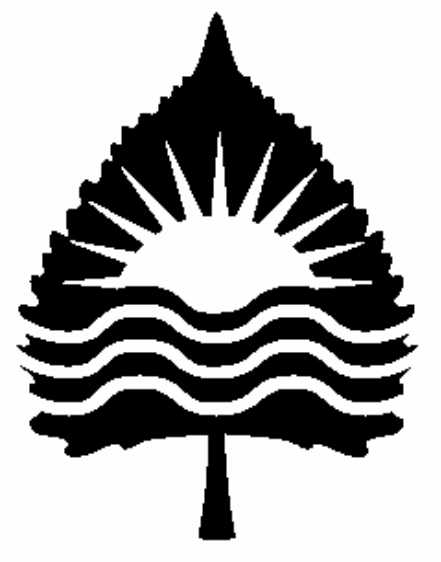


Total Maximum Daily Loads
For the
Nemaha River Basin

(NE1-10000, NE2-10000, NE2-10600, NE2-12100, NE2-12130 NE2-12200, NE2-12330, NE2-12500 and NE3-10000)

Parameters of Concern: *E. coli* and Atrazine (NE2-10000 only)

Nebraska Department of Environmental Quality
Planning Unit, Water Quality Division

June 2007

Table of Contents

Table of Contents – Continued

List of Figures and Tables

List of Figures and Tables - continued

Executive Summary

Eight segments in the Nemaha River Basin were included in the 2006 Nebraska Surface Water Quality Integrated Report (NDEQ 2006c) in Category 5 as impaired by excessive atrazine, *E.* coli, low dissolved oxygen and having impaired biological communities. As such, total maximum daily loads must be developed in accordance with the Clean Water Act. Recently, the primary contact recreation beneficial use was added to additional segments in the basin. Data from these segments indicate three of the waterbodies are impaired and will be included on the 2008 Integrated Report. Rather than delay preparation of the TMDLs until the listing, these two segments have been included.

TMDLs will not be prepared to address the impaired biological communities as these procedures for development of this type of TMDL has not been completed. Also, low dissolved oxygen in the waterbody in question appears to be a function or flow rather than a pollutant and thus no TMDL will be developed.

The information contained herein should be considered ten TMDLs. These TMDLs have been prepared to comply with the current (1992) regulations found at 40 CFR Part 130.7.

1. Name and geographic location of the impaired waterbody for which the TMDLs are being developed.
Nemaha River Basin: NE1-10000, NE2-10000, NE2-10600, NE2-12100, NE2-12130, NE2-12200, NE2-12330, NE2-12500 and NE3-10000.

2. Identification of the pollutant and applicable water quality standard
The pollutants causing the impairment(s) of the water quality standards and designated beneficial uses (for which TMDLs will be developed) are atrazine and *E. coli*. Designated uses assigned to the above-identified segments include: primary contact recreation, aquatic life Warmwater class A and B, agriculture, public drinking and industrial water supplies class A and aesthetics (NDEQ 2006b). Excessive atrazine and *E. coli* have been determined to be impairing the aquatic life and primary contact recreation beneficial uses, respectively.

3. Quantification of the pollutant load that may be present in the waterbody and still allows attainment and maintenance of the water quality standards.
The allowable pollutant load is based upon the available stream flow volume. That is, loading capacities are developed for each flow by multiplying the water quality standard (WQS) by the selected stream flow and a conversion factor (C) with the equation being:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

4. Quantification of the amount or degree by which the current pollutant load in the waterbody, including upstream sources that is being accounted for as background loading deviates from the pollutant load needed to attain and maintain water quality standards.
Assessment of May-June atrazine data for segment NE2-10000 indicates 5of 22 values exceed the applicable criteria. The deviation from the *E. coli* criteria is presented in the table below.

Segment	#/100 ml Above WQS
NE1-10000	90
NE2-10000	20
NE2-10600	3
NE2-12100	111
NE2-12130	996
NE2-12200	374
NE2-12330	710
NE2-12500	358
NE3-10000	1120

5. Identification of the pollutant source categories.

Both point and nonpoint sources (including natural sources) have been identified to be contributing to the *E. coli* loads being delivered to the Nemaha River Basin segments. The entire atrazine pollutant source has been determined to originate from nonpoint sources.

6. Wasteload allocations for pollutants from point sources.

For *E. coli* the wasteload allocations for point source discharges will be equivalent to the water quality criteria associated with the primary contact recreation beneficial use – a geometric mean of 126/100 ml. The wasteload allocation for atrazine will be zero (0).

7. Load allocations for pollutants from nonpoint sources.

The load allocations assigned to this atrazine TMDL will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * C_s * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
C_s = seasonal atrazine criteria
C = conversion factor

The load allocations assigned to the *E coli* TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

The load allocation assigned to the atrazine TMDL will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 12\ \mu g/l * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
12 µg/l = applicable/target water quality criteria for atrazine from Title 117
C = conversion factor

8 A margin of safety.

This TMDL contain an implicit and explicit margin of safety. For *E. coli* the targeted reduction will focus on achieving 90% of the water quality target (≤113/100 ml). The reduction necessary to support the beneficial use will be set at 60% whereas only a 45% reduction is needed to meet full support status. Also, implementation of controls will result in year-round protection of water quality. This will be important should application practices change in the future.

9. Consideration for seasonal variation.

For *E. coli* the water quality criteria are only applicable during the Title 117 defined recreation season that starts May 1 and ends September 30. Because of this, the water quality and stream volume data was limited to this time period.

For atrazine, assessment and analysis of the data, as well as the TMDL was based on the May-June timeframe when atrazine application generally occurs and deviations from the water quality criteria have been observed.

10. Allowances for reasonably foreseeable increases in pollutant loads.

There was no allowance for future growth included in this TMDL.

11. Implementation Plan

Implementation of the reductions for *E. coli* will be carried out through a combination of regulatory and non-regulatory activities. Point sources will be regulated under the auspice of the National Pollutant Discharge Elimination System and the Rules and Regulations Pertaining to Livestock Waste Control. Nonpoint source pollution will be addressed using available programs, technical advice, information and educations and financial incentives such as cost share.

The lead agency for pesticides and water quality issues in Nebraska is the Department of Agriculture (NDA). Implementation of the reductions for atrazine will be coordinated with the NDA.

This TMDL included in the following text can be considered a "phased TMDL" and as such are an iterative approach to managing water quality based on the feedback mechanism of implementing a required monitoring plan that will determine the adequacy of load reductions to meet water quality standards and revision of the TMDL in the future if necessary. A description of the future monitoring (Section 4.0) that is planned has been included.

Monitoring is essential to all TMDLs in order to:

- Assess the future beneficial use status;
- Determine if the water quality is improving, degrading or remaining status quo;
- Evaluate the effectiveness of implemented best management practices.

The additional data collected should be used to determine if the implemented TMDL has been or is effective in addressing the identified water quality impairments. As well the data and information can be used to determine if the TMDLs have accurately identified the required components (i.e. loading capacity, load allocations, etc.) and if revisions are appropriate.

1.0 Introduction

Eight segments within the Nemaha River basin were listed in Category 5 of the 2006 Nebraska Surface Water Quality Integrated Report (Integrated Report) (NDEQ 2006c). Category 5 waterbodies are deemed impaired and in need of a TMDL. Data collected in 2004 indicate the primary contact recreation beneficial use is impaired in six segments with the pollutant of concern being *E. coli* bacteria and the aquatic life beneficial use is impaired on four segments with the pollutants of concern being atrazine, dissolved oxygen and unknown pollutants. In 2005, the NDEQ added the primary contact recreation beneficial used to several waterbodies, Muddy Creek (NE2-10600), Turkey Creek (NE2-12130) and the North Fork Big Nemaha River (NE2-12200). Assessment of the data collected from Muddy Creek, Turkey Creek and the North Fork Big Nemaha River in 2004 does indicate each waterbody exceeded the applicable criteria and should be included on Category 5 of the 2008 Integrated Report. Rather than delay the preparation of the TMDLs until the listing, both TMDLs will be included in this document.

Table 1 below provides information of the 2006 Integrated Report assessments for all of the segments in the Nemaha River basin, including the additional streams designated with the primary contact recreation beneficial use.

Table 1. 2006 Integrated Report Status for Waters in Nemaha Basin

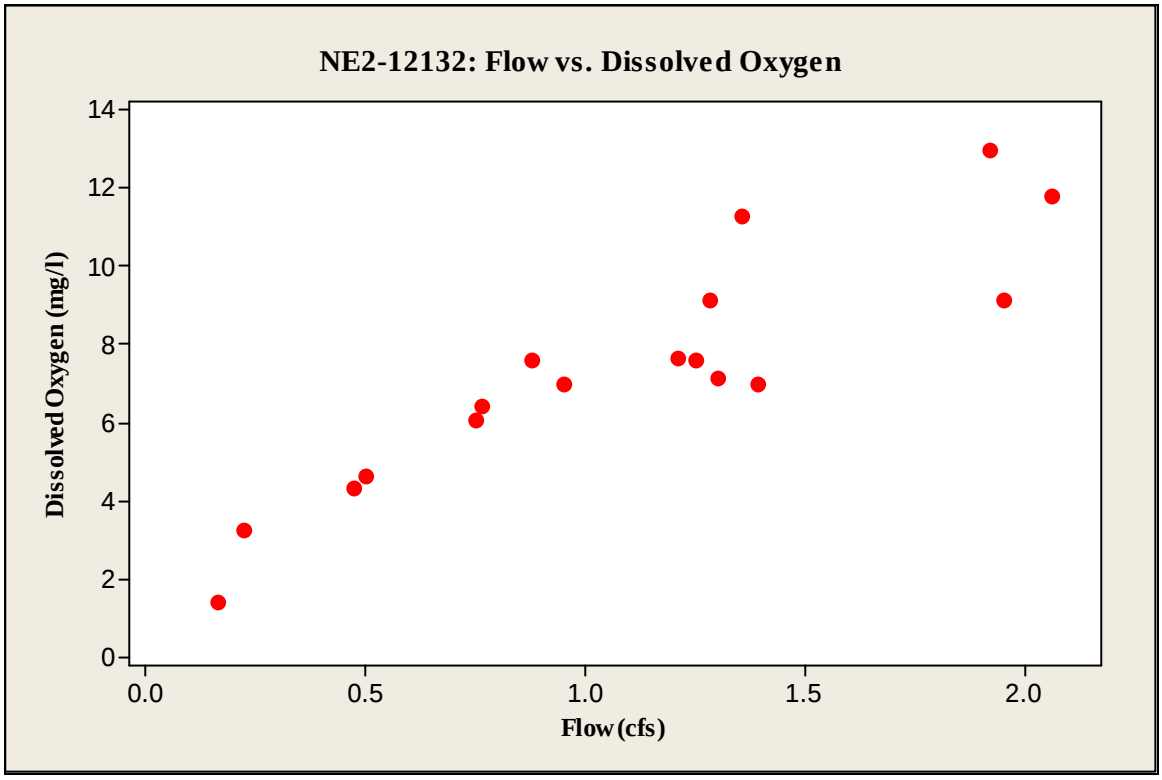
Segment	Waterbody Name	2006 Integrated Report Status	Parameters of Concern
NE1-10000	Missouri River	Category 5	*E. coli*, PCBs and Dieldrin
NE1-13400	Ervine Creek	Category 5	Impaired biological community
NE2-10000	Big Nemaha River	Category 5	*E. coli* and Atrazine
NE2-10600	Muddy Creek	Category 2[1]	*E. coli*
NE2-12100	South Fork Big Nemaha River	Category 5	*E. coli*
NE2-12130	Turkey Creek	Category 2[1]	*E. coli*
NE2-12132	Johnson Creek	Category 5	Dissolved Oxygen
NE2-12200	North Fork Big Nemaha River	Category 2[1]	*E. coli*
NE2-12330	Long Branch Creek	Category 5	*E. coli* and Impaired biological community
NE2-12500	North Fork Big Nemaha River	Category 5	*E. coli*
NE3-10000	Little Nemaha River	Category 5	*E. coli*

[1]Assessment of the available *E. coli* data for the segment was not conducted for the 2006 Integrated Report because the primary contact recreation beneficial use had not been assigned. Following submission of the Integrated Report to EPA Region 7, approval of the designation by the Governor was received. Assessment of the data yields an impaired status.

During the 2006 reporting cycle, the Department included the results biological assessments using a suite of metrics and a comparison to a "reference" condition. At this time the procedures for developing TMDLs for impaired biological communities are nonexistent. Until this process has been completed, the aquatic life TMDLs for the impaired biological communities will not be pursued.

In regards to segment NE2-12132: Johnson Creek, the impairment of aquatic life was the result of low dissolved oxygen. A review of the data indicated Johnson Creek went dry during the monitoring period and an assessment (figure 1) shows the correlation of dissolved oxygen measurement to flow to be 0.91. It appears the low dissolved oxygen is more a function of stream flow than a pollutant. Therefore, a recommendation will be made to relocated Johnson Creek to Category 4C of the 2008 Integrated Report.

Figure 1. Johnson Creek Stream Flow and Dissolved Oxygen Scatter Plot



In 2004, Nebraska prepared a document supporting a category 4b listing for all waters with impairments due to PCBs and Dieldrin in fish tissue. The issue remains unresolved with EPA Region 7. At this time no TMDL will be prepared for PCBs or Dieldrin.

Based on the above, and as required by Section 303(d) of the Clean Water Act and 40 CFR Part 130, TMDLs have been developed for the impaired waters in the Nemaha River Basin identified in Category 5 of the 2006 Nebraska Integrated Report as being impaired by excessive *E. coli* bacteria as well as those that will be deemed impaired in the 2008 Integrated Report. Also, the atrazine TMDL for segment NE2-10000 will be included. The approach for these TMDLs will be to address all of the identified waterbodies simultaneously or as a watershed. Based upon this, the information contain herein should be considered ten TMDLs (nine *E. coli* and one atrazine).

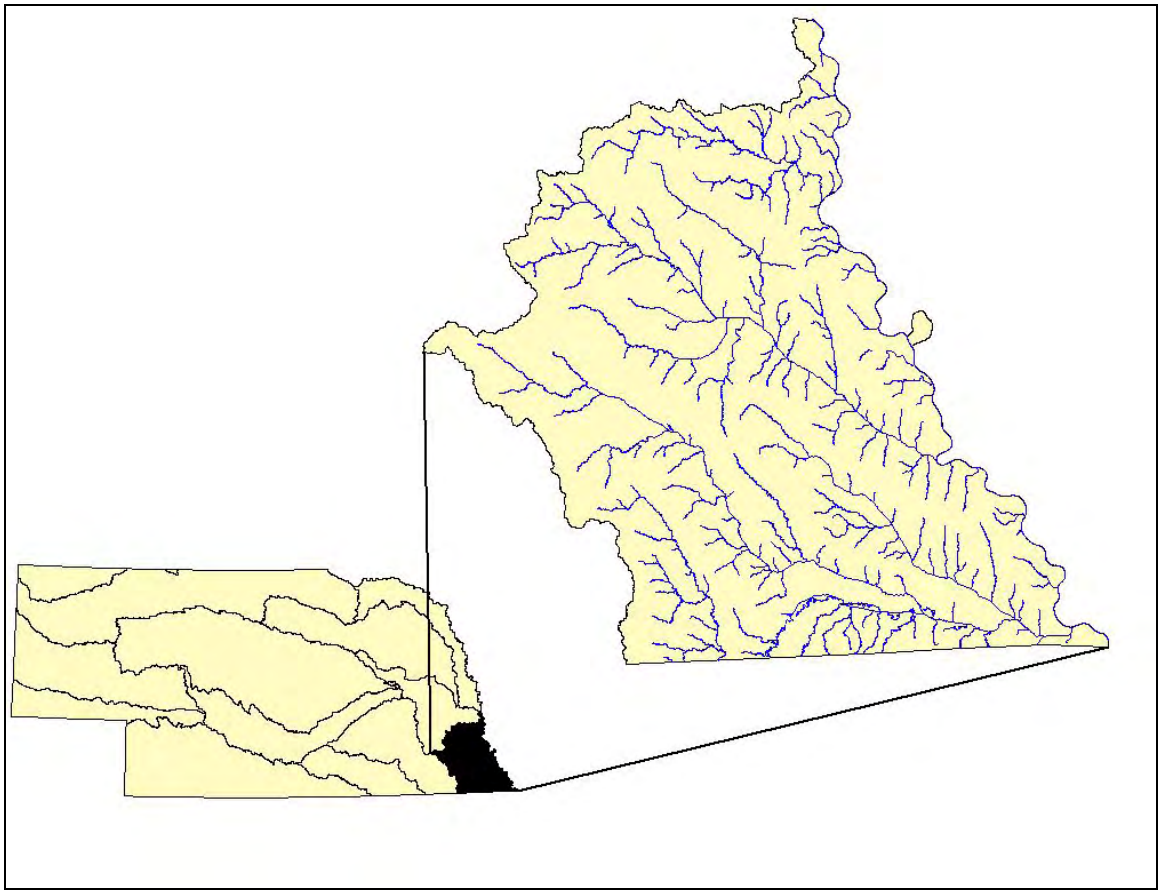
1.1 Background Information

The Nemaha River Basin located in southeast Nebraska (Figure 1.1) and consists of the segment of the Missouri River from the confluence of the Platte River to the State line and the Big and Little Nemaha Rivers and all tributaries. Stream flow in the basin is a function of surface run-off and groundwater contributions. Several municipalities reside in the basin ranging from a first class city to villages.

1.1.1 Waterbody Description

1.1.1.1 Waterbody Names and Stream Identification Numbers: The waterbodies for which TMDLs are being prepared are: Missouri River – NE1-10000, Big Nemaha River – NE2-10000, Muddy Creek – NE2-10600, South Fork Big Nemaha River – NE2-12100, Turkey Creek – NE2-12130, North Fork Big Nemaha River – NE2-12200, Long Branch Creek – NE2-12330, North Fork Big Nemaha River – NE2-12500 and Little Nemaha River – NE3-10000.

Figure 1.1 Location of the Nemaha River Basin



1.1.1.2 Major River Basin: Missouri

1.1.1.3 Minor River Basin: Nemaha

1.1.1.4 Hydrologic Unit Codes: 10240001, 10240005, 10240006, 10240007 and 10240008

1.1.1.5 Assigned Beneficial Uses: Source Title 117 Nebraska Surface Water Quality Standards (Title 117)

Segment	Primary Contact Recreation	Aquatic Life Use	Water Supply	Aesthetics	Key Aquatic Species
NE1-10000	Yes	Warmwater A	Agriculture A Public Drinking, Industrial	Yes	Title 117: 1,2,18, b, h, i, j
NE2-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i, j
NE2-10600	Yes	Warmwater A	Agriculture A	Yes	Title 117: i, j
NE2-12100	Yes	Warmwater A	Agriculture A	Yes	Title 117: i, j
NE2-12130	Yes	Warmwater A	Agriculture A	Yes	Title 117: i,
NE2-12200	Yes	Warmwater A	Agriculture A	Yes	Title 117: i, j
NE2-12330	Yes	Warmwater A	Agriculture A	Yes	Title 117: i
NE2-12500	Yes	Warmwater A	Agriculture A	Yes	Title 117: i,
NE3-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i, j

Table 1.1.1.5 Title 117 Key Aquatic Species

Species Code	Common Name	Species Code	Common Name
1	Lake sturgeon	c	Brook trout
2	Pallid sturgeon	d	Brown trout
3	Northern redbelly dace	e	Rainbow trout
4	Pearl dace	f	Northern pike
5	Finescale dace	g	Muskellunge
6	Blacknose shiner	h	Blue catfish
7	Lake chub	i	Channel catfish
8	Brook Stickleback	j	Flathead catfish
9	Iowa darter	k	Striped bass
10	Johnny darter	l	White bass
11	Orangethroat darter	m	Rock bass
12	Blacknose dace	n	Largemouth bass
13	Grass pickerel	o	Smallmouth bass
14	Pumpkinseed	p	Spotted bass
15	Golden shiner	q	Redear sunfish
16	Common shiner	r	Bluegill
17	Topeka shiner	s	Black crappie
18	Sturgeon chub	t	White crappie
19	Scaleshell mussel	u	Yellow perch
a	Shovelnose sturgeon	v	Sauger
b	Paddlefish	w	Walleye

1.1.1.6 Major Tributaries: Weeping Water Creek, Muddy Creek, Turkey Creek, Rock Creek and South Fork Little Nemaha River.

Table 1.1 Physical Description of the Nemaha River Basin

Parameter	Nemaha River Basin
State	Nebraska
Counties (whole or in part)	Cass, Gage, Johnson, Lancaster, Nemaha Otoe, Pawnee and Richardson
Watershed Area	2,770 mi^2
Sub-basins	3
Designated Stream Segments	326
Stream Miles (designated)	1,747 miles

1.1.2 Watershed Characteristics

1.1.2.1 Physical Features: The Nemaha River Basin watershed encompasses approximately 2,770 mi^2 in the southeast portion of the state. The basin includes a segment of the Missouri River from the confluence of the Missouri and Platte Rivers to the State line as well as the Big and Little Nemaha Rivers and tributaries. The entire basin is included in the Western Corn Belt Plains ecoregion (Chapman, et. al. 2001). Drainage in the basin is generally east and southeast. Agriculture is the major land use with approximately 95% of the acres being classified as agricultural lands. Limitations such as slope provide challenges for crop production (NNRC 1976).

The basin is located entirely within the glaciated portion of the State with loess soils lying on glacial deposits. The result is land surface of rolling hills, which descend to flat valleys of the major streams. Many of the steeper slopes in the basin are wooded particularly along the steep bluffs bordering the Missouri River valley (NNRC 1976).

1.1.2.2 Climate: Precipitation ranges from an annual average of 32 inches in the northwestern portion of the basin to approximately 35 inches near Falls City in the southeast corner of the basin. Typically, a majority of the precipitation occurs during the spring and early summer. Temperatures in the basin range from an average high in the 80's during the summer to average lows in the 10's during the winter (High Plains Regional Climate Center Database).

1.1.2.3 Demographics: Fifty-two municipal communities reside in the Nemaha River basin boundaries and range from first class cities to villages. Some of the larger communities include: Nebraska City – population 7,228, Falls City – population 4,671, Syracuse – population 1,764 and Tecumseh – population 1,722. Along with the municipal governments, several cluster developments lies in the basin with or without formal governing bodies.

1.1.2.4 Land Use: Much of the basin is devoted to agricultural purposes. While much of the basin and the soils are considered irrigable, only about 15% are considered well suited for irrigation. The remaining lands have limitations and provide only limited suitability for irrigation. Tall grass prairie and eastern deciduous forest are the native vegetation types.

The mineral resources of the basin include sand and gravel, limestone and oil. There are several limestone quarries, mostly in the northern portion and the first oil field to be developed was in Richardson County (NNRC 1976).

2.0 *E. coli* TMDL

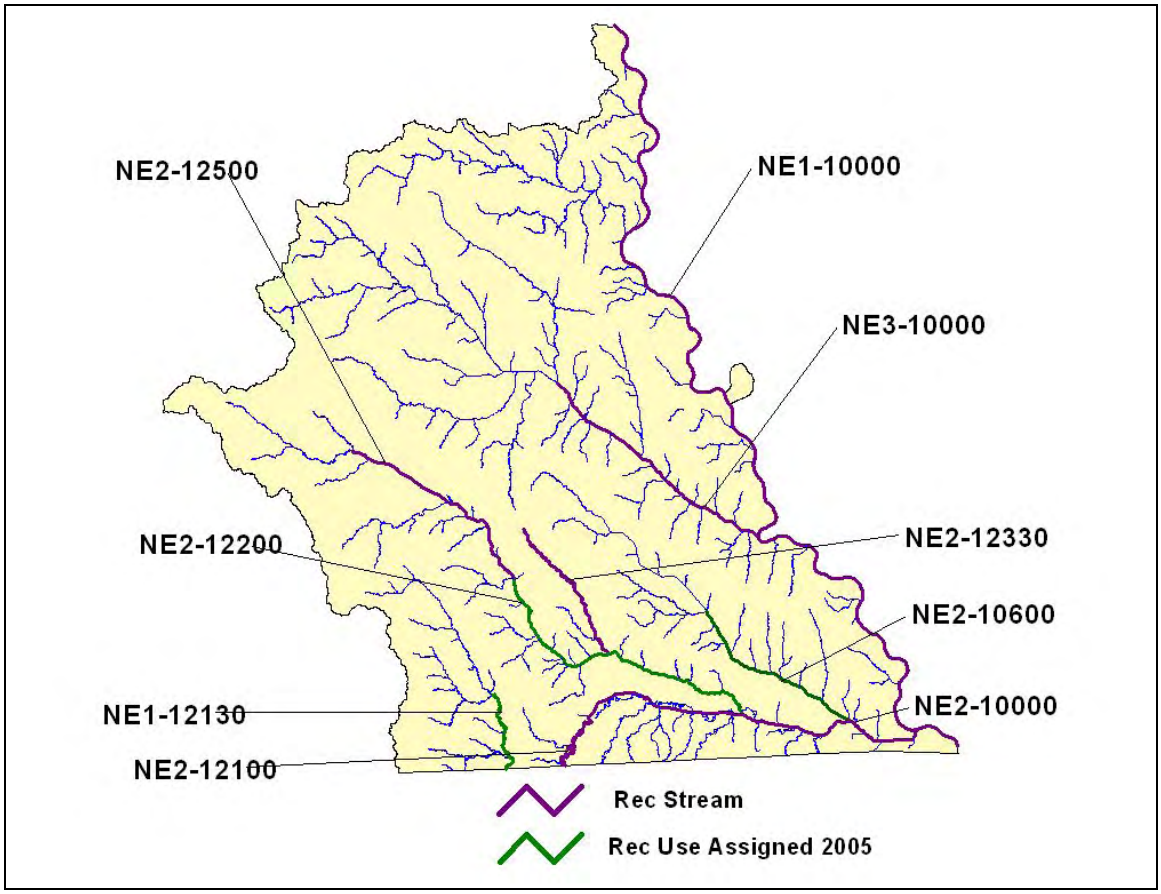
2.1 Problem Identification

Segments NE1-10000, NE2-10000, NE2-12100, NE2- 12330, NE2-12500 and NE3-10000 were included in Category 5 of the 2006 Integrated Report as having an impaired primary contact recreation beneficial use with the parameter of concern being *E. coli* bacteria. Recently, the primary contact recreation beneficial use was assigned to segments NE2-10600, NE2-12130 and NE2-12200. *E* coli data from these segments indicates the use is not being met. This section deals with the extent and nature of the water quality impairments caused by excessive *E. coli* bacteria in the Nemaha River Basin.

2.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Primary Contact Recreation beneficial use has been deemed impaired on the above-identified segments. The Primary Contact Recreation beneficial use applies to surface waters which are used or have the potential to be used for primary contact recreation that includes activities where the body may come into prolonged or intimate contact with the water such that water may be accidentally ingested or sensitive body organs (e.g. eyes, ears, nose) may be exposed (NDEQ 2006a). Stream segments assign the primary contact recreation use for which these TMDLs are being developed are found in figure 2.1.1.

Figure 2.1.1 Nemaha TMDL Streams Assigned the Primary Contact Recreation Beneficial Use



2.1.1 Data Sources

The Nebraska Department of Environmental Quality (NDEQ) monitors surface waters based upon a rotating basin scheme, whereby monitoring is limited to two or three river basins each year with all 13 basins being (partially) examined in a five year period. Under the auspice of the rotating basin plan, data was collected from the Nemaha River Basin in 2004. Data collected in 2004 included stream flow (volume) information and will be used for these TMDLs. Stream flow data and information were obtained from the United States Geological Survey (USGS) and Nebraska Department of Natural Resources (NDNR) who operates the monitoring gages. Where long-term data was lacking, field measurements and extrapolations were used to develop hydrographs.

During the triennial review of Title 117 – Nebraska Surface Water Quality Standards (Title 117), conducted in 2005, removed fecal coliform as a Title 117 parameter for assessing the primary contact recreation in the future.

E. coli will be the sole parameter for assessing the recreation use and the advances of analytical techniques; fecal coliform data was not obtained during 2004. Because fecal coliform will be removed as criteria in the future, these TMDLs will focus on the attainment of the primary contact recreation beneficial use, using only *E. coli*.

2.1.2 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5/impaired waters for the 2006 Integrated Report. The procedures are based on the application of the "binomial distribution" method that applies a confidence interval to the exceedance rate in an effort to determine the true exceedance of the waterbody versus the data set. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development the 2004 Integrated Report for Nebraska*, October 2003.

The details of the assessment process to determine the use support of the Primary Contact Recreation beneficial use can be found in table 2.1.3

Table 2.1.3 Assessment of the Primary Contact Recreation Beneficial Use Using *E. coli* Bacteria Data

Parameter	Season Geometric Mean	Supported	Impaired
E. coli	≤126/100 ml	Season geometric mean ≤126/100 ml	Season geometric mean >126/100 ml

2.1.4 Water Quality Conditions

E. coli data collected during the 2004 recreation season (May 1 through September 30) was assessed to determine the beneficial use support for primary contact recreation. Table 2.1.4 presents this information.

Table 2.1.4 Nemaha River Basin – 2004 *E. coli* Data and Assessments – Category 5 Waterbodies

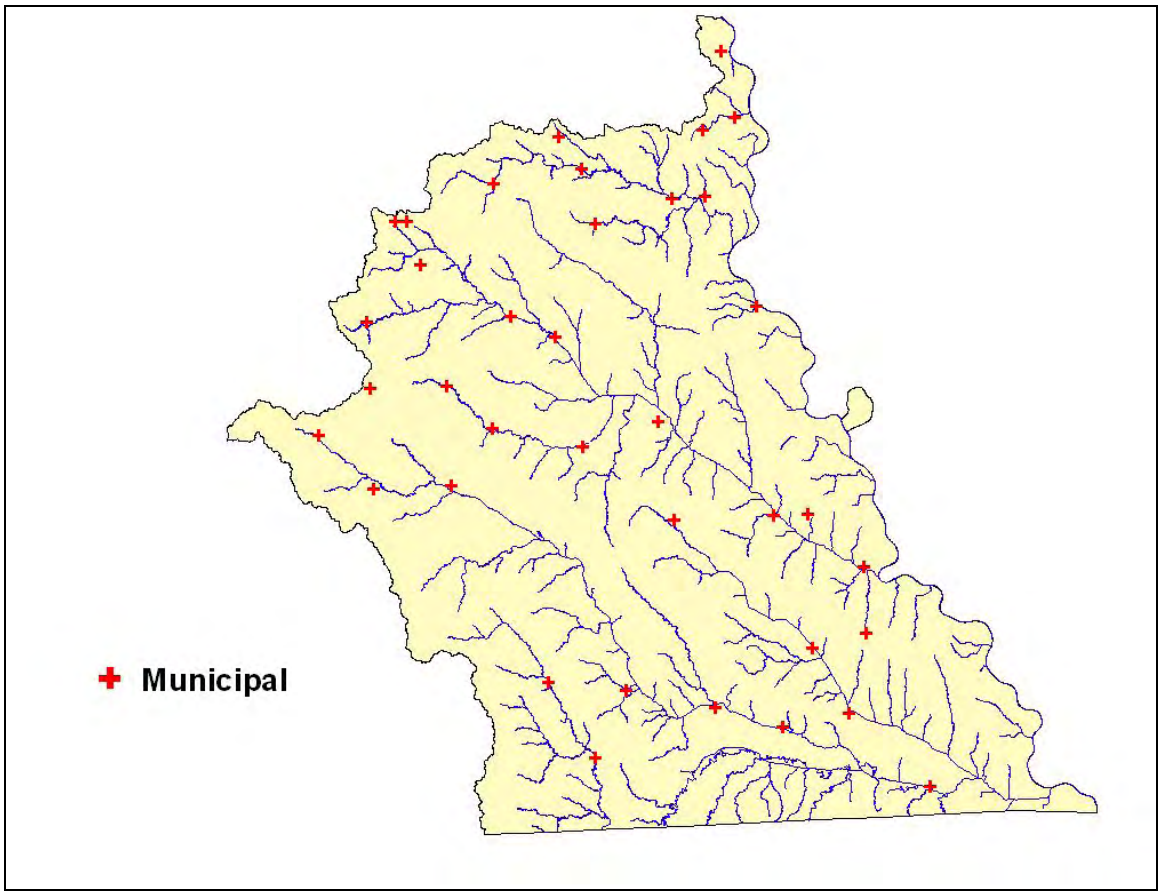
Segment	Site Location	USGS/DNR Gage Associated with Site	Number of Samples	Season Geometric Mean (#/100 ml)
NE1-10000	Missouri River @ Rulo	06813500	22	216
NE2-10000	Big Nemaha River @ Falls City	06815000	22	146
NE2-10600	Muddy Creek @ Verdon	None	22	129
NE2-12100	South Fork Big Nemaha River @ DuBois	None	21	237
NE2-12130	Turkey Creek @ Pawnee City	None	21	1122
NE2-12200	North Fork Big Nemaha River @ Humboldt	06814500	21	500
NE2-12330	Long Branch Creek @ Humboldt	None	21	836
NE2-12500	North Fork Big Nemaha River @ Tecumseh	None	21	484
NE3-10000	Little Nemaha River @ Auburn	06811500	22	1246

2.1.5 Potential Pollutant Sources

2.1.5.1 Point Sources: Point sources discharge or have the potential to discharge to waters in the Nemaha River basin. Facility types include: municipal wastewater treatment facilities and industrial facilities. The facilities that have been issued a National Pollutant Discharge Elimination System Permit (according to EPA's Permit Compliance System) in the Nemaha River Basin are shown in Figure 2.1.5.1a.

Illicit connections, discharges, combined sewer overflows; sanitary sewer overflows, straight pipes from septic tanks or other on-site wastewater systems can also be sources of *E. coli* bacteria.

Figure 2.1.5.1a NPDES Permitted Facilities in the Nemaha River Basin

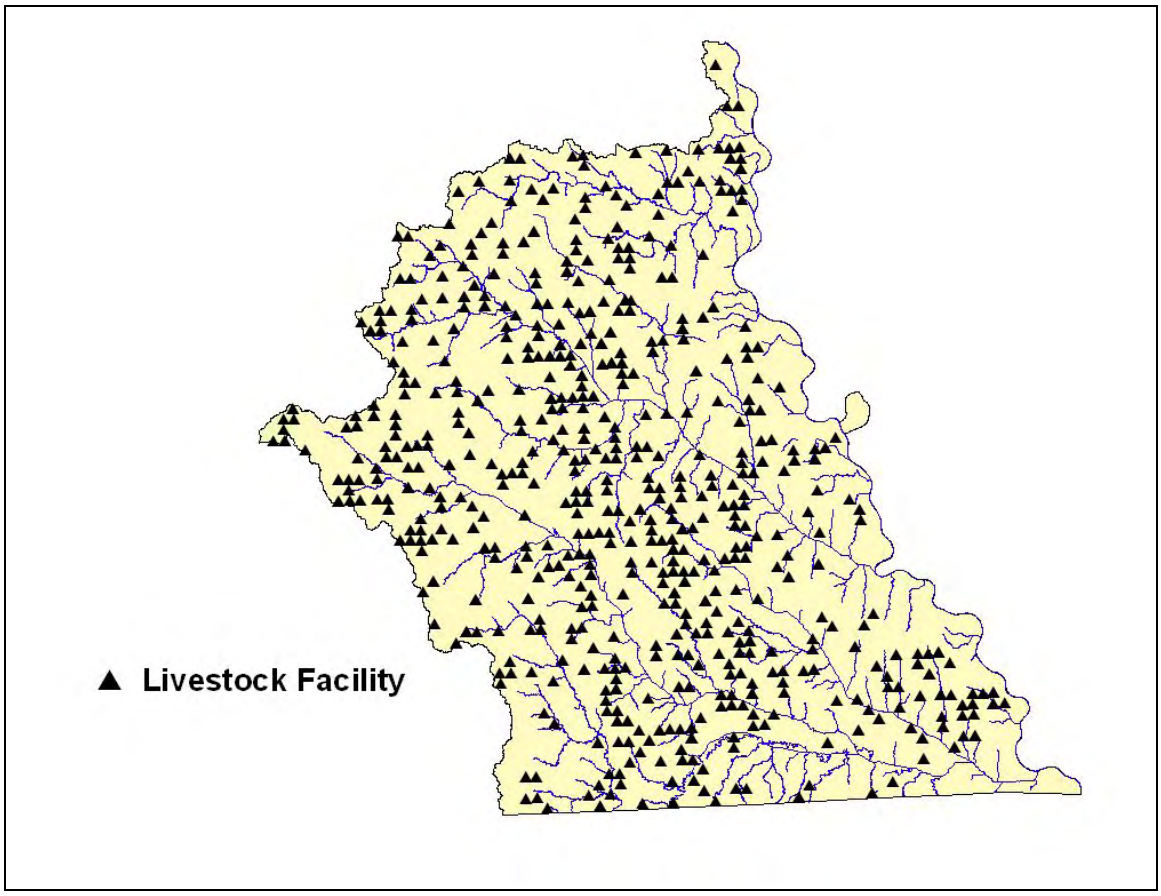


Animal feeding operations that have been issued State of Nebraska permits, required for construction and operation of livestock waste control facilities (LWCF) if the operation has discharged, or has the potential to discharge, livestock waste to waters of the State are also considered potential sources. Figure 2.1.5.1b shows the facilities within the Nemaha River Basin that have been issued or requested a permit. These facilities are designed to contain any run-off that is generated by storm events that are less in intensity than the 25 year, 24-hour rainfall.

2.1.5.2 Nonpoint Sources: Several nonpoint sources of *E. coli* exist in the Nemaha River Basin. These sources include: failing septic tanks or other on-site wastewater systems, run-off from livestock pastures, improper or over-application of biosolids (wastewater treatment facility sludge, septage or manure) and urban stormwater runoff not regulated by an NPDES permit.

2.1.5.3 Natural Sources: The primary natural source of *E. coli* is wildlife. A variety of wildlife is native to or have adapted to the diverse habitat of the Nemaha River Basin. Big game, upland game, furbearers, waterfowl and non-game species have been documented to reside within the basin.

Figure 2.1.5.1b Animal Feeding Operations in the Nemaha River Basin Issued or Requesting a State Construction or Operating Permit or Requesting an Inspection



2.2 TMDL Endpoint

The endpoint for these TMDLs will be based on the numeric criteria associated with the Primary Contact Recreation beneficial use.

2.2.1 Numeric Water Quality Criteria

Water quality criteria established for the protection of the Primary Contact Recreation beneficial use can be found in Title 117, Chapter 4 and are as follows:

E. coli
E. coli bacteria shall not exceed a geometric mean of 126/100 ml. For increased confidence of the criteria, the geometric mean should be based on a minimum of five samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines. The following single sample maxima shall be used solely for issuing periodic public advisories regarding use of waterbodies for Primary Contact Recreation.

235/100 ml at designated bathing beaches
298/100 ml at moderately used recreational waters
406/100 ml at lightly used recreation al waters
576/100 ml at infrequently used recreational waters

The November 16, 2004 Federal Register (Volume 69, No. 220) contained information regarding the final rule for "Water Quality Standards for Costal and Great Lakes Recreational Waters". This rule includes a discussion on the use of the single season maximum (SSM). Specifically:

"EPA expects that the single season maximum values would be used for making beach notification and closure decisions. EPA recognizes however that States and Territories also use criteria in their water quality standards for other purposes under the Clean Water Act in order to protect and improve water quality. Other than in the beach notification and closure decision context, the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation and more directly linked to the underlying studies on which the 1986 criteria were based.

Given this discussion and recommendation regarding the use of single season maximum in TMDLs and waterbody assessments, these TMDLs will focus on meeting the *E. coli* recreation season geometric mean of 126/100 ml.

2.2.2 Selection of Critical Environmental Conditions

The water quality criteria associated with the Primary Contact Recreation beneficial use only applies from May 1 through September 30. Therefore, the critical conditions for these TMDLs will be those occurring from May 1 through September 30.

2.2.3 Waterbody Pollutant Loading Capacity

Defining waterbody pollutant loading capacity implies a steady state. These TMDLs recognize loadings are dynamic and can vary with stream flow. As well, the above section indicates a wide range of environmental conditions that must be accounted for.

The method chosen to account for the variation in flow is based upon a load duration (TMDL) curve. TMDL curves are initiated by the development a stream's hydrograph using the long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values by the water quality standard (WQS) and a conversion factor (C). The acceptable "load" is then plotted graphically.

Therefore, the loading capacity for each of the segments will be defined by:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

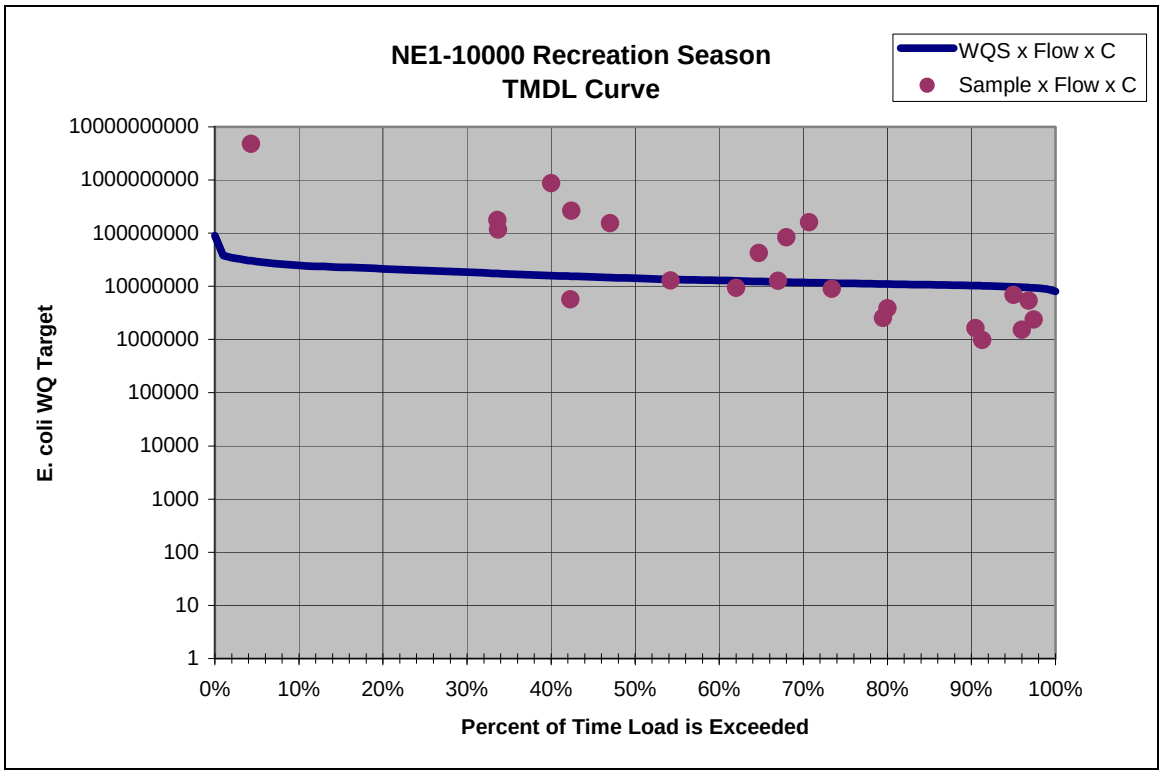
2.3 Pollutant Source Assessment

For these TMDLs the source loading is based upon the position of the monitoring data points in relation to the boundary established on the TMDL curve between point source and nonpoint source influences. This process for selecting the load point is described in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology (NDEQ 2002d). In the situation where a boundary has not been included on a TMDL curve, the information indicates no point source facilities discharge to the contributing watershed. For these waterbodies, the pollutant will be considered derived from nonpoint and natural sources.

2.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the TMDL curves (Figure 2.3.1a through 2.3.1i) provided for each of the segments where a TMDL is being developed. The points plotted above the acceptable loading indicate a deviance from the water quality criteria.

Figure 2.3.1a. TMDL Curve for NE1-10000



2.3.2 Deviation from Acceptable Pollutant Loading Capacity

Table 2.3.2 describes the deviation from the acceptable water quality standards based upon the 2004 *E. coli* monitoring information.

Table 2.3.2 Deviation From the Applicable Water Quality Criteria

Segment	Observed Season Geometric Mean (#/100 ml)	#/100 ml Above WQS
NE1-10000	216	90
NE2-10000	146	20
NE2-10600	129	3
NE2-12100	237	111
NE2-12130	1122	996
NE2-12200	500	374
NE2-12330	836	710
NE2-12500	484	358
NE3-10000	1246	1120

Figure 2.3.1b. TMDL Curve for NE2-10000

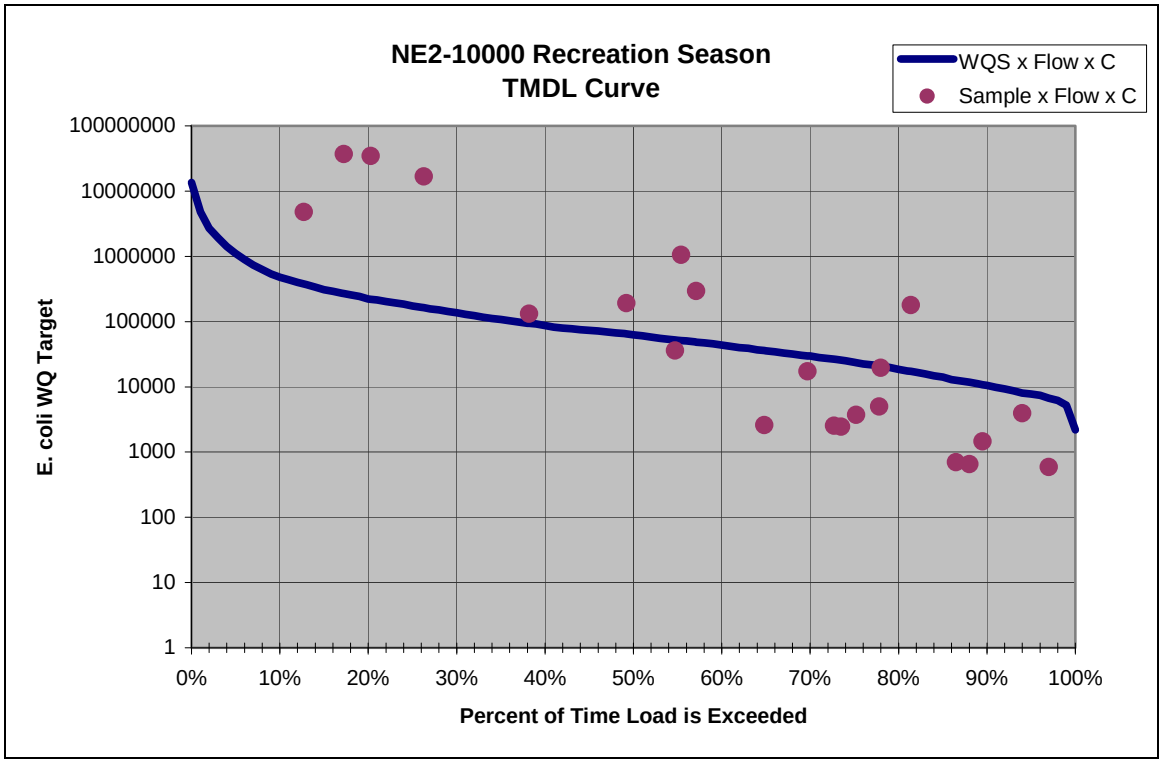


Figure 2.3.1c. TMDL Curve for NE2-10600

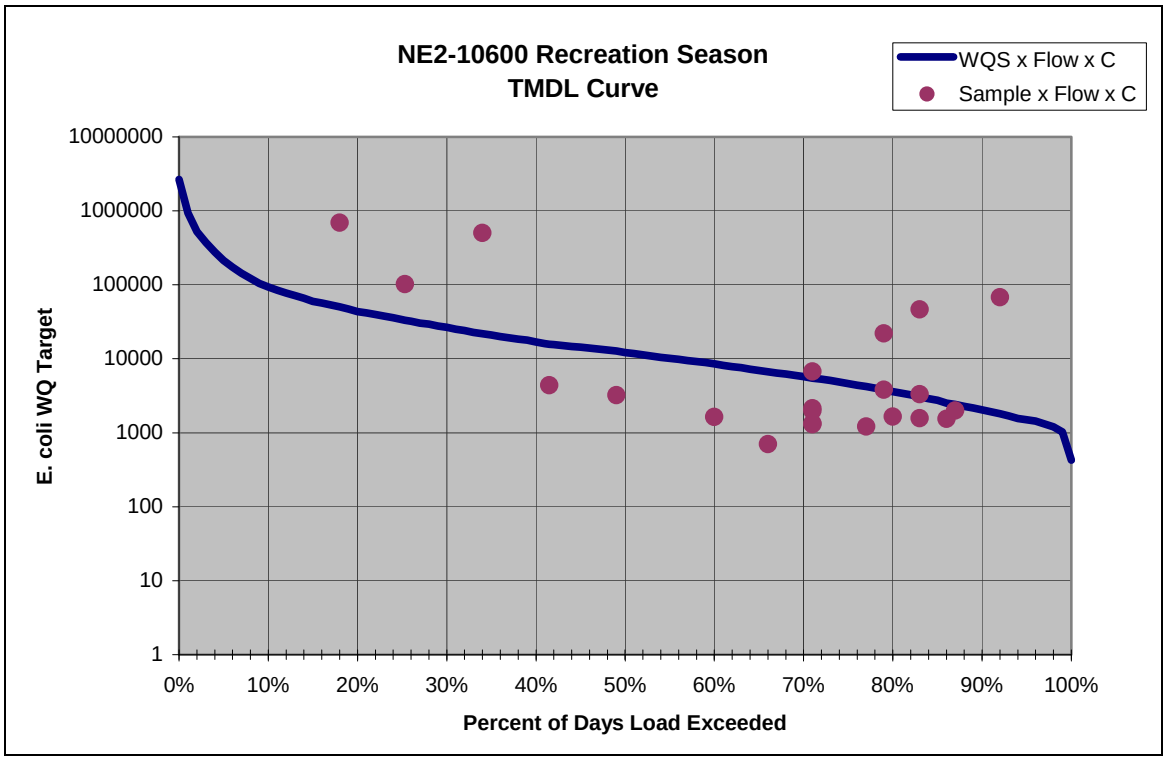


Figure 2.3.1d. TMDL Curve for NE2-12100

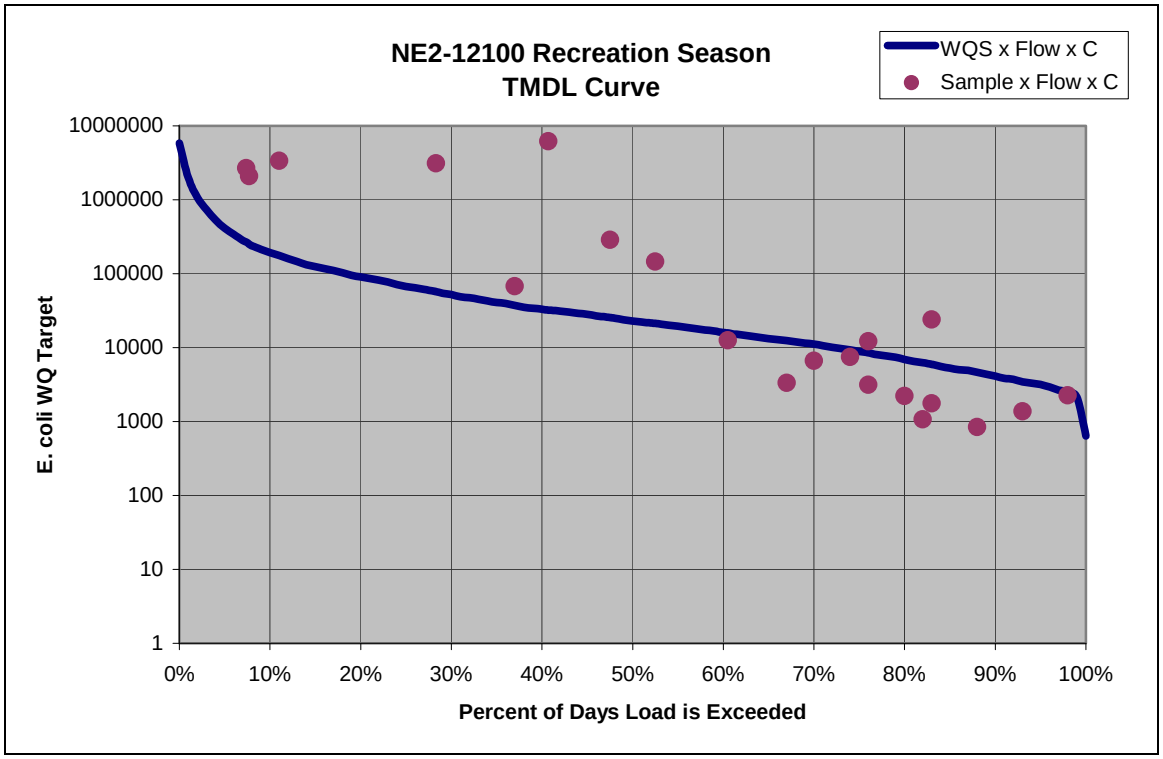


Figure 2.3.1e. TMDL Curve for NE2-12130

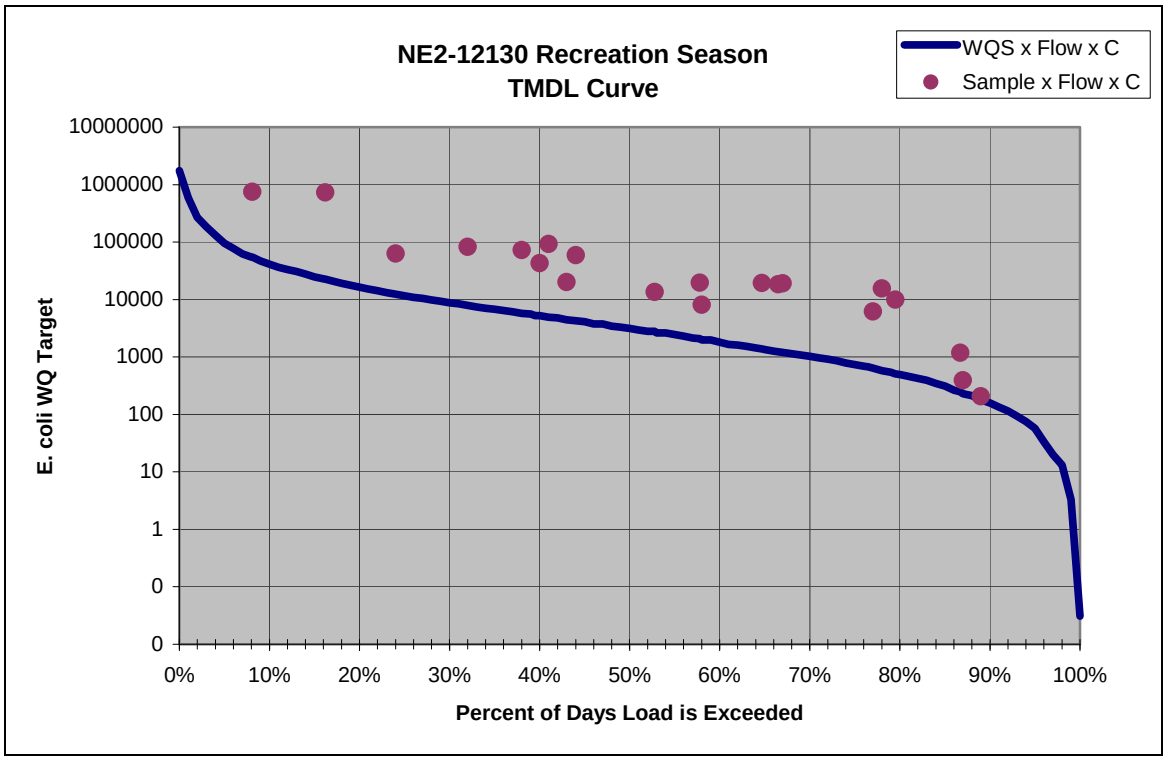


Figure 2.3.1f. TMDL Curve for NE2-12200

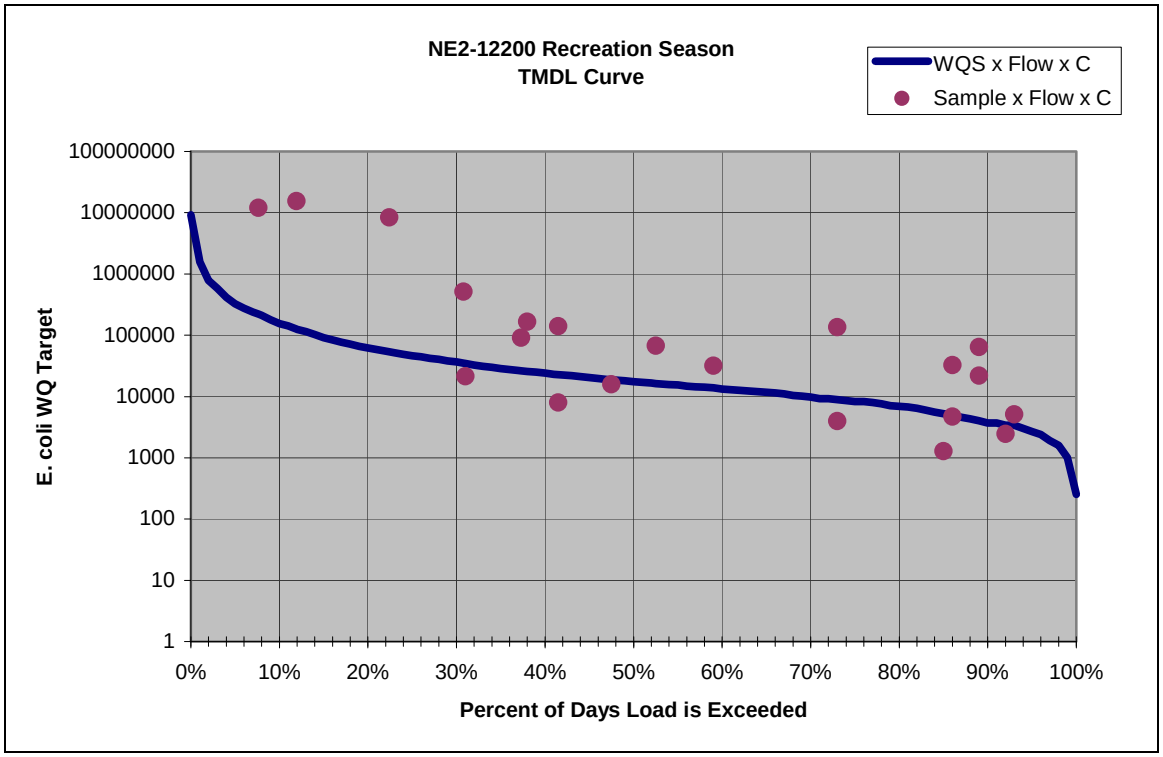


Figure 2.3.1g. TMDL Curve for NE2-12330

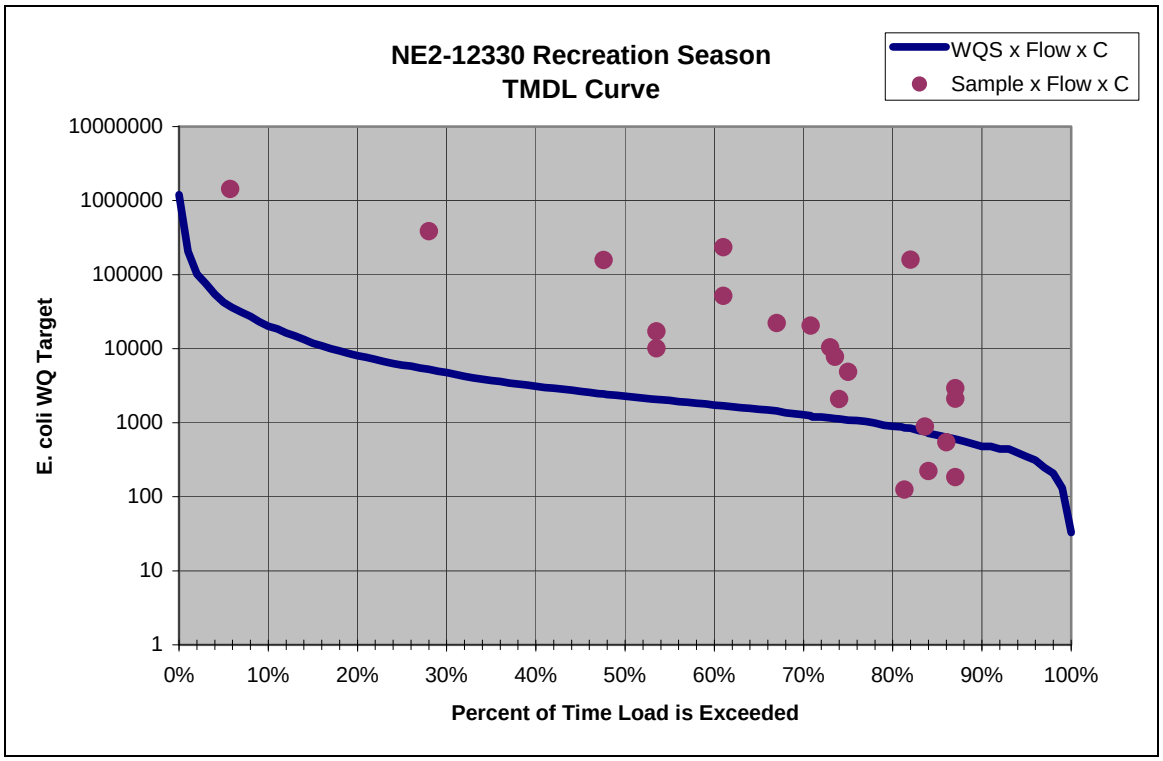


Figure 2.3.1h. TMDL Curve for NE2-12500

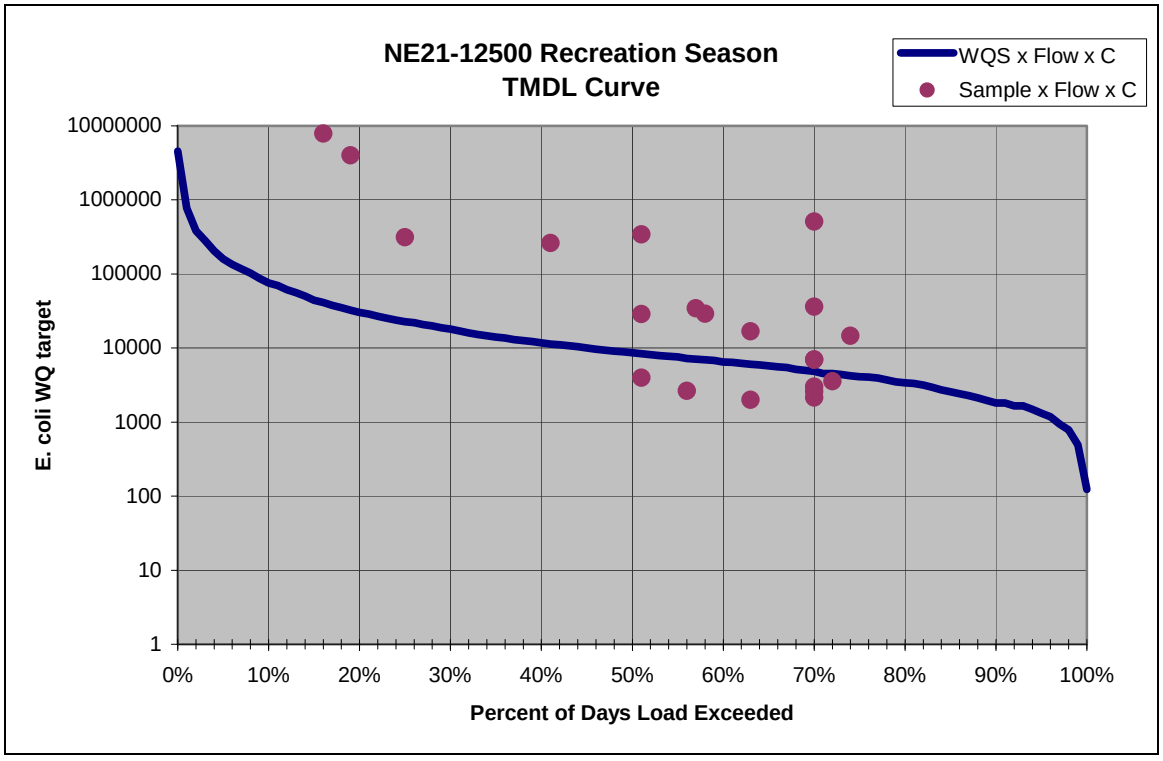
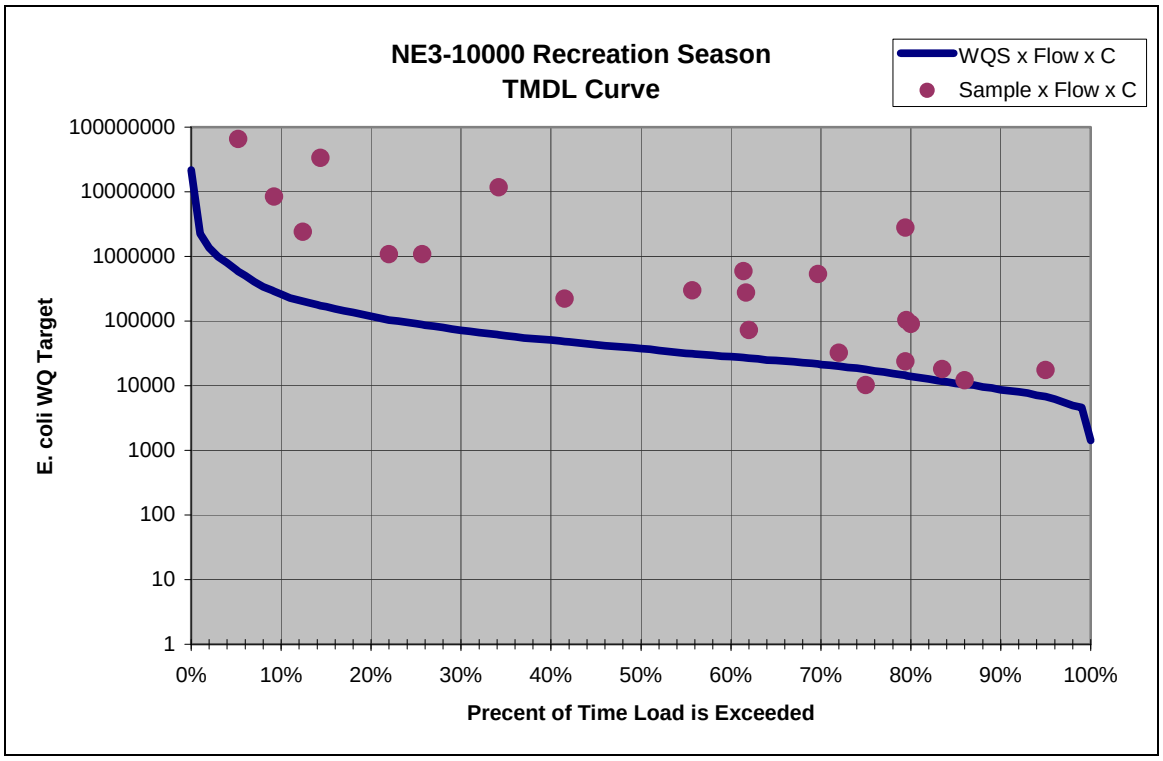


Figure 2.3.1i. TMDL Curve for NE3-10000



2.3.3 Identification of Pollutant Sources

Both point and nonpoint sources are known to exist along the segment and within the contributing watersheds. Due to the size of the watersheds, the somewhat limited data, the delivery methods and the location of the potential sources in relation to the impaired waterbody; it is difficult to definitively identify specific sources. It is important to note that all potential sources may not contribute to the water quality impairments and some sources may contribute at a greater degree than others.

The method utilized to determine the contributions of the sources will be based upon a demarcation where point source discharges are not expected to further impact the waterbody. That is, based on the concept of a continuous and relatively constant effluent volume, a dilution or flow value can be determined where point sources are no longer expected to contribute to water quality excursions. The process is explained in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology.

E. coli concentrations in wastewater can vary greatly, depending upon treatment technology, wastewater strength, industrial contributions, treatment efficiency and season. The selection of an all-encompassing effluent density value must then account for these and other variables. To that end, the NDEQ has collected effluent *E. coli* information from several facilities not providing disinfection of the wastewater discharge. The data was obtained from 24 facilities that include both mechanical and lagoon facilities and as seen in Figure 2.3.3a, exhibits a normal distribution. The median value was selected as the input for the "expected pollutant concentration". The equation to determine the point source/nonpoint source boundary then becomes:

$$Q_s = (8{,}400/100 \text{ ml} * \Sigma Q_e)/126/100 \text{ ml}$$

Where:

Q_s	= stream flow volume necessary to meet water quality standards
8,400/100 ml	= expected *E. coli* coliform density from point sources
ΣQ_e	= sum of **all** design flows from point sources discharging to the segment (direct or via tributaries)
126/100 ml	= water quality standard

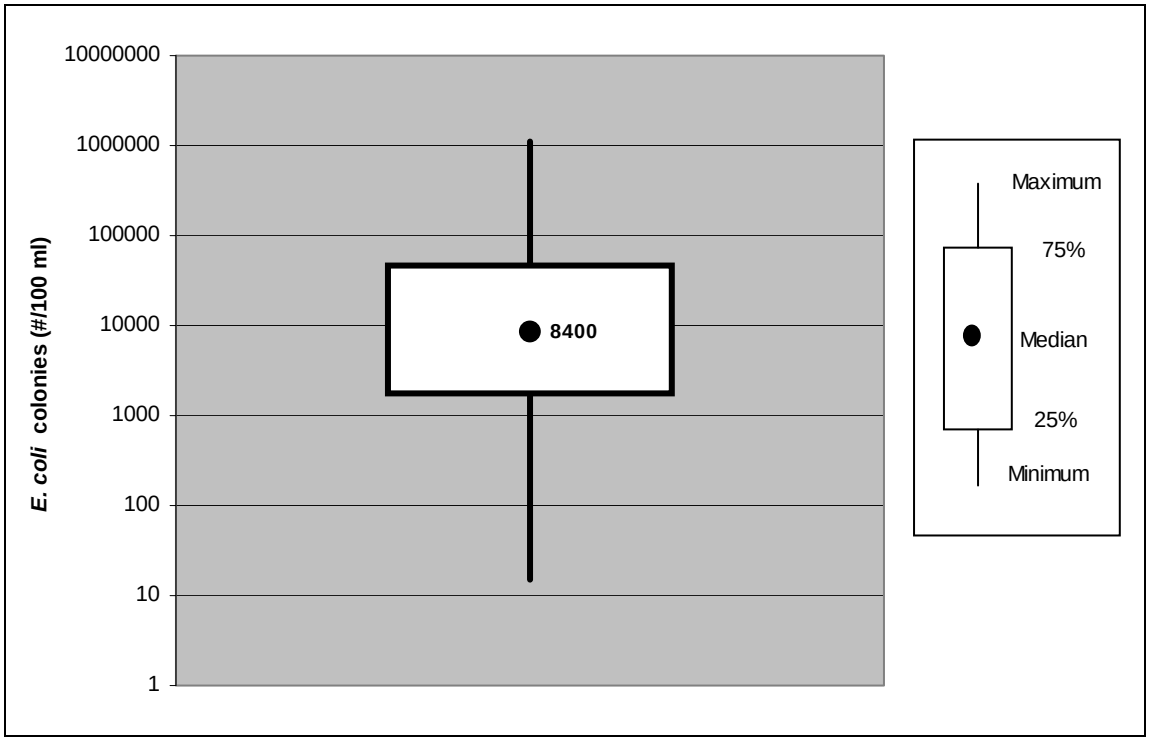
The values for ΣQ_e can be found in Table 2.3.3b as can the boundary flows.

Table 2.3.3 Sum of Wastewater Treatment Facility Design Flows in the Nemaha River Basin

Segment	Total Number of Facilities	Sum of Contributing Facility Design Flows	Flow Value for Point vs. Nonpoint Boundary
NE1-10000	11	6.26 cfs	28456 cfs*
NE2-10000	1	1.11cfs	74 cfs
NE2-10600	3	0.37	25
NE2-12100	0		
NE2-12130	2	0.28	19
NE2-12200	3	0.47	31
NE2-12330	0		
NE2-12500	5	2.28	152
NE3-10000	13	3.18	212

* Recreation season 7q10 value

Figure 2.3.3a. *E. coli* Data from 24 Wastewater Treatment Facilities



The identification of pollutant sources and impacts are shown in figures 2.3.3b-2.3.3. No pollutant source chart will be presented for segment NE2-11900 and NE2-12330, as there are no point source discharges to the segment. As well, no chart will be presented for NE1-10000, as there are no points that fall below the flow boundary.

2.3.3.1 Point Sources of *E. coli*: Based upon the TMDL curves and the position of the monitoring data points it appears point sources are contributing to the *E. coli* impairment within segments NE2-10000, NE2-10600, NE2-12130, NE2-12200, NE2-12500 and NE3-10000. The facilities that discharge either directly to or into a tributary of the Nemaha River basin recreation segments that are a potential source are listed in Table 2.3.3.1.

2.3.3.2 Nonpoint and Natural Sources of *E. coli*: Due to the diverse nature, distribution and delivery method, nonpoint and natural sources will not be separated. Therefore, the monitoring data that fall to the left of the boundary are considered to be the result of nonpoint and natural background sources.

The source identification process utilized was done so in order to get a general idea of the source category. This simplified numeric process should not be considered exclusive as an overlap of source contributions is recognized during periods where run-off is contributing to stream volume. In the future, expanded sampling may target specific source identification. Future monitoring and assessment will also take into account the controls (i.e. wastewater disinfection) that have been instituted. When considered, the demarcation may fluctuate and the source contributions re-evaluated.

Figure 2.3.3b. Identification of Pollutant Sources Using the TMDL Curve for NE2-10000

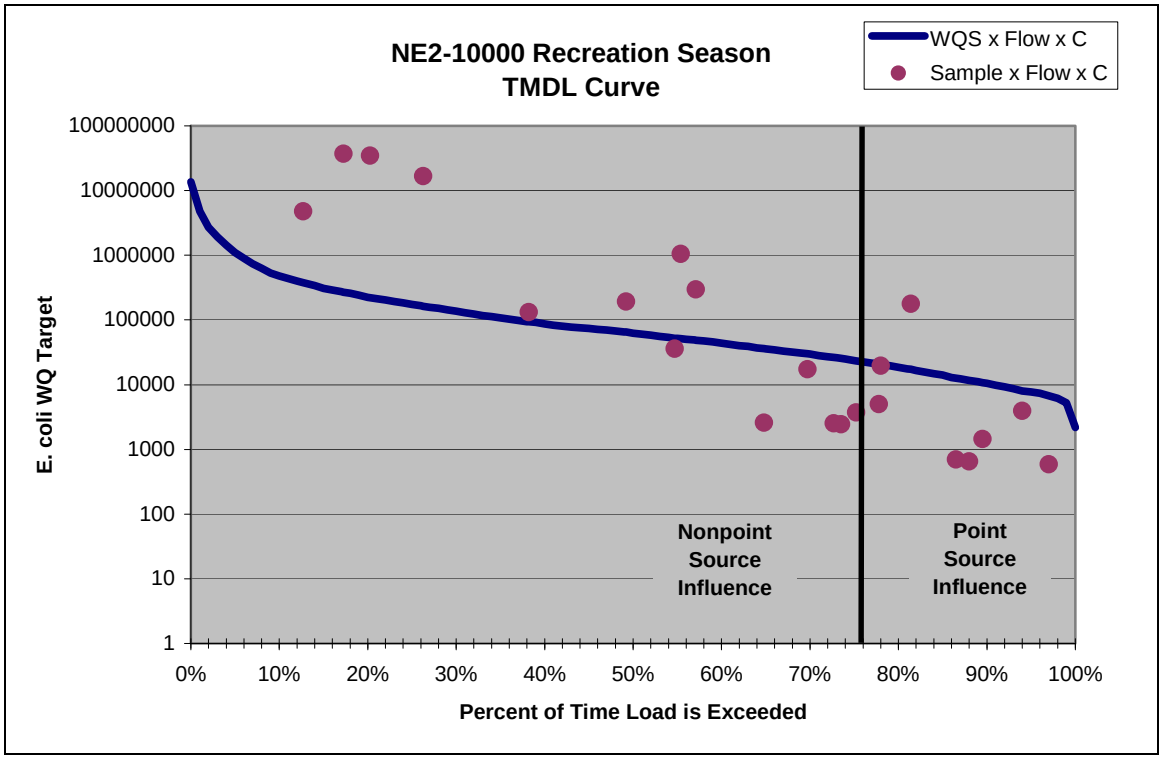


Figure 2.3.3c. Identification of Pollutant Sources Using the TMDL Curve for NE2-10600

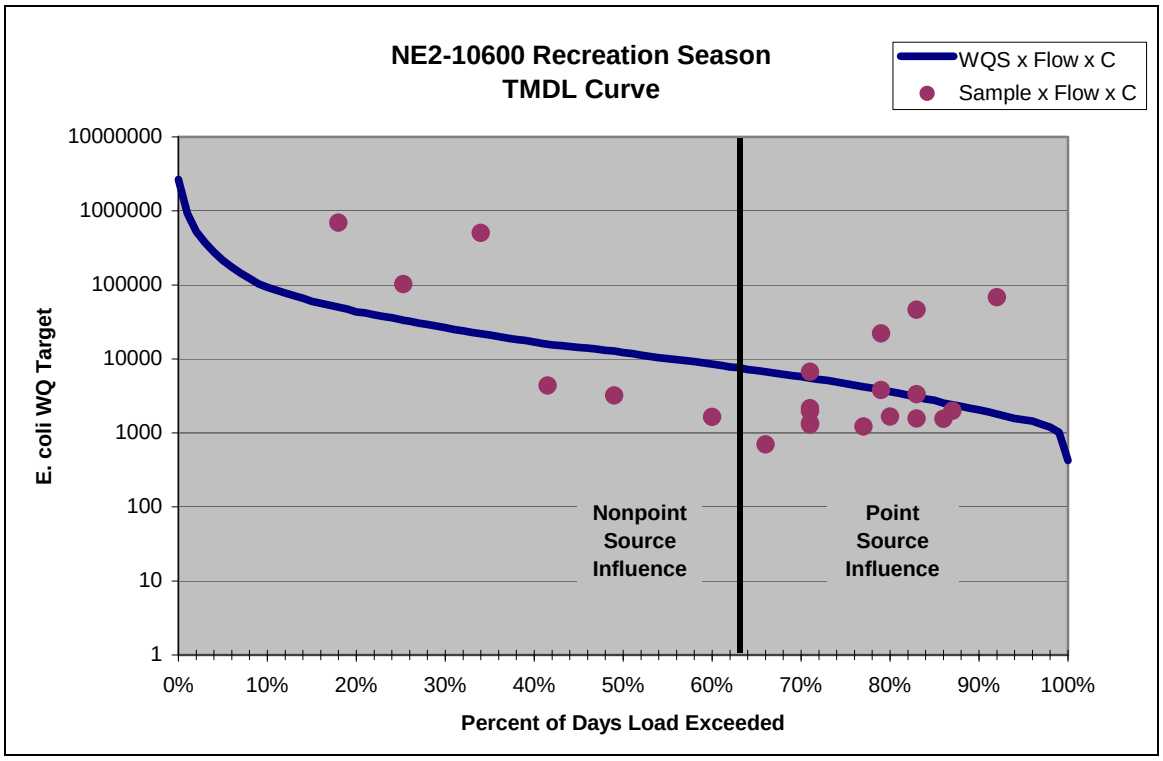


Figure 2.3.3d. Identification of Pollutant Sources Using the TMDL Curve for NE2-12130

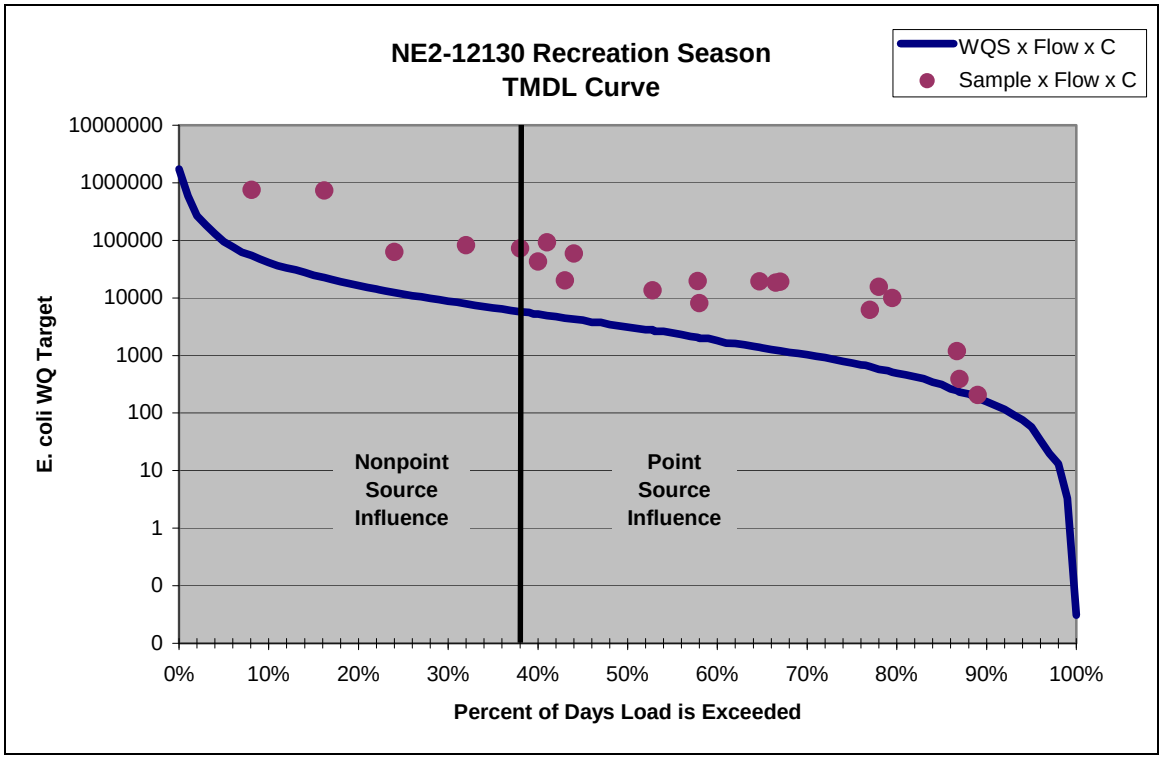


Figure 2.3.3e. Identification of Pollutant Sources Using the TMDL Curve for NE2-12200

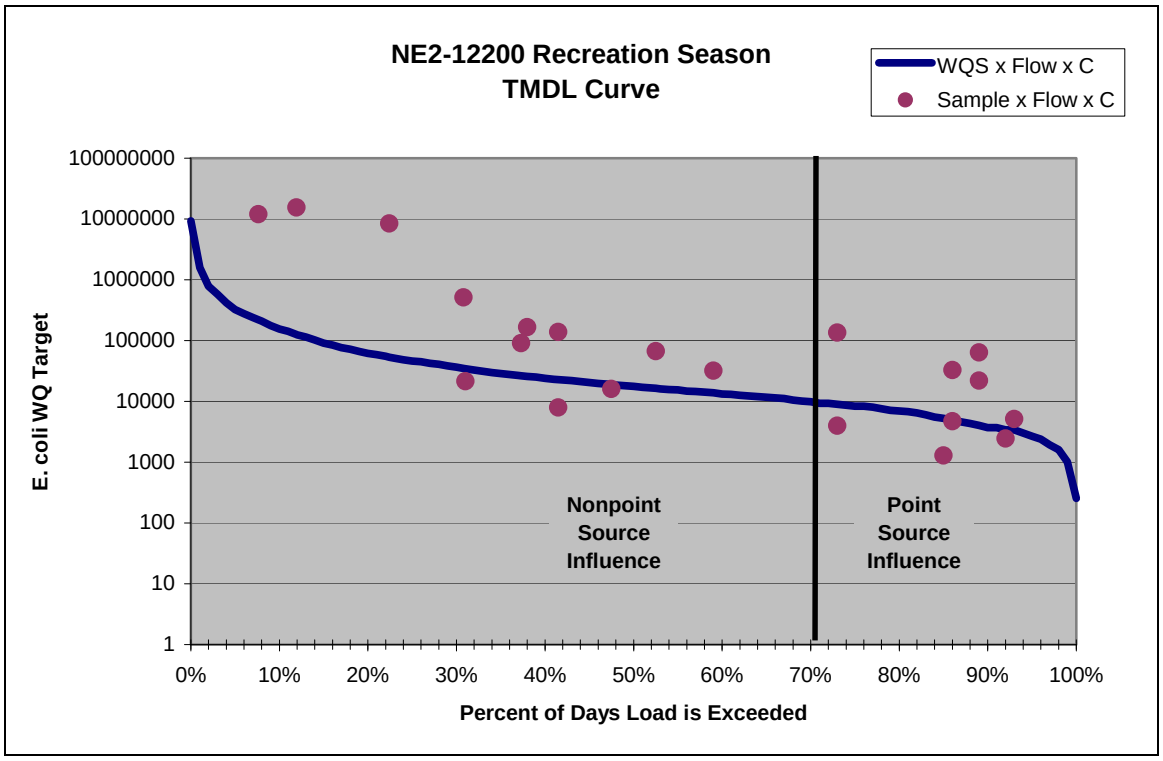


Figure 2.3.3f. Identification of Pollutant Sources Using the TMDL Curve for NE2-12500

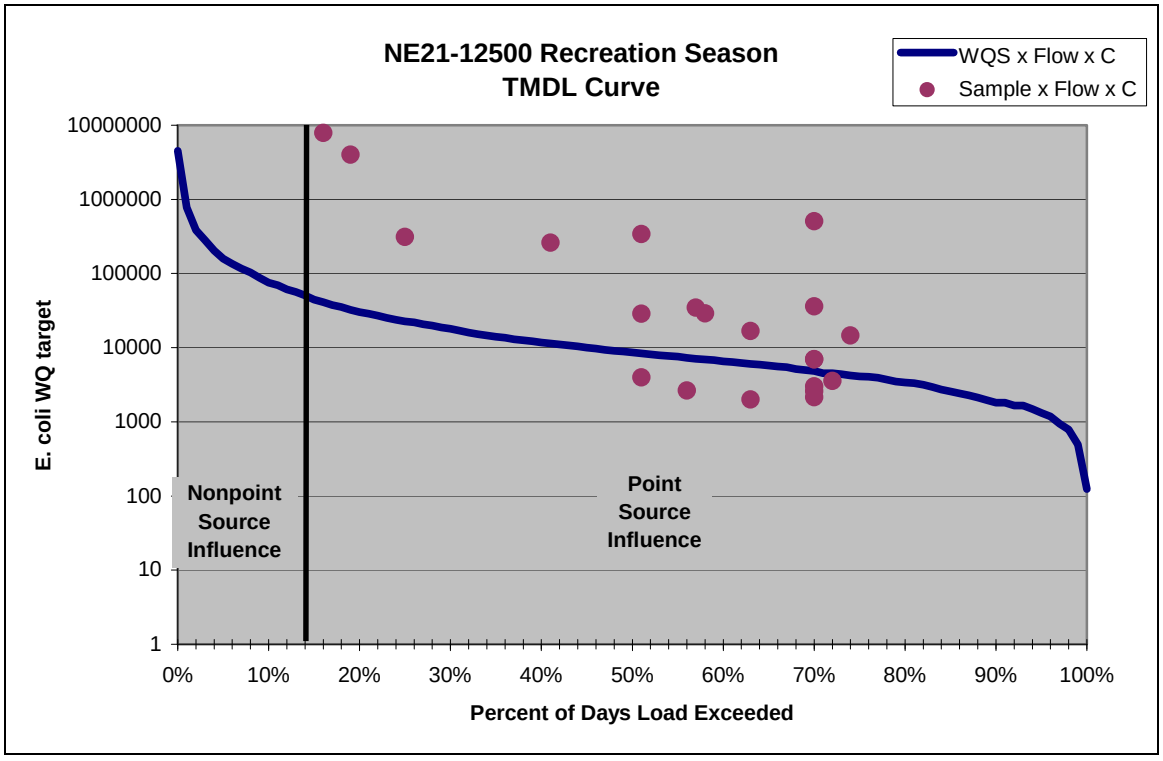


Figure 2.3.3g. Identification of Pollutant Sources Using the TMDL Curve for NE3-10000

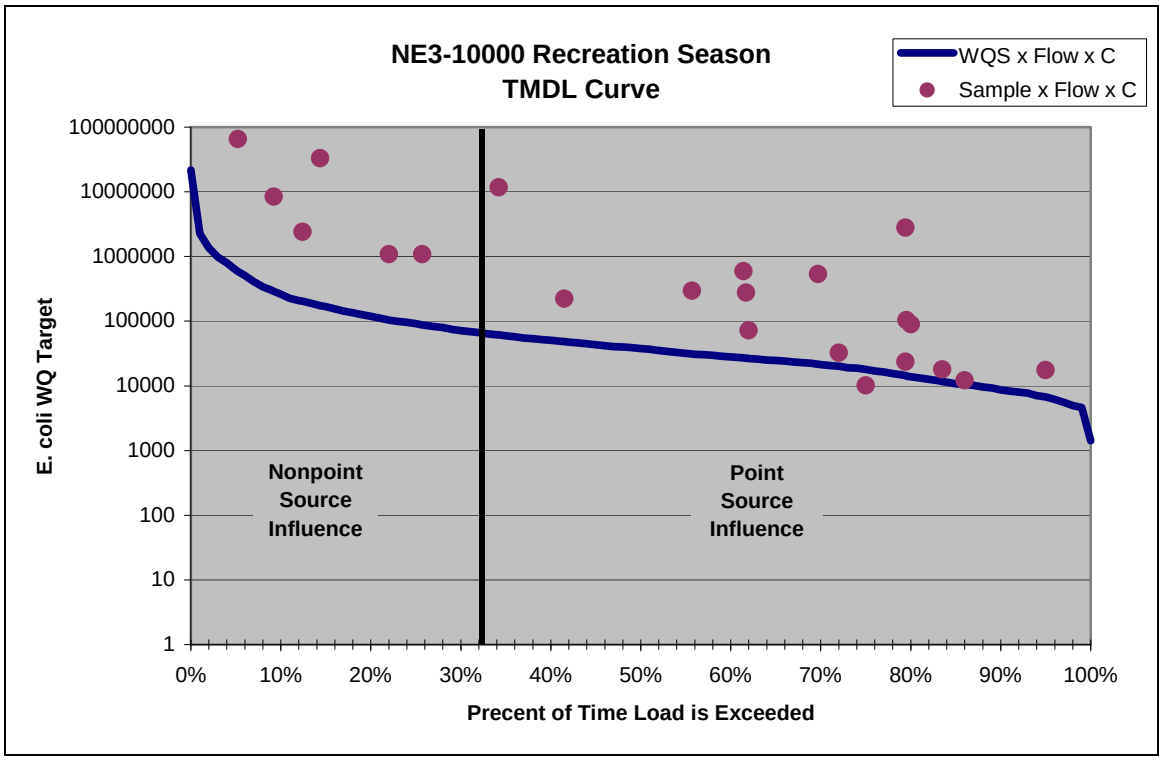


Table 2.3.3.1 NPDES Permitted Facilities in the Nemaha River Basin

Recreation Segment	Receiving Water	Facility	NPDES Permit Number	Facility Design Flow (cfs)	Facility Discharge Directly to Recreation Segment?	Approximate Distance to Recreation Segment (stream miles)	*E. coli*/ Fecal coliform Limits in NPDES permit?
NE1-10000	NE1-10000	Brownville WWTF	NE0050890	0.062	Yes		Yes
	NE1-10000	Nebraska City WWTF	NE0027774	3.265	Yes		Yes
	NE1-10000	Plattsmouth WWTF	NE0040282	1.392	Yes		Yes
	NE1-12800	Nehawka WWTF	NE0032107	0.034	No	10.7	No
	NE1-12800	Union WWTF	NE0045055	0.070	No	8.6	No
	NE1-12800	Weeping Water WWTF	NE0113131	0.309	No	12.5	No
	NE1-12840	Avoca WWTF	NE0112984	0.039	No	23.7	No
	NE1-12920	Manley WWTF	NE0046116	0.015	No	25.3	No
	NE1-13110	Elmwood WWTF	NE0023914	0.309	No	34.7	No
	NE1-13700	Beaver Lake Association	NE0046159	0.681	No	1.5	Yes
	NE1-13700	Murray WWTF	NE0112062	0.080	No	4	Yes
NE2-10000	NE2-10000	Falls City WWTF	NE0112127	1.14	Yes		**No**
NE2-10600	NE2-10600	Verdon WWTF	NE0021148	0.232	Yes		**No**
	NE2-10800	Stella WWTF	NE0031844	0.067	No	1.2	**No**
	NE2-10900	Johnson WWTF	NE0037001	0.070	No	20	**No**
NE2-12130	NE2-12130	Pawnee City WWTF	NE0042340	0.278	Yes		**No**
	NE2-12140	Steinauer WWTF	NE0021245	0.005	No	8.1	**No**
NE2-12200	NE2-12200	Dawson WWTF	NE0025399	0.032	Yes		**No**
	NE2-12200	Humboldt WWTF	NE0046256	0.387	Yes		**No**
	NE2-12420	Table Rock WWTF	NE0042048	0.048	No	0.6	**No**
NE2-12500	NE2-12500	Sterling WWTF	NE0021121	0.096	Yes		Yes
	NE2-12500	Tecumseh WWTF	NE0021725	1.934	Yes		**No**
	NE2-12600	Adams WWTF	NE0024279	0.124	No	6.8	**No**
	NE2-12610	Firth WWTF	NE0045314	0.09	No	12.9	**No**
	UD to NE2-12700	Panama WWTF	NE0112241	0.04	No	13.4	**No**
NE3-10000	NE3-10000	Auburn WWTF	NE0040967	0.572	Yes		**No**
	NE3-10000	Nemaha WWTF	NE0023868	0.027	Yes		**No**
	UD to NE3-10000	Talmage WWTF	NE0121304	0.155	No	0.8	Yes
	NE3-10100	Shubert WWTF	NE0112526	0.029	No	6.2	**No**
	NE3-20300	Cook WWTF	NE0030911	0.540	No	10.8	**No**

Recreation Segment	Receiving Water	Facility	NPDES Permit Number	Facility Design Flow (cfs)	Facility Discharge Directly to Recreation Segment?	Approximate Distance to Recreation Segment (stream miles)	*E. coli*/ Fecal coliform Limits in NPDES permit?
	NE3-20400	Burr WWTF	NE0025461	0.309	No	19	**No**
	NE3-20500	Douglas WWTF	NE0028118	0.028	No	27	**No**
	NE3-30000	Syracuse WWTF	NE0027928	0.511	No	12.5	**No**
	NE3-30000	Unadilla WWTF	NE0046329	0.087	No	18.3	**No**
	NE3-31230	Eagle WWTF	NE0040916	0.410	No	33	**No**
	NE3-31300	Woodland Hills WWTF	NE0031640	0.015	No	30.8	**No**
	NE3-31310	Eagle Lake WWTF	NE0112895	0.031	No	34.5	**No**
	NE3-50000	Bennet WWTF	NE0123986	0.464	No	31.8	**No**

2.4 Pollutant Allocation

A TMDL is defined as:

TMDL = Loading Capacity = WLA + LA + Background + MOS

As stated above, the loading capacity is based upon flow position in the hydrograph and is defined by:

Load Capacity = Flow x 126/100 ml x C

Where:

Flow = Stream flow volume (cubic feet per second)
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor.

By regulation, a TMDL requires a loading capacity value for the pollutant of concern. In the case of *E. coli*, a "load" (flow rate x concentration x time) could be calculated, but the approach may not be appropriate for expressing this non-conservative parameter. Therefore, for the purposes of these TMDLs, a loading capacity will not be "calculated" but will be expressed as the water quality standard. Because the water quality is expressed as a concentration, the LC will not equal the WLA + the LA.

The flow hydrographs (0-100th Percentile) used in the *E. coli* TMDL are provided in Table 2.4.

To achieve the desired loading capacities requires the following allocations:

2.4.1 Wasteload Allocations

2.4.1.1 NPDES Permitted Facilities: Title 117 does not allow for the application of a mixing zone for the initial assimilation of effluents in order to meet the criteria associated with the recreation beneficial use. Because of this, the water quality criteria are applied to the “end-of-pipe” concentrations and are applicable at all stream flows >7q10. Therefore, the *E. coli* wasteload allocation established by this TMDL will be a monthly geometric mean 126/100 ml.

The wasteload allocation will initially be applied to all facilities that discharge directly to a recreational segment. Future monitoring and evaluation will be utilized to determine if *E. coli* limitations are necessary for facilities discharging to the recreation segment's tributaries.

Table 2.4 Recreation Season Hydrograph for Nemaha TMDLs

	Flow Value (cfs)								
Percentile	NE1-10000	NE2-10000	NE2-10600	NE2-12100	NE2-12130	NE2-12200	NE2-12330	NE2-12500	NE3-10000
0	25,900	7	1.4	2.06	0.01	1	0.11	0.4	5
10	33,500	34	7	13	0.5	12	1.6	5.9	28
20	35,800	60	12	22	1.6	22	2.9	11	45
30	38,300	96	19	36	3.4	32	4.2	16	69
40	41,860	142	28	52	5.9	43	5.6	21	91
50	46,000	203	39	74	10	57	7.4	28	122
60	51,500	281	55	107	17	78	10	38	165
70	59,600	442	86	169	28	119	15	58	232
80	69,200	720	140	292	53	200	26	98	386
90	80,000	1,550	302	624	133	499	65	245	846
100	289,000	44,000	8,580	18,928	5,646	30,000	3,900	14,700	70,400

2.4.1.2 Dry Weather Discharges: Dry weather discharges can either be from illicit sources, cross-connections or mechanical failure and often exhibit the greatest influence on the base flow conditions of the stream. Thus, it is most appropriate to group these discharges and limit similarly to the WWTFs. Specifically, the wasteload allocations assigned to these discharges shall be a seasonal geometric mean of 126/100 ml.

2.1.4.3 Non-Discharging Facilities: Several facilities including confined animal feeding operations and lagoons are designed for "zero" discharge. In the case of animal feeding operations, discharges may only occur as the result of a 25 year 24 hour storm event or a chronic wet period with an accumulative precipitation equivalent to a 25 year 24 hour storm. Based on this permitting provision, the WLA for facilities classified as non-discharging will be zero (0).

2.4.2 Load Allocations

The load allocations assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

2.4.2.1 Load Reduction to Meet Water Quality Criteria: It is important to report the reductions necessary to meet the water quality criteria. The necessary reductions were determined based upon the 2004 data, which is considered representative information. The targeted reductions found in Table 2.4.2.1 provide water quality managers with a quantitative endpoint by which implementation planning can be carried out. The noted reductions along including the application of point source controls if achieved should result in the waterbodies fully supporting the primary contact recreation beneficial use. The reductions stated in the table also include the margin of safety described below.

Table 2.4.2.1 Targeted *E. coli* Load Reductions

Segment	Targeted Reduction	Expected Season Geometric Mean
NE1-10000	48%	112/100 ml
NE2-10000	23%	112/100 ml
NE2-10600	20%	91/100 ml
NE2-12100	53%	112/100 ml
NE2-12130	90%	112/100 ml
NE2-12200	78%	110/100 ml
NE2-12330	87%	109/100 ml
NE2-12500	77%	111/100 ml
NE3-10000	91%	112/100 ml

2.4.3 Margin of Safety

A margin of safety (MOS) must be incorporated into TMDLs in an attempt to account for uncertainty in the data, analysis or targeted allocations. The MOS can either be explicit or implicit and for these TMDLs are as follows:

- To account for uncertainty in the nonpoint source load reduction, the targeted reductions will be set at 90% of the water quality target (126/100 ml). Specifically the reductions shall be applied to meet a seasonal geometric mean of ≤113/100 ml.
- Decay and/or die off of *E. coli* were not accounted for in either the source assessment or in establishment of the load reduction. That is, the entire concentration/load from the source was assumed to be present within the waterbody and the reductions should focus on the load.
- These TMDLs assumed the effluents discharge the *E. coli* density allowed by the WLA or 126/100 ml. WWTF disinfection systems are often designed and operated to achieve 100% reduction in the indicator bacteria or 0/100ml. Thus, the actual NPDES permitted point source contribution is likely less than expected by the TMDL.

3.0 Atrazine TMDL

3.1 Problem Identification

Segment NE2-10000 was included in Category 5 of the 2006 Integrated Report as having an impaired aquatic life beneficial use with the parameter of concern being atrazine. This section deals with the extent and nature of the water quality impairments caused by excessive atrazine in the Big Nemaha River.

3.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Warmwater A-Aquatic Life beneficial use has been deemed impaired within NE2-10000. The warmwater A aquatic life beneficial use applies to surface waters where a variety of warmwater biota is presently limited by water volume of flow, water quality (natural or irretrievable human-induced conditions), substrate composition, or other habitat conditions. These waters are only capable of maintaining year-round populations of tolerant warmwater fish and associated vertebrate and invertebrate organisms and plants. Key species may be supported on a seasonal or intermittent basis (e.g., during high flows) but year round populations cannot be maintained (NDEQ 2006a).

3.1.2 Data Sources

Atrazine data is collected as part of the Nebraska Ambient Stream Monitoring network. Within the Ambient Stream Network, samples are collected twice per month during April through September. Also, data was collected from segment NE2-10000 as part of the 2004 Basin Rotation Monitoring. Stream flow information was obtained from USGS Gage #06815000.

3.1.3 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5/impaired waters for the 2006 Integrated Report. The procedures are based on the application of the "binomial distribution" method that applies a confidence interval to the exceedance rate in an effort to determine the true exceedance of the waterbody versus the data set. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development the 2006 Integrated Report for Nebraska*, January 2006.

In assessment process, all data will be initially assessed for seasonal variability in concentration or occurrence. This process will be accomplished by creating charts of time-series plots for each parameter of interest. These charts will be created from data gathered within the most recent 5-year monitoring period, or where continuous datasets exist (i.e., no more than a 2-year gap in data availability) over longer periods of time. If review of these charts reveals that seasonal differences occur, the NDEQ will focus its assessment efforts within the season(s) where parameter concentrations/occurrence are evident. By examining only the timeframe (seasons) where parameters appear in detectable levels, or at or near levels of concern, a waterbody can be more accurately assessed for use support / impairment. In contrast, when seasonal differences are present, but a long-term database is used to assess beneficial use support, the impacts to beneficial uses are underestimated and waters where real seasonal concerns exist may be overlooked.

The details of the assessment process to determine the use support of the Aquatic Life beneficial use can be found in table 3.1.3

Table 3.1.3 Assessment of the Aquatic Life Beneficial Use Using Chemical Water Quality Data

Supported	Impaired
≤10% of samples exceed acute or chronic water quality criteria	>10% of samples exceed acute or chronic water quality criteria

3.1.4 Water Quality Conditions

Atrazine data collected from 2001-2005was assessed to determine the beneficial use support for the warmwater A aquatic life designation. Table 3.1.4 and figure 3.1.4 presents this information.

Table 3.1.4 Big Nemaha River 2001-2005 Data Assessment

Date Range	Number of Samples	Number of Samples >12 µg/l
January-December	90	5
May-June	22	5

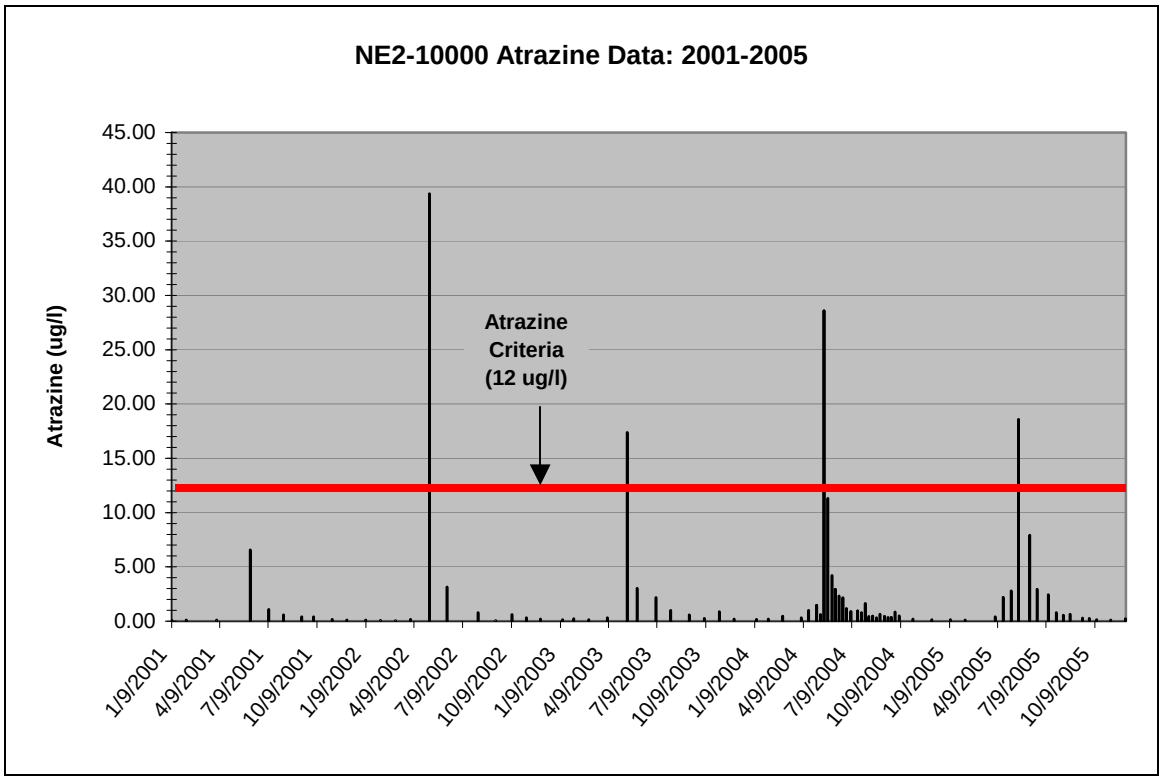
From the data assessment process a seasonal concern/impairment (May-June) exists for atrazine, which coincides with observed periods of increased precipitation and application of the herbicide. Because the impairment is seasonal, this TMDL will focus on that period.

3.1.5 Potential Pollutant Sources

Atrazine is a triazine herbicide currently registered for use against broadleaf and some grassy weeds. Atrazine is currently registered for use on corn (field and sweet); sorghum; range grasses for the establishment of permanent grass cover on rangelands and pastures under USDA's Conservation Reserve Program (CRP) in OK, NE, TX, and OR; wheat (where application is to wheat stubble on fallow land following wheat harvests; wheat is not the target crop); conifer forests; Christmas tree farms; sod farms; and golf courses (EPA 2006).

Atrazine is one of the most heavily used pesticides in North America (EPA 2003). Given this usage and source, point and natural sources are likely not contributing atrazine to surface waters in Nebraska. Therefore, for this TMDL the entire load will be considered the result of nonpoint source discharges.

Figure 3.1.4 Big Nemaha River (NE2-10000) Atrazine Data: 2001-05



3.2 TMDL Endpoint

The endpoint for this TMDL will be based on the numeric criteria associated with the Class A Warmwater Aquatic Life Beneficial Use.

3.2.1 Numeric Water Quality Criteria

Water quality criteria established for the Class A – Warmwater Aquatic Life protection of the beneficial use can be found in Title 117, Chapter 4. Assessment of the data and the TMDL are based on the chronic criterion of 12 μg/l.

3.2.2 Selection of Critical Environmental Conditions

The critical environmental conditions for this TMDL have been identified in the assessment process. Specifically, the data and information will be limited to the May-June timeframe when the deviations from the water quality criteria were observed.

3.2.3 Waterbody Pollutant Loading Capacity

Defining waterbody pollutant loading capacity implies a steady state. This TMDL recognizes loadings are dynamic and can vary with stream flow. As well, the above section indicates a potentially wide range of environmental conditions that must be accounted for.

The method chosen to account for the variation in flow is based upon a TMDL curve (NDEQ 2002). TMDL curves are initiated by the development of a stream's hydrograph using the long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values by the water quality standard (WQS) and a conversion factor (C). The acceptable "load" is then plotted graphically. Appendix B provides a table with the 0-100th percentile flow values and associated daily load values.

Therefore, the loading capacity for each of the segments will be defined by:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

3.3 Pollutant Source Assessment

As indicated in Section 3.1.5 the only source of atrazine considered for this TMDL is nonpoint source discharges. Although the source has been determined, it is important to illustrate the existing conditions.

3.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the TMDL curve (Figure 3.3.1) provided for NE2-10000. The points plotted above the acceptable loading indicate a deviance from the water quality criteria.

3.4 Pollutant Allocation

A TMDL is defined as:

$$\text{TMDL} = \text{Loading Capacity} = \text{WLA} + \text{LA} + \text{Background} + \text{MOS}$$

As stated above, the loading capacity is based upon flow position in the hydrograph and is defined by:

$$\text{Load Capacity} = \text{Flow} \times 12\ \mu\text{g/l} \times \text{C}$$

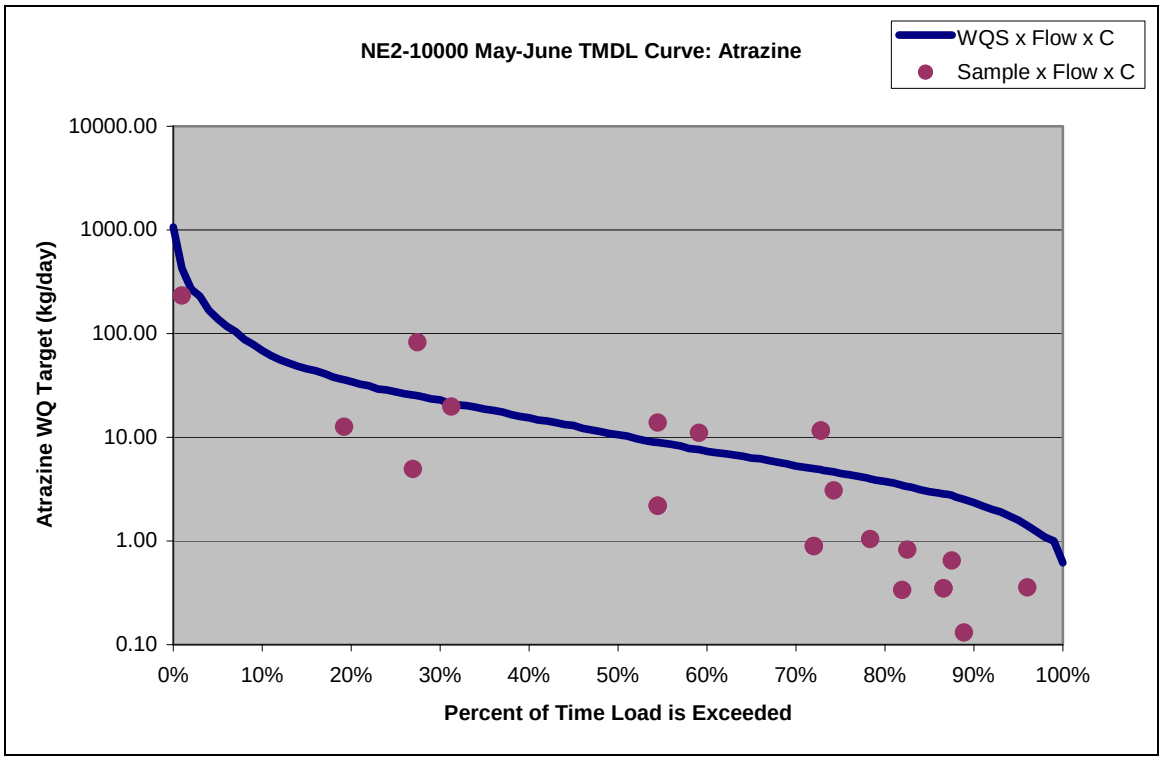
Where:

Flow = Stream flow volume (cubic feet per second)
12 µg/l = applicable/target water quality criteria atrazine from Title 117
C = conversion factor

3.4.1 Wasteload Allocation

As stated previously, elevated atrazine concentrations are typically not the result of point source discharges. For this TMDL the wasteload allocation will be zero (0).

Figure 3.3.1 Big Nemaha River (NE2-10000) TMDL Curve



3.4.2 Load Allocation

The load allocations assigned to this TMDL will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 12\ \mu g/l * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
12 µg/l = applicable/target water quality criteria for atrazine from Title 117
C = conversion factor

The flow hydrographs (0-100th Percentile) used in the Atrazine TMDL is provided in Table 3.4.2.

Because the WLA and natural background are zero (0) the entire loading capacity is the LA and can be found in Appendix B.

Table 3.4.2 May-June Hydrograph for Big Nemaha River TMDL

Percentile	Flow Value
0	21
10	80
20	128
30	180
40	249
50	361
60	525
70	781
80	1,172
90	2,331
100	36,400

3.4.3 Natural Background

Atrazine does not occur naturally in the environment therefore the allocation for natural background will be zero (0).

3.4.4 Load Reduction to Meet Water Quality Criteria

It is important to report the reductions necessary to meet the water quality criteria. The necessary reductions were determined based upon the 2001-05 data, which is considered representative information. The targeted reductions provide water quality managers with a quantitative endpoint by which implementation planning can be carried out. In order to meet full support status the atrazine load must be reduced by 60%.

3.4.5 Margin of Safety

The margin of safety for this TMDL is both implicit and explicit and will be:

- The targeted reduction will result in only one of twenty-two measurements exceeding the 12 µg/l criteria. Assessment procedures allow for four deviations from water quality standards with three being the threshold for impairment. A 45% reduction will result in 2 deviations. Therefore, the explicit margin of safety is 15%.
- Assessment of the data and the TMDL focused on the critical period where application of atrazine occurs. Implementation of controls will result in year-round protection of water quality. This will be important should application practices change in the future.

4.0 Implementation Plan

The implementation of controls to manage *E. coli* within the Nemaha River Basin and atrazine in the Big Nemaha River includes but is not limited to:

4.1 NPDES Permitted Point Sources

Facilities that discharge directly to all segments within the Nemaha River basin designated with the primary contact recreation use will be required to meet the wasteload allocations – *E. coli* = 126/100 ml – at the end of the pipe. Facilities discharging to tributaries will be evaluated to determine the extent of the effluent's impact on the recreation segment. If deemed significant, a request will be made to limit the *E. coli* concentration discharged from these facilities in the NPDES permit.

In addition to the permits, in the course of compliance audits, deficiencies in the operation of the WWTF disinfection appurtenances and noncompliance with the NPDES permit limits should be noted and corrective action pursued.

Biosolids (sludge) generated by municipal and industrial facilities are regulated under 40 CFR Part 257 and 40 CFR Part 503, respectively. 40 CFR part 257 requires that facilities and practices not cause nonpoint source pollution of waters of the United States. Part 503 specifically requires that sludge applications be not less that 10 meters from waters of the United States and that the sludge not be applied to frozen, flooded or snow covered ground if the sludge can enter into waters of the United States.

Consistent with Section 3.4 below, a recommendation will be made that all NPDES permittees be required to adhere to items #1and #2 for land application activities taking place either during or 10 days prior to the recreation season (May 1 – September 30). In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with #3

4.2 NPDES Storm Water Discharges

The WLA defined in section 2.4.1.1 will be applicable to all NPDES discharges including discharge from regulated stormwater outfall. The NDEQ is responsible for determining the applicability of NPDES stormwater permits for urbanized areas with populations >10,000 but <100,000. As well, other municipal or construction areas can be designated for coverage under an NPDES (stormwater) permit if the NDEQ determines control of the stormwater is necessary.

Facilities discharging stormwater under the authority of a NPDES permit are required to implement the following minimum control measures:

- Implement a public education and outreach program on stormwater impacts
- Develop and enforce a program to detect and eliminate illicit discharges.
- Develop, implement and enforce a program to reduce pollutants from construction activities.
- Develop, implement and enforce a program to reduce pollutants from post construction activities in new or redevelopment projects
- Develop a pollution prevention/good housekeeping program.

Rather than apply numeric limitations on individual stormwater outfalls, the strategy will be to initially allow the municipalities sufficient opportunity to comply with the NPDES requirements; either voluntarily or under the authority of an NPDES permit. In the future, should additional monitoring data indicate the minimum control measures are inadequate or have not been incorporated; consideration will be given to application of wasteload allocations for the outfalls in the area of concern.

4.3 Dry Weather Discharges

Title 119 – Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System, Chapter 2 states:

> "All persons discharging pollutants from a point source into any waters of the State are required to apply for and have a permit to discharge."

Discharges not permitted should be required to obtain the proper authorization to discharge. All discharges are then subject to the appropriate limitations consistent with the WLAs established by this TMDL. Elimination of the discharge should be undertaken in the event permitting and control is not feasible.

4.4 Animal Feeding Operations

Title 130 – Rules and Regulations Pertaining to Livestock Waste Control states:

> 001 A livestock waste control facility shall be required for an existing or proposed livestock operation of three hundred animal units or larger, when livestock wastes:
>
> > 001.01 Violate or threaten to violate Title 117 (Neb. Administrative Code (NAC)), Nebraska Surface Water Quality Standards;
> > 001.02 Violate or threaten to violate Title 118 (NAC), Ground Water Quality Standards and Use Classification;
> > 001.03 Discharge into waters of the State; or
> > 001.04 Violate The Nebraska Environmental Protection Act.
>
> 002 Any livestock operation less than three hundred animal units is exempt from the permitting process, including the requirement to request an inspection, unless there has been a confirmed discharge into waters of the State, or the Department has determined that because of conditions at the livestock operation there is a high potential for discharge into waters of the State in which case the Department shall notify the owner of the livestock operation by certified mail that the owner is subject to the Livestock Waste Management Act.

When a livestock waste control facility is required the owner/operator must also be issued a construction and/or a state-operating permit. State operating permits require facilities be properly operated and maintained to prevent water pollution and to protect the environment of the State.

Livestock waste control facilities for open lots, by regulation must be designed and constructed to contain all waste generated under conditions less than a 25 year 24 hour precipitation event. Confined animal feeding operations are required to maintain 180 days of storage or a lagoon to treat the waste products. Meeting these permit requirements should equate to "zero" discharge during conditions less than a 25 year 24 hour precipitation event, or a chronic wet period.

Wastewater and biosolids (manure) produced by the animal feeding operations are most often land applied for beneficial reuse. Permitted facilities are required to follow best management practices (BMPs) for the land application as defined in Title 130, Chapter 11. Those BMPs include:

1. Utilize application areas which are under proper conservation treatment to prevent run-off into waters of the State
2. Not apply waste within 30 feet of any stream, lake or impounded waters identified in Chapter 6 and Chapter 7 of Title 117, unless in accordance with an approved comprehensive nutrient management plan
3. When waste is applied within 100 feet of any streams, lakes an impounded waters identified in Chapter 6 and 7 of Title 117, the Department may also require additional buffer and/or vegetative buffers, and that the livestock waste be applied in a manner which reduces potential for run-off of nutrients or pathogens by incorporation, injection of waste or other approved practices.

Based upon the above, it shall be recommended that the NDEQ's Agriculture Section stipulate in the state operating or other permits, for facilities located in the Nemaha River Basin, that the application of livestock waste occurring during or 10 days prior to the Recreation Season (May 1 – September 30) be consistent with the above #1 and #2 and the application setback be the minimum of 30 feet regardless of the status of the comprehensive nutrient management plan. In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with the requirements of #3 with the minimum setback being 100 feet.

4.5 Exempt Facilities/Other Agricultural Sources

Animal feeding operations are exempt from regulations set forth in Title 130 if:

- The operation is less than 300 animal units

- There has not been a confirmed discharge to waters of the State, or
- The Department has determined that because of conditions at the livestock operation there is **not** a high potential for discharge to waters of the state.

Periodically, the NDEQ will receive a complaint on or a request for an inspection from a facility operating with <300 animal units. Should deficiencies be noted during the on-site visit, the owners/operator will often be given an opportunity to make corrections prior to enforcement or permit action being taken. In the event the efforts at voluntary compliance fail, civil enforcement or the issuance of a permit will be pursued to bring about the necessary corrective measures.

Because these facilities are "non-regulated", it is difficult to assess the impacts to the environment. As well, pastures or other temporary feeding practices may contribute to the *E. coli* impairments if conditions are such that run-off from the site occurs. In lieu of regulatory requirements, the NDEQ will first look to the USDA-Natural Resource Conservation Service for assistance utilizing programs under the control of the Service such as Conservation Reserve Program, Environmental Quality Incentives Program, Conservation Farm Option, Conservation of Private Grazing Land Initiative, the Wetlands Reserve Program and others that aid in the maintenance and improvement of water quality.

4.6 Nebraska Department of Agriculture

The Nebraska Pesticide Act provides that the Nebraska Department of Agriculture (NDA) shall serve as the lead state agency in matters relating to pesticides and water quality. It further provides that NDA shall work closely with the Nebraska Department of Environmental Quality, Nebraska Department of Natural Resources, and the Nebraska Department of Health in matters relating to water quality.

Since 1995, the NDA has been the lead agency for the regulation of pesticides that might enter or pollute water and is responsible for development and implementation of state management plans for the prevention, evaluation and mitigation of occurrences of pesticides, or pesticide breakdown products, in ground and surface water. By working closely with those state agencies listed above as well as the Natural Resources Districts and others, NDA can be assured that the plans will be more comprehensive and effective in addressing these issues.

The NDA has been consulted in the completion of this TMDL and will be provided a copy upon EPA approval.

4.7 Section 319 – Nonpoint Source Management Program

The United States Environmental Protection Agency supplies grant funds to states to aid in managing nonpoint source pollution. When grant applications are submitted for review, an effort should be made to include the control of *E. coli* and surface run-off for the proposed projects in the Nemaha River Basin. As well, an effort will be made to redirect applicants to develop proposals consistent with the goals of this TMDL. Preference may be given to those projects that will have a direct reduction in the *E. coli* contributions of nonpoint source discharges.

4.8 Non-Government Organizations

Several non-governmental organizations with an emphasis on agriculture disseminate information to their members on a regular basis. As well, some of the organizations have established environmental education programs to assist in the understanding of environmental regulations and topics. The NDEQ will communicate with these entities in an attempt to utilize the membership distribution process as a means of providing information on the water quality impairments, the TMDL and suggestions to assist in solving the identified problems.

4.9 Reasonable Assurances

The NDEQ is responsible for the issuance of NPDES or state operating permits for industrial and municipal wastewater discharges, regulated stormwater discharges and livestock operations (open lot or confined). Issued permits must be consistent with or more stringent then the wasteload allocations set forth by this TMDL. Compliance with the permit may require construction or modification of a facility and the issued permits may account for this through the inclusion of a compliance schedule or administrative order.

Effective management of nonpoint source pollution in Nebraska necessarily requires a cooperative and coordinated effort by many agencies and organizations, both public and private. Each organization is uniquely equipped to deliver specific services and assistance to the citizens of Nebraska to help reduce the effects of nonpoint source pollution on the State's water resources. While a few of the organizations have been previously identified, Appendix A is a more complete compilation of those entities that may be included in the implementation process. These agencies have been identified as being responsible for program oversight or fund allocation that may be useful in addressing and reducing *E. coli* contributions to the Nemaha River. Participation will depend on the agency/organization's program capabilities.

5.0 Future Monitoring

Future monitoring will generally be consistent with the ambient monitoring and rotating basin monitoring scheme. The Nemaha River Basin was monitored in 2004 and will again be targeted in 2009. An effort will be made to expand the monitoring to isolate areas of concern and to focus resources to address identified problems.

Periodically, compliance monitoring will be conducted at NPDES permitted facilities to verify permit limitations are being adhered to. Facilities are selected either randomly or in response to inspection or reported information.

As well, the NPDES permits require self-monitoring of the effluent by the permittee with the frequency of the monitoring being based on the discharge characteristics. The data is then reported to NDEQ quarterly, semiannually or annually and entered into the EPA's Permitting Compliance System. The compliance monitoring and self-monitoring information will be used in assessing the success of the TMDL.

Recently, analytical techniques have been introduced that may provide a greater level of confidence in the identification of pollutant sources. These techniques include microbial source tracking and specialized sampling the targets human wastewater. As the science progresses the application of these analytical techniques may become a valuable tool for source identification and pollutant reduction.

6.0 Public Participation

The availability of the TMDLs in draft form was published in the Falls City Journal, Lincoln Journal Star and the Nebraska City News-Press with the public comment period running from approximately May 14, 2007 to June 18, 2007. These TMDLs were also made available to the public on the NDEQ's Internet site and interested stakeholders were informed via email of the availability of the draft TMDLs. No comments were received during the public participation period.

7.0 References

Chapman, Shannen, S. Omernik, J.M., Freeouf, J.A., Huggins, D.G., McCauley, J.R., Freeman, C.C., Steiner, G.A., Robert, T., Schlepp, R.L., 2001. Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables and photographs): Reston, Virginia, U.S. Geological Survey

EPA 2003. Ambient Aquatic Life Water Quality Criteria for Atrazine – Revised Draft. EPA-822-R-03-023. U.S. Environmental Protection Agency. Office of Water. Washington, D.C.

EPA 2003. Ambient Aquatic Life Water Quality Criteria for Atrazine – Revised Draft. EPA-822-R-03-023. U.S. Environmental Protection Agency. Office of Water. Washington, D.C.

NDEQ 2002. Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2005a. Title 130 – Rules and Regulations Pertaining to Livestock Waste Control. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2005b. Title 119 – Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2006a. Title 117 – Nebraska Surface Water Quality Standards. Nebraska Department of Environmental Quality. Lincoln, NE.

7.0 References (continued)

NDEQ 2006b. Methodologies for Waterbody Assessments and Development the 2004 Integrated Report for Nebraska. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2006c. 2004 Surface Water Quality Integrated Report. Nebraska Department of Environmental Quality. Lincoln, NE.

NNRC 1976. Nemaha River Basin Water Quality Management Plan. Nebraska Natural Resources Commission. Lincoln, NE.

Appendix A – Federal, State Agency and Private Organizations Included in TMDL Implementation.

FEDERAL

- Bureau of Reclamation
- Environmental Protection Agency
- Fish and Wildlife Service
- Geological Survey
- Department of Agriculture - Farm Services Agency
- Department of Agriculture - Natural Resources Conservation Service

STATE

- Nebraska Association of Resources Districts
- Department of Agriculture
- Department of Environmental Quality
- Department of Roads
- Department of Water Resources
- Department of Health and Human Services
- Environmental Trust
- Game and Parks Commission
- Natural Resources Commission
- University of Nebraska Institute of Agriculture and Natural Resources (IANR)
- UN-IANR: Agricultural Research Division
- UN-IANR: Cooperative Extension Division
- UN-IANR: Conservation and Survey Division
- UN-IANR: Nebraska Forest Service
- UN-IANR: Water Center and Environmental Programs

LOCAL

- Natural Resources Districts
- County Governments (Zoning Board)
- City/Village Governments

NON-GOVERNMENTAL ORGANIZATIONS

- Nebraska Wildlife Federation
- Pheasants Forever
- Nebraska Water Environment Association
- Nebraska Corn Growers Association, Wheat Growers, etc.
- Nebraska Cattlemen's Association, Pork Producers, etc
- Other specialty interest groups
- Local Associations (i.e. homeowners associations)

Appendix B – 0-100th Percentile Flows and Maximum Daily Atrazine Loadings for the Big Nemaha River

Ranking/Percentile	Flow Value (cfs)	Maximum Daily Load (kg/day)
0	21	0.62
10	80	2.35
20	128	376
30	180	5.29
40	249	7.31
50	361	10.61
60	525	15.44
70	781	22.94
80	1172	34.44
90	2090	61.42
100	36400	1070