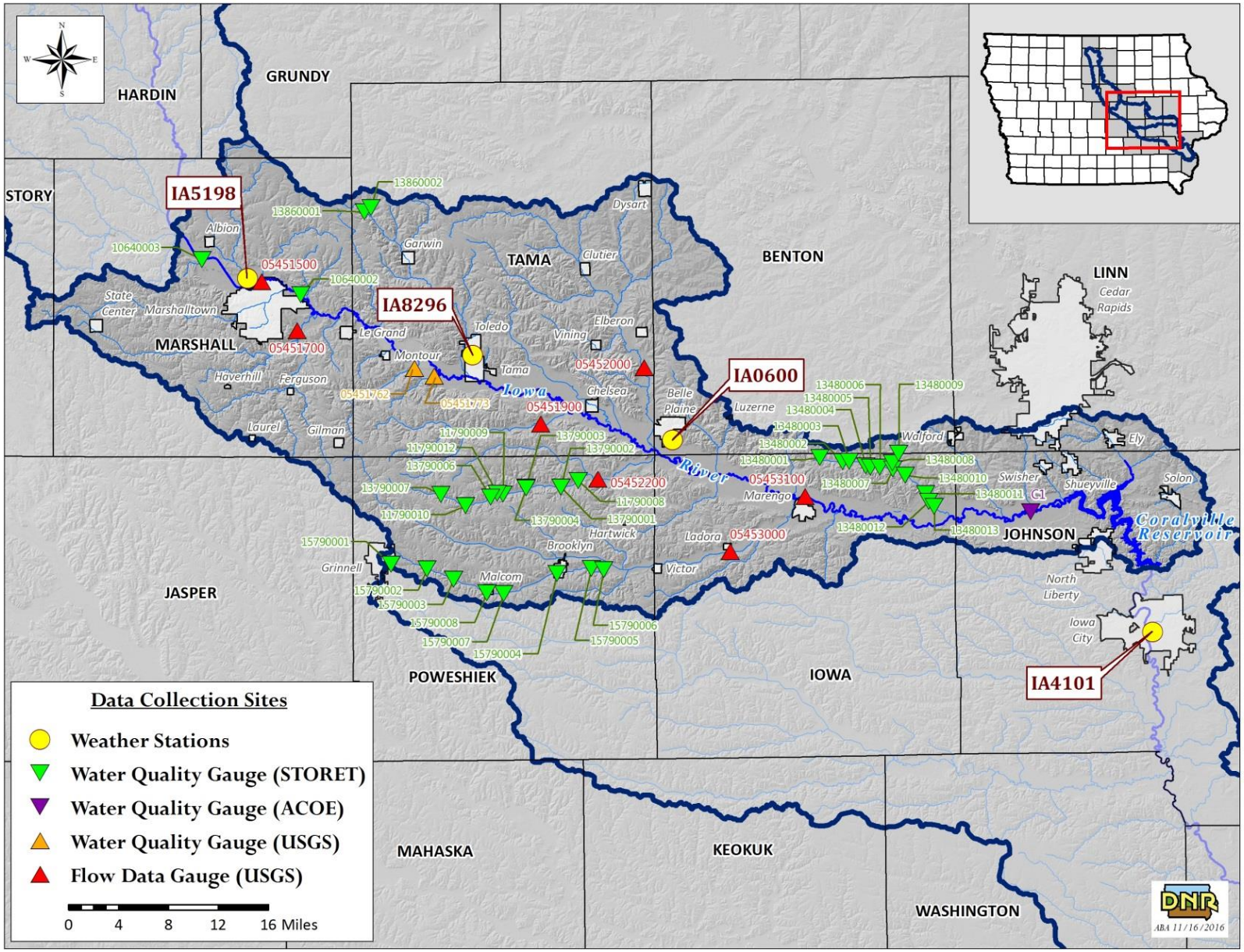

Figure 5-4. Middle Iowa Watershed Data Collection Points.

Land Use

The land use coverage comes from the 2014 USDA Cropland Data Layer (USDA, National Agricultural Statistics Service). The two predominate land uses are row crops and grassland, with row crops making up approximately 58.7% and grassland comprising 20.3% of the watershed (Table 5-4). Row crops consist of corn, and soybeans, with less than 0.1% being other crops. The nine land uses shown in Table 5-4 were aggregated from the fourteen land uses in the cropland data layer as shown in the description column. Figure 5-6 shows the distribution of the various land uses throughout the Lower Iowa watershed in a pie-chart.

Table 5-4. Middle Iowa Watershed Land Uses.

Land Use	Description	Area (AC)	Percent of total
Water/Wetland	Water and Wetlands	22,145	2.1%
Forested	Bottomland, Coniferous, Deciduous	96,832	9.1%
Grassland	Ungrazed, Grazed, & CRP-	215,120	20.3%
Alfalfa/Hay	Perennial Hay Crop-	22,645	2.1%
Row crop	Corn, Soybeans, & other	622,547	58.7%
Roads	Roads Lightly Developed Urban	55,466	5.2%
Urban	Intensively Developed Urban	6,526	0.6%
Residential	Residential/Moderately Developed	18,863	1.8%
Barren	-	336	0.0%
Total		**1,060,480**	**100%**

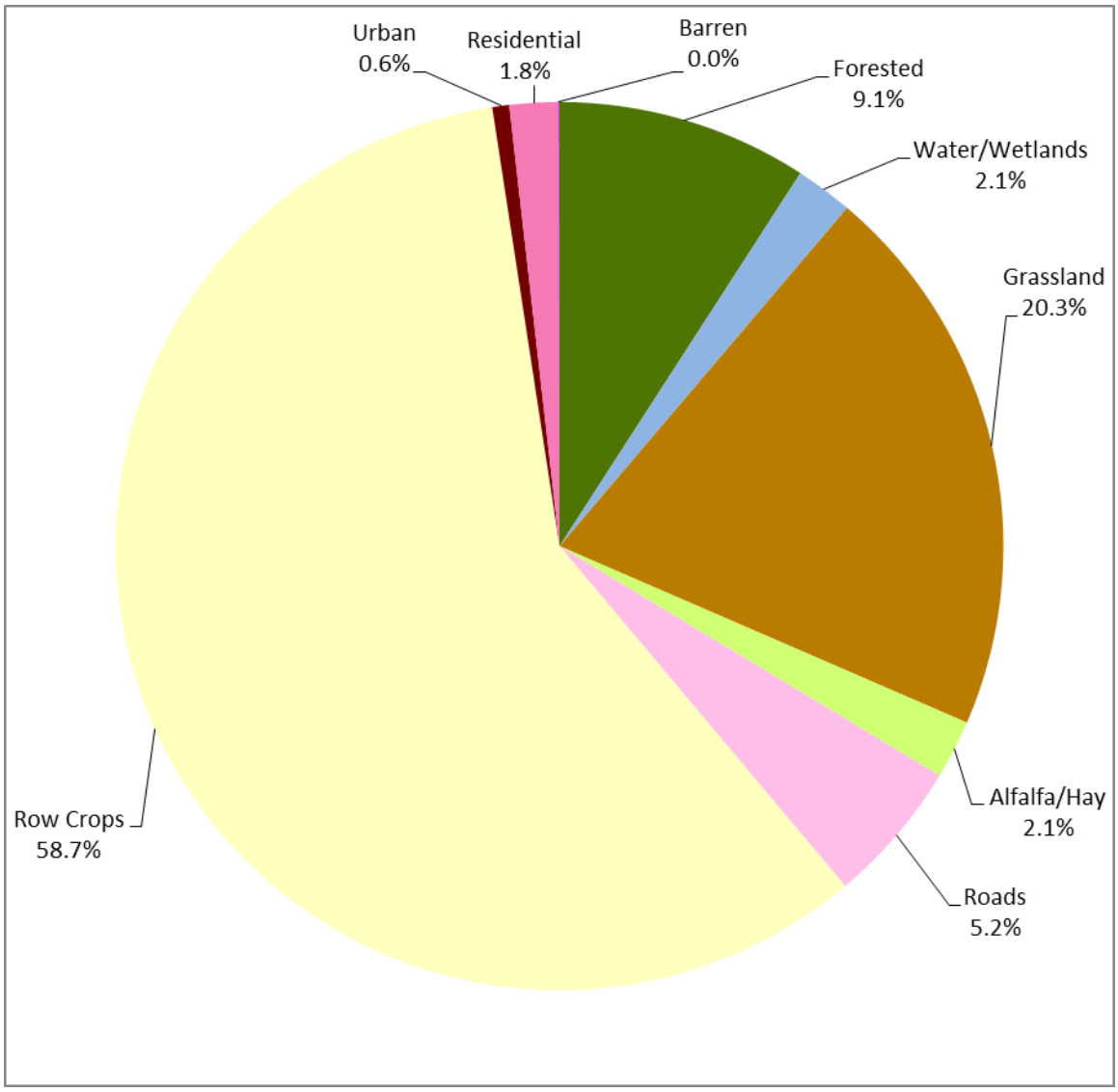

Figure 5-5. Land Use Composition of the Middle Iowa Watershed.

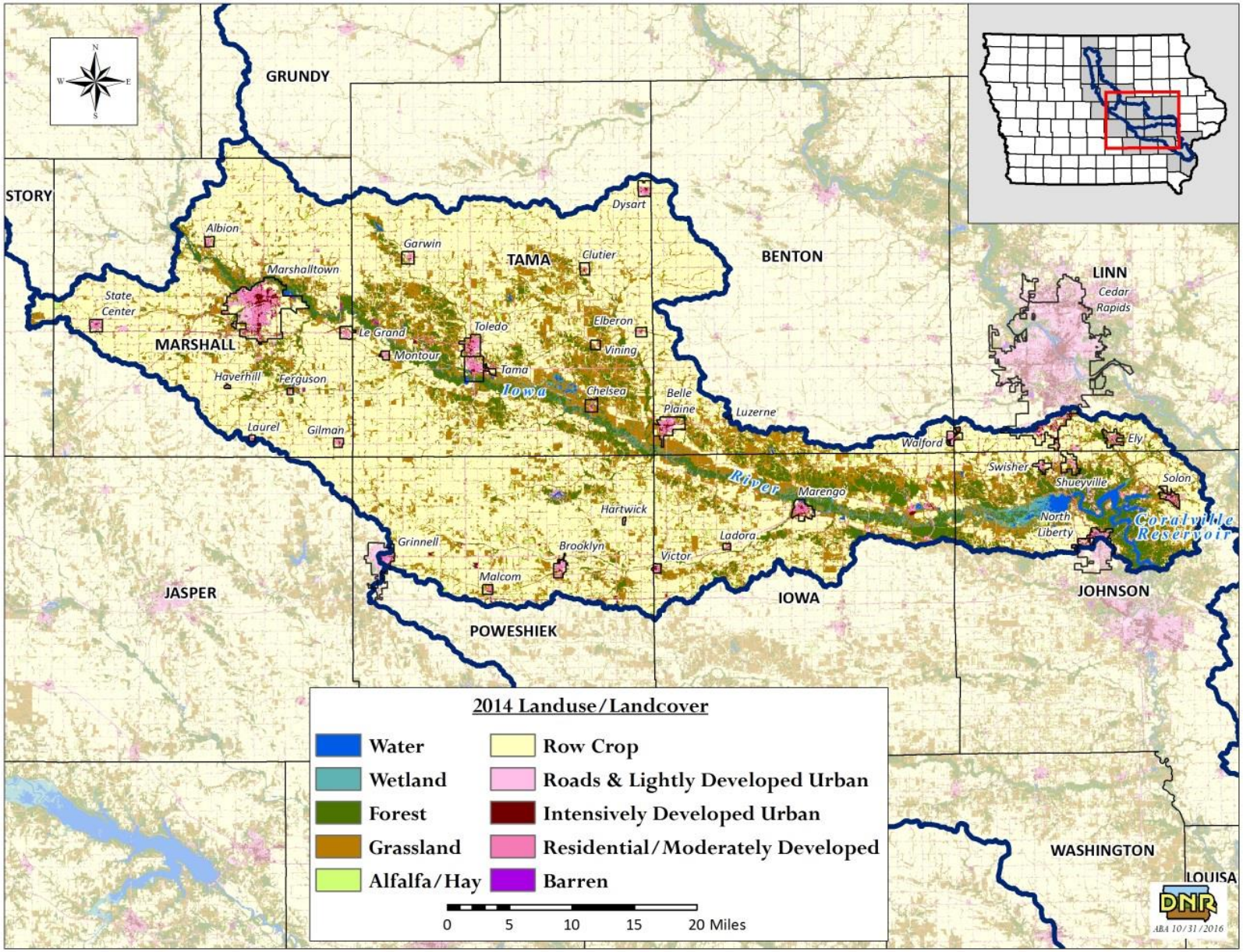

Figure 5-6. Land Use Map of the Middle Iowa Watershed.

Soils

From data obtained from the NRCS, there are 172 different soils types in this watershed. No soil type makes up a majority in the area. The top two soil types in the watershed are the Tama silty clay loan and the Fayette silt loam which makes up 31.9% of the soil types in the watershed. Of the seven hydrologic soil types, hydrologic soil type C makes up the majority of the soils in the watershed at 61.2%. A summary of the hydrologic soil types is shown in Table 5-5.

5.2. Stream Segment Designations and Descriptions

Nineteen stream segments in the Middle Iowa watershed do not meet water quality standards (WQS) and are not fully supporting Class A1 (primary contact recreation) and Class A3 (children's recreation) uses due to the presence of high levels of an indicator bacteria called *Escherichia coli* (*E. coli*). Figure 5-7 shows graphically all the impaired segments in the Middle Iowa watershed and Table 5-6 is a summary of the impaired stream segments, segment identifications, location description, segment length, and designated uses.

Table 5-5. Hydrologic Soil Groups in the Middle Iowa Watershed.

Soil Group	Watershed Area (%)	Description
A	2.7	Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
B	4.0	Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
C	61.2	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
D	1.7	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification.
Unclassified	2.4	
Dual Hydrologic Soil Groups		
A/D	0.1	Groups A/D, B/D, and C/D are dual hydrologic soil group. Some soils are placed in group D due to the depth of the water table within 24 inches of the surface even though the soils exhibit favorable properties for water transmission. If these soils can be drained they are classified dual hydrologic soils. The first letter applies to the drained condition and the second to the undrained condition.
B/D	1.3	
C/D	26.7	

Source: USDA-NRCS, 2009, Part 630 Hydrology, National Engineering Handbook, Chapter 7

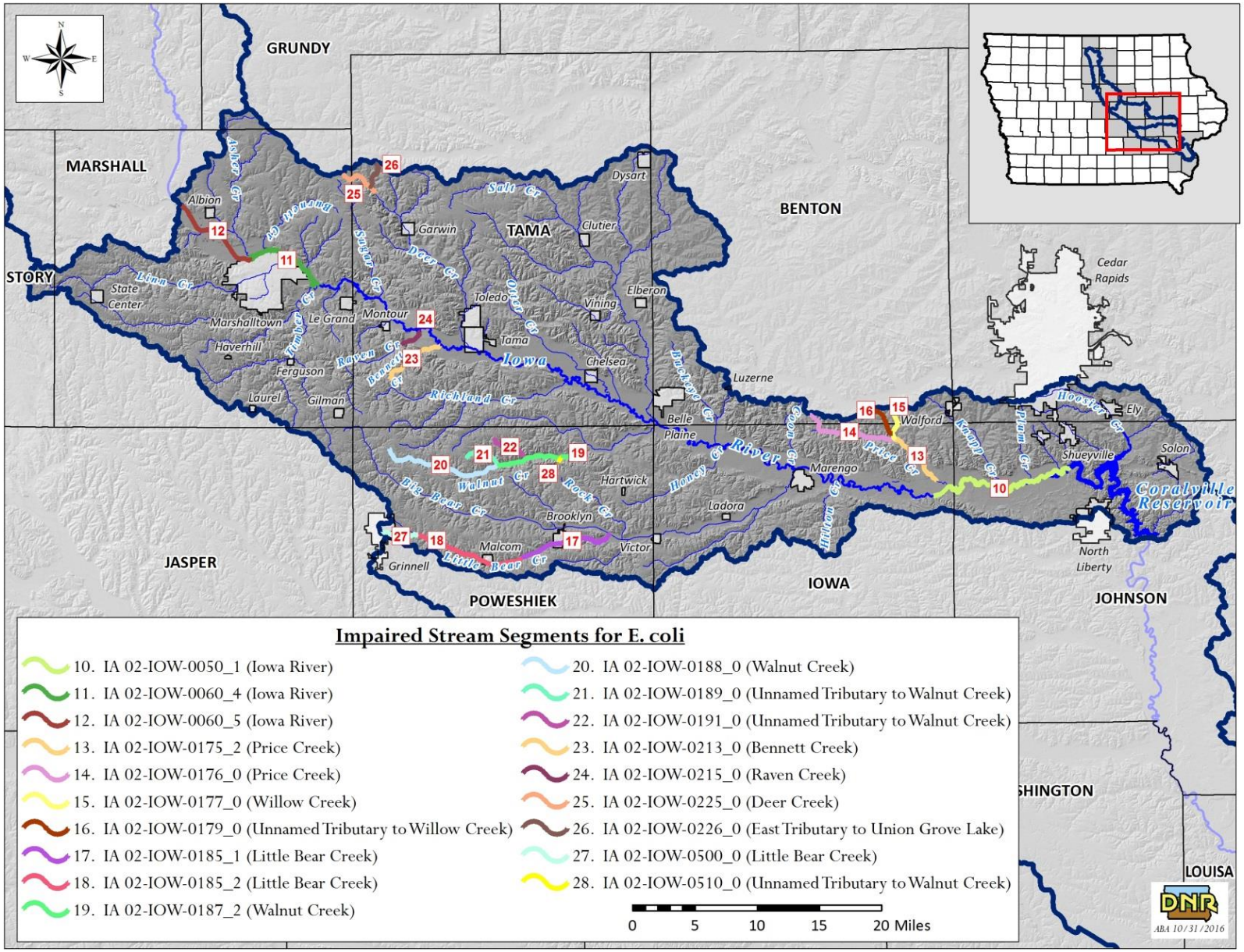

Figure 5-7. Middle Iowa Watershed Impaired Stream Segments for *E coli*.

Table 5-6. Middle Iowa Watershed Impaired Stream Segments and Designated Uses.

Stream Name	Legacy ID[(1)]	Segment ID[(2)]	Location Description	Length (mi.)	Designated Uses
Iowa River	0050_1	633	from upper end of Coralville Reservoir (=U.S. Highway 218 bridge in SW 1/4, S22, T81N, R7W, Johnson Co.) to the state Highway 149 bridge in S35, T81N, R9W, Iowa Co.	16.4	A1 – primary contact B(WW-1) HH
Iowa River	0060_4	641	from confluence Timber Cr. (S3, T83N, R17W, Marshall Co.) to confluence with Asher Cr. in S27, T84N, R18W, Marshall Co.	13.7	A1 – primary contact B(WW-1) HH
Iowa River	0060_5	642	from confluence with Asher Cr. at Marshalltown (S27, T84N, R18W, Marshall Co.) to confluence with Minerva Cr. in S2, T84N, R19W, Marshall Co.	8.0	A1 – primary contact B(WW-1) HH
Price Creek	0175_2	699	from mouth of Mill Race (S26, T81N, R9W, Iowa Co.) to confluence with unnamed tributary in NW 1/4, S8, T81N, R9W, Iowa Co	5.5	A1 – primary contact B(WW-2)
Price Creek	0176_0	6377	from confluence with unnamed trib in NW1/4, S8, T81N, R9W, Iowa Co. to headwaters in S31, T82N, R10W, Benton Co.	8.1	A1 – primary contact B(WW-1)
Willow Creek	0177_0	6586	from mouth (T81N R9W Sec8, Benton Co.) to headwaters (T82N R9W Sec29 SW, Benton Co.)	2.9	A1 – primary contact B(WW-1
Unnamed Tributary to Willow Creek	0179_0	6587	from mouth (T81N R9W Sec5, Iowa Co.) to headwaters (T82N R10W Sec36 NW, Benton Co.)	2.9	A1 – primary contact B(WW-1)
Little Bear Creek	0185_1	705	mouth (S16, T80N, R13W, Poweshiek Co.) to confluence with unnamed tributary in SE 1/4, NW 1/4, S29, T80N, R14W, Poweshiek Co.	8.4	A1 – primary contact B(WW-2)
Little Bear Creek	0185_2	706	from confluence with unnamed tributary (SE 1/4, NW 1/4, S29, T80N, R14W, Poweshiek Co.) to confluence with unnamed tributary in SW 1/4, S13, T80N, R16W, Poweshiek Co.	9.1	A1 – primary contact B(WW-2)
Little Bear Creek	0500_0	6563	from confluence with unnamed tributary(T80N R16W Sec13, Poweshiek Co.) to headwaters (T80N R16W Sec16, Poweshiek Co.	3.3	A1 – primary contact B(WW-1)
Walnut Creek	0187_2	709	from confluence with North Walnut Cr. (S7, T81N, R13W, Poweshiek Co.) to confluence with unnamed tributary in NW 1/4, S24, T81N, R15W, Poweshiek Co.	7.9	A1 – primary contact B(WW-2)
Walnut Creek	0188_0	1916	confluence with unnamed tributary in NW 1/4, S24, T81N, R15W, Poweshiek Co. to headwaters in S10, T81N, R16W, Poweshiek Co.	10.0	A1 – primary contact B(WW-1)
Unnamed Tributary to Walnut Creek	0189_0	6317	from mouth (T81N R15W Sec24, Poweshiek Co.) to headwaters (T81N R15W Sec15 SW, Poweshiek Co.)	3.9	A1 – primary contact B(WW-1)
Unnamed Tributary to Walnut Creek	0191_0	6318	from mouth (T81N R14W Sec17, Poweshiek Co.) to headwaters (T81N R15W Sec1, Poweshiek Co.)	3.4	A1 – primary contact B(WW-1)
Unnamed Tributary to Walnut Creek	0510_0	6590	from mouth to Holiday Lake(T81N R14W Sec14, Poweshiek Co.)	0.4	A1 – primary contact B(WW-1)

Stream Name	Legacy ID(1)	Segment ID(2)	Location Description	Length (mi.)	Designated Uses
Bennett Creek	0213_0	6263	From mouth (T83N R15W Sec32, Tama Co.) to headwaters (T82N R16W Sec16, Tama Co.) excluding portion on Meskwaki Settlement	5.4	A1 – primary contact B(WW-1)
Raven Creek	0215_0	723	mouth (S25, T83N,R16W, Tama Co.) to W line of S35, T83N, R16W, Tama Co.	2.0	A1 – primary contact B(WW-2)
Deer Creek	0225_0	6538	from Union Grove Lake (Tama Co.) to headwaters (T85N R17W Sec24 SW)	4.2	A1 – primary contact B(WW-1)
East Tributary to Union Grove Lake	0226_0	6539	from mouth (T85N R16W Sec29, Tama Co.) to headwaters (T85N R16W Sec17 SE, Tama Co.)	2.5	A1 – primary contact B(WW-1)

(1) Prefix for Legacy ID is IA 02-IOW (Legacy ID: IA 02-IOW-0010_1).
(2) Prefix for Segment ID is 02-IOW (Segment ID: IA 02-IOW-621).

Data Sources and Monitoring Sites

Table 5-2 (in Section 5.1) lists the USGS Gaging Stations used and Table 5-7 lists water quality monitoring locations. STORET sites refer to data collected by Iowa DNR personal for the STOrage and RETrieval sponsored by the US EPA.

Table 5-7. WQ Data Monitoring Sites of the Middle Iowa Watershed.

Site Name	ID	Latitude	Longitude
Iowa River Downstream of Marshalltown	STORET 10640002	42° 03’ 03”	92° 50’ 48”
Iowa River Upstream of Marshalltown	STORET 10640003	42° 05’ 30”	93° 00’ 01”
B Avenue (West) Tributary to Union Grove Lake	STORET 13860001	42° 08’ 49”	92° 44’ 50”
200th St. (East) Tributary to Union Grove Lake	STORET 13860002	42° 09’ 06”	92° 44’ 11”
Walnut Creek nr Hartwick (site WLNT1)	STORET 11790008	41° 49’ 60”	92° 24’ 58”
Walnut Creek nr Brooklyn (site WLNT2)	STORET 11790009	41° 49’ 05”	92° 31’ 59”
Walnut Creek nr Malcolm (site WLNT3)	STORET 11790010	41° 48’ 19”	92° 35’ 28”
Unnamed Trib. to Walnut Creek nr Malcolm (site WLNT5)	STORET 11790012	41° 49’ 09”	92° 32’ 32”
Price Creek at NN Ave (Site 1)	STORET 13480001	41° 51’ 28”	92° 02’ 28”
Price Creek at P Ave (Site 2)	STORET 13480002	41° 51’ 08”	92° 00’ 21”
Price Creek at PP Ave (Site 3)	STORET 13480003	41° 51’ 10”	91° 59’ 43”
Price Creek at 110th St (Site 4)	STORET 13480004	41° 50’ 50”	91° 58’ 10”
Price Creek at R Ave (Site 5)	STORET 13480005	41° 50’ 45”	91° 57’ 45”
Price Creek at 100th St and S Ave (Site 6)	STORET 13480006	41° 50’ 44”	91° 56’ 53”
Price Creek at T Ave (Site 7)	STORET 13480007	41° 50’ 36”	91° 55’ 42”
Unnamed Creek at T Ave near 110th St (Site 7A)	STORET 13480008	41° 51’ 02”	91° 55’ 42”
Willow Creek at Benton-Iowa Rd near T Ave (Site 7B)	STORET 13480009	41° 51’ 42”	91° 55’ 06”
Price Creek at U Ave (Site 8)	STORET 13480010	41° 50’ 10”	91° 54’ 31”
Price Creek above campground (Site 9)	STORET 13480011	41° 48’ 51”	91° 52’ 39”
Price Creek at Hwy 151 (Site 10)	STORET 13480012	41° 48’ 19”	91° 52’ 23”
Price Creek at 220th Trail at Amana (Site 11A)	STORET 13480013	41° 47’ 58”	91° 51’ 53”
Unnamed Creek near 328th Ave (Site 2)	STORET 13790001	41° 49’ 33”	92° 26’ 35”
Walnut Creek near 328th Ave (Site 2m)	STORET 13790002	41° 49’ 33”	92° 26’ 36”
Unnamed Creek near 150th St (Site 4)	STORET 13790003	41° 49’ 35”	92° 29’ 53”
Walnut Creek near 150th St (Site 4m)	STORET 13790004	41° 49’ 32”	92° 29’ 50”
Walnut Creek at 120th St (Site 5m)	STORET 13790006	41° 48’ 53”	92° 33’ 09”
Walnut Creek at 80th St (Site 6)	STORET 13790007	41° 49’ 05”	92° 37’ 47”
Little Bear Creek at Penrose St (LB1)	STORET 15790001	41° 44’ 14”	92° 42’ 26”
Little Bear Creek at 390th Ave (LB2)	STORET 15790002	41° 43’ 54”	92° 39’ 05”
Little Bear Creek at 90th St (LB3)	STORET 15790003	41° 43’ 11”	92° 36’ 37”
Little Bear Creek at S Orchard St(LB4)	STORET 15790004	41° 43’ 32”	92° 27’ 00”
Little Bear Creek at 200th St (LB5)	STORET 15790005	41° 43’ 52”	92° 23’ 48”
Little Bear Creek at 385th Ave (LB6)	STORET 15790006	41° 43’ 47”	92° 22’ 40”
Little Bear Creek at 130th St (LB-M2)	STORET 15790007	41° 42’ 10”	92° 31’ 59”
Little Bear Creek at Webster St (LB-M1)	STORET 15790008	41° 42’ 14”	92° 33’ 33”
Raven Creek near Montour, IA	USGS 05451762	41° 57’ 53”	92° 40’ 14”
Bennett Creek near Tama, IA	USGS 05451773	41° 57’ 10”	92° 38’ 58”
Iowa River Upstream Station, Green Castle Avenue, NW	ACOE C-1	41° 47’31”	91° 42’ 53”

Interpreting Data
Analysis of the data shows consistently high *E. coli* levels that exceed the criterion set for in Iowa's WQS for primary contact recreation. Significant reductions in *E. coli* loading will be required to comply with the standards and fully support the designated recreational use in the impaired segments.

Identification of pollutant sources
There are a variety of *E. coli* sources in the Middle Iowa watershed. These sources can be divided into two categories, point and non-point sources. Point sources include municipal separate storm sewer systems (MS4s), municipal and industrial wastewater treatment facilities (WWTFs), sanitary sewer overflows (SSOs), onsite wastewater systems with permitted discharges, and animal feeding operations (AFOs) regulated as concentrated animal feeding operations (CAFOs). Nonpoint sources include wildlife, manure application to row crops, grazing livestock and small feeding operations, direct deposition by livestock in streams, and non-permitted (i.e., non-discharging) onsite wastewater systems.

Load duration curves (LDCs) were used in the development of *E. coli* TMDLs for impaired stream segments in the Iowa River Basin (Section 5.3). The use of LDCs is helpful for understanding the importance that hydrology plays on pollutant loading. Information illustrated in LDCs provides a basic understanding of the importance of potential pollutant sources, although the approach does not offer explicit calculation of source-specific pollutant loads. However, when analyzed in conjunction with a detailed inventory of sources, LDCs can provide a quantitative means of comparing the relative importance of specific pollutant sources.

Point Sources
There are a total of 67 active or pending NPDES permits in this watershed. This includes 28 municipal system permits, 18 semi-public permits, 10 industrial permits, four (4) stormwater permits, two (2) operation permits, three (4) municipal water treatment permits, and one (1) agricultural permit. Operation permits do not discharge to surface water and industrial facilities and municipal water treatment plants are not expected to have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources with the exception of those facilities that have an *E. coli* limit in their NPDES permit. In addition, 16 of these facilities do not discharge to an impaired stream segment reviewed in this WQIP, therefore these facilities will not be considered in this WQIP. An inventory of the facilities not considered in this WQIP is located in Appendix D. Other point sources in the watershed include private sewage disposal systems covered under General Permit #4. Systems covered by this general permit must meet specified requirements, which include a population equivalent of less than 15 persons. Figure 5-8 shows the locations of NPDES permitted wastewater facilities, concentrated animal feeding operation facilities, unsewered communities, and NPDES General Permit #4 facilities that discharge to an impaired stream segment within the Middle Iowa HUC8 watershed. An inventory of these dischargers and their respective WLAs is provided in Appendix D.

Nonpoint Sources
The nonpoint sources of pathogen indicators include contributors that do not have localized points of release into a stream. In the watershed these sources are:

- Grazing animals
- Direct deposition of manure in streams
- Land application and subsequent runoff of manure
- Developed / urban area runoff
- Wildlife
- Faulty septic tank systems

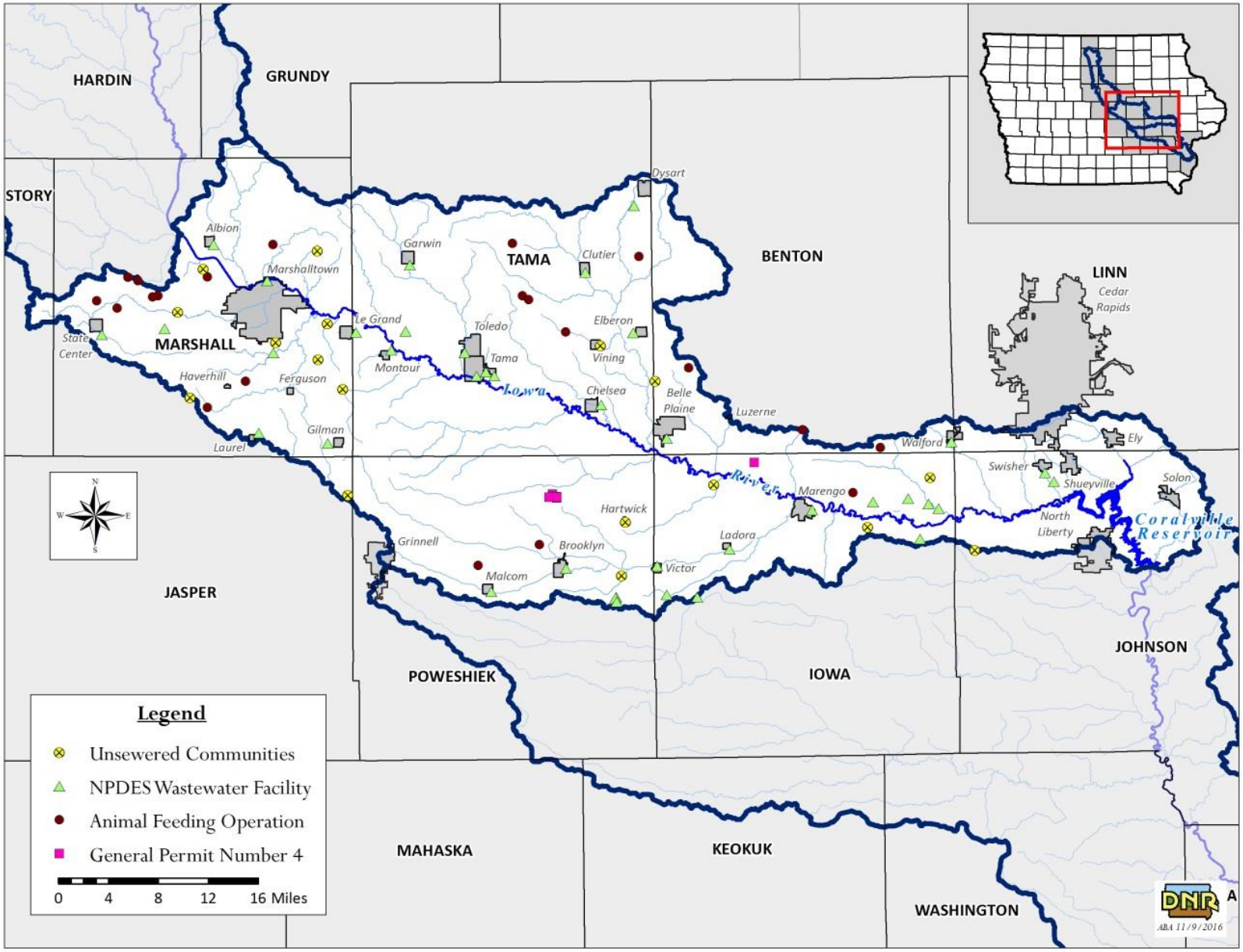

Figure 5-8. Point Source Location Map for the Middle Iowa Watershed.

5.3. Pollution Source Assessment

Departure from Load Capacity

LDCs for each stream segment show the existing GM loading (green, dotted lines) for each flow condition and the target GM loading (red, dashed line). The difference between these two is the departure from the loading capacity. The LDCs, observed loads, and observed GM loads for each flow condition are plotted in Figure 5-10 through Figure 5-28. This methodology enables calculation of a TMDL target at the midpoint of each flow condition for each impaired segment, as provided in Table 5-9 through Table 5-46.

Allowance for Increases in Pollutant Loads

There are a total of 17 unsewered communities in the Middle Iowa watershed. A reserve wasteload allocation (WLA) was calculated for each community and applied to the WLA for the associated segment. Table D-1 in Appendix D.2 lists all the unsewered communities in the Middle Iowa watershed. Any new or expanded dischargers will be expected to meet the same end-of-pipe criteria (GM of 126 orgs/100 mL) as dischargers for which WLAs were calculated and included in this TMDL

5.4. Pollutant Allocations

Wasteload Allocations (WLA)

A WLA was calculated for each wastewater treatment facility (WWTF), MS4 community, and an aggregate reserve WLA for unsewered communities in the watershed. Table 5-8 shows the aggregate WLA summary by facility type for the Lower Iowa watershed. Individual WLAs for each discharger are included in Appendix D.

Table 5-8. WLA Summary by Facility Type for the Middle Iowa Watershed.

Facility Type	Number of Facilities	Flow (MGD)(1)	GM Conc (orgs/100 mL)	GM Load (orgs/day)
WWTF	37	31.07	126	1.48E+11
Unsewered	17	0.08	126	5.21E+08
CAFO	21	0.00	0	0.00E+00
GP #4	7	--	126	--
Stormwater	1	--	126	1.78E+11
Totals	**83**	**31.15**	**126**	**3.27E+11**

(1) Flows used to calculate the wasteload allocation. See Appendix D.

Load Allocation (LA)

Nonpoint sources result from livestock, pets, wildlife, and humans that live, work, and play in and around the stream. Specific examples of potential nonpoint sources of bacteria include animals directly depositing into streams, manure applied to row crops, manure runoff from grazed land, non-permitted onsite wastewater systems, and natural sources such as wildlife.

Margin of Safety

An explicit margin of safety (MOS) of 10 percent is applied to the calculation of loading capacities in this TMDL. Additionally, targeting the GM in each flow condition, rather than only the overall GM, provides an implicit MOS by require WQS compliance across flow conditions.

Load Duration Curve

Figure 5-10 through Figure 5-28 are load durations for the impaired stream segments in this watershed. Table 5-9 through Table 5-46 are the existing load estimates and the TMDL summary for each impaired segment.

Bennett Creek, Segment IA 02-IOW-0213_0

Bennett Creek crosses over the border into the Meskwaki Settlement (Sac and Fox Tribe of the Mississippi in Iowa) as shown in Figure 5-9. Consequently, the portion of the stream (approximately one-half mile) passing into the Meskwaki Settlement will not be considered in this WQIP.

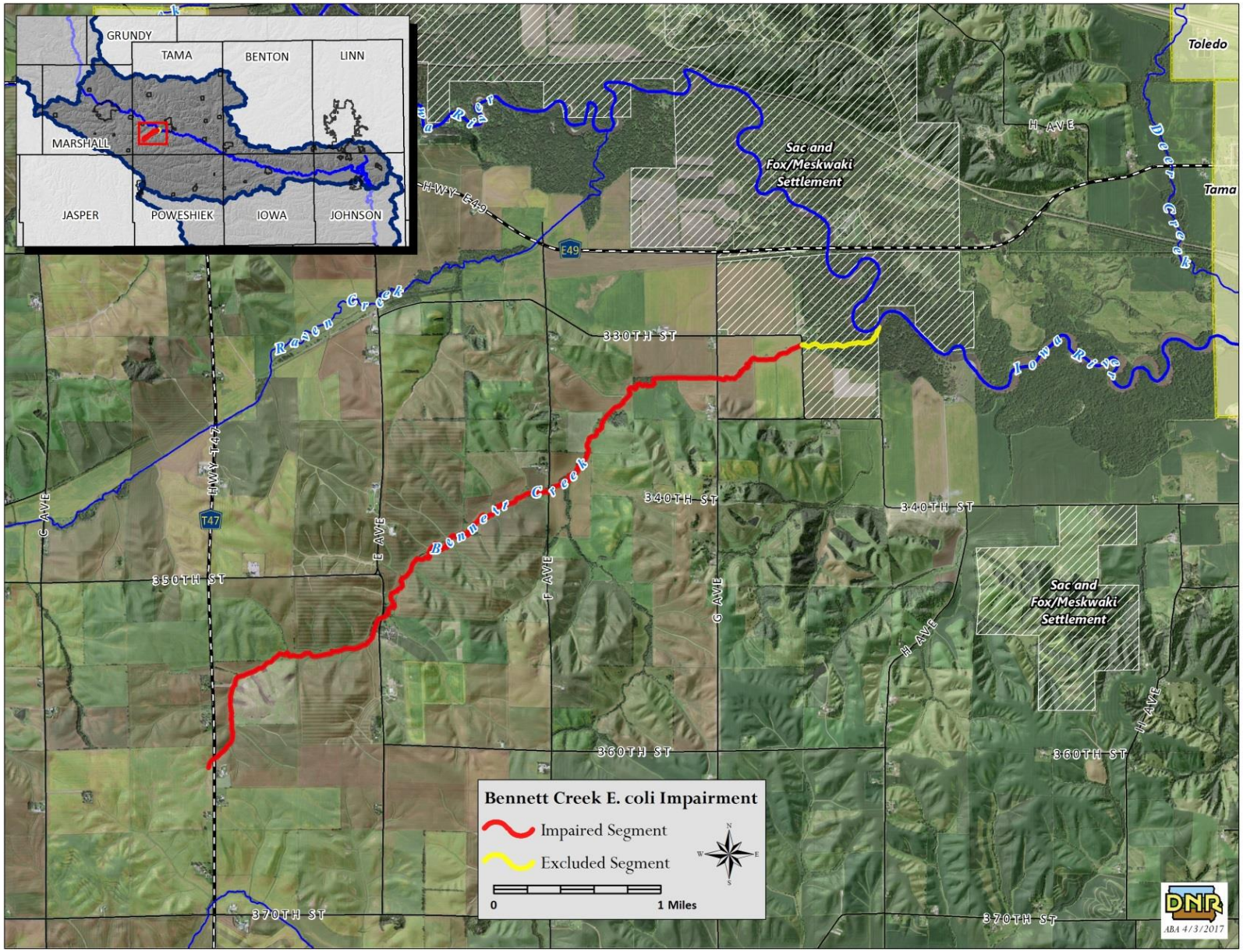

Figure 5-9. Bennett Creek, IA 02-IOW-0213_0

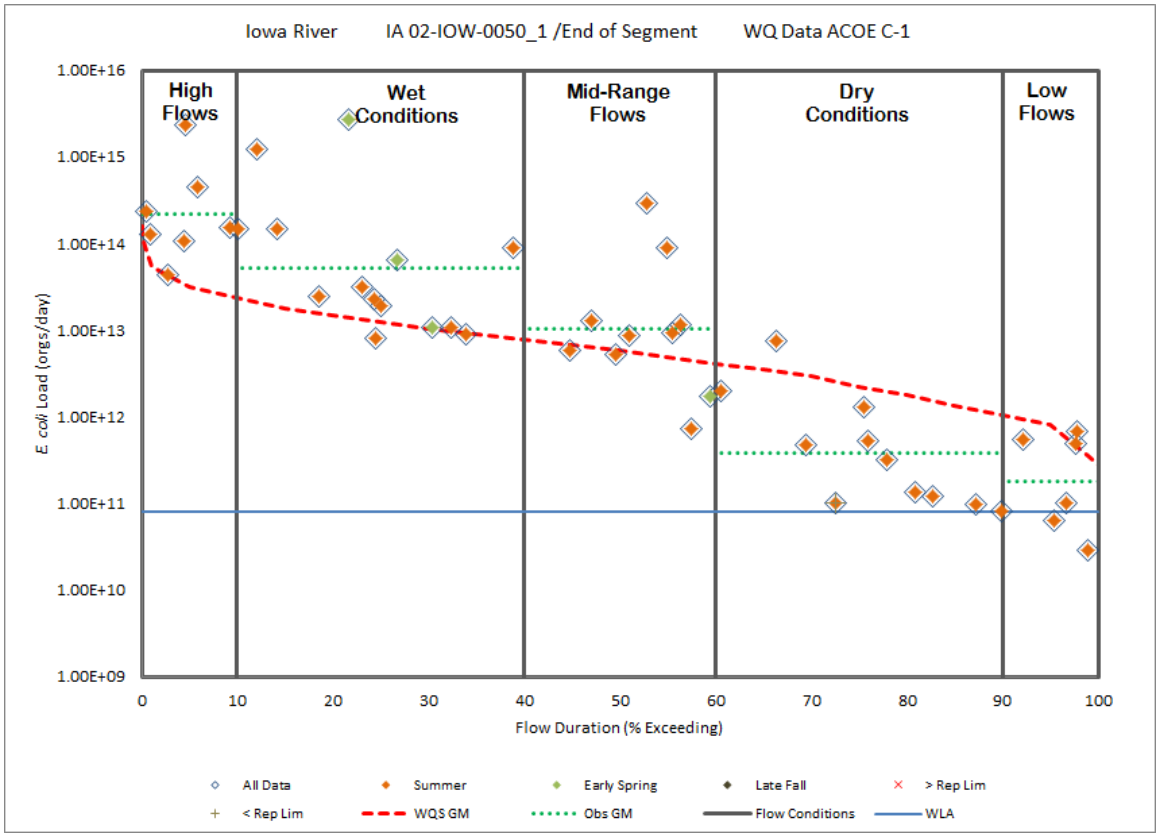

Figure 5-10. Load Duration Curve, Iowa River, Segment IA 02-IOW-0050_1.

Table 5-9. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0050_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.16E+14	5.26E+13	1.02E+13	3.76E+11	1.80E+11
GM Departure (% Reduction)	1.85E+14 (85.6)	4.01E+13 (76.3)	4.31E+12 (42.1)	-1.87E+12 (0)	-6.21E+11 (0)
Midpoint Flow (cfs)	1,0114.5	4,034.5	1,922.0	728.0	259.8

Table 5-10. TMDL Summary for Iowa River, Segment IA 02-IOW-0050_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.12E+13	1.24E+13	5.92E+12	2.24E+12	8.01E+11
WLA (orgs/day)	7.99E+10	7.99E+10	7.99E+10	7.99E+10	7.99E+10
LA (orgs/day)	2.80E+13	1.11E+13	5.25E+12	1.94E+12	6.41E+11
MOS (orgs/day)	3.12E+12	1.24E+12	5.92E+11	2.24E+11	8.01E+10

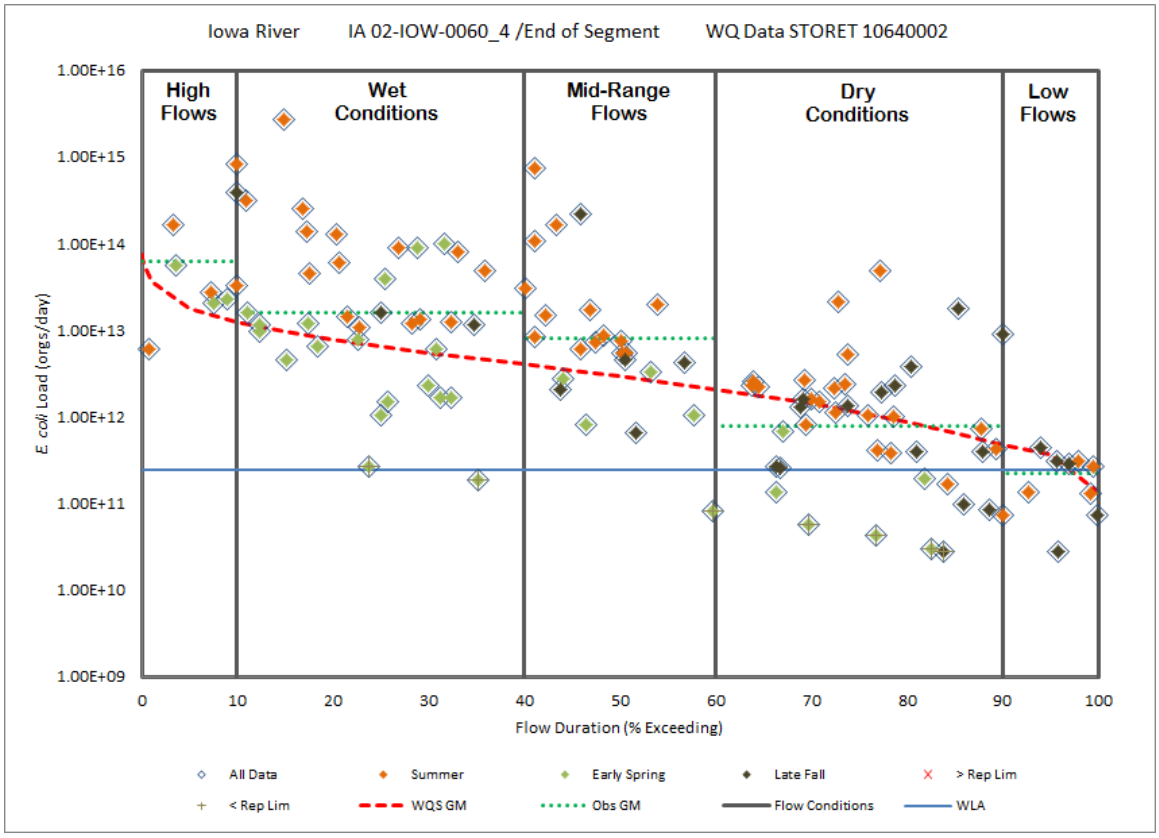

Figure 5-11. Load Duration Curve, Iowa River, Segment IA 02-IOW-0060_4.

Table 5-11. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0060_4.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	6.25E+13	1.62E+13	8.03E+12	7.79E+11	2.25E+11
GM Departure (% Reduction)	4.50E+13 (71.9)	9.70E+12 (59.9)	5.12E+12 (63.8)	-3.57E+11 (0)	-1.37E+11 (0)
Midpoint Flow (cfs)	5,694.8	2,108.3	944.5	368.3	117.7

Table 5-12. TMDL Summary for Iowa River, Segment IA 02-IOW-0060_4.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.76E+13	6.50E+12	2.91E+12	1.14E+12	3.63E+11
WLA (orgs/day)	2.42E+11	2.42E+11	2.42E+11	2.42E+11	2.42E+11
LA (orgs/day)	1.56E+13	5.61E+12	2.38E+12	7.80E+11	8.49E+10
MOS (orgs/day)	1.76E+12	6.50E+11	2.91E+11	1.14E+11	3.63E+10

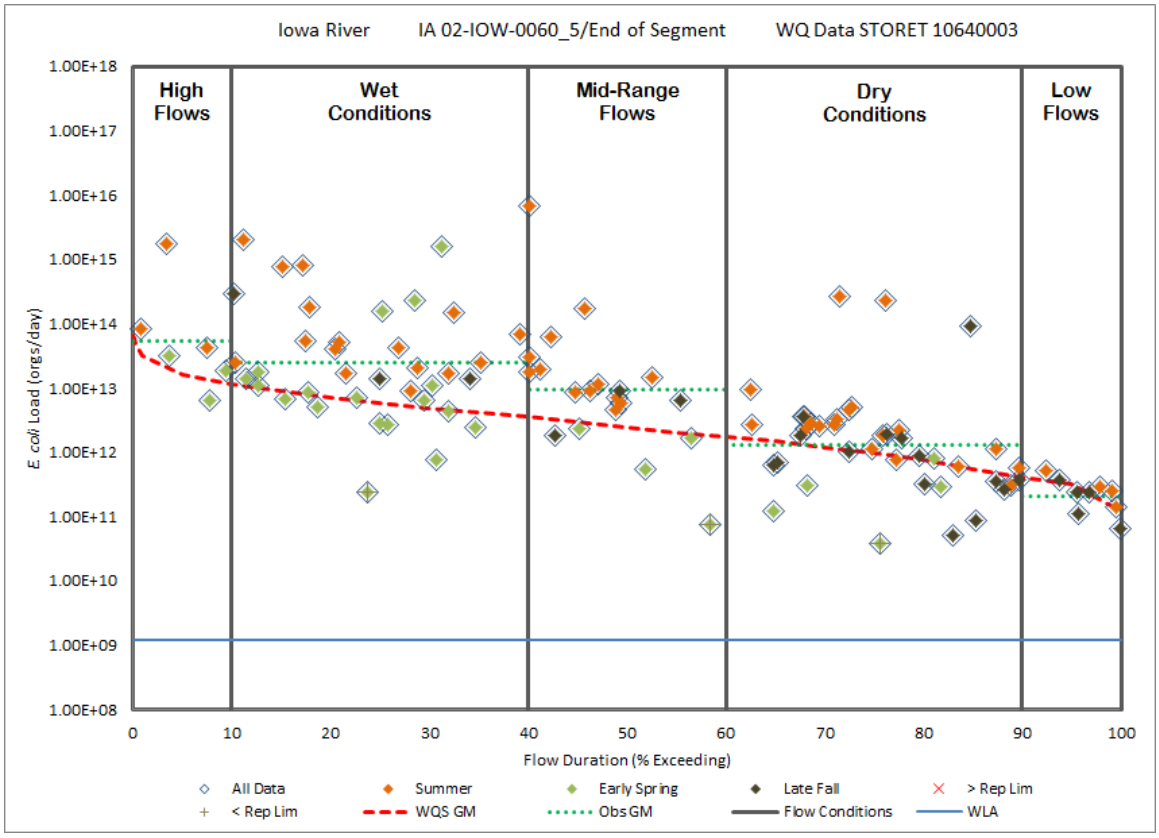

Figure 5-12. Load Duration Curve, Iowa River, Segment IA 02-IOW-0060_5.

Table 5-13. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0060_5.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	5.39E+13	2.52E+13	9.45E+12	1.33E+12	2.12E+11
GM Departure (% Reduction)	3.79E+13 (70.3)	1.94E+13 (76.9)	6.96E+12 (73.6)	3.49E+11 (26.2)	-1.11E+11 (0)
Midpoint Flow (cfs)	5,192.1	1,888.9	810.3	318.7	104.6

Table 5-14. TMDL Summary for Iowa River, Segment IA 02-IOW-0060_5.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.60E+13	5.82E+12	2.50E+12	9.82E+11	3.23E+11
WLA (orgs/day)	1.20E+09	1.20E+09	1.20E+09	1.20E+09	1.20E+09
LA (orgs/day)	1.44E+13	5.24E+12	2.25E+12	8.83E+11	2.89E+11
MOS (orgs/day)	1.60E+12	5.82E+11	2.50E+11	9.82E+10	3.23E+10

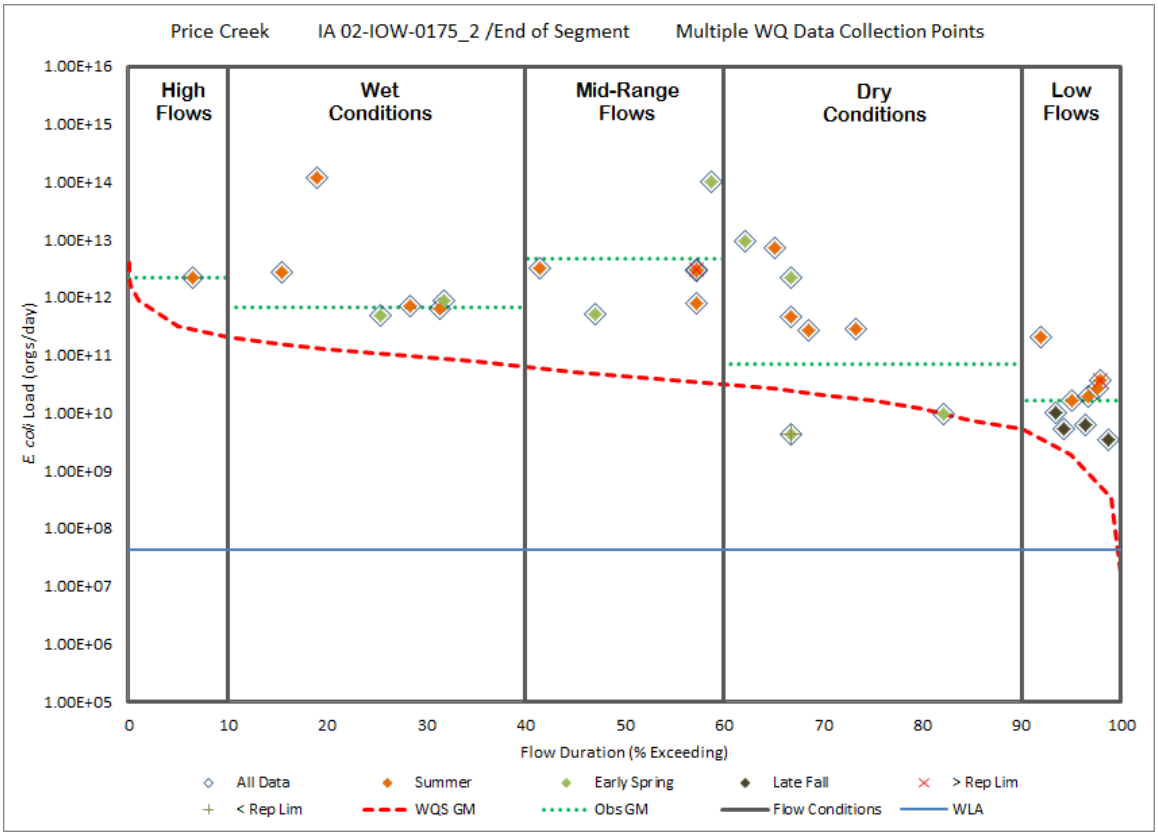

Figure 5-13. Load Duration Curve, Price Creek, Segment IA 02-IOW-0175_2.

Table 5-15. Existing Load Estimates for Price Creek, Segment IA 02-IOW-0175_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.17E+12	6.90E+11	4.73E+12	7.11E+10	1.61E+10
GM Departure (% Reduction)	1.85E+12 (85.3)	5.79E+11 (84.0)	4.69E+12 (99.1)	5.48E+10 (77.1)	1.42E+10 (88.4)
Midpoint Flow (cfs)	103.5	35.8	14.3	5.3	0.6

Table 5-16. TMDL Summary for Price Creek, Segment IA 02-IOW-0175_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.19E+11	1.10E+11	4.41E+10	1.63E+10	1.87E+09
WLA (orgs/day)	4.29E+07	4.29E+07	4.29E+07	4.29E+07	4.29E+07
LA (orgs/day)	2.87E+11	9.93E+10	3.97E+10	1.46E+10	1.64E+09
MOS (orgs/day)	3.19E+10	1.10E+10	4.41E+09	1.63E+09	1.87E+08

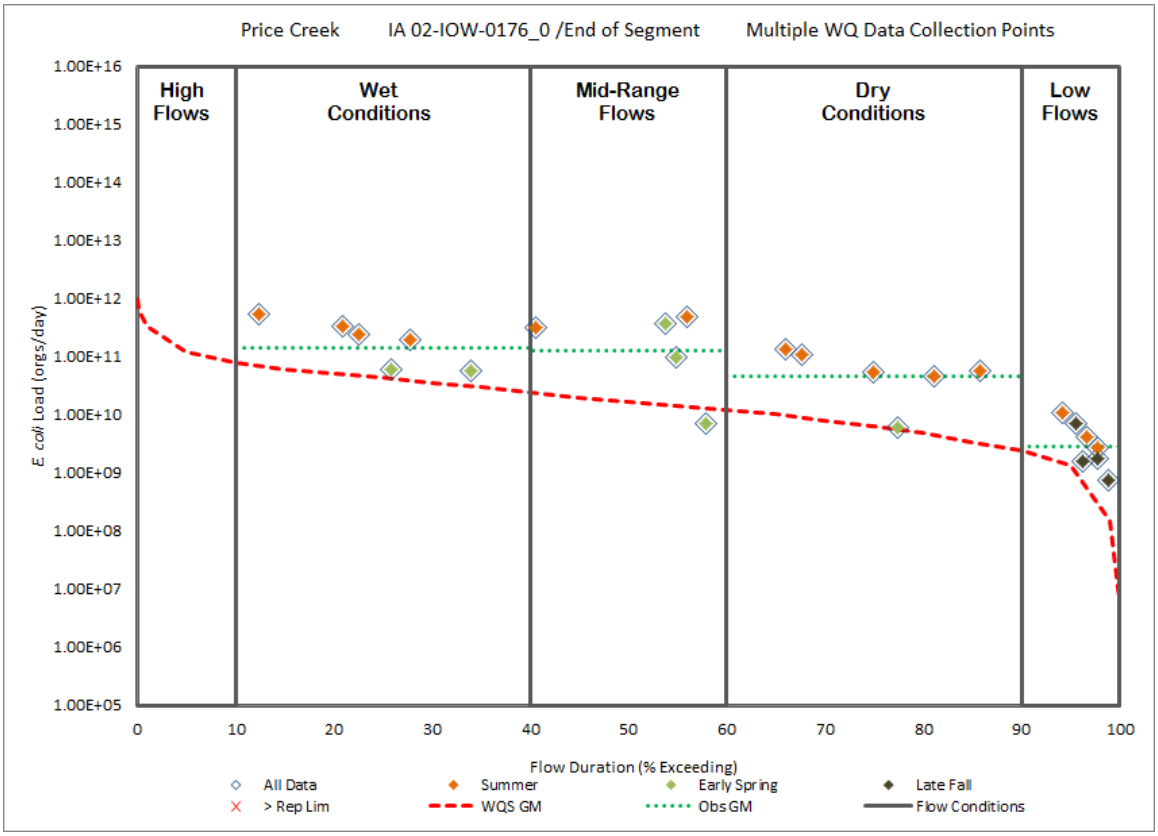

Figure 5-14. Load Duration Curve, Price Creek, Segment IA 02-IOW-0176_0.

Table 5-17. Existing Load Estimates for Price Creek, Segment IA 02-IOW-0176_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	N/A	1.40E+11	1.31E+11	4.73E+10	2.89E+09
GM Departure (% Reduction)	N/A N/A	9.71E+10 (69.2)	1.15E+11 (87.1)	4.08E+10 (86.2)	1.54E+09 (53.2)
Midpoint Flow (cfs)	39.7	14.0	5.5	2.1	0.4

Table 5-18. TMDL Summary for Price Creek, Segment IA 02-IOW-0176_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.22E+11	4.33E+10	1.69E+10	6.51E+09	1.36E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.10E+11	3.89E+10	1.52E+10	5.85E+09	1.22E+09
MOS (orgs/day)	1.22E+10	4.33E+09	1.69E+09	6.51E+08	1.36E+08

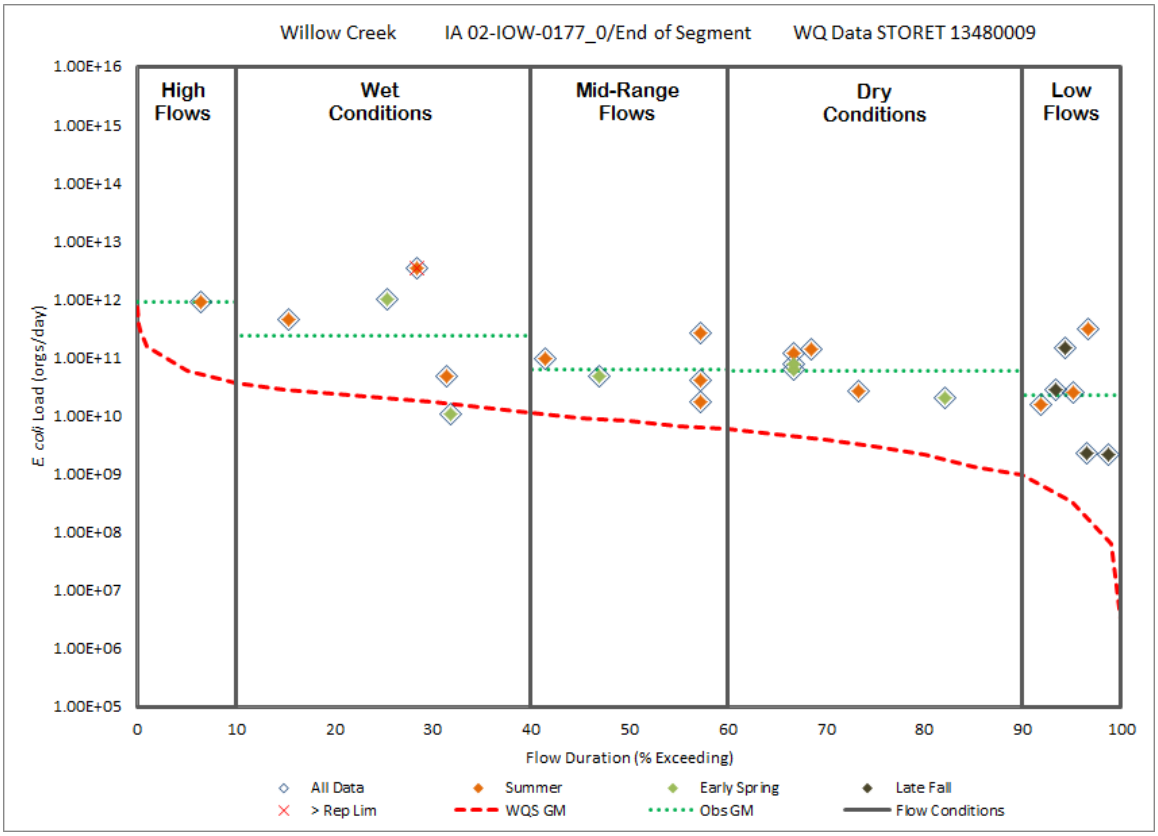

Figure 5-15. Load Duration Curve, Willow Creek, Segment IA 02-IOW-0177_0.

Table 5-19. Existing Load Estimates for Willow Creek, Segment IA 02-IOW-0177_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	8.79E+11	2.40E+11	6.11E+10	5.92E+10	2.20E+10
GM Departure (% Reduction)	8.21E+11 (93.4)	2.20E+11 (91.7)	5.31E+10 (87.0)	5.63E+10 (95.0)	2.17E+10 (98.5)
Midpoint Flow (cfs)	18.7	6.5	2.6	1.0	0.1

Table 5-20. TMDL Summary for Willow Creek, Segment IA 02-IOW-0177_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	5.76E+10	1.99E+10	7.97E+09	2.94E+09	3.37E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	5.19E+10	1.79E+10	7.17E+09	2.65E+09	3.04E+08
MOS (orgs/day)	5.76E+09	1.99E+09	7.97E+08	2.94E+08	3.37E+07

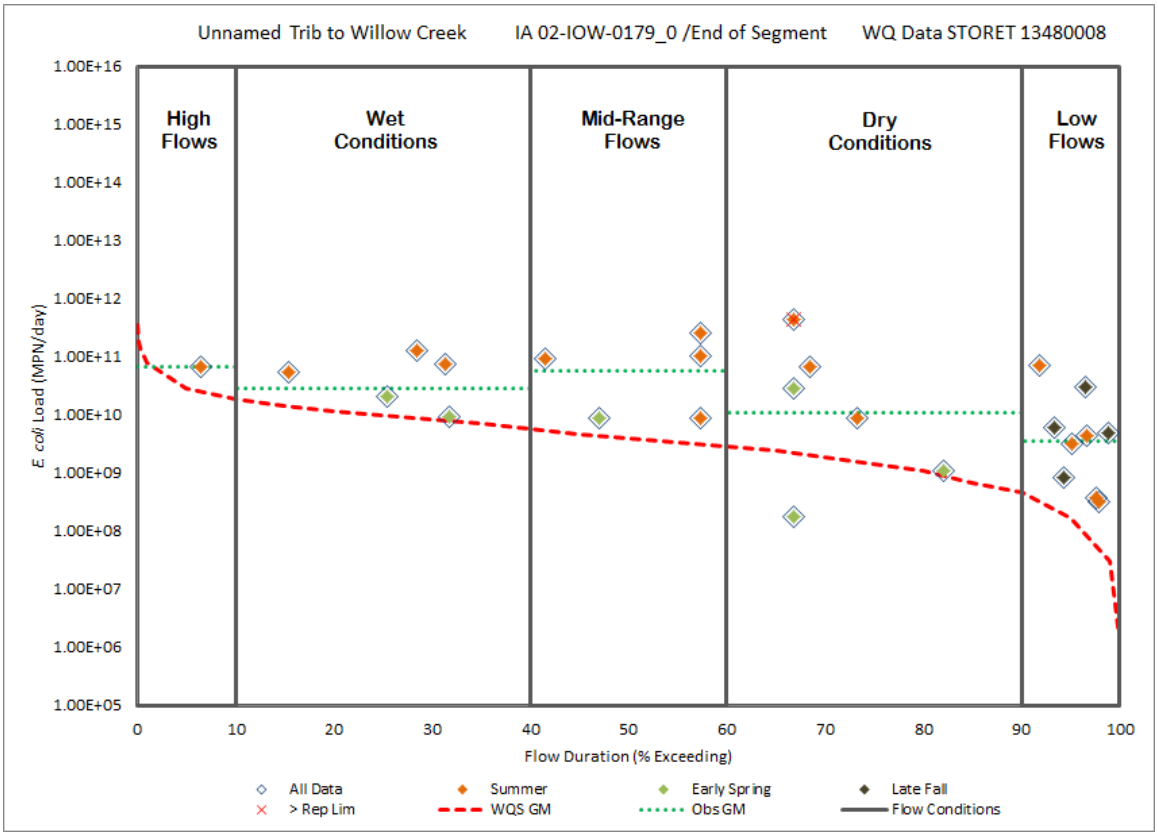

Figure 5-16. Load Duration Curve, Unnamed Tributary to Willow Creek, Segment IA 02-IOW-0179_0.

Table 5-21. Existing Load Estimates for Unnamed Tributary to Willow Creek, Segment IA 02-IOW-0179_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	6.83E+10	2.91E+10	5.88E+10	1.11E+10	3.57E+09
GM Departure (% Reduction)	3.97E+10 (58.1)	1.92E+10 (66.0)	5.48E+10 (93.3)	9.65E+09 (86.8)	3.40E+09 (95.3)
Midpoint Flow (cfs)	9.3	3.2	1.3	0.5	0.1

Table 5-22. TMDL Summary for Unnamed Tributary to Willow Creek, Segment IA 02-IOW-0179_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.86E+10	9.89E+09	3.96E+09	1.46E+09	1.67E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	2.57E+10	8.90E+09	3.56E+09	1.32E+09	1.51E+08
MOS(orgs/day)	2.86E+09	9.89E+08	3.96E+08	1.46E+08	1.67E+07

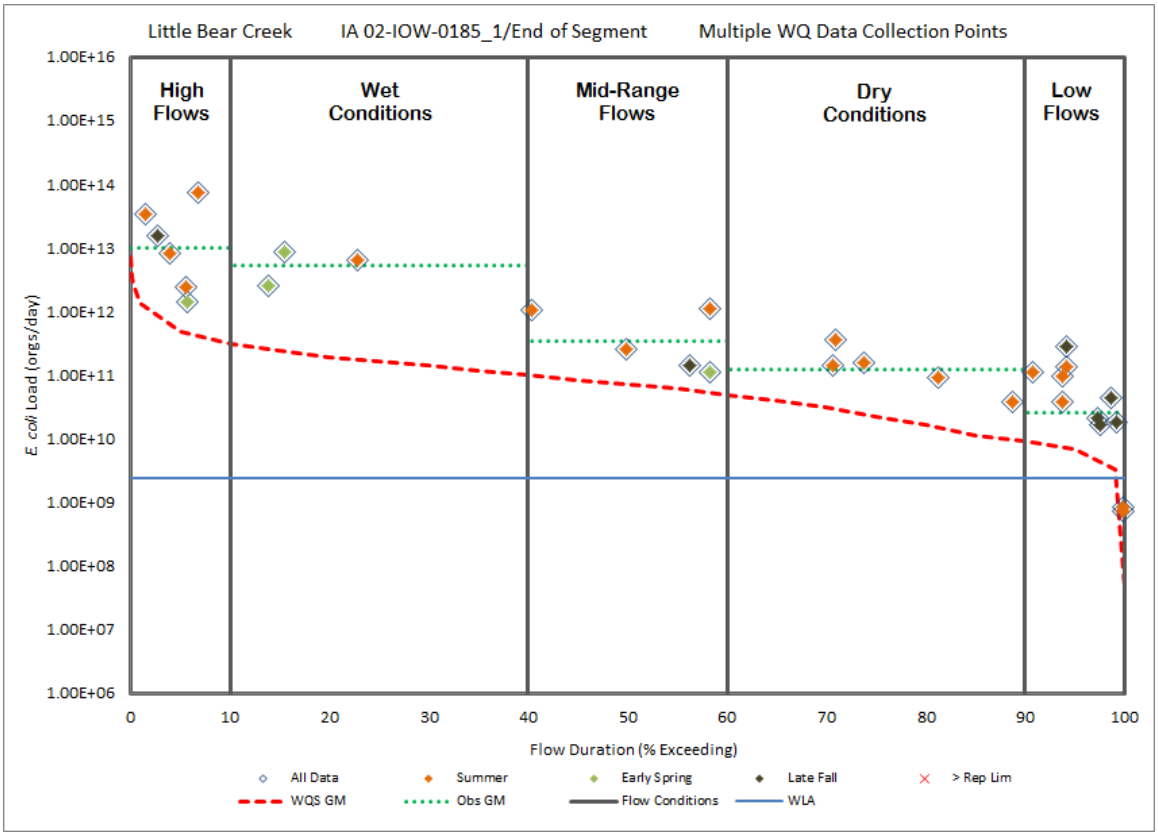

Figure 5-17. Load Duration Curve, Little Bear Creek, Segment IA 02-IOW-0185_1.

Table 5-23. Existing Load Estimates for Little Bear Creek, Segment IA 02-IOW-0185_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.01E+13	5.27E+12	3.43E+11	1.22E+11	2.53E+10
GM Departure (% Reduction)	9.67E+12 (95.3)	5.11E+12 (96.9)	2.72E+11 (79.2)	9.97E+10 (81.7)	1.85E+10 (73.2)
Midpoint Flow (cfs)	154.5	52.5	23.2	7.3	2.2

Table 5-24. TMDL Summary for Little Bear Creek, Segment IA 02-IOW-0185_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	4.76E+11	1.62E+11	7.16E+10	2.24E+10	6.78E+09
WLA (orgs/day)	2.38E+09	2.38E+09	2.38E+09	2.38E+09	2.38E+09
LA (orgs/day)	4.26E+11	1.43E+11	6.20E+10	1.77E+10	3.72E+09
MOS (orgs/day)	4.76E+10	1.62E+10	7.16E+09	2.24E+09	6.78E+08

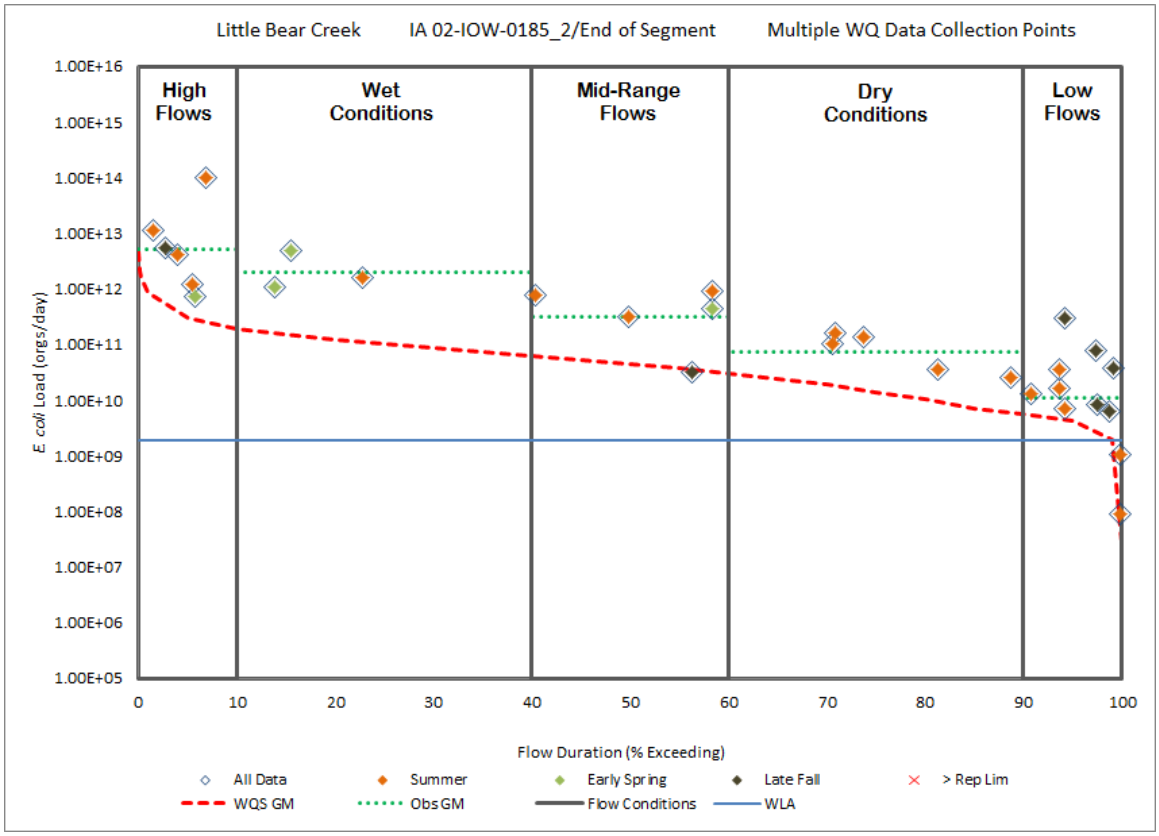

Figure 5-18. Load Duration Curve, Little Bear Creek, Segment IA 02-IOW-0185_2.

Table 5-25. Existing Load Estimates for Little Bear Creek, Segment IA 02-IOW-0185_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	5.33E+12	2.05E+12	3.18E+11	7.47E+10	1.09E+10
GM Departure (% Reduction)	5.03E+12 (94.4)	1.95E+12 (95.1)	2.73E+11 (85.9)	6.06E+10 (81.2)	6.62E+09 (60.9)
Midpoint Flow (cfs)	97.0	33.0	14.6	4.6	1.4

Table 5-26. TMDL Summary for Little Bear Creek, Segment IA 02-IOW-0185_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.99E+11	1.02E+11	4.49E+10	1.40E+10	4.26E+09
WLA (orgs/day)	1.89E+09	1.89E+09	1.89E+09	1.89E+09	1.89E+09
LA (orgs/day)	2.67E+11	8.95E+10	3.86E+10	1.08E+10	1.95E+09
MOS (orgs/day)	2.99E+10	1.02E+10	4.49E+09	1.40E+09	4.26E+08

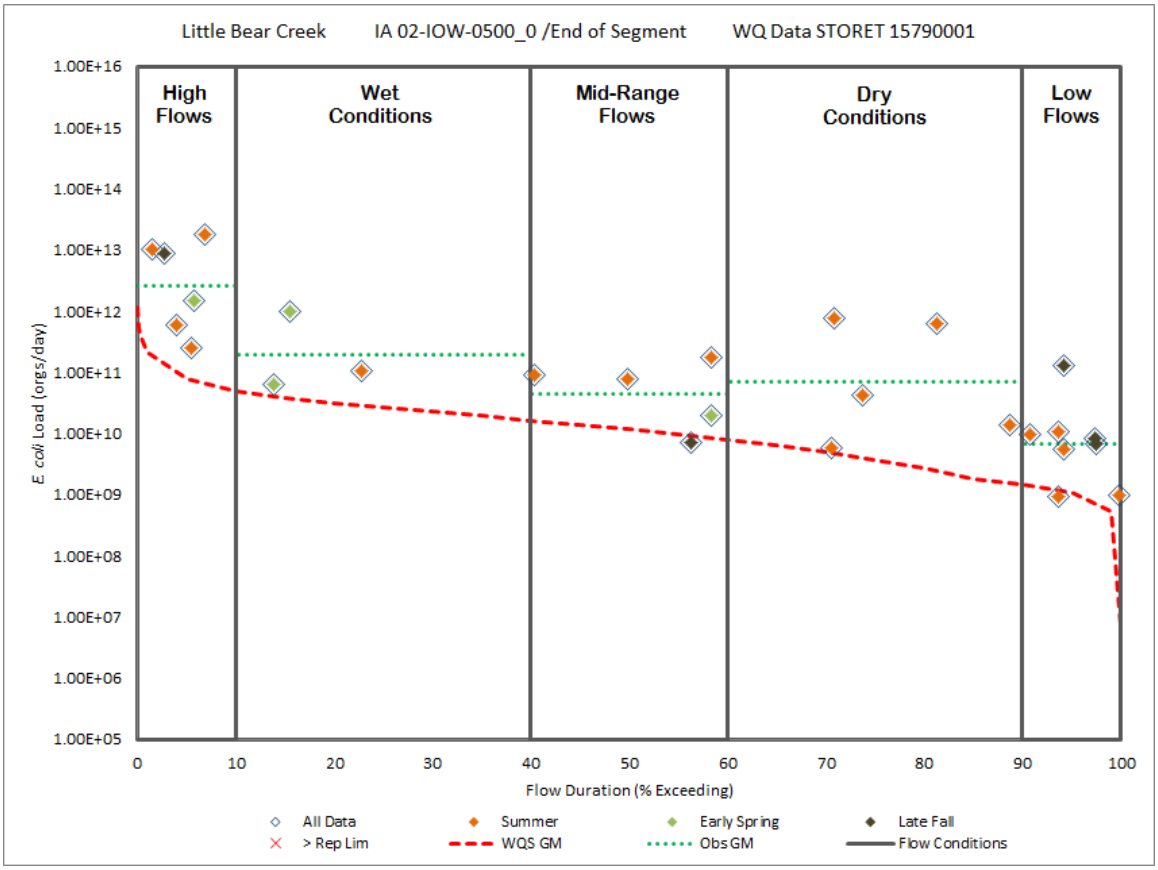

Figure 5-19. Load Duration Curve, Little Bear Creek, Segment IA 02-IOW-0500_0.

Table 5-27. Existing Load Estimates for Little Bear Creek, Segment IA 02-IOW-0500_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.67E+12	1.90E+11	4.48E+10	6.91E+10	6.69E+09
GM Departure (% Reduction)	2.59E+12 (97.1)	1.64E+11 (86.2)	3.31E+10 (74.0)	6.54E+10 (94.7)	5.58E+09 (83.5)
Midpoint Flow (cfs)	25.2	8.5	3.8	1.2	0.4

Table 5-28. TMDL Summary for Little Bear Creek, Segment IA 02-IOW-0500_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	7.75E+10	2.63E+10	1.16E+10	3.64E+09	1.10E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	6.98E+10	2.37E+10	1.05E+10	3.28E+09	9.94E+08
MOS (orgs/day)	7.75E+09	2.63E+09	1.16E+09	3.64E+08	1.10E+08

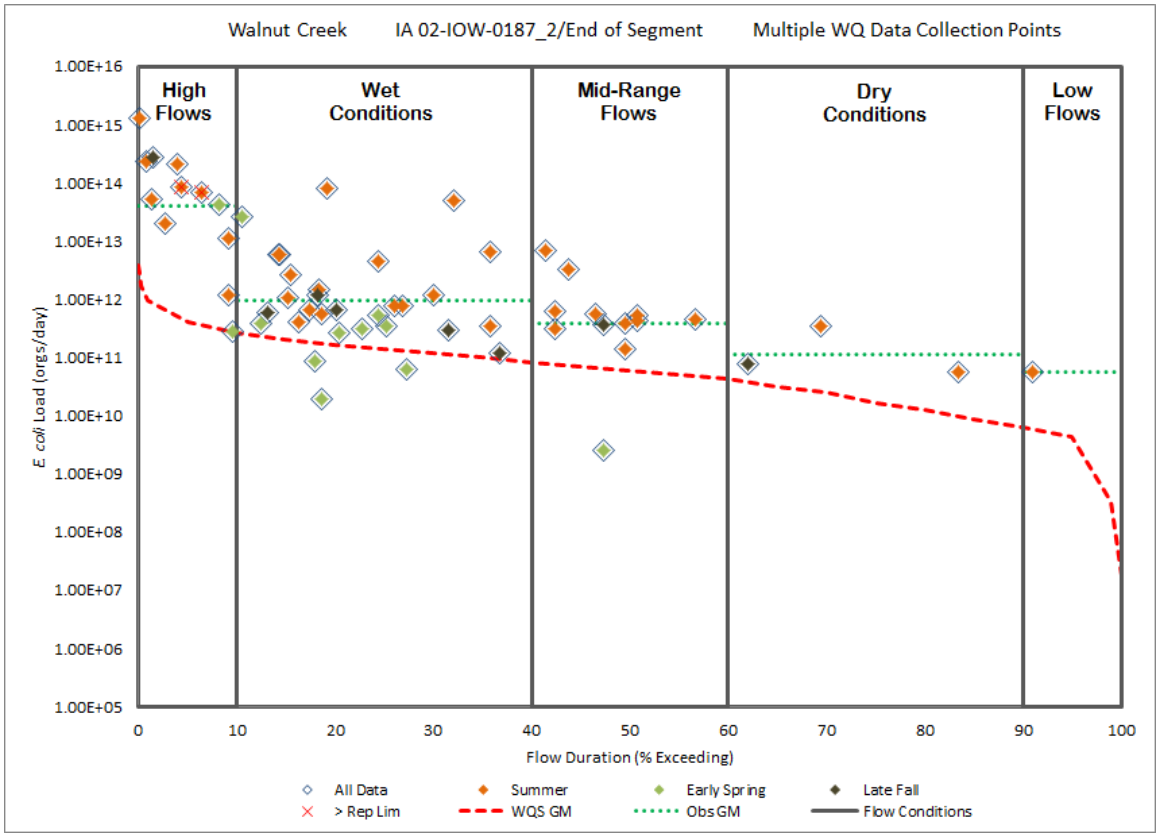

Figure 5-20. Load Duration Curve, Walnut Creek, Segment IA 02-IOW-0187_2.

Table 5-29. Existing Load Estimates for Walnut Creek, Segment IA 02-IOW-0187_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	4.01E+13	9.49E+11	3.90E+11	1.16E+11	5.68E+10
GM Departure (% Reduction)	3.97E+13 (99.0)	8.08E+11 (85.2)	3.31E+11 (84.9)	9.87E+10 (85.4)	5.25E+10 (92.5)
Midpoint Flow (cfs)	133.6	45.7	19.1	5.5	1.4

Table 5-30. TMDL Summary for Walnut Creek, Segment IA 02-IOW-0187_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	4.12E+11	1.41E+11	5.88E+10	1.69E+10	4.28E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	3.71E+11	1.27E+11	5.29E+10	1.52E+10	3.85E+09
MOS (orgs/day)	4.12E+10	1.41E+10	5.88E+09	1.69E+09	4.28E+08

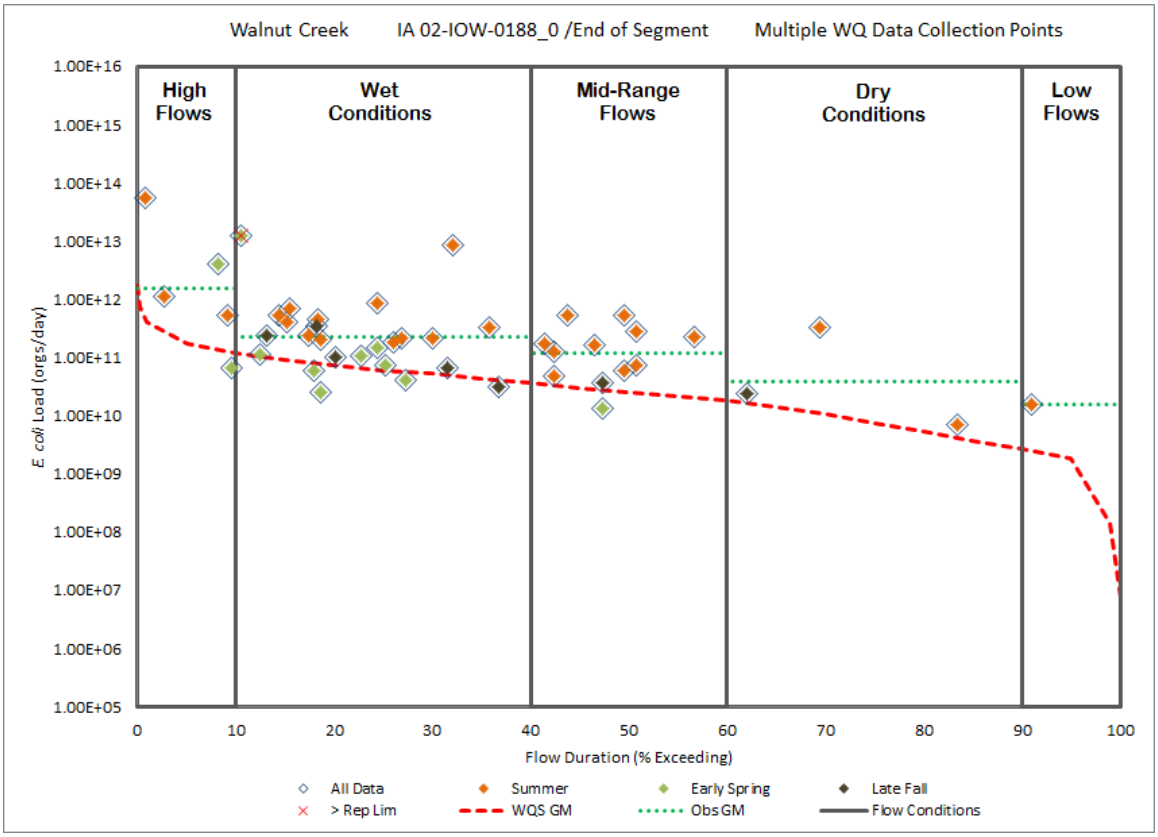

Figure 5-21. Load Duration Curve, Walnut Creek, Segment IA 02-IOW-0188_0.

Table 5-31. Existing Load Estimates for Walnut Creek, Segment IA 02-IOW-0188_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.55E+12	2.32E+11	1.18E+11	3.83E+10	1.56E+10
GM Departure (% Reduction)	1.37E+12 (88.5)	1.71E+11 (73.8)	9.24E+10 (78.4)	3.09E+10 (80.9)	1.37E+10 (88.1)
Midpoint Flow (cfs)	57.7	19.7	8.2	2.4	0.6

Table 5-32. TMDL Summary for Walnut Creek, Segment IA 02-IOW-0188_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.78E+11	6.08E+10	2.54E+10	7.31E+09	1.85E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.60E+11	5.47E+10	2.29E+10	6.58E+09	1.66E+09
MOS (orgs/day)	1.78E+10	6.08E+09	2.54E+09	7.31E+08	1.85E+08

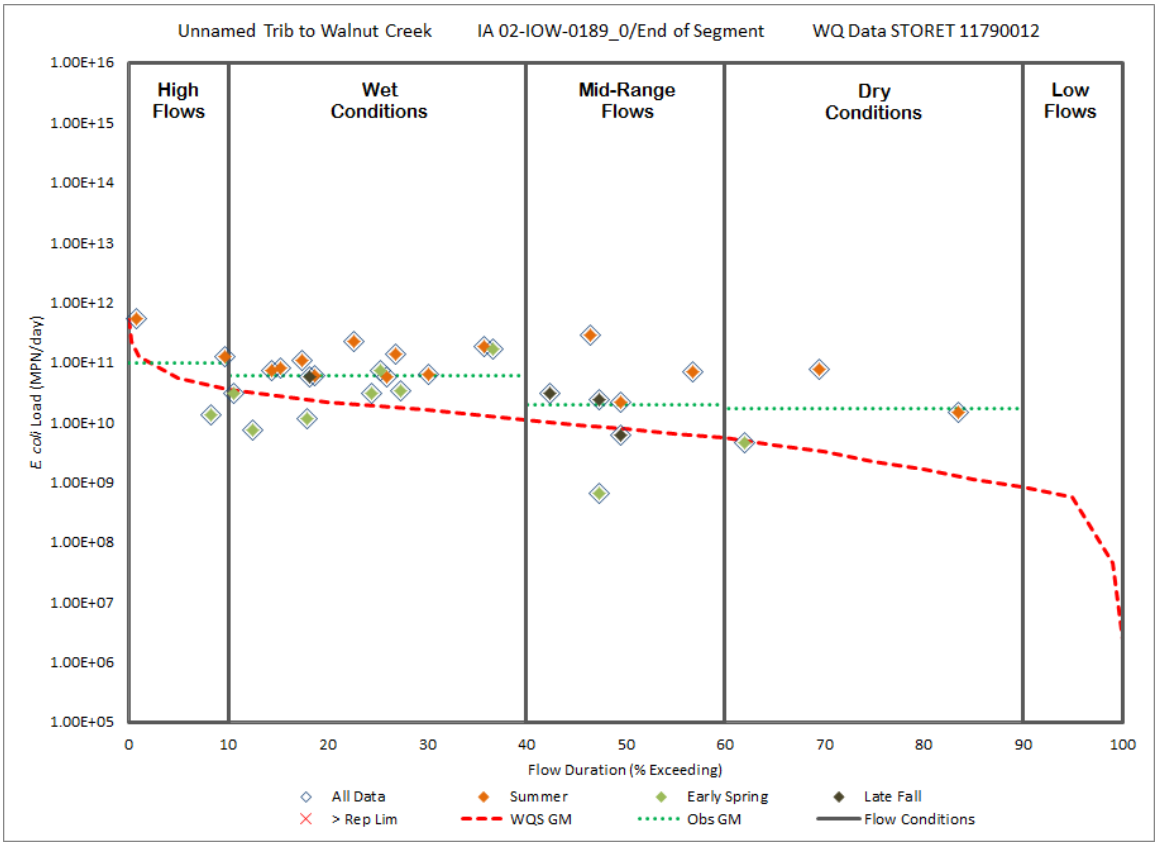

Figure 5-22. Load Duration Curve, Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0189_0.

Table 5-33. Existing Load Estimates for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0189_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	9.61E+10	5.94E+10	1.99E+10	1.72E+10	N/A
GM Departure (% Reduction)	4.23E+10 (44.0)	4.11E+10 (69.1)	1.23E+10 (61.5)	1.50E+10 (87.2)	N/A N/A
Midpoint Flow (cfs)	17.4	6.0	2.5	0.7	0.2

Table 5-34. TMDL Summary for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0189_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	5.38E+10	1.84E+10	7.68E+09	2.21E+09	5.58E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	4.84E+10	1.65E+10	6.91E+09	1.99E+09	5.02E+08
MOS (orgs/day)	5.38E+09	1.84E+09	7.68E+08	2.21E+08	5.58E+07

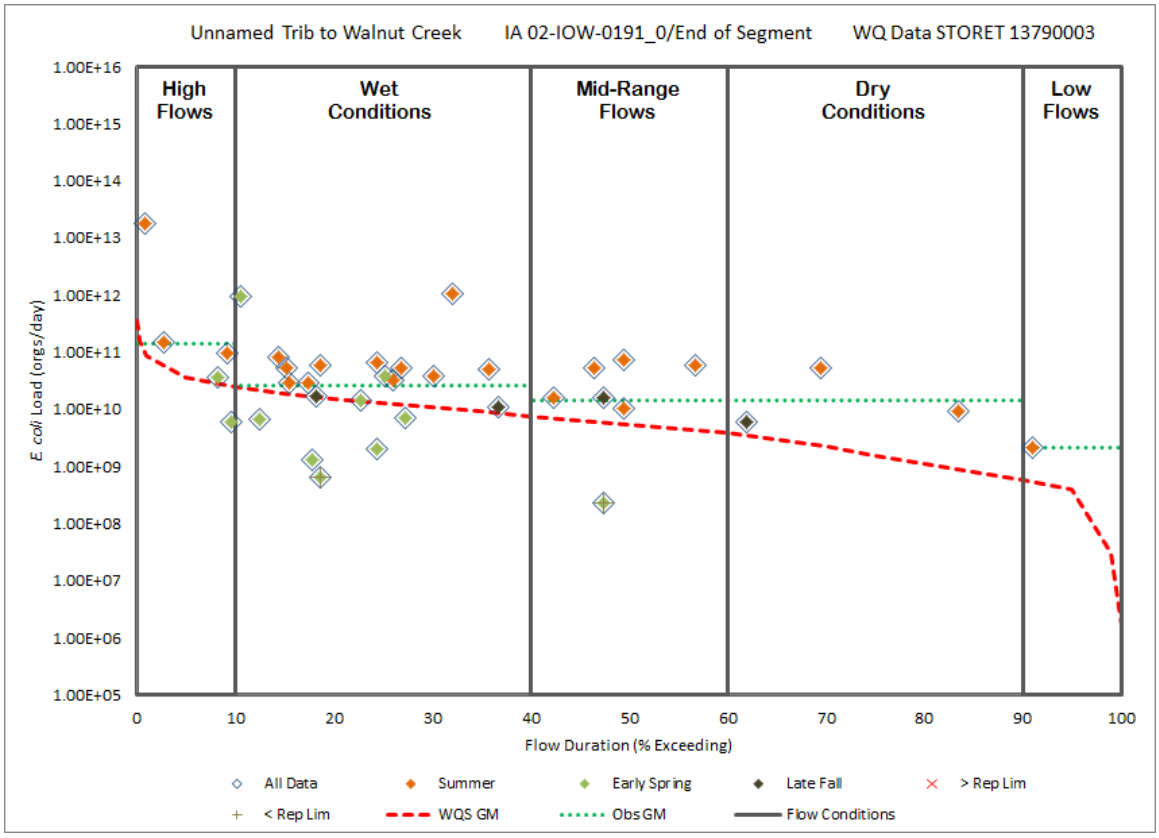

Figure 5-23. Load Duration Curve, Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0191_0.

Table 5-35. Existing Load Estimates for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0191_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.41E+11	2.58E+10	1.46E+10	1.42E+10	2.17E+09
GM Departure (% Reduction)	1.04E+11 (73.6)	1.31E+10 (50.7)	9.31E+09 (63.7)	1.27E+10 (89.3)	1.78E+09 (82.2)
Midpoint Flow (cfs)	12.1	4.1	1.7	0.5	0.1

Table 5-36. TMDL Summary for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0191_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.72E+10	1.27E+10	5.31E+09	1.53E+09	3.86E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	3.35E+10	1.14E+10	4.78E+09	1.38E+09	3.47E+08
MOS (orgs/day)	3.72E+09	1.27E+09	5.31E+08	1.53E+08	3.86E+07

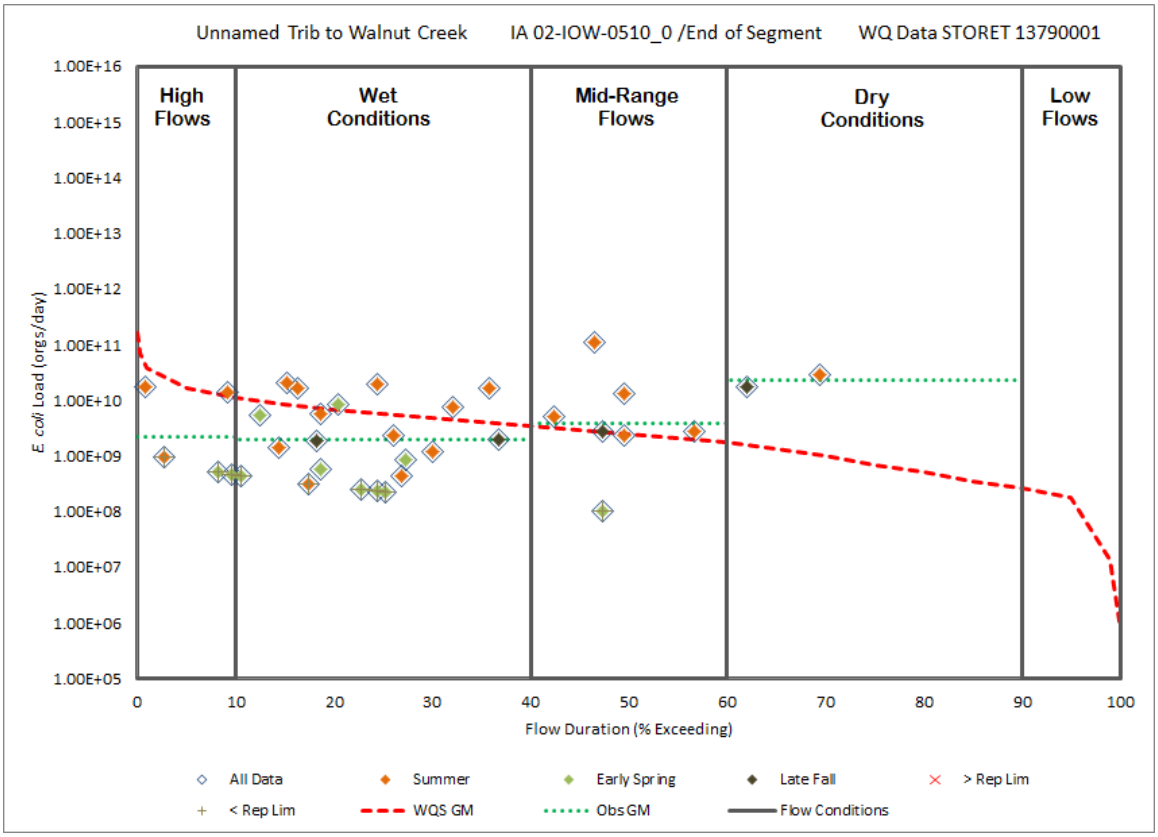

Figure 5-24. Load Duration Curve, Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0510_0.

Table 5-37. Existing Load Estimates for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0510_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.23E+09	1.96E+09	3.94E+09	2.31E+10	N/A
GM Departure (% Reduction)	-1.47E+10 (0)	-3.85E+09 (0)	1.51E+09 (38.4)	2.24E+10 (97.0)	N/A (N/A)
Midpoint Flow (cfs)	5.5	1.9	0.8	0.2	0.1

Table 5-38. TMDL Summary for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0510_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.70E+10	5.80E+09	2.42E+09	6.98E+08	1.76E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.53E+10	5.22E+09	2.18E+09	6.28E+08	1.59E+08
MOS (orgs/day)	1.70E+09	5.80E+08	2.42E+08	6.98E+07	1.76E+07

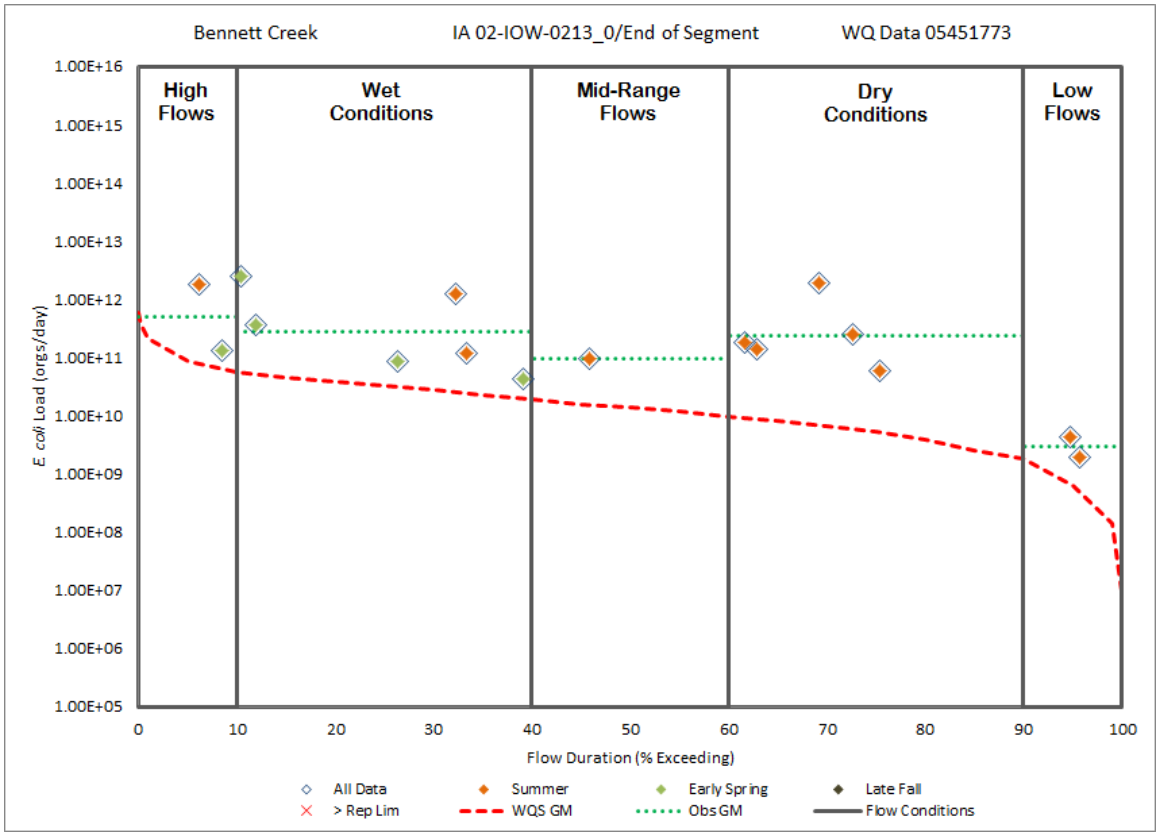

Figure 5-25. Load Duration Curve, Bennett Creek, Segment IA 02-IOW-0213_0, @ Meskwaki Settlement Border.

Table 5-39. Existing Load Estimates for Bennett Creek, Segment IA 02-IOW-0213_0, @ Meskwaki Settlement Border.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	4.27E+11	2.30E+11	7.22E+10	1.68E+11	1.70E+09
GM Departure (% Reduction)	3.52E+11 (82.4)	2.03E+11 (88.5)	6.18E+10 (85.6)	1.64E+11 (97.8)	1.34E+09 (78.9)
Midpoint Flow (cfs)	24.4	8.5	3.4	1.2	0.1

Table 5-40. TMDL Summary for Bennett Creek, Segment IA 02-IOW-0213_0, @ Meskwaki Settlement Border.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	7.51E+10	2.63E+10	1.04E+10	3.70E+09	3.59E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	6.76E+10	2.37E+10	9.34E+09	3.33E+09	3.23E+08
MOS (orgs/day)	7.51E+09	2.63E+09	1.04E+09	3.70E+08	3.59E+07

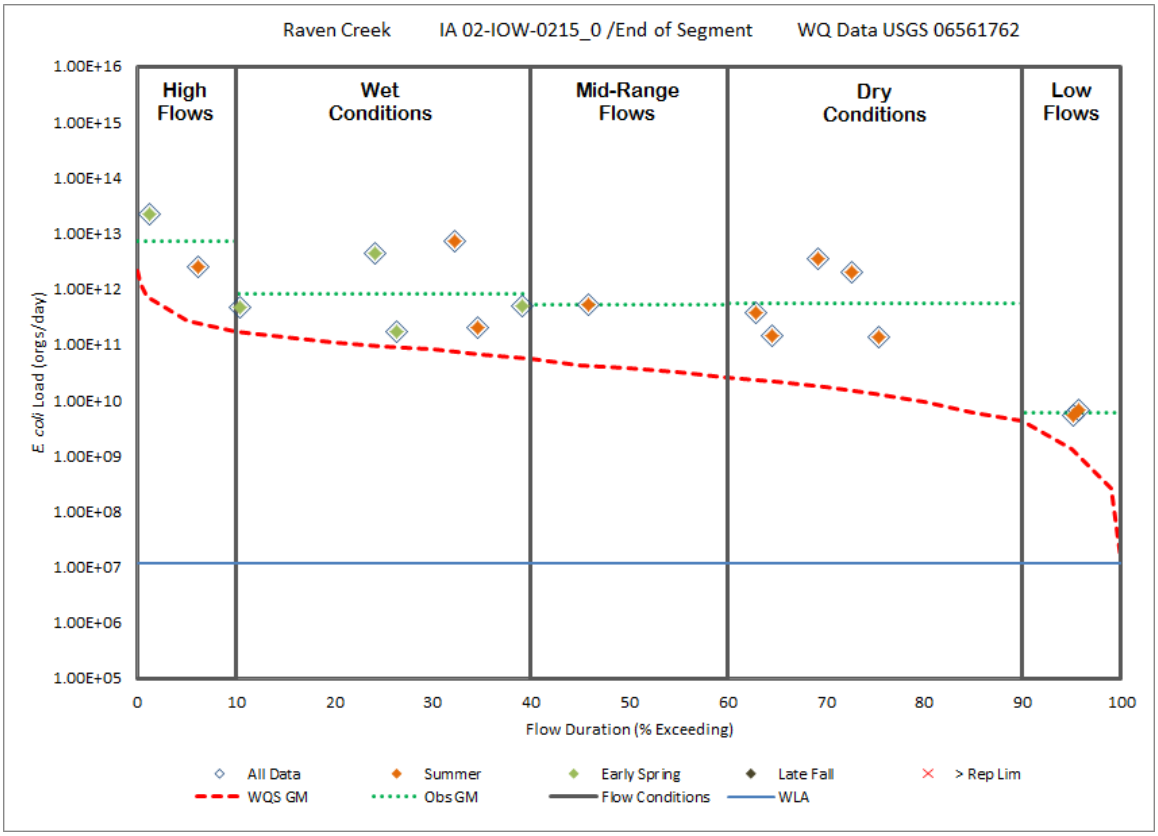

Figure 5-26. Load Duration Curve, Raven Creek, Segment IA 02-IOW-0215_0.

Table 5-41. Existing Load Estimates for Raven Creek, Segment IA 02-IOW-0215_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	7.41E+12	8.01E+11	5.16E+11	5.52E+11	6.05E+09
GM Departure (% Reduction)	7.14E+12 (96.3)	7.06E+11 (88.1)	4.79E+11 (92.7)	5.38E+11 (97.6)	4.75E+09 (78.5)
Midpoint Flow (cfs)	88.3	30.9	12.2	4.3	0.4

Table 5-42. TMDL Summary for Raven Creek, Segment IA 02-IOW-0215_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.72E+11	9.54E+10	3.76E+10	1.34E+10	1.30E+09
WLA (orgs/day)	1.14E+07	1.14E+07	1.14E+07	1.14E+07	1.14E+07
LA (orgs/day)	2.45E+11	8.58E+10	3.38E+10	1.21E+10	1.16E+09
MOS (orgs/day)	2.72E+10	9.54E+09	3.76E+09	1.34E+09	1.30E+08

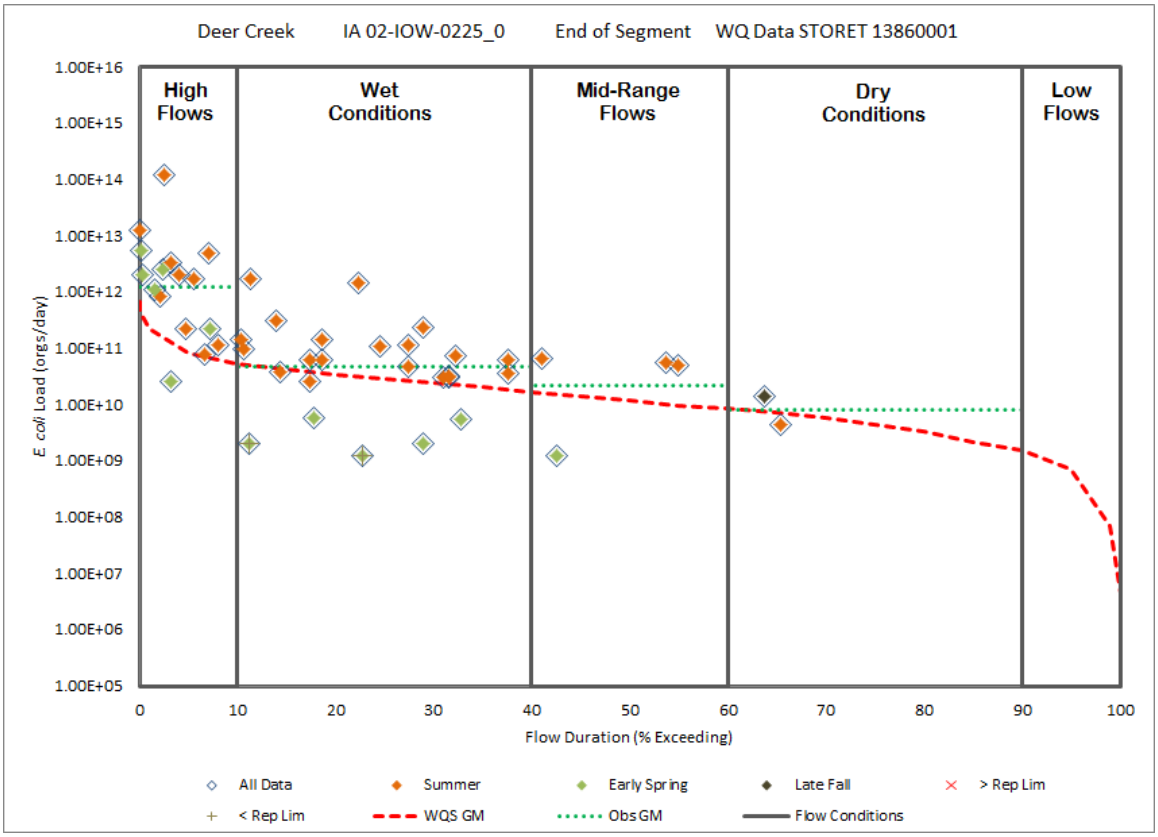

Figure 5-27. Load Duration Curve, Deer Creek, Segment IA 02-IOW-0225_0.

Table 5-43. Existing Load Estimates for Deer Creek, Segment IA 02-IOW-0225_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.21E+12	4.70E+10	2.17E+10	8.03E+09	N/A
GM Departure (% Reduction)	1.13E+12 (93.2)	1.78E+10 (37.8)	1.02E+10 (47.0)	3.68E+09 (45.8)	N/A (N/A)
Midpoint Flow (cfs)	26.5	9.5	3.7	1.4	0.2

Table 5-44. TMDL Summary for Deer Creek, Segment IA 02-IOW-0225_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	8.17E+10	2.92E+10	1.15E+10	4.35E+09	7.09E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	7.36E+10	2.63E+10	1.04E+10	3.92E+09	6.38E+08
MOS (orgs/day)	8.17E+09	2.92E+09	1.15E+09	4.35E+08	7.09E+07

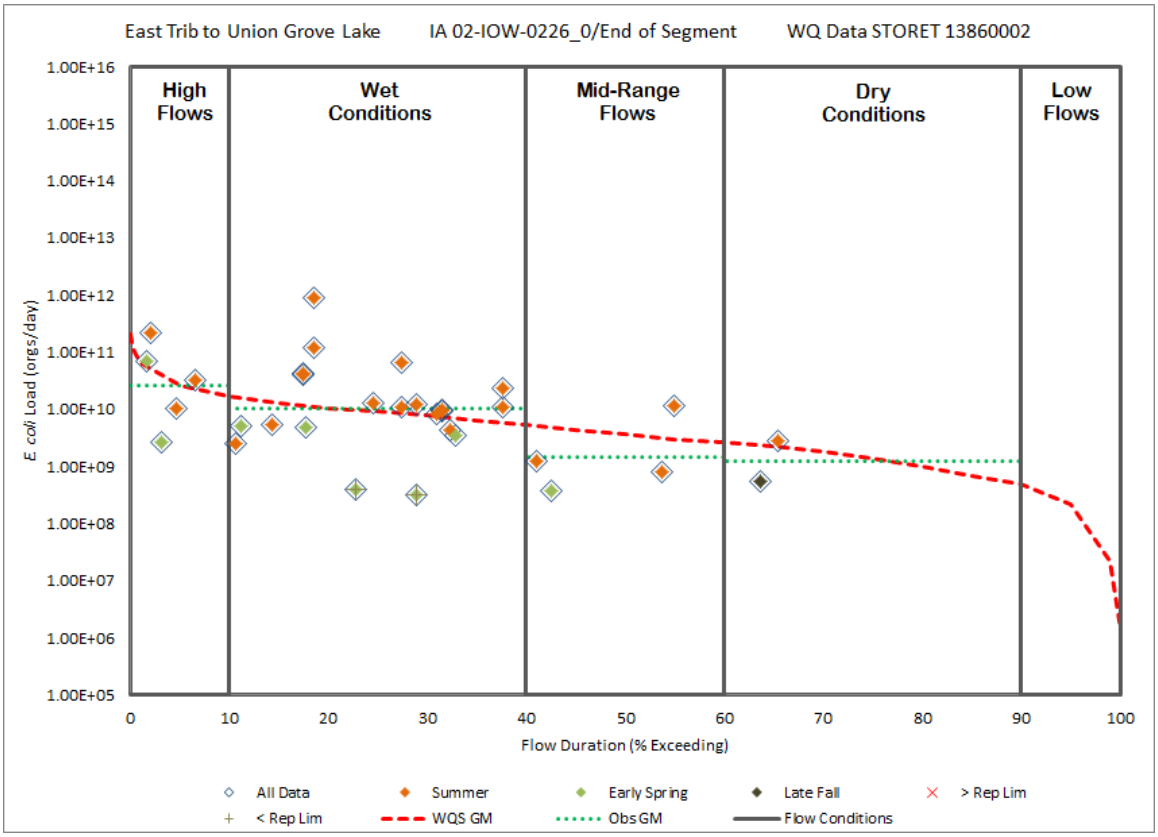

Figure 5-28. Load Duration Curve, East Tributary to Union Grove Lake, Segment IA 02-IOW-0226_0.

Table 5-45. Existing Load Estimates for the East Tributary to Union Grove Lake, Segment IA 02-IOW-0226_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.65E+10	1.05E+10	1.45E+09	1.26E+09	N/A
GM Departure (% Reduction)	9.04E+08 (3.4)	1.40E+09 (13.3)	-2.15E+09 (0)	-1.05E+08 (0)	N/A (N/A)
Midpoint Flow (cfs)	8.3	3.0	1.2	0.4	0.1

Table 5-46. TMDL Summary for the East Tributary to Union Grove Lake, Segment IA 02-IOW-0226_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.56E+10	9.14E+09	3.60E+09	1.36E+09	2.22E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	2.30E+10	8.23E+09	3.24E+09	1.22E+09	1.99E+08
MOS (orgs/day)	2.56E+09	9.14E+08	3.60E+08	1.36E+08	2.22E+07

5.5. TMDL Summary

This TMDL is based on meeting the water quality criteria for primary contact and children's recreation in the Middle Iowa HUC-8 watershed. Although the WQS are based on *E. coli* concentration, the TMDL is also expressed as a load, in light of the November 2006 EPA memorandum. The following equation represents the total maximum daily load (TMDL) and its components:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

Where: TMDL = total maximum daily load
LC = loading capacity
ΣWLA = sum of wasteload allocations (point sources)
ΣLA = sum of load allocations (nonpoint sources)
MOS = margin of safety (to account for uncertainty)

Once the components of the TMDL are determined, the general equation above can be expressed for each segment and flow.

Table 5-47. TMDL Summary by Segment for the Middle Iowa HUC-8 Watershed.

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Iowa River, IA 02-IOW-0050_1				
High Flow	3.12E+13	7.99E+10	2.80E+13	3.12E+12
Moist	1.24E+13	7.99E+10	1.11E+13	1.24E+12
Mid-Range	5.92E+12	7.99E+10	5.25E+12	5.92E+11
Dry	2.24E+12	7.99E+10	1.94E+12	2.24E+11
Low Flow	8.01E+11	7.99E+10	6.41E+11	8.01E+10
Iowa River, IA 02-IOW-0060_4				
High Flow	1.76E+13	2.42E+11	1.56E+13	1.76E+12
Moist	6.50E+12	2.42E+11	5.61E+12	6.50E+11
Mid-Range	2.91E+12	2.42E+11	2.38E+12	2.91E+11
Dry	1.14E+12	2.42E+11	7.80E+11	1.14E+11
Low Flow	3.63E+11	2.42E+11	8.49E+10	3.63E+10
Iowa River, IA 02-IOW-0060_5				
High Flow	1.60E+13	1.20E+09	1.44E+13	1.60E+12
Moist	5.82E+12	1.20E+09	5.24E+12	5.82E+11
Mid-Range	2.50E+12	1.20E+09	2.25E+12	2.50E+11
Dry	9.82E+11	1.20E+09	8.83E+11	9.82E+10
Low Flow	3.23E+11	1.20E+09	2.89E+11	3.23E+10
Price Creek, IA 02-IOW-0175_2				
High Flow	3.19E+11	4.29E+07	2.87E+11	3.19E+10
Moist	1.10E+11	4.29E+07	9.93E+10	1.10E+10
Mid-Range	4.41E+10	4.29E+07	3.97E+10	4.41E+09
Dry	1.63E+10	4.29E+07	1.46E+10	1.63E+09
Low Flow	1.87E+09	4.29E+07	1.64E+09	1.87E+08

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Price Creek, IA 02-IOW-0176_0				
High Flow	1.22E+11	0.00E+00	1.10E+11	1.22E+10
Moist	4.33E+10	0.00E+00	3.89E+10	4.33E+09
Mid-Range	1.69E+10	0.00E+00	1.52E+10	1.69E+09
Dry	6.51E+09	0.00E+00	5.85E+09	6.51E+08
Low Flow	1.36E+09	0.00E+00	1.22E+09	1.36E+08
Willow Creek, IA 02-IOW-0177_0				
High Flow	5.76E+10	0.00E+00	5.19E+10	5.76E+09
Moist	1.99E+10	0.00E+00	1.79E+10	1.99E+09
Mid-Range	7.97E+09	0.00E+00	7.17E+09	7.97E+08
Dry	2.94E+09	0.00E+00	2.65E+09	2.94E+08
Low Flow	3.37E+08	0.00E+00	3.04E+08	3.37E+07
Unnamed Tributary to Willow Creek, IA 02-IOW-0179_0				
High Flow	2.86E+10	0.00E+00	2.57E+10	2.86E+09
Moist	9.89E+09	0.00E+00	8.90E+09	9.89E+08
Mid-Range	3.96E+09	0.00E+00	3.56E+09	3.96E+08
Dry	1.46E+09	0.00E+00	1.32E+09	1.46E+08
Low Flow	1.67E+08	0.00E+00	1.51E+08	1.67E+07
Little Bear Creek, IA 02-IOW-0185_1				
High Flow	4.76E+11	2.38E+09	4.26E+11	4.76E+10
Moist	1.62E+11	2.38E+09	1.43E+11	1.62E+10
Mid-Range	7.16E+10	2.38E+09	6.20E+10	7.16E+09
Dry	2.24E+10	2.38E+09	1.77E+10	2.24E+09
Low Flow	6.78E+09	2.38E+09	3.72E+09	6.78E+08
Little Bear Creek, IA 02-IOW-0185_2				
High Flow	2.99E+11	1.89E+09	2.67E+11	2.99E+10
Moist	1.02E+11	1.89E+09	8.95E+10	1.02E+10
Mid-Range	4.49E+10	1.89E+09	3.86E+10	4.49E+09
Dry	1.40E+10	1.89E+09	1.08E+10	1.40E+09
Low Flow	4.26E+09	1.89E+09	1.95E+09	4.26E+08
Little Bear Creek, IA 02-IOW-0500_0				
High Flow	7.75E+10	0.00E+00	6.98E+10	7.75E+09
Moist	2.63E+10	0.00E+00	2.37E+10	2.63E+09
Mid-Range	1.16E+10	0.00E+00	1.05E+10	1.16E+09
Dry	3.64E+09	0.00E+00	3.28E+09	3.64E+08
Low Flow	1.10E+09	0.00E+00	9.94E+08	1.10E+08

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Walnut Creek, IA 02-IOW-0187_2				
High Flow	4.12E+11	0.00E+00	3.71E+11	4.12E+10
Moist	1.41E+11	0.00E+00	1.27E+11	1.41E+10
Mid-Range	5.88E+10	0.00E+00	5.29E+10	5.88E+09
Dry	1.69E+10	0.00E+00	1.52E+10	1.69E+09
Low Flow	4.28E+09	0.00E+00	3.85E+09	4.28E+08
Walnut Creek, IA 02-IOW-0188_0				
High Flow	1.78E+11	0.00E+00	1.60E+11	1.78E+10
Moist	6.08E+10	0.00E+00	5.47E+10	6.08E+09
Mid-Range	2.54E+10	0.00E+00	2.29E+10	2.54E+09
Dry	7.31E+09	0.00E+00	6.58E+09	7.31E+08
Low Flow	1.85E+09	0.00E+00	1.66E+09	1.85E+08
Unnamed Tributary to Walnut Creek, IA 02-IOW-0189_0				
High Flow	5.38E+10	0.00E+00	4.84E+10	5.38E+09
Moist	1.84E+10	0.00E+00	1.65E+10	1.84E+09
Mid-Range	7.68E+09	0.00E+00	6.91E+09	7.68E+08
Dry	2.21E+09	0.00E+00	1.99E+09	2.21E+08
Low Flow	5.58E+08	0.00E+00	5.02E+08	5.58E+07
Unnamed Tributary to Walnut Creek, IA 02-IOW-0191_0				
High Flow	3.72E+10	0.00E+00	3.35E+10	3.72E+09
Moist	1.27E+10	0.00E+00	1.14E+10	1.27E+09
Mid-Range	5.31E+09	0.00E+00	4.78E+09	5.31E+08
Dry	1.53E+09	0.00E+00	1.38E+09	1.53E+08
Low Flow	3.86E+08	0.00E+00	3.47E+08	3.86E+07
Unnamed Tributary to Walnut Creek, IA 02-IOW-0510_0				
High Flow	1.70E+10	0.00E+00	1.53E+10	1.70E+09
Moist	5.80E+09	0.00E+00	5.22E+09	5.80E+08
Mid-Range	2.42E+09	0.00E+00	2.18E+09	2.42E+08
Dry	6.98E+08	0.00E+00	6.28E+08	6.98E+07
Low Flow	1.76E+08	0.00E+00	1.59E+08	1.76E+07
Bennett Creek, IA 02-IOW-0213_0				
High Flow	7.51E+10	0.00E+00	6.76E+10	7.51E+09
Moist	2.63E+10	0.00E+00	2.37E+10	2.63E+09
Mid-Range	1.04E+10	0.00E+00	9.34E+09	1.04E+09
Dry	3.70E+09	0.00E+00	3.33E+09	3.70E+08
Low Flow	3.59E+08	0.00E+00	3.23E+08	3.59E+07

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Raven Creek, IA 02-IOW-0215_0				
High Flow	2.72E+11	1.14E+07	2.45E+11	2.72E+10
Moist	9.54E+10	1.14E+07	8.58E+10	9.54E+09
Mid-Range	3.76E+10	1.14E+07	3.38E+10	3.76E+09
Dry	1.34E+10	1.14E+07	1.21E+10	1.34E+09
Low Flow	1.30E+09	1.14E+07	1.16E+09	1.30E+08
Deer Creek, IA 02-IOW-0225_0				
High Flow	8.17E+10	0.00E+00	7.36E+10	8.17E+09
Moist	2.92E+10	0.00E+00	2.63E+10	2.92E+09
Mid-Range	1.15E+10	0.00E+00	1.04E+10	1.15E+09
Dry	4.35E+09	0.00E+00	3.92E+09	4.35E+08
Low Flow	7.09E+08	0.00E+00	6.38E+08	7.09E+07
East Tributary to Union Grove Lake, IA 02-IOW-0226_0				
High Flow	2.56E+10	0.00E+00	2.30E+10	2.56E+09
Moist	9.14E+09	0.00E+00	8.23E+09	9.14E+08
Mid-Range	3.60E+09	0.00E+00	3.24E+09	3.60E+08
Dry	1.36E+09	0.00E+00	1.22E+09	1.36E+08
Low Flow	2.22E+08	0.00E+00	1.99E+08	2.22E+07

6. TMDLs for the Upper Iowa HUC-8 Watershed

6.1. Watershed/Waterbody Description

The Upper Iowa watershed (HUC-8 ID: 07080207) has a drainage area of 1,456 mi^2, comprising 30 percent of the Iowa River Basin. Nine (9) HUC-10 watersheds covering portions of Cerro Gordo, Franklin, Grundy, Hamilton, Hancock, Hardin, Marshall, Story, Winnebago, and Wright Counties, are within the Upper Iowa watershed.

Based on LiDAR data collected between 2007 and 2010, elevations in the watershed range from 856 feet NAVD 88 to 1,362 feet NAVD 88. The low point in the watershed is on land that is operated as a quarry located in Hardin County. The lowest natural point in the watershed is at the Upper Iowa and Middle Iowa watershed boundary. The high point is located at the northern end of the watershed in Hancock County.

From the upper reach in the Upper Iowa HUC-8 watershed, the Iowa River runs approximately 102 miles in a southeasterly direction passing through Wright, Franklin, Hardin, and Marshall Counties before passing into the Middle Iowa HUC-8 watershed. The division between the Middle and Upper Iowa HUC-8 watersheds is in the NW ¼ of Section 2, Township 84 North, Range 19 West, Marshall County, and approximately 7 miles northwest of the City of Marshalltown corporate limits,

The Iowa River flows through or adjacent to several incorporated areas including, Alden, Belmond, Dows, Eldora, Iowa Falls, Popejoy, Steamboat Rock, and Union. In addition, the Iowa River flows through several parks owned and operated by City, County, and State entities that provide recreational opportunities to the local population, including Pine Lake State Park. The river also flows through several wildlife management areas (WMA), including the Hawkeye WMA. The Iowa River provides recreation, aquatic and riparian wildlife habitat, aesthetic qualities, and storm drainage.

Tributaries to the Iowa River with a drainage area over 30 mi^2 includes: East Branch Iowa River, Honey Creek, Luicks Creek, South Fork Iowa River, West Branch Iowa River, and Wheeler Creek. Many smaller streams also drain to the Iowa River in the Upper Iowa HUC-8 watershed, including Bear Creek, Cedar Creek, Dowd Creek, Drainage Ditch #123, Drainage Ditch #2, Drainage Ditch # 32, Drainage Ditch #7, Elk Creek, Elk Run, Joint Drainage Ditch #14, Pine Creek, School Creek, Sheldon Creek, and other small unnamed tributaries. A map of the Upper Iowa HUC-8 watershed is shown in Figure 6-1 and general river and watershed information is provide in Table 6-1.

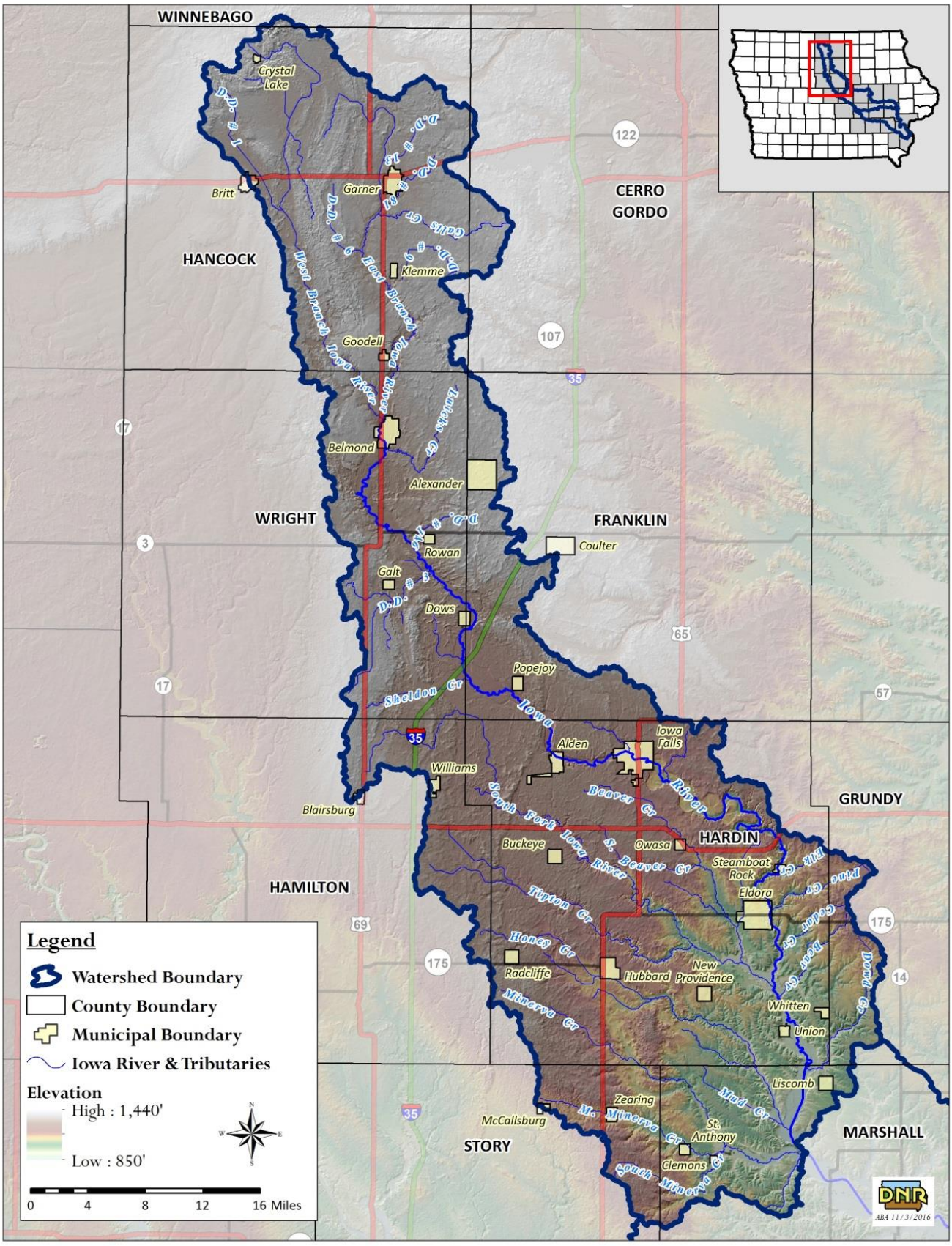

Figure 6-1. The Upper Iowa Watershed.

Table 6-1. Iowa River and Upper Iowa Watershed Information.

Waterbody	Iowa River
8 Digit Hydrologic Unit Code (HUC)	07080207
8 Digit HUC Name	Upper Iowa
Location	Beginning in the NW ¼ of NW ¼ of Sec 19, T93N, R23W; Wright County, running in a southeasterly direction for 102 miles to the boundary between the Upper Iowa and Middle Iowa HUC-8 watersheds.
Designated Uses	A1 – primary contact recreation B(WW-1) – aquatic life (warm water) HH – human health/fish consumption
Tributaries	East Branch Iowa River, Honey Creek, Luicks Creek, South Fork Iowa River, West Branch Iowa River, and Wheeler Creek, Bear Creek, Cedar Creek, Dowd Creek, Drainage Ditch #123, Drainage Ditch #2, Drainage Ditch # 32, Drainage Ditch #7, Elk Creek, Elk Run, Joint Drainage Ditch #14, Pine Creek, School Creek, Sheldon Creek, and several unnamed tributaries.
HUC – Length	102 Miles
Receiving Waterbody	Iowa River, Middle Iowa HUC-8, 07080208

Landforms

The Upper Iowa watershed is made up of three landforms the Des Moines Lobe (85%), Southern Iowa Drift Plain (13%), and the Iowan Surface (3%).

The Des Moines Lobe consists of a poorly drained landscape of pebbly deposits, sand and gravel from swiftly flowing meltwater streams, as well as clay and peat from glacial lakes. Today, broadly curved bands of ridges and knobby hills set among irregular ponds and wetlands punctuate the otherwise subtle terrain of this freshly glaciated landscape. (Prior, Kohrt, and Quade, 2009).

The Southern Iowa Drift Plain landscape consists of rolling hills of Wisconsin-age loess on Illinoisan till. Numerous rills, creeks, and rivers branch out across the landscape shaping the old glacial deposits into steeply rolling hills and valleys (Prior, 1991).

The Iowan Surface is dominated by gently rolling terrain. Glacial boulders lie scattered across the landscape, and northwest to southeast trending loess-mantled hills (paha) stand above the surrounding plain. (Prior, Kohrt, and Quade, 2009).

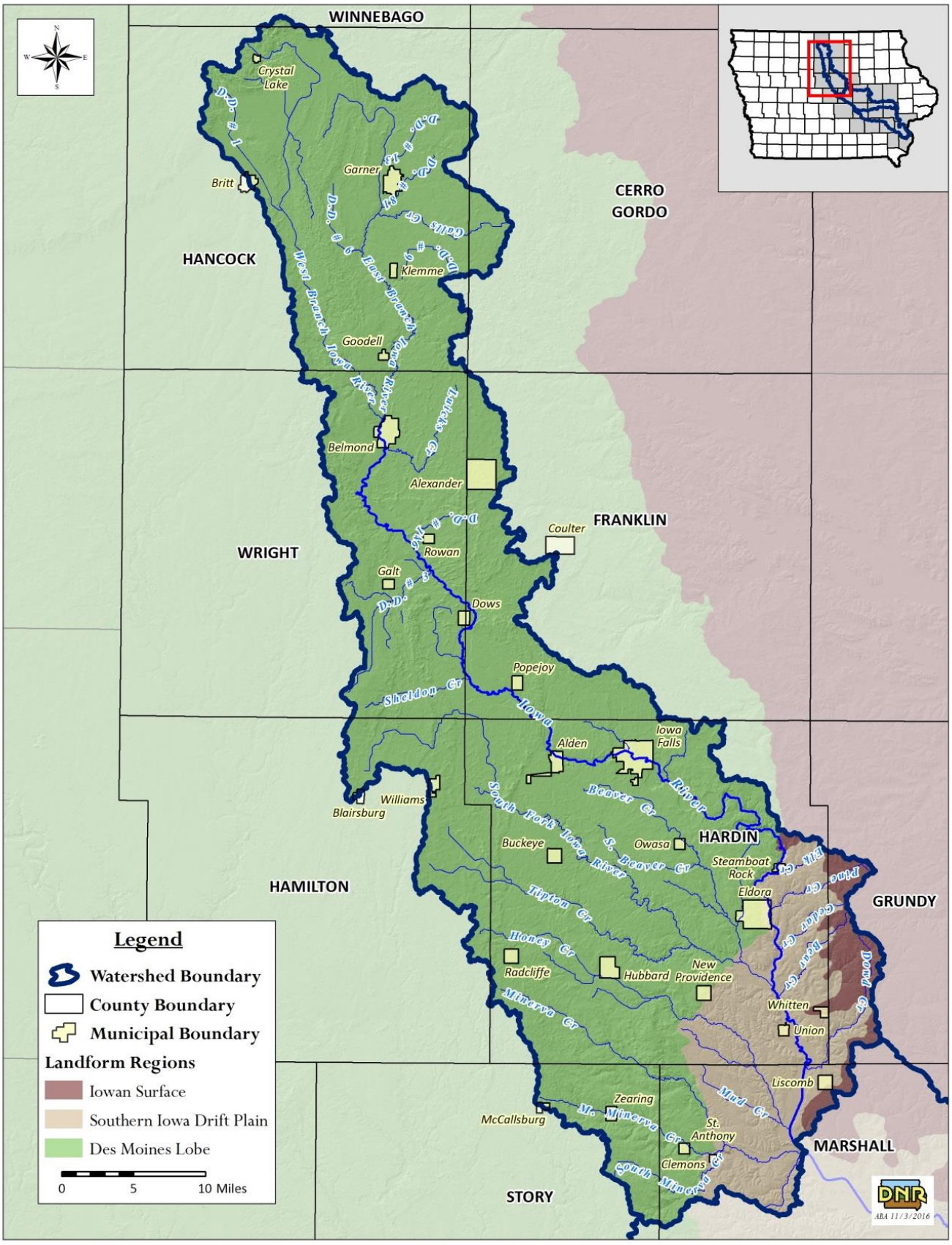

Figure 6-2. Upper Iowa Watershed Landforms.

Hydrology

Based on the USGS National Hydrography Database (NHD), the Upper Iowa watershed includes approximately 1850 miles of streams, with the Iowa River having a total stream length of approximately 102 miles.

The USGS currently maintains 11surface water gaging stations in this watershed. These gaging stations are used to collect stream data such as gage height, discharge rate, and in some cases water quality data. Table 6-2 lists the USGS stream gage information for the active gages used in this WQIP.

Table 6-2. Selected USGS Stream Gages in the Upper Iowa Watershed.

Station Number	Station Name	Latitude	Longitude	Stream	Drainage Area (mi^2)
05449500	Iowa River near Rowan, IA	42°45'36"	93°37'18"	Iowa River	429
05451210	South Fork Iowa River NE of New Providence, IA	42°18'54"	93°09'07"	S. Fork Iowa River	224
05451500	Iowa River at Marshalltown, IA	42°03'57"	92°54'27"	Iowa River	1,532

From 1997 to 2014, rainfall across the watershed ranged from 32 to 37 inches (Table 6-3), with some variation across location and years (Figure 6-4).

Table 6-3. Weather Station Information for Iowa-North Central, Iowa Falls, Eldora, Forest City, and Iowa-Central Climate.

IEM Station ID	IAC002	IA4142	IA2573	IA2977	IAC005
Station Name	Iowa - North Central Climate Division	Iowa Falls	Eldora	Forest City	Iowa - Central Climate Division
Latitude	43° 3' 00"	42° 31' 48"	42° 21' 43"	43° 16' 48"	42° 2' 28"
Longitude	93° 29' 20"	93° 16' 12"	93° 5' 56"	93° 37' 48"	93° 20' 7"
Miles from Watershed	3.6	N/A	N/A	3.8	3.6
Average Annual Precipitation (1997-2014)	32.4 inches	37.2 inches	37.0 inches	33.6 inches	34.3 inches

Source: https://mesonet.agron.iastate.edu/climodat and https://mesonet.agron.iastate.edu/sites/locate.php?network=IACLIMATE

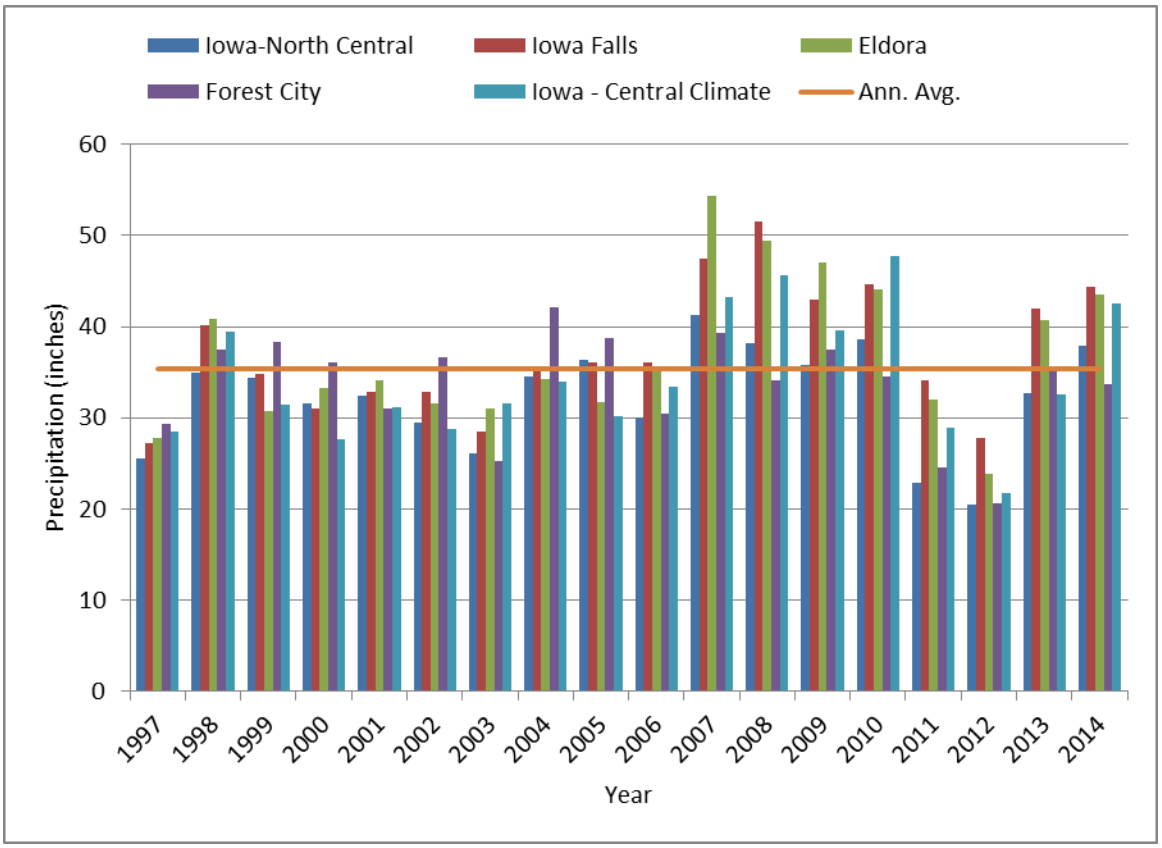

Figure 6-3. Annual Precipitation Iowa-North Central, Iowa Falls, Eldora, Forest City, and Iowa-Central Climate.

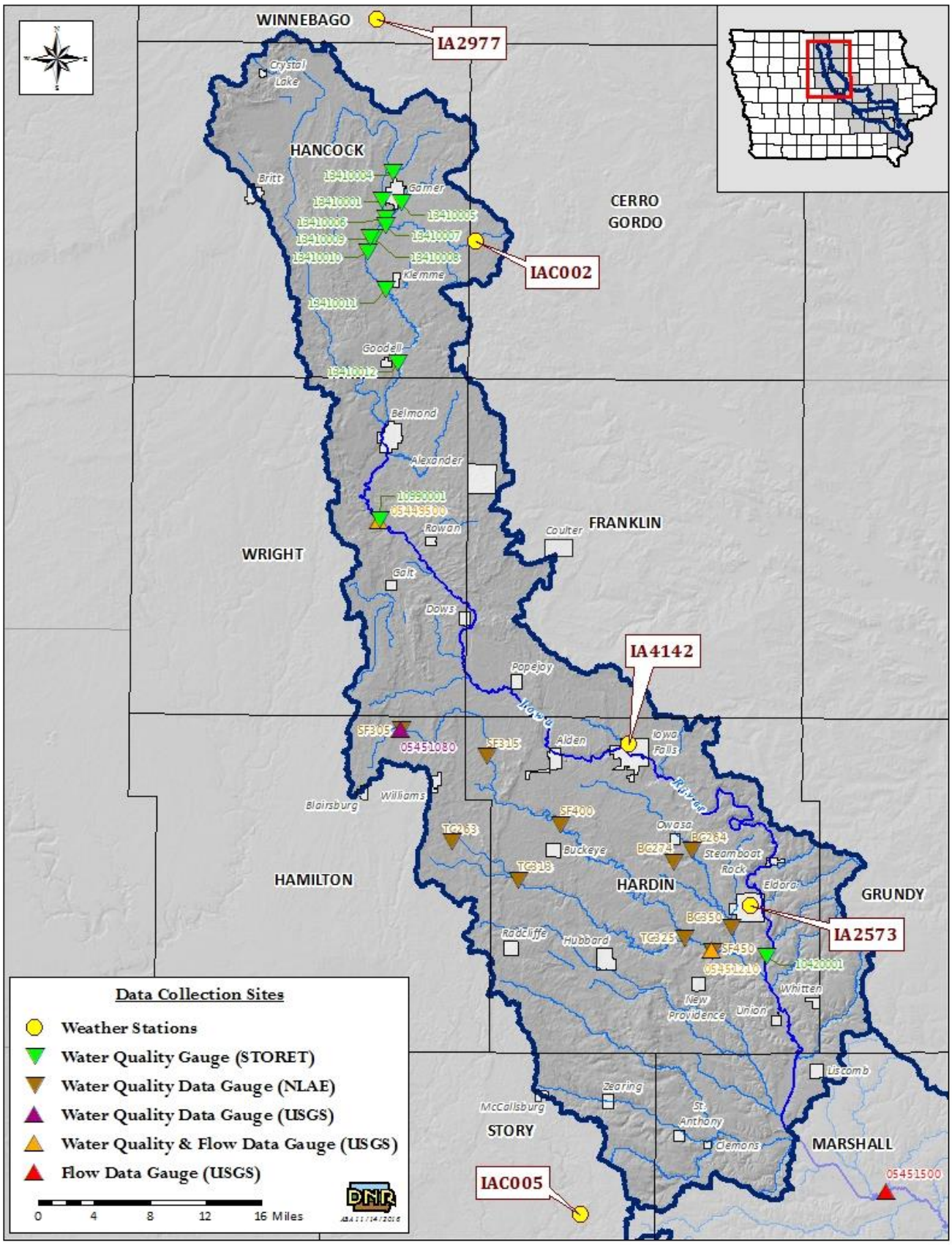

Figure 6-4. Upper Iowa Watershed Data Collection Points.

Land Use

The land use coverage comes from the 2014 USDA Cropland Data Layer (USDA, National Agricultural Statistics Service). The predominate land use is row crops making up approximately 79.1% with grassland being the second highest land use at only 9.5%. (Table 6-4). Row crops consist of corn, and soybeans, with less than 0.1% being other crops. The nine land uses shown in Table 6-4 were aggregated from the fourteen land uses in the cropland data layer as shown in the description column. Figure 6-6 shows the distribution of the various land uses throughout the Upper Iowa watershed in a pie-chart.

Table 6-4. Upper Iowa Watershed Land Uses.

Land Use	Description	Area (AC)	Percent of total
Water/Wetland	Water and Wetlands	10,518	1.1%
Forested	Bottomland, Coniferous, Deciduous	28,082	3.0%
Grassland	Ungrazed, Grazed, & CRP-	88,175	9.5%
Alfalfa/Hay	Perennial Hay Crop-	5,046	0.5%
Row crop	Corn, Soybeans, & other	736,830	79.1%
Roads	Roads Lightly Developed Urban	50,178	5.4%
Urban	Intensively Developed Urban	3,559	0.4%
Residential	Residential/Moderately Developed	9,060	1.0%
Barren	-	391	0.0%
Total		931,839	100%

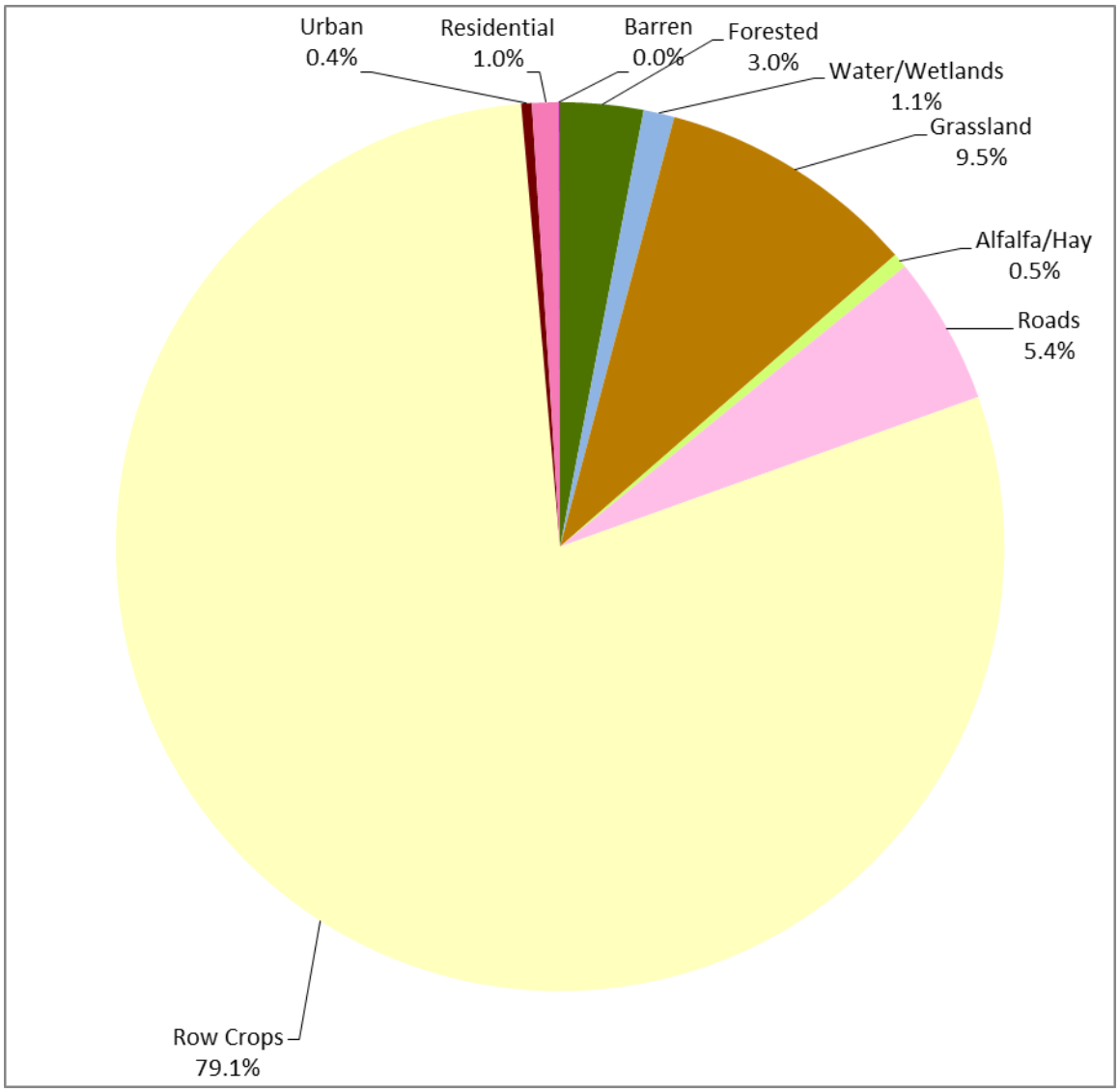

Figure 6-5. Land Use Composition of the Upper Iowa Watershed.

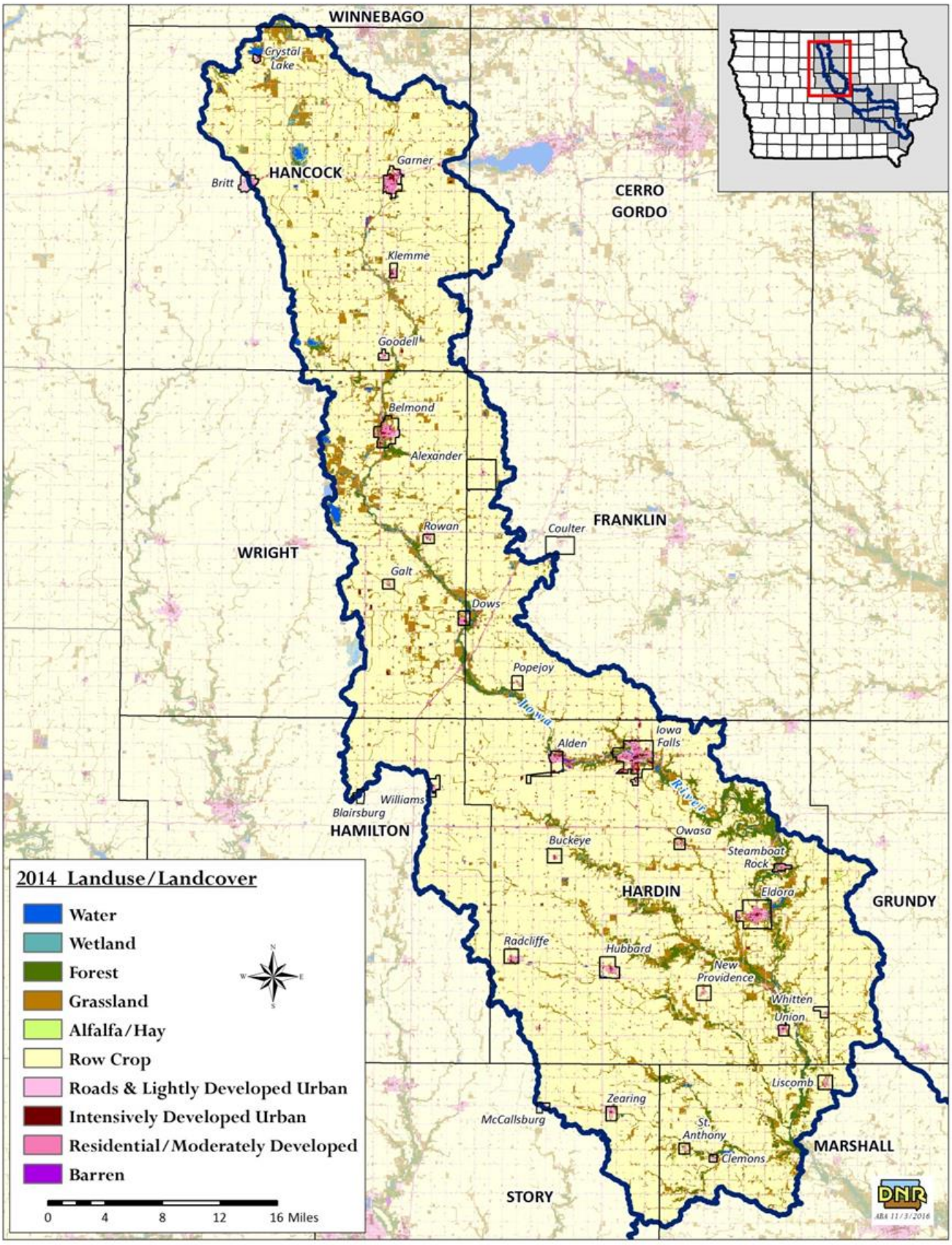

Figure 6-6. Land Use Map of the Upper Iowa Watershed..

Soils

From data obtained from the NRCS, there are 156 different soils types in this watershed. No soil type makes up a majority in the area. The top two soil types in the watershed are the Clarion loam and the Nicollet loam which makes up 18.6% and 8.0% of the watershed, respectively. Of the seven hydrologic soil types, hydrologic soil type C/D makes up the majority of the soils in the watershed at 50.2%. A summary of the hydrologic soil types is shown in Table 6-5.

6.2. Stream Segment Designations and Descriptions

Nineteen stream segments in the Upper Iowa watershed do not meet WQS and are not fully supporting Class A1 (primary contact) recreational use due to the presence of high levels of an indicator bacteria called *Escherichia coli* (*E. coli*). Figure 6-7 shows graphically all the impaired segments in the Lower Iowa watershed and Table 6-6 is a summary of the impaired stream segments, segment identifications, location description, segment length, and designated uses.

Table 6-5. Hydrologic Soil Groups in the Upper Iowa Watershed.

Soil Group	Watershed Area (%)	Description
A	2.4	Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
B	21.3	Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
C	17.2	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
D	2.2	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches] and all soils with a water table within 60 centimeters [24 inches] of the surface are in this group, although some may have a dual classification.
Unclassified	1.3	
Dual Hydrologic Soil Groups		
A/D	0.6	Groups A/D, B/D, and C/D are dual hydrologic soil group. Some soils are placed in group D due to the depth of the water table within 24 inches of the surface even though the soils exhibit favorable properties for water transmission. If these soils can be drained they are classified dual hydrologic soils. The first letter applies to the drained condition and the second to the undrained condition.
B/D	4.8	
C/D	50.2	

Source: USDA-NRCS, 2009, Part 630 Hydrology, National Engineering Handbook, Chapter 7

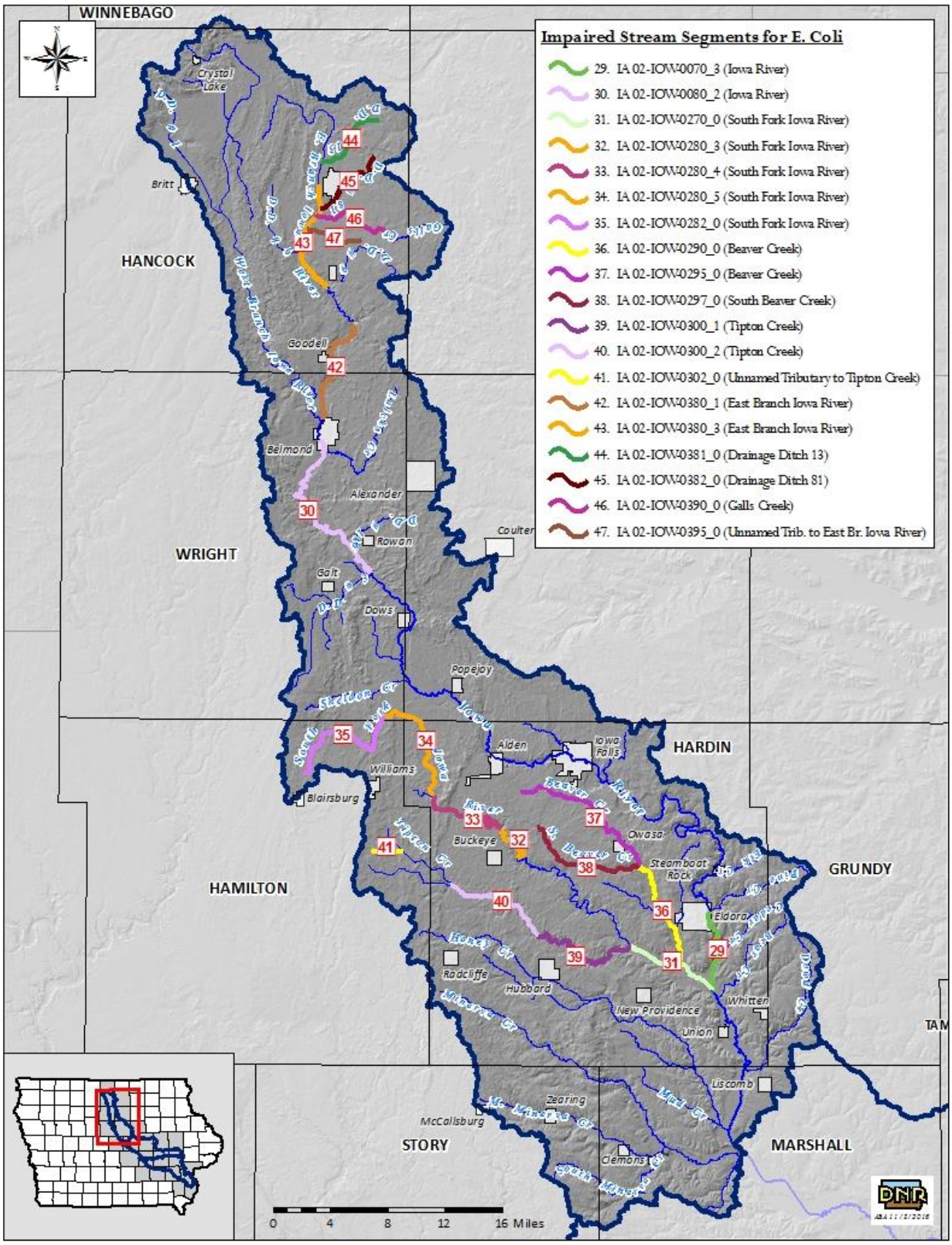

Figure 6-7. Upper Iowa Watershed Impaired Stream Segments for *E coli*.

Table 6-6. Upper Iowa Watershed Impaired Stream Segments and Designated Uses.

Stream Name	Legacy ID[1]	Segment ID[2]	Location Description	Length (mi.)	Designated Uses
Iowa River	0070_3	646	from confluence with South Fork Iowa R. (S25, T87N, R20W, Hardin Co.) to confluence with Pine Cr. in S8, T87N, R19W, Hardin Co.	6.2	A1 – primary contact B(WW-1) HH
Iowa River	0080_2	651	from confluence with Drainage Ditch No. 3 (aka Wheeler Cr.) in NW 1/4, SE 1/4, S10, T91N, R23W, Wright Co., to the Hwy 69 bridge at the south edge of Belmond in S30, T93N, R23W, Wright Co.	16.1	A1 – primary contact B(WW-1) HH
South Fork Iowa River	0270_0	746	mouth (S4, T86N, R19W, Hardin Co.) to confluence with Tipton Cr. in S21, T87N, R20W, Hardin Co.	7.8	A1 – primary contact B(WW-1) HH
South Fork Iowa River	0280_3	749	from confluence with unnamed tributary in W 1/2, S19, T88N, R21W, Hardin Co. to confluence with unnamed tributary in E 1/2, S11, T88N, R22W, Hardin Co.	4.5	A1 – primary contact B(WW-2)
South Fork Iowa River	0280_4	750	from confluence with unnamed tributary in E 1/2, S11, T88N, R22W, Hardin Co. to confluence with unnamed tributary in NE 1/4, S32, T89N, R22W, Hardin Co.	8.3	A1 – primary contact B(WW-2)
South Fork Iowa River	0280_5	751	from confluence with unnamed tributary in NE 1/4, S32, T89N, R22W, Hardin Co. to confluence with unnamed tributary in SE 1/4, S35, T90N, R23W, Wright Co.	9.0	A1 – primary contact B(WW-2)
South Fork Iowa River	0282_0	752	from confluence with unnamed tributary (S35, T90N, R23W, Wright Co.) to headwaters in S24, T89N, R24W, Hamilton Co.	10.3	A1 – primary contact B(WW-1)
Beaver Creek	0290_0	753	mouth (SE 1/4, S25, T87N, R19W, Hardin Co.) to confluence with South Beaver Cr. in NE 1/4, S28, T88N, R20W, Hardin Co.	8.8	A1 – primary contact B(WW-2)
Beaver Creek	0295_0	6362	from confluence with South Beaver Creek (NE1/4, S28, T88N, R20W) to headwaters (S28, T89N, R21W, Hardin Co.)	12.5	A1 – primary contact B(WW-1)
South Beaver Creek	0297_0	6363	from mouth (NE 1/4 S28 T88N R20W, Hardin Co.) to headwaters (S5, T88N, R21W, Hardin Co.)	10.2	A1 – primary contact B(WW-1)
Tipton Creek	0300_1	754	mouth (S21, T87N, R20W, Hardin Co.) to confluence with unnamed tributary in SE 1/4, S17, T87N, R21W, Hardin Co.	11.4	A1 – primary contact B(WW-2)
Tipton Creek	0300_2	755	from confluence with unnamed tributary (SE 1/4, S17, T87N, R21W, Hardin Co.) to confluence with New York Branch in S32, T88N, R22W, Hardin Co.	7.9	A1 – primary contact B(WW-2)
Unnamed Tributary to Tipton Creek	0302_0	6364	from mouth (NW1/4, S23, T88N, R23W) to headwaters in NE1/4, S20, T88N, R23W, Hamilton Co.	2.3	A1 – primary contact B(WW-1)
East Branch Iowa River	0380_1	769	mouth (S19,T93N, R23W, Wright Co.) to confluence with unnamed tributary in S16, T94N, R23W, Hancock Co., north of Goodell State Wildlife Management Area.	10.6	A1 – primary contact B(WW-2)
East Branch Iowa River	0380_3	771	from confluence with Ditch No. 9 (S31, T95N, R23W, Hancock Co.) to confluence with unnamed tributary at Garner in SE 1/4, S25, T96N, R24W, Hancock Co.	9.7	A1 – primary contact B(WW-2)
Drainage Ditch 13	0381_0	6550	from mouth (T96N R24W Sec24, Hancock Co.) to confluence of tributaries (T96N R23W Sec3, Hancock Co.)	5.9	A1 – primary contact B(WW-1)

Stream Name	Legacy ID(1)	Segment ID(2)	Location Description	Length (mi.)	Designated Uses
Drainage Ditch 81	0382_0	6551	from mouth (T95N R24W Sec1, Hancock Co.) to headwaters (T96N R23W Sec15, Hancock Co.)	6.4	A1 – primary contact B(WW-1)
Galls Creek	0390_0	774	mouth (S12, T95N, R24W, Hancock Co.) to unnamed tributary in SW 1/4, S13, T95N, R23W, Hancock Co.	7.9	A1 – primary contact B(WW-1)
Unnamed Tributary to East Branch Iowa River	0395_0	6559	from mouth (T95N R24W Sec11, Hancock Co.) to headwaters (T95N R23W Sec16 SE, Hancock Co.)	4.4	A1 – primary contact B(WW-1)

(1) Prefix for Legacy ID is IA 02-IOW (Legacy ID: IA 02-IOW-0010_1).
(2) Prefix for Segment ID is 02-IOW (Segment ID: IA 02-IOW-621).

Data Sources and Monitoring Sites

Table 6-2 (in Section 6.1) lists the USGS Gaging Stations used and Table 6-7 lists water quality monitoring locations. STORET sites refer to data collected by Iowa DNR personal for the STOrage and RETrieval sponsored by the US EPA. NLAE sites refer to data collected by the National Laboratory for Agriculture and the Environment sponsored by Iowa State University.

Table 6-7. WQ Data Monitoring Sites of the Upper Iowa Watershed.

Site Name	ID	Latitude	Longitude
Iowa River near Gifford	STORET 10420001	42° 18’ 37”	93° 04’ 32”
Iowa River near Rowan	STORET 10990001	42° 45’ 37”	93° 37’ 20”
E. Branch Iowa River near Garner (Upstream)	STORET 13410001	43° 05’ 31”	93° 37’ 19”
Drainage Ditch 13 at Sioux (Site 1)	STORET 13410004	43° 07’ 16”	93° 36’ 24”
East Branch Iowa River at W. Lyons St. (Site 1a)	STORET 13410005	43° 05’ 26”	93° 35’ 40”
Drainage Ditch 81 at Hwy 69 (Site 3)	STORET 13410006	43° 04’ 26”	93° 36’ 59”
Galls Creek at Hwy 69 (Site 4)	STORET 13410007	43° 03’ 57”	93° 36’ 58”
East Branch Iowa River at 200th (Site 5)	STORET 13410008	43° 03’ 11”	93° 37’ 59”
East Branch Iowa River at 200th (Site 5a)	STORET 13410009	43° 03’ 11”	93° 38’ 21”
East Branch Iowa River at 190th (Site 6)	STORET 13410010	43° 02’ 19”	93° 38’ 33”
East Branch Iowa River at Hwy 69 (Site 7)	STORET 13410011	43° 00’ 01”	93° 36’ 59”
East Branch Iowa River at 110th (Site 8)	STORET 13410012	42° 55’ 23”	93° 35’ 55”
Beaver Creek	NLAE BC264	42° 25’ 09”	93° 10’ 50”
South Beaver Creek	NLAE BC274	42° 24’ 25”	93° 12’ 25”
Beaver Creek	NLAE BC350	42° 20’ 21”	93° 07’ 30”
South Fork Iowa River	NLAE SF305	42° 32’ 36”	93° 35’ 23”
South Fork Iowa River	NLAE SF315	42° 30’ 57”	93° 28’ 11”
South Fork Iowa River	NLAE SF400	42° 26’ 45”	93° 21’ 55”
South Fork Iowa River	NLAE SF450	42° 18’ 54”	93° 09’ 09”
Tipton Creek	NLAE TC263	42° 25’ 36”	93° 31’ 04”
Tipton Creek	NLAE TC313	42° 23’ 17”	93° 25’ 29”
Tipton Creek	NLAE TC325	42° 19’ 41”	93° 11’ 28”
Iowa River near Rowan, IA	USGS 05449500	42° 45’ 36”	93° 37’ 19”
South Fork Iowa River NE of New Providence, IA	USGS 05451210	42° 18’ 55”	93° 09’ 08”
South Fork Iowa River near Blairsburg, IA	USGS 05451080	42° 32’ 37”	93° 35’ 22”

Interpreting Data
Analysis of the data shows consistently high *E. coli* levels that exceed the criterion set for in Iowa's WQS for primary contact recreation. Significant reductions in *E. coli* loading will be required to comply with the standards and fully support the designated recreational use in the impaired segments.

Identification of pollutant sources
There are a variety of *E. coli* sources in the Upper Iowa watershed. These sources can be divided into two categories, point and non-point sources. Point sources include municipal and industrial wastewater treatment facilities (WWTFs), sanitary sewer overflows (SSOs), onsite wastewater systems with permitted discharges, and animal feeding operations (AFOs) regulated as concentrated animal feeding operations (CAFOs). Nonpoint sources include wildlife, manure application to row crops, grazing livestock and small feeding operations, direct deposition by livestock in streams, and non-permitted (i.e., non-discharging) onsite wastewater systems.

Load duration curves (LDCs) were used in the development of *E. coli* TMDLs for impaired stream segments in the Upper Iowa River Basin (Section 6.3). The use of LDCs is helpful for understanding the importance that hydrology plays on pollutant loading. Information illustrated in LDCs provides a basic understanding of the importance of potential pollutant sources, although the approach does not offer explicit calculation of source-specific pollutant loads. However, when analyzed in conjunction with a detailed inventory of sources, LDCs can provide a quantitative means of comparing the relative importance of specific pollutant sources.

Point Sources
There are a total of 30 active or pending NPDES permits in this watershed. This includes 21 municipal system permits, three (3) semi-public permits, three (3) industrial permits, and three (3) operation permit. Nine (9) of these facilities are not within the drainage boundaries of an impaired stream segment covered in this WQIP and therefore will not be considered in this WQIP. In addition, operating permits have no discharge and typically, industrial facilities and municipal water treatment plants do not have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources with the exception of those with a bacteria limit in their NPDES permit. An inventory of the facilities not considered in this WQIP is located in Appendix E. Other point sources in the watershed include private sewage disposal systems covered under General Permit #4. Systems covered by this general permit must meet specified requirements, which include a population equivalent of less than 15 persons. Figure 6-8 shows the locations of NPDES permitted wastewater facilities, concentrated animal feeding operation facilities, unsewered communities, and NPDES General Permit #4 facilities that discharge to an impaired stream segment within the Upper Iowa HUC8 watershed. An inventory of these dischargers and their respective WLAs is provided in Appendix E.

Nonpoint Sources
The nonpoint sources of pathogen indicators include contributors that do not have localized points of release into a stream. In the watershed these sources are:

- Grazing animals
- Direct deposition of manure in streams
- Land application and subsequent runoff of manure
- Developed / urban area runoff
- Wildlife
- Faulty septic tank systems

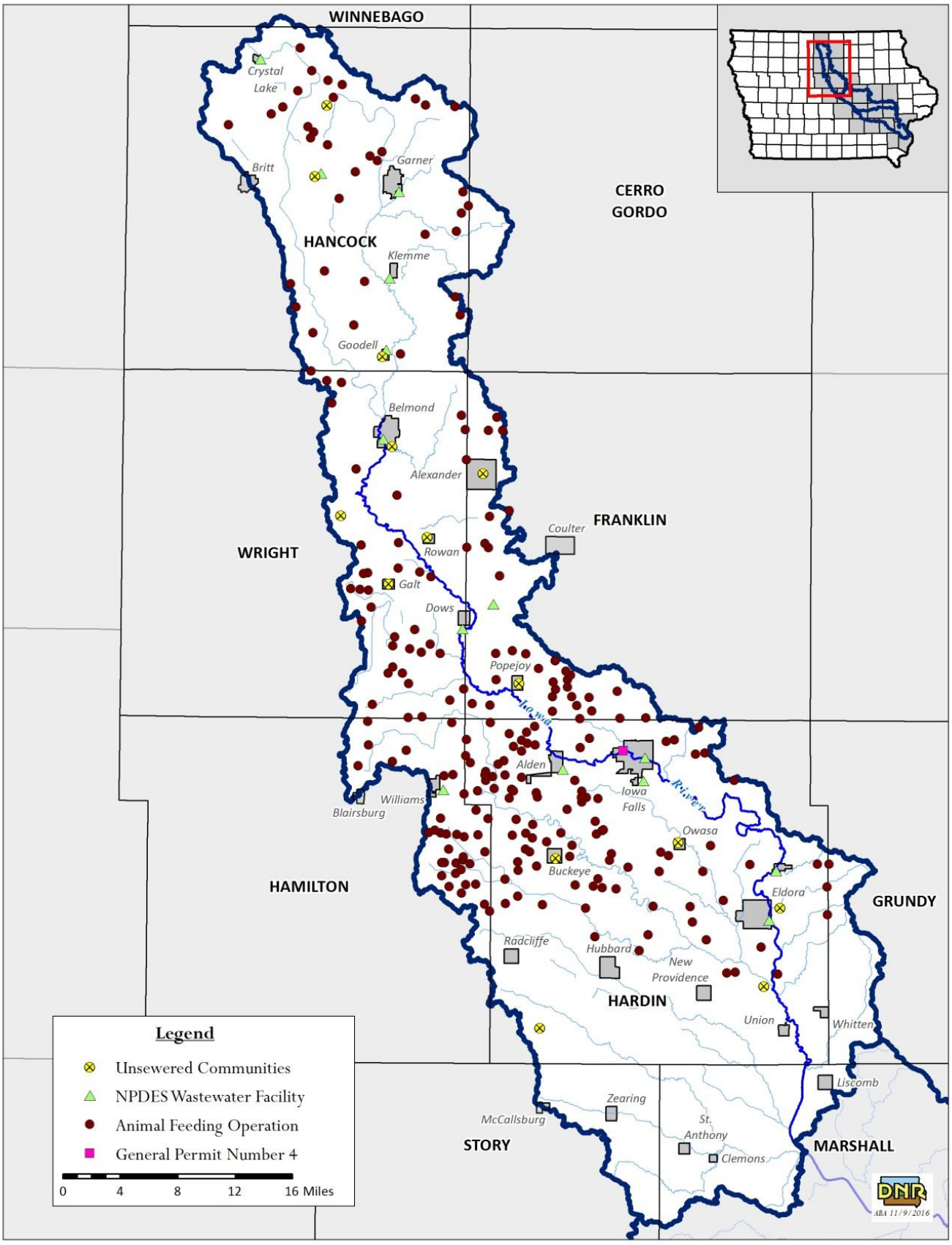

Figure 6-8. Point Source Location Map for the Upper Iowa Watershed.

6.3. Pollution Source Assessment

Departure from Load Capacity

LDCs for each stream segment show the existing GM loading (green, dotted lines) for each flow condition and the target GM loading (red, dashed line). The difference between these two is the departure from the loading capacity. The LDCs, observed loads, and observed GM loads for each flow condition are plotted in Figure 6-9 through Figure 6-27. This methodology enables calculation of a TMDL target at the midpoint of each flow condition for each impaired segment, as provided in Table 6-9 through Table 6-46.

Allowance for Increases in Pollutant Loads

There are a total of 14 unsewered communities in the Upper Iowa watershed. A reserve wasteload allocation (WLA) was calculated for each community and aggregated to the WLA for the associated segment. Table E-23 in Appendix E.2 lists all the unsewered communities in the Upper Iowa watershed. Any new or expanded dischargers will be expected to meet the same end-of-pipe criteria (GM of 126 orgs/100 mL) as dischargers for which WLAs were calculated and included in this TMDL

6.4. Pollutant Allocations

Wasteload Allocations (WLA)

A WLA was calculated for each wastewater treatment facility (WWTF), and an aggregate reserve WLA for unsewered communities in the watershed. Table 6-8 shows the aggregate WLA summary by facility type for the Lower Iowa watershed. Individual WLAs for each discharger are included in Appendix E.

Table 6-8. WLA Summary by Facility Type for the Upper Iowa Watershed.

Facility Type	Number of Facilities	Flow (MGD)(1)	GM Conc (orgs/100 mL)	GM Load (orgs/day)
WWTF	14	10.33	126	4.93E+10
Unsewered	11	0.09	126	4.51E+08
CAFO	237	0.00	0	0.00E+00
Stormwater	1	--	126	--
Totals		10.42	126	4.97E+10

(1) Flows used to calculate the wasteload allocation. See Appendix E.

Wastewater Treatment Facility (WWTF)

WWTF can be grouped two types of discharging facilities, continuous and intermittent. All of the WWTF listed in this WQIP are continuous discharging facilities with the exception of Waste Stabilization Lagoons which are intermittent discharging facilities.

The design flow for WWTF is the NPDES permitted average wet weather (AWW) flow. For a continuous discharging facility this is the 30-day AWW flow and the 180-day AWW flow for intermittent discharging facilities.

The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.

Intermittent discharging facilities operate as a hold and discharge facility with a minimum holding time of 180-days. These facilities typically discharge twice per year for short periods of time in the spring and in the fall when stream flows are at the highest. These facilities are permitted to discharge at a rate that is ten times the 180-day AWW flow. WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Unsewered (UNSWD)

WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day. Populations for unsewered communities was obtained or estimated from the 2010 US Census (U.S. Census Bureau,

2010). The per capita flow rate of 100 gallons per capita-day is required for facility planning of new WWTP by the Iowa Wastewater Facilities Design Standards.

Concentrated Animal Feeding Operations (CAFOs)
Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

General Permit No. 4 (GP#4)
Facilities operating under a GP #4 are private systems that only treat domestic waste from commercial and residential properties and serve an equivalent population of less than 16 people. These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Load Allocation (LA.)
Nonpoint sources result from livestock, pets, wildlife, and humans that live, work, and play in and around the stream. Specific examples of potential nonpoint sources of bacteria include animals directly depositing into streams, manure applied to row crops, manure runoff from grazed land, non-permitted onsite wastewater systems, and natural sources such as wildlife.

Margin of Safety
An explicit margin of safety (MOS) of 10 percent is applied to the calculation of loading capacities in this TMDL. Additionally, targeting the GM in each flow condition, rather than only the overall GM, provides an implicit MOS by require WQS compliance across flow conditions.

Load Duration Curve
Figure 6-9 thru Figure 6-27 are load durations for the impaired stream segments in this watershed. Table 6-9 through Table 6-46 are the existing load estimates and the TMDL summary for each impaired segment.

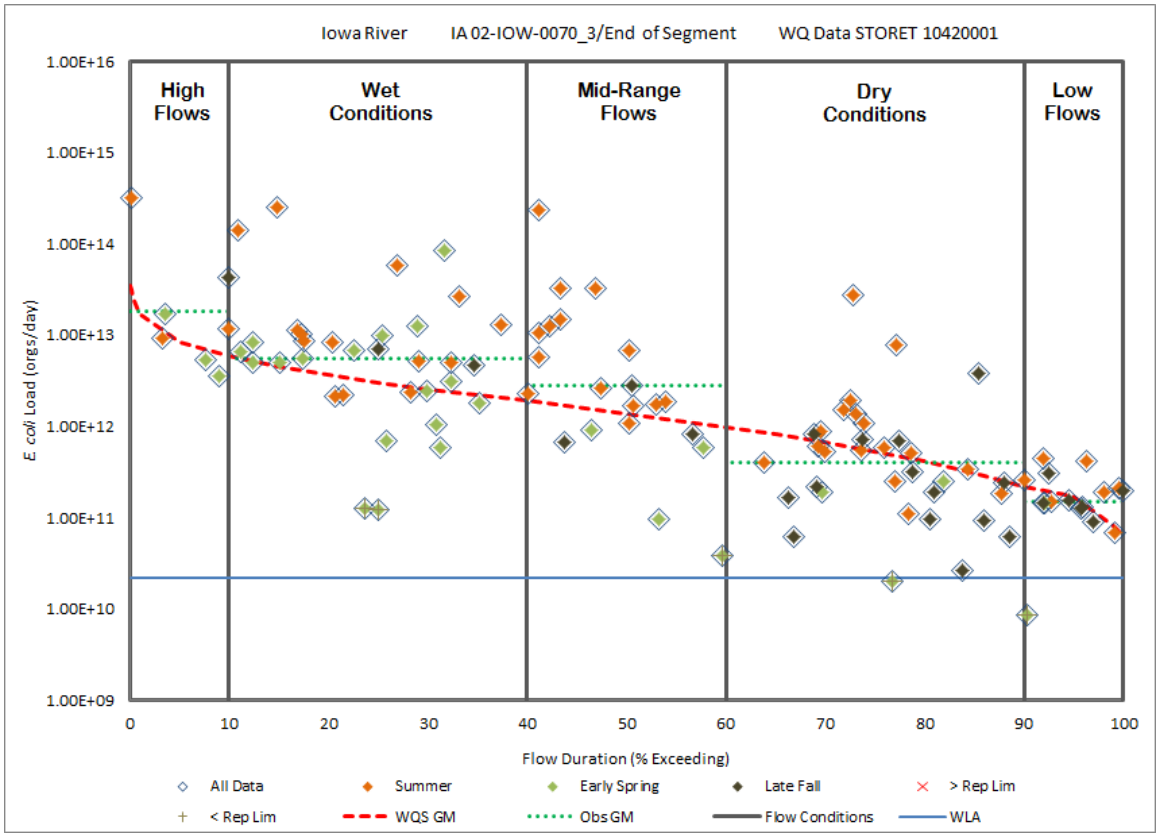

Figure 6-9. Load Duration Curve, Iowa River, Segment IA 02-IOW-0070_3.

Table 6-9. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0070_3.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.86E+13	5.64E+12	2.78E+12	3.96E+11	1.48E+11
GM Departure (% Reduction)	1.04E+13 (55.6)	2.58E+12 (45.7)	1.41E+12 (50.8)	-1.39E+11 (0)	-2.32E+10 (0)
Midpoint Flow (cfs)	2,681.7	992.8	444.8	173.5	55.4

Table 6-10. TMDL Summary for Iowa River, Segment IA 02-IOW-0070_3.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	8.27E+12	3.06E+12	1.37E+12	5.35E+11	1.71E+11
WLA (orgs/day)	2.20E+10	2.20E+10	2.20E+10	2.20E+10	2.20E+10
LA (orgs/day)	7.42E+12	2.73E+12	1.21E+12	4.59E+11	1.32E+11
MOS (orgs/day)	8.27E+11	3.06E+11	1.37E+11	5.35E+10	1.71E+10

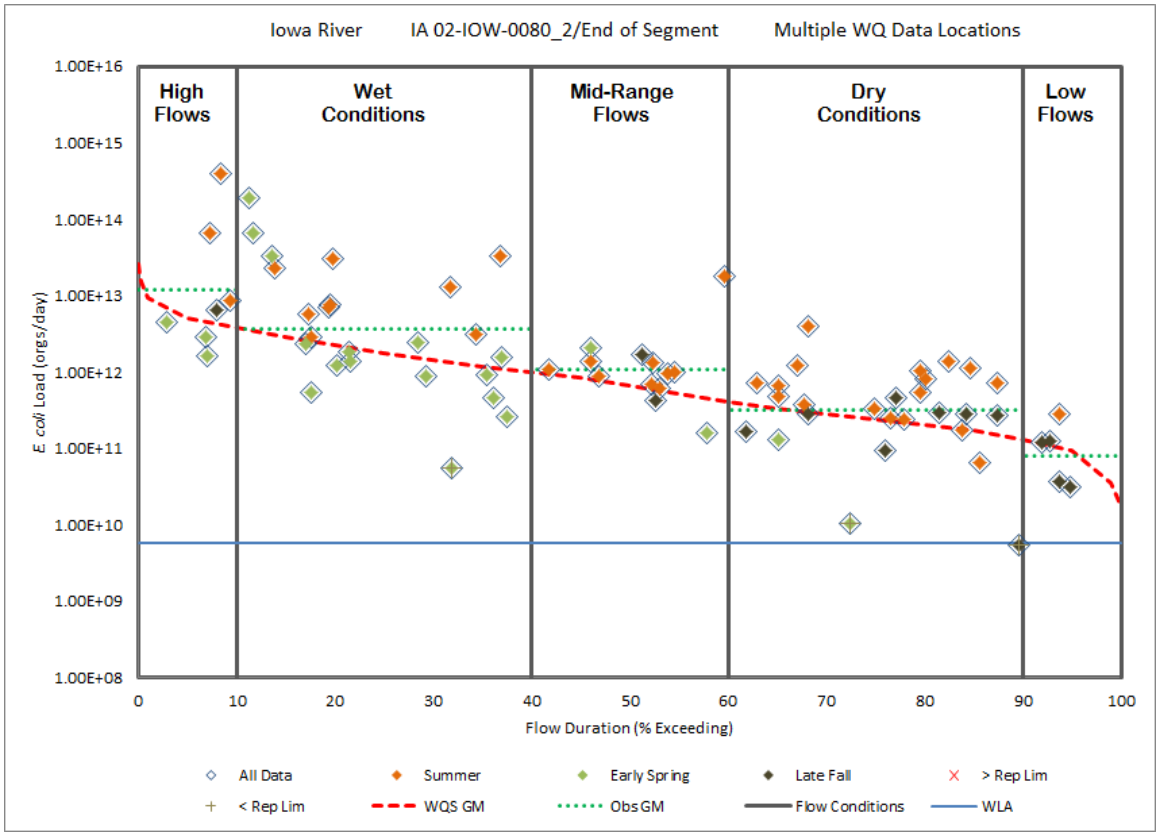

Figure 6-10. Load Duration Curve, Iowa River, Segment IA 02-IOW-0080_2.

Table 6-11. Existing Load Estimates for Iowa River, Segment IA 02-IOW-0080_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.18E+13	3.63E+12	1.09E+12	3.14E+11	7.91E+10
GM Departure (% Reduction)	6.75E+12 (57.2)	1.85E+12 (50.8)	4.12E+11 (37.9)	7.59E+10 (24.1)	-1.42E+10 (0)
Midpoint Flow (cfs)	1,637.8	579.4	219.3	77.4	30.3

Table 6-12. TMDL Summary for Iowa River, Segment IA 02-IOW-0080_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	5.05E+12	1.79E+12	6.76E+11	2.39E+11	9.34E+10
WLA (orgs/day)	5.84E+09	5.84E+09	5.84E+09	5.84E+09	5.84E+09
LA (orgs/day)	4.54E+12	1.60E+12	6.03E+11	2.09E+11	7.82E+10
MOS (orgs/day)	5.05E+11	1.79E+11	6.76E+10	2.39E+10	9.34E+09

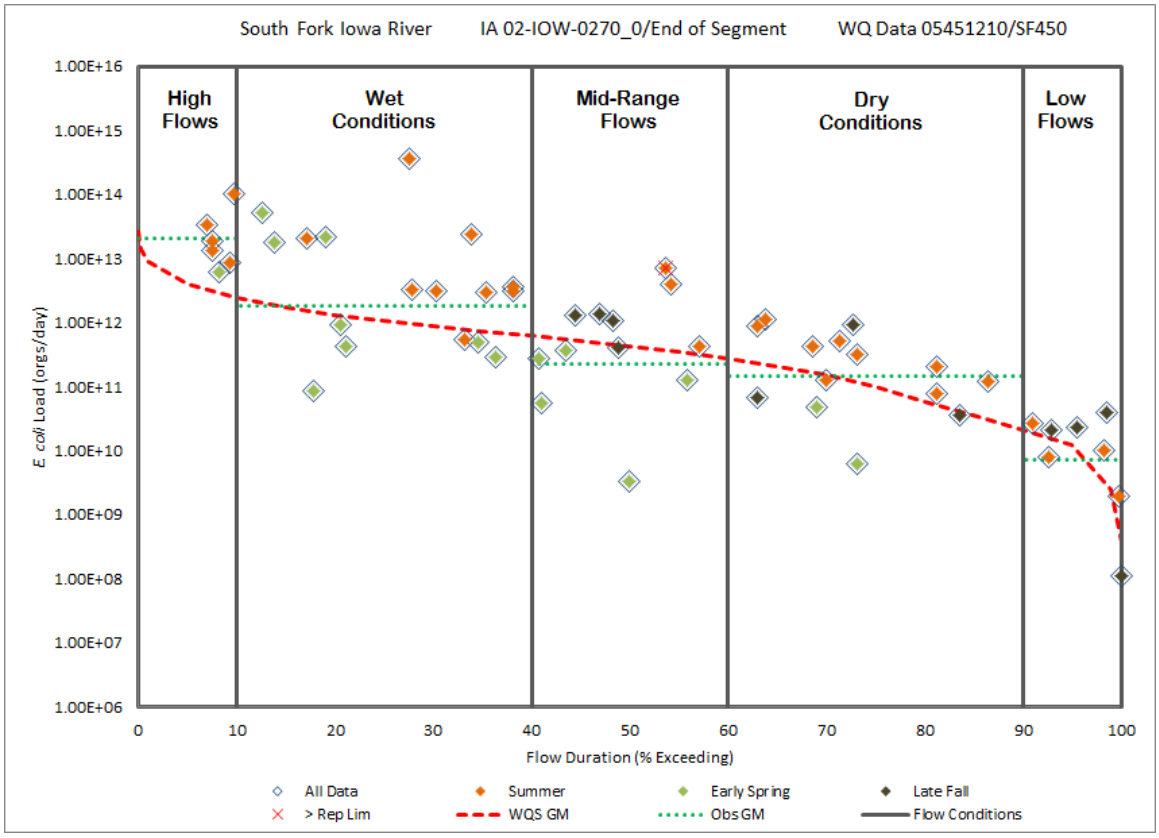

Figure 6-11. Load Duration Curve, South Fork Iowa River, Segment IA 02-IOW-0270_0.

Table 6-13. Existing Load Estimates for South Fork Iowa River, Segment IA 02-IOW-0270_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.03E+13	1.85E+12	2.26E+11	1.48E+11	7.39E+09
GM Departure (% Reduction)	1.63E+13 (80.0)	8.03E+11 (43.3)	-1.98E+11 (0)	4.64E+10 (31.3)	-4.91E+09 (0)
Midpoint Flow (cfs)	1319.9	341.0	137.5	33.0	4.0

Table 6-14. TMDL Summary for South Fork Iowa River, Segment IA 02-IOW-0270_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	4.07E+12	1.05E+12	4.24E+11	1.02E+11	1.23E+10
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	3.66E+12	9.46E+11	3.81E+11	9.16E+10	1.11E+10
MOS (orgs/day)	4.07E+11	1.05E+11	4.24E+10	1.02E+10	1.23E+09

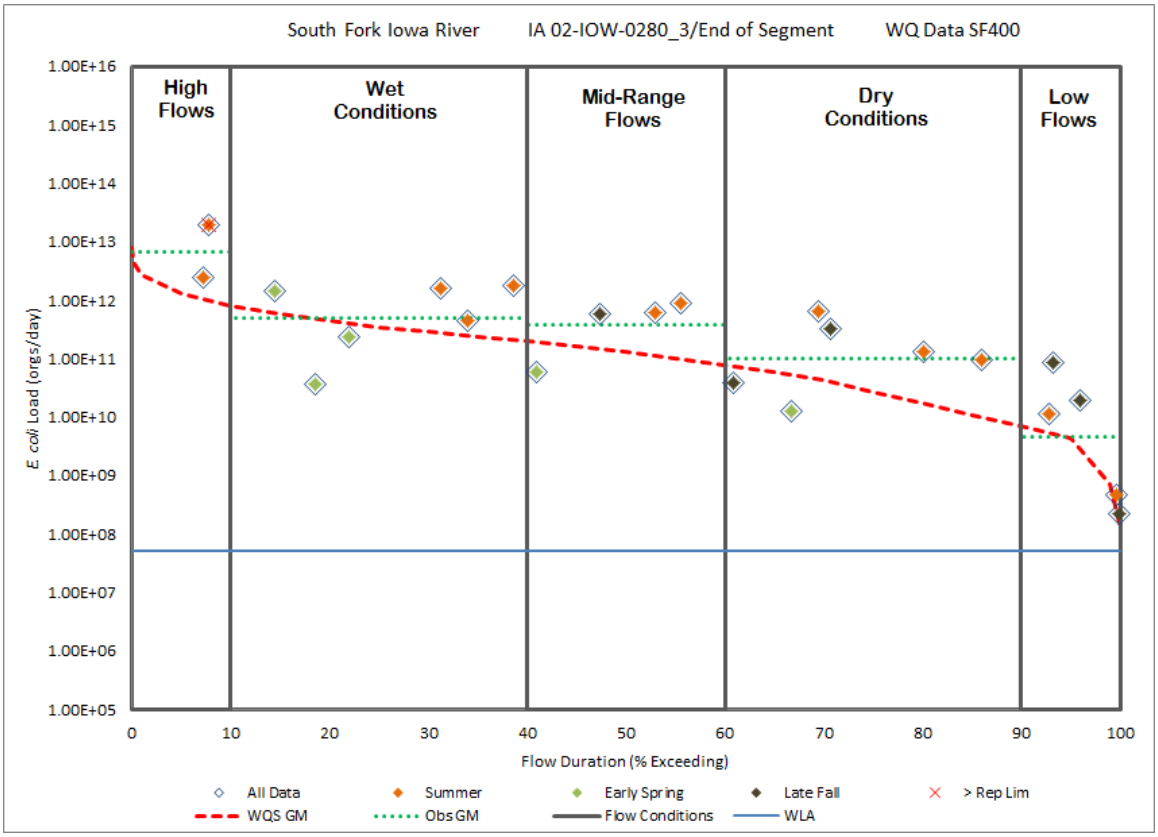

Figure 6-12. Load Duration Curve, South Fork Iowa River, Segment IA 02-IOW-0280_3.

Table 6-15. Existing Load Estimates for South Fork Iowa River, Segment IA 02-IOW-0280_3.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	6.79E+12	5.03E+11	3.75E+11	1.04E+11	4.58E+09
GM Departure (% Reduction)	5.48E+12 (80.7)	1.52E+11 (30.1)	2.46E+11 (65.5)	7.67E+10 (73.8)	2.22E+08 (4.9)
Midpoint Flow (cfs)	426.1	113.9	41.9	8.8	1.4

Table 6-16. TMDL Summary for South Fork Iowa River, Segment IA 02-IOW-0280_3.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.31E+12	3.51E+11	1.29E+11	2.72E+10	4.36E+09
WLA (orgs/day)	5.10E+07	5.10E+07	5.10E+07	5.10E+07	5.10E+07
LA (orgs/day)	1.18E+12	3.16E+11	1.16E+11	2.44E+10	3.87E+09
MOS (orgs/day)	1.31E+11	3.51E+10	1.29E+10	2.72E+09	4.36E+08

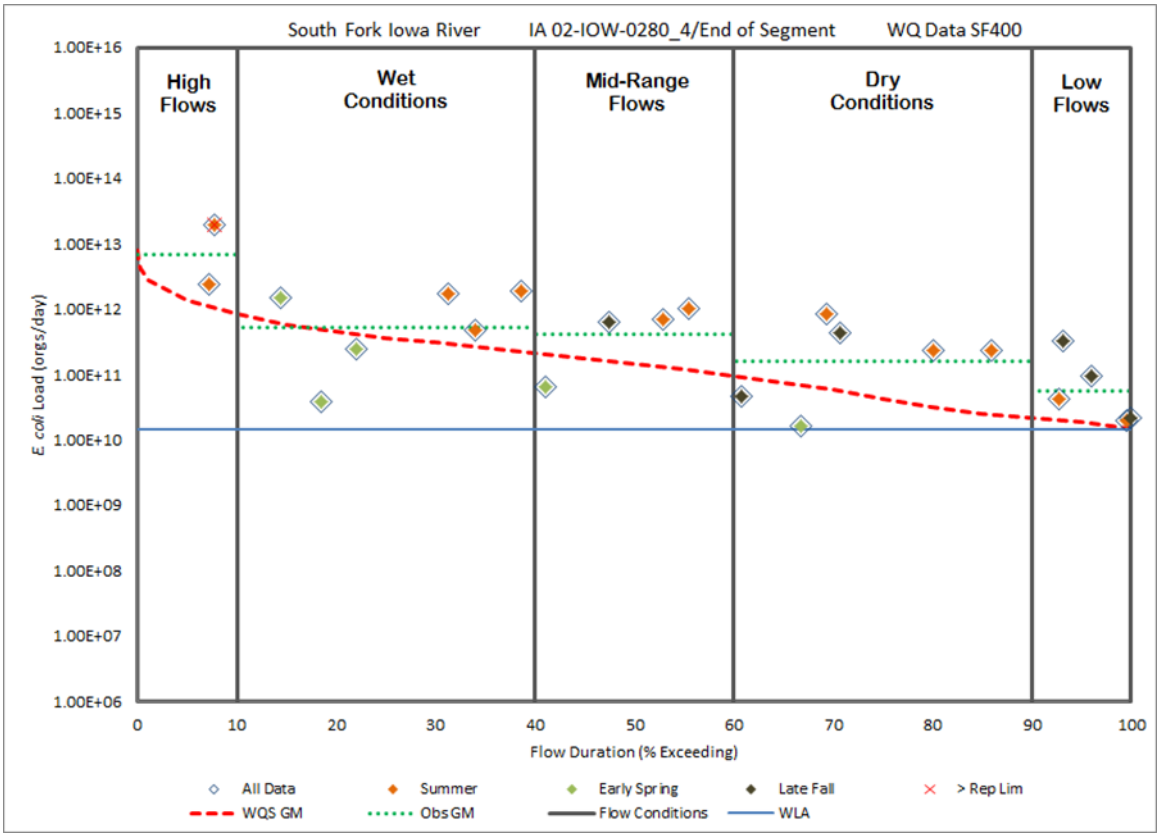

Figure 6-13. Load Duration Curve, South Fork Iowa River, Segment IA 02-IOW-0280_4.

Table 6-17. Existing Load Estimates for South Fork Iowa River, Segment IA 02-IOW-0280_4.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	6.88E+12	5.25E+11	4.17E+11	1.58E+11	5.59E+10
GM Departure (% Reduction)	5.55E+12 (80.7)	1.59E+11 (30.4)	2.73E+11 (65.5)	1.16E+11 (73.4)	3.68E+10 (65.8)
Midpoint Flow (cfs)	430.4	118.6	46.7	13.6	6.2

Table 6-18. TMDL Summary for South Fork Iowa River, Segment IA 02-IOW-0280_4.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.33E+12	3.66E+11	1.44E+11	4.20E+10	1.91E+10
WLA (orgs/day)	1.48E+10	1.48E+10	1.48E+10	1.48E+10	1.48E+10
LA (orgs/day)	1.18E+12	3.14E+11	1.15E+11	2.30E+10	2.44E+09
MOS (orgs/day)	1.33E+11	3.66E+10	1.44E+10	4.20E+09	1.91E+09

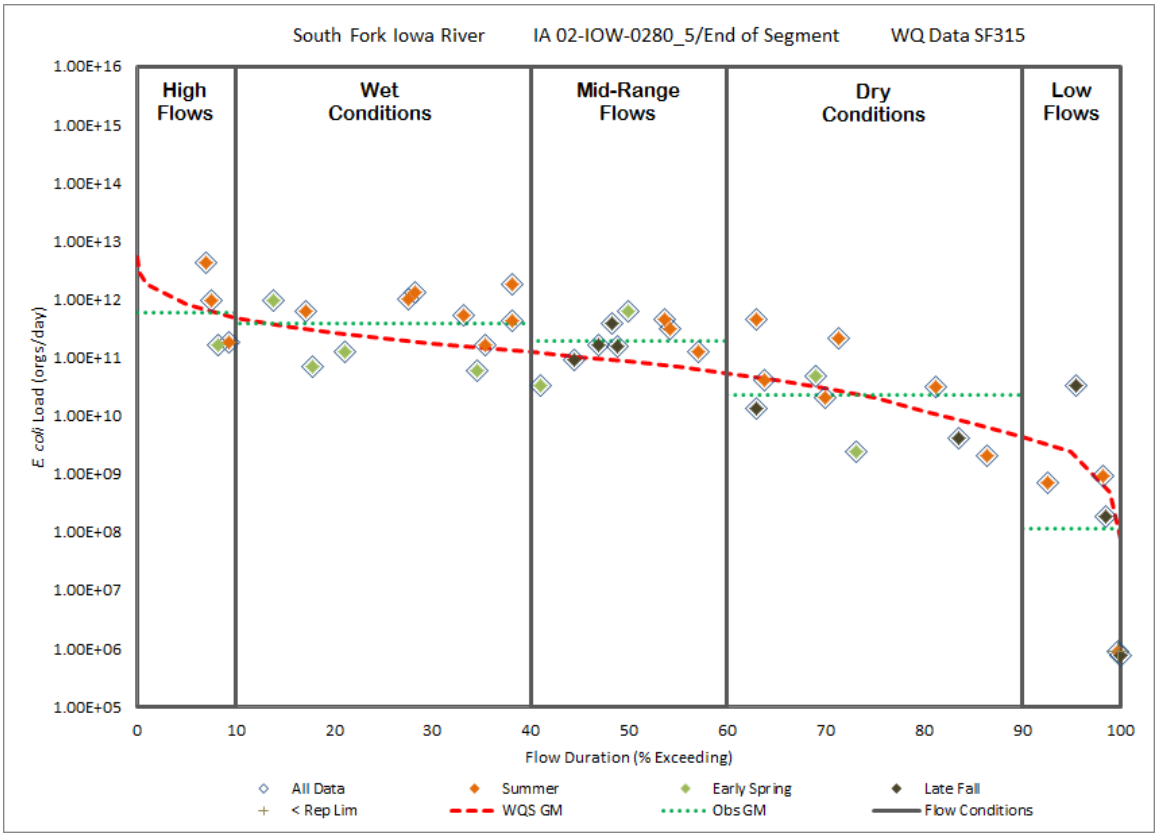

Figure 6-14. Load Duration Curve, South Fork Iowa River, Segment IA 02-IOW-0280_5.

Table 6-19. Existing Load Estimates for South Fork Iowa River, Segment IA 02-IOW-0280_5.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	5.90E+11	3.89E+11	1.91E+11	2.26E+10	1.18E+08
GM Departure (% Reduction)	-2.25E+11 (0)	1.78E+11 (45.8)	1.06E+11 (55.5)	2.27E+09 (10.0)	-2.34E+09 (0)
Midpoint Flow (cfs)	264.4	68.3	27.5	6.6	0.8

Table 6-20. TMDL Summary for South Fork Iowa River, Segment IA 02-IOW-0280_5.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	8.15E+11	2.11E+11	8.49E+10	2.04E+10	2.46E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	7.34E+11	1.90E+11	7.64E+10	1.83E+10	2.22E+09
MOS (orgs/day)	8.15E+10	2.11E+10	8.49E+09	2.04E+09	2.46E+08

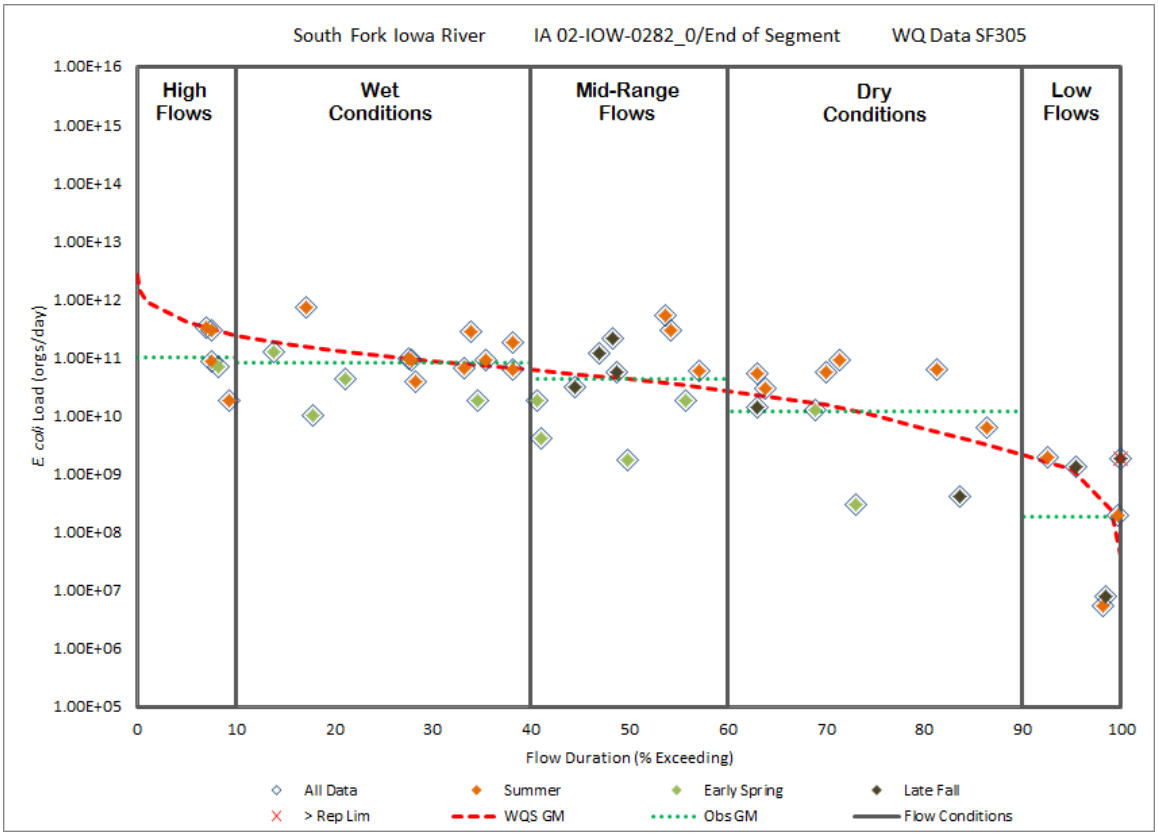

Figure 6-15. Load Duration Curve, South Fork Iowa River, Segment IA 02-IOW-0282_0.

Table 6-21. Existing Load Estimates for South Fork Iowa River, Segment IA 02-IOW-0282_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.02E+11	7.97E+10	4.30E+10	1.22E+10	1.84E+08
GM Departure (% Reduction)	-3.03E+11 (0)	-2.47E+10 (0)	9.35E+08 (2.2)	2.07E+09 (17.0)	-1.04E+09 (0)
Midpoint Flow (cfs)	131.1	33.9	13.7	3.3	0.4

Table 6-22. TMDL Summary for South Fork Iowa River, Segment IA 02-IOW-0282_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	4.04E+11	1.04E+11	4.21E+10	1.01E+10	1.22E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	3.64E+11	9.40E+10	3.79E+10	9.10E+09	1.10E+09
MOS (orgs/day)	4.04E+10	1.04E+10	4.21E+09	1.01E+09	1.22E+08

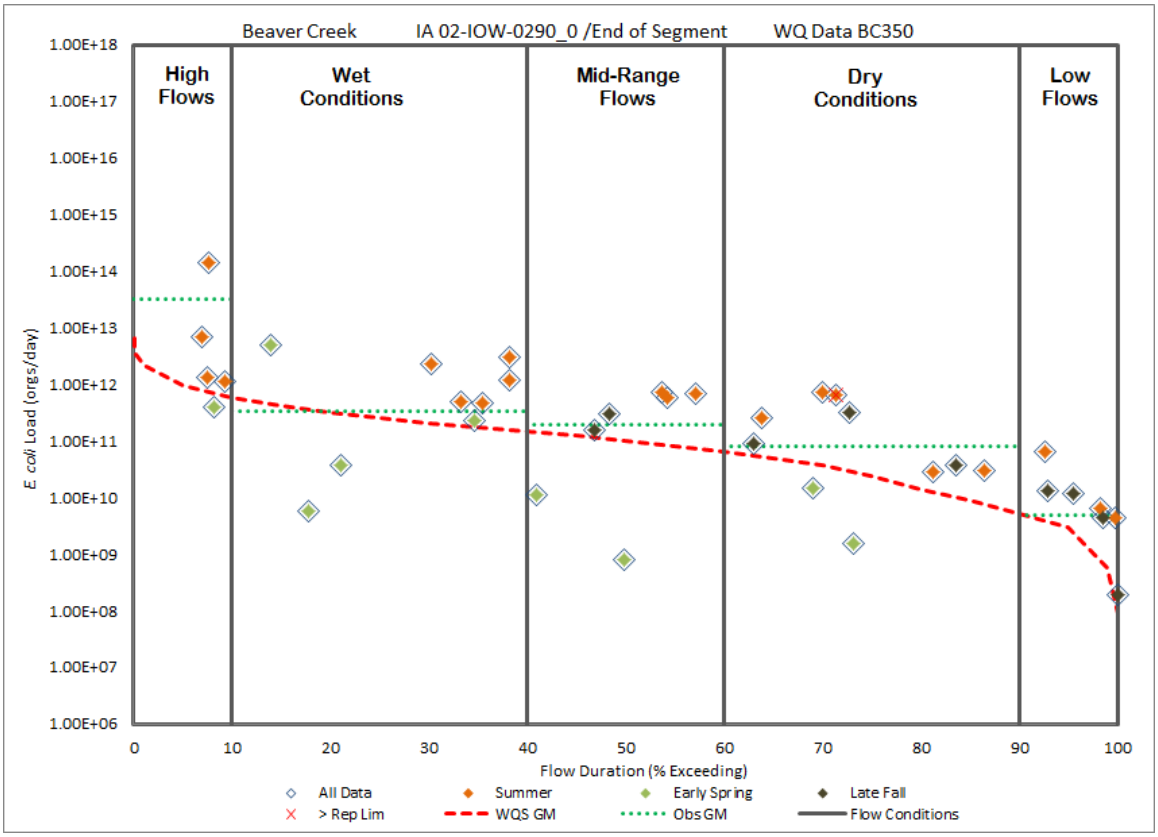

Figure 6-16. Load Duration Curve, Beaver Creek, Segment IA 02-IOW-0290_0.

Table 6-23. Existing Load Estimates for Beaver Creek, Segment IA 02-IOW-0290_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	3.18E+13	3.37E+11	1.92E+11	7.92E+10	5.05E+09
GM Departure (% Reduction)	3.09E+13 (96.9)	8.48E+10 (25.1)	9.04E+10 (47.0)	5.48E+10 (69.2)	2.09E+09 (41.5)
Midpoint Flow (cfs)	317.1	81.9	33.0	7.9	1.0

Table 6-24. TMDL Summary for Beaver Creek, Segment IA 02-IOW-0290_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	9.78E+11	2.53E+11	1.02E+11	2.44E+10	2.95E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	8.80E+11	2.27E+11	9.17E+10	2.20E+10	2.66E+09
MOS (orgs/day)	9.78E+10	2.53E+10	1.02E+10	2.44E+09	2.95E+08

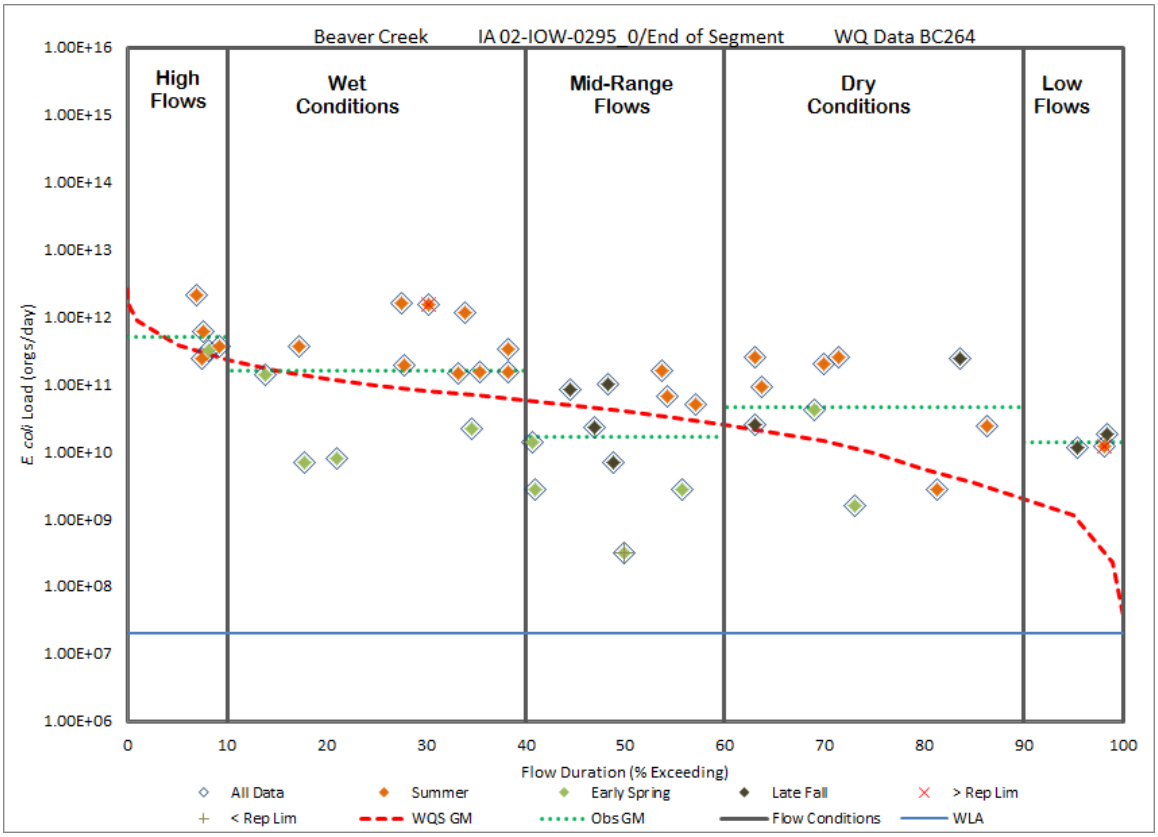

Figure 6-17. Load Duration Curve, Beaver Creek, Segment IA 02-IOW-0295_0.

Table 6-25. Existing Load Estimates for Beaver Creek, Segment IA 02-IOW-0295_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	5.11E+11	1.58E+11	1.54E+10	4.48E+10	1.36E+10
GM Departure (% Reduction)	1.34E+11 (26.1)	6.00E+10 (38.1)	-2.39E+10 (0)	3.53E+10 (78.9)	1.25E+10 (91.6)
Midpoint Flow (cfs)	122.6	31.7	12.8	3.1	0.4

Table 6-26. TMDL Summary for Beaver Creek, Segment IA 02-IOW-0295_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	3.78E+11	9.76E+10	3.94E+10	9.45E+09	1.14E+09
WLA (orgs/day)	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07
LA (orgs/day)	3.40E+11	8.78E+10	3.54E+10	8.48E+09	1.01E+09
MOS (orgs/day)	3.78E+10	9.76E+09	3.94E+09	9.45E+08	1.14E+08

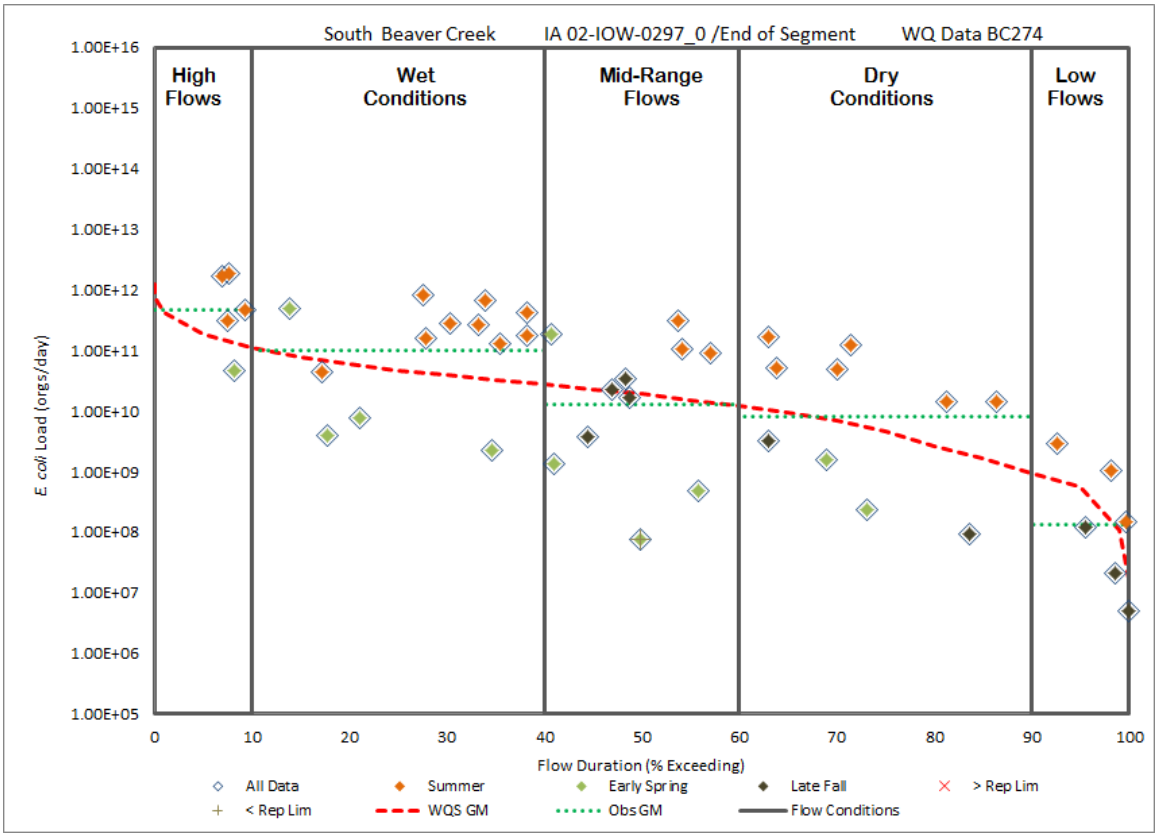

Figure 6-18. Load Duration Curve, South Beaver Creek, Segment IA 02-IOW-0297_0.

Table 6-27. Existing Load Estimates for South Beaver Creek, Segment IA 02-IOW-0297_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	4.63E+11	9.95E+10	1.27E+10	8.08E+09	1.35E+08
GM Departure (% Reduction)	2.81E+11 (60.6)	5.24E+10 (52.7)	-6.31E+09 (0)	3.52E+09 (43.6)	-4.16E+08 (0)
Midpoint Flow (cfs)	59.1	15.3	6.2	1.5	0.2

Table 6-28. TMDL Summary for South Beaver Creek, Segment IA 02-IOW-0297_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.82E+11	4.71E+10	1.90E+10	4.56E+09	5.51E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.64E+11	4.24E+10	1.71E+10	4.10E+09	4.96E+08
MOS (orgs/day)	1.82E+10	4.71E+09	1.90E+09	4.56E+08	5.51E+07

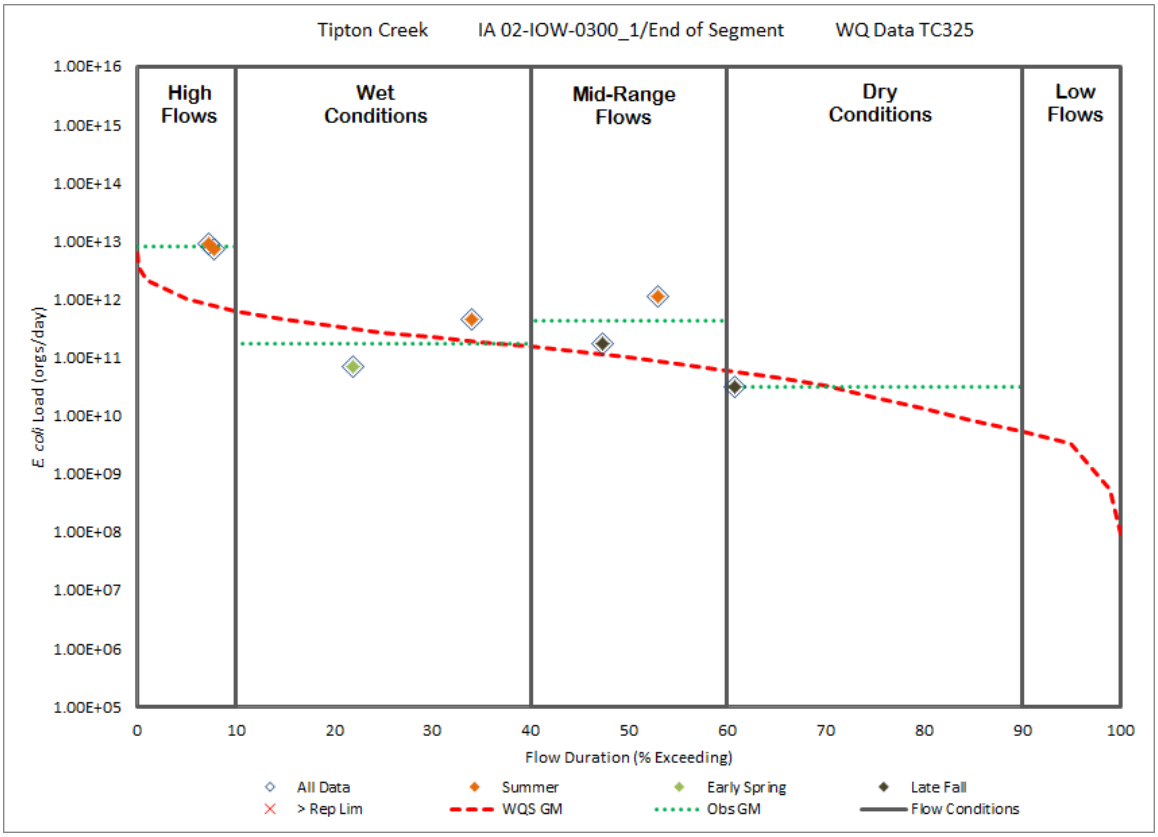

Figure 6-19. Load Duration Curve, Tipton Creek, Segment IA 02-IOW-0300_1.

Table 6-29. Existing Load Estimates for Tipton Creek, Segment IA 02-IOW-0300_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	8.16E+12	1.76E+11	4.34E+11	3.20E+10	N/A
GM Departure (% Reduction)	7.14E+12 (87.5)	-9.52E+10 (0)	3.34E+11 (76.9)	1.09E+10 (34.1)	N/A (N/A)
Midpoint Flow (cfs)	329.6	88.1	32.4	6.8	1.1

Table 6-30. TMDL Summary for Tipton Creek, Segment IA 02-IOW-0300_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.02E+12	2.72E+11	1.00E+11	2.11E+10	3.37E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	9.14E+11	2.44E+11	9.00E+10	1.90E+10	3.03E+09
MOS (orgs/day)	1.02E+11	2.72E+10	1.00E+10	2.11E+09	3.37E+08

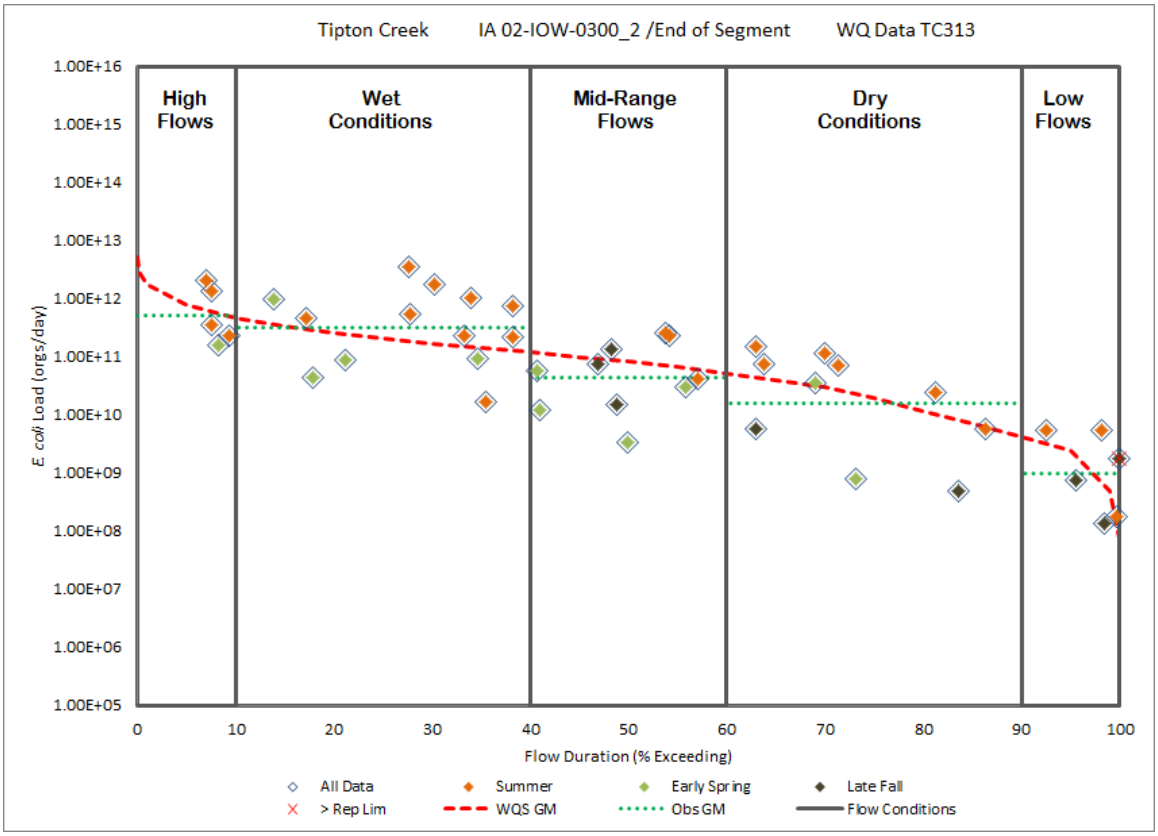

Figure 6-20. Load Duration Curve, Tipton Creek, Segment IA 02-IOW-0300_2.

Table 6-31. Existing Load Estimates for Tipton Creek, Segment IA 02-IOW-0300_2.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	5.23E+11	3.21E+11	4.42E+10	1.60E+10	9.76E+08
GM Departure (% Reduction)	-2.68E+11 (0)	1.16E+11 (36.3)	-3.82E+10 (0)	-3.79E+09 (0)	-1.41E+09 (0)
Midpoint Flow (cfs)	256.7	66.3	26.7	6.4	0.8

Table 6-32. TMDL Summary for Tipton Creek, Segment IA 02-IOW-0300_2.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	7.91E+11	2.04E+11	8.24E+10	1.98E+10	2.39E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	7.12E+11	1.84E+11	7.42E+10	1.78E+10	2.15E+09
MOS (orgs/day)	7.91E+10	2.04E+10	8.24E+09	1.98E+09	2.39E+08

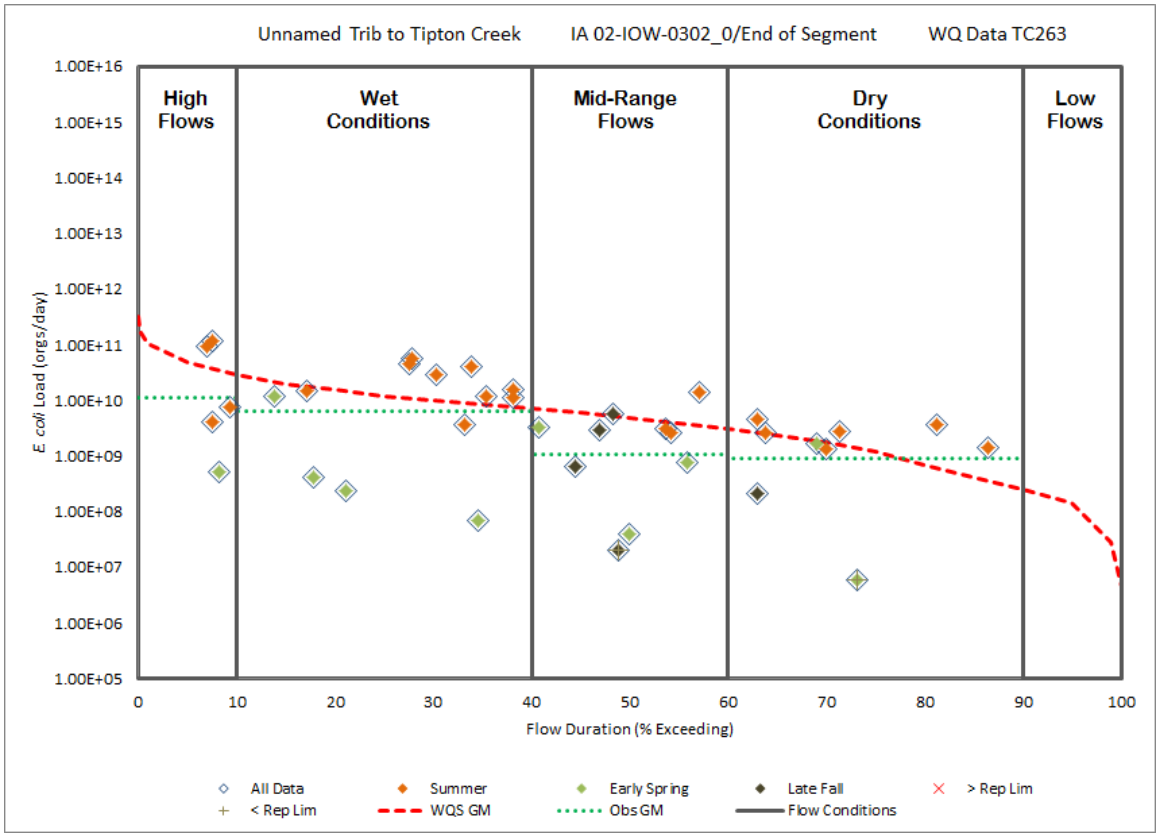

Figure 6-21. Load Duration Curve, Unnamed Tributary to Tipton Creek, Segment IA 02-IOW-0302_0.

Table 6-33. Existing Load Estimates for Unnamed Tributary to Tipton Creek, Segment IA 02-IOW-0302_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	1.13E+10	6.40E+09	1.10E+09	9.31E+08	N/A
GM Departure (% Reduction)	-3.58E+10 (0)	-5.79E+09 (0)	-3.81E+09 (0)	-2.49E+08 (0)	N/A (N/A)
Midpoint Flow (cfs)	15.3	4.0	1.6	0.4	0.0

Table 6-34. TMDL Summary for Unnamed Tributary to Tipton Creek, Segment IA 02-IOW-0302_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	4.72E+10	1.22E+10	4.91E+09	1.18E+09	1.42E+08
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	4.24E+10	1.10E+10	4.42E+09	1.06E+09	1.28E+08
MOS (orgs/day)	4.72E+09	1.22E+09	4.91E+08	1.18E+08	1.42E+07

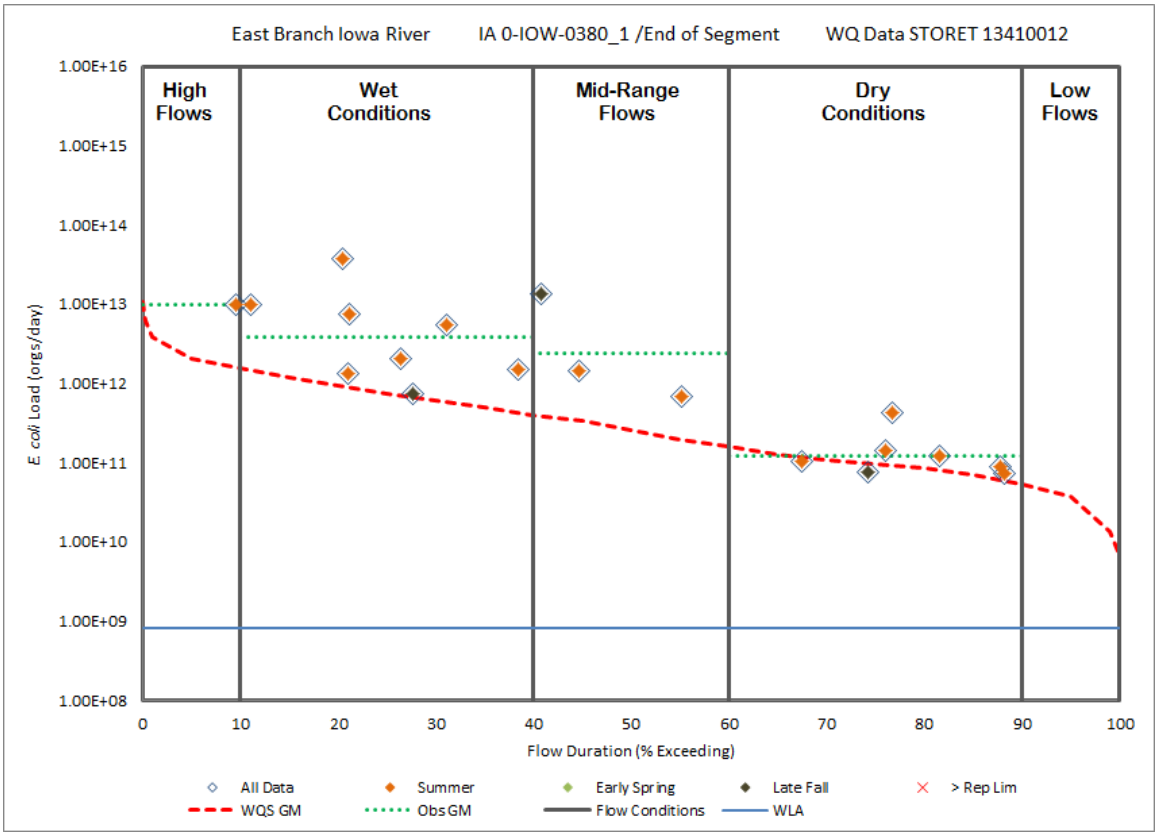

Figure 6-22. Load Duration Curve, East Branch Iowa River, Segment IA 02-IOW-0380_1.

Table 6-35. Existing Load Estimates for East Branch Iowa River, Segment IA 02-IOW-0380_1.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	9.78E+12	3.87E+12	2.38E+12	1.22E+11	N/A
GM Departure (% Reduction)	7.70E+12 (78.7)	3.12E+12 (80.6)	2.12E+12 (89.1)	2.59E+10 (21.3)	N/A (N/A)
Midpoint Flow (cfs)	677.0	242.9	84.4	31.1	12.1

Table 6-36. TMDL Summary for East Branch Iowa River, Segment IA 02-IOW-0380_1.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.09E+12	7.49E+11	2.60E+11	9.58E+10	3.72E+10
WLA (orgs/day)	8.30E+08	8.30E+08	8.30E+08	8.30E+08	8.30E+08
LA (orgs/day)	1.88E+12	6.73E+11	2.33E+11	8.54E+10	3.26E+10
MOS (orgs/day)	2.09E+11	7.49E+10	2.60E+10	9.58E+09	3.72E+09

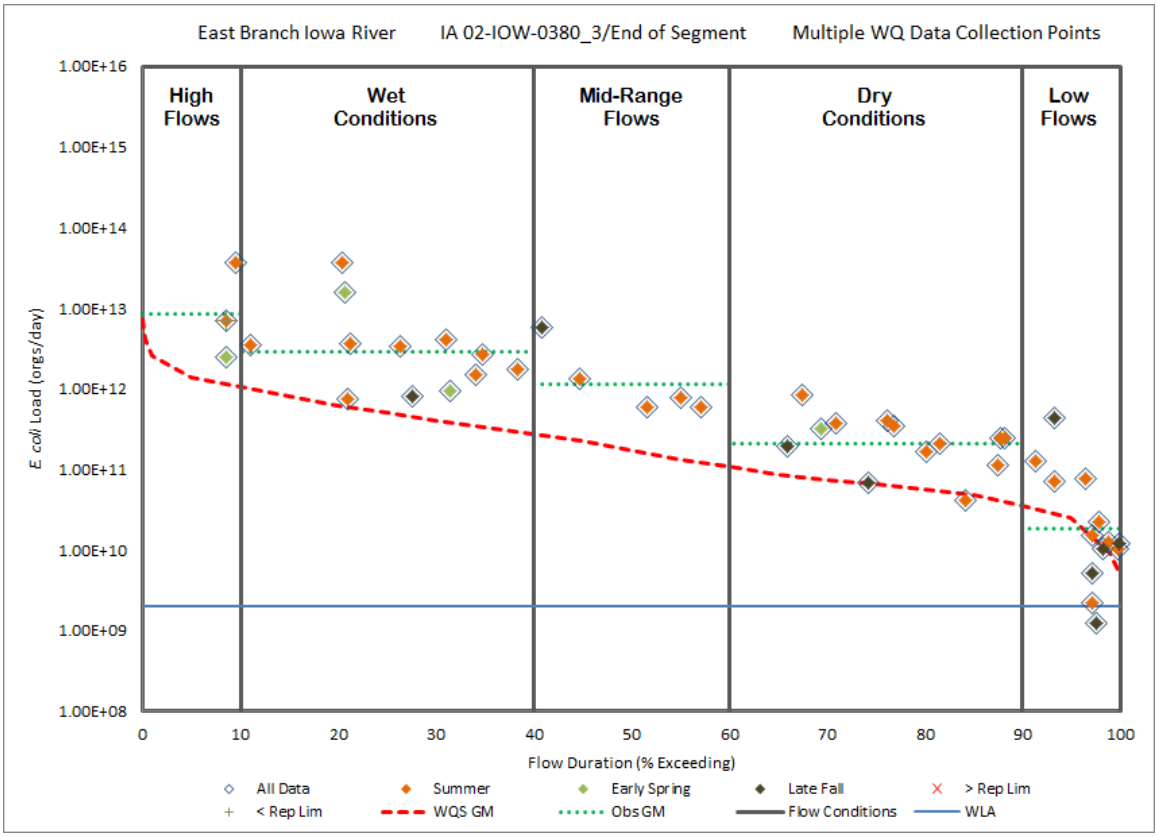

Figure 6-23. Load Duration Curve, East Branch Iowa River, Segment IA 02-IOW-0380_3.

Table 6-37. Existing Load Estimates for East Branch Iowa River, Segment IA 02-IOW-0380_3.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	8.69E+12	2.93E+12	1.17E+12	2.14E+11	1.82E+10
GM Departure (% Reduction)	7.28E+12 (83.8)	2.43E+12 (82.7)	9.92E+11 (84.9)	1.49E+11 (69.7)	-6.97E+09 (0)
Midpoint Flow (cfs)	458.2	164.4	57.1	21.0	8.2

Table 6-38. TMDL Summary for East Branch Iowa River, Segment IA 02-IOW-0380_3.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.41E+12	5.07E+11	1.76E+11	6.48E+10	2.52E+10
WLA (orgs/day)	2.03E+09	2.03E+09	2.03E+09	2.03E+09	2.03E+09
LA (orgs/day)	1.27E+12	4.54E+11	1.56E+11	5.63E+10	2.06E+10
MOS (orgs/day)	1.41E+11	5.07E+10	1.76E+10	6.48E+09	2.52E+09

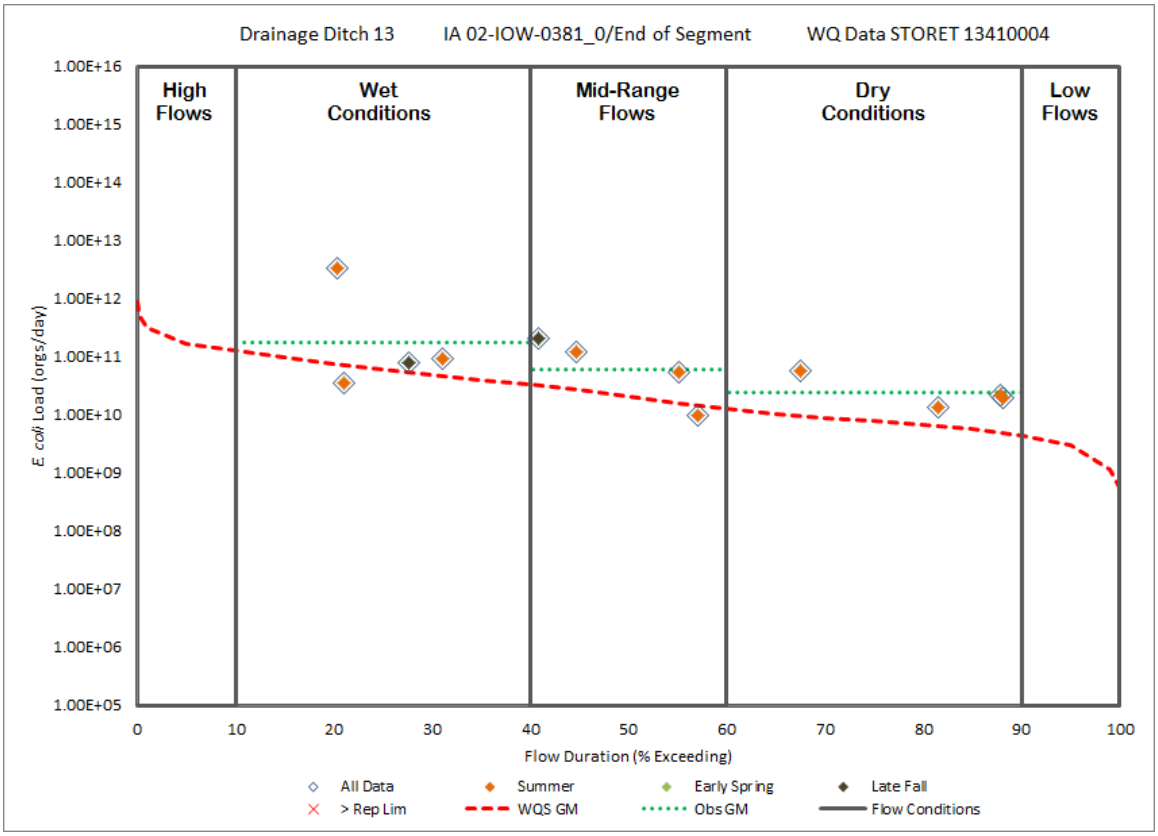

Figure 6-24. Load Duration Curve, Drainage Ditch #13, Segment IA 02-IOW-0381_0.

Table 6-39. Existing Load Estimates for Drainage Ditch #13, Segment IA 02-IOW-0381_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	N/A	1.74E+11	6.11E+10	2.40E+10	N/A
GM Departure (% Reduction)	N/A (N/A)	1.13E+11 (64.9)	3.98E+10 (65.2)	1.61E+10 (67.3)	N/A (N/A)
Midpoint Flow (cfs)	55.4	19.9	6.9	2.5	1.0

Table 6-40. TMDL Summary for Drainage Ditch #13, Segment IA 02-IOW-0381_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	1.71E+11	6.13E+10	2.13E+10	7.84E+09	3.04E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	1.54E+11	5.51E+10	1.92E+10	7.05E+09	2.74E+09
MOS (orgs/day)	1.71E+10	6.13E+09	2.13E+09	7.84E+08	3.04E+08

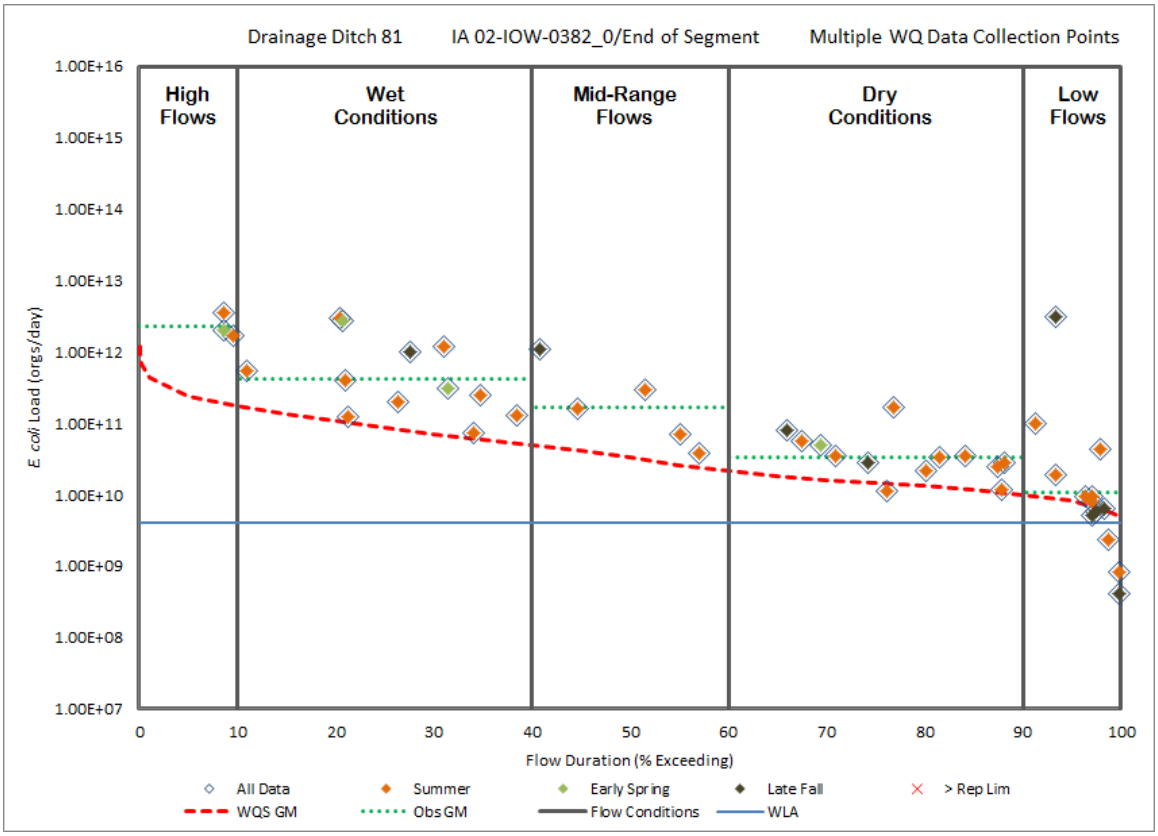

Figure 6-25. Load Duration Curve, Drainage Ditch #81, Segment IA 02-IOW-0382_0.

Table 6-41. Existing Load Estimates for Drainage Ditch #81, Segment IA 02-IOW-0382_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	2.32E+12	4.32E+11	1.71E+11	3.44E+10	1.09E+10
GM Departure (% Reduction)	2.08E+12 (89.8)	3.44E+11 (79.8)	1.38E+11 (80.7)	1.96E+10 (57.0)	2.56E+09 (23.6)
Midpoint Flow (cfs)	76.6	28.3	10.7	4.8	2.7

Table 6-42. TMDL Summary for Drainage Ditch #81, Segment IA 02-IOW-0382_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.36E+11	8.73E+10	3.31E+10	1.48E+10	8.29E+09
WLA (orgs/day)	4.16E+09	4.16E+09	4.16E+09	4.16E+09	4.16E+09
LA (orgs/day)	2.08E+11	7.45E+10	2.56E+10	9.16E+09	3.30E+09
MOS (orgs/day)	2.36E+10	8.73E+09	3.31E+09	1.48E+09	8.29E+08

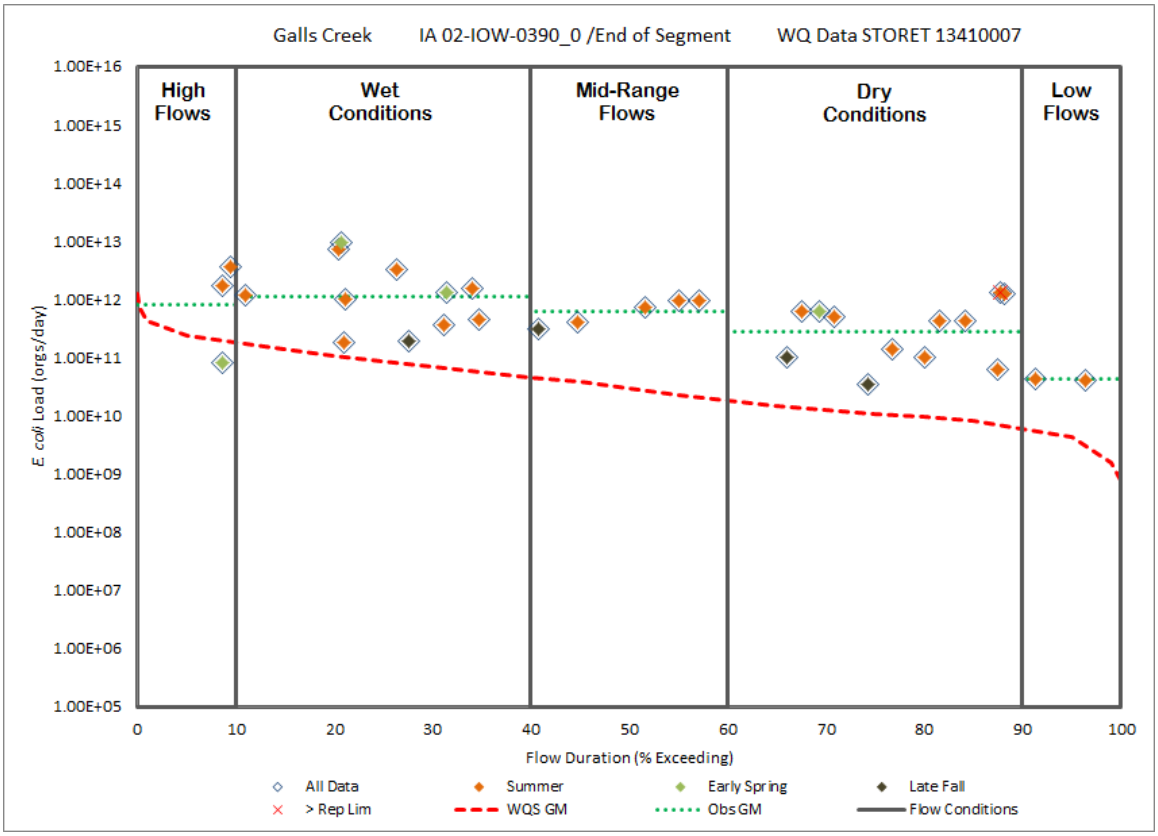

Figure 6-26. Load Duration Curve, Galls Creek, Segment IA 02-IOW-0390_0.

Table 6-43. Existing Load Estimates for Galls Creek, Segment IA 02-IOW-0390_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	7.92E+11	1.12E+12	6.07E+11	2.73E+11	4.23E+10
GM Departure (% Reduction)	5.56E+11 (70.2)	1.03E+12 (92.4)	5.77E+11 (95.1)	2.62E+11 (96.0)	3.80E+10 (90.0)
Midpoint Flow (cfs)	76.6	27.5	9.5	3.5	1.4

Table 6-44. TMDL Summary for Galls Creek, Segment IA 02-IOW-0390_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	2.36E+11	8.47E+10	2.94E+10	1.08E+10	4.20E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	2.12E+11	7.62E+10	2.65E+10	9.75E+09	3.78E+09
MOS (orgs/day)	2.36E+10	8.47E+09	2.94E+09	1.08E+09	4.20E+08

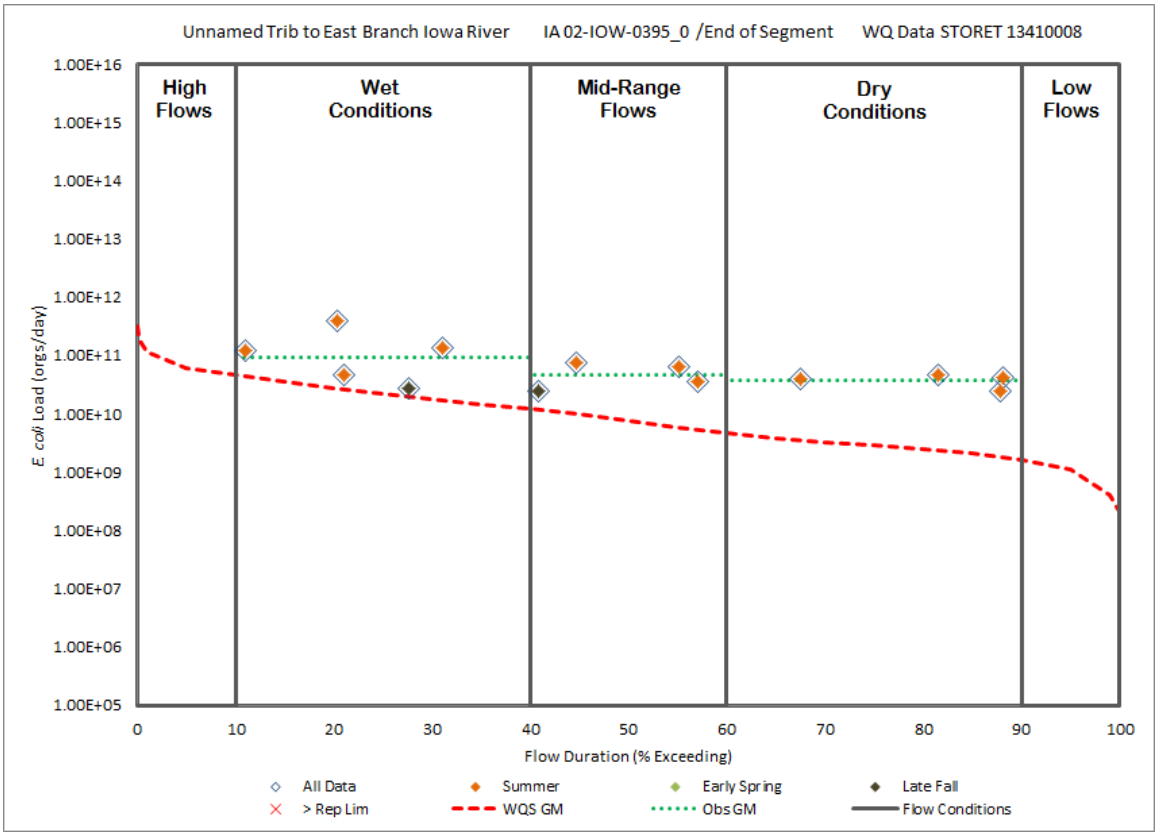

Figure 6-27. Load Duration Curve, Unnamed Tributary to East Branch Iowa River, Segment IA 02-IOW-0395_0.

Table 6-45. Existing Load Estimates for Unnamed Tributary to East Branch Iowa River, Segment IA 02-IOW-0395_0.

Load Summary	Loads (orgs/day)				
	High	Wet	Mid-Range	Dry	Low
Obs GM	N/A	9.63E+10	4.64E+10	3.71E+10	N/A
GM Departure (% Reduction)	N/A (N/A)	7.39E+10 (76.7)	3.86E+10 (83.2)	3.43E+10 (92.3)	N/A (N/A)
Midpoint Flow (cfs)	20.3	7.3	2.5	0.9	0.4

Table 6-46. TMDL Summary for Unnamed Tributary to East Branch Iowa River, Segment IA 02-IOW-0395_0.

Flow Condition	High	Wet	Mid-Range	Dry	Low
TMDL (orgs/day)	6.26E+10	2.25E+10	7.80E+09	2.87E+09	1.11E+09
WLA (orgs/day)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA (orgs/day)	5.63E+10	2.02E+10	7.02E+09	2.59E+09	1.00E+09
MOS (orgs/day)	6.26E+09	2.25E+09	7.80E+08	2.87E+08	1.11E+08

6.5. TMDL Summary

This TMDL is based on meeting the water quality criteria for primary contact and children's recreation in the Middle Iowa HUC-8 watershed. Although the WQS are based on *E. coli* concentration, the TMDL is also expressed as a load, in light of the November 2006 EPA memorandum. The following equation represents the total maximum daily load (TMDL) and its components:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

Where: TMDL = total maximum daily load
LC = loading capacity
ΣWLA = sum of wasteload allocations (point sources)
ΣLA = sum of load allocations (nonpoint sources)
MOS = margin of safety (to account for uncertainty)

Once the loading capacity, waste load allocations, load allocations, and margin of safety are determined for the Lower Iowa River watershed, the general equation above can be expressed for each segment and flow condition for *E. coli* as the allowable daily load.

Table 6-47. TMDL Summary by Segment for the Upper Iowa HUC-8 Watershed.

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Iowa River, IA 02-IOW-0070_3				
High Flow	8.27E+12	2.20E+10	7.42E+12	8.27E+11
Moist	3.06E+12	2.20E+10	2.73E+12	3.06E+11
Mid-Range	1.37E+12	2.20E+10	1.21E+12	1.37E+11
Dry	5.35E+11	2.20E+10	4.59E+11	5.35E+10
Low Flow	1.71E+11	2.20E+10	1.32E+11	1.71E+10
Iowa River, IA 02-IOW-0080_2				
High Flow	5.05E+12	5.84E+09	4.54E+12	5.05E+11
Moist	1.79E+12	5.84E+09	1.60E+12	1.79E+11
Mid-Range	6.76E+11	5.84E+09	6.03E+11	6.76E+10
Dry	2.39E+11	5.84E+09	2.09E+11	2.39E+10
Low Flow	9.34E+10	5.84E+09	7.82E+10	9.34E+09
South Fork Iowa River, IA 02-IOW-0270_0				
High Flow	4.07E+12	0.00E+00	3.66E+12	4.07E+11
Moist	1.05E+12	0.00E+00	9.46E+11	1.05E+11
Mid-Range	4.24E+11	0.00E+00	3.81E+11	4.24E+10
Dry	1.02E+11	0.00E+00	9.16E+10	1.02E+10
Low Flow	1.23E+10	0.00E+00	1.11E+10	1.23E+09
South Fork Iowa River, IA 02-IOW-0280_3				
High Flow	1.31E+12	5.10E+07	1.18E+12	1.31E+11
Moist	3.51E+11	5.10E+07	3.16E+11	3.51E+10
Mid-Range	1.29E+11	5.10E+07	1.16E+11	1.29E+10
Dry	2.72E+10	5.10E+07	2.44E+10	2.72E+09
Low Flow	4.36E+09	5.10E+07	3.87E+09	4.36E+08

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
South Fork Iowa River, IA 02-IOW-0280_4				
High Flow	1.31E+12	1.48E+10	1.17E+12	1.31E+11
Moist	3.51E+11	1.48E+10	3.01E+11	3.51E+10
Mid-Range	1.29E+11	1.48E+10	1.01E+11	1.29E+10
Dry	2.72E+10	1.48E+10	9.69E+09	2.72E+09
Low Flow	4.35E+09	1.48E+10	-1.09E+10	4.35E+08
South Fork Iowa River, IA 02-IOW-0280_5				
High Flow	8.15E+11	0.00E+00	7.34E+11	8.15E+10
Moist	2.11E+11	0.00E+00	1.90E+11	2.11E+10
Mid-Range	8.49E+10	0.00E+00	7.64E+10	8.49E+09
Dry	2.04E+10	0.00E+00	1.83E+10	2.04E+09
Low Flow	2.46E+09	0.00E+00	2.22E+09	2.46E+08
South Fork Iowa River, IA 02-IOW-0282_0				
High Flow	4.04E+11	0.00E+00	3.64E+11	4.04E+10
Moist	1.04E+11	0.00E+00	9.40E+10	1.04E+10
Mid-Range	4.21E+10	0.00E+00	3.79E+10	4.21E+09
Dry	1.01E+10	0.00E+00	9.10E+09	1.01E+09
Low Flow	1.22E+09	0.00E+00	1.10E+09	1.22E+08
Beaver Creek, IA 02-IOW-0290_0				
High Flow	9.78E+11	0.00E+00	8.80E+11	9.78E+10
Moist	2.53E+11	0.00E+00	2.27E+11	2.53E+10
Mid-Range	1.02E+11	0.00E+00	9.17E+10	1.02E+10
Dry	2.44E+10	0.00E+00	2.20E+10	2.44E+09
Low Flow	2.95E+09	0.00E+00	2.66E+09	2.95E+08
Beaver Creek, IA 02-IOW-0295_0				
High Flow	3.78E+11	2.05E+07	3.40E+11	3.78E+10
Moist	9.76E+10	2.05E+07	8.78E+10	9.76E+09
Mid-Range	3.94E+10	2.05E+07	3.54E+10	3.94E+09
Dry	9.45E+09	2.05E+07	8.48E+09	9.45E+08
Low Flow	1.14E+09	2.05E+07	1.01E+09	1.14E+08
South Beaver Creek, IA 02-IOW-0297_0				
High Flow	1.82E+11	0.00E+00	1.64E+11	1.82E+10
Moist	4.71E+10	0.00E+00	4.24E+10	4.71E+09
Mid-Range	1.90E+10	0.00E+00	1.71E+10	1.90E+09
Dry	4.56E+09	0.00E+00	4.10E+09	4.56E+08
Low Flow	5.51E+08	0.00E+00	4.96E+08	5.51E+07

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Tipton Creek, IA 02-IOW-0300_1				
High Flow	1.02E+12	0.00E+00	9.14E+11	1.02E+11
Moist	2.72E+11	0.00E+00	2.44E+11	2.72E+10
Mid-Range	1.00E+11	0.00E+00	9.00E+10	1.00E+10
Dry	2.11E+10	0.00E+00	1.90E+10	2.11E+09
Low Flow	3.37E+09	0.00E+00	3.03E+09	3.37E+08
Tipton Creek, IA 02-IOW-0300_2				
High Flow	7.91E+11	0.00E+00	7.12E+11	7.91E+10
Moist	2.04E+11	0.00E+00	1.84E+11	2.04E+10
Mid-Range	8.24E+10	0.00E+00	7.42E+10	8.24E+09
Dry	1.98E+10	0.00E+00	1.78E+10	1.98E+09
Low Flow	2.39E+09	0.00E+00	2.15E+09	2.39E+08
Unnamed Tributary to Tipton Creek, IA 02-IOW-0302_0				
High Flow	4.72E+10	0.00E+00	4.24E+10	4.72E+09
Moist	1.22E+10	0.00E+00	1.10E+10	1.22E+09
Mid-Range	4.91E+09	0.00E+00	4.42E+09	4.91E+08
Dry	1.18E+09	0.00E+00	1.06E+09	1.18E+08
Low Flow	1.42E+08	0.00E+00	1.28E+08	1.42E+07
East Branch Iowa River, IA 02-IOW-0380_1				
High Flow	2.09E+12	8.30E+08	1.88E+12	2.09E+11
Moist	7.49E+11	8.30E+08	6.73E+11	7.49E+10
Mid-Range	2.60E+11	8.30E+08	2.33E+11	2.60E+10
Dry	9.58E+10	8.30E+08	8.54E+10	9.58E+09
Low Flow	3.72E+10	8.30E+08	3.26E+10	3.72E+09
East Branch Iowa River, IA 02-IOW-0380_3				
High Flow	1.41E+12	2.03E+09	1.27E+12	1.41E+11
Moist	5.07E+11	2.03E+09	4.54E+11	5.07E+10
Mid-Range	1.76E+11	2.03E+09	1.56E+11	1.76E+10
Dry	6.48E+10	2.03E+09	5.63E+10	6.48E+09
Low Flow	2.52E+10	2.03E+09	2.06E+10	2.52E+09
Drainage Ditch #13, IA 02-IOW-0381_0				
High Flow	1.71E+11	0.00E+00	1.54E+11	1.71E+10
Moist	6.13E+10	0.00E+00	5.51E+10	6.13E+09
Mid-Range	2.13E+10	0.00E+00	1.92E+10	2.13E+09
Dry	7.84E+09	0.00E+00	7.05E+09	7.84E+08
Low Flow	3.04E+09	0.00E+00	2.74E+09	3.04E+08

Flow Condition	TMDL (orgs/day)	WLA (orgs/day)	LA (orgs/day)	MOS (orgs/day)
Drainage Ditch #81, IA 02-IOW-0382_0				
High Flow	2.36E+11	4.16E+09	2.08E+11	2.36E+10
Moist	8.73E+10	4.16E+09	7.45E+10	8.73E+09
Mid-Range	3.31E+10	4.16E+09	2.56E+10	3.31E+09
Dry	1.48E+10	4.16E+09	9.16E+09	1.48E+09
Low Flow	8.29E+09	4.16E+09	3.30E+09	8.29E+08
Galls Creek, IA 02-IOW-0390_0				
High Flow	2.36E+11	0.00E+00	2.12E+11	2.36E+10
Moist	8.47E+10	0.00E+00	7.62E+10	8.47E+09
Mid-Range	2.94E+10	0.00E+00	2.65E+10	2.94E+09
Dry	1.08E+10	0.00E+00	9.75E+09	1.08E+09
Low Flow	4.20E+09	0.00E+00	3.78E+09	4.20E+08
Unnamed Tributary to East Branch Iowa River, IA 02-IOW-0395_0				
High Flow	6.26E+10	0.00E+00	5.63E+10	6.26E+09
Moist	2.25E+10	0.00E+00	2.02E+10	2.25E+09
Mid-Range	7.80E+09	0.00E+00	7.02E+09	7.80E+08
Dry	2.87E+09	0.00E+00	2.59E+09	2.87E+08
Low Flow	1.11E+09	0.00E+00	1.00E+09	1.11E+08

7. Implementation Plan

An implementation plan is not a required component of a TMDL document but it is a useful and logical extension of TMDL development. It provides Iowa DNR staff, partners, and watershed stakeholders with a general idea of how a specific strategy and work plan can be developed. This strategy should guide stakeholders and the Iowa DNR in the development of a detailed and priority-based plan that implements best management practices, improves Iowa River watershed water quality, and meets TMDL targets.

This water quality improvement plan sets targets for *E. coli* for the impaired segments of the Iowa River Basin. Watershed stakeholders, including municipalities and agricultural interests, will need to participate in the implementation of bacteria controls and continuing evaluation to accomplish water quality improvement goals. It will take an ongoing effort to develop best management practices in the watershed through projects funded by a variety of county, state and federal water quality improvement programs.

As a start, it would be useful to create a local watershed advisory committee, where none exist, to help identify high priority areas where resources can be concentrated for the greatest effect. This would facilitate the organization and provide direction for monitoring specific stream sites to identify significant pollutant sources and to plan water quality improvement activities.

7.1. General Approach & Timeline

Collaboration and action by watershed residents, landowners, producers, business owners, and local agencies will be required to improve water quality in the Iowa River Basin to support designated uses. Locally-driven efforts have proven to be the most successful in obtaining real and significant water quality improvements. Each group has a stake in promoting awareness and educating others about the Iowa River Basin, working together to adopt a comprehensive watershed improvement plan, and applying BMPs and land practice changes in the watershed. This large and diverse group of stakeholders provides the opportunity for an effective network of partnerships to be built.

General Approach

The existing loads, loading targets and allocations, and a general menu of potential BMPs needed to improve water quality are provided in this Water Quality Improvement Plan (WQIP). The TMDL must be followed by the development of a locally-led watershed management planning process. The watershed plan should include:

- A more comprehensive and detailed assessment of potential nonpoint pollutant sources that shows the source location, magnitude, and relative impact based on proximity to streams and runoff controls in place.
- Continued monitoring to better understand and document bacteria sources.
- Application of watershed and water quality models to provide information on which best management practices to implement that will have the most impact and where they can be most effectively employed
- Assessment of water quality trends.
- Assessment of water quality standards (WQS) attainment.

A phased approach to improving water quality is recommended for the Iowa River Basin. Sources of bacteria, both large and small, must be reduced. However, the largest and most identifiable sources of bacteria should be given highest priority and addressed first. Less significant and/or less understood sources can be addressed later as funding allows and new monitoring data increases stakeholder understanding of their impacts to water quality.

Timeline

Development of a comprehensive watershed management plan may take one to two years from the completion of the WQIP. Implementation of BMPs could take five to ten years, depending on funding, willingness of stakeholder participation, and time needed for design and construction of structural BMPs. Realization and documentation of water quality benefits may take an additional five to ten years, depending on weather patterns, amount of water quality data collected, and the successful location, design, construction, and maintenance of BMPs. Utilization of the monitoring plan outlined in Section 8 should begin as soon as possible to help identify undocumented bacteria sources and establish a

baseline. Monitoring should continue throughout implementation of BMPs and beyond to document water quality improvement.

7.2. Best Management Practices

This section provides a general summary of BMPs applicable to bacteria reduction. It is not an all-inclusive list, and further investigation (during development of the watershed management plan) may suggest that some alternatives should be implemented in favor of others. An important task in development of the watershed management plan will be to identify additional water quality improvement BMPs (both structural and non-structural), as well as prioritize, locate, and schedule implementation of BMPs.

There are two general strategies for reducing pollutant loads: source control and in-drainage reduction. Source control strategies are usually non-structural practices related to the management of runoff or production and application of pollutants (e.g., manure, fertilizer, industrial products). As the name implies, source control strategies focus on stopping or reducing the pollution at its source. Examples of source control strategies for bacteria reduction are listed in Table 7-1.

Table 7-1. Example Source Control Strategies (BMPs).

Strategy/BMP	Examples
Livestock manure management	Storage and/or treatment facilities, disposal
Manure management	Manure storage and strategic application (location, timing, and methods).
Pasture management	Elimination of stream access, grazing rotation
Septic system improvements	Inspection/repair/replacement
Wildlife management activities	Population control (particularly for geese)
Highway/roadway cleanup	Street sweeping, road kill pickup programs
Pet waste management	Educational programs, local ordinances
Low impact development (LID) (1)	LID ordinances/practices for new development
Runoff reduction(1)	Disconnection of impervious areas using rain barrels, porous pavement, rain gardens, etc.

(1) Some LID and runoff reduction strategies could be considered either source control or in-line drainage reduction.

In-drainage reduction strategies usually involve the use of structural BMPs to eliminate or reduce pollutants by intercepting and/or treating them within the drainage system using physical, chemical, or biological processes. Examples of in-drainage BMPs are provided in Table 7-2, along with their respective removal mechanisms.

Table 7-2. Example In-Drainage Strategies (BMPs).

Strategy/BMP	Removal Mechanism(s) (1)
Constructed wetlands	UV exposure, settling, predation
Wet detention ponds	UV exposure, settling, predation
Dry detention basin	UV exposure, settling, drying
Vegetated filter strips	Filtration, infiltration
Riparian buffers	Exclusion from stream, filtration, infiltration
Sand filters	Filtration
Infiltration trenches	Infiltration
Bioswales/bioretention	UV exposure, settling, infiltration, drying
Proprietary stormwater treatment systems(2)	Varies with device – usually settling and/or filtration

(1) Modified from North Carolina Cooperative Extension Service, 2008.
(2) Examples include hydrodynamic devices, gravity separators, and catch basin inserts.

Estimated bacteria removal efficiencies associated with the various source control BMPs are provided in Table 7-3. Table 7-4 lists removal rates associated with in-drainage BMPs. Note that these rates are highly variable. Rates listed in Table 7-3 and Table 7-4 assume that the BMP is properly designed, implemented, and maintained. Additionally, these rates apply only to the specific source of bacteria they treat, not the overall reduction. These removal rates must be applied with caution on a case-by-case basis to avoid overestimating potential water quality improvements.

Because of the large reductions required for attainment of WQS in Iowa River Basin and the highly variable nature of observed concentrations and removal, a combination of source control and in-drainage BMPs will be necessary. Additionally, many in-drainage BMPs function better when multiple systems are implemented in series. For example, grass bioswales may convey runoff to a vegetated filter strip before flows reach a constructed wetland. This type of treatment train approach offers the advantage of multiple removal mechanisms and built in redundancy to increase the reliability of bacteria reduction. The watershed management plan developed for the Iowa River Basin should consider the use of treatment train approaches wherever possible.

Table 7-3. Source Control BMPs and Estimated Bacteria Removal Rates.

BMP	Removal (%)	Additional Comments
Manure injection	Up to 90(1)	Removal will vary with injection method, application rates, land slope, weather, and other variables. Injection can offer up to 90% reduction in bacteria transport when compared to surface application.
Manure export/disposal	Up to 100	Removing manure from the watershed would provide a 100% reduction from this source. However, if manure application is increased elsewhere, impacts to that watershed must be investigated.
Exclusion of livestock from streams	Up to 100	The removal associated with this practice is proportional to the percent of livestock that are excluded. If all livestock are excluded from streams at all times, then bacteria reduction from this source would be 100%.
Septic system improvements	Up to 100	Repair/replacement of all failing systems provides 100% reduction. Watershed wide removal rate would be proportional to the percent of failing systems fixed.
Wildlife management	Varies	If there are known areas of waterfowl populations (e.g., stormwater ponds), management of geese populations would provide some bacteria reductions. Removal rates would be proportional to population reduction.
Street sweeping	Up to 22(1)	Published literature contains conflicting information regarding potential bacteria reduction from street sweeping. This BMP should not be relied upon as a key part of the implementation strategy, but may help reduce bacteria loads in highly pervious urban areas.
Pet waste management	Up to 75(1)	Includes information and education programs regarding the importance of picking up after your pets. Could include the adoption of local ordinances.
LID and runoff reduction BMPs	Varies	Proportional to the amount of runoff reduction obtained. Some LID and runoff reduction measures are included as in-drainage BMPs in Table 7-4.

(1) Source: VDEQ et al., 2009

Table 7-4. In-Drainage BMPs and Estimated Bacteria Removal Rates.

BMP	Removal (%)	Additional Comments
Constructed wetlands	78-99[2][3]	Wetlands could act as a source if not properly designed or maintained, including management of potential waterfowl populations.
Wet detention ponds	44-99[2][3]	Ponds could act as a source if not properly designed or maintained, including management of potential waterfowl populations.
Dry detention basins	Varies[2][3]	Dry detention basins often act as a net source of bacteria and should not be considered reliable as stand-alone systems.
Vegetated filter strips	43-57[2]	Vegetated filter strips are flat or very gently sloped segments of land intended to "treat" inflows to the stream. Filter strips should be distinguished from riparian buffers, which offer less removal potential.
Riparian buffers	Up to 40[1]	The primary benefits of buffers are to "buffer" the stream from nearby land uses and activities, as the name suggests. Actual removal rates depend on the width of the buffer and the type and density of vegetation, as well as the portion of runoff that the buffer intercepts.
Sand filters	36-83[2]	Generally designed as part of the stormwater infrastructure to capture and treat the first flush of runoff from impervious surfaces.
Bioswales and bioretention	69-99[1][2][3]	Includes rain gardens. Should be used with caution or avoided in areas where possible groundwater contamination is a concern.
Pervious concrete; porous asphalt	30-65[4]	Requires careful design and construction and is only feasible in areas with adequate soil infiltration rates (at least 0.5 inches/hour).
Permeable pavers	65-100[4]	Similar to pervious concrete and porous asphalt. Utilizes pre-cast permeable blocks to infiltrate water. Adequate soil infiltration rates required.
Hydrodynamic devices	<30[4]	Type of proprietary stormwater treatment system.
Gravity separators	<30[4]	Type of proprietary stormwater treatment system.
Coagulation and/or flocculation	65-100[4]	Chemical treatment of stormwater. Usually implemented in conjunction with a stormwater pond. Offers high removal, but addition of coagulation/flocculation chemicals such as alum is required.

(1) Source: VDEQ et al., 2009
(2) Source: EPA, 2004
(3) Source: North Carolina Cooperative Extension Service, 2008
(4) Source: Iowa Stormwater Management Manual

8. Future Monitoring

Water quality monitoring is a critical element in assessing the current status of water resources and the historical trends. Furthermore, monitoring is necessary to track the effectiveness of water quality improvements made in the watershed and document the status of the waterbody in terms of achieving total maximum daily loads and water quality standards (WQS).

Future monitoring in the Iowa River watershed can be agency-led, volunteer-based, or a combination of both. The Iowa Department of Natural Resources (Iowa DNR) Watershed Monitoring and Assessment Section administer a water quality monitoring program that provides training to interested volunteers. More information can be found at the program website: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Volunteer-Water-Monitoring.

It is important that volunteer-based monitoring efforts include an approved water quality monitoring plan, called a Quality Assurance Project Plan (QAPP), in accordance with Iowa Administrative Code (IAC) 567-61.10(455B) through 567-61.13(455B). The IAC can be viewed here: https://www.legis.iowa.gov/docs/iac/chapter/11-23-2016.567.61.pdf. Failure to prepare an approved QAPP will prevent data from being used to assess a waterbody's status on the state's 303(d) list – the list that assesses waterbodies and their designated uses as impaired.

Some of the monitoring projects that provided the data used to create this report are expected to be ongoing. Monitoring of Iowa River bacteria are expected to continue at the ISU/ACOE sites identified in this report. Data collected at all of these sites will continue to be used by the Iowa DNR for its biannual water quality assessments (305(b) report) of the Iowa River.

8.1. Monitoring Plan to Track TMDL Effectiveness

Given current resources and funding, future water quality data collection in the Iowa River watershed to assess water quality trends and compliance with WQS will be limited. Unless there is local interest in collecting additional water quality data, it will be difficult to implement a watershed management plan and document TMDL effectiveness and water quality improvement with respect to bacteria.

As noted in the implementation plan, follow-up to this report requires stakeholder driven solutions and more effective management practices. Continuing monitoring plays an important role in determining what practices result in load reductions and the attainment of WQS. Continued monitoring will:

- Assess the future beneficial use status;
- Determine if water quality is improving, getting worse, or staying the same;
- Evaluate the effectiveness of implemented best management practices.

Table 8-1 is an example monitoring plan.

Table 8-1. Example Monitoring Plan for Individual Segments.

Parameter(s)	Sampling Interval	Sampling Duration	Purpose
E. coli and flow	Weekly snapshot	Throughout recreation season (ongoing)	Evaluate ambient conditions
Microbial source tracking (MST)	Snapshot	At least two sampling events within recreation season. Consider one during high flow and one during low flow.	Determine the source(s) of *E. coli*
E. coli and flow (event sampling)	15-60 minutes	Throughout rising and falling limbs of hydrograph during at least two runoff events within recreation season.	Evaluate the importance of high flow conditions
E. coli and flow (dry weather sampling)	Snapshot	At least twice during low flow conditions within recreation season.	Evaluate the importance of low flow conditions

Additional monitoring locations may be needed or existing ones as shown in Figure 4-4, Figure 5-4, and Figure 6-4 may need to be relocated based on potential sources of impairments in the area. Monitoring plans should be continually evaluated. Adjustment of parameters, sampling intervals, and/or monitoring locations should be based on newly discovered or suspected pollutant sources, BMP placement/installation, and other dynamic factors. The IOWA DNR Watershed Improvement Section can provide technical support to locally led efforts in collecting and analyzing further water quality and flow data in the Iowa River watershed.

8.2. Idealized Plan for Future Watershed Projects

Future watershed improvement projects should be developed and implemented to help restore and protect water quality. If the watershed project is funded with incremental Clean Water Act section 319 funds the EPA requires that nine minimum elements be addressed in the watershed plan and recommends that these nine minimum elements be included in all other watershed plans funded through other sources (EPA, 2008). A summary of the nine minimum elements follows. For a more detailed discussion of these elements see EPA, 2008. :

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan.
2. An estimate of the load reductions expected from management measures.
3. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in item 2, and a description of the critical areas in which those measures will be needed to implement this plan.
4. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.
5. An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.
6. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.
7. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item 8 immediately above.

Other elements that could be included in a watershed plan are but not limited to the following:

- Complete a Use Attainability Assessment (UAA) on streams that have not been assessed. The UAA is used to determine what uses each stream can support and will help in prioritizing the streams to focus on.
- Evaluate and determine gaps in data and collecting additional data where necessary. This could include determining the location of sampling points; frequency of sampling; determining groups or individuals responsible for sampling, this could be private groups, federal, state, or local governmental agencies.
- Community education and involvement. While this was mentioned as one of the nine minimum elements it cannot be overstressed the importance to obtain local involvement.
- Review of funding availability and funding sources.
- Determination of the size or scope of the watershed plan. This report reviewed the impaired streams based on HUC-8 watershed. However, this is too large for local and community involvement. Planning should be based on a HUC-12 watershed or smaller.
- Determine the source of the impairment, point or nonpoint.
- Determine potential BMP's for reducing and eliminating the impairment and modeling the BMP's to identify the most efficient placement.

9. Public Participation

Public involvement is important in the TMDL process since it is the land owners, tenants, and citizens who directly manage land and live in the watershed that determine the water quality in the Iowa River. During the development of this TMDL, efforts were made to ensure that local stakeholders were involved in the decision-making process regarding goals and required actions for improving water quality in the Iowa River.

9.1. Public Meetings

Public information meetings were held at three locations, one in each HUC-8 watershed, within the Iowa River Basin. The dates and locations where the the public information meetings were held are:

- Eldora Public Library, September 20, 2017, 6 - 7:30 pm
- Marshalltown Public Library, September 26, 2017, 6 – 7:30 pm
- Coralville Public Library, October 4, 2017, 6 – 7:30 pm

Attendance at each meeting was approximately 20-25 people consisting of local residents, wastewater treatment plant operators, and representatives from the respective Iowa DNR Field Offices.

9.2. Written Comments

A press release was issued on September 7, 2017 to begin a 45 day public comment period which ended on October 22, 2017. During the public comment period the Iowa DNR received one (1) public comment. The public comment and the corresponding official response from the Iowa DNR will be included in Appendix H.

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Appendix A. Glossary of Terms, Abbreviations, and Acronyms

303(d) list: Refers to section 303(d) of the Federal Clean Water Act, which requires a listing of all public surface waterbodies (creeks, rivers, wetlands, and lakes) that do not support their general and/or designated uses. Also called the state's "Impaired Waters List."

305(b) assessment: Refers to section 305(b) of the Federal Clean Water Act, it is a comprehensive assessment of the state's public waterbodies' ability to support their general and designated uses. Those bodies of water which are found to be not supporting or only partially supporting their uses are placed on the 303(d) list.

319: Refers to Section 319 of the Federal Clean Water Act, the Nonpoint Source Management Program. Under this amendment, States receive grant money from EPA to provide technical & financial assistance, education, & monitoring to implement local nonpoint source water quality projects.

AFO: Animal Feeding Operation. A lot, yard, corral, building, or other area in which animals are confined and fed and maintained for 45 days or more in any 12-month period, and all structures used for the storage of manure from animals in the operation. Open feedlots and confinement feeding operations are considered to be separate animal feeding operations.

AU: Animal Unit. A unit of measure used to compare manure production between animal types or varying sizes of the same animal. For example, one 1,000 pound steer constitutes one AU, while one mature hog weighing 200 pounds constitutes 0.2 AU.

Benthic: Associated with or located at the bottom (in this context, "bottom" refers to the bottom of streams, lakes, or wetlands). Usually refers to algae or other aquatic organisms that reside at the bottom of a wetland, lake, or stream (see periphyton).

Benthic macroinvertebrates: Animals larger than 0.5 mm that do not have backbones. These animals live on rocks, logs, sediment, debris and aquatic plants during some period in their life. They include crayfish, mussels, snails, aquatic worms, and the immature forms of aquatic insects such as stonefly and mayfly nymphs.

Base flow: Sustained flow of a stream in the absence of direct runoff. It can include natural and human-induced stream flows. Natural base flow is sustained largely by groundwater discharges.

Biological impairment: A stream segment is classified as biologically impaired if one or more of the following occurs, the FIBI and or BMIBI scores fall below biological reference conditions, a fish kill has occurred on the segment, or the segment has seen a > 50% reduction in mussel species.

Biological reference condition: Biological reference sites represent the least disturbed (i.e. most natural) streams in the ecoregion. The biological data from these sites are used to derive least impacted BMIBI and FIBI scores for each ecoregion. These scores are used to develop Biological Impairment Criteria (BIC) scores for each ecoregion. The BIC is used to determine the impairment status for other stream segments within an ecoregion.

BMIBI: Benthic Macroinvertebrate Index of Biotic Integrity. An index-based scoring method for assessing the biological health of streams and rivers (scale of 0-100) based on characteristics of bottom-dwelling invertebrates.

BMP: Best Management Practice. A general term for any structural or upland soil or water conservation practice. For example terraces, grass waterways, sediment retention ponds, reduced tillage systems, etc.

CAFO: Concentrated Animal Feeding Operation. A federal term defined as any animal feeding operation (AFO) with more than 1000 animal units confined on site, or an AFO of any size that discharges pollutants (e.g. manure, wastewater) into any ditch, stream, or other water conveyance system, whether man-made or natural.

CBOD5: 5-day Carbonaceous Biochemical Oxygen Demand. Measures the amount of oxygen used by microorganisms to oxidize hydrocarbons in a sample of water at a temperature of 20°C and over an elapsed period of five days in the dark.

CFU: A Colony Forming Unit is a cell or cluster of cells capable of multiplying to form a colony of cells. Used as a unit of bacteria concentration when a traditional membrane filter method of analysis is used. Though not necessarily equivalent to most probably number (MPN), the two terms are often used interchangeably.

Confinement feeding operation: An animal feeding operation (AFO) in which animals are confined to areas which are totally roofed.

Credible data law: Refers to 455B.193 of the Iowa Administrative Code, which ensures that water quality data used for all purposes of the Federal Clean Water Act are sufficiently up-to-date and accurate. To be considered "credible," data must be collected and analyzed using methods and protocols outlined in an approved Quality Assurance Project Plan (QAPP).

Cyanobacteria (blue-green algae): Members of the phytoplankton community that are not true algae but are capable of photosynthesis. Some species produce toxic substances that can be harmful to humans and pets.

Designated use(s): Refer to the type of economic, social, or ecological activities that a specific waterbody is intended to support. See Appendix B for a description of all general and designated uses.

DNR (or Iowa DNR): Iowa Department of Natural Resources.

Ecoregion: Areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources based on geology, vegetation, climate, soils, land use, wildlife, and hydrology.

EPA (or USEPA): United States Environmental Protection Agency.

Ephemeral gully erosion: Ephemeral gullies occur where runoff from adjacent slopes forms concentrated flow in drainage ways. Ephemerals are void of vegetation and occur in the same location every year. They are crossable with farm equipment and are often partially filled in by tillage.

FIBI: Fish Index of Biotic Integrity. An index-based scoring method for assessing the biological health of streams and rivers (scale of 0-100) based on characteristics of fish species.

FSA: Farm Service Agency (United States Department of Agriculture). Federal agency responsible for implementing farm policy, commodity, and conservation programs.

General use(s): Refer to narrative water quality criteria that all public waterbodies must meet to satisfy public needs and expectations. See Appendix B for a description of all general and designated uses.

Geometric Mean (GM): A statistic that is a type of mean or average (different from arithmetic mean or average) that measures central tendency of data. It is often used to summarize highly skewed data or data with extreme values such as wastewater discharges and bacteria concentrations in surface waters. In Iowa's water quality standards and assessment procedures, the geometric mean criterion for *E. coli* is measured using at least five samples collected over a 30-day period.

GIS: Geographic Information System(s). A collection of map-based data and tools for creating, managing, and analyzing spatial information.

Groundwater: Subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

Gully erosion: Soil movement (loss) that occurs in defined upland channels and ravines that are typically too wide and deep to fill in with traditional tillage methods.

HEL: Highly Erodible Land. Defined by the USDA Natural Resources Conservation Service (NRCS), it is land which has the potential for long term annual soil losses to exceed the tolerable amount by eight times for a given agricultural field.

IDALS: Iowa Department of Agriculture and Land Stewardship

Integrated report: Refers to a comprehensive document which combines the 305(b) assessment with the 303(d) list, as well as narratives and discussion of overall water quality trends in the state's public waterbodies. The Iowa Department of Natural Resources submits an integrated report to the EPA biennially in even numbered years.

LA: Load Allocation. The portion of the loading capacity attributed to (1) the existing or future nonpoint sources of pollution and (2) natural background sources. Wherever possible, nonpoint source loads and natural loads should be distinguished. (The total pollutant load is the sum of the wasteload and load allocations.)

LiDAR: Light Detection and Ranging. Remote sensing technology that uses laser scanning to collect height or elevation data for the earth's surface.

Load: The total amount of pollutants entering a waterbody from one or multiple sources, measured as a rate, as in weight per unit time or per unit area.

Macrophyte: An aquatic plant that is large enough to be seen with the naked eye and grows either in or near water. It can be floating, completely submerged (underwater), or partially submerged.

MOS: Margin of Safety. A required component of the TMDL that accounts for the uncertainty in the response of the water quality of a waterbody to pollutant loads.

MPN: Most Probable Number. Used as a unit of bacteria concentration when a more rapid method of analysis (such as Colisure or Colilert) is utilized. Though not necessarily equivalent to colony forming units (CFU), the two terms are often used interchangeably.

MS4: Municipal Separate Storm Sewer System. A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States.

Nonpoint source pollution: Pollution that is not released through pipes but rather originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related either to land or water use including failing septic tanks, improper animal-keeping practices, forestry practices, and urban and rural runoff.

NPDES: National Pollution Discharge Elimination System. The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under Section 307, 402, 318, and 405 of the Clean Water Act. Facilities subjected to NPDES permitting regulations include operations such as municipal wastewater treatment plants and industrial waste treatment facilities, as well as some MS4s.

NRCS: Natural Resources Conservation Service (United States Department of Agriculture). Federal agency which provides technical assistance for the conservation and enhancement of natural resources.

Open feedlot: An unroofed or partially roofed animal feeding operation (AFO) in which no crop, vegetation, or forage growth or residue cover is maintained during the period that animals are confined in the operation.

Periphyton: Algae that are attached to substrates (rocks, sediment, wood, and other living organisms). Are often located at the bottom of a wetland, lake, or stream.

Phytoplankton: Collective term for all photosynthetic organisms suspended in the water column. Includes many types of algae and cyanobacteria.

Point source pollution: Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. Point sources are generally regulated by a federal NPDES permit.

Pollutant: As defined in Clean Water Act section 502(6), a pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

Pollution: The man-made or man-induced alteration of the chemical, physical, biological, and/or radiological integrity of water.

PPB: Parts per Billion. A measure of concentration which is the same as micrograms per liter (µg/L).

PPM: Parts per Million. A measure of concentration which is the same as milligrams per liter (mg/L).

RASCAL: Rapid Assessment of Stream Conditions Along Length. RASCAL is a global positioning system (GPS) based assessment procedure designed to provide continuous stream and riparian condition data at a watershed scale.

Riparian: Refers to areas near the banks of natural courses of water. Features of riparian areas include specific physical, chemical, and biological characteristics that differ from upland (dry) sites. Usually refers to the area near a bank of a stream or river.

RUSLE: Revised Universal Soil Loss Equation. An empirical model for estimating long term, average annual soil losses due to sheet and rill erosion.

Scientific notation: See explanation on page 107.

Secchi disk: A device used to measure transparency in waterbodies. The greater the Secchi depth (typically measured in meters), the more transparent the water.

Sediment delivery ratio: A value, expressed as a percent, which is used to describe the fraction of gross soil erosion that is delivered to the waterbody of concern.

Seston: All particulate matter (organic and inorganic) suspended in the water column.

Sheet & rill erosion: Sheet and rill erosion is the detachment and removal of soil from the land surface by raindrop impact, and/or overland runoff. It occurs on slopes with overland flow and where runoff is not concentrated.

Single-Sample Maximum (SSM): A water quality standard criterion used to quantify *E. coli* levels. The single-sample maximum is the maximum allowable concentration measured at a specific point in time in a waterbody.

SI: Stressor Identification. A process by which the specific cause(s) of a biological impairment to a waterbody can be determined from cause-and-effect relationships.

Storm flow (or stormwater): The discharge (flow) from surface runoff generated by a precipitation event. *Stormwater* generally refers to runoff which is routed through some artificial channel or structure, often in urban areas.

STP: Sewage Treatment Plant. General term for a facility that treats municipal sewage prior to discharge to a waterbody according to the conditions of an NPDES permit.

SWCD: Soil and Water Conservation District. Agency which provides local assistance for soil conservation and water quality project implementation, with support from the Iowa Department of Agriculture and Land Stewardship.

TDS: Total Dissolved Solids: The quantitative measure of matter (organic and inorganic material) dissolved, rather than suspended, in the water column. TDS is analyzed in a laboratory and quantifies the material passing through a filter and dried at 180 degrees Celsius.

TMDL: Total Maximum Daily Load. As required by the Federal Clean Water Act, a comprehensive analysis and quantification of the maximum amount of a particular pollutant that a waterbody can tolerate while still meeting its general and designated uses. A TMDL is mathematically defined as the sum of all individual wasteload allocations (WLAs), load allocations (LAs), and a margin of safety (MOS).

Trophic state: The level of ecosystem productivity, typically measured in terms of algal biomass.

TSI (or Carlson's TSI): Trophic State Index. A standardized scoring system developed by Carlson (1977) that places trophic state on an exponential scale of Secchi depth, chlorophyll, and total phosphorus. TSI ranges between 0 and 100, with 10 scale units representing a doubling of algal biomass.

TSS: Total Suspended Solids. The quantitative measure of matter (organic and inorganic material) suspended, rather than dissolved, in the water column. TSS is analyzed in a laboratory and quantifies the material retained by a filter and dried at 103 to 105 degrees Celsius.

Turbidity: A term used to indicate water transparency (or lack thereof). Turbidity is the degree to which light is scattered or absorbed by a fluid. In practical terms, highly turbid waters have a high degree of cloudiness or murkiness caused by suspended particles.

UAA: Use Attainability Analysis. A protocol used to determine which (if any) designated uses apply to a particular waterbody. (See Appendix B for a description of all general and designated uses.)

UHL: University Hygienic Laboratory (University of Iowa). Provides physical, biological, and chemical sampling for water quality purposes in support of beach monitoring, ambient monitoring, biological reference monitoring and impaired water assessments.

USDA: United States Department of Agriculture

USGS: United States Geologic Survey (United States Department of the Interior). Federal agency responsible for implementation and maintenance of discharge (flow) gauging stations on the nation's waterbodies.

Watershed: The land area that drains water (usually surface water) to a particular waterbody or outlet.

WLA: Wasteload Allocation. The portion of a receiving waterbody's loading capacity that is allocated to one of its existing or future point sources of pollution (e.g., permitted waste treatment facilities).

WQS: Water Quality Standards. Defined in Chapter 61 of Environmental Protection Commission [567] of the Iowa Administrative Code, they are the specific criteria by which water quality is gauged in Iowa.

WWTF: Wastewater Treatment Facility. General term for a facility which treats municipal, industrial, or agricultural wastewater for discharge to public waters according to the conditions of the facility's NPDES permit. Used interchangeably with wastewater treatment plant (WWTP).

Zooplankton: Collective term for all animal plankton suspended in the water column which serve as secondary producers in the aquatic food chain and the primary food source for larger aquatic organisms.

Scientific Notation

Scientific notation is the way that scientists easily handle very large numbers or very small numbers. For example, instead of writing 45,000,000,000 we write 4.5E+10. So, how does this work?

We can think of 4.5E+10 as the product of two numbers: 4.5 (the digit term) and E+10 (the exponential term). Here are some examples of scientific notation.

10,000 = 1E+4	24,327 = 2.4327E+4
1,000 = 1E+3	7,354 = 7.354E+3
100 = 1E+2	482 = 4.82E+2
1/100 = 0.01 = 1E-2	0.053 = 5.3E-2
1/1,000 = 0.001 = 1E-3	0.0078 = 7.8E-3
1/10,000 = 0.0001 = 1E-4	0.00044 = 4.4E-4

As you can see, the exponent is the number of places the decimal point must be shifted to give the number in long form. A positive exponent shows that the decimal point is shifted that number of places to the right. A negative exponent shows that the decimal point is shifted that number of places to the left.

Appendix B. General and Designated Uses of Iowa's Waters

Introduction

Iowa's water quality standards (Environmental Protection Commission [567], Chapter 61 of the Iowa Administrative Code) provide the narrative and numerical criteria by which water bodies are judged when determining the health and quality of our aquatic ecosystems. These standards vary depending on the type of water body (lakes vs. rivers) and the assigned uses (general use vs. designated uses) of the water body that is being dealt with. This appendix is intended to provide information about how Iowa's water bodies are classified and what the use designations mean, hopefully providing a better general understanding for the reader.

All public surface waters in the state are protected for certain beneficial uses, such as livestock and wildlife watering, aquatic life, non-contact recreation, crop irrigation, and other incidental uses (e.g. withdrawal for industry and agriculture). However, certain rivers and lakes warrant a greater degree of protection because they provide enhanced recreational, economical, or ecological opportunities. Thus, all public bodies of surface water in Iowa are divided into two main categories: *general* use segments and *designated* use segments. This is an important classification because it means that not all of the criteria in the state's WQS apply to all water ways; rather, the criteria which apply depend on the use designation & classification of the water body.

General Use Segments

A general use segment water body is one which does not maintain perennial (year-round) flow of water or pools of water in most years (i.e. ephemeral or intermittent waterways). In other words, stream channels or basins which consistently dry up year after year would be classified as general use segments. Exceptions are made for years of extreme drought or floods. For the full definition of a general use water body, consult section 61.3(1) in the state's published WQS, which became effective on March 22, 2006 (Environmental Protection Commission [567], Chapter 61 of the Iowa Administrative Code).

General use waters are protected for the beneficial uses listed above, which are: livestock and wildlife watering, aquatic life, non-contact recreation, crop irrigation, and industrial, agricultural, domestic and other incidental water withdrawal uses. The criteria used to ensure protection of these uses are described in section 61.3(2) in the state's published WQS, which became effective on March 22, 2006 (Environmental Protection Commission [567], Chapter 61 of the Iowa Administrative Code).

Designated Use Segments

Designated use segments are water bodies which maintain flow throughout the year, or at least hold pools of water which are sufficient to support a viable aquatic community (i.e. perennial waterways). In addition to being protected for the same beneficial uses as the general use segments, these perennial waters are protected for more specific activities such as primary contact recreation, drinking water sources, or cold-water fisheries. There are a total of thirteen different designated use classes (Table B-1) which may apply, and a water body may have more than one designated use. For definitions of the use classes and more detailed descriptions, consult section 61.3(1) in the state's published WQS, which became effective on March 22, 2006 (Environmental Protection Commission [567], Chapter 61 of the Iowa Administrative Code).

Table B-1. Designated Use Classes for Iowa Water Bodies.

Class prefix	Class	Designated use	Brief comments
A	A1	Primary contact recreation	Supports swimming, water skiing, etc.
	A2	Secondary contact recreation	Limited/incidental contact occurs, such as boating
	A3	Children's contact recreation	Urban/residential waters that are attractive to children
B	B(CW1)	Cold water aquatic life – Type 2	Able to support coldwater fish (e.g. trout) populations
	B(CW2)	Cold water aquatic life – Type 2	Typically unable to support consistent trout populations
	B(WW-1)	Warm water aquatic life – Type 1	Suitable for game and nongame fish populations
	B(WW-2)	Warm water aquatic life – Type 2	Smaller streams where game fish populations are limited by physical conditions & flow
	B(WW-3)	Warm water aquatic life – Type 3	Streams that only hold small perennial pools which extremely limit aquatic life
	B(LW)	Warm water aquatic life – Lakes and Wetlands	Artificial and natural impoundments with "lake-like" conditions
C	C	Drinking water supply	Used for raw potable water
Other	HQ	High quality water	Waters with exceptional water quality
	HQR	High quality resource	Waters with unique or outstanding features
	HH	Human health	Fish are routinely harvested for human consumption

Appendix C. Lower Iowa HUC 8 Watershed – 07080209

Appendix C.1. Wasteload Allocation by Stream Segment for the Lower Iowa Watershed

This appendix provides the wasteload allocation (WLA) for each facility based on the stream segment that it discharges to. Below is a summary of the Facility Types in the Watershed.

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- CAFO – Concentrated Animal Feeding Operation.
- GP #4 – Private Facility operating under an NPDES General Permit #4
- ST/SF – Septic Tank Sand Filter
- SW – Stormwater
- TF – Trickling Filter
- UNSWD – Unsewered Community
- WSL – Waste Stabilization Lagoon (Controlled Discharge Lagoon, CDL)

Stream segments for the Muddy River, IA 02-IOW-0162_0 and the Unnamed Tributary to the Muddy Creek, IA 02-IOW-0166_0 do not have any NPDES permitted facilities within the drainage area consequently, there is not a WLA contribution for these segments and are not addressed in this appendices.

Wastewater Treatment Facility (WWTF)

WWTF can be grouped two types of discharging facilities, continuous and intermittent. All of the WWTF listed in this WQIP are continuous discharging facilities with the exception of Waste Stabilization Lagoons which are intermittent discharging facilities.

The design flow for WWTF is the NPDES permitted average wet weather (AWW) flow. For a continuous discharging facility this is the 30-day AWW flow and the 180-day AWW flow for intermittent discharging facilities.

The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.

Intermittent discharging facilities operate as a hold and discharge facility with a minimum holding time of 180-days. These facilities typically discharge twice per year for short periods of time in the spring and in the fall when stream flows are at the highest. These facilities are permitted to discharge at a rate that is ten times the 180-day AWW flow. WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Unsewered (UNSWD)

WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day. Populations for unsewered communities was obtained or estimated from the 2010 US Census (U.S. Census Bureau, 2010). The per capita flow rate of 100 gallons per capita-day is required for facility planning of new WWTP by the Iowa Wastewater Facilities Design Standards.

Concentrated Animal Feeding Operations (CAFOs)

Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

General Permit No. 4 (GP#4)

Facilities operating under a GP #4 are private systems that only treat domestic waste from commercial and residential properties and serve an equivalent population of less than 16 people. These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Stormwater (SW)
NPDES permits for MS4 communities do not include numeric limits for E. Coli. However, they do include storm water pollution prevention and management provisions that include the implementation of Best Management Practices (BMP) to reduce pollutants in the discharge.

The WLA for MS4 communities in this WQIP are based on the ratio of the area of the MS4 community to the drainage area attributed to the impaired segment that the community discharges to times the TMDL attributed to the drainage area of that impaired segment.

Table C-1. WLA for Iowa River, Segment IA 02-IOW-0010_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
City of Morning Sun	AL	5857001	0059587	4.52E+05	126	2.16E+09
Garland	UNSWD	--	--	1.00E+03	126	4.77E+06
Northfield	UNSWD	--	--	1.80E+03	126	8.58E+06
Elrick	UNSWD	--	--	3.20E+03	126	1.53E+07
Hawkeye Woods	UNSWD	--	--	3.60E+03	126	1.72E+07
Toolesboro	UNSWD	--	--	2.60E+03	126	1.24E+07
Pennway Farrowing	CAFO	60025	--	0.0	126	0.0
JC Ball Farms, LLC	CAFO	68373	--	0.0	126	0.0
Totals	**--**	**--**		**--**	**126**	**2.21E+09**

Table C-2. WLA for Iowa River, Segment IA 02-IOW-0010_2.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Odessa Residential Care Facility	WSL	5800901	0062901	6.00E+03	126	2.86E+08
Grandview, City of STP	AL	5842001	0061492	1.66E+05	126	7.92E+08
Letts, City of STP	WSL	5847001	0066117	9.18E+04	126	4.38E+09
Wapello, City of STP	WSL	5879001	0047961	4.15E+05	126	1.98E+10
Indian Creek Pork LLC	CAFO	61073	--	0.0	126	0.0
1 Permitted Facility	GP#4	--	--	3.00E+02	126	1.43E+06
Totals	**--**	**--**		**--**	**126**	**2.52E+10**

Table C-3. WLA for Iowa River, Segment IA 02-IOW-0010_3.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Ainsworth Four Corners	ST/SF	9200201	0074080	7.50E+03	126	3.58E+07
Water's Edge Subdivision WWTF	ST/SF	9200302	0077089	9.90E+03	126	4.72E+07
Ainsworth, City of STP	WSL	9203001	0069183	6.00E+04	126	2.86E+09
Cairo	UNSWD	--	--	2.40E+03	126	1.14E+07
Wyman	UNSWD	--	--	1.65E+03	126	7.87E+06
Doug Wilson	CAFO	57849	--	0.0	126	0.0
Finke William - Finisher #1	CAFO	58320	--	0.0	126	0.0
Dennis Friese Site #1 - Home	CAFO	58684	--	0.0	126	0.0
Robert & Nance Utter Farm	CAFO	58736	--	0.0	126	0.0
Kurt Rossiter Farm	CAFO	58871	--	0.0	126	0.0
Bran-cor Inc. Section 5	CAFO	59141	--	0.0	126	0.0
Janden Inc. - Home Farm	CAFO	59313	--	0.0	126	0.0
Wayne Humphreys Ltd.	CAFO	59665	--	0.0	126	0.0
Lcp Inc.	CAFO	60032	--	0.0	126	0.0
Tobin Hog Farm	CAFO	60033	--	0.0	126	0.0
Wayne Zieser	CAFO	61490	--	0.0	126	0.0
Smith Finishing	CAFO	62177	--	0.0	126	0.0
Darrell Egli	CAFO	62384	--	0.0	126	0.0
William Finke Finisher #2	CAFO	62593	--	0.0	126	0.0
Tom Vittetoe Finishers	CAFO	62642	--	0.0	126	0.0
Spruce Avenue Farms	CAFO	62700	--	0.0	126	0.0
Prairie Pork Inc. - East Site	CAFO	62890	--	0.0	126	0.0
Eugene Reed Ltd	CAFO	62985	--	0.0	126	0.0
Drew Hartzler	CAFO	64557	--	0.0	126	0.0
Twinam Farms Ltd.	CAFO	64838	--	0.0	126	0.0
Finke 3	CAFO	65904	--	0.0	126	0.0
Dennis Friese Site #3 - Farrowing	CAFO	66310	--	0.0	126	0.0
This'll Do Farm	CAFO	66400	--	0.0	126	0.0
5 Cairo	CAFO	67734	--	0.0	126	0.0
Dave Friese 2102	CAFO	67757	--	0.0	126	0.0
7 Permitted Facilities	GP#4	--	--	--	126	--
Totals				**--**	**126**	**2.96E+09**

Table C-4. WLA for Iowa River, Segment IA 02-IOW-0020_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Lone Tree, City of STP (South)	AL	5240001	0060330	4.17E+05	126	1.99E+09
Tyson Fresh Meats, Inc. - Columbus Junction	AS	5800100	0003361	1.80E+06	126	8.58E+09
Columbus Junction, City of STP	AL	5815001	0023523	7.20E+05	126	3.43E+09
Conesville, City of STP	WSL	7016001	0058769	9.70E+04	126	4.63E+09
Highland Community School	TF	9200501	0070084	3.20E+03	126	1.53E+07
Cotter	UNSWD	--	--	4.70E+03	126	2.24E+07
Haskins	UNSWD	--	--	3.60E+03	126	1.72E+07
River Junction	UNSWD	--	--	2.20E+03	126	1.05E+07
TDL Ltd.	CAFO	59194	--	0.0	126	0.0
Gerot Farms LLC	CAFO	59405	--	0.0	126	0.0
Thomann Jason	CAFO	59698	--	0.0	126	0.0
Circle T Farms	CAFO	59722	--	0.0	126	0.0
MIPA Hog Farms Llc	CAFO	60592	--	0.0	126	0.0
JSBB (cotter)	CAFO	62738	--	0.0	126	0.0
Doug Shalla Farm	CAFO	62809	--	0.0	126	0.0
Rj Pork Ltd (south) - Home	CAFO	63100	--	0.0	126	0.0
Alan Thomann Farm	CAFO	63112	--	0.0	126	0.0
Gama Inc. (Section 19)	CAFO	63299	--	0.0	126	0.0
Psi-1 (solomon Farm)	CAFO	63300	--	0.0	126	0.0
Psi-1 (buser Pivot)	CAFO	63301	--	0.0	126	0.0
Psi-1 (peartree)	CAFO	63727	--	0.0	126	0.0
Bloomer Finisher	CAFO	65905	--	0.0	126	0.0
Doug & Nic	CAFO	68791	--	0.0	126	0.0
Bob Robertson	CAFO	68921	--	0.0	126	0.0
7 Permitted Facilities	GP#4	--	--	3.90E+03	126	1.86E+07
Totals				**--**		**1.87E+10**

Table C-5. WLA for Iowa River, Segment IA 02-IOW-0030_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Conroy, Iowa - Poweshiek Water Assoc.	WSL	4807001	0079901	2.08E+04	126	9.92E+08
Gateway Commercial Condominium Assoc.	AL	5200201	0074985	9.80E+04	126	4.67E+08
Makada Subdivision - STP	WSL	5200306	0073733	1.03E+04	126	4.91E+08
Lake Ridge, Inc. - STP	AS	5200316	0074284	1.30E+05	126	6.20E+08
Breckenridge Estates Mobile Homes	AS	5200601	0066303	3.10E+04	126	1.48E+08
Sunrise Mobile Home Village	AL	5200602	0067911	3.80E+04	126	1.81E+08
Modern Manor Mobile Home Court	AS	5200605	0064874	1.00E+05	126	4.77E+08
Knollwood Mobile Home Court	ST/SF	5200607	PENDING	2.50E+03	126	1.19E+07
U.S. Army – Coralville Dam	WSL	5200908	0084298	1.16E+03	126	5.51E+07
Coralville, City of STP	AS/SBR	5208001	0020788	3.89E+06	126	1.86E+10
Iowa City, City Of (South) STP	AS	5225002	0070866	2.42E+07	126	1.15E+11
Iowa City Regency Mobile Home Park STP	AS	5225601	0063274	6.70E+04	126	3.20E+08
University Heights, City of MS4	SW	5290002	0078930	--	126	2.30E+09
Upper South Amana	UNSWD	--	--	5.20E+03	126	2.48E+07
Dane Road SE	UNSWD	--	--	2.40E+03	126	1.14E+07
Frytown CDP	UNSWD	--	--	1.65E+04	126	7.87E+07
Morse	UNSWD	--	--	4.60E+03	126	2.19E+07
River Front Estates	UNSWD	--	--	5.20E+03	126	2.48E+07
Sharon Center	UNSWD	--	--	4.00E+03	126	1.91E+07
Zahner Sub.	UNSWD	--	--	4.00E+03	126	1.91E+07
Home Site	CAFO	58686	--	0.0	126	0.0
Slabaugh Hog Farm	CAFO	59394	--	0.0	126	0.0
Pechous Ed	CAFO	59678	--	0.0	126	0.0
Triple P	CAFO	59680	--	0.0	126	0.0
Pleasant Valley Pork - 1	CAFO	61095	--	0.0	126	0.0
11 Permitted Facilities	GP #4	--	--	--	126	--
Totals				**--**		**1.40E+11**

Table C-6. WLA for English River, Segment IA 02-IOW-0100_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
East Iowa Bible Camp-STP	ST/SF	4800401	0075213	6.50E+03	126	3.10E+07
Millersburg, City Of (Poweshiek Water Assn)	WSL	4852001	0077283	1.88E+04	126	8.97E+08
North English, City of STP	TF	4858001	0034282	2.42E+05	126	1.15E+09
Parnell, City of STP	WSL	4863001	0071188	2.95E+04	126	1.41E+09
Keswick, City of STP	WSL	5442001	0079910	2.95E+04	126	1.41E+09
Kinross, City of STP (RUSS)	WSL	5444001	0077186	6.70E+03	126	3.20E+08
Webster, City of STP	WSL	5491001	0078719	1.20E+04	126	5.72E+08
Barnes City, City of STP	WSL	7905001	0081329	2.10E+04	126	1.00E+09
Deep River, City of STP	WSL	7915001	0071943	3.59E+04	126	1.71E+09
Shiloh	AL	9200402	0070653	8.50E+04	126	4.05E+08
Kalona, City of STP	WSL	9233001	0059196	8.12E+05	126	3.87E+10
Riverside, City of STP	AS/SBR	9260001	0047945	6.54E+05	126	3.12E+09
Wellman, City of STP	AS	9276001	0032301	4.50E+05	126	2.15E+09
Gibson	UNSWD	--	--	6.00E+03	126	2.86E+07
Guernsey	UNSWD	--	--	6.20E+03	126	2.96E+07
Richmond	UNSWD	--	--	1.32E+04	126	6.30E+07
Kalona Pork	CAFO	58161	--	0.0	126	0.0
Sieren Pork Ltd (North Farm)	CAFO	58562	--	0.0	126	0.0
Brenneman Pork Inc. Sow Farm	CAFO	58768	--	0.0	126	0.0
Litwiller Ridge Inc.	CAFO	58887	--	0.0	126	0.0
Whetstine Farms	CAFO	59761	--	0.0	126	0.0
Luers Pork Ltd	CAFO	59962	--	0.0	126	0.0
Wellman Feeder Pig	CAFO	60190	--	0.0	126	0.0
Kinross Sow Unit Expansion	CAFO	60966	--	0.0	126	0.0
Maple Grove Hog Producers Inc.	CAFO	61014	--	0.0	126	0.0
Rebuh Feeders Inc./psi Research Hog Facility	CAFO	61082	--	0.0	126	0.0
Dale Faas	CAFO	61294	--	0.0	126	0.0
County Line Pork (Bontrager)	CAFO	61378	--	0.0	126	0.0
Kos Allen R.	CAFO	61535	--	0.0	126	0.0
P.s.l. Inc. (sec. 5)	CAFO	62164	--	0.0	126	0.0
P.s.l. Inc. (sec.9)	CAFO	62165	--	0.0	126	0.0
Poweshiek County Pullets Llp (sec 3)	CAFO	62389	--	0.0	126	0.0
Bill Huber - Flynn Place #2	CAFO	62622	--	0.0	126	0.0
Tyler's Havel Finisher	CAFO	62655	--	0.0	126	0.0
Norman's Havel Farm	CAFO	62656	--	0.0	126	0.0

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Maple Creek Lane	CAFO	64317	--	0.0	126	0.0
Tri County Pork Llc	CAFO	64498	--	0.0	126	0.0
Blake Hershberger Home Site	CAFO	64718	--	0.0	126	0.0
Blake Hershberger #2	CAFO	65187	--	0.0	126	0.0
Windy Ridge Farms	CAFO	65674	--	0.0	126	0.0
Triple A Pork	CAFO	65676	--	0.0	126	0.0
Lime Creek 2	CAFO	66054	--	0.0	126	0.0
Brown Place	CAFO	67686	--	0.0	126	0.0
Lee Barns	CAFO	68541	--	0.0	126	0.0
24 Permitted Facilities	GP #4	--	--	--	126	--
Totals				**--**		**5.30E+10**

Table C-7. WLA for Old Mans Creek, Segment IA 02-IOW-0150_2.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Kinze Manufacturing, Inc.	WSL	4800104	0076881	1.12E+04	126	5.34E+08
Monsanto East Migrant Camp	WSL	4800105	0052268	1.71E+04	126	8.16E+08
Crest Country Inn	WSL	4800715	0065480	2.10E+03	126	1.00E+08
Hillside Estates Care Facility	WSL	4800901	0065927	7.00E+03	126	3.34E+08
Williamsburg, City of STP	AS	4884001	0033880	5.85E+05	126	2.79E+09
Windham	UNSWD	--	--	2.20E+03	126	1.05E+07
South Ridge Swine Finisher	CAFO	58043	--	0.0	126	0.0
Hocker Swine LLC	CAFO	63958	--	0.0	126	0.0
1 Permitted Facility	GP #4	--	--	--	126	--
Totals				**--**		**4.58E+09**

Appendix C.2. WLA by Treatment Type for the Lower Iowa Watershed

This appendix provides the WLA for each facility based on the Treatment Type. Treatment types include: Municipal and Semi-public (WWTF); CAFO; General Permit #4; Unsewered; and Stormwater.

Wastewater Treatment Facility (WWTF) includes the following facility types:

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- ST/SF – Septic Tank Sand Filter
- TF – Trickling Filter
- WSL – Waste Stabilization Lagoon

Table C-8. WLA for WWTF in the Lower Iowa Watershed.

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Tyson Fresh Meats, Inc. - Columbus Junction (2)	AS	5800100	0003361	1.80E+06	IA 02-IOW-0020_1	126	8.58E+09
Lake Ridge, Inc.- STP	AS	5200316	0074284	1.30E+05	IA 02-IOW-0030_1	126	6.20E+08
Breckenridge Estates Mobile Homes	AS	5200601	0066303	3.10E+04	IA 02-IOW-0030_1	126	1.48E+08
Modern Manor Mobile Home Court	AS	5200605	0064874	1.00E+05	IA 02-IOW-0030_1	126	4.77E+08
Iowa City, City of (South) STP	AS	5225002	0070866	2.42E+07	IA 02-IOW-0030_1	126	1.15E+11
Iowa City Regency Mobile Home Park STP	AS	5225601	0063274	6.70E+04	IA 02-IOW-0030_1	126	3.20E+08
Wellman, City of STP	AS	9276001	0032301	4.50E+05	IA 02-IOW-0100_1	126	2.15E+09
Williamsburg, City of STP	AS	4884001	0033880	5.85E+05	IA 02-IOW-0150_2	126	2.79E+09
Morning Sun, City of STP	AL	5857001	0059587	4.52E+05	IA 02-IOW-0010_1	126	2.16E+09
Grandview, City of STP	AL	5842001	0062901	1.66E+05	IA 02-IOW-0010_2	126	7.92E+08
Lone Tree, City of STP (South)	AL	5240001	0060330	4.17E+05	IA 02-IOW-0020_1	126	1.99E+09
Columbus Junction, City of STP	AL	5815001	0023523	7.20E+05	IA 02-IOW-0020_1	126	3.43E+09
Gateway Commercial Condominium Association	AL	5200201	0074985	9.80E+04	IA 02-IOW-0030_1	126	4.67E+08
Sunrise Mobile Home Village	AL	5200602	0067911	3.80E+04	IA 02-IOW-0030_1	126	1.81E+08
Shiloh	AL	9200402	0070653	8.50E+04	IA 02-IOW-0100_1	126	4.05E+08
Ainsworth Four Corners	ST/SF	9200201	0074080	7.50E+03	IA 02-IOW-0010_3	126	3.58E+07
Water'S Edge Subdivision - WWTF	ST/SF	9200302	0077089	9.90E+03	IA 02-IOW-0010_3	126	4.72E+07
Knollwood Mobile Home Court	ST/SF	5200607	PENDING	2.50E+03	IA 02-IOW-0030_1	126	1.19E+07
East Iowa Bible Camp-STP	ST/SF	4800401	0075213	6.50E+03	IA 02-IOW-0100_1	126	3.10E+07
Coralville, City of STP	AS/SBR	5208001	0020788	3.89E+06	IA 02-IOW-0030_1	126	1.86E+10
Riverside, City of STP	AS/SBR	9260001	0047945	6.54E+05	IA 02-IOW-0100_1	126	3.12E+09
Highland Community School	TF	9200501	0070084	3.20E+03	IA 02-IOW-0020_1	126	1.53E+07
North English, City of STP	TF	4858001	0034282	2.42E+05	IA 02-IOW-0100_1	126	1.15E+09

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Odessa Residential Care Facility [(2)]	WSL	5800901	0066117	6.00E+03	IA 02-IOW-0010_2	126	2.86E+08
Letts, City of STP [(2)]	WSL	5847001	0061492	9.18E+04	IA 02-IOW-0010_2	126	4.38E+09
Wapello, City of STP [(2)]	WSL	5879001	0047961	4.15E+05	IA 02-IOW-0010_2	126	1.98E+10
Ainsworth, City of STP [(2)]	WSL	9203001	0069183	6.00E+04	IA 02-IOW-0010_3	126	2.86E+09
Conesville, City of STP [(2)]	WSL	7016001	0058769	9.70E+04	IA 02-IOW-0020_1	126	4.63E+09
Conroy, Iowa - Poweshiek Water Assoc [(2)]	WSL	4807001	0079901	2.08E+04	IA 02-IOW-0030_1	126	9.92E+08
Makada Subdivision-STP [(2)]	WSL	5200306	0073733	1.03E+04	IA 02-IOW-0030_1	126	4.91E+08
U.S. Army – Coralville Dam [(2)]	WSL	5200908	0084298	1.16E+03	IA 02-IOW-0030_1	126	5.53E+07
Millersburg, City of (Poweshiek Water Assn) [(2)]	WSL	4852001	0077283	1.88E+04	IA 02-IOW-0100_1	126	8.97E+08
Parnell, City of STP [(2)]	WSL	4863001	0071188	2.95E+04	IA 02-IOW-0100_1	126	1.41E+09
Keswick, City of STP [(2)]	WSL	5442001	0079910	2.95E+04	IA 02-IOW-0100_1	126	1.41E+09
Kinross, City of STP (Russ) [(2)]	WSL	5444001	0077186	6.70E+03	IA 02-IOW-0100_1	126	3.20E+08
Webster, City of STP [(2)]	WSL	5491001	0078719	1.20E+04	IA 02-IOW-0100_1	126	5.72E+08
Barnes City, City of STP [(2)]	WSL	7905001	0081329	2.10E+04	IA 02-IOW-0100_1	126	1.00E+09
Deep River, City of STP [(2)]	WSL	7915001	0071943	3.59E+04	IA 02-IOW-0100_1	126	1.71E+09
Kalona, City of STP [(2)]	WSL	9233001	0059196	2.85E+05	IA 02-IOW-0100_1	126	1.36E+10
Kinze Manufacturing, Inc. [(2)]	WSL	4800104	0076881	1.12E+04	IA 02-IOW-0150_2	126	5.34E+08
Monsanto East Migrant Camp [(2)]	WSL	4800105	0052268	1.71E+04	IA 02-IOW-0150_2	126	8.16E+08
Crest Country Inn [(2)]	WSL	4800715	0065480	2.10E+03	IA 02-IOW-0150_2	126	1.00E+08
Hillside Estates Care Facility [(2)]	WSL	4800901	0065927	7.00E+03	IA 02-IOW-0150_2	126	3.34E+08
Totals				--			**2.44E+11**

(1) The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.
(2) The WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Table C-9. WLA for CAFO in the Lower Iowa Watershed.

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day[(1)]
Pennway Farrowing	CAFO	60025	IA 02-IOW-0010_1	0.0
JC Ball Farms LLC	CAFO	68373	IA 02-IOW-0010_1	0.0
Indian Creek Pork LLC	CAFO	61073	IA 02-IOW-0010_2	0.0
Doug Wilson	CAFO	57849	IA 02-IOW-0010_3	0.0
Finke William - Finisher #1	CAFO	58320	IA 02-IOW-0010_3	0.0
Dennis Friese Site #1 - Home	CAFO	58684	IA 02-IOW-0010_3	0.0
Robert & Nance Utter Farm	CAFO	58736	IA 02-IOW-0010_3	0.0
Kurt Rossiter Farm	CAFO	58871	IA 02-IOW-0010_3	0.0
Bran-cor Inc. Section 5	CAFO	59141	IA 02-IOW-0010_3	0.0
Janden Inc. - Home Farm	CAFO	59313	IA 02-IOW-0010_3	0.0
Wayne Humphreys Ltd.	CAFO	59665	IA 02-IOW-0010_3	0.0
Lcp Inc.	CAFO	60032	IA 02-IOW-0010_3	0.0
Tobin Hog Farm	CAFO	60033	IA 02-IOW-0010_3	0.0
Wayne Zieser	CAFO	61490	IA 02-IOW-0010_3	0.0
Smith Finishing	CAFO	62177	IA 02-IOW-0010_3	0.0
Darrell Egli	CAFO	62384	IA 02-IOW-0010_3	0.0
William Finke Finisher #2	CAFO	62593	IA 02-IOW-0010_3	0.0
Tom Vittetoe Finishers	CAFO	62642	IA 02-IOW-0010_3	0.0
Spruce Avenue Farms	CAFO	62700	IA 02-IOW-0010_3	0.0
Prairie Pork Inc. - East Site	CAFO	62890	IA 02-IOW-0010_3	0.0
Eugene Reed Ltd	CAFO	62985	IA 02-IOW-0010_3	0.0
Drew Hartzler	CAFO	64557	IA 02-IOW-0010_3	0.0
Twinam Farms Ltd.	CAFO	64838	IA 02-IOW-0010_3	0.0
Finke 3	CAFO	65904	IA 02-IOW-0010_3	0.0
Dennis Friese Site #3 - Farrowing	CAFO	66310	IA 02-IOW-0010_3	0.0
This'll Do Farm	CAFO	66400	IA 02-IOW-0010_3	0.0
5 Cairo	CAFO	67734	IA 02-IOW-0010_3	0.0
Dave Friese 2102	CAFO	67757	IA 02-IOW-0010_3	0.0
Tdl Ltd.	CAFO	59194	IA 02-IOW-0020_1	0.0
Gerot Farms Llc	CAFO	59405	IA 02-IOW-0020_1	0.0
Thomann Jason	CAFO	59698	IA 02-IOW-0020_1	0.0
Circle T Farms	CAFO	59722	IA 02-IOW-0020_1	0.0
Mipa Hog Farms Llc	CAFO	60592	IA 02-IOW-0020_1	0.0
Jsbb (cotter)	CAFO	62738	IA 02-IOW-0020_1	0.0
Doug Shalla Farm	CAFO	62809	IA 02-IOW-0020_1	0.0
Rj Pork Ltd (south) - Home	CAFO	63100	IA 02-IOW-0020_1	0.0
Alan Thomann Farm	CAFO	63112	IA 02-IOW-0020_1	0.0
Gama Inc. (section 19)	CAFO	63299	IA 02-IOW-0020_1	0.0
Psi-1 (solomon Farm)	CAFO	63300	IA 02-IOW-0020_1	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day[(1)]
Psi-1 (buser Pivot)	CAFO	63301	IA 02-IOW-0020_1	0.0
Psi-1 (peartree)	CAFO	63727	IA 02-IOW-0020_1	0.0
Bloomer Finisher	CAFO	65905	IA 02-IOW-0020_1	0.0
Doug & Nic	CAFO	68791	IA 02-IOW-0020_1	0.0
Bob Robertson	CAFO	68921	IA 02-IOW-0020_1	0.0
Home Site	CAFO	58686	IA 02-IOW-0030_1	0.0
Slabaugh Hog Farm	CAFO	59394	IA 02-IOW-0030_1	0.0
Pechous Ed	CAFO	59678	IA 02-IOW-0030_1	0.0
Triple P	CAFO	59680	IA 02-IOW-0030_1	0.0
Pleasant Valley Pork - 1	CAFO	61095	IA 02-IOW-0030_1	0.0
Kalona Pork	CAFO	58161	IA 02-IOW-0100_1	0.0
Sieren Pork Ltd (north Farm)	CAFO	58562	IA 02-IOW-0100_1	0.0
Brenneman Pork Inc. Sow Farm	CAFO	58768	IA 02-IOW-0100_1	0.0
Litwiller Ridge Inc.	CAFO	58887	IA 02-IOW-0100_1	0.0
Whetstine Farms	CAFO	59761	IA 02-IOW-0100_1	0.0
Luers Pork Ltd	CAFO	59962	IA 02-IOW-0100_1	0.0
Wellman Feeder Pig	CAFO	60190	IA 02-IOW-0100_1	0.0
Kinross Sow Unit Expansion	CAFO	60966	IA 02-IOW-0100_1	0.0
Maple Grove Hog Producers Inc.	CAFO	61014	IA 02-IOW-0100_1	0.0
Rebuh Feeders Inc./psi Research Hog Facility	CAFO	61082	IA 02-IOW-0100_1	0.0
Dale Faas	CAFO	61294	IA 02-IOW-0100_1	0.0
County Line Pork (bontrager)	CAFO	61378	IA 02-IOW-0100_1	0.0
Kos Allen R.	CAFO	61535	IA 02-IOW-0100_1	0.0
P.s.l. Inc. (sec. 5)	CAFO	62164	IA 02-IOW-0100_1	0.0
P.s.l. Inc. (sec.9)	CAFO	62165	IA 02-IOW-0100_1	0.0
Poweshiek County Pullets Llp (sec 3)	CAFO	62389	IA 02-IOW-0100_1	0.0
Bill Huber - Flynn Place #2	CAFO	62622	IA 02-IOW-0100_1	0.0
Tyler's Havel Finisher	CAFO	62655	IA 02-IOW-0100_1	0.0
Norman's Havel Farm	CAFO	62656	IA 02-IOW-0100_1	0.0
Maple Creek Lane	CAFO	64317	IA 02-IOW-0100_1	0.0
Tri County Pork Llc	CAFO	64498	IA 02-IOW-0100_1	0.0
Blake Hershberger Home Site	CAFO	64718	IA 02-IOW-0100_1	0.0
Blake Hershberger #2	CAFO	65187	IA 02-IOW-0100_1	0.0
Windy Ridge Farms	CAFO	65674	IA 02-IOW-0100_1	0.0
Triple A Pork	CAFO	65676	IA 02-IOW-0100_1	0.0
Lime Creek 2	CAFO	66054	IA 02-IOW-0100_1	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day[(1)]
Brown Place	CAFO	67686	IA 02-IOW-0100_1	0.0
Lee Barns	CAFO	68541	IA 02-IOW-0100_1	0.0
South Ridge Swine Finisher	CAFO	58043	IA 02-IOW-0150_2	0.0
Hocker Swine Llc	CAFO	63958	IA 02-IOW-0150_2	0.0
Totals				**0.00E+00**

(1) Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

Table C-10. Estimated Wasteloads for General Permit #4 in the Lower Iowa Watershed.

Facility Name	Facility Type	Facility ID	Design Flow (gpd)	Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
1 Permitted Facility	GP #4	--	--	IA 02-IOW-0010_2	126	--
7 Permitted Facilities	GP #4	--	--	IA 02-IOW-0010_3	126	--
7 Permitted Facilities	GP #4	--	--	IA 02-IOW-0020_1	126	--
11 Permitted Facilities	GP #4	--	--	IA 02-IOW-0030_1	126	--
24 Permitted Facilities	GP #4	--	--	IA 02-IOW-0100_1	126	--
1 Permitted Facility	GP #4	--	--	IA 02-IOW-0150_2	126	--
Totals			**--**			**--**

(1) These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Table C-11. WLA for Unsewered Communities in the Lower Iowa Watershed.

Facility Name	Facility Type	Population[(1)]	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day[(1)]
Garland	UNSWD	10	1.00E+03	IA 02-IOW-0010_1	126	4.77E+06
Northfield	UNSWD	18	1.80E+03	IA 02-IOW-0010_1	126	8.59E+06
Elrick	UNSWD	32	3.20E+03	IA 02-IOW-0010_1	126	1.53E+07
Hawkeye Woods	UNSWD	36	3.60E+03	IA 02-IOW-0010_1	126	1.72E+07
Toolesboro	UNSWD	26	2.60E+03	IA 02-IOW-0010_1	126	1.24E+07
Cairo	UNSWD	32	3.20E+03	IA 02-IOW-0010_3	126	1.53E+07
Wyman	UNSWD	22	2.20E+03	IA 02-IOW-0010_3	126	1.05E+07
Cotter	UNSWD	47	4.70E+03	IA 02-IOW-0020_1	126	2.24E+07
Haskins	UNSWD	36	3.60E+03	IA 02-IOW-0020_1	126	1.72E+07
Upper South Amana	UNSWD	52	5.20E+03	IA 02-IOW-0030_1	126	2.48E+07
Dane Road SE	UNSWD	24	2.40E+03	IA 02-IOW-0030_1	126	1.14E+07
Frytown CDP	UNSWD	165	1.65E+04	IA 02-IOW-0030_1	126	7.87E+07
Morse	UNSWD	46	4.60E+03	IA 02-IOW-0030_1	126	2.19E+07
River Front Estates	UNSWD	52	5.20E+03	IA 02-IOW-0030_1	126	2.48E+07
River Junction	UNSWD	22	2.20E+03	IA 02-IOW-0030_1	126	1.05E+07
Sharon Center	UNSWD	40	4.00E+03	IA 02-IOW-0030_1	126	1.91E+07
Zahner Sub.	UNSWD	40	4.00E+03	IA 02-IOW-0030_1	126	1.91E+07
Gibson	UNSWD	60	6.00E+03	IA 02-IOW-0100_1	126	2.86E+07
Guernsey	UNSWD	62	6.20E+03	IA 02-IOW-0100_1	126	2.96E+07
Richmond	UNSWD	132	1.32E+04	IA 02-IOW-0100_1	126	6.30E+07
Windham	UNSWD	22	2.20E+03	IA 02-IOW-0150_2	126	1.05E+07
Totals			**7.32E+04**		**126**	**3.49E+08**

(1) WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day times the WQS concentration.

Table C-12. WLA for Stormwater in the Lower Iowa Watershed.

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day[(1)]
University Heights, City of MS4	SW	5290002	0078930	--	IA 02-IOW-0030_1	126	2.30E+09
Totals				**--**			**2.30E+09**

(1) The WLA for MS4 communities in this WQIP are based on the ratio of the area of the MS4 community to the drainage area attributed to the impaired segment that the community discharges to times the TMDL attributed to the drainage area of that impaired segment.

Appendix C.3. NPDES Facilities Not Considered

Table C-13. NPDES Facilities not Considered in this WQIP.

Facility Name	Iowa NPDES ID	EPA NPDES ID	Receiving Stream Segment	Reason Not Used
Colony Village Rest-sandersfeld Food	4800201	0069035	IA 02-IOW-0030_2	07 TMDL(1)
Heritage Inn Amana Colonies	4800205	0074225	IA 02-IOW-0030_2	07 TMDL(1)
Ramada Hotel	4800705	0066265	IA 02-IOW-0030_2	07 TMDL(1)
Timber Trails Estates Homeowner's Assoc	5200303	0069108	IA 02-IOW-0030_2	07 TMDL(1)
Sleepy Hollow Campground & Rv Park	5200403	0069094	IA 02-IOW-0030_2	07 TMDL(1)
Parkview Mobile Home Court	5200603	0068349	IA 02-IOW-0030_2	07 TMDL(1)
Coralville, City Of Ms4	5208002	0078646	IA 02-IOW-0030_2	07 TMDL(1)
Iowa City, City Of Ms4	5225005	0078298	IA 02-IOW-0030_2	07 TMDL(1)
University Of Iowa Ms4	5225006	0078182	IA 02-IOW-0030_2	07 TMDL(1)
North Liberty City Of Stp	5252001	0032905	IA 02-IOW-0030_2	07 TMDL(1)
North Liberty, City Of Ms4	5252003	0078794	IA 02-IOW-0030_2	07 TMDL(1)
Oxford City of Stp	5260001	0032531	IA 02-IOW-0030_2	07 TMDL(1)
Tiffin City Of Stp	5288001	0036617	IA 02-IOW-0030_2	07 TMDL(1)
Enterprise Products Operating Llc	0000117	0078093	IA 02-IOW-0030_1	INDUSTRIAL(2)
Iowa County Sanitary Landfill	4800904	0072206	IA 02-IOW-0030_1	INDUSTRIAL(2)
Kalona Creamery, Llc	5200116	0052476	IA 02-IOW-0100_1	OPERATION PERMIT(2)
Coralville Muni Water System	5208000	0079405	IA 02-IOW-0030_1	MUNICIPAL-WT(2)
Magellan Pipeline Company, Llc - Coralville Terminal	5208102	0071340	IA 02-IOW-0030_1	INDUSTRIAL(2)
Iowa City Water Treatment Plant	5225000	0076082	IA 02-IOW-0030_1	MUNICIPAL-WT(2)
University Of Iowa Main Power Plant	5225101	0003077	IA 02-IOW-0030_1	INDUSTRIAL(2)
The University Of Iowa Water Plant	5225105	0071919	IA 02-IOW-0030_1	MUNICIPAL-WT(2)
University Of Iowa Cooling Tower Blowdown	5225108	0069159	IA 02-IOW-0030_1	INDUSTRIAL(2)
Iowa City Ready Mix	5225109	0070327	IA 02-IOW-0030_1	INDUSTRIAL(2)
Iihr Oakdale Annex	5225110	0079235	IA 02-IOW-0030_1	INDUSTRIAL(2)
Natural Gas Pipeline Co. Of America - Station 204	5800107	0058262	IA 02-IOW-0010_3	INDUSTRIAL(2)
Natural Gas Pipeline Company Of America - Cairo/ Coloumbus Junction	5800108	0075485	IA 02-IOW-0010_3	OPERATION PERMIT(2)
Natural Gas Pipeline Company Of America - Cairo/ Coloumbus Junction	5800109	0081701	IA 02-IOW-0010_3	OPERATION PERMIT(2)
Bloomer Truck Wash	5800201	PENDING	IA 02-IOW-0020_1	OPERATION PERMIT(2)(3)
Riverside, City Of Water Treatment Plant	9260000	PENDING	IA 02-IOW-0100_1	MUNICIPAL-WT(2)(3)

(1) These facilities were included in the TMDL for Pathogen Indicators Iowa River, Johnson County, Iowa, 2007.
(2) Operation permits do not discharge to surface water and industrial facilities and municipal water treatment plants are not expected to have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources.
(3) The NPDES permit application is pending.

Appendix C.4. Water Quality Data

Table C-14. Estimated Flow for Iowa River, Segment IA 02 IOW-0010_1 and observed *E. coli* at USGS 05465500 and STORET site 10580003.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/30/1997	8,214.3	10(2)	8/1/2011	8,193.6	84
5/29/1997	13,306.0	3400	9/1/2011	3,219.0	10
6/5/1997	9,831.7	64(2)	10/5/2011	2,189.6	41
6/12/1997	8,510.4	210	11/1/2011	1,907.6	5(3)
6/25/1997	15,804.7	2000	4/2/2012	5,404.3	130
7/2/1997	19,138.8	3700	5/1/2012	10,182.3	790
7/16/1997	8,618.2	600	6/5/2012	5,873.2	31
8/13/1997	4,127.7	540	10/1/2014	4,681.0	10
8/28/1997	3,674.1	280(2)	11/5/2014	5,943.9	10
9/5/1997	4,242.7	830	4/1/2015	5,543.7	5(3)
9/23/1997	3,412.9	180	5/4/2015	10,583.1	20
10/6/1997	2,514.8	16(2)	6/2/2015	16,025.4	86
10/22/1997	5,339.5	240	7/1/2015	31,968.1	360
11/3/1997	5,749.2	510	8/3/2015	17,125.5	250
3/30/1998	16,116.1	54(2)	--	--	--
5/4/1998	15,325.8	1800	Min =	1,907.6	5
10/12/2010	9,641.9	75	1st Quartile =	5,174.9	39
11/4/2010	5,480.6	41	Median =	8,362.4	108
4/5/2011	16,142.4	370	3rd Quartile =	15,445.5	405
5/3/2011	28,837.0	63	Max =	31,968.1	3,700
6/2/2011	27,724.6	160	Mean(4) =	10,419.1	115
7/7/2011	14,495.0	41	Std Dev =	7,523.7	871

(1) *E. coli* samples collected between 4/30/1997 and 5/4/1998 were collected at USGS 05465500.
(2) *E. coli* counts were estimated by USGS.
(3) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(4) For *E. coli* this is a Geomean.

Table C-15. Estimated Flow for Iowa River, Segment IA 02 IOW-0010_2 and observed *E. coli* at USGS 05465500 and STORET site 10580003.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs))	*E. coli* (orgs/100 mL)
4/30/1997	8,150.0	10(2)	8/1/2011	8,120.0	84
5/29/1997	13,200.0	3400	9/1/2011	3,190.0	10
6/5/1997	9,750.0	64(2)	10/5/2011	2,170.0	41
6/12/1997	8,440.0	210	11/1/2011	1,890.0	Not Detected(3)
6/25/1997	15,700.0	2000	4/2/2012	5,360.0	130
7/2/1997	19,000.0	3700	5/1/2012	10,100.0	790
7/16/1997	8,550.0	600	6/5/2012	5,820.0	31
8/13/1997	4,090.0	540	10/1/2014	4,640.0	10
8/28/1997	3,640.0	280(2)	11/5/2014	5,900.0	10
9/5/1997	4,200.0	830	4/1/2015	5,500.0	Not Detected(3)
9/23/1997	3,380.0	180	5/4/2015	10,500.0	20
10/6/1997	2,490.0	16(2)	6/2/2015	15,900.0	86
10/22/1997	5,290.0	240	7/1/2015	31,700.0	360
11/3/1997	5,700.0	510	8/3/2015	17,000.0	250
3/30/1998	16,000.0	54(2)	--	--	--
5/4/1998	15,200.0	1800	Min =	1,890.0	5
10/12/2010	9,560.0	75	1st Quartile =	5,127.5	39
11/4/2010	5,430.0	41	Median =	8,295.0	108
4/5/2011	16,000.0	370	3rd Quartile =	15,325.0	405
5/3/2011	28,600.0	63	Max =	31,700.0	3,700
6/2/2011	27,500.0	160	Mean(4) =	10,335.0	115
7/7/2011	14,400.0	41	Std Dev =	7,464.8	871

(1) *E. coli* samples collected between 4/30/1997 and 5/4/1998 were collected at USGS 05465500.
(2) *E. coli* counts were estimated by USGS.
(3) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(4) For *E. coli* this is a Geomean.

Table C-16. Estimated Flow for Iowa River, Segment IA 02 IOW-0010_3 and observed *E. coli* at STORET site 10580001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/12/1998	9,753.2	920.0	6/4/2003	8,244.8	50.0
4/19/1999	27,950.0	490.0	7/2/2003	11,210.2	160.0
5/6/1999	22,121.8	850.0	8/7/2003	3,778.5	50.0
6/9/1999	24,695.6	210.0	9/8/2003	1,635.5	10.0
7/13/1999	18,266.2	36.0	10/2/2003	1,357.4	10.0
8/2/1999	26,756.3	140.0	11/3/2003	1,546.7	100.0
9/2/1999	5,790.6	18.0	4/1/2004	15,573.9	50.0
10/14/1999	2,337.5	20.0	5/5/2004	6,246.9	30.0
11/1/1999	2,188.1	Not Detected(1)	6/2/2004	49,431.6	1400.0
4/3/2000	2,892.1	10.0	7/1/2004	15,100.6	80.0
5/23/2000	4,278.5	130.0	8/2/2004	6,461.5	200.0
6/21/2000	29,632.4	60.0	9/1/2004	11,721.5	380.0
7/18/2000	33,002.7	130.0	10/7/2004	5,403.5	30.0
8/22/2000	4,092.0	18.0	11/11/2004	4,785.5	50.0
9/14/2000	2,835.7	10.0	4/11/2005	8,432.2	210.0
10/3/2000	2,724.3	150.0	5/9/2005	6,546.6	10.0
11/6/2000	2,544.8	30.0	6/1/2005	12,301.2	170.0
4/2/2001	22,946.8	20.0	7/5/2005	26,278.2	380.0
5/1/2001	19,567.2	170.0	8/1/2005	5,307.7	170.0
6/11/2001	21,734.9	70.0	9/1/2005	2,834.2	Not Detected(1)
7/5/2001	11,800.6	150.0	10/4/2005	7,694.8	200.0
8/7/2001	5,314.7	40.0	11/2/2005	2,712.4	Not Detected(1)
9/5/2001	2,525.7	30.0	4/4/2006	10,723.9	420.0
10/2/2001	3,053.4	220.0	5/3/2006	13,194.0	82.0
11/5/2001	3,159.9	82.0	6/6/2006	7,497.0	260.0
4/1/2002	3,479.6	Not Detected(1)	7/6/2006	4,777.2	270.0
5/8/2002	8,269.2	27.0	8/2/2006	3,280.4	Not Detected(1)
6/5/2002	11,708.5	360.0			
7/8/2002	6,284.2	180.0	Min=	1,357.4	5
8/1/2002	6,805.7	180.0	1st Quartile=	3,282.4	28
9/4/2002	5,649.7	45.0	Median=	6,372.9	81
10/2/2002	3,288.4	82.0	3rd Quartile=	12,207.0	195
11/7/2002	3,804.8	50.0	Max=	49,431.6	1,400
4/3/2003	2,914.6	Not Detected(1)	Mean(2)=	10,164.1	67
5/8/2003	11,924.3	300	Std Dev=	9,520.2	239

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table C-17. Estimated Flow for Iowa River, Segment IA 02 IOW-0020_1 and observed *E. coli* at STORET site 10580002.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
9/12/2006	379.3	270	11/1/2011	279.3	130
10/4/2006	804.0	64	4/2/2012	1,877.0	1,000
11/2/2006	625.9	Not Detected(1)	5/1/2012	3,955.4	1,700
4/2/2007	7,902.0	8,400	6/5/2012	1,233.1	97
5/7/2007	11,161.6	22,000	7/5/2012	646.6	20
6/7/2007	7,584.7	270	8/6/2012	294.7	360
7/5/2007	6,827.7	110	9/6/2012	202.5	250
8/7/2007	1,428.5	73	10/1/2012	151.4	31
9/4/2007	6,804.0	120	11/6/2012	177.7	150
10/2/2007	3,303.9	3,500	4/1/2013	2,670.1	Not Detected(1)
11/5/2007	6,499.6	30	5/1/2013	7,811.1	31
4/2/2008	12,260.5	100	6/3/2013	21,098.5	300
5/1/2008	12,486.8	50	7/8/2013	6,851.0	63
6/2/2008	10,344.2	500	8/5/2013	1,133.2	41
7/10/2008	12,046.4	3,100	9/3/2013	161.0	63
8/4/2008	8,202.5	180	10/7/2013	229.6	720
9/4/2008	2,530.2	810	11/7/2013	167.5	86
4/7/2009	3,254.9	10	4/1/2014	1,663.4	20
5/4/2009	9,320.7	930	5/6/2014	4,541.7	41
6/3/2009	6,876.0	190	6/5/2014	2,145.2	260
7/7/2009	7,362.2	330	7/1/2014	61,795.9	14,000
8/3/2009	2,091.5	63	8/5/2014	3,294.1	830
9/1/2009	8,647.2	600	9/11/2014	15,716.9	30,000
10/1/2009	4,355.1	210	10/2/2014	1,499.7	20
11/3/2009	9,630.9	1,100	11/5/2014	2,261.7	85
4/1/2010	11,146.9	Not Detected(1)	4/1/2015	1,784.1	10
5/4/2010	6,493.8	210	5/4/2015	3,481.2	86
6/2/2010	6,994.1	140	6/2/2015	5,171.6	75
7/6/2010	22,004.7	23,000	7/1/2015	7,842.0	150
8/10/2010	11,601.8	980	8/3/2015	5,682.2	98
9/9/2010	2,537.0	690	9/1/2015	5,197.6	380
10/12/2010	2,625.1	150			
11/4/2010	1,203.8	150			
4/5/2011	3,245.4	910	Min =	151.4	5
5/3/2011	7,616.4	63	1st Quartile =	1,464.1	63
6/1/2011	9,044.4	720	Median =	3,955.4	150
7/7/2011	6,293.7	160	3rd Quartile =	7,826.6	645
8/1/2011	1,626.6	110	Max =	61,795.9	30,000
9/1/2011	603.2	140	Mean(2) =	6,016.2	193

10/5/2011	369.1	41	Std Dev =	8,175.6	5,315

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(2) For *E. coli* this is a Geomean.

Table C-18. Estimated Flow for Iowa River, Segment IA 02 IOW-0030_1 and observed E. coli at STORET site 10520003.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/8/2000	445.2	120	7/6/2006	868.8	110
10/9/2000	447.8	50	8/1/2006	589.4	82
11/7/2000	1,012.9	1,900	9/6/2006	343.4	27
4/4/2001	8,607.6	10	10/5/2006	745.2	140
5/2/2001	7,041.8	Not Detected(1)	11/7/2006	760.1	180
6/5/2001	11,546.4	110	4/4/2007	8,569.2	510
7/9/2001	3,120.7	3,100	5/2/2007	7,569.6	50
8/9/2001	1,216.8	30	6/6/2007	7,479.1	150
9/6/2001	325.9	50	7/9/2007	6,400.7	30
10/3/2001	516.0	18	8/9/2007	5,182.7	7,700
11/7/2001	737.7	330	9/5/2007	6,613.8	30
4/4/2002	848.0	30	10/3/2007	5,900.5	4,200
5/6/2002	3,321.5	20	11/6/2007	6,276.3	70
6/5/2002	5,002.4	1,300	4/3/2008	11,706.2	Not Detected(1)
7/10/2002	1,599.7	240	5/15/2008	12,208.2	20
8/13/2002	1,667.3	210	6/9/2008	29,438.6	2,200
9/11/2002	540.3	120	7/15/2008	9,831.5	120
10/1/2002	665.4	54	8/7/2008	6,706.6	97
11/12/2002	1,293.5	250	9/3/2008	2,241.7	1,900
4/8/2003	840.6	36	4/2/2009	6,362.5	20
5/8/2003	5,506.8	120	5/5/2009	7,839.8	2,300
6/4/2003	2,448.5	20	6/1/2009	6,746.5	86
7/9/2003	3,760.4	1,000	7/1/2009	7,265.6	41
8/6/2003	870.0	10	8/3/2009	2,005.0	84
9/4/2003	374.2	40	9/2/2009	7,844.2	200
10/1/2003	169.2	60	10/1/2009	4,251.8	31
11/5/2003	1,790.7	1,500	11/4/2009	8,730.2	130
4/7/2004	3,179.8	20	4/1/2010	10,977.6	Not Detected(1)
5/5/2004	1,786.4	40	5/4/2010	6,287.9	96
6/3/2004	7,400.2	170	6/1/2010	6,748.4	74
7/7/2004	6,301.4	180	7/1/2010	9,909.6	200
8/5/2004	2,867.3	660	8/2/2010	10,847.8	52
9/1/2004	4,941.3	180	9/2/2010	7,057.1	10,000
10/7/2004	279.0	120	10/4/2010	3,510.1	75
11/4/2004	991.4	650	11/1/2010	1,219.0	63
3/16/2005	1,897.7	60	4/7/2011	2,746.4	150
4/6/2005	1,806.5	100	5/5/2011	7,318.3	52
5/2/2005	3,510.0	30	6/1/2011	8,690.7	150
6/2/2005	3,217.7	36	7/6/2011	6,270.4	52
7/6/2005	5,849.1	100	8/1/2011	1,569.6	110

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
8/3/2005	1,309.3	100	9/7/2011	341.5	330
9/7/2005	472.5	150	10/3/2011	367.8	75
10/10/2005	364.6	110	11/1/2011	273.5	540
11/7/2005	434.8	590	4/3/2012	1,842.5	10
4/3/2006	3,491.9	150	5/2/2012	3,782.7	230
5/2/2006	3,115.0	250	6/6/2012	1,161.1	170
6/1/2006	2,046.7	40	7/2/2012	795.9	160
8/2/2012	163.1	10	5/7/2014	4,306.5	31
9/4/2012	173.7	41	6/4/2014	1,977.1	530
10/1/2012	149.7	52	7/7/2014	21,287.0	160
11/5/2012	163.6	790	8/7/2014	3,098.5	86
4/1/2013	2,614.0	Not Detected(1)	9/2/2014	3,219.0	300
5/2/2013	6,811.6	63			
6/5/2013	20,527.2	120	Min =	148.0	5
7/1/2013	10,207.0	52	1st Quartile =	829.4	40
8/6/2013	1,119.2	74	Median =	2,806.9	99
9/9/2013	148.0	31	3rd Quartile =	6,637.0	200
10/2/2013	159.1	52	Max =	29,438.6	10,000
11/4/2013	163.7	560	Mean(2) =	4,206.5	104
4/2/2014	1,670.4	Not Detected(1)	Std Dev =	4,646.8	1,304

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table C-19. Estimated Flow for English River, Segment IA 02 IOW-0100_1 and observed E. coli at STORET site 10920001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/11/1999	32.8	250	11/3/2003	66.2	44,000
11/2/1999	32.8	64	11/6/2003	212.0	35,000
4/5/2000	58.4	Not Detected(1)	4/1/2004	834.3	330
5/2/2000	156.4	150	5/3/2004	267.7	150
6/1/2000	960.1	30,000	6/1/2004	1,831.8	12,000
7/5/2000	2,366.1	27,000	7/8/2004	237.6	2,500
7/21/2000	168.6	160	8/2/2004	65.1	210
8/3/2000	80.7	380	9/2/2004	145.2	1,200
9/21/2000	47.3	1,100	10/5/2004	59.5	140
10/4/2000	193.1	330,000	11/1/2004	129.6	420
11/7/2000	444.7	69,000	4/13/2005	1,509.0	46,000
3/22/2001	3,457.1	560	5/11/2005	212.0	510
4/4/2001	749.7	10	6/1/2005	157.5	280
4/9/2001	939.0	3,400	7/7/2005	101.8	130
5/2/2001	394.6	45	8/4/2005	49.5	310
5/7/2001	1,308.6	7,100	9/1/2005	26.3	180
5/14/2001	3,189.9	85,000	10/3/2005	23.4	410
6/4/2001	1,230.6	2,000	11/3/2005	23.3	120
6/15/2001	4,180.7	47,000	4/5/2006	330.0	950
7/2/2001	220.9	140	5/3/2006	389.0	980
8/1/2001	81.8	270	6/7/2006	110.7	14,000
9/4/2001	33.9	250	7/5/2006	48.4	470
10/1/2001	35.0	910	8/3/2006	45.0	58,000
10/23/2001	522.6	390,000	9/12/2006	29.5	810
11/1/2001	82.9	220	10/2/2006	26.1	650
4/2/2002	112.9	91	11/1/2006	62.9	120
4/29/2002	1,475.6	13,000	4/3/2007	1,464.4	4,000
5/1/2002	794.3	800	5/1/2007	1,130.4	390
5/13/2002	3,345.8	16,000	6/4/2007	1,831.8	7,000
5/22/2002	589.4	90	7/3/2007	282.2	170
5/30/2002	1,998.8	7,300	8/1/2007	76.2	480
6/4/2002	841.0	1,500	9/11/2007	236.5	1,000
6/13/2002	1,464.4	22,000	10/8/2007	265.5	930
7/2/2002	158.6	300	11/8/2007	278.8	130
8/1/2002	72.9	200	4/10/2008	2,822.6	2,300
9/5/2002	57.3	180	5/14/2008	1,653.7	1,400
10/2/2002	231.0	15,000	6/12/2008	4,091.7	3,200
11/6/2002	148.6	60	7/14/2008	556.0	830
4/2/2003	72.9	Not Detected(1)	8/6/2008	483.7	3,700
5/1/2003	483.7	15,000	9/2/2008	148.6	740

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/5/2003	533.8	73,000	4/2/2009	528.2	370
6/2/2003	136.3	Not Detected(1)	5/5/2009	750.8	410
7/1/2003	161.9	1,700	6/3/2009	689.6	660
7/11/2003	788.7	21,000	7/1/2009	822.1	470
8/6/2003	51.7	170	8/4/2009	137.4	960
9/9/2003	26.0	260	9/3/2009	822.1	850
10/6/2003	25.6	82	10/5/2009	684.0	13,000
11/4/2009	1,408.8	620	7/8/2013	249.9	270
4/6/2010	392.4	260	8/5/2013	55.1	120
5/5/2010	591.6	600	9/3/2013	30.6	170
6/1/2010	415.7	330	10/7/2013	45.0	2,100
7/1/2010	1,241.8	1,200	11/7/2013	31.7	2,300
8/10/2010	1,820.7	11,000	4/1/2014	104.0	Not Detected(1
9/8/2010	718.6	2,000	5/6/2014	298.9	200
10/12/2010	355.6	400	6/5/2014	346.7	1,800
11/4/2010	210.9	41	7/1/2014	14,712.0	20,000
4/5/2011	373.4	1,400	8/5/2014	297.7	96,000
5/3/2011	616.1	250	9/11/2014	6,474.0	24,000
6/1/2011	1,464.4	2,400	10/2/2014	263.2	52
7/7/2011	361.2	200	11/3/2014	345.6	110
8/1/2011	127.4	260	4/1/2015	224.3	85
9/1/2011	53.9	250	5/4/2015	472.5	200
10/5/2011	33.9	220	6/1/2015	655.1	620
11/1/2011	35.0	160	7/1/2015	939.0	2,900
4/2/2012	419.1	1,600	8/4/2015	244.3	120
5/1/2012	654.0	3,900	9/1/2015	269.9	560
6/5/2012	160.8	85			
7/5/2012	59.5	120			
8/6/2012	45.0	370	Min =	23.3	5
9/6/2012	33.9	320	1st Quartile =	72.9	180
10/1/2012	26.8	190	Median =	265.5	480
11/6/2012	31.7	140	3rd Quartile =	749.7	2,400
4/1/2013	248.8	31	Max =	14,712.0	390,000
5/1/2013	719.7	140	Mean(2) =	717.6	784
6/3/2013	1,208.4	830	Std Dev =	1,508.8	44,955

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table C-20. Estimated Flow for Old Mans Creek, Segment IA 02 IOW-0150_2 and observed E. coli at STORET site 10520001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
7/21/2000	99.0	490	8/2/2006	8.5	470
10/4/2000	40.4	1,600	9/12/2006	6.6	480
11/6/2000	36.4	410	10/4/2006	2.0	3,100
4/2/2001	202.0	40	11/2/2006	5.3	30
5/1/2001	118.2	1,900	4/2/2007	352.5	4,500
6/11/2001	312.1	5,000	5/7/2007	977.6	50,000
7/5/2001	90.9	420	6/7/2007	227.2	2,400
8/6/2001	26.3	110	7/5/2007	122.2	640
9/5/2001	9.5	200	8/6/2007	56.6	880
10/2/2001	6.8	1,500	9/4/2007	103.0	840
11/5/2001	30.3	230	10/2/2007	146.4	6,400
4/1/2002	40.4	Not Detected(1)	11/5/2007	110.1	210
5/8/2002	141.4	100	4/2/2008	361.5	610
6/5/2002	322.2	11,000	5/1/2008	385.8	270
7/8/2002	46.5	460	6/2/2008	273.7	1,300
8/1/2002	35.3	1,700	7/10/2008	345.4	7,500
9/4/2002	17.2	150	8/12/2008	126.2	2,500
10/2/2002	495.9	26,000	9/4/2008	170.7	7,600
11/7/2002	45.4	73	4/7/2009	140.4	40
4/3/2003	18.2	Not Detected(1)	5/4/2009	274.7	770
5/8/2003	109.1	410	6/3/2009	154.5	1,400
6/4/2003	46.5	310	7/7/2009	222.2	3,500
7/2/2003	39.4	940	8/3/2009	98.0	230
8/7/2003	12.1	130	9/1/2009	426.2	1,500
9/8/2003	3.5	160	10/1/2009	117.1	3,000
10/2/2003	4.3	60	11/3/2009	552.4	630
11/3/2003	47.5	160,000	4/1/2010	191.9	120
4/1/2004	219.1	91	5/4/2010	233.3	640
5/5/2004	83.8	150	6/2/2010	166.6	3,400
6/2/2004	320.1	1,700	7/6/2010	2,009.7	36,000
7/1/2004	56.6	620	8/10/2010	288.8	12,000
8/2/2004	32.3	780	9/9/2010	148.5	1,700
9/1/2004	91.9	1,600	10/12/2010	117.1	1,100
10/7/2004	21.2	910	11/4/2010	80.8	230
11/11/2004	53.5	320	4/5/2011	93.9	190
4/11/2005	99.0	390	5/3/2011	194.9	250
5/9/2005	84.8	1,700	6/1/2011	400.9	2,200
6/1/2005	72.7	670	7/7/2011	126.2	1,200
7/5/2005	45.4	750	8/1/2011	64.6	790
8/1/2005	8.1	420	9/1/2011	20.2	340

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
9/1/2005	3.8	300	10/5/2011	6.1	230
10/4/2005	1.6	310	11/1/2011	6.6	700
11/2/2005	2.2	1,400	4/2/2012	105.0	300
4/4/2006	139.4	430	5/1/2012	244.4	5,800
5/3/2006	89.9	660	6/5/2012	63.6	990
6/6/2006	141.4	1,800	7/5/2012	15.1	910
7/6/2006	11.1	230	8/6/2012	21.2	2,800
9/6/2012	9.7	760	9/11/2014	2,231.9	20,000
10/1/2012	1.9	440	10/2/2014	66.7	130
11/6/2012	6.2	370	11/3/2014	79.8	98
4/1/2013	63.6	52	4/1/2015	59.6	10
5/1/2013	164.6	85	5/4/2015	121.2	630
6/3/2013	310.0	1,000	6/1/2015	172.7	730
7/8/2013	101.0	200	7/1/2015	202.0	1,600
8/5/2013	24.2	500	8/4/2015	65.6	650
9/3/2013	4.3	400			
10/7/2013	13.1	860	Min =	1.6	5
11/7/2013	5.0	110	1st Quartile =	27.3	230
4/1/2014	42.4	120	Median =	87.4	640
5/6/2014	74.7	230	3rd Quartile =	169.7	1,675
6/9/2014	116.1	16,000	Max =	8,250.9	160,000
7/1/2014	8,250.9	24,000	Mean(2) =	225.3	665
8/5/2014	59.6	2,800	Std Dev =	797.9	15,955

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table C-21. Estimated Flow for Muddy Creek, Segment IA 02 IOW-0162_0 and observed *E. coli* at STORET sites 15520002, 15520003, 16520003, and 16520004.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/9/2006	1.1	295	5/7/2013	44.7	1,940
5/17/2012	6.8	715	6/4/2013	20.8	585
5/30/2012	4.5	500	6/18/2013	4.8	638
6/14/2012	3.3	823	7/9/2013	7.8	2,325
6/28/2012	2.6	698	7/23/2013	3.2	6,700
7/11/2012	1.4	808	8/7/2013	2.0	11,575
7/26/2012	0.9	30,550	8/13/2013	1.8	708
8/9/2012	0.9	2,500			
8/23/2012	0.7	310			
9/6/2012	1.1	3,550	Min =	0.6	253
9/20/2012	0.7	860	1st Quartile =	1.0	543
10/4/2012	0.6	368	Median =	1.8	808
10/18/2012	1.4	975	3rd Quartile =	4.7	2,133
11/1/2012	0.9	253	Max =	44.7	30,550
11/15/2012	1.4	1,205	Mean =	5.6	1,106
4/16/2013	14.7	283	Std Dev =	9.6	6,392

(1) *E. coli* data is an average of the 4 sampling sites collected on this segment.
(2) For *E. coli* this is a Geomean.

Table C-22. Estimated Flow for Muddy Creek, Segment IA 02 IOW-0166_0 and observed *E. coli* at STORET site 15520001

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/17/2012	0.28	960	5/7/2013	0.90	880
5/30/2012	0.15	210	6/4/2013	0.45	2,800
6/14/2012	0.13	660	6/18/2013	0.24	3,300
6/28/2012	0.12	740	7/9/2013	0.72	2,900
7/11/2012	0.11	610	7/23/2013	0.15	1,200,000
7/26/2012	0.16	9200	8/7/2013	0.18	32,000
8/9/2012	0.25	62,000	8/13/2013	0.07	340
8/23/2012	0.15	86			
9/6/2012	0.23	3,300	Min =	0.07	86
9/20/2012	0.14	190	1st Quartile =	0.14	375
10/4/2012	0.13	420	Median =	0.20	810
10/18/2012	0.39	450	3rd Quartile =	0.28	3,200
11/1/2012	0.22	170	Max =	0.90	1,200,000
11/15/2012	0.27	2,200	Mean =	0.28	1,546
4/16/2013	0.68	360	Std Dev =	0.22	249,121

(1) For *E. coli* this is a Geomean.

Appendix D. Middle Iowa HUC 8 Watershed – 07080208

Appendix D.1. Wasteload Allocation by Stream Segment for the Middle Iowa Watershed

This appendix provides the wasteload allocation (WLA) for each facility based on the stream segment that it discharges to. Below is a summary of the Facility Types in the Watershed.

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- CAFO – Concentrated Animal Feeding Operation.
- GP #4 – Private Facility operating under an NPDES General Permit #4
- RBC – Rotation Biological Contactor
- ST/SF – Septic Tank Sand Filter
- SW – Stormwater
- TF – Trickling Filter
- UNSWD – Unsewered Community
- WSL – Waste Stabilization Lagoon (Controlled Discharge Lagoon, CDL)

The following stream segments do not have any NPDES permitted facilities within the segments drainage area consequently, they do not have a WLA contribution and are not addressed in this appendices: Price Creek, IA 02-IOW-0176_0; Willow Creek, IA 02-IOW-0177_0; Walnut Creek, IA 02-IOW-0187_2; Walnut Creek, IA 02-IOW-0188_0; Unnamed Tributary to Walnut Creek, IA 02-IOW-0189_0; Unnamed Tributary to Walnut Creek, IA 02-IOW-0191_0; Raven Creek, IA 02-IOW-0215_0; Deer Creek, IA 02-IOW-0225_0; East Tributary to Union Grove Lake, IA 02-IOW-0226_0; and Little Bear Creek, IA 02-IOW-0500_0.

Wastewater Treatment Facility (WWTF)

WWTF can be grouped two types of discharging facilities, continuous and intermittent. All of the WWTF listed in this WQIP are continuous discharging facilities with the exception of Waste Stabilization Lagoons which are intermittent discharging facilities.

The design flow for WWTF is the NPDES permitted average wet weather (AWW) flow. For a continuous discharging facility this is the 30-day AWW flow and the 180-day AWW flow for intermittent discharging facilities.

The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.

Intermittent discharging facilities operate as a hold and discharge facility with a minimum holding time of 180-days. These facilities typically discharge twice per year for short periods of time in the spring and in the fall when stream flows are at the highest. These facilities are permitted to discharge at a rate that is ten times the 180-day AWW flow. WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Unsewered (UNSWD)

WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day. Populations for unsewered communities was obtained or estimated from the 2010 US Census (U.S. Census Bureau, 2010). The per capita flow rate of 100 gallons per capita-day is required for facility planning of new WWTP by the Iowa Wastewater Facilities Design Standards.

Concentrated Animal Feeding Operations (CAFOs)

Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

General Permit No. 4 (GP#4)
Facilities operating under a GP #4 are private systems that only treat domestic waste from commercial and residential properties and serve an equivalent population of less than 16 people. These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Stormwater (SW)
NPDES permits for MS4 communities do not include numeric limits for E. Coli. However, they do include storm water pollution prevention and management provisions that include the implementation of Best Management Practices (BMP) to reduce pollutants in the discharge.

The WLA for MS4 communities in this WQIP are based on the ratio of the area of the MS4 community to the drainage area attributed to the impaired segment that the community discharges to times the TMDL attributed to the drainage area of that impaired segment.

Table D-1. WLA for Iowa River, Segment IA 02-IOW-0050_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Belle Plaine, City of STP	AS	610001	0065404	6.09E+05	126	2.90E+09
Walford, City of STP	AS	690001	0062545	4.30E+05	126	2.05E+09
River Bend Industries	WSL	4800103	0072044	2.78E+04	126	1.33E+09
Amana Colonies Golf Club	AL	4800801	0071544	5.90E+04	126	2.83E+08
Iowa Dot Rest Area #06, I-80 Victor	WSL	4800903	0067598	1.60E+04	126	7.63E+08
Whirlpool Corp - Amana Appliance Division	AS	4802102	0067598	3.00E+05	126	1.43E+09
Amana Sanitary District	WSL	4802901	0059161	1.58E+05	126	7.54E+09
Homestead Sanitary District	WSL	4830901	0023591	8.40E+04	126	4.01E+09
Ladora, City of STP	AL	4840001	0058521	2.01E+05	126	9.59E+08
Marengo, City of STP	AL	4843001	0047937	5.49E+05	126	2.62E+09
Victor, City of STP	AS	4875001	0058190	1.25E+05	126	5.96E+08
West/High Amana Sanitary District	AL	4880901	0077372	1.49E+05	126	7.10E+08
Timberlake Homeowners Association	WSL	5200311	0070076	7.50E+03	126	3.58E+08
Swisher, City of STP	AS	5285001	0033774	3.20E+05	126	1.53E+09
Timber Valley Estates-Mhc-STP	AL	6400601	0068659	2.00E+04	126	9.54E+07
Gilman, City of STP	AL	6436001	0029033	4.48E+05	126	2.14E+09
Laurel,, City of STP	AL	6452001	0072214	7.30E+04	126	3.48E+08
State Center, City of STP	AL	6484001	0041807	4.65E+05	126	2.22E+09
Baymont Inn Motel	ST/SF	7900208	0078018	5.00E+03	126	2.38E+07
Pilot Travel Center #495	ST/SF	7900209	0078361	5.00E+03	126	2.38E+07
Kwik Star #303	AL	7900714	0067458	1.20E+04	126	5.72E+07
Pilgrim Heights Retreat Center-STP	ST/SF	8600402	0074977	8.00E+03	126	3.82E+07
Chelsea, City of STP	AL	8609001	0071552	4.30E+04	126	2.05E+08

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Clutier, City of STP	WSL	8616001	0056812	2.90E+04	126	1.38E+09
Dysart, City of STP	AL	8627001	0020745	8.30E+05	126	3.96E+09
Elberon, City of STP	WSL	8631001	0061964	2.25E+04	126	1.07E+09
Garwin, City of STP	WSL	8637001	0025925	7.50E+04	126	3.58E+09
Legrand, City of STP	WSL	8657001	0027235	3.15E+05	126	1.50E+10
Montour, City of STP	AL	8666001	0058700	8.30E+04	126	3.96E+08
Iowa Premium Beef	AS	8670101	0000795	1.49E+06	126	7.09E+09
Tama, City of STP	AS	8670002	0043681	2.00E+06	126	9.54E+09
Toledo, City of STP	AS	8676001	0033103	1.10E+06	126	5.25E+09
Carnforth	UNSWD	--	--	2.30E+03	126	1.10E+07
Dillion	UNSWD	--	--	2.50E+03	126	1.19E+07
Hartwick	UNSWD	--	--	8.60E+03	126	4.10E+07
Irving	UNSWD	--	--	5.00E+03	126	2.38E+07
Koszta	UNSWD	--	--	2.60E+03	126	1.24E+07
Newburg	UNSWD	--	--	1.00E+04	126	4.77E+07
Quarry	UNSWD	--	--	5.40E+03	126	2.58E+07
South Amana	UNSWD	--	--	1.65E+04	126	7.87E+07
Upper Old Hwy 6 NW	UNSWD	--	--	3.20E+03	126	1.53E+07
Van Cleve	UNSWD	--	--	4.00E+03	126	1.91E+07
Vining	UNSWD	--	--	5.00E+03	126	2.38E+07
Wolf Lake Addition	UNSWD	--	--	1.36E+04	126	6.49E+07
Amana Farms - Feedlot	CAFO	56996	--	0.0	126	0.0
Timber Creek Pork	CAFO	58019	--	0.0	126	0.0
Kevin Herink	CAFO	59520	--	0.0	126	0.0
Jesina Farms Inc.	CAFO	59769	--	0.0	126	0.0
Central Iowa Pork	CAFO	60614	--	0.0	126	0.0
Mtm Farms L.c.	CAFO	61010	--	0.0	126	0.0
Geno Source Llc	CAFO	61209	--	0.0	126	0.0
Mayo Farm Inc.	CAFO	62488	--	0.0	126	0.0
Bear Creek Dairy	CAFO	64879	--	0.0	126	0.0
Wieben Pork Works	CAFO	64936	--	0.0	126	0.0
Prairieview Hog Farm Inc. - Kane 33	CAFO	65743	--	0.0	126	0.0
1 Permitted Facility	GP #4	--	--	--	126	--
Totals				**--**		**7.99E+10**

Table D-2. WLA for Iowa River, Segment IA 02-IOW-0060_4.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Marshall County Law Center	WSL	6400901	0075973	2.17E+04	126	1.03E+09
Marshalltown, City of Water Pollution Control	AS/SBR	6469001	0038610	1.30E+07	126	6.22E+10
Marshalltown, City of MS4	SW	6469002	0080039	--	126	1.78E+11
Green Mountain	UNSWD	--	--	1.20E+04	126	5.72E+07
LaMoille	UNSWD	--	--	4.60E+03	126	2.19E+07
Eggers Farms	CAFO	56995	--	0.0	126	0.0
Edler Brothers Farm-section 19	CAFO	58296	--	0.0	126	0.0
Edler Brothers Farm-section 36	CAFO	58297	--	0.0	126	0.0
Burt Farm & Livestock - Home Site	CAFO	60557	--	0.0	126	0.0
Dennis A. Anderson	CAFO	62848	--	0.0	126	0.0
Edler Brothers -sec 33	CAFO	64799	--	0.0	126	0.0
Jeff Breja	CAFO	65417	--	0.0	126	0.0
Totals				**--**		**2.42E+11**

Table D-3. WLA for Iowa River, Segment IA 02-IOW-0060_5.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Albion, City of STP	AL	6403001	0034321	2.50E+05	126	1.19E+09
Marietta	UNSWD	--	--	2.50E+03	126	1.19E+07
Mead Family Farms Llc	CAFO	61407	--	0.0	126	0.0
Totals				**--**		**1.20E+09**

Table D-4. WLA for Price Creek, Segment IA 02-IOW-0175_2.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Waldenburg Addition	UNSWD	--	--	9.00E+03	126	4.29E+07
Totals				--		4.29E+07

Table D-5. WLA for Unnamed Tributary to Willow Creek, Segment IA 02-IOW-0179_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Wilco Farm Ltd	CAFO	59046	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table D-6. WLA for Little Bear Creek, Segment IA 02-IOW-0185_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Brooklyn, City of STP	AL	7909001	0020958	5.00E+05	126	2.38E+09
Fremont Farms Of Iowa, Llp	CAFO	60767	--	0.0	126	0.0
Totals				--		2.38E+09

Table D-7. WLA for Little Bear Creek, Segment IA 02-IOW-0185_2.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Malcom City of STP	WSL	7945001	0048011	3.96E+04	126	1.89E+09
Totals				--		1.89E+09

Table D-8. WLA for Raven Creek, Segment IA 02-IOW-0215_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Dunbar	UNSWD	--	--	2.40E+03	126	1.14E+07
Totals				**--**		**1.14E+07**

Table D-9. WLA for Unnamed Tributary to Walnut Creek, Segment IA 02-IOW-0510_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
6 Permitted Facilities	GP #4	--	--	--	126	--
Totals				**--**		**--**

Appendix D.2. WLA by Treatment Type for the Middle Iowa Watershed

This appendix provides the WLA for each facility based on the Treatment Type. Treatment types include: Municipal and Semi-public (WWTF); CAFO; General Permit #4; Unsewered; and Stormwater;

Wastewater Treatment Facility includes the following facility types:

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- ST/SF – Septic Tank Sand Filter
- TF – Trickling Filter
- WSL – Waste Stabilization Lagoon

Table D-10. WLA for WWTF in the Middle Iowa Watershed.

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Amana Colonies Golf Club	AL	4800801	0071544	5.94E+04	IA 02-IOW-0050_1	126	2.83E+08
Chelsea, City of STP	AL	8609001	0071552	4.30E+04	IA 02-IOW-0050_1	126	2.05E+08
Dysart, City of STP	AL	8627001	0020745	8.30E+05	IA 02-IOW-0050_1	126	3.96E+09
Gilman, City of STP	AL	6436001	0029033	4.48E+05	IA 02-IOW-0050_1	126	2.14E+09
Kwik Star #303	AL	7900714	0067458	1.20E+04	IA 02-IOW-0050_1	126	5.72E+07
Ladora, City of STP	AL	4840001	0058521	2.01E+05	IA 02-IOW-0050_1	126	9.59E+08
Laurel, City of STP	AL	6452001	0072214	7.30E+04	IA 02-IOW-0050_1	126	3.48E+08
Marengo, City of STP	AL	4843001	0047937	5.49E+05	IA 02-IOW-0050_1	126	2.62E+09
Montour, City of STP	AL	8666001	0058700	8.30E+04	IA 02-IOW-0050_1	126	3.96E+08
State Center, City of STP	AL	6484001	0041807	4.65E+05	IA 02-IOW-0050_1	126	2.22E+09
Timber Valley Estates-Mhc-STP	AL	6400601	0068659	2.00E+04	IA 02-IOW-0050_1	126	9.54E+07
West/High Amana Sanitary District	AL	4880901	0077372	1.49E+05	IA 02-IOW-0050_1	126	7.10E+08
Albion, City of STP	AL	6403001	0034321	2.50E+05	IA 02-IOW-0060_5	126	1.19E+09
Brooklyn, City of STP	AL	7909001	0020958	5.00E+05	IA 02-IOW-0185_1	126	2.38E+09
Belle Plaine, City of STP	AS	610001	0065404	6.09E+05	IA 02-IOW-0050_1	126	2.90E+09
Iowa Premium Beef	AS	8670101	0000795	1.49E+06	IA 02-IOW-0050_1	126	7.09E+09
Swisher, City of STP	AS	5285001	0033774	3.20E+05	IA 02-IOW-0050_1	126	1.53E+09
Tama, City of STP	AS	8670002	0043681	2.00E+06	IA 02-IOW-0050_1	126	9.54E+09
Toledo, City of STP	AS	8676001	0033103	1.10E+06	IA 02-IOW-0050_1	126	5.25E+09
Victor, City of STP	AS	4875001	0058190	1.25E+05	IA 02-IOW-0050_1	126	5.96E+08
Walford, City of STP	AS	690001	0062545	4.30E+05	IA 02-IOW-0050_1	126	2.05E+09
Whirlpool Corp – Amana Appliance Division	AS	4802102	0000744	3.00E+05	IA 02-IOW-0050_1	126	1.43E+09
Marshalltown City of Water Pollution Control	AS/SBR	6469001	0038610	1.30E+07	IA 02-IOW-0060_4	126	6.22E+10
Baymont Inn Motel	ST/SF	7900208	0078018	5.00E+03	IA 02-IOW-0050_1	126	2.38E+07
Pilgrim Heights Retreat Center-STP	ST/SF	8600402	0074977	8.00E+03	IA 02-IOW-0050_1	126	3.82E+07
Pilot Travel Center #495	ST/SF	7900209	0078361	5.00E+03	IA 02-IOW-0050_1	126	2.38E+07

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
River Bend Industries (2)	WSL	4800103	0072044	2.78E+04	IA 02-IOW-0050_1	126	1.33E+09
Amana Sanitary District (2)	WSL	4802901	0059161	1.58E+04	IA 02-IOW-0050_1	126	7.54E+09
Clutier, City of STP (2)	WSL	8616001	0056812	2.90E+03	IA 02-IOW-0050_1	126	1.38E+09
Elberon, City of STP (2)	WSL	8631001	0061964	2.25E+03	IA 02-IOW-0050_1	126	1.07E+09
Garwin, City of STP (2)	WSL	8637001	0025925	7.50E+04	IA 02-IOW-0050_1	126	3.58E+09
Homestead Sanitary District (2)	WSL	4830901	0023591	8.40E+04	IA 02-IOW-0050_1	126	4.01E+09
Iowa Dot Rest Area #06 I80 Victor (2)	WSL	4800903	0067598	1.60E+03	IA 02-IOW-0050_1	126	7.63E+08
Legrand, City of STP (2)	WSL	8657001	0027235	3.15E+04	IA 02-IOW-0050_1	126	1.50E+10
Timberlake Homeowners Association (2)	WSL	5200311	0070076	7.50E+02	IA 02-IOW-0050_1	126	3.58E+08
Marshall County Law Center (2)	WSL	6400901	0075973	2.17E+03	IA 02-IOW-0060_4	126	1.03E+09
Malcom, City of STP (2)	WSL	7945001	0048011	3.96E+03	IA 02-IOW-0185_2	126	1.89E+09
Totals				--			**1.48E+11**

(1) The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.
(2) The WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Table D-11. WLA for CAFO in the Middle Iowa Watershed.

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Eggers Farms	CAFO	56995	IA 02-IOW-0060_4	0.0
Amana Farms - Feedlot	CAFO	56996	IA 02-IOW-0050_1	0.0
Timber Creek Pork	CAFO	58019	IA 02-IOW-0050_1	0.0
Edler Brothers Farm-section 19	CAFO	58296	IA 02-IOW-0060_4	0.0
Edler Brothers Farm-section 36	CAFO	58297	IA 02-IOW-0060_4	0.0
Wilco Farm Ltd	CAFO	59046	IA 02-IOW-0179_0	0.0
Kevin Herink	CAFO	59520	IA 02-IOW-0050_1	0.0
Jesina Farms Inc.	CAFO	59769	IA 02-IOW-0050_1	0.0
Burt Farm & Livestock - Home Site	CAFO	60557	IA 02-IOW-0060_4	0.0
Central Iowa Pork	CAFO	60614	IA 02-IOW-0050_1	0.0
Fremont Farms Of Iowa, Llp	CAFO	60767	IA 02-IOW-0185_1	0.0
Mtm Farms L.c.	CAFO	61010	IA 02-IOW-0050_1	0.0
Geno Source Llc	CAFO	61209	IA 02-IOW-0050_1	0.0
Mead Family Farms Llc	CAFO	61407	IA 02-IOW-0060_5	0.0
Mayo Farm Inc.	CAFO	62488	IA 02-IOW-0050_1	0.0
Dennis A. Anderson	CAFO	62848	IA 02-IOW-0060_4	0.0
Edler Brothers -sec 33	CAFO	64799	IA 02-IOW-0060_4	0.0
Bear Creek Dairy	CAFO	64879	IA 02-IOW-0050_1	0.0
Wieben Pork Works	CAFO	64936	IA 02-IOW-0050_1	0.0
Jeff Breja	CAFO	65417	IA 02-IOW-0060_4	0.0
Prairieview Hog Farm Inc. - Kane 33	CAFO	65743	IA 02-IOW-0050_1	0.0
Totals				**0.00**

(1) Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

Table D-12. WLA for General Permit #4 in the Middle Iowa Watershed.

Facility Name	Facility Type	Facility ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
1 Permitted Facility	GP #4	--	--	IA 02-IOW-0050_1	126	--
6 Permitted Facilities	GP #4	--	--	IA 02-IOW-0510_0	126	--
Totals			**--**			**--**

(1) These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Table D-13. WLA for Unsewered Communities in the Middle Iowa Watershed.

Facility Name	Facility Type	Facility ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day(1)
Carnforth	UNSWD	--	2.30E+03	IA 02-IOW-0050_1	126	1.10E+07
Dillon	UNSWD	--	2.50E+03	IA 02-IOW-0050_1	126	1.19E+07
Hartwick	UNSWD	--	8.60E+03	IA 02-IOW-0050_1	126	4.10E+07
Irving	UNSWD	--	5.00E+03	IA 02-IOW-0050_1	126	2.38E+07
Koszta	UNSWD	--	2.60E+03	IA 02-IOW-0050_1	126	1.24E+07
Marietta	UNSWD	--	2.50E+03	IA 02-IOW-0050_1	126	1.19E+07
Newburg	UNSWD	--	1.00E+04	IA 02-IOW-0050_1	126	4.77E+07
Quarry	UNSWD	--	5.40E+03	IA 02-IOW-0050_1	126	2.58E+07
South Amana	UNSWD	--	1.65E+04	IA 02-IOW-0050_1	126	7.87E+07
Upper Old Hwy 6 NW	UNSWD	--	3.20E+03	IA 02-IOW-0050_1	126	1.53E+07
Van Cleve	UNSWD	--	4.00E+03	IA 02-IOW-0050_1	126	1.91E+07
Vining	UNSWD	--	5.00E+03	IA 02-IOW-0050_1	126	2.38E+07
Wolf Lake Addition	UNSWD	--	1.36E+04	IA 02-IOW-0050_1	126	6.49E+07
Green Mountain	UNSWD	--	1.20E+04	IA 02-IOW-0060_4	126	5.72E+07
LaMoille	UNSWD	--	4.60E+03	IA 02-IOW-0060_4	126	2.19E+07
Waldenburg Addition	UNSWD	--	9.00E+03	IA 02-IOW-0175_2	126	4.29E+07
Dunbar	UNSWD	--	2.40E+03	IA 02-IOW-0215_0	126	1.14E+07
Totals			**--**			**5.21E+08**

(1) WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day times the WQS concentration.

Table D-14. WLA for Stormwater in the Middle Iowa Watershed.

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day(1)
Marshalltown, City of MS4	SW	6469002	0080039	--	IA 02-IOW-0060_4	126	1.78E+11
Totals				**--**			**1.78E+11**

(1) The WLA for MS4 communities in this WQIP are based on the ratio of the area of the MS4 community to the drainage area attributed to the impaired segment that the community discharges to times the TMDL attributed to the drainage area of that impaired segment.

Appendix D.3. NPDES Facilities Not Considered

Table D-15. NPDES Facilities not Considered in this WQIP.

Facility Name	Iowa NPDES ID	EPA NPDES ID	Receiving Stream Segment	Reason Not Used
Buckeye Terminals, Llc - Cedar Rapids / N Liberty	5200109	0072273	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Lakeview Knolls Homeowners Assn.	5200304	0061514	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Longview Estates Hoa	5200323	0080730	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Lakewoods Development Subdivision/bowersox Addition Subdivision	5200327	PENDING	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)(3)]
Macbride Estates Wtp	5200328	PENDING	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)(3)]
Camp Iodiseca	5200401	0067083	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Scales Pointe Campground & Marina	5200405	0073041	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Cottage Reserve Corporation	5200801	0068331	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Dnr Lake Macbride State Park-campground	5200900	0072079	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Macbride Sanitary Sewer District	5200906	0073580	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Sugar Bottom Recreation Area	5200907	0083674	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Corridor Ridge Subdivision-shueyville	5280301	0077992	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)(3)]
Solon City of Stp	5282001	0036978	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
The Eastern Iowa Airport	5715145	0082236	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Ely City Of Stp	5728001	0047988	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Ely, City Of Ms4	5728002	0084476	IA 02-IOW-0040-L_0	Does not discharge to an impaired segment[(1)]
Poweshiek Water Association (iac)	4800802	0080969	IA 02-IOW-0050_1	MUNICIPAL-WT[(2)]
Amana Farms - Feedlot	4856996	0077500	IA 02-IOW-0050_1	AGRICULTURAL[(2)]
Cedar Ridge Vineyard & Winery	5200203	0082821	IA 02-IOW-0050_1	OPERATION PERMIT[(2)]
Oxford Water Treatment Plant	5260000	0082252	IA 02-IOW-0050_1	MUNICIPAL-WT[(2)]
Sutherland Generating Sta-alliant Energy	6469103	0000108	IA 02-IOW-0050_1	INDUSTRIAL[(2)]
Fremont Farms Of Iowa L.l.p.	7900104	0083577	IA 02-IOW-0050_1	OPERATION PERMIT[(2)]
Bituminous Materials & Supply	8600102	0078158	IA 02-IOW-0050_1	INDUSTRIAL STORMWATER[(2)]

Facility Name	Iowa NPDES ID	EPA NPDES ID	Receiving Stream Segment	Reason Not Used
Tama Paperboard	8670100	0000841	IA 02-IOW-0050_1	INDUSTRIAL(2)
Koch Nitrogen Company - Marshalltown	6400112	0075591	IA 02-IOW-0060_4	INDUSTRIAL(2)
Bruin Manufacturing Co., Inc.	6400113	0081434	IA 02-IOW-0060_4	INDUSTRIAL(2)
Ipl - Precision Pipeline, Llc-W656	6400114	0052365	IA 02-IOW-0060_4	INDUSTRIAL(2)(3)
Marshalltown Water Treatment Plant	6469000	0075345	IA 02-IOW-0060_4	MUNICIPAL-WT(2)
Fisher Controls International Llc (main Office)	6469102	0000230	IA 02-IOW-0060_4	INDUSTRIAL(2)

(1) These facilities are within the drainage area of a segment that has not been assessed for bacteria. Therefore, they were not considered in this WQIP.
(2) Operation permits do not discharge to surface water and industrial facilities and municipal water treatment plants are not expected to have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources.
(3) The NPDES permit application is pending.

Appendix D.4. Water Quality Data

Table D-16. Estimated Flow for Iowa River, Segment IA 02 IOW-0050_1 and observed *E. coli* at Army Corps Site C-1, Coralville Reservoir WQ Monitoring.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/14/2010	6850.4	7300	6/3/2013	25125.3	380
6/28/2010	9566.9	1900	6/24/2013	4048.0	190
7/12/2010	10844.7	400	7/8/2013	3156.8	140
7/19/2010	4133.9	230	7/15/2013	2201.1	110
7/26/2010	6109.5	1000	7/22/2013	1471.0	20
8/9/2010	4359.3	300	8/5/2013	1309.9	62
8/30/2010	1954.2	110	8/12/2013	823.6	Not Detected(1)
5/23/2011	3844.0	700	8/23/2013	503.6	10
6/6/2011	4112.4	80	9/9/2013	257.7	10
6/13/2011	7580.5	800	5/19/2014	3393.0	130
6/27/2011	5078.7	200	6/2/2014	1535.4	310
7/11/2011	2083.0	250	6/9/2014	1760.9	6900
7/18/2011	1578.4	240	6/23/2014	10565.5	9200
7/25/2011	1610.6	2300	7/7/2014	18790.3	280
8/1/2011	1095.2	280	7/14/2014	7913.4	790
8/15/2011	557.3	10	7/28/2014	2587.7	1400
9/1/2011	394.1	10	8/18/2014	650.7	20
5/21/2012	1363.6	52	8/25/2014	972.8	20
6/18/2012	714.0	75	9/8/2014	1879.0	190
6/25/2012	707.6	31			
7/9/2012	338.2	10	Min=	119.2	5
7/16/2012	302.8	73	1st Quartile=	709.2	36
7/23/2012	210.5	20	Median=	1,820.0	175
8/6/2012	179.3	110	3rd Quartile=	4,303.0	395
8/13/2012	175.0	160	Max=	25,125.3	24,000
9/12/2012	119.2	10	Mean(2)=	3,681.8	162
5/20/2013	4552.6	24000	Std Dev=	4,852.1	3,889

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-17. Estimated Flow for Iowa River, Segment IA 02 IOW-0060_4 and observed *E. coli* at STORET Site 10640002.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/11/1999	127.1	140	7/6/2006	392.0	250
4/17/2000	243.4	Not Detected(1)	8/9/2006	339.3	5800
10/18/2000	113.1	10	9/12/2006	3188.0	35000
3/21/2001	7000.7	330	10/10/2006	475.0	140
4/17/2001	4717.4	180	11/7/2006	533.1	20
5/15/2001	2843.3	170	4/10/2007	3144.9	60
6/19/2001	4071.1	330	5/9/2007	4308.1	220
7/17/2001	588.1	160	6/12/2007	1852.5	300
8/21/2001	341.4	50	7/10/2007	934.9	240
9/17/2001	408.2	2100	8/8/2007	1184.7	5700
10/15/2001	337.1	230	9/12/2007	939.2	330
11/13/2001	281.1	550	10/10/2007	4081.9	3900
4/10/2002	343.6	Not Detected(1)	11/13/2007	1174.0	72
5/15/2002	2207.9	Not Detected(1)	4/8/2008	2111.0	20
6/11/2002	1314.0	950	5/14/2008	3586.5	110
7/9/2002	461.0	140	6/16/2008	12278.1	20
8/13/2002	1051.2	660	7/15/2008	1669.4	300
9/10/2002	312.3	130	8/6/2008	1087.8	230
10/8/2002	1561.7	300	9/4/2008	415.7	210
11/12/2002	541.7	20	4/7/2009	1723.2	40
4/7/2003	465.3	Not Detected(1)	5/12/2009	3586.5	130
5/13/2003	3780.4	170.0	6/9/2009	2487.9	1000
6/10/2003	1884.8	260.0	7/8/2009	1637.1	2000
7/9/2003	3834.2	3300.0	8/10/2009	1270.9	24000
8/12/2003	316.6	50.0	9/9/2009	224.0	30
9/9/2003	53.9	100.0	10/12/2009	926.2	200
10/8/2003	199.2	20.0	11/10/2009	2121.7	310
11/11/2003	308.0	300.0	4/13/2010	1798.6	52
4/14/2004	668.8	Not Detected(1)	5/11/2010	1863.3	2000
5/11/2004	703.3	60	6/8/2010	1960.2	1900
6/9/2004	2401.8	240	7/13/2010	2509.5	2100
7/13/2004	2854.1	2000	8/9/2010	2886.4	3600
8/12/2004	470.7	70	9/7/2010	819.6	990
9/8/2004	387.7	560	10/12/2010	732.4	240
10/13/2004	176.6	90	11/9/2010	481.4	110
11/9/2004	271.4	60	4/13/2011	1063.0	31
4/12/2005	1701.7	2400	5/10/2011	1669.4	41
5/2/2005	1540.1	Not Detected(1)	6/15/2011	2821.8	650
6/8/2005	1227.8	490	7/12/2011	1270.9	3400
7/13/2005	1033.9	290	8/8/2011	410.3	110

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
8/9/2005	358.6	120	9/13/2011	151.9	20
9/15/2005	177.7	170	10/12/2011	151.9	2400
10/10/2005	389.9	140	11/9/2011	205.7	3600
11/8/2005	229.4	Not Detected(1)	4/10/2012	257.4	31
4/11/2006	2035.6	30	5/9/2012	1744.8	140
5/9/2006	2294.1	140	6/5/2012	473.9	230
6/6/2006	917.6	240	7/9/2012	133.6	41
8/6/2012	74.3	170	9/4/2014	1507.8	1300
9/11/2012	49.5	220	10/23/2014	1087.8	8200
10/9/2012	47.4	63	11/3/2014	888.5	30
11/13/2012	91.5	130	4/2/2015	526.7	52
4/8/2013	842.2	160	5/13/2015	1163.2	97
5/1/2013	2067.9	770	6/2/2015	2283.3	190
6/5/2013	7226.8	930	7/7/2015	4081.9	8200
7/9/2013	1270.9	270	8/5/2015	570.8	160
8/6/2013	583.7	180			
9/4/2013	158.3	110			
10/10/2013	114.2	110	Min=	47.4	5
11/12/2013	170.2	20	1st Quartile=	351.1	60
4/7/2014	541.7	10	Median=	934.9	170
5/5/2014	2735.6	98	3rd Quartile=	1,997.9	425
6/5/2014	1002.7	360	Max=	12,278.1	35,000
7/9/2014	4846.6	230	Mean(2)=	1,470.6	188
8/13/2014	442.7	140	Std Dev=	1,711.6	4,039

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-18. Estimated Flow for Iowa River, Segment IA 02 IOW-0060_5 and observed *E. coli* at STORET Site 10640003.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/11/1999	117.8	130.0	6/6/2006	850.9	290.0
4/17/2000	225.7	54.0	7/6/2006	363.5	520.0
10/18/2000	104.9	45.0	8/9/2006	314.6	31,000.0
3/21/2001	6,491.5	210.0	9/12/2006	2956.1	11,000.0
4/17/2001	4,374.3	63.0	10/10/2006	440.4	340.0
5/15/2001	2,636.6	140.0	11/7/2006	494.4	60.0
6/19/2001	3,775.1	280.0	4/10/2007	2916.2	100.0
7/17/2001	545.3	750.0	5/9/2007	3994.8	200.0
8/21/2001	316.6	240.0	6/12/2007	1717.8	500.0
9/17/2001	378.5	29,000.0	7/10/2007	866.9	340.0
10/15/2001	312.6	260.0	8/8/2007	1098.6	2,400.0
11/13/2001	260.7	140.0	9/12/2007	870.9	220.0
4/10/2002	318.6	Not Detected(1)	10/10/2007	3785.1	3,300.0
5/15/2002	2,047.3	Not Detected(1)	11/13/2007	1088.6	72.0
6/11/2002	1,218.4	2,400.0	4/8/2008	1957.4	60.0
7/9/2002	427.4	280.0	5/14/2008	3325.7	140.0
8/13/2002	974.7	7,400.0	6/16/2008	11385.1	310.0
9/10/2002	289.6	320.0	7/15/2008	1548.0	460.0
10/8/2002	1,448.1	400.0	8/6/2008	1008.7	360.0
11/12/2002	502.3	54.0	9/4/2008	385.5	300.0
4/7/2003	431.4	30.0	4/7/2009	1597.9	20.0
5/13/2003	3505.4	170.0	5/12/2009	3325.7	230.0
6/10/2003	1747.7	220.0	6/9/2009	2307.0	930.0
7/9/2003	3555.4	24,000.0	7/8/2009	1518.0	4,100.0
8/12/2003	293.6	110.0	8/10/2009	1178.5	240,000.0
9/9/2003	49.9	210.0	9/9/2009	207.7	120.0
10/8/2003	184.8	20.0	10/12/2009	858.9	440.0
11/11/2003	285.6	250.0	11/10/2009	1967.4	300.0
4/14/2004	620.2	Not Detected(1)	4/13/2010	1667.8	160.0
5/11/2004	652.1	110.0	5/11/2010	1727.7	5,500.0
6/9/2004	2227.1	320.0	6/8/2010	1817.6	1,000.0
7/13/2004	2646.5	850.0	7/13/2010	2327.0	740.0
8/12/2004	436.4	230.0	8/9/2010	2676.5	13,000.0
9/8/2004	359.5	600.0	9/7/2010	760.0	830.0
10/13/2004	163.8	90.0	10/12/2010	679.1	400.0
11/9/2004	251.7	54.0	11/9/2010	446.4	170.0
4/12/2005	1577.9	43,000.0	4/13/2011	985.7	98.0
5/2/2005	1428.1	72.0	5/10/2011	1548.0	120.0
6/8/2005	1138.5	710.0	6/15/2011	2616.6	2,900.0
7/13/2005	958.7	400.0	7/12/2011	1178.5	1,100.0

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
8/9/2005	332.6	140.0	8/8/2011	380.5	370.0
9/15/2005	164.8	290.0	9/13/2011	140.8	170.0
10/10/2005	361.5	120.0	10/12/2011	140.8	110.0
11/8/2005	212.7	10.0	11/9/2011	190.8	20,000.0
4/11/2006	1887.5	60.0	4/10/2012	238.7	140.0
5/9/2006	2127.2	140.0	5/9/2012	1617.9	280.0
6/5/2012	439.4	340.0	4/7/2014	502.3	10.0
7/9/2012	123.8	180.0	5/5/2014	2536.7	85.0
8/6/2012	68.9	180.0	6/5/2014	929.8	510.0
9/11/2012	45.9	130.0	7/9/2014	4494.1	390.0
10/9/2012	43.9	63.0	8/13/2014	410.5	260.0
11/13/2012	84.9	120.0	9/4/2014	1398.2	740.0
4/8/2013	781.0	30.0			
5/1/2013	1917.5	3,400.0	Min=	43.9	5
6/5/2013	6701.2	11,000.0	1st Quartile=	316.1	110
7/9/2013	1178.5	650.0	Median=	862.9	235
8/6/2013	541.3	210.0	3rd Quartile=	1,835.1	540
9/4/2013	146.8	86.0	Max=	11,385.1	240,000
10/10/2013	105.9	95.0	Mean(2)=	1,361.1	301
11/12/2013	157.8	72.0	Std Dev=	1,612.9	23,290

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-19. Estimated Flow for Price Creek, Segment IA 02 IOW-0175_2 and observed *E. coli* at STORET Sites 13480010, 13480011, 13480012, & 13480013.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/24/2011	46.3	918	5/20/2014	20.9	1,338
7/6/2011	25.8	6,675	5/28/2014	43.1	380,000
7/21/2011	18.2	10,200	5/29/2014	25.5	40,000
8/9/2011	8.0	1,465	6/5/2014	19.2	2,315
8/24/2011	4.0	6,120	6/8/2014	18.2	34,000
9/6/2011	3.7	1,128	6/24/2014	64.3	2,200
9/19/2011	4.5	2,560	7/10/2014	59.2	915
10/6/2011	2.6	805	7/12/2014	57.8	110,000
10/18/2011	2.2	963	8/13/2014	11.9	1,930
11/1/2011	1.9	453	9/3/2014	34.7	2,830
11/14/2011	2.6	298	9/29/2014	16.0	>10748(2)
5/16/2013	26.9	1,280			
6/4/2013	100.4	1,025	Min =	1.5	5
8/27/2013	2.0	4,793	1st Quartile =	4.1	929
9/11/2013	1.5	>7220(2)	Median =	17.1	2,065
3/20/2014	9.4	<22(3)	3rd Quartile =	32.8	9,319
4/3/2014	5.6	120	Max =	100.4	380,000
4/22/2014	15.2	11,050	Mean(4) =	23.2	2,641
5/1/2014	45.6	573	Std Dev =	23.5	69,675

(1) *E. coli* data is an average of the 4 sampling sites collected on this segment.
(2) Individual sampling points had *E.coli* values greater than quantification value of 24,000 orgs/100 mL. In these cases 24,000 orgs/100 mL was used for calculation purposes.
(3) Individual sampling points had *E. coli* values below the detection limit of 10 orgs/100 mL. In these cases 5 orgs/100 mL was used for calculation purposes.
(4) For *E. coli* this is a Geomean.

Table D-20. Estimated Flow for Price Creek, Segment IA 02 IOW-0176_0 and observed *E. coli* at STORET Sites 13480001, 13480002, 13480003, 13480004, 13480005, 13480007, & 13480007.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/24/2011	12.1	613	4/22/2014	4.8	830
7/6/2011	7.6	1,671	5/1/2014	10.2	231
7/21/2011	5.2	4,343	5/20/2014	4.9	3,082
8/9/2011	17.1	1,470	6/5/2014	3.1	1,779
8/24/2011	3.0	813	6/24/2014	16.2	833
9/6/2011	2.2	707	7/10/2014	15.3	641
9/19/2011	2.0	900	8/13/2014	2.1	1,046
10/6/2011	1.5	555	9/3/2014	3.4	1,909
10/18/2011	1.6	540	9/29/2014	2.3	1,019
11/1/2011	1.4	763			
11/14/2011	3.1	223	Min =	1.0	67
5/16/2013	13.7	186	1st Quartile =	2.0	570
6/4/2013	22.7	1,003	Median =	3.3	832
8/27/2013	1.5	1,230	3rd Quartile =	9.6	1,410
9/11/2013	1.0	2,288	Max =	22.7	4,343
3/20/2014	4.2	67	Mean(2) =	6.3	763
4/3/2014	1.9	127	Std Dev =	6.0	949

(1) *E. coli* data is an average of the 7 sampling sites collected on this segment.
(2) For *E. coli* this is a Geomean.

Table D-21. Estimated Flow for Willow Creek, Segment IA 02 IOW-0177_0 and observed *E. coli* at STORET Site 13480009.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/24/2011	5.3	Present Above Quantification Limit(1)	5/1/2014	4.5	6,500
7/6/2011	3.3	1,100	5/20/2014	2.1	680
7/21/2011	2.3	5,200	6/5/2014	1.3	3,300
8/9/2011	7.4	4,100	6/24/2014	7.1	2,000
8/24/2011	1.3	2,600	7/10/2014	6.7	360
9/6/2011	1.0	9,600	8/13/2014	0.9	1,000
9/19/2011	0.9	230,000	9/3/2014	1.5	780
10/6/2011	0.6	1,600	9/29/2014	1.0	340
10/18/2011	0.7	3,400			
11/1/2011	0.6	6,900	Min =	0.6	85
11/14/2011	1.3	46,000	1st Quartile =	1.0	1,075
5/16/2013	6.0	85	Median =	1.7	2,200
6/4/2013	9.9	2,300	3rd Quartile =	4.7	5,525
3/20/2014	1.8	1,700	Max =	9.9	230,000
4/3/2014	0.8	1,400	Mean =	2.9	2,656
4/22/2014	2.1	2,100	Std Dev =	2.6	45,898

(1) *E. coli* was present above the quantification limit of 24,000 orgs/100 mL. Consequently 24,000 org/100 mL was used for calculation purposes.

(2) For *E. coli* this is a Geomean.

Table D-22. Estimated Flow for Unnamed Tributary to Willow Creek, Segment IA 02 IOW-0179_0 and observed *E. coli* at STORET Site 13480008.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	E. coli (orgs/100 mL)
6/24/2011	2.5	1,800	4/22/2014	1.0	1,600
7/6/2011	1.6	2,100	5/1/2014	2.1	260
7/21/2011	1.1	10,000	5/20/2014	1.0	250
8/9/2011	3.6	4,100	6/5/2014	0.6	Present Above Quantification Limit(1)
8/24/2011	0.6	24,000	6/24/2014	3.4	500
9/6/2011	0.5	2,400	7/10/2014	3.2	1,200
9/19/2011	0.4	6,500	8/13/2014	0.4	680
10/6/2011	0.3	44,000	9/3/2014	0.7	4,100
10/18/2011	0.3	16,000	9/29/2014	0.5	340
11/1/2011	0.3	3,000			
11/14/2011	0.6	540	Min =	0.2	10
5/16/2013	2.9	150	1st Quartile =	0.4	395
6/4/2013	4.7	360	Median =	0.7	1,400
8/27/2013	0.3	740	3rd Quartile =	2.0	4,100
9/11/2013	0.2	690	Max =	4.7	44,000
3/20/2014	0.9	10	Mean(2) =	1.3	1,374
4/3/2014	0.4	150	Std Dev =	1.3	10,171

(1) *E. coli* was present above the quantification limit of 24,000 orgs/100 mL. Consequently 24,000 org/100 mL was used for calculation purposes.

(2) For *E. coli* this is a Geomean.

Table D-23. Estimated Flow for Little Bear Creek, Segment IA 02 IOW-0185_1 and observed *E. coli* at STORET Site 15790004, 15790005, & 15790006.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
7/5/2011	31.1	1,333	10/28/2013	2.0	525
7/19/2011	17.7	2,567	4/15/2014	73.5	1,295
8/9/2011	8.6	807	4/29/2014	68.6	4,750
9/2/2011	2.9	1,613	5/20/2014	17.7	265
9/13/2011	3.6	490	6/3/2014	10.3	595
9/17/2012	0.0	1,220	6/23/2014	279.6	4,050
9/25/2012	0.0	1,433	7/7/2014	155.1	1,850
10/8/2012	1.2	770	8/13/2014	23.2	450
10/22/2012	2.8	4,733	9/2/2014	52.6	4,600
11/5/2012	1.4	1,570	10/7/2014	19.0	310
5/7/2013	122.4	400	10/15/2014	188.9	2750
6/4/2013	127.0	655			
6/24/2013	111.2	24,000	Min=	0.0	265
7/30/2013	10.0	1,560	1st Quartile=	2.8	610
8/12/2013	5.4	760	Median=	10.2	1,314
8/27/2013	3.4	1,580	3rd Quartile=	64.6	2,240
9/9/2013	2.8	2,370	Max=	279.6	24,000
9/25/2013	2.9	655	Mean(2)=	44.9	1,265
10/14/2013	1.9	435	Std Dev=	67.5	4,234

(1) *E. coli* data is an average of the 3 sampling sites collected on this segment.
(2) For *E. coli* this is a Geomean.

Table D-24. Estimated Flow for Little Bear Creek, Segment IA 02 IOW-0185_2 and observed *E. coli* at STORET Site 15790002, 15790003, & 15790007.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
7/5/2011	19.1	1,550	10/28/2013	1.2	3,060
7/19/2011	10.8	3,425	4/15/2014	45.1	870
8/9/2011	5.3	1,130	4/29/2014	42.1	4,200
9/2/2011	1.8	945	5/20/2014	10.8	1,676
9/13/2011	2.2	543	6/3/2014	6.3	710
9/17/2012	0.0	2,776	6/23/2014	171.5	2,100
9/25/2012	0.0	248	7/7/2014	95.2	1,475
10/8/2012	0.8	2,622	8/13/2014	14.3	870
10/22/2012	1.7	8,300	9/2/2014	32.2	1,850
11/5/2012	0.9	373	10/7/2014	11.7	114
5/7/2013	75.1	340	10/15/2014	115.9	1,550
6/4/2013	77.9	530			
6/24/2013	68.3	51,500	Min=	0.0	114
7/30/2013	6.2	1,150	1st Quartile=	1.7	453
8/12/2013	3.3	490	Median=	6.3	1,038
8/27/2013	2.1	296	3rd Quartile=	39.6	2,038
9/9/2013	1.7	200	Max=	171.5	51,500
9/25/2013	1.8	440	Mean(2)=	27.6	1,077
10/14/2013	1.2	340	Std Dev=	41.4	9,118

(1) *E. coli* data is an average of the 3 sampling sites collected on this segment.
(2) For *E. coli* this is a Geomean.

Table D-25. Estimated Flow for Little Bear Creek, Segment IA 02 IOW-0500_0 and observed *E. coli* at STORET Site 15790001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
7/5/2011	4.6	710	4/29/2014	10.2	3,300
7/19/2011	2.6	2,600	5/20/2014	2.6	280
8/9/2011	1.3	1,300	6/3/2014	1.5	150
9/2/2011	0.4	1,100	6/23/2014	41.6	7,300
9/13/2011	0.5	1,100	7/7/2014	23.1	800
9/17/2012	0.0	10,000	8/13/2014	3.5	830
10/22/2012	0.4	14,000	9/2/2014	7.8	470
5/7/2013	18.2	2,700	10/7/2014	2.8	97
6/4/2013	18.9	420	10/15/2014	28.1	10,000
6/24/2013	16.5	35,000			
7/30/2013	1.5	20,000			
8/12/2013	0.8	33,000	Min=	0.0	97
8/27/2013	0.5	820	1st Quartile=	0.5	535
9/9/2013	0.4	600	Median=	2.6	1,100
9/25/2013	0.4	98	3rd Quartile=	10.6	5,300
10/14/2013	0.3	1,100	Max=	41.6	35,000
10/28/2013	0.3	1,300	Mean(1)=	7.4	1,487
4/15/2014	10.9	200	Std Dev=	10.3	9,376

(1) For *E. coli* this is a Geomean.

Table D-26. Estimated Flow for Walnut Creek, Segment IA 02 IOW-0187_2 and observed *E. coli* at STORET Sites 11790008, 11790009, & 13790002.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/20/2009	23.3	<10(3)	3/22/2010	59.7	14(3)
5/4/2009	61.4	60	4/6/2010	85.7	12,733
5/5/2009	55.9	200	4/20/2010	45.2	59
5/18/2009	78.2	210	5/11/2010	99.5	17,333
6/1/2009	67.9	1,600	5/18/2010	90.5	127
6/9/2009	65.7	265	6/9/2010	41.8	1,270
6/16/2009	71.2	3,500	6/22/2010	92.6	517
7/7/2009	141.6	> 24000(2)	7/8/2010	178.0	4,303
7/8/2009	112.1	> 24000(2)	7/20/2010	69.0	663
7/9/2009	71.7	3,400	8/6/2010	46.9	703
7/10/2009	147.7	57,000	8/19/2010	59.7	400
7/11/2009	92.6	4,900	9/10/2010	27.4	510
7/13/2009	60.3	1,030	9/22/2010	49.2	3,967
7/20/2009	35.0	450	10/8/2010	23.3	703
7/27/2009	27.4	1,005	11/4/2010	14.8	257
8/3/2009	22.1	823	4/21/2011	49.2	460
8/11/2009	26.2	5,650	5/5/2011	48.1	307
8/17/2009	39.6	56,000	5/19/2011	52.0	253
8/20/2009	58.1	59,000	6/10/2011	304.4	28,000
8/21/2009	35.0	8,200	6/22/2011	45.8	740
8/25/2009	21.5	1,140	7/7/2011	23.9	1,067
8/27/2009	871.1	50,000	7/19/2011	17.9	1,180
8/28/2009	244.4	8,200	8/3/2011	10.4	1,600
9/1/2009	63.0	447	9/2/2011	4.3	707
9/9/2009	28.6	10,650	9/16/2011	2.6	1,180
9/15/2009	22.1	287			
9/21/2009	21.5	940	Min =	2.6	5
10/7/2009	60.8	843	1st Quartile =	27.7	351
10/13/2009	40.1	320	Median =	54.0	892
10/20/2009	33.8	153	3rd Quartile =	74.2	4,751
10/23/2009	240.4	43,000	Max =	871.1	59,000
10/28/2009	75.0	335	Mean(4) =	79.5	1,258
11/10/2009	56.4	510	Std Dev =	119.6	15,284

(1) E. coli data is an average of the 3 sampling sites collected on this segment.
(2) Individual sampling points had E.coli values greater than the quantification value of 24,000 orgs/100 mL. In these cases 24,000 orgs/100 mL was used for calculation purposes.
(3) Individual sampling points had E. coli values below the detection limit of 10 orgs/100 mL. In these cases 5 orgs/100 mL was used for calculation purposes.
(4) For E. coli this is a Geomean.

Table D-27. Estimated Flow for Walnut Creek, Segment IA 02 IOW-0188_0 and observed *E. coli* at STORET Sites 11790010, 13790006, & 13790007.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/20/2009	9.6	<63(3)	6/22/2010	38.3	550
5/4/2009	25.4	95	7/8/2010	73.7	560
5/18/2009	32.4	135	7/20/2010	28.6	575
6/1/2009	28.1	990	8/6/2010	19.4	385
6/16/2009	29.5	732	8/19/2010	24.7	330
7/13/2009	24.9	750	9/10/2010	11.4	185
7/20/2009	14.5	945	9/22/2010	20.4	1,750
7/27/2009	11.4	480	10/8/2010	9.6	165
8/3/2009	9.1	2,600	11/4/2010	6.1	177
8/11/2009	10.9	2,100	4/21/2011	20.4	300
8/17/2009	16.4	22,000	5/5/2011	19.9	151
8/25/2009	8.9	360	5/19/2011	21.5	210
9/1/2009	26.1	375	6/10/2011	126.0	15,250
9/9/2009	11.8	620	6/22/2011	19.0	465
9/15/2009	9.1	295	7/7/2011	9.9	735
9/21/2009	8.9	1,400	7/19/2011	7.4	1,400
10/7/2009	25.2	560	8/3/2011	4.3	3,600
10/13/2009	16.6	170	9/2/2011	1.8	205
10/20/2009	14.0	96	9/16/2011	1.1	750
10/28/2009	31.0	310			
11/10/2009	23.3	180	Min =	1.1	5
3/22/2010	24.7	42	1st Quartile =	10.2	181
4/6/2010	35.5	>13650(2)	Median =	19.2	473
4/20/2010	18.7	91	3rd Quartile =	25.9	896
5/11/2010	41.2	3,850	Max =	126.0	24,000
5/18/2010	37.5	69	Mean(4) =	22.3	485
6/9/2010	17.3	525	Std Dev =	20.0	5,030

(1) E. coli data is an average of the 3 sampling sites collected on this segment.
(2) Individual sampling points had E. coli values greater than the quantification value of 24,000 orgs/100 mL. In these cases 24,000 orgs/100 mL was used for calculation purposes.
(3) Individual sampling points had E. coli values below the detection limit of 10 orgs/100 mL. In these cases 5 orgs/100 mL was used for calculation purposes.
(4) For E. coli this is a Geomean.

Table D-28. Estimated Flow for Unnamed Tributary to Walnut Creek, Segment IA 02 IOW-0189_0 and observed *E. coli* at STORET Sites 11790012.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/20/2009	2.7	10	11/4/2010	1.7	360
5/4/2009	7.2	60	4/21/2011	5.8	110
5/18/2009	9.2	30	5/5/2011	5.7	200
6/16/2009	8.4	320	5/19/2011	6.1	500
7/20/2009	4.1	790	6/10/2011	35.9	1,400
8/3/2009	2.6	1,800	6/22/2011	5.4	500
9/1/2009	7.4	350	7/7/2011	2.8	1,000
9/15/2009	2.6	560	7/19/2011	2.1	4,100
10/7/2009	7.2	97	8/3/2011	1.2	1,400
10/20/2009	4.0	300	9/2/2011	0.5	2,800
4/6/2010	10.1	1,700	9/16/2011	0.3	1,400
4/20/2010	5.3	110			
5/11/2010	11.7	250			
5/18/2010	10.7	41	Min =	0.3	10
6/9/2010	4.9	430	1st Quartile =	2.7	225
7/20/2010	8.1	500	Median =	5.4	380
8/6/2010	5.5	380	3rd Quartile =	7.3	895
8/19/2010	7.0	410	Max =	35.9	4,100
9/10/2010	3.2	320	Mean(1) =	6.2	363
10/8/2010	2.7	380	Std Dev =	6.2	883

(1) For E. coli this is a Geomean.

Table D-29. Estimated Flow for Unnamed Tributary to Walnut Creek, Segment IA 02 IOW-0191_0 and observed *E. coli* at STORET Sites 13790003.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/20/2009	1.9	Not Detected(1)	9/10/2010	2.2	300
5/4/2009	4.9	10	9/22/2010	3.9	640
5/18/2009	6.3	40	10/8/2010	1.9	350
6/1/2009	5.4	200	11/4/2010	1.2	210
6/16/2009	5.7	530	4/21/2011	3.9	20
7/20/2009	2.8	700	5/5/2011	3.8	390
8/3/2009	1.8	1,700	5/19/2011	4.2	130
8/17/2009	3.2	13,000	6/10/2011	24.4	24,000
9/1/2009	5.0	210	6/22/2011	3.7	560
9/15/2009	1.8	240	7/7/2011	1.9	1,100
10/7/2009	4.9	130	7/19/2011	1.4	1,700
10/20/2009	2.7	160	8/3/2011	0.8	2,700
3/22/2010	4.8	Not Detected(1)	9/2/2011	0.3	1,300
4/6/2010	6.9	4,900	9/16/2011	0.2	500
4/20/2010	3.6	74			
5/11/2010	8.0	160			
5/18/2010	7.2	30	Min =	0.2	5
6/9/2010	3.3	450	1st Quartile =	1.9	160
6/22/2010	7.4	480	Median =	3.8	350
7/8/2010	14.2	350	3rd Quartile =	5.4	640
7/20/2010	5.5	360	Max =	24.4	24,000
8/6/2010	3.8	340	Mean(2) =	4.6	305
8/19/2010	4.8	470	Std Dev =	4.2	4,337

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-30. Estimated Flow for Unnamed Tributary to Walnut Creek, Segment IA 02 IOW-0510_0 and observed *E. coli* at STORET Sites 13790001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/20/2009	0.8	Not Detected(1)	8/19/2010	2.1	97
5/5/2009	2.0	160	9/10/2010	1.0	200
5/18/2009	2.7	70	9/22/2010	1.7	420
6/9/2009	2.3	250	10/8/2010	0.8	130
6/16/2009	2.5	20	11/4/2010	0.5	1,400
7/20/2009	1.2	510	4/21/2011	1.7	Not Detected(1)
8/3/2009	0.8	680	5/5/2011	1.7	Not Detected(1)
8/17/2009	1.4	200	5/19/2011	1.8	Not Detected(1)
9/1/2009	2.2	Not Detected(1)	6/10/2011	10.7	52
9/15/2009	0.8	120	6/22/2011	1.6	10
10/7/2009	2.1	31	7/7/2011	0.8	5,200
10/20/2009	1.2	63	7/19/2011	0.6	180
3/22/2010	2.1	10	8/3/2011	0.4	3400
4/6/2010	3.0	Not Detected(1)			
4/20/2010	1.6	20			
5/11/2010	3.5	Not Detected(1)	Min=	0.4	5
5/18/2010	3.2	Not Detected(1)	1st Quartile=	1.2	9
6/9/2010	1.5	31	Median=	1.7	67
6/22/2010	3.3	150	3rd Quartile=	2.4	213
7/8/2010	6.3	Not Detected(1)	Max=	10.7	5,200
7/20/2010	2.4	300	Mean(2)=	2.2	62
8/6/2010	1.6	52	Std Dev=	1.9	1,005

(1) E. coli was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-31. Estimated Flow for Bennett Creek, Segment IA 02 IOW-0213_0 and observed *E. coli* at USGS WQ Data Sites 05451773.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/25/2006	6.6	270	5/22/2013	18.1	5,500
6/7/2006	5.0	760	6/26/2013	24.3	3,100
7/11/2006	8.4	6,000	7/24/2013	3.0	1,900
8/9/2006	2.3	33,000	8/20/2013	0.2	480
8/14/2006	2.0	5,000			
9/19/2006	1.7	1,400	Min=	0.2	260
4/20/2011	16.7	900	1st Quartile=	2.2	578
5/24/2011	20.5	260	Median=	5.8	1,150
6/28/2011	8.1	610	3rd Quartile=	11.8	3,575
8/2/2011	3.2	2,400	Max=	24.3	33,000
9/6/2011	0.2	730	Mean(1)=	8.2	1,449
4/23/2013	10.2	340	Std Dev=	7.5	7,741

(1) For *E. coli* this is a Geomean.

Table D-32. Estimated Flow for Raven Creek, Segment IA 02 IOW-0215_0 and observed *E. coli* at USGS WQ Data Sites 05451762.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/25/2006	22.1	1,100	5/22/2013	49.6	340
6/7/2006	19.7	1,500	6/26/2013	68.2	1300
7/11/2006	9.2	12,000	7/24/2013	12.6	1900
8/9/2006	5.9	23,000	8/20/2013	3.1	780
8/14/2006	7.7	16,000			
9/19/2006	5.2	1,300	Min=	2.9	240
4/19/2011	28.3	5,500	1st Quartile=	7.3	720
5/25/2011	339.4	4,000	Median=	16.2	1,300
6/29/2011	30.7	370	3rd Quartile=	31.2	4,375
8/3/2011	7.9	800	Max=	339.4	23,000
9/7/2011	2.9	540	Mean(1)=	40.3	1,708
4/23/2013	32.5	240	Std Dev=	79.2	6,497

(1) For *E. coli* this is a Geomean.

Table D-33. Estimated Flow for Deer Creek, Segment IA 02 IOW-0225_0 and observed *E. coli* at STORET Site 13860001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/2/2008	42.0	230	9/28/2009	7.6	1,100
6/16/2008	41.0	140	4/1/2010	4.6	31
6/30/2008	14.1	460	4/20/2010	4.1	10
7/14/2008	7.7	170	4/25/2010	27.0	860
7/28/2008	19.5	320	5/4/2010	10.2	20
8/11/2008	6.0	230	5/11/2010	16.8	430
8/26/2008	4.0	670	5/12/2010	33.8	2,600
9/22/2008	2.6	80	5/13/2010	186.2	1,700
10/6/2008	2.3	240	5/19/2010	20.1	Not Detected(1)
4/14/2009	5.7	10	6/3/2010	10.3	220
4/28/2009	62.7	30	6/13/2010	49.1	2,800
5/12/2009	11.6	Not Detected(1)	6/22/2010	18.3	240
5/27/2009	17.0	840	6/27/2010	33.4	3,900
6/7/2009	8.6	9,200	7/6/2010	21.7	770
6/8/2009	39.4	890	7/19/2010	7.1	220
6/9/2009	17.5	86	8/5/2010	12.1	520
6/13/2009	12.8	350	8/24/2010	5.0	410
6/18/2009	24.0	4,400	9/9/2010	4.1	500
6/23/2009	17.5	110	9/29/2010	13.8	160
7/6/2009	8.9	160			
7/10/2009	12.0	2,800			
7/20/2009	6.5	400	Min=	2.3	5
8/3/2009	4.4	610	1st Quartile=	5.9	160
8/17/2009	3.2	480	Median=	12.1	400
8/20/2009	5.0	5,800	3rd Quartile=	22.9	875
8/27/2009	30.3	2,400	Max=	186.2	130,000
9/1/2009	5.2	210	Mean(2)=	20.3	354
9/25/2009	36.7	130,000	Std Dev=	28.1	18,690

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.

(2) For *E. coli* this is a Geomean.

Table D-34. Estimated Flow for East Tributary to Union Grove Lake, Segment IA 02 IOW-0226_0 and observed *E. coli* at STORET Site 13860002.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/16/2008	10.9	190	4/1/2010	2.0	63
6/30/2008	3.4	170	4/20/2010	2.6	Not Detected(1)
7/14/2008	3.4	160	5/4/2010	2.9	52
7/28/2008	3.0	50	5/19/2010	4.2	41
8/11/2008	1.9	510	6/3/2010	3.1	990
8/26/2008	1.2	30	6/22/2010	5.5	20
9/22/2008	1.2	160	7/6/2010	12.9	650
10/6/2008	0.8	30	7/19/2010	3.3	10,000
4/14/2009	1.0	10	8/5/2010	3.1	160
4/28/2009	13.5	10	8/24/2010	2.3	75
5/12/2009	2.1	Not Detected(1)	9/9/2010	1.3	31
5/27/2009	4.2	170	9/29/2010	2.2	170
6/9/2009	2.3	470			
6/23/2009	3.9	52	Min=	0.8	5
7/6/2009	1.8	140	1st Quartile=	1.9	39
7/20/2009	1.4	230	Median=	2.8	160
8/3/2009	0.9	450	3rd Quartile=	3.5	280
8/17/2009	3.2	1,300	Max=	13.5	10,000
9/1/2009	4.4	430	Mean(2)=	3.5	112
9/28/2009	2.7	190	Std Dev=	3.1	1,725

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(2) For *E. coli* this is a Geomean.

Appendix E. Upper Iowa HUC 8 Watershed – 07080207

Appendix E.1. Wasteload Allocation by Stream Segment for the Upper Iowa Watershed

This appendix provides the wasteload allocation (WLA) for each facility based on the stream segment that it discharges to. Below is a summary of the Facility Types in the Watershed.

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- CAFO – Concentrated Animal Feeding Operation.
- GP #4 – Private Facility operating under an NPDES General Permit #4
- RBC – Rotation Biological Contactor
- ST/SF – Septic Tank Sand Filter
- SW – Stormwater
- TF – Trickling Filter
- UNSWD – Unsewered Community
- WSL – Waste Stabilization Lagoon (Controlled Discharge Lagoon, CDL)

Wastewater Treatment Facility (WWTF)
WWTF can be grouped two types of discharging facilities, continuous and intermittent. All of the WWTF listed in this WQIP are continuous discharging facilities with the exception of Waste Stabilization Lagoons which are intermittent discharging facilities.

The design flow for WWTF is the NPDES permitted average wet weather (AWW) flow. For a continuous discharging facility this is the 30-day AWW flow and the 180-day AWW flow for intermittent discharging facilities.

The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.

Intermittent discharging facilities operate as a hold and discharge facility with a minimum holding time of 180-days. These facilities typically discharge twice per year for short periods of time in the spring and in the fall when stream flows are at the highest. These facilities are permitted to discharge at a rate that is ten times the 180-day AWW flow. WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Unsewered (UNSWD)
WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day. Populations for unsewered communities was obtained or estimated from the 2010 US Census (U.S. Census Bureau, 2010). The per capita flow rate of 100 gallons per capita-day is required for facility planning of new WWTP by the Iowa Wastewater Facilities Design Standards.

Concentrated Animal Feeding Operations (CAFOs)
Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

General Permit No. 4 (GP#4)
Facilities operating under a GP #4 are private systems that only treat domestic waste from commercial and residential properties and serve an equivalent population of less than 16 people. These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Stormwater (SW)
NPDES permits for MS4 communities do not include numeric limits for E. Coli. However, they do include storm water pollution prevention and management provisions that include the implementation of Best Management Practices (BMP) to reduce pollutants in the discharge.

The WLA for MS4 communities in this WQIP are based on the ratio of the area of the MS4 community to the drainage area attributed to the impaired segment that the community discharges to times the TMDL attributed to the drainage area of that impaired segment.

Table E-1. WLA for Iowa River, Segment IA 02-IOW-0070_3

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Iowa Dot Rest Area I35 Dows (Ciwa)	WSL	3500904	0077321	1.10E+04	126	5.25E+08
Southpark Estates	AS	4200601	0067679	3.00E+04	126	1.43E+08
Eldora, City of STP	AS/SBR	4236001	0025933	1.52E+06	126	7.23E+09
Iowa Falls, City of STP	TF	4260001	0023442	2.63E+06	126	1.25E+10
Steamboat Rock, City of STP	AS	4289001	0033324	4.90E+04	126	2.34E+08
Dows, City of STP	AL	9921001	0042811	2.67E+05	126	1.27E+09
Galt	UNSWD	--	--	3.20E+03	126	1.53E+07
Popejoy	UNSWD	--	--	7.80E+03	126	3.72E+07
The Pines	UNSWD	--	--	4.60E+03	126	2.19E+07
Burdette Site	CAFO	57742	--	0.0	126	0.0
Rommel Finishers	CAFO	57743	--	0.0	126	0.0
Popejoy Site	CAFO	57747	--	0.0	126	0.0
Thomas Dunning	CAFO	57777	--	0.0	126	0.0
Peterson Pork	CAFO	58074	--	0.0	126	0.0
County Line Finishers	CAFO	58096	--	0.0	126	0.0
Barhite Finisher	CAFO	58102	--	0.0	126	0.0
Tremark Pork	CAFO	58152	--	0.0	126	0.0
Mcnickle Finisher Farm	CAFO	58224	--	0.0	126	0.0
Rankin Brothers	CAFO	58237	--	0.0	126	0.0
F023	CAFO	58322	--	0.0	126	0.0
Kyle Janes - Home Site	CAFO	58702	--	0.0	126	0.0
Ham And Eggs, L.l.c.	CAFO	58822	--	0.0	126	0.0
Cross Farms Finisher	CAFO	58979	--	0.0	126	0.0
Meints Finishing Farm	CAFO	59022	--	0.0	126	0.0
Jordahl Site 2	CAFO	59275	--	0.0	126	0.0
Matrix Farms Inc 1	CAFO	59445	--	0.0	126	0.0
Luiken	CAFO	59615	--	0.0	126	0.0
Bittner Site	CAFO	59658	--	0.0	126	0.0
Lloyd Site	CAFO	59660	--	0.0	126	0.0
Lindell Janes	CAFO	59715	--	0.0	126	0.0
Decoster Farms - Sow 15	CAFO	60000	--	0.0	126	0.0

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Decoster Farms - Sow 16	CAFO	60001	--	0.0	126	0.0
Decoster Farms - Sow 17	CAFO	60002	--	0.0	126	0.0
Iowa Select - Wright Sow Farm	CAFO	60155	--	0.0	126	0.0
Decoster Farms - Sow 2	CAFO	60512	--	0.0	126	0.0
Decoster Farms - Sow 5	CAFO	60515	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 203	CAFO	60543	--	0.0	126	0.0
Kd Feeders Llc	CAFO	60645	--	0.0	126	0.0
Decoster Farms - Nursery 4	CAFO	60680	--	0.0	126	0.0
Decoster Farms - Nursery 1	CAFO	60681	--	0.0	126	0.0
Decoster Farms - Nursery 8	CAFO	60686	--	0.0	126	0.0
Decoster Farms - Nursery 3	CAFO	60688	--	0.0	126	0.0
Decoster Farms - Sow 14	CAFO	60693	--	0.0	126	0.0
Decoster Farms - Sow 6	CAFO	60700	--	0.0	126	0.0
Rehm Site	CAFO	60772	--	0.0	126	0.0
Iowa Select - Aldinger Finishing Site	CAFO	60853	--	0.0	126	0.0
Iowa Select - Gast Finisher	CAFO	60868	--	0.0	126	0.0
Iowa Select - Stockdale Sow	CAFO	60897	--	0.0	126	0.0
Iowa Select - Swartz Finishing Site	CAFO	60898	--	0.0	126	0.0
Centrum Valley Farms, Llp	CAFO	61185	--	0.0	126	0.0
Rv Pork	CAFO	61405	--	0.0	126	0.0
Oakland Site	CAFO	61420	--	0.0	126	0.0
Kevin Finisher Farm	CAFO	61600	--	0.0	126	0.0
Cardinal Site	CAFO	62285	--	0.0	126	0.0
Centrum Valley East Layer	CAFO	62586	--	0.0	126	0.0
Centrum Valley Farms North Layer	CAFO	62588	--	0.0	126	0.0
Balvanz East Finisher Farm	CAFO	63007	--	0.0	126	0.0
Jag Site 1 & 2	CAFO	63089	--	0.0	126	0.0
Jordahl Site 5	CAFO	63162	--	0.0	126	0.0
Lyon Site 1	CAFO	63580	--	0.0	126	0.0
Lyon Site 2	CAFO	63711	--	0.0	126	0.0
Thomas Site 1	CAFO	63934	--	0.0	126	0.0
Franklin Morgan Site	CAFO	64261	--	0.0	126	0.0
Rollene Finisher Farm	CAFO	64688	--	0.0	126	0.0
Oakland Finisher Farm	CAFO	64844	--	0.0	126	0.0
Goldie's Site	CAFO	65271	--	0.0	126	0.0
Darren Holtkamp	CAFO	65289	--	0.0	126	0.0
Iso Pork Finisher Farm	CAFO	65446	--	0.0	126	0.0
Jordahl Site 10	CAFO	65774	--	0.0	126	0.0
Aunt May's Site	CAFO	65989	--	0.0	126	0.0

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Owasa Finisher Farm	CAFO	66906	--	0.0	126	0.0
Centrum Valley Farms South Layer	CAFO	66939	--	0.0	126	0.0
Schager Finisher Farm	CAFO	67004	--	0.0	126	0.0
Oakland 10	CAFO	67910	--	0.0	126	0.0
Frye Pork Resort Lc	CAFO	68883	--	0.0	126	0.0
1 Permitted Facility	GP #4	--	--	--	126	--
Totals				**--**		**2.20E+10**

Table E-2. WLA for Iowa River, Segment IA 02-IOW-0080_2

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Duncan Heights Care Facility	WSL	4100901	0065901	5.50E+03	126	2.62E+08
Crystal Lake, City of STP	WSL	4115001	0062367	3.30E+04	126	1.57E+09
Belmond, City of STP	RBC	9905001	0041777	7.76E+05	126	3.70E+09
Alexander	UNSWD	--	--	1.72E+04	126	8.20E+07
Duncan	UNSWD	--	--	1.31E+04	126	6.25E+07
Elm Lake	UNSWD	--	--	6.40E+03	126	3.05E+07
Hayfield	UNSWD	--	--	4.30E+03	126	2.05E+07
Rowan	UNSWD	--	--	1.54E+04	126	7.34E+07
Tyrrell Grove	UNSWD	--	--	7.50E+03	126	3.58E+07
Richard Formanek Sr. Nedved Site	CAFO	57767	--	0.0	126	0.0
Daren Mennenga	CAFO	57827	--	0.0	126	0.0
G.l. Pork Llc Vern Gordon	CAFO	58084	--	0.0	126	0.0
R Triple T Inc	CAFO	58169	--	0.0	126	0.0
Marton Gruis Finisher Farm	CAFO	58291	--	0.0	126	0.0
Schmidt Family Farms	CAFO	58574	--	0.0	126	0.0
F9	CAFO	58881	--	0.0	126	0.0
Swanson's Hillside Farm Inc.	CAFO	59456	--	0.0	126	0.0
Prestage Farms Of Iowa Llc P220	CAFO	60159	--	0.0	126	0.0
Prestage Farms Of Iowa Llc P219	CAFO	60161	--	0.0	126	0.0
Thompson Family Farms	CAFO	60669	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 221	CAFO	60866	--	0.0	126	0.0
Iowa Select - Palmetto Finishing Site	CAFO	60890	--	0.0	126	0.0
Diamond K Company	CAFO	61721	--	0.0	126	0.0
Formanek Farms - Huling	CAFO	62553	--	0.0	126	0.0
Richard Formanek Sr. Frazier Site	CAFO	62554	--	0.0	126	0.0
Wenzel Finisher Farm	CAFO	62974	--	0.0	126	0.0
Dcm Site	CAFO	63896	--	0.0	126	0.0
Garfield - Nash Site	CAFO	63982	--	0.0	126	0.0

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Crystal-maple Site	CAFO	63983	--	0.0	126	0.0
Crystal - Ladd Site	CAFO	63984	--	0.0	126	0.0
F088	CAFO	64329	--	0.0	126	0.0
F090	CAFO	64615	--	0.0	126	0.0
Trees Family Pork Llc	CAFO	64732	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 236	CAFO	64813	--	0.0	126	0.0
Amsterdam Finisher Farm	CAFO	65260	--	0.0	126	0.0
Wisner Finisher Farm	CAFO	65604	--	0.0	126	0.0
Quail Ridge	CAFO	65806	--	0.0	126	0.0
Mcneese Finisher Farm	CAFO	65959	--	0.0	126	0.0
Erin Finisher Farm	CAFO	65964	--	0.0	126	0.0
Oak Site	CAFO	65973	--	0.0	126	0.0
Frohling Site	CAFO	67145	--	0.0	126	0.0
Totals				**--**		**5.84E+09**

Table E-3. WLA for South Fork Iowa River, Segment IA 02-IOW-0270_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
New Providence Finisher	CAFO	58314	--	0.0	126	0.0
Reece Finisher	CAFO	59661	--	0.0	126	0.0
Mcdonald Finisher Farm	CAFO	63851	--	0.0	126	0.0
Buck Run	CAFO	64234	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-4. WLA for South Fork Iowa River, Segment IA 02-IOW-0280_3.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Buckeye	UNSWD	--	--	1.07E+04	126	5.10E+07
Max Pork	CAFO	58154	--	0.0	126	0.0
Staley Finishers	CAFO	58321	--	0.0	126	0.0
Buckeye Finisher	CAFO	58324	--	0.0	126	0.0
359 Pork	CAFO	61486	--	0.0	126	0.0
Mallard Bay Site	CAFO	63866	--	0.0	126	0.0
Robinson Site	CAFO	67088	--	0.0	126	0.0
Totals				**--**		**5.10E+07**

Table E-5. WLA for South Fork Iowa River, Segment IA 02-IOW-0280_4.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Williams, City of STP	WSL	4070001	0058483	1.10E+05	126	5.25E+09
Alden, City of STP	WSL	4213001	0034339	2.00E+05	126	9.54E+09
Hoversten Finisher	CAFO	57779	--	0.0	126	0.0
Gator Pork Finisher	CAFO	57786	--	0.0	126	0.0
Renaud 1 East Finisher	CAFO	57793	--	0.0	126	0.0
Dunn Finisher	CAFO	58316	--	0.0	126	0.0
F125	CAFO	58335	--	0.0	126	0.0
Alden - Centrum Valley Farms	CAFO	59162	--	0.0	126	0.0
Bartlett Finisher Farm	CAFO	59248	--	0.0	126	0.0
Sterling Finisher Farm	CAFO	59481	--	0.0	126	0.0
Prestage Farms Of Iowa Llc P201	CAFO	60516	--	0.0	126	0.0
Windmill	CAFO	61518	--	0.0	126	0.0
Todd Janes Finisher	CAFO	61645	--	0.0	126	0.0
Ldh	CAFO	61756	--	0.0	126	0.0
Renaud Finisher Farm	CAFO	62113	--	0.0	126	0.0
F085	CAFO	64258	--	0.0	126	0.0
Burton Finisher Farm	CAFO	64301	--	0.0	126	0.0
Boothill Cattle	CAFO	64885	--	0.0	126	0.0
Totals				**--**		**1.48E+10**

Table E-6. WLA for South Fork Iowa River, Segment IA 02-IOW-0280_5.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Kyle Janes - Harms Site	CAFO	57783	--	0.0	126	0.0
Janet Finisher Farm	CAFO	59484	--	0.0	126	0.0
Peter Decoster Nursery 15	CAFO	59796	--	0.0	126	0.0
Robert Schager	CAFO	61144	--	0.0	126	0.0
Transformer	CAFO	61421	--	0.0	126	0.0
Red Barn Site	CAFO	61423	--	0.0	126	0.0
Alden Finisher	CAFO	61424	--	0.0	126	0.0
Young Finisher	CAFO	61425	--	0.0	126	0.0
Hubbell	CAFO	61426	--	0.0	126	0.0
120th Site	CAFO	61479	--	0.0	126	0.0
C Ave Site	CAFO	61480	--	0.0	126	0.0
Hardin Site	CAFO	61516	--	0.0	126	0.0
Lawrence W Eide	CAFO	61786	--	0.0	126	0.0
Brian Lauterbach	CAFO	62254	--	0.0	126	0.0
F112	CAFO	64526	--	0.0	126	0.0
Elk Site	CAFO	64625	--	0.0	126	0.0
Ten Pork	CAFO	64629	--	0.0	126	0.0
Young Avenue Pork	CAFO	64756	--	0.0	126	0.0
Kyle Janes -110th Street Site	CAFO	65952	--	0.0	126	0.0
Wilke Beef	CAFO	66541	--	0.0	126	0.0
County Line Cattle	CAFO	66728	--	0.0	126	0.0
Totals				**0.00E+00**		**0.00E+00**

Table E-7. WLA for South Fork Iowa River, Segment IA 02-IOW-0282_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Keith Schwandt	CAFO	58797	--	0.0	126	0.0
Ron & Deb Kohl	CAFO	59222	--	0.0	126	0.0
Jerry Finisher	CAFO	59475	--	0.0	126	0.0
Rockow Finisher	CAFO	59504	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 203	CAFO	60546	--	0.0	126	0.0
Decoster Farms - Sow 10	CAFO	60689	--	0.0	126	0.0
Iowa Select - Tipton Finisher	CAFO	60902	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 294	CAFO	65661	--	0.0	126	0.0
Blairsburg 1	CAFO	67738	--	0.0	126	0.0
Totals				**0.00E+00**		**0.00E+00**

Table E-8. WLA for Beaver Creek, Segment IA 02-IOW-0290_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Marett Feeder	CAFO	58117	--	0.0	126	0.0
Teske Site	CAFO	59566	--	0.0	126	0.0
Teske Pork	CAFO	63286	--	0.0	126	0.0
Totals				**0.00E+00**		**0.00E+00**

Table E-9. WLA for Beaver Creek, Segment IA 02-IOW-0295_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Owasa	UNSWD	--	--	4.30E+03	126	2.05E+07
Iowa Select - Kulow Ii Finisher	CAFO	57780	--	0.0	126	0.0
Iowa Select - Kulow 1 Finisher	CAFO	57781	--	0.0	126	0.0
Iowa Select - Kulow 3 Finisher	CAFO	57782	--	0.0	126	0.0
F095	CAFO	64322	--	0.0	126	0.0
F096	CAFO	64377	--	0.0	126	0.0
Totals				**--**		**2.05E+07**

Table E-10. WLA for South Beaver Creek, Segment IA 02-IOW-0297_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
F103	CAFO	57774	--	0.0	126	0.0
Emil Central Finisher	CAFO	58325	--	0.0	126	0.0
F104	CAFO	58329	--	0.0	126	0.0
Tessendorf	CAFO	58336	--	0.0	126	0.0
Magnum Site	CAFO	59309	--	0.0	126	0.0
F109	CAFO	61105	--	0.0	126	0.0
F102	CAFO	62181	--	0.0	126	0.0
Summit Farms - Johnson Site	CAFO	63778	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-11. WLA for Tipton Creek, Segment IA 02-IOW-0300_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Axtell Finisher	CAFO	57775	--	0.0	126	0.0
Gaal Llc 2	CAFO	57776	--	0.0	126	0.0
Lake Farm	CAFO	57791	--	0.0	126	0.0
Research Farm	CAFO	58099	--	0.0	126	0.0
Southland Pork Finishers	CAFO	58129	--	0.0	126	0.0
Hagge Grow Finish Unit	CAFO	58345	--	0.0	126	0.0
Dennis Winter Finisher Farm	CAFO	58971	--	0.0	126	0.0
Iowa Select - Hornung Nursery Site	CAFO	60871	--	0.0	126	0.0
Iowa Select - Winter Finisher	CAFO	60872	--	0.0	126	0.0
Jeske Finisher Farm	CAFO	62112	--	0.0	126	0.0
J Avenue	CAFO	63981	--	0.0	126	0.0
North Tipton Ridge	CAFO	65214	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-12. WLA for Tipton Creek, Segment IA 02-IOW-0300_2

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Hamco West	CAFO	57759	--	0.0	126	0.0
Hamco East	CAFO	57762	--	0.0	126	0.0
Vierkandt	CAFO	57796	--	0.0	126	0.0
Krause Stock Farm	CAFO	58272	--	0.0	126	0.0
F086	CAFO	58323	--	0.0	126	0.0
F101	CAFO	58326	--	0.0	126	0.0
Prism Hamilton Finisher Farm	CAFO	58395	--	0.0	126	0.0
J & J Stock Farm	CAFO	58482	--	0.0	126	0.0
R-site	CAFO	58603	--	0.0	126	0.0
Henke Farm Lp	CAFO	58604	--	0.0	126	0.0
Madden Farms Inc.	CAFO	58916	--	0.0	126	0.0
Vierkandt Finisher Farm	CAFO	59247	--	0.0	126	0.0
Renaud 3 South Finisher	CAFO	59307	--	0.0	126	0.0
C-site Finishers	CAFO	59466	--	0.0	126	0.0
Don Williams #1	CAFO	59937	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 208	CAFO	59993	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 206	CAFO	60180	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 207	CAFO	60181	--	0.0	126	0.0
Merlyn Hegland - Farm A	CAFO	60606	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 205	CAFO	60676	--	0.0	126	0.0
Iowa Select - Kielsmeier Sow Site	CAFO	60878	--	0.0	126	0.0
Mike (marlene) Williams	CAFO	61272	--	0.0	126	0.0
J-site Finishers	CAFO	61457	--	0.0	126	0.0
Travis Twedt	CAFO	61580	--	0.0	126	0.0
Runge Finisher Farm	CAFO	61704	--	0.0	126	0.0
Merlyn Hegland - Farm B	CAFO	61746	--	0.0	126	0.0
Prestage Farms Of Iowa Pi 222	CAFO	64282	--	0.0	126	0.0
Rose Grove	CAFO	64585	--	0.0	126	0.0
240th Street Finisher	CAFO	65717	--	0.0	126	0.0
Buckeye 27	CAFO	67918	--	0.0	126	0.0
Buckeye 21	CAFO	67934	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-13. WLA for Unnamed Tributary to Tipton Creek, Segment IA 02-IOW-0302_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Doolittle Finisher	CAFO	59745	--	0.0	126	0.0
Don Williams #2	CAFO	59938	--	0.0	126	0.0
Lynn Elm	CAFO	60924	--	0.0	126	0.0
Merlyn Hegland - Farm C	CAFO	61124	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-14. WLA for East Branch Iowa River, Segment IA 02-IOW-0380_1.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Goodell	WSL	4135001	PENDING	1.74E+04	126	8.30E+08
Sparboe Farms (goodell)	CAFO	61195	--	0.0	126	0.0
Midwest Pork P-2	CAFO	63425	--	0.0	126	0.0
Sunray Pork Site 2	CAFO	65881	--	0.0	126	0.0
Schmidt Family Farms - Wean To Finish 2012	CAFO	67125	--	0.0	126	0.0
Totals				**--**		**8.30E+08**

Table E-15. WLA for East Branch Iowa River, Segment IA 02-IOW-0380_3.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Klemme, City of STP	AL	4155001	0038466	4.26E+05	126	2.03E+09
D & D Pork	CAFO	58724	--	0.0	126	0.0
Eagle Pork Iv	CAFO	59465	--	0.0	126	0.0
Rick Prohaska	CAFO	59618	--	0.0	126	0.0
B & J Pork	CAFO	61370	--	0.0	126	0.0
A & D Pork Llc	CAFO	61373	--	0.0	126	0.0
T & T Hogs Llc	CAFO	61578	--	0.0	126	0.0
Wellik Farms Lc	CAFO	61779	--	0.0	126	0.0
Tom Schmidt	CAFO	62743	--	0.0	126	0.0
Vail Site	CAFO	64527	--	0.0	126	0.0
A & D Pork Llc	CAFO	65341	--	0.0	126	0.0
Totals				**--**		**2.03E+09**

Table E-16. WLA for Drainage Ditch 13, Segment IA 02-IOW-0381_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Dsp Llc	CAFO	63812	--	0.0	126	0.0
Totals				**--**	**126**	**0.00E+00**

Table E-17. WLA for Drainage Ditch 81, Segment IA 02-IOW-0382_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Garner, City of STP	AS/SBR	4130002	--	8.73E+05	126	4.16E+09
Dornbier Hog Inc	CAFO	60723	--	0.0	126	0.0
Rustys Site	CAFO	61494	--	0.0	126	0.0
Totals				**--**		**4.16E+09**

Table E-18. WLA for Galls Creek, Segment IA 02-IOW-0390_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Bottlebrush Swine	CAFO	65839	--	0.0	126	0.0
Sunray Pork 3	CAFO	66172	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Table E-19. WLA for Unnamed Tributary to East Branch Iowa River, Segment IA 02-IOW-0395_0.

Facility Name	Facility Type	Iowa NPDES ID or AFO ID	EPA NPDES ID	Design Flow (gpd)	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Greiman Brothers	CAFO	56840	--	0.0	126	0.0
Totals				**--**		**0.00E+00**

Appendix E.2. WLA by Treatment Type for the Upper Iowa Watershed.

This appendix provides the WLA for each facility based on the Treatment Type. Treatment types include: Municipal and Semi-public (WWTF); CAFO; General Permit #4; Unsewered; and Stormwater;

Wastewater Treatment Facility (WWTF) includes the following facility types:

- AL – Aerated Lagoon
- AS – Activated Sludge
- AS/SBR- Activated Sludge/Sequencing Batch Reactor
- ST/SF – Septic Tank Sand Filter
- TF – Trickling Filter
- WSL – Waste Stabilization Lagoon

Table E-20. WLA for WWTF in the Upper Iowa Watershed

Facility Name	Facility Type	Iowa NPDES ID	EPA NPDES ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
Southpark Estates	AS	4200601	0067679	3.00E+04	IA 02-IOW-0070_3	126	1.43E+08
Steamboat Rock, City of STP	AS	4289001	0033324	4.90E+04	IA 02-IOW-0070_3	126	2.34E+08
Dows, City of STP	AL	9921001	0042811	2.67E+05	IA 02-IOW-0070_3	126	1.27E+09
Klemme, City of STP	AL	4155001	0038466	4.26E+05	IA 02-IOW-0380_3	126	2.03E+09
Belmond, City of STP	RBC	9905001	0041777	7.76E+05	IA 02-IOW-0080_2	126	3.70E+09
Eldora, City of STP	AS/SBR	4236001	0025933	1.52E+06	IA 02-IOW-0070_3	126	7.23E+09
Garner, City of STP	AS/SBR	4130002	0036153	8.73E+05	IA 02-IOW-0382_0	126	4.16E+09
Iowa Falls, City of STP	TF	4260001	0023442	2.63E+06	IA 02-IOW-0070_3	126	1.25E+10
Iowa Dot Rest Area I35 Dows (Ciwa) (2)	WSL	3500904	0077321	1.10E+04	IA 02-IOW-0070_3	126	5.25E+08
Duncan Heights Care Facility (2)	WSL	4100901	0065901	5.50E+03	IA 02-IOW-0080_2	126	2.62E+08
Crystal Lake, City of STP (2)	WSL	4115001	0062367	3.30E+04	IA 02-IOW-0080_2	126	1.57E+09
Williams, City of STP (2)	WSL	4070001	0058483	1.10E+05	IA 02-IOW-0280_4	126	5.25E+09
Alden, City of STP (2)	WSL	4213001	0034339	2.00E+05	IA 02-IOW-0280_4	126	9.54E+09
Goodell (2)	WSL	4135001	PENDING	1.74E+04	IA 02-IOW-0380_1	126	8.30E+08
Totals				--			**4.93E+10**

(1) The WLA for continuous discharging facilities is the product of the WQS concentration of 126 orgs/100 ml and the design flow.
(2) The WLA for intermittent discharging facilities is the WQS concentration multiplied by ten times the 180-day AWW flow.

Table E-21. WLA for CAFO in the Upper Iowa Watershed

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Burdette Site	CAFO	57742	IA 02-IOW-0070_3	0.0
Rommel Finishers	CAFO	57743	IA 02-IOW-0070_3	0.0
Popejoy Site	CAFO	57747	IA 02-IOW-0070_3	0.0
Thomas Dunning	CAFO	57777	IA 02-IOW-0070_3	0.0
Peterson Pork	CAFO	58074	IA 02-IOW-0070_3	0.0
County Line Finishers	CAFO	58096	IA 02-IOW-0070_3	0.0
Barhite Finisher	CAFO	58102	IA 02-IOW-0070_3	0.0
Tremark Pork	CAFO	58152	IA 02-IOW-0070_3	0.0
Mcnickle Finisher Farm	CAFO	58224	IA 02-IOW-0070_3	0.0
Rankin Brothers	CAFO	58237	IA 02-IOW-0070_3	0.0
F023	CAFO	58322	IA 02-IOW-0070_3	0.0
Kyle Janes - Home Site	CAFO	58702	IA 02-IOW-0070_3	0.0
Ham And Eggs, L.l.c.	CAFO	58822	IA 02-IOW-0070_3	0.0
Cross Farms Finisher	CAFO	58979	IA 02-IOW-0070_3	0.0
Meints Finishing Farm	CAFO	59022	IA 02-IOW-0070_3	0.0
Jordahl Site 2	CAFO	59275	IA 02-IOW-0070_3	0.0
Matrix Farms Inc 1	CAFO	59445	IA 02-IOW-0070_3	0.0
Luiken	CAFO	59615	IA 02-IOW-0070_3	0.0
Bittner Site	CAFO	59658	IA 02-IOW-0070_3	0.0
Lloyd Site	CAFO	59660	IA 02-IOW-0070_3	0.0
Lindell Janes	CAFO	59715	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 15	CAFO	60000	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 16	CAFO	60001	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 17	CAFO	60002	IA 02-IOW-0070_3	0.0
Iowa Select - Wright Sow Farm	CAFO	60155	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 2	CAFO	60512	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 5	CAFO	60515	IA 02-IOW-0070_3	0.0
Prestage Farms Of Iowa Pi 203	CAFO	60543	IA 02-IOW-0070_3	0.0
Kd Feeders Llc	CAFO	60645	IA 02-IOW-0070_3	0.0
Decoster Farms - Nursery 4	CAFO	60680	IA 02-IOW-0070_3	0.0
Decoster Farms - Nursery 1	CAFO	60681	IA 02-IOW-0070_3	0.0
Decoster Farms - Nursery 8	CAFO	60686	IA 02-IOW-0070_3	0.0
Decoster Farms - Nursery 3	CAFO	60688	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 14	CAFO	60693	IA 02-IOW-0070_3	0.0
Decoster Farms - Sow 6	CAFO	60700	IA 02-IOW-0070_3	0.0
Rehm Site	CAFO	60772	IA 02-IOW-0070_3	0.0
Iowa Select - Aldinger Finishing Site	CAFO	60853	IA 02-IOW-0070_3	0.0
Iowa Select - Gast Finisher	CAFO	60868	IA 02-IOW-0070_3	0.0
Iowa Select - Stockdale Sow	CAFO	60897	IA 02-IOW-0070_3	0.0
Iowa Select - Swartz Finishing Site	CAFO	60898	IA 02-IOW-0070_3	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Centrum Valley Farms, Llp	CAFO	61185	IA 02-IOW-0070_3	0.0
Rv Pork	CAFO	61405	IA 02-IOW-0070_3	0.0
Oakland Site	CAFO	61420	IA 02-IOW-0070_3	0.0
Kevin Finisher Farm	CAFO	61600	IA 02-IOW-0070_3	0.0
Cardinal Site	CAFO	62285	IA 02-IOW-0070_3	0.0
Centrum Valley East Layer	CAFO	62586	IA 02-IOW-0070_3	0.0
Centrum Valley Farms North Layer	CAFO	62588	IA 02-IOW-0070_3	0.0
Balvanz East Finisher Farm	CAFO	63007	IA 02-IOW-0070_3	0.0
Jag Site 1 & 2	CAFO	63089	IA 02-IOW-0070_3	0.0
Jordahl Site 5	CAFO	63162	IA 02-IOW-0070_3	0.0
Lyon Site 1	CAFO	63580	IA 02-IOW-0070_3	0.0
Lyon Site 2	CAFO	63711	IA 02-IOW-0070_3	0.0
Thomas Site 1	CAFO	63934	IA 02-IOW-0070_3	0.0
Franklin Morgan Site	CAFO	64261	IA 02-IOW-0070_3	0.0
Rollene Finisher Farm	CAFO	64688	IA 02-IOW-0070_3	0.0
Oakland Finisher Farm	CAFO	64844	IA 02-IOW-0070_3	0.0
Goldie's Site	CAFO	65271	IA 02-IOW-0070_3	0.0
Darren Holtkamp	CAFO	65289	IA 02-IOW-0070_3	0.0
Iso Pork Finisher Farm	CAFO	65446	IA 02-IOW-0070_3	0.0
Jordahl Site 10	CAFO	65774	IA 02-IOW-0070_3	0.0
Aunt May's Site	CAFO	65989	IA 02-IOW-0070_3	0.0
Owasa Finisher Farm	CAFO	66906	IA 02-IOW-0070_3	0.0
Centrum Valley Farms South Layer	CAFO	66939	IA 02-IOW-0070_3	0.0
Schager Finisher Farm	CAFO	67004	IA 02-IOW-0070_3	0.0
Oakland 10	CAFO	67910	IA 02-IOW-0070_3	0.0
Frye Pork Resort Lc	CAFO	68883	IA 02-IOW-0070_3	0.0
Richard Formanek Sr. Nedved Site	CAFO	57767	IA 02-IOW-0080_2	0.0
Daren Mennenga	CAFO	57827	IA 02-IOW-0080_2	0.0
G.l. Pork Llc Vern Gordon	CAFO	58084	IA 02-IOW-0080_2	0.0
R Triple T Inc	CAFO	58169	IA 02-IOW-0080_2	0.0
Marton Gruis Finisher Farm	CAFO	58291	IA 02-IOW-0080_2	0.0
Schmidt Family Farms	CAFO	58574	IA 02-IOW-0080_2	0.0
F9	CAFO	58881	IA 02-IOW-0080_2	0.0
Swanson's Hillside Farm Inc.	CAFO	59456	IA 02-IOW-0080_2	0.0
Prestage Farms Of Iowa Llc P220	CAFO	60159	IA 02-IOW-0080_2	0.0
Prestage Farms Of Iowa Llc P219	CAFO	60161	IA 02-IOW-0080_2	0.0
Thompson Family Farms	CAFO	60669	IA 02-IOW-0080_2	0.0
Prestage Farms Of Iowa Pi 221	CAFO	60866	IA 02-IOW-0080_2	0.0
Iowa Select - Palmetto Finishing Site	CAFO	60890	IA 02-IOW-0080_2	0.0
Diamond K Company	CAFO	61721	IA 02-IOW-0080_2	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Formanek Farms - Huling	CAFO	62553	IA 02-IOW-0080_2	0.0
Richard Formanek Sr. Frazier Site	CAFO	62554	IA 02-IOW-0080_2	0.0
Wenzel Finisher Farm	CAFO	62974	IA 02-IOW-0080_2	0.0
Dcm Site	CAFO	63896	IA 02-IOW-0080_2	0.0
Garfield - Nash Site	CAFO	63982	IA 02-IOW-0080_2	0.0
Crystal-maple Site	CAFO	63983	IA 02-IOW-0080_2	0.0
Crystal - Ladd Site	CAFO	63984	IA 02-IOW-0080_2	0.0
F088	CAFO	64329	IA 02-IOW-0080_2	0.0
F090	CAFO	64615	IA 02-IOW-0080_2	0.0
Trees Family Pork Llc	CAFO	64732	IA 02-IOW-0080_2	0.0
Prestage Farms Of Iowa Pi 236	CAFO	64813	IA 02-IOW-0080_2	0.0
Amsterdam Finisher Farm	CAFO	65260	IA 02-IOW-0080_2	0.0
Wisner Finisher Farm	CAFO	65604	IA 02-IOW-0080_2	0.0
Quail Ridge	CAFO	65806	IA 02-IOW-0080_2	0.0
Mcneese Finisher Farm	CAFO	65959	IA 02-IOW-0080_2	0.0
Erin Finisher Farm	CAFO	65964	IA 02-IOW-0080_2	0.0
Oak Site	CAFO	65973	IA 02-IOW-0080_2	0.0
Frohling Site	CAFO	67145	IA 02-IOW-0080_2	0.0
New Providence Finisher	CAFO	58314	IA 02-IOW-0270_0	0.0
Reece Finisher	CAFO	59661	IA 02-IOW-0270_0	0.0
Mcdonald Finisher Farm	CAFO	63851	IA 02-IOW-0270_0	0.0
Buck Run	CAFO	64234	IA 02-IOW-0270_0	0.0
Max Pork	CAFO	58154	IA 02-IOW-0280_3	0.0
Staley Finishers	CAFO	58321	IA 02-IOW-0280_3	0.0
Buckeye Finisher	CAFO	58324	IA 02-IOW-0280_3	0.0
359 Pork	CAFO	61486	IA 02-IOW-0280_3	0.0
Mallard Bay Site	CAFO	63866	IA 02-IOW-0280_3	0.0
Robinson Site	CAFO	67088	IA 02-IOW-0280_3	0.0
Hoversten Finisher	CAFO	57779	IA 02-IOW-0280_4	0.0
Gator Pork Finisher	CAFO	57786	IA 02-IOW-0280_4	0.0
Renaud 1 East Finisher	CAFO	57793	IA 02-IOW-0280_4	0.0
Dunn Finisher	CAFO	58316	IA 02-IOW-0280_4	0.0
F125	CAFO	58335	IA 02-IOW-0280_4	0.0
Alden - Centrum Valley Farms	CAFO	59162	IA 02-IOW-0280_4	0.0
Bartlett Finisher Farm	CAFO	59248	IA 02-IOW-0280_4	0.0
Sterling Finisher Farm	CAFO	59481	IA 02-IOW-0280_4	0.0
Prestage Farms Of Iowa Llc P201	CAFO	60516	IA 02-IOW-0280_4	0.0
Windmill	CAFO	61518	IA 02-IOW-0280_4	0.0
Todd Janes Finisher	CAFO	61645	IA 02-IOW-0280_4	0.0
Ldh	CAFO	61756	IA 02-IOW-0280_4	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Renaud Finisher Farm	CAFO	62113	IA 02-IOW-0280_4	0.0
F085	CAFO	64258	IA 02-IOW-0280_4	0.0
Burton Finisher Farm	CAFO	64301	IA 02-IOW-0280_4	0.0
Boothill Cattle	CAFO	64885	IA 02-IOW-0280_4	0.0
Kyle Janes - Harms Site	CAFO	57783	IA 02-IOW-0280_5	0.0
Janet Finisher Farm	CAFO	59484	IA 02-IOW-0280_5	0.0
Peter Decoster Nursery 15	CAFO	59796	IA 02-IOW-0280_5	0.0
Robert Schager	CAFO	61144	IA 02-IOW-0280_5	0.0
Transformer	CAFO	61421	IA 02-IOW-0280_5	0.0
Red Barn Site	CAFO	61423	IA 02-IOW-0280_5	0.0
Alden Finisher	CAFO	61424	IA 02-IOW-0280_5	0.0
Young Finisher	CAFO	61425	IA 02-IOW-0280_5	0.0
Hubbell	CAFO	61426	IA 02-IOW-0280_5	0.0
120th Site	CAFO	61479	IA 02-IOW-0280_5	0.0
C Ave Site	CAFO	61480	IA 02-IOW-0280_5	0.0
Hardin Site	CAFO	61516	IA 02-IOW-0280_5	0.0
Lawrence W Eide	CAFO	61786	IA 02-IOW-0280_5	0.0
Brian Lauterbach	CAFO	62254	IA 02-IOW-0280_5	0.0
F112	CAFO	64526	IA 02-IOW-0280_5	0.0
Elk Site	CAFO	64625	IA 02-IOW-0280_5	0.0
Ten Pork	CAFO	64629	IA 02-IOW-0280_5	0.0
Young Avenue Pork	CAFO	64756	IA 02-IOW-0280_5	0.0
Kyle Janes -110th Street Site	CAFO	65952	IA 02-IOW-0280_5	0.0
Wilke Beef	CAFO	66541	IA 02-IOW-0280_5	0.0
County Line Cattle	CAFO	66728	IA 02-IOW-0280_5	0.0
Keith Schwandt	CAFO	58797	IA 02-IOW-0282_0	0.0
Ron & Deb Kohl	CAFO	59222	IA 02-IOW-0282_0	0.0
Jerry Finisher	CAFO	59475	IA 02-IOW-0282_0	0.0
Rockow Finisher	CAFO	59504	IA 02-IOW-0282_0	0.0
Prestage Farms Of Iowa Pi 203	CAFO	60546	IA 02-IOW-0282_0	0.0
Decoster Farms - Sow 10	CAFO	60689	IA 02-IOW-0282_0	0.0
Iowa Select - Tipton Finisher	CAFO	60902	IA 02-IOW-0282_0	0.0
Prestage Farms Of Iowa Pi 294	CAFO	65661	IA 02-IOW-0282_0	0.0
Blairsburg 1	CAFO	67738	IA 02-IOW-0282_0	0.0
Marett Feeder	CAFO	58117	IA 02-IOW-0290_0	0.0
Teske Site	CAFO	59566	IA 02-IOW-0290_0	0.0
Teske Pork	CAFO	63286	IA 02-IOW-0290_0	0.0
Iowa Select - Kulow Ii Finisher	CAFO	57780	IA 02-IOW-0295_0	0.0
Iowa Select - Kulow 1 Finisher	CAFO	57781	IA 02-IOW-0295_0	0.0
Iowa Select - Kulow 3 Finisher	CAFO	57782	IA 02-IOW-0295_0	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
F095	CAFO	64322	IA 02-IOW-0295_0	0.0
F096	CAFO	64377	IA 02-IOW-0295_0	0.0
F103	CAFO	57774	IA 02-IOW-0297_0	0.0
Emil Central Finisher	CAFO	58325	IA 02-IOW-0297_0	0.0
F104	CAFO	58329	IA 02-IOW-0297_0	0.0
Tessendorf	CAFO	58336	IA 02-IOW-0297_0	0.0
Magnum Site	CAFO	59309	IA 02-IOW-0297_0	0.0
F109	CAFO	61105	IA 02-IOW-0297_0	0.0
F102	CAFO	62181	IA 02-IOW-0297_0	0.0
Summit Farms - Johnson Site	CAFO	63778	IA 02-IOW-0297_0	0.0
Axtell Finisher	CAFO	57775	IA 02-IOW-0300_1	0.0
Gaal Llc 2	CAFO	57776	IA 02-IOW-0300_1	0.0
Lake Farm	CAFO	57791	IA 02-IOW-0300_1	0.0
Research Farm	CAFO	58099	IA 02-IOW-0300_1	0.0
Southland Pork Finishers	CAFO	58129	IA 02-IOW-0300_1	0.0
Hagge Grow Finish Unit	CAFO	58345	IA 02-IOW-0300_1	0.0
Dennis Winter Finisher Farm	CAFO	58971	IA 02-IOW-0300_1	0.0
Iowa Select - Hornung Nursery Site	CAFO	60871	IA 02-IOW-0300_1	0.0
Iowa Select - Winter Finisher	CAFO	60872	IA 02-IOW-0300_1	0.0
Jeske Finisher Farm	CAFO	62112	IA 02-IOW-0300_1	0.0
J Avenue	CAFO	63981	IA 02-IOW-0300_1	0.0
North Tipton Ridge	CAFO	65214	IA 02-IOW-0300_1	0.0
Hamco West	CAFO	57759	IA 02-IOW-0300_2	0.0
Hamco East	CAFO	57762	IA 02-IOW-0300_2	0.0
Vierkandt	CAFO	57796	IA 02-IOW-0300_2	0.0
Krause Stock Farm	CAFO	58272	IA 02-IOW-0300_2	0.0
F086	CAFO	58323	IA 02-IOW-0300_2	0.0
F101	CAFO	58326	IA 02-IOW-0300_2	0.0
Prism Hamilton Finisher Farm	CAFO	58395	IA 02-IOW-0300_2	0.0
J & J Stock Farm	CAFO	58482	IA 02-IOW-0300_2	0.0
R-site	CAFO	58603	IA 02-IOW-0300_2	0.0
Henke Farm Lp	CAFO	58604	IA 02-IOW-0300_2	0.0
Madden Farms Inc.	CAFO	58916	IA 02-IOW-0300_2	0.0
Vierkandt Finisher Farm	CAFO	59247	IA 02-IOW-0300_2	0.0
Renaud 3 South Finisher	CAFO	59307	IA 02-IOW-0300_2	0.0
C-site Finishers	CAFO	59466	IA 02-IOW-0300_2	0.0
Don Williams #1	CAFO	59937	IA 02-IOW-0300_2	0.0
Prestage Farms Of Iowa Pi 208	CAFO	59993	IA 02-IOW-0300_2	0.0
Prestage Farms Of Iowa Pi 206	CAFO	60180	IA 02-IOW-0300_2	0.0
Prestage Farms Of Iowa Pi 207	CAFO	60181	IA 02-IOW-0300_2	0.0

Facility Name	Facility Type	Iowa AFO ID	Receiving Stream Segment	WLA, *E. coli*, orgs/day
Merlyn Hegland - Farm A	CAFO	60606	IA 02-IOW-0300_2	0.0
Prestage Farms Of Iowa Pi 205	CAFO	60676	IA 02-IOW-0300_2	0.0
Iowa Select - Kielsmeier Sow Site	CAFO	60878	IA 02-IOW-0300_2	0.0
Mike (marlene) Williams	CAFO	61272	IA 02-IOW-0300_2	0.0
J-site Finishers	CAFO	61457	IA 02-IOW-0300_2	0.0
Travis Twedt	CAFO	61580	IA 02-IOW-0300_2	0.0
Runge Finisher Farm	CAFO	61704	IA 02-IOW-0300_2	0.0
Merlyn Hegland - Farm B	CAFO	61746	IA 02-IOW-0300_2	0.0
Prestage Farms Of Iowa Pi 222	CAFO	64282	IA 02-IOW-0300_2	0.0
Rose Grove	CAFO	64585	IA 02-IOW-0300_2	0.0
240th Street Finisher	CAFO	65717	IA 02-IOW-0300_2	0.0
Buckeye 27	CAFO	67918	IA 02-IOW-0300_2	0.0
Buckeye 21	CAFO	67934	IA 02-IOW-0300_2	0.0
Doolittle Finisher	CAFO	59745	IA 02-IOW-0302_0	0.0
Don Williams #2	CAFO	59938	IA 02-IOW-0302_0	0.0
Lynn Elm	CAFO	60924	IA 02-IOW-0302_0	0.0
Merlyn Hegland - Farm C	CAFO	61124	IA 02-IOW-0302_0	0.0
Sparboe Farms (goodell)	CAFO	61195	IA 02-IOW-0380_1	0.0
Midwest Pork P-2	CAFO	63425	IA 02-IOW-0380_1	0.0
Sunray Pork Site 2	CAFO	65881	IA 02-IOW-0380_1	0.0
Schmidt Family Farms - Wean To Finish 2012	CAFO	67125	IA 02-IOW-0380_1	0.0
D & D Pork	CAFO	58724	IA 02-IOW-0380_3	0.0
Eagle Pork Iv	CAFO	59465	IA 02-IOW-0380_3	0.0
Rick Prohaska	CAFO	59618	IA 02-IOW-0380_3	0.0
B & J Pork	CAFO	61370	IA 02-IOW-0380_3	0.0
A & D Pork Llc	CAFO	61373	IA 02-IOW-0380_3	0.0
T & T Hogs Llc	CAFO	61578	IA 02-IOW-0380_3	0.0
Wellik Farms Lc	CAFO	61779	IA 02-IOW-0380_3	0.0
Tom Schmidt	CAFO	62743	IA 02-IOW-0380_3	0.0
Vail Site	CAFO	64527	IA 02-IOW-0380_3	0.0
A & D Pork Llc	CAFO	65341	IA 02-IOW-0380_3	0.0
Dsp Llc	CAFO	63812	IA 02-IOW-0381_0	0.0
Dornbier Hog Inc	CAFO	60723	IA 02-IOW-0382_0	0.0
Rustys Site	CAFO	61494	IA 02-IOW-0382_0	0.0
Bottlebrush Swine	CAFO	65839	IA 02-IOW-0390_0	0.0
Sunray Pork 3	CAFO	66172	IA 02-IOW-0390_0	0.0
Greiman Brothers	CAFO	56840	IA 02-IOW-0395_0	0.0
Totals				**0.00E+00**

(1) Regulatory CAFOs are not allowed to discharge therefore their WLA is zero.

Table E-22. WLA for General Permit #4 in the Upper Iowa Watershed.

Facility Name	Facility Type	Facility ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day
1 Permitted Facility	GP #4	--	--	IA 02-IOW-0070_3	126	--
Totals			**--**			**--**

(1) These sources are small and do not significantly contribute to the impairment. Therefore, a WLA for these systems is not included in this WQIP.

Table E-23. WLA for Unsewered Communities in the Upper Iowa Watershed.

Facility Name	Facility Type	Facility ID	Design Flow (gpd)	Receiving Stream Segment	GM, *E. coli*, orgs/100 mL	WLA, *E. coli*, orgs/day(1)
Galt	UNSWD	--	2.40E+03	IA 02-IOW-0070_3	126	1.14E+07
Popejoy	UNSWD	--	5.85E+03	IA 02-IOW-0070_3	126	2.79E+07
The Pines	UNSWD	--	3.45E+03	IA 02-IOW-0070_3	126	1.65E+07
Alexander	UNSWD	--	1.29E+04	IA 02-IOW-0080_2	126	6.15E+07
Duncan	UNSWD	--	9.83E+03	IA 02-IOW-0080_2	126	4.69E+07
Elm Lake	UNSWD	--	4.80E+03	IA 02-IOW-0080_2	126	2.29E+07
Hayfield	UNSWD	--	3.23E+03	IA 02-IOW-0080_2	126	1.54E+07
Rowan	UNSWD	--	1.16E+04	IA 02-IOW-0080_2	126	5.51E+07
Tyrrell Grove	UNSWD	--	5.63E+03	IA 02-IOW-0080_2	126	2.68E+07
Buckeye	UNSWD	--	8.03E+03	IA 02-IOW-0280_3	126	3.83E+07
Owasa	UNSWD	--	3.23E+03	IA 02-IOW-0295_0	126	1.54E+07
Totals			**7.09E+04**			**3.38E+08**

(1) WLA for unsewered communities is the product of the population and a per capita rate of 100 gallons per capita-day times the WQS concentration.

Appendix E.3. NPDES Facilities Not Considered

Table E-24. NPDES Facilities not Considered in this WQIP

Facility Name	Iowa NPDES ID	EPA NPDES ID	Receiving Stream Segment	Reason Not Used
Hubbard City Of Stp	4254001	0031429	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
New Providence City of Stp	4271001	0028193	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Radcliffe City of Stp	4283001	0033707	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Union City of Stp	4291001	0034266	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Whitten City Of Stp-(central Iowa Water Assn).	4293001	0062448	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Clemons City of Stp	6415001	0057509	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Liscomb City of Stp	6462001	0056847	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
St. Anthony City Of-central Iowa Water Association	6482001	0077291	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Zearing City Of Stp	8590001	0058513	IA 02-IOW-0070_1	Discharges to an unassessed segment(1)
Iowa Select Farms L.l.p. Truck Wash	3500115	0073644	IA 02-IOW-0070_3	OPERATION PERMIT(2)
Flint Hills Resources Iowa Falls, Llc	4200121	0078841	IA 02-IOW-0070_3	INDUSTRIAL(2)
Centrum Valley Farms, Llp	9900123	0082783	IA 02-IOW-0070_3	OPERATION PERMIT(2)
Primera Foods	4100105	0004791	IA 02-IOW-0080_2	OPERATION PERMIT(2)
The Maschhoffs, Inc - Buckeye	4200123	0083313	IA 02-IOW-0280_3	INDUSTRIAL(2)
Northern Natural Gas Co - Ventura Compressor	4100100	0064327	IA 02-IOW-0381_0	INDUSTRIAL(2)

(1) These facilities are within the drainage area of a segment that has not been assessed for bacteria. Therefore, they were not considered in this WQIP.

(2) Operation permits do not discharge to surface water and industrial facilities and municipal water treatment plants are not expected to have *E.coli* in their effluents. Consequently, these facilities will not be considered in this WQIP as contributing sources.

Appendix E.4. Water Quality Data

Table E-25. Estimated Flow for Iowa River, Segment IA 02 IOW-0070_3 and observed E. coli at STORET Site 10420001.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
10/7/1999	63.4	200	8/9/2005	168.9	140
11/8/1999	65.9	90	9/15/2005	83.7	90
4/4/2000	70.5	Not Detected(1)	10/10/2005	183.6	160
5/8/2000	64.9	90	11/8/2005	108.0	10
6/6/2000	674.5	780	4/11/2006	958.6	30
7/18/2000	557.9	2,400	5/9/2006	1,080.3	260
8/1/2000	200.8	310	6/6/2006	432.1	160
9/11/2000	52.2	330	7/6/2006	184.6	120
10/18/2000	53.3	99	8/9/2006	159.8	2,000
3/21/2001	3,296.7	210	9/12/2006	1,501.3	6,800
4/17/2001	2,221.4	99	10/10/2006	223.7	40
5/15/2001	1,339.0	170	11/7/2006	251.1	10
6/19/2001	1,917.1	250	4/10/2007	1,481.0	140
7/17/2001	276.9	60	5/9/2007	2,028.7	72
8/21/2001	160.8	63	6/12/2007	872.3	240
9/17/2001	192.2	5,900	7/10/2007	440.2	630
10/15/2001	158.7	180	8/8/2007	557.9	1,100
11/13/2001	132.4	30	9/12/2007	442.3	100
4/10/2002	161.8	Not Detected(1)	10/10/2007	1,922.2	930
5/15/2002	1,039.7	Not Detected(1)	11/13/2007	552.8	50
6/11/2002	618.8	150	4/8/2008	994.1	Not Detected(1)
7/9/2002	217.1	100	5/14/2008	1,688.9	120
8/13/2002	495.0	2,700	6/9/2008	9,332.1	1,400
9/10/2002	147.1	140	7/15/2008	786.1	260
10/8/2002	735.4	260	8/12/2008	401.2	180
11/12/2002	255.1	27	4/7/2009	811.5	30
4/7/2003	219.1	36	5/12/2009	1,688.9	200
5/13/2003	1,780.2	150	6/9/2009	1,171.6	75
6/10/2003	887.6	110	7/8/2009	770.9	1,400
7/9/2003	1,805.6	3,200	8/10/2009	598.5	16,000
8/12/2003	149.1	30	9/9/2009	105.5	130
9/9/2003	25.4	110	10/12/2009	436.2	260
10/8/2003	93.8	40	11/10/2009	999.1	290
11/11/2003	145.1	90	4/13/2010	847.0	120
4/14/2004	315.0	Not Detected(1)	5/11/2010	877.4	590
5/11/2004	331.2	72	6/8/2010	923.1	2,600
6/9/2004	1,131.0	81	7/13/2010	1,181.7	290
7/13/2004	1,344.0	310	8/9/2010	1,359.2	340

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
8/12/2004	221.6	160	9/7/2010	386.0	200
9/8/2004	182.6	240	10/12/2010	344.9	97
10/13/2004	83.2	120	11/9/2010	226.7	150
11/9/2004	127.8	60	4/13/2011	500.6	74
4/12/2005	801.3	4,400	5/10/2011	786.1	160
5/2/2005	725.3	100	6/15/2011	1,328.8	270
6/8/2005	578.2	900	7/12/2011	598.5	390
7/13/2005	486.9	220	8/8/2011	193.2	410
9/13/2011	71.5	150	5/5/2014	1,288.2	52
10/11/2011	57.8	110	6/5/2014	472.2	200
11/9/2011	96.9	1,600	7/2/2014	11,208.7	560
4/10/2012	121.2	85	8/7/2014	300.3	780
5/9/2012	821.6	52	9/4/2014	710.1	440
6/5/2012	223.2	110	10/1/2014	291.1	630
7/9/2012	62.9	97	11/3/2014	418.4	97
8/6/2012	35.0	220	4/2/2015	248.0	20
9/11/2012	23.3	370	5/13/2015	547.8	31
10/9/2012	22.3	360	6/2/2015	1,075.2	120
11/13/2012	43.1	85	7/7/2015	1,922.2	1,900
4/8/2013	396.6	10	8/5/2015	268.8	160
5/1/2013	973.8	410			
6/5/2013	3,403.2	110	Min =	22.3	5
7/9/2013	598.5	730	1st Quartile =	160.6	84
8/14/2013	189.7	300	Median =	425.3	150
9/11/2013	65.9	280	3rd Quartile =	896.5	315
10/10/2013	53.8	97	Max =	11,208.7	16,000
11/12/2013	80.1	31	Mean(2) =	773.5	163
4/7/2014	255.1	31	Std Dev =	1,375.9	1,716

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(2) For *E. coli* this is a Geomean.

Table E-26. Estimated Flow for Iowa River, Segment IA 02 IOW-0080_2 and observed *E. coli* at STORET Site 10990001 and USGS Site 05449500.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
4/29/1997[(2)]	260.3	330	10/9/2002	1,391.0	190
5/13/1997[(2)]	670.8	84	11/13/2002	195.2	90
5/20/1997[(2)]	502.6	200	4/14/2003	353.4	30
5/28/1997[(2)]	360.1	180	5/14/2003	1,492.0	80
6/4/1997[(2)]	253.5	140	6/11/2003	739.3	430
6/10/1997[(2)]	182.9	210	7/8/2003	728.0	1,700
6/17/1997[(2)]	135.7	5,400	8/13/2003	74.0	140
6/23/1997[(2)]	1,368.6	12,000	9/10/2003	33.7	340
7/1/1997[(2)]	1,008.5	940	10/6/2003	31.4	40
7/29/1997[(2)]	362.3	3,800	11/12/2003	33.7	45
8/11/1997[(2)]	99.8	500	4/14/2004	107.7	50
8/26/1997[(2)]	67.3	620	5/12/2004	147.0	45
9/11/1997[(2)]	49.4	600	6/7/2004	829.0	140
9/25/1997[(2)]	67.3	330	7/14/2004	742.6	380
10/20/1997[(2)]	57.2	200	8/11/2004	107.7	180
11/5/1997[(2)]	49.4	220	9/8/2004	53.8	50
3/31/1998[(2)]	1,024.2	1,300	10/14/2004	62.8	190
5/1/1998[(2)]	488.0	73	11/10/2004	75.2	50
5/5/1998[(2)]	382.5	100	4/13/2005	1,166.7	6,700
8/8/1998[(2)]	444.2	1,200	5/2/2005	372.4	50
10/17/2000	35.9	140	6/8/2005	402.7	320
3/22/2001	673.1	110	7/13/2005	192.9	130
4/10/2001[(2)]	2,008.0	92	8/10/2005	96.5	1,700
4/18/2001	1,469.5	45	9/14/2005	66.2	510
5/2/2001[(2)]	1,133.0	2,400	10/12/2005	207.5	330
5/16/2001	853.7	110	11/8/2005	123.4	54
6/8/2001[(2)]	841.3	280	4/12/2006	826.8	27
6/20/2001	1,290.0	270	5/9/2006	717.9	70
7/12/2001[(2)]	261.4	220	6/7/2006	300.6	150
7/17/2001	177.2	230	7/12/2006	107.7	250
8/7/2001[(2)]	197.4	270	8/9/2006	60.6	930
8/14/2001	117.8	250	9/12/2006	56.1	820
9/6/2001[(2)]	70.7	140	10/11/2006	38.1	130
9/18/2001	78.5	170	11/7/2006	43.7	Not Detected[(1)]
10/15/2001	96.5	120			
11/14/2001	72.9	260	Min =	31.4	5
4/10/2002	84.1	Not Detected[(1)]	1st Quartile =	73.7	92
5/14/2002	443.1	Not Detected[(1)]	Median =	196.3	185
6/12/2002	199.7	140	3rd Quartile =	684.3	350

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
7/9/2002	58.3	120	Max =	2,008.0	12,000
8/14/2002	1,447.1	1,900	Mean(3) =	414.7	202
9/11/2002	97.6	160	Std Dev =	458.4	1,704

(1) *E. coli* was not detectable. The minimum detection limits is 10 orgs/100 mL. Consequently 5 org/100 mL was used in calculations.
(2) Samples collected at USGS Station 05449500.
(3) For *E. coli* this is a Geomean.

Table E-27. Estimated Flow for South Fork Iowa River, Segment IA 02 IOW-0270_0 and observed *E. coli* at USGS Site 05451210 and NLAE Site SF450.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
3/30/1998	452.4	2,000	4/2/2013	138.9	1
4/1/1998	646.3	3,300	5/8/2013	937.8	264
5/4/1998	229.6	52	6/5/2013	856.6	411
9/14/1998	17.9	480	7/1/2013	237.9	512
4/9/2001	418.0	92	7/31/2013	74.3	613
5/1/2001	176.0	86	9/4/2013	2.2	186
6/7/2001	825.0	5,200	10/21/2013	1.7	980
7/11/2001	55.0	320	11/5/2013	13.6	105
8/6/2001	41.3	320	4/9/2014	41.3	6
9/5/2001	6.5	170	5/6/2014	244.8	83
5/4/2010	409.8	43	6/3/2014	217.3	687
6/1/2010	257.1	87	7/8/2014	1,013.4	548
7/6/2010	1,075.3	1,300	8/5/2014	50.9	104
8/3/2010	1,006.5	754	9/2/2014	119.6	>2419.6
9/8/2010	116.9	1,414	10/8/2014	156.8	361
10/12/2010	149.9	291	11/5/2014	147.1	114
11/8/2010	77.0	36	4/8/2015	110.0	48
4/4/2011	195.3	12	5/6/2015	196.6	57
5/2/2011	486.8	7	6/3/2015	310.8	432
6/7/2011	283.3	461	7/7/2015	251.6	3,870
7/5/2011	217.3	579	8/4/2015	77.0	461
8/1/2011	46.8	461	9/8/2015	501.9	1,710
8/29/2011	17.9	179	9/29/2015	312.1	48,392
10/3/2011	3.9	248	11/3/2015	170.5	316
11/9/2011	42.6	907			
4/3/2012	53.6	36			
5/7/2012	598.1	1,203	Min =	0.2	1
6/4/2012	103.1	172	1st Quartile =	42.6	87
7/9/2012	10.0	488	Median =	149.9	316
8/6/2012	5.6	57	3rd Quartile =	310.8	613
9/4/2012	0.4	213	Max =	1,075.3	48,392
10/1/2012	0.2	31	Mean(3) =	249.4	249
11/6/2012	5.5	155	Std Dev =	288.2	6,346

(1) Samples collected between March 30, 1998 and September 5, 2001 were collected as USGS Station 05451210

(2) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.

(3) For *E. coli* this is a Geomean.

Table E-28. Estimated Flow for South Fork Iowa River, Segment IA 02 IOW-0280_3 and observed *E. coli* at NLAE Site SF400.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	146.3	73	5/7/2012	213.6	308
6/1/2010	91.8	219	6/4/2012	36.8	1,120
7/6/2010	384.0	285	7/9/2012	3.6	1,203
8/3/2010	359.5	>2419.2(1)	8/6/2012	2.0	260
9/8/2010	41.7	687	9/4/2012	0.1	161
10/12/2010	53.5	488	10/1/2012	0.1	186
11/8/2010	27.5	64	11/6/2012	2.0	1,986
4/4/2011	69.7	39			
5/2/2011	173.8	10			
6/7/2011	101.2	727	Min=	0.1	10
7/5/2011	77.6	1,046	1st Quartile=	5.0	174
8/1/2011	16.7	1,733	Median=	36.8	488
8/29/2011	6.4	921	3rd Quartile=	96.5	1,003
10/3/2011	1.4	649	Max=	384.0	2,400
11/9/2011	15.2	960	Mean(2)=	80.2	337
4/3/2012	19.2	31	Std Dev=	107.0	652

(1) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.
(2) For *E. coli* this is a Geomean.

Table E-29. Estimated Flow for South Fork Iowa River, Segment IA 02 IOW-0280_4 and observed *E. coli* at NLAE Site SF400.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	136.2	73	5/7/2012	196.7	308
6/1/2010	87.3	219	6/4/2012	37.9	1,120
7/6/2010	349.7	285	7/9/2012	8.0	1,203
8/3/2010	327.7	>2419.2(1)	8/6/2012	6.6	260
9/8/2010	42.3	687	9/4/2012	4.9	161
10/12/2010	52.9	488	10/1/2012	4.8	186
11/8/2010	29.5	64	11/6/2012	6.6	1,986
4/4/2011	67.4	39			
5/2/2011	160.9	10			
6/7/2011	95.7	727	Min =	4.8	10
7/5/2011	74.5	1,046	1st Quartile =	9.3	174
8/1/2011	19.8	1,733	Median =	37.9	488
8/29/2011	10.5	921	3rd Quartile =	91.5	1,003
10/3/2011	6.0	649	Max =	349.7	2,400
11/9/2011	18.5	960	Mean(2) =	76.8	337
4/3/2012	22.0	31	Std Dev =	96.1	652

(1) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.
(2) For *E. coli* this is a Geomean.

Table E-30. Estimated Flow for South Fork Iowa River, Segment IA 02 IOW-0280_5 and observed *E. coli* at NLAE Site SF315.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	82.1	63	7/31/2013	14.9	115
6/1/2010	51.5	435	9/4/2013	0.4	86
7/6/2010	215.4	816	10/21/2013	0.3	23
9/8/2010	23.4	548	11/5/2013	2.7	61
10/12/2010	30.0	517	4/9/2014	8.3	12
11/8/2010	15.4	36	5/6/2014	49.0	50
4/4/2011	39.1	34	6/3/2014	43.5	411
5/2/2011	97.5	29	7/8/2014	203.0	194
6/6/2011	61.1	866	8/5/2014	10.2	84
7/5/2011	43.5	1,733	9/2/2014	24.0	770
8/1/2011	9.4	921	10/8/2014	31.4	214
8/29/2011	3.6	365	11/5/2014	29.5	219
10/3/2011	0.8	1,733	8/4/2015	15.4	1,203
4/3/2012	10.7	184	9/8/2015	100.5	260
5/7/2012	119.8	328	9/29/2015	62.5	664
6/4/2012	20.7	249	11/3/2015	34.2	111
7/9/2012	2.0	41			
8/6/2012	1.1	26	Min =	0.0	1
9/4/2012	0.1	Not Detected(1)	1st Quartile =	9.1	43
10/1/2012	0.0	1	Median =	28.7	189
4/2/2013	27.8	921	3rd Quartile =	53.9	525
5/8/2013	187.9	35	Max =	215.4	1,733
6/5/2013	171.6	43	Mean =	47.3	143
7/1/2013	47.7	141	Std Dev =	57.3	443

(1) *E. coli* was not detectable. The minimum detection limits is 1 orgs/100 mL. Consequently 0.5 org/100 mL was used in calculations.
(2) For *E. coli* this is a Geomean.

Table E-31. Estimated Flow for South Fork Iowa River, Segment IA 02 IOW-0282_0 and observed *E. coli* at NLAE Site SF305.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	40.7	44	10/21/2013	0.2	2
6/1/2010	25.5	107	11/5/2013	1.4	12
7/6/2010	106.8	127	4/9/2014	4.1	3
8/3/2010	100.0	35	5/6/2014	24.3	31
9/8/2010	11.6	1,046	6/3/2014	21.6	120
10/12/2010	14.9	579	7/8/2014	100.7	121
11/8/2010	7.7	75	8/5/2014	5.1	461
4/4/2011	19.4	9	9/2/2014	11.9	1,814
5/2/2011	48.4	9	10/8/2014	15.6	308
6/6/2011	30.3	53	11/5/2014	14.6	160
7/5/2011	21.6	345	4/8/2015	10.9	67
8/1/2011	4.6	816	5/6/2015	19.5	38
8/29/2011	1.8	1,414	6/3/2015	30.9	121
10/3/2011	0.4	145	7/7/2015	25.0	461
4/3/2012	5.3	96	8/4/2015	7.7	288
5/7/2012	59.4	88	9/8/2015	49.9	613
6/4/2012	10.2	236	9/29/2015	31.0	126
7/9/2012	1.0	261	11/3/2015	16.9	75
8/6/2012	0.6	142			
9/4/2012	0.0	211			
10/1/2012	0.0	4,884	Min =	0.0	1
4/2/2013	13.8	5	1st Quartile =	5.1	38
5/8/2013	93.2	31	Median =	14.9	121
6/5/2013	85.1	9	3rd Quartile =	30.3	288
7/1/2013	23.6	157	Max =	106.8	4,884
7/31/2013	7.4	166	Mean(1) =	25.0	97
9/4/2013	0.2	1	Std Dev =	29.2	776

(1) For *E. coli* this is a Geomean.

Table E-32. Estimated Flow for Beaver Creek, Segment IA 02 IOW-0290_0 and observed *E. coli* at NLAE Site BC350.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	98.4	16	9/4/2013	0.5	498
6/1/2010	61.8	326	10/21/2013	0.4	461
7/6/2010	258.3	1,120	11/5/2013	3.3	461
8/3/2010	241.8	24,192	4/9/2014	9.9	6
9/8/2010	28.1	866	5/6/2014	58.8	157
10/12/2010	36.0	345	6/3/2014	52.2	2,420
11/8/2010	18.5	201	7/8/2014	243.5	222
4/4/2011	46.9	10	8/5/2014	12.2	2,420
5/2/2011	116.9	2	9/2/2014	28.7	1,046
6/7/2011	68.1	1,414	10/8/2014	37.7	168
7/5/2011	52.2	921	11/5/2014	35.3	86
8/1/2011	11.2	>2419.2(1)	4/8/2015	26.4	66
8/29/2011	4.3	276	5/6/2015	47.2	184
10/3/2011	0.9	517	6/3/2015	74.7	345
11/9/2011	10.2	1,281	7/7/2015	60.5	2,420
4/3/2012	12.9	46	8/4/2015	18.5	1,542
5/7/2012	143.7	1,414	9/8/2015	120.6	770
6/4/2012	24.8	1,120	9/29/2015	75.0	2,420
7/9/2012	2.4	517	11/3/2015	41.0	38
8/6/2012	1.4	1,986			
9/4/2012	0.1	1,986			
10/1/2012	0.0	219	Min =	0.0	1
11/6/2012	1.3	411	1st Quartile =	10.7	176
4/2/2013	33.4	1	Median =	35.3	461
5/8/2013	225.3	71	3rd Quartile =	65.0	1,201
6/5/2013	205.8	219	Max =	258.3	24,192
7/1/2013	57.2	345	Mean(2) =	58.0	323
7/31/2013	17.8	598	Std Dev =	69.8	3,470

(1) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.

(2) For *E. coli* this is a Geomean.

Table E-33. Estimated Flow for Beaver Creek, Segment IA 02 IOW-0295_0 and observed *E. coli* at NLAE Site BC264.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	38.0	9	11/5/2013	1.3	7,701
6/1/2010	23.9	248	4/9/2014	3.8	17
7/6/2010	99.8	866	5/6/2014	22.7	39
8/3/2010	93.5	261	6/3/2014	20.2	308
9/8/2010	10.9	253	7/8/2014	94.1	107
10/12/2010	13.9	291	8/5/2014	4.7	1,733
11/8/2010	7.2	147	9/2/2014	11.1	579
4/4/2011	18.1	6	10/8/2014	14.6	64
5/2/2011	45.2	6	11/5/2014	13.7	21
6/7/2011	26.3	>2419.2(1)	4/8/2015	10.2	11
7/5/2011	20.2	687	5/6/2015	18.3	31
8/1/2011	4.3	2,419	6/3/2015	28.9	268
8/29/2011	1.7	69	7/7/2015	23.4	1,986
10/3/2011	0.4	1,300	8/4/2015	7.2	1,414
4/3/2012	5.0	345	9/8/2015	46.6	326
5/7/2012	55.5	102	9/29/2015	29.0	2,224
6/4/2012	9.6	214	11/3/2015	15.8	219
7/9/2012	0.9	1,046			
4/2/2013	12.9	<1.0(2)	Min =	0.2	1
5/8/2013	87.1	148	1st Quartile =	7.0	77
6/5/2013	79.5	184	Median =	15.2	265
7/1/2013	22.1	285	3rd Quartile =	28.3	1,001
7/31/2013	6.9	548	Max =	99.8	7,701
9/4/2013	0.2	>2419.2(1)	Mean(3) =	25.0	217
10/21/2013	0.2	4,884	Std Dev =	27.5	1,455

(1) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.

(2) *E. coli* was not detectable. The minimum detection limits is 1 orgs/100 mL. Consequently 0.5 org/100 mL was used in calculations.

(3) For *E. coli* this is a Geomean.

Table E-34. Estimated Flow for South Beaver Creek, Segment IA 02 IOW-0297_0 and observed *E. coli* at NLAE Site BC274.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	18.4	17	10/21/2013	0.1	12
6/1/2010	11.5	921	11/5/2013	0.6	6
7/6/2010	48.2	1,414	4/9/2014	1.8	5
8/3/2010	45.1	1,733	5/6/2014	11.0	9
9/8/2010	5.2	816	6/3/2014	9.7	1733
10/12/2010	6.7	205	7/8/2014	45.4	276
11/8/2010	3.5	38	8/5/2014	2.279464	866
4/4/2011	8.7	6	9/2/2014	5.359821	2420
5/2/2011	21.8	7	10/8/2014	7.023214	131
6/7/2011	12.7	921	11/5/2014	6.591964	105
7/5/2011	9.7	727	4/8/2015	4.928571	4
8/1/2011	2.1	2,419	5/6/2015	8.809821	866
8/29/2011	0.8	727	6/3/2015	13.92321	461
10/3/2011	0.2	29	7/7/2015	11.27411	2420
4/3/2012	2.4	27	8/4/2015	3.45	1986
5/7/2012	26.8	770	9/8/2015	22.48661	81
6/4/2012	4.6	816	9/29/2015	13.98482	2420
7/9/2012	0.4	1,300	11/3/2015	7.639286	20
8/6/2012	0.3	461			
9/4/2012	0.0	365			
10/1/2012	0.0	31	Min =	0.0	1
4/2/2013	6.2	<1	1st Quartile =	2.3	29
5/8/2013	42.0	46	Median =	6.7	461
6/5/2013	38.4	488	3rd Quartile =	12.7	866
7/1/2013	10.7	488	Max =	48.2	2,420
7/31/2013	3.3	649	Mean(1) =	11.2	175
9/4/2013	0.1	435	Std Dev =	13.1	752

(1) For *E. coli* this is a Geomean.

Table E-35. Estimated Flow for Tipton Creek, Segment IA 02 IOW-0300_1 and observed *E. coli* at NLAE Site TC325.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	290.0	28	Min=	54.5	28
6/1/2010	182.0	291	1st Quartile=	94.4	128
7/6/2010	761.1	1,414	Median=	182.0	291
8/3/2010	712.4	1,178	3rd Quartile=	501.2	1,296
9/8/2010	82.7	1,553	Max=	761.1	1,553
10/12/2010	106.1	187	Mean(1)=	312.7	309
11/8/2010	54.5	68	Std Dev=	277.9	626

(1) For *E. coli* this is a Geomean.

Table E-36. Estimated Flow for Tipton Creek, Segment IA 02 IOW-0300_2 and observed *E. coli* at NLAE Site TC313.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	79.7	47	9/4/2013	0.4	524
6/1/2010	50.0	185	10/21/2013	0.3	17
7/6/2010	209.1	411	11/5/2013	2.6	8
8/3/2010	195.7	291	4/9/2014	8.0	4
9/8/2010	22.7	411	5/6/2014	47.6	81
10/12/2010	29.1	186	6/3/2014	42.3	214
11/8/2010	15.0	16	7/8/2014	197.1	75
4/4/2011	38.0	13	8/5/2014	9.9	488
5/2/2011	94.7	19	9/2/2014	23.3	461
6/7/2011	55.1	1,300	10/8/2014	30.5	102
7/5/2011	42.3	727	11/5/2014	28.6	22
8/1/2011	9.1	313	4/8/2015	21.4	59
8/29/2011	3.5	291	5/6/2015	38.2	62
10/3/2011	0.7	40	6/3/2015	60.4	365
4/3/2012	10.4	142	7/7/2015	48.9	866
5/7/2012	116.3	344	8/4/2015	15.0	411
6/4/2012	20.1	84	9/8/2015	97.6	194
7/9/2012	2.0	120	9/29/2015	60.7	2,420
8/6/2012	1.1	201			
9/4/2012	0.1	98	Min =	0.0	4
10/1/2012	0.0	>2419.2(1)	1st Quartile =	9.7	45
4/2/2013	27.0	5	Median =	28.9	164
5/8/2013	182.4	35	3rd Quartile =	56.4	377
6/5/2013	166.6	58	Max =	209.1	2,420
7/1/2013	46.3	15	Mean(2) =	49.2	120
7/31/2013	14.4	218	Std Dev =	57.7	522

(1) *E. coli* was present above the quantification limit of 2,420 orgs/100 mL. Consequently 2,420 org/100 mL was used for calculation purposes.
(2) For *E. coli* this is a Geomean.

Table E-37. Estimated Flow for Unnamed Tributary to Tipton Creek, Segment IA 02 IOW-0302_0 and observed *E. coli* at NLAE Site TC263.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
5/4/2010	4.7	2	6/3/2014	2.5	250
6/1/2010	3.0	50	7/8/2014	11.7	15
7/6/2010	12.5	313	8/5/2014	0.6	96
8/3/2010	11.7	411	9/2/2014	1.386563	93.4
9/8/2010	1.4	79	10/8/2014	1.816875	67.7
10/12/2010	1.7	133	11/5/2014	1.705313	<1
11/8/2010	0.9	10	4/8/2015	1.275	24.6
5/2/2011	5.6	3	5/6/2015	2.279063	59.4
6/7/2011	3.3	365	6/3/2015	3.601875	648.8
7/5/2011	2.5	184	7/7/2015	2.916563	579.4
8/1/2011	0.5	210	8/4/2015	0.8925	214.2
8/29/2011	0.2	727	9/8/2015	5.817188	105.4
4/3/2012	0.6	114	9/29/2015	3.617813	517.2
5/7/2012	6.9	70	11/3/2015	1.97625	13.2
6/4/2012	1.2	488			
7/9/2012	0.1	488			
4/2/2013	1.6	1	Min =	0.1	1
5/8/2013	10.9	2	1st Quartile =	1.2	15
6/5/2013	9.9	31	Median =	2.3	96
7/1/2013	2.8	178	3rd Quartile =	3.6	250
7/31/2013	0.9	125	Max =	12.5	727
4/9/2014	0.5	<1(1)	Mean(2) =	3.5	53
5/6/2014	2.8	1	Std Dev =	3.5	204

(1) *E. coli* was not detectable. The minimum detection limits is 1 orgs/100 mL. Consequently 0.5 org/100 mL was used in calculations.
(2) For *E. coli* this is a Geomean.

Table E-38. Estimated Flow for East Branch Iowa River, Segment IA 02 IOW-0380_1 and observed *E. coli* at STORET Site 13410012.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	285.6	190	7/28/2010	533.3	750
6/17/2009	188.7	1,200	8/11/2010	283.3	1,100
7/1/2009	110.4	530	9/8/2010	30.6	190
7/15/2009	298.2	5,200	9/22/2010	30.1	580
7/30/2009	64.5	440	10/20/2010	32.5	97
8/12/2009	38.5	110			
8/31/2009	26.0	190			
9/9/2009	19.5	190	Min =	19.0	97
9/23/2009	19.0	160	1st Quartile =	31.6	190
10/7/2009	126.1	4,400	Median =	126.1	440
11/11/2009	217.5	140	3rd Quartile =	256.4	795
6/2/2010	139.1	440	Max =	533.3	5,200
6/16/2010	491.5	840	Mean(1) =	166.5	434
7/14/2010	229.5	370	Std Dev =	152.7	1,381

(1) For *E. coli* this is a Geomean.

Table E-39. Estimated Flow for East Branch Iowa River, Segment IA 02 IOW-0380_3 and observed *E. coli* at STORET Sites 13410001, 13410009, 13410010, & 13410011.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	193.3	157	7/20/2011	53.7	450
6/17/2009	127.7	1,287	8/3/2011	23.9	650
7/1/2009	74.7	733	8/24/2011	16.3	106
7/15/2009	201.8	7,533	9/14/2011	7.2	435
7/30/2009	43.6	740	9/28/2011	9.1	325
8/12/2009	26.0	1,313	10/12/2011	9.1	1930
8/31/2009	17.6	487	5/23/2012	24.8	525
9/9/2009	13.2	750	6/6/2012	18.5	370
9/23/2009	12.9	780	6/20/2012	13.5	345
10/7/2009	85.4	2,767	7/5/2012	10.7	485
11/11/2009	147.2	223	7/18/2012	6.0	106
6/2/2010	94.1	763	8/1/2012	6.0	15
6/16/2010	332.6	433	8/15/2012	4.7	195
7/14/2010	155.3	885	8/29/2012	3.5	150
7/28/2010	360.9	4,175	9/12/2012	2.1	200
8/11/2010	191.7	788	10/1/2012	1.9	255
8/25/2010	39.5	623	10/15/2012	6.0	36
9/8/2010	20.7	803	10/31/2012	4.4	97
9/22/2010	20.4	695	11/14/2012	5.0	10
10/6/2010	27.6	290			
10/20/2010	22.0	129	Min =	1.9	1
4/27/2011	382.9	270	1st Quartile =	9.5	206
5/11/2011	126.2	310	Median =	24.4	468
5/25/2011	197.1	3,250	3rd Quartile =	123.0	776
6/8/2011	110.5	980	Max =	382.9	7,533
6/22/2011	382.9	<753(2)	Mean(3) =	81.5	360
7/6/2011	113.3	535	Std Dev =	106.3	1,295

(1) E. coli data is an average of the 4 sampling sites collected on this segment.
(2) Individual sampling points had E. coli values below the detection limit of 1 orgs/100 mL. In these cases 0.5 orgs/100 mL was used for calculation purposes.
(3) For E. coli this is a Geomean.

Table E-40. Estimated Flow for Drainage Ditch 13, Segment IA 02 IOW-0381_0 and observed *E. coli* at STORET Site 13410004.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	23.4	63	11/11/2009	17.8	180
6/17/2009	15.4	250	8/25/2010	4.8	85
7/1/2009	9.0	560			
7/15/2009	24.4	5,800	Min =	1.6	63
7/30/2009	5.3	430	1st Quartile =	2.9	233
8/12/2009	3.1	750	Median =	7.2	470
8/31/2009	2.1	260	3rd Quartile =	16.0	608
9/9/2009	1.6	560	Max =	24.4	5,800
9/23/2009	1.6	510	Mean(1) =	9.9	397
10/7/2009	10.3	810	Std Dev =	8.1	1,509

(1) For *E. coli* this is a Geomean.

Table E-41. Estimated Flow for Drainage Ditch 81, Segment IA 02 IOW-0382_0 and observed *E. coli* at STORET Sites 13410005 & 13410006.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	9.5	500	7/20/2011	67.8	1,225
6/17/2009	8.4	2,200	8/3/2011	53.9	270
7/1/2009	7.5	490	8/24/2011	42.8	355
7/15/2009	7.5	3,600	9/14/2011	41.3	155
7/30/2009	8.3	340	9/28/2011	42.0	271
8/12/2009	7.9	410	10/12/2011	59.6	44,600
8/31/2009	10.2	320	5/23/2012	70.9	380
9/9/2009	11.4	140	6/6/2012	72.5	205
9/23/2009	13.0	330	6/20/2012	66.8	290
10/7/2009	13.6	2,900	7/5/2012	57.5	1,326
11/11/2009	13.4	1,600	7/18/2012	64.2	165
6/2/2010	17.0	315	8/1/2012	66.8	140
6/16/2010	23.3	405	8/15/2012	61.1	830
7/14/2010	28.3	300	8/29/2012	42.0	51
7/28/2010	37.0	1,165	9/12/2012	35.8	20
8/11/2010	41.3	157	10/1/2012	32.1	10
8/25/2010	48.4	200	10/15/2012	28.9	91
9/8/2010	51.4	97	10/31/2012	25.2	128
9/22/2010	48.9	1,488	11/14/2012	22.2	110
10/6/2010	42.0	555			
10/20/2010	34.7	235	Min =	7.5	10
4/27/2011	29.7	1,300	1st Quartile =	18.3	159
5/11/2011	26.0	575	Median =	39.2	335
5/25/2011	41.8	3,400	3rd Quartile =	56.6	1,081
6/8/2011	65.8	525	Max =	75.0	44,600
6/22/2011	74.5	2,250	Mean(2) =	38.0	397
7/6/2011	75.0	149	Std Dev =	21.5	6,460

(1) *E. coli* data is an average of the 2 sampling sites collected on this segment.
(2) For *E. coli* this is a Geomean.

Table E-42. Estimated Flow for Galls Creek, Segment IA 02 IOW-0382_0 and observed *E. coli* at STORET Site 13410007.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	32.3	230	5/25/2011	32.9	12,000
6/17/2009	21.4	710	6/8/2011	18.5	1,000
7/1/2009	12.5	1,300	6/22/2011	64.0	1,100
7/15/2009	33.7	8,700	7/6/2011	18.9	3,400
7/30/2009	7.3	5,200	7/20/2011	9.0	3,300
8/12/2009	4.4	5,800	8/3/2011	4.0	5,200
8/31/2009	2.9	5,800	8/24/2011	2.7	6500
9/9/2009	2.2	Present Above Quantification Limit(1)	9/14/2011	1.2	1400
9/23/2009	2.2	24,000	5/23/2012	4.1	6100
10/7/2009	14.3	910	6/6/2012	3.1	1300
11/11/2009	24.6	320	6/20/2012	2.3	1100
6/16/2010	55.6	880	7/5/2012	1.8	990
7/14/2010	26.0	5,200			
7/28/2010	60.3	2,400			
8/11/2010	32.1	1,300	Min =	1.2	52
8/25/2010	6.6	6,000	1st Quartile =	3.4	990
9/22/2010	3.4	1,700	Median =	9.0	1,700
10/6/2010	4.6	910	3rd Quartile =	26.0	5,800
10/20/2010	3.7	380	Max =	64.0	24,000
4/27/2011	64.0	52	Mean(2) =	18.1	2,056
5/11/2011	21.1	2,500	Std Dev =	19.0	5,719

(1) *E. coli* was present above the quantification limit of 24,000 orgs/100 mL. Consequently 24,000 org/100 mL was used for calculation purposes.

(2) For *E. coli* this is a Geomean.

Table E-43. Estimated Flow for Unnamed Tributary to East Branch Iowa River, Segment IA 02 IOW-0395_0 and observed *E. coli* at STORET Site 13410008.

Date	Flow (cfs)	*E. coli* (orgs/100 mL)	Date	Flow (cfs)	*E. coli* (orgs/100 mL)
6/3/2009	8.6	220	6/16/2010	14.7	340
6/17/2009	5.7	990	8/25/2010	1.8	840
7/1/2009	3.3	960			
7/15/2009	8.9	1,800			
7/30/2009	1.9	1,400	Min=	0.6	170
8/12/2009	1.2	1,400	1st Quartile=	1.2	340
8/31/2009	0.8	2,400	Median=	3.3	990
9/9/2009	0.6	1,700	3rd Quartile=	6.5	1,700
9/23/2009	0.6	3,100	Max=	14.7	3,100
10/7/2009	3.8	270	Mean=	4.5	851
11/11/2009	6.5	170	Std Dev=	4.1	859

(1) For *E. coli* this is a Geomean.

Appendix F. Flow Development

The majority of the impaired stream segments are on ungaged streams. Consequently was necessary to estimate average daily flow rates for those segments using estimation methods.

In all but one case the drainage area ratio method was used to estimate average daily flow rates. Where stream gages existed on impaired streams no estimation methods were needed since average daily flow rates could be read directly from the gage data. A third method was used when the effluent discharge rates from NPDES permitted facilities exceeded the estimated average daily flow rates in the stream. A brief description of each method is given below.

Drainage Area Ration (DAR)
This is a common method where average daily flows from a gaged site are transferred to an ungaged site by using the average daily flow at the reference gage multiplied by the ratio of the drainage areas of the unknown site to the reference gage.

USGS
In one case, WQ sampling locations were coincidental to a USGS flow data monitoring gage. In this case the recorded flow collected at the gage site was used.

NPDES Effluent Exceeds Estimated Stream Flow (EST)
In some cases, the aggregate effluent discharge rate from the NPDES permitted facilities within a segment reach exceeded the estimated average daily stream flow. This resulted in a load allocation less than zero in the TMDL calculation. In these cases, the average daily stream flow rates were estimated using the drainage area ratio method. After which the aggregate average wet weather flows from of the NPDES permitted facilities, located within the segment reach, was added to the estimated daily stream flows before performing any of the load duration curve calculations. A summary of these cases is below.

Table F-1 lists each of the impaired segment, the reference gage used, method used to estimate flow rates, and the watershed that the segment is located in.

Table F-1. Summary of Flow Determinations

Waterbody	Stream Segment	Reference Gage (USGS Gage)	Method	Watershed
Iowa River	IA 02-IOW-0010_1	05465500	DAR	L
Iowa River	IA 02-IOW-0010_2	05465500	USGS	L
Iowa River	IA 02-IOW-0010_3	05465500	DAR	L
Iowa River	IA 02-IOW-0020_1	05455700	DAR	L
Iowa River	IA 02-IOW-0030_1	05455700	DAR	L
English River	IA 02-IOW-0100_1	05455500	EST	L
Old Mans Creek	IA 02-IOW-0150_2	05455100	DAR	L
Muddy Creek	IA 02-IOW-0162_0	05454090	DAR	L
Unnamed Tributary to Muddy Creek	IA 02-IOW-0166_0	05454090	DAR	L
Iowa River	IA 02-IOW-0050_1	05453100	DAR	M
Iowa River	IA 02-IOW-0060_4	05451500	DAR	M
Iowa River	IA 02-IOW-0060_5	05451500	DAR	M
Price Creek	IA 02-IOW-0175_2	05451900	DAR	M
Price Creek	IA 02-IOW-0176_0	05451900	DAR	M
Willow Creek	IA 02-IOW-0177_0	05451900	DAR	M

Waterbody	Stream Segment	Reference Gage (USGS Gage)	Method	Watershed
Unnamed Tributary to Willow Creek	IA 02-IOW-0179_0	05451900	DAR	M
Little Bear Creek	IA 02-IOW-0185_1	05453000	DAR	M
Little Bear Creek	IA 02-IOW-0185_2	05453000	DAR	M
Little Bear Creek	IA 02-IOW-0500_0	05453000	DAR	M
Walnut Creek	IA 02-IOW-0187_2	05452200	DAR	M
Walnut Creek	IA 02-IOW-0188_0	05452200	DAR	M
Unnamed Tributary to Walnut Creek	IA 02-IOW-0189_0	05452200	DAR	M
Unnamed Tributary to Walnut Creek	IA 02-IOW-0191_0	05452200	DAR	M
Unnamed Tributary to Walnut Creek	IA 02-IOW-0510_0	05452200	DAR	M
Bennett Creek	IA 02-IOW-0213_0	05451900	DAR	M
Raven Creek	IA 02-IOW-0215_0	05451900	DAR	M
Deer Creek	IA 02-IOW-0225_0	05451900	DAR	M
East Tributary to Union Grove Lake	IA 02-IOW-0226_0	05451900	DAR	M
Iowa River	IA 02-IOW-0070_3	05451500	DAR	U
Iowa River	IA 02-IOW-0080_2	05449500	DAR	U
South Fork Iowa River	IA 02-IOW-0280_3	05451210	DAR	U
South Fork Iowa River	IA 02-IOW-0280_4	05451210	EST	U
South Fork Iowa River	IA 02-IOW-0280_5	05451210	DAR	U
South Fork Iowa River	IA 02-IOW-0282_0	05451210	DAR	U
Beaver Creek	IA 02-IOW-0290_0	05451210	DAR	U
Beaver Creek	IA 02-IOW-0295_0	05451210	DAR	U
South Beaver Creek	IA 02-IOW-0297_0	05451210	DAR	U
Tipton Creek	IA 02-IOW-0300_1	05451210	DAR	U
Tipton Creek	IA 02-IOW-0300_2	5451210	DAR	U
Unnamed Tributary to Tipton Creek	IA 02-IOW-0302_0	5451210	DAR	U
East Branch Iowa River	IA 02-IOW-0380_1	5449500	DAR	U
East Branch Iowa River	IA 02-IOW-0380_3	5449500	DAR	U
Drainage Ditch 13	IA 02-IOW-0381_0	5449500	DAR	U
Drainage Ditch 81	IA 02-IOW-0382_0	5449500	EST	U
Galls Creek	IA 02-IOW-0390_0	5449500	DAR	U
Unnamed Tributary to East Branch Iowa River	IA 02-IOW-0395_0	5449500	DAR	U

DAR – Drainage Area Ratio Method
USGS – Flow Data Came Directly from USGS Gage.
EST – NPDES Effluent Exceeds Estimated Stream Flow
L – Lower Iowa HUC-8 Watershed
M – Middle Iowa HUC-8 Watershed
U – Upper Iowa HUC-8 Watershed

Summary of Cases Where NPDES Effluent Exceeds Estimated Average Daily Stream Flow

English River, Segment IA 02-IOW-0100_1, Lower Iowa Watershed

Table F-2 shows the estimated average daily stream flow rate using the drainage area ratio method and the adjusted average daily stream flow rate for each of the five flow regimes.

From Table C-6, the aggregate NPDES permitted facilities discharge rate is 11.12 mgd (17.2 cfs).

Table F-2. Adjusted Midpoint Flow Rates for the English River

Flow Condition	High	Moist	Mid-Range	Dry	Low
Midpoint Flow (cfs)	2,858.2	655.7	223.8	59.0	12.2
Adjusted Midpoint Flow (cfs)	2,875.5	672.9	241.0	76.2	29.5

South Fork Iowa River, Segment IA 02-IOW-0280_4, Upper Iowa Watershed
Table F-3 shows the estimated average daily stream flow rate using the drainage area ratio method and the adjusted average daily stream flow rate for each of the five flow regimes.

From Table E-5, the aggregate NPDES permitted facilities discharge rate is 3.1 mgd (4.8 cfs).

Table F-3. Adjusted Midpoint Flow Rates for the South Fork Iowa River

Flow Condition	High	Moist	Mid-Range	Dry	Low
Midpoint Flow (cfs)	425.6	113.8	41.9	8.8	1.4
Adjusted Midpoint Flow (cfs)	430.4	118.6	46.7	13.6	6.2

Drainage Ditch #81, Segment IA 02-IOW-0382_0, Upper Iowa Watershed
Table F-4 shows the estimated average daily stream flow rate using the drainage area ratio method and the adjusted average daily stream flow rate for each of the five flow regimes.

From Table E-17, the aggregate NPDES permitted facilities discharge rate is 0.873 mgd (1.35 cfs).

Table F-4. Adjusted Midpoint Flow Rates for the Drainage Ditch #81

Flow Condition	High	Moist	Mid-Range	Dry	Low
Midpoint Flow (cfs)	75.2	27.0	9.4	3.5	1.3
Adjusted Midpoint Flow (cfs)	76.6	28.3	10.7	4.8	2.7

Appendix G. DNR Project Files and Locations

This appendix is primarily for future reference by DNR staff that may wish to access the original spreadsheets, models, maps, figures, and other files utilized in the development of the TMDL.

Table G-1. Project Files and Locations

Directory\folder path	File name	Description
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Data\Raw	Bacteria Data.XLS	General Summary of all stream segments. Includes tabs with WQ Data for each stream organized by stream segment and data collection site.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Data\Reduced	Various files, File Type: .XLS Example: "0010_1_Flows Iowa River 10580003". This is the stream flow calculation for stream segment IA 02-IOW-0010_1 on the Iowa River. Some files have WQ Data collection location listed which indicates WQ data was only collected at one site on the segment. If no site is listed, WQ data was collected at multiple sites on the stream segment.	Stream Segment Flow Calculation spreadsheets. The flow calculations are organized by HUC-8 watersheds and subdivided by stream and subdivided by stream segment.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Modeling\LDC	Various files, File Type: .XLS Example 1: "LDC _0100_1_English River 10920001". This is the LDC for stream segment IA 02-IOW-0100_1 on the English River, WQ data was collected at STORET site 10920001. Example 2: "LDC _0380_3_East Branch Iowa River". This is the LDC for stream segment IA 02-IOW-0308_3 on the East Branch Iowa River, WQ data was collected at multiple sites along the segment.	Load Duration Curve spreadsheets. The LDC's are organized by HUC-8 watersheds and subdivided by stream within the listed directory.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Modeling\NPDES	Various files, File Type: .XLS Example: "WLA Lower Iowa 07262016". This is the WLA for the Lower Iowa HUC-8 watershed.	Waste Load Allocation spreadsheets. The WLA's are organized by HUC-8 watersheds. .
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Data\Weather	Various files, File Type: .XLS Example: "Precip Lower.XLS". This is precipitation data for the Lower Iowa HUC-8.	Weather Data. 3 separate files exist for each HUC-8 watershed within the Iowa River watershed.

Directory\folder path	File name	Description
\\iowa.gov.state.ia.us\data\DNR_GIS_Data\NASS\National_cropland_data_layer\CDL_2014\03RECODE\Grids. (Location of original file)	cdl2014rc, Raster File	National Crop Land Layer. This was used to generate Land Use Coverage data and statistics.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Data\Land_Use	Combined LandUse.XLS	Land Use Statistics. The spreadsheet has a separate tab for each HUC-8 watershed in the Iowa River watershed.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\GIS\GIS_Data	Various shapefiles (.shp) and raster files (.grd)	Used to develop models and maps.
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Documents, Presentations\References	Various .pdf and .doc files	References cited in the WQIP and/or utilized to develop model input parameters
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\GIS\GIS_Data	Various shapefiles (.shp) and raster files (.grd)	Used to develop models and maps
\\iowa.gov.state.ia.us\data\DNR_WQB_WIS_TMDL\Draft_TMDLs\Iowa_River_Basin\Data	Various Files Various File Formats	Raw data collected from various sources used to develop the report.

Appendix H. Public Comments

From: **Ronn Rickels** <rrickels56@gmail.com>
Date: Fri, Oct 20, 2017 at 6:05 PM
Subject: Water Quality Management Plan for the Iowa River
To: jeff.berckes@dnr.iowa.gov

I attended a public meeting last month in Eldora on the water quality plan for the Iowa River. I live in Iowa Falls and have Iowa River access in my backyard. I do have concerns about the water quality of the river. I have taken time to look at the 300 page report on your website. I find it difficult to understand. The presentation given by DNR was informative, but I felt it was mostly a requirement to be checked off.

It seems there could be a simpler way to share information. I was surprised that there was no comparison over time of what has been happening with the river in the report. I know that it is an impaired waterway. When did it first become impaired? Has it been getting better or worse over the years? I would like a graph to show data over time. I looked at dates given in the 300 page report. Many of the charts did not seem to have current data. Only a few included data as current as 2015. Why is that?

I am requesting a simpler way of reporting data to the public regarding water quality. I would like to see data that shows how the Iowa River is doing over a period of time. What is the goal for acceptable water quality for the Iowa River? When was the Iowa River last considered an unimpaired waterway? How long has it been impaired? Is the Iowa River improving over time or is it getting worse over time?

Thank you for listening to my concerns and questions. Perhaps you can direct me to sources that would answer my questions.

Alene Rickels
19775 Hwy. D20
Iowa Falls, IA 50126
641-373-3230

November 15, 2017

Alene Rickels
19775 Hwy. D20
Iowa Falls, IA 50126

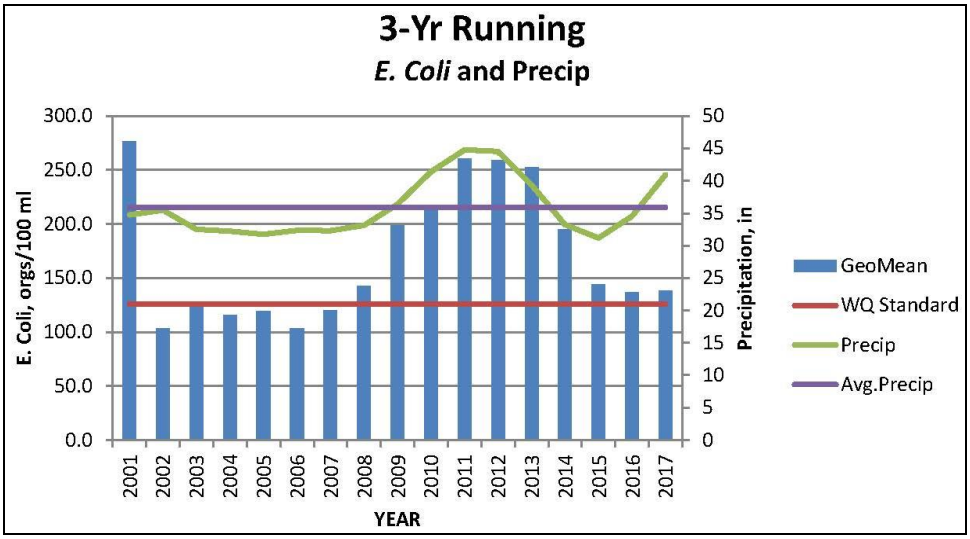
Ms. Rickels,

Thank you for your public comment submitted to the DNR on October 20, 2017 with regards to the Iowa River TMDL. We appreciate the time and effort it took to review the document and craft a comment. We have broken down your comment letter into four major questions / groups of questions and attempt to answer each below to the best of our knowledge and abilities. If you have any further questions, please feel free to contact me for more information.

1. When was the river first impaired / last considered unimpaired? How long has it been impaired?
   The Department of Natural Resources issued the first Impaired Waters List for the state in 1998 using available data to determine impairments. The DNR has issued an updated list every even numbered year since starting in 2002 with the 2016 list currently pending EPA approval. Before that time, the concept of impaired waters was not pursued in Iowa and therefore, it would be impossible to determine just how far back these problems go.

   We do know that the first impairments for bacteria in this watershed showed up on the 2002 impaired waters list for three stream segments (IA 02-IOW-0030_2, IA 02-IOW-0050_1, IA 02-IOW-0070_3). Each subsequent cycle has added additional stream segments and/or tributaries to the impaired waters list for the Iowa River watershed. Currently, 13 of the 25 Iowa River stream segments are impaired for bacteria. The 12 segments not impaired have not been assessed, meaning samples have not been collected and analyzed to determine compliance with water quality standards. Thus, there is still an incomplete picture as to the total extent of bacteria impairments in the basin and additional data analysis may reveal additional impairments.

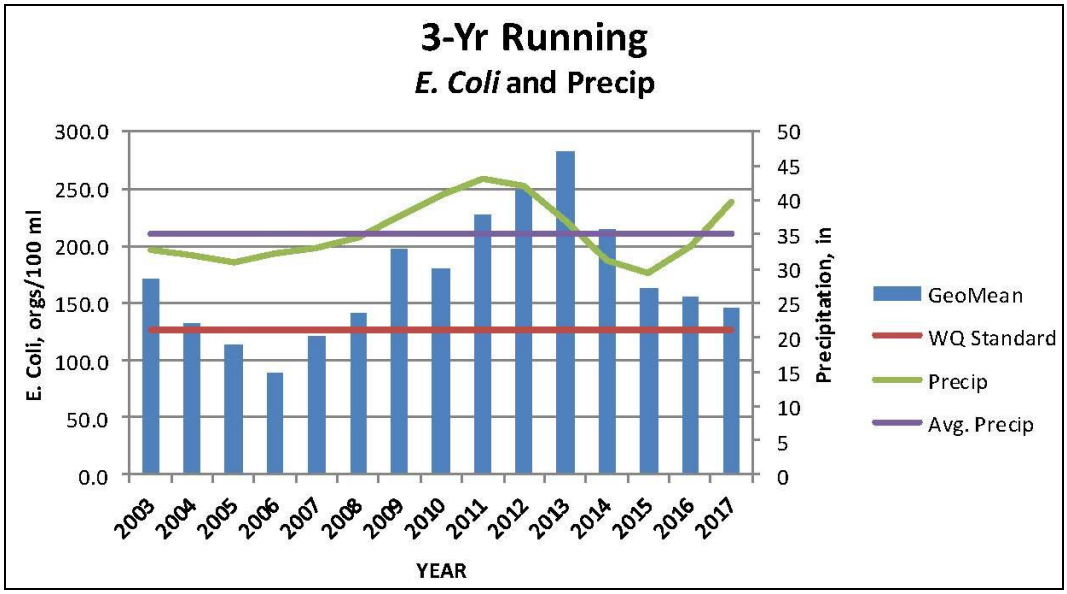
2. I would like a graph to show data over time.
   Below is a graph showing a three year running geometric mean for *E. Coli*, the current water quality standard for *E. Coli* of 126 orgs/ 100ml, three year running precipitation average, and the average precipitation. This graph consists of all *E. Coli* data collected on the Iowa River between the years 1997 and 2017.



3-Year Running *E. Coli* Concentration Geometric Mean and Precipitation Averages from 1997-2017 for the entire Iowa River.

A three year running geometric mean was used because that is the time period used to evaluate the water quality of a water body in accordance with the Methodology for Iowa's Water Quality Assessment, which uses three consecutive years of data beginning with the fourth year prior to the assessment period year. The purpose of this graph is not evaluate the extent of the impairment or the overall water quality of the Iowa River but to show a general trend with regards to the water quality of the Iowa River, which appears to show a good correlation between water quality and precipitation. It is noted that the periods where *E. Coli* concentrations are the highest are generally during periods of high precipitation.

Below is a graph showing water quality overtime for Iowa Stream Segment, IA 02-IOW-0070_3 for *E. Coli*. This segment is approximately 33 miles downstream from the property referenced in the comment letter and is the closest downstream segment on the Iowa River to that property. This stream segment was added to the Impaired Waters List during the 2002 assessment cycle.



3-Year Running E. Coli Concentration Geometric Mean and Precipitation Averages from 1999-2017 for Iowa River Segment, IA 02-IOW-0070_3.

From this graph it can be seen that water quality varies from year to year with there being some correlation between precipitation and water quality. Water bodies are placed on the Impaired Waters List if sampling results show that the pollutant exceeds the state water quality standards and when the sampling is done in accordance with the Methodology for Iowa's Water Quality Assessment. The ultimate goal would be to remove the impaired water body from the Impaired Waters List. To remove a water body from the Impaired Waters List sampling results must show that the geometric mean levels of *E. Coli* are less than the applicable state water quality criterion for two consecutive listing cycles in accordance with Methodology for Iowa's Water Quality Assessment. Assessment cycles occur during even numbered years.

3. Many of the charts did not seem to have current data. Only a few included data as current as 2015. Why is that?
   The DNR will use all credible data over an appropriate amount of time to analyze the waterbody. Out of all of the monitoring sites used for this report, only a few sites are sampled on a monthly basis. All other data collection sites have either been phased out or were the result of a short-term monitoring project. Because of a reduction of funds dedicated to monitoring, fewer sites are maintained, resulting in less data to analyze.

   Additionally, this project was based off of the draft 2016 impaired waters list that used data only as current as 2015 for assessment purposes. Any data more recent than that was collected after the project started and/or has not been analyzed yet.

4. What is the goal for acceptable water quality for the Iowa River?

The goal for acceptable water quality for a stream designated for Primary Contact Recreational Use during the recreational season of March 15 – November 15 is an *E. Coli* concentration of 126 orgs/100 ml as required by the Iowa Administrative Code (IAC) 567-61.3(3).

As mentioned earlier, to be removed from the 303d list the results of sampling must show that the geometric mean levels of *E. Coli* are less than the applicable state water quality standard for two consecutive listing cycles in accordance with Methodology for Iowa's Water Quality Assessment. With assessment cycles occur during even numbered years.

Again, thank you for your time and interest in the Iowa River TMDL. Please let us know if we can provide additional information.

Sincerely,

Jeff Berckes