Fecal Coliform Bacteria TMDLs for the Knife River Tributaries in Mercer County, North Dakota

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Knife River watershed is a 247,000 acre watershed in Mercer and portions of Morton, Oliver, and Dunn Counties, in southwestern North Dakota (Figure 1). The Knife River tributaries of Brush Creek (ND-10130201-36-S_00), Coyote Creek (ND-10130201-37-S_00), Willow Creek (ND-10130201-45-S_00) and Elm Creek (ND-10130201-46-S_00) will be the focus of this report. The individual watersheds of the four impaired reaches range in size from 22,725 to 68,205 acres for a combined acreage of 154,783 acres. Table 1 summarizes the geographical, hydrological and physical characteristics.

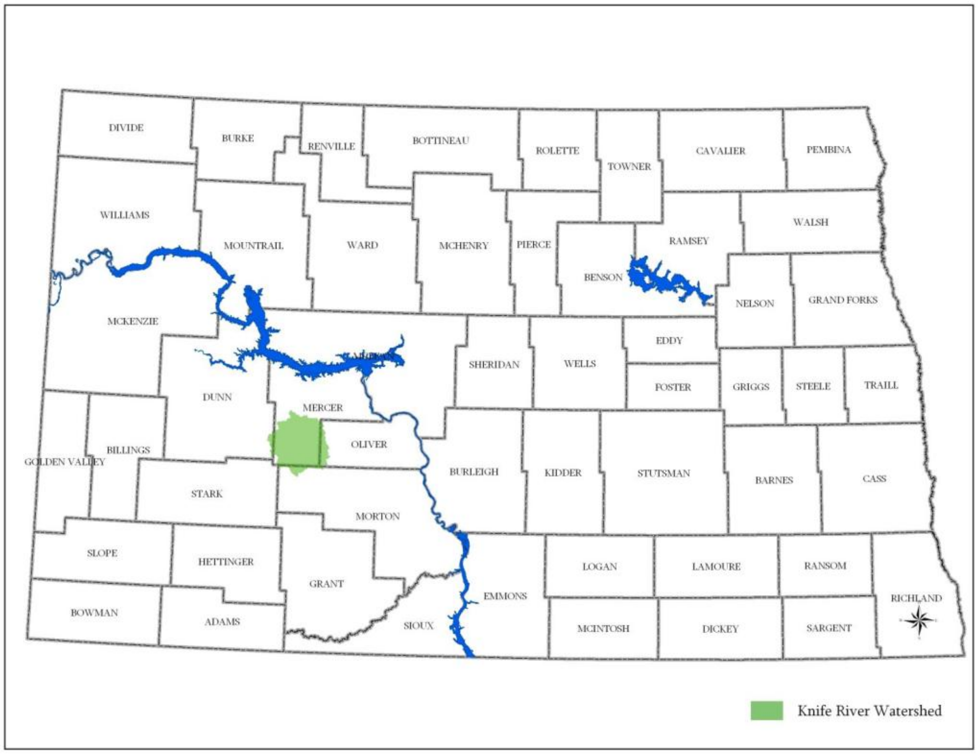

Figure 1. General Location of the Knife River Watershed in North Dakota.

Table 1. General Characteristics of the Knife River Tributaries

Legal Name	Brush Creek, Coyote Creek, Willow Creek, and Elm Creek
Stream Classification	Class III
Major Drainage Basin	Knife River
8-Digit Hydrologic Unit	10130201
Counties	Mercer, Morton, Oliver and Dunn Counties
Ecoregions	Northwestern Great Plains (Level III), Missouri Plateau and River Breaks (Level IV)
Total Watershed Area	247,040 acres

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2010 Section 303(d) List of Waters Needing TMDLs (NDDoH, 2010), the North Dakota Department of Health (NDDoH) has identified a 61.06 mile segment (ND-10130201-036-S_00) of Brush Creek, a 17.24 mile segment (ND-10130201-037-S_00) of Coyote Creek, a 137.89 mile segment (ND-10130201-045-S_00) of Elm Creek, and a 29.54 mile segment (ND-10130201-046-S_00) of Willow Creek including all tributaries as fully supporting, but threatened for recreational uses due to fecal coliform bacteria (Tables 2-5). Figure 2 shows the listed waterbodies, sampling stations, and corresponding subwatershed boundaries.

Table 2. Section 303(d) TMDL Listing Information for Brush Creek Waterbody ND-10130201-036-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-036-S_00
Waterbody Description	Brush Creek and tributaries.
Size	61.06 miles
Designated Uses Impaired	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 3. Section 303(d) TMDL Listing Information for Coyote Creek Waterbody ND-10130201-037-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-037-S_00
Waterbody Description	Coyote Creek from its confluence with Beaver Creek downstream to its confluence with the Knife River.
Size	17.24 miles
Designated Uses Impaired	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 4. Section 303(d) TMDL Listing Information for Elm Creek Waterbody ND-10130201-045-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-045-S_00
Waterbody Description	Elm Creek and tributaries.
Size	137.89 miles
Designated Uses Impaired	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 5. Section 303(d) TMDL Listing Information for Willow Creek Waterbody ND-10130201-046-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130201-046-S_00
Waterbody Description	Willow Creek and tributaries.
Size	29.54 miles
Designated Uses Impaired	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

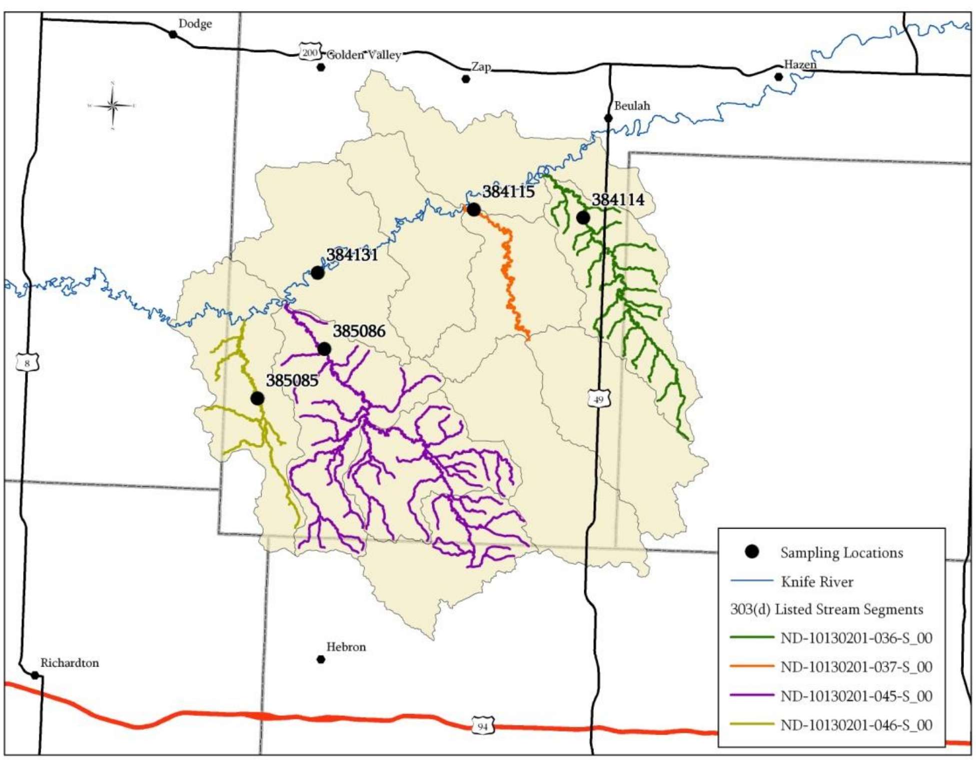

Figure 2. Knife River Watershed Sampling Sites and Section 303(d) Listed Waterbodies.

1.2 Ecoregions

The impaired reaches of the Knife River watershed lie within the Missouri Plateau (43a) and River Breaks (43c) level IV ecoregions of the Northwestern Great Plains level III ecoregion and is characterized by rolling hills on the eastern side of the region and rough terrain, in the west, with large buttes, steep hills, and deep draws (USGS, 2006). Elevation ranges are from 1,670-feet (msl) where the Missouri River leaves the county to about 2,400-feet (msl) in the southwestern part of the county.

Soils vary greatly in different areas of the watershed and range from soft shale plains to extreme sand. The soils belong to the Orders Mollisols, Entisols, Aridisols, Vertisols, and Inceptisols and are typically Cabba, Armor, Flasher, Vebar, Chama, and Zahl. A mosaic of small grains and grazing land covers the shortgrass prairie, but agriculture is limited by erratic precipitation patterns and limited opportunities for irrigation (USGS, 2006). Unique to Mercer County is the Knife River Flint used by the early Native Americans and early settlers.

Important artesian aquifers are located in the Fox Hills and Hell Creek formations of Late Cretaceous age and the Tongue River formations of Tertiary age. Most of the water used as domestic and livestock water for farms is derived from the lignite coal veins in Ft. Union shale.

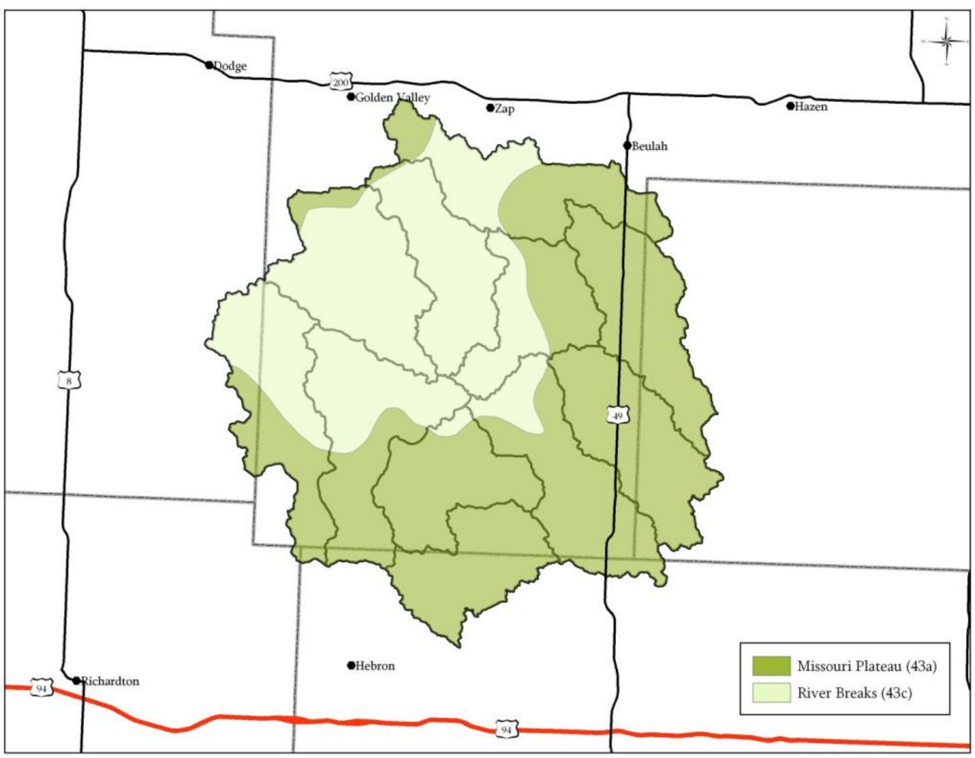

Figure 3. Level IV Ecoregions in the Knife River Watershed.

1.3 Land Use

The dominant land use in the Knife River watershed is grassland/rangeland. According to the 2007 National Agricultural Statistical Service land survey data (NASS, 2007), approximately 76 percent of the land is grassland/rangeland, 18 percent is actively cultivated, and six percent is comprised of wetlands, water, woods, and urban development. The majority of the crops grown consist of spring wheat, barley, and oats (Figure 4). There are three medium (<1,000 cattle) and one small (<400 cattle) permitted animal feeding operations (AFOs) which allow zero discharge, and no confined feeding operations (CAFOs) within the watershed. Unpermitted animal feeding operations and "hobby farms" are also present in the Knife River watershed, but their number and location are unknown.

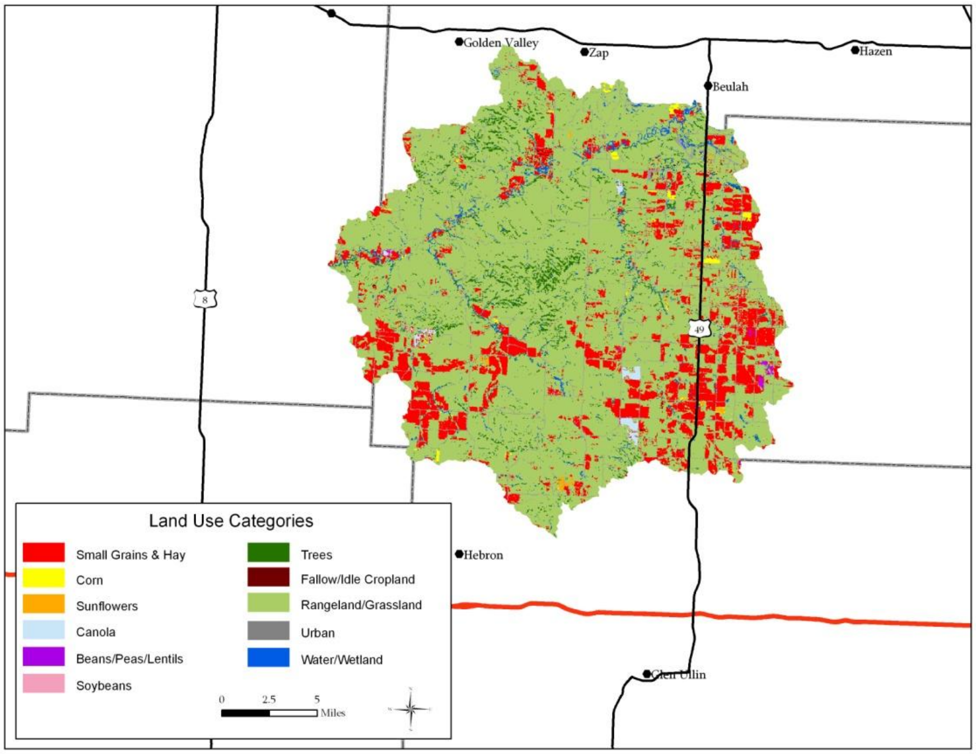

Figure 4. Land Use in the Knife River Watershed (NASS, 2007).

1.4 Climate and Precipitation

North Dakota's climate is characterized by large temperature variation across all time scales, light to moderate irregular precipitation, plentiful sunshine, low humidity, and nearly continuous wind. Its location at the geographic center of North America results in a strong continental climate, which is intensified by the mountains to the west. There are no barriers to the north or south so a combination of cold, dry air masses originating in the far north and warm humid air masses originating in the tropical regions regularly overflow the state. Movement of these air masses and their associated fronts causes near continuous wind and often results in large day to day temperature fluctuations in all seasons. The average last freeze in spring occurs in late May. In the fall, the first 32 degree or lower temperature occurs between September 10th and 25th. However, freezing temperatures have occurred as late as mid-June and as early as mid-August. About 75 percent of the annual precipitation falls during the period of April to September.

The climate of the region varies significantly depending on the season. Climate data for the period of 1994 through 2009 was obtained for the North Dakota Agricultural Network (NDAWN) at Hazen, ND monitoring station, which is located 10 miles northeast of the watershed (Figures 5 and 6). The average daily temperature is 42^{o} F, with an average monthly temperature of 66^{o} F in July and 1 ^{o} F in January. Average annual precipitation is approximately 12.28 inches for the region.

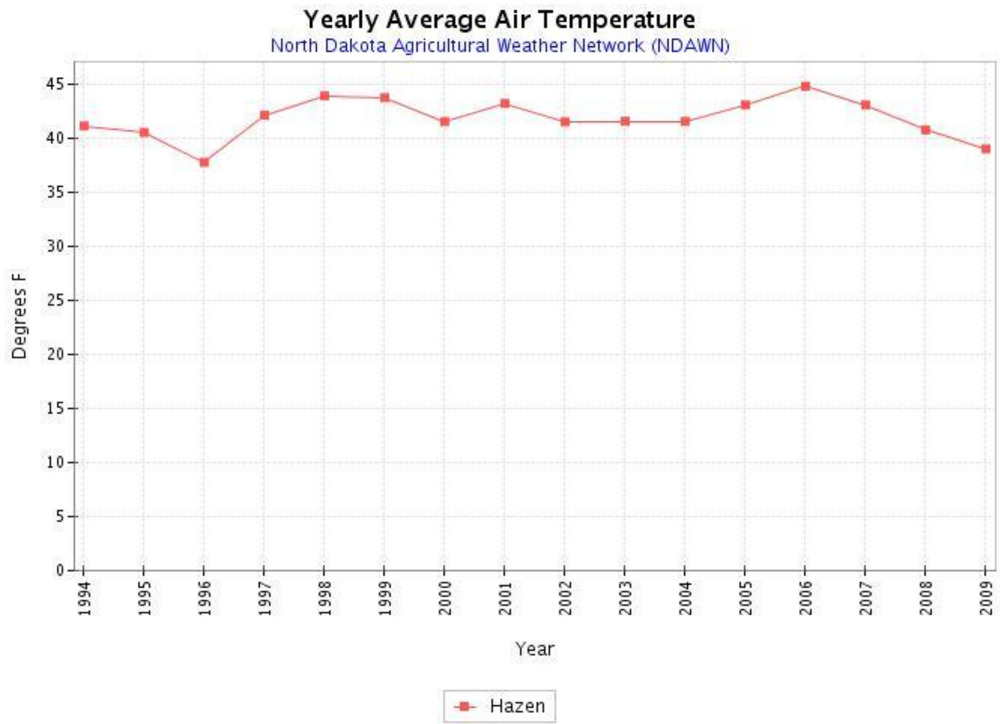

Figure 5. Annual Average Air Temperature at Hazen, North Dakota from 1994-2009 (NDAWN, 2010).

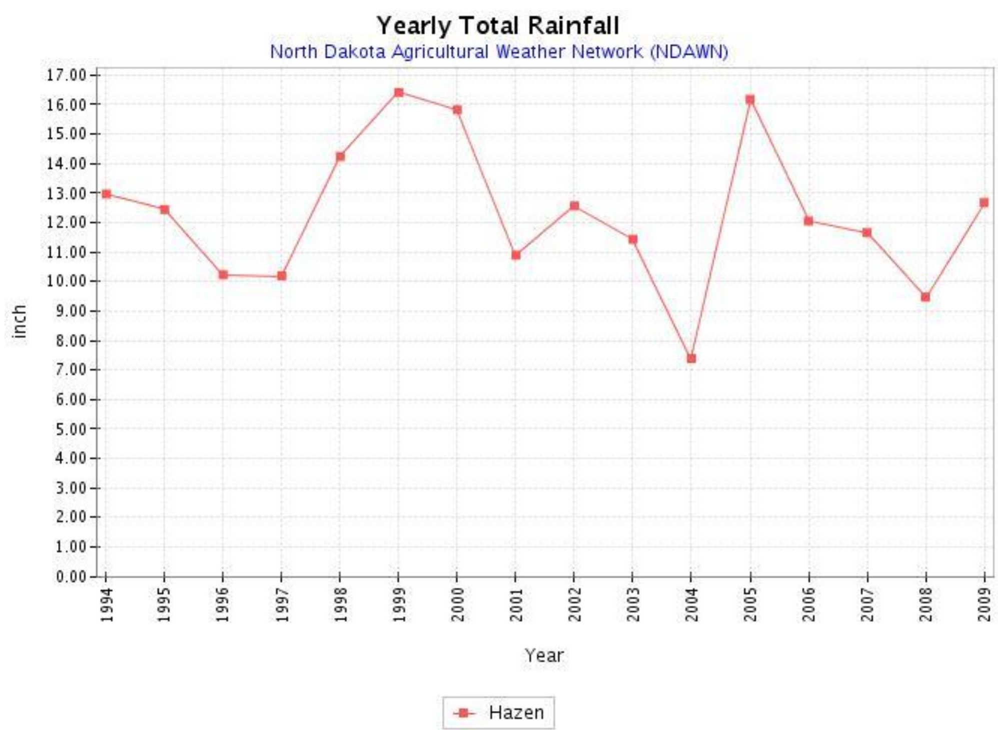

Figure 6. Annual Total Precipitation at Hazen, North Dakota from 1994-2009 (NDAWN, 2010).

1.5 Available Data

1.5.1 Fecal Coliform Bacteria Data

Fecal coliform bacteria samples were collected at four locations corresponding to each of the four impaired reaches listed in this TMDL (Figure 2). Sites 384114 and 384115 were sampled in 2001, 2002, 2005, 2008 and 2009, while sites 385085 and 385086 were sampled in 2001, 2002 and 2005. All sites were sampled weekly or when flow conditions were present during the recreation season. The recreation season in North Dakota is May 1 to September 30 (NDDoH, 2006). All sites were sampled by the Mercer County Soil Conservation District. While the state of North Dakota has an E. coli bacteria standard (see Section 2.0), no E. coli data are available for the TMDL reaches described in this report.

Tables 6-9 provide a summary of monthly fecal coliform bacteria geometric mean concentrations, the percentage of samples exceeding 400 CFU/100mL for each month and the recreational use assessment by month. The geometric mean fecal coliform bacteria concentration and the percent of samples over 400 CFU/100mL were calculated for each month (May 1st to September 30th) using samples pooled by month across the years.

Table 6. Summary of Fecal Coliform Bacteria Data for Site 384114 (Data Collected in 2001-2002, 2005 and 2008-2009).

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	20	55	15%	Fully Supporting but Threatened
June	17	540	82%	Not Supporting
July	12	184	8%	Fully Supporting
August	7	115	29%	Fully Supporting but Threatened
September	5	195	20%	Fully Supporting but Threatened

Table 7. Summary of Fecal Coliform Bacteria Data for Site 384115 (Data Collected in 2001-2002, 2005 and 2008-2009).

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	20	38	15%	Fully Supporting but Threatened
June	16	189	31%	Fully Supporting but Threatened
July	11	184	18%	Fully Supporting but Threatened
August	7	46	0%	Fully Supporting
September	5	19	0%	Fully Supporting

Table 8. Summary of Fecal Coliform Bacteria Data for Site 385085 (Data Collected in 2001-2002 and 2005).

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	6	60	17%	Fully Supporting but Threatened
June	6	359	50%	Not Supporting
July	5	88	40%	Fully Supporting but Threatened
August	N/A	N/A	N/A	N/A
September	N/A	N/A	N/A	N/A

N/A – data not collected due to no flow

Table 9. Summary of Fecal Coliform Bacteria Data for Site 385086 (Data Collected in 2001-2002 and 2005).

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	10	97	10%	Fully Supporting
June	8	269	50%	Not Supporting
July	6	290	33%	Not Supporting
August	2	42	0%	Fully Supporting
September	N/A	N/A	N/A	N/A

N/A – data not collected due to no flow

1.5.2 Hydraulic Discharges

A discharge record was constructed for the listed segments using the Drainage Area Ratio Method (Ries et al., 2000) and the historical discharge measurements collected by the USGS at the Knife River near Golden Valley, ND gauging station (06339500) from 1989-2009. USGS gauging station 06339500 is located on the Knife River between its confluence with Elm Creek (upstream) and Coyote Creek (downstream) and is collocated with water quality monitoring site 384131 (Figure 2). Due to its location, its assumed that the contributing watershed for USGS site 06339500 is similar in land use and slope to the Brush Creek, Coyote Creek, Elm Creek, Willow Creek watersheds.

1.5.3 Other Data

Other data were also collected throughout the watershed in addition to the water chemistry data. A land use assessment was conducted by the Mercer County Soil Conservation District with the help from the NDDoH using the Land Use Quarter/Quarter Assessment Protocol (Appendix C). A random selection of 100 quarter-quarter (40 acre) sites were assessed by local project office staff for a minimum of 50 crop and 50 rangeland sites. Each site was scored based on numerous ranking questions including those on erosion, vegetative cover and livestock caused bare ground/hummocking. A summary of the assessment is provided in Tables 10 and 11. The assessment found an over abundance of livestock use along the streams in the listed watersheds. However, of the 50 sites sampled for the range portion of the assessment, all scored in the "Good" range. This assessment is a useful tool in identifying livestock presence, and therefore fecal coliform bacteria, in the listed watersheds, as well as determining areas of high erosion potential which could facilitate fecal coliform bacteria transport into the waters of the listed reaches.

Table 10. Average Soil Loss Estimates from Cropped Acres and Total Watershed Acres

Site	Tons/Crop	Tons/Watershed
Brush Creek	2.87	0.73
Coyote Creek	5.07	1.32
Elm Creek	3.68	0.48
Willow Creek	3.31	0.96
Knife River (East)	5.00	0.53
Knife River (West)	4.87	0.05

Table 11. Mean Range Condition Scores

Site	Mean Score
Brush Creek	55.25
Knife River (East)	60.69
Coyote Creek	61.14
Willow Creek	62.4
Elm Creek	64.61
Knife River (West)	65

(Poor = 0-25, Fair = 25-50, Good = 50-75, Excellent = 75-100)

2.0 WATER QUALITY STANDARDS

The Clean Water Act requires that Total Maximum Daily Loads (TMDLs) be developed for waters on a state's Section 303(d) list. A TMDL is defined as "the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background" such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded. The purpose of a TMDL is to identify the pollutant load reductions or other actions that should be taken so that impaired waters will be able to attain water quality standards. TMDLs are required to be developed with seasonal variations and must include a margin of safety that addresses the uncertainty in the analysis. Separate TMDLs are required to address each pollutant or cause of impairment (i.e., fecal coliform bacteria).

2.1 Narrative Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the state. The narrative general water quality standards are listed below (NDDoH, 2006).

- All waters of the state shall be free from substances attributable to municipal, industrial, or other discharges or agricultural practices in concentrations or combinations that are toxic or harmful to humans, animals, plants, or resident aquatic biota.

- No discharge of pollutants, which alone or in combination with other substances, shall:

- Cause a public health hazard or injury to environmental resources;
- Impair existing or reasonable beneficial uses of the receiving water; or
- Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set a biological goal for all surface waters in the state. The goal states that "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites" (NDDoH, 2006).

2.2 Numeric Water Quality Standards

The Knife River tributaries are Class III streams. The NDDoH definition of Class III streams are shown below.

Class III - The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses (NDDoH, 2006).

Numeric criteria have been developed for Class III streams for both fecal coliform bacteria and E. coli (Table 12). Both bacteria standards apply only during the recreation season from May 1 to September 30.

Table 12. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class III Streams.

Parameter	Water Quality Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

[1] **Expressed as a geometric mean of representative samples collected during any consecutive 30-day period.**
[2] **No more than 10 percent of samples collected during any consecutive 30-day period shall individually exceed the standard.**

3.0 TMDL TARGETS

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on state water quality standards, but can also include site specific values when no numeric criteria are specified in the standard. The following TMDL target for the impaired reaches of the Knife River tributaries is based on the NDDoH water quality standard for fecal coliform bacteria.

3.1 Knife River Tributaries Target Reductions in Fecal Coliform Bacteria Concentrations

The four reaches of the Knife River tributaries listed in this TMDL are impaired because of fecal coliform bacteria. Reaches ND-10130201-036-S_00, ND-10130201-037-S_00, ND-10130201-045-S_00, and ND-10130201-046-S_00 are listed as fully supporting but threatened for recreational beneficial uses because of fecal coliform bacteria counts exceeding the North Dakota water quality standard. The North Dakota water quality standard for fecal coliform bacteria is a 30-day geometric mean concentration of 200 CFU/100 mL during the recreation season from May 1 to September 30. Thus, the TMDL target for this report is 200 CFU/100 mL. In addition, no more than ten percent of samples collected for fecal coliform bacteria should exceed 400 CFU/100 mL.

While the standard is intended to be expressed as the 30-day geometric mean, the target is based on the 200 CFU/100 mL geometric mean standard. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and recreational uses are restored.

Currently, the state of North Dakota has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the current triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. This standards change is recommended by the USEPA as E. coli is believed to be a better indicator of recreational use risk (i.e., incidence of gastrointestinal disease). During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for this TMDL and the resulting load allocation is believe to be protective of the E. coli standard as well. This conclusion is based on the assumption that the ratio of E. coli to fecal coliform in the environment is equal to or less that the ratio of the E. coli bacteria standard to the fecal coliform bacteria standard, which is 63% (126:200). If the ratio of E. coli to fecal coliform in the environment is greater than 63%, then it is unlikely that the current TMDL will result in attainment of the E. coli standard. The department will assess attainment of the E. coli standard through additional monitoring consistent with the State's water quality standards and beneficial use assessment methodology.

4.0 SIGNIFICANT SOURCES

4.1 Point Sources

Within the listed segments of the Knife River tributaries there are no point sources permitted through the North Dakota Pollutant Discharge Elimination System (NPDES) Program. Dwellings located within the watershed utilize septic waste systems.

There are no CAFOS in the TMDL watershed of the Knife River. There are three permitted medium (<1,000 cattle) and one small (<400 cattle) AFOs in the watershed, however all four are zero discharge facilities and are not deemed a significant point source of fecal coliform bacteria loadings for this report. There are several unpermitted AFOs in the watershed, but the exact location and number of these operations is unknown.

4.2 Nonpoint Sources

The TMDL listed segments in the Knife River Watershed are experiencing fecal coliform bacteria pollution from nonpoint sources in the watershed. With agriculture being the predominant land use, farms and ranches are located throughout the watershed. Livestock production is a dominant agricultural practice in the watershed. The North Dakota Agricultural Statistics Service indicates that out of 53 counties in North Dakota Morton County, Dunn County, Mercer County, and Oliver County ranked 1st, 2nd, 9th, and 17th in livestock production, respectively (NASS, 2001).

This assessment is also supported by the load duration curve analysis (Section 5.3) which shows exceedences of the fecal coliform bacteria standard occurring during high, moist, and dry condition flows.
Wildlife may also contribute to the fecal coliform bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife are nomadic, with fewer numbers concentrated in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

Septic system failure might contribute to the fecal coliform bacteria in the water quality samples. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002).

5.0 TECHNICAL ANALYSIS

In TMDL development, the goal is to define the linkage between the water quality target and the identified source or sources of the pollutant (in this case total fecal coliform bacteria) to determine the load reduction needed to meet the target. To determine the cause-and-effect relationship between the water quality target and the identified sources, the "load duration curve" methodology was used.

The loading capacity or TMDL is the amount of pollutant (i.e., total fecal coliform bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the total fecal coliform bacteria reductions necessary to achieve the water quality standards target of 200 CFU/100 mL, with a margin of safety.

5.1 Mean Daily Stream Flow

In southwest North Dakota, rain events are variable and can be sporadic and heavy or light, occurring over a short duration. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime. The medium flow regime (moist and dry conditions on the flow duration curve analysis) is represented by runoff that contributes to the stream over a longer duration. The low flow regime is characteristic of drought or precipitation events of small duration and/or magnitude that do not contribute to runoff.

Flows for the watershed were estimated by utilizing the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000). The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site is hydrologically similar (same per unit area) to the stream gauging station used as an index. Drainage area for the ungauged sites (384114, 384115, 385086, and 385085) and index station (06339500) was determined through GIS using digital elevation models (DEMs). Streamflow data for the index station (06339500) was obtained from the USGS Water Science Center website. The index station (06339500) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged sites to obtain estimated flow statistics for the ungauged sites.

5.2 Flow Duration Curve Analysis

The flow duration curve serves as the foundation for the load duration curve used in the TMDL. Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified time period. A flow duration curve relates flow (expressed as mean daily discharge) to the percent of time those mean daily flow values have been met or exceeded. The use of *"percent of time exceeded"* (i.e., duration) provides a uniform scale ranging from 0 to 100 percent, thus accounting for the full range of stream flows for the period of record. Low flows are exceeded most of the time, while flood flows are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 7). Using this approach, flow duration intervals are expressed as a percentage, with zero corresponding to the highest flows in the record (i.e., flood conditions) and 100 to the lowest flows in the record (i.e., drought). Therefore, as depicted in Figure 7, a flow duration interval of 42 percent, associated with a stream flow of two cfs, implies that 42 percent of all observed mean daily discharge values equal or exceed two cfs.

Once the flow duration curve is developed for the stream site, flow duration intervals can be defined which can be used as a general indicator of hydrologic condition (i.e. wet vs dry conditions and to what degree). These intervals (or zones) provide additional insight about conditions and patterns associated with the impairment (fecal coliform bacteria in this case) (USEPA, 2007). As depicted in the example in Figure 7, the flow duration curve for site 384114 and representing TMDL segment ND-10130201-036-S_00, was divided into four zones, one representing high flows (0-18 percent), another for moist conditions (18-42 percent), dry conditions (42-84 percent), and one for low flows (84-99 percent). Based on the flow duration curve analysis, no flow occurred one percent of the time (99-100 percent).

These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot (Figure 7). A secondary factor in determining the flow intervals used in each analysis was the number of fecal coliform bacteria observations available for each flow interval. Flow duration curves developed for sites 384115, 385085 and 385086 are provided in Appendix C.

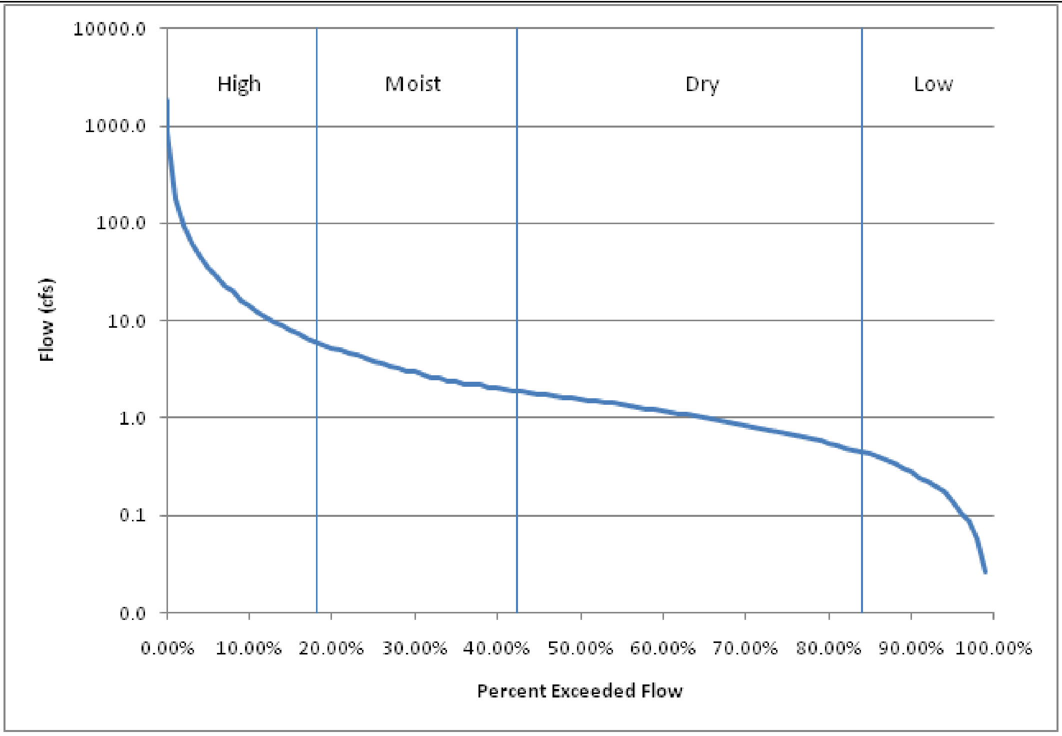

Figure 7. Flow Duration Curve for the Brush Creek Monitoring Station 384114.

5.3 Load Duration Curve Analysis

An important factor in determining nonpoint source pollution loads is variability in stream flows and loads associated with high and low flow. To better correlate the relationship between the pollutant of concern and hydrology of the Section 303(d) TMDL listed segments, load duration curves were developed for the four Knife River tributary TMDL segments. The load duration curves were derived using the 200 CFU/100 mL State water quality standard and the flows generated as described in Section 5.1 and 5.2.

Observed in-stream total fecal coliform bacteria concentrations from monitoring sites 384114, 384115, 385085, and 385086 (Appendix A) were converted to pollutant loads by multiplying total fecal coliform bacteria concentrations by the daily flow on the date the sample was collected and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection. Points plotted above the 200 CFU/100 mL TMDL target curve exceed the TMDL target. Points plotted below the curve are meeting the water quality target of 200 CFU/100 mL.

For each flow regime and each site, a regression relationship was developed between the samples above the TMDL target (200 CFU/100 mL) curve and the percent exceeded flow. The load duration curves for sites 384114, representing TMDL segment ND 10130102-036-S_00, 384115, representing TMDL segment ND 10130102-037-S_00, 385086, representing TMDL segment ND 10130102-045-S_00, and 385086, representing TMDL segment ND 10130102-046-S_00, showing the regression relationship for each flow regime are provided in Figures 8-11. The regression line for each flow interval was then used with the midpoint of the percent exceeded flow for that interval to calculate existing total fecal coliform bacteria load for that flow interval.

For example, in Figure 8 the regression relationship between observed fecal coliform bacteria loading and percent exceeded flow for the high, moist condition, dry condition and low flow intervals are:

Fecal coliform load (expressed as 10^7 CFUs/day) = antilog (Intercept+ (Slope*Percent Exceeded Flow))

Where the midpoint of the high flow interval from 0 to 18 percent is 9.01 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (5.30+ (-9.51*0.0901))
= 27,441 x 10^7 CFUs/day

Where the midpoint of the moist condition flow interval from 18 to 42 percent is 30 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (4.038+ (-0.81*0.30))
= 6,124 x 10^7 CFUs/day

Where the midpoint of the dry condition flow interval from 42 to 84 percent is 63 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (3.68+ (-0.95*0.63))
= 1,211 x 10^7 CFUs/day

The midpoint for the flow intervals is also used to estimate the TMDL target load. In the case of the previous examples, the TMDL target load for the midpoints of 9.01, 30 and 63 percent exceeded flow derived from the 200 CFU/100 mL TMDL target curves are 7,908 x 10^7 CFUs/day, 1,483 x 10^7 CFUs/day and 534 x 10^7 CFUs/day, respectively.

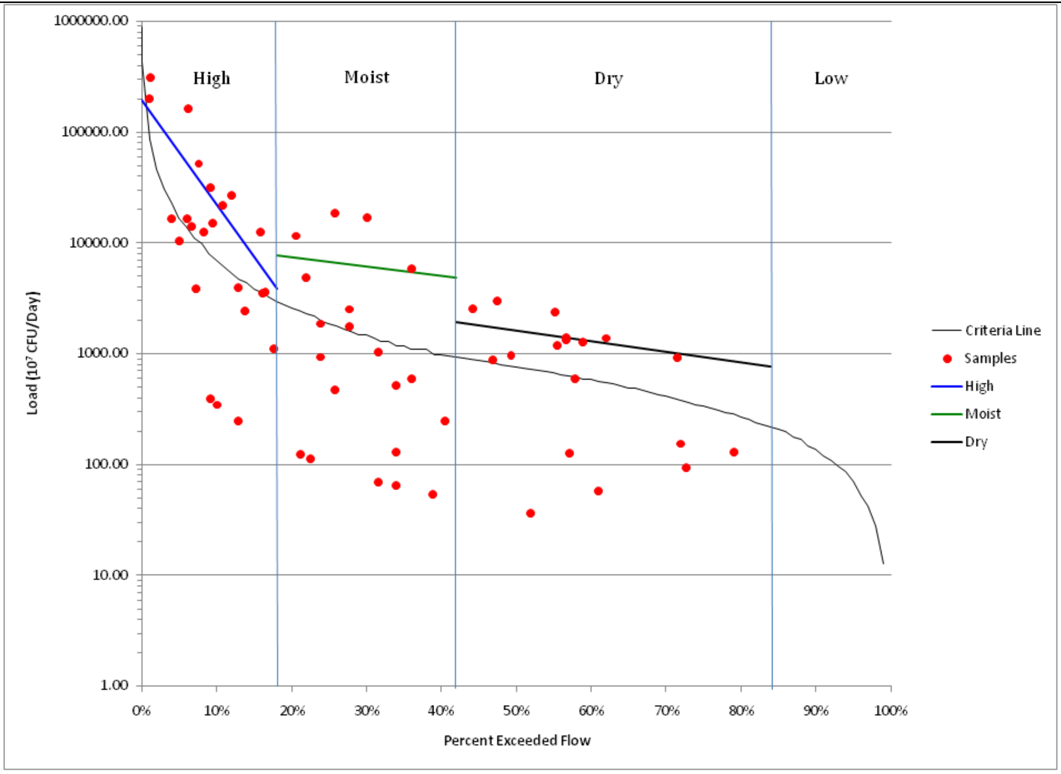

Figure 8. Load Duration Curve for the Brush Creek Monitoring Station 384114.

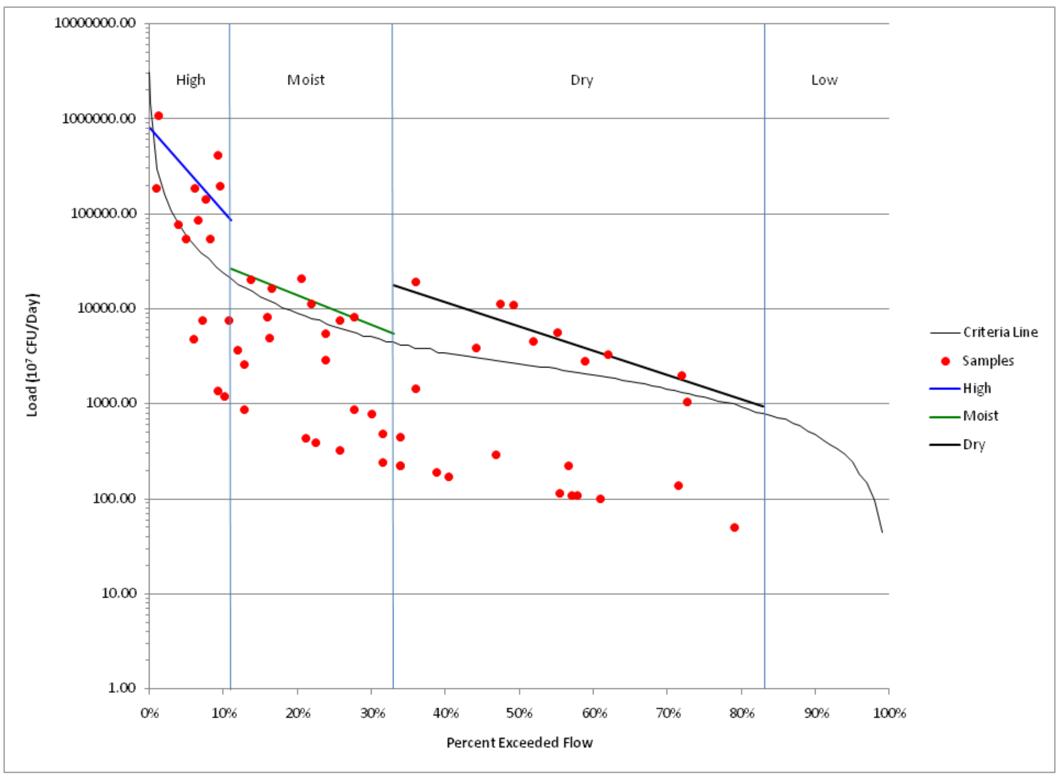

Figure 9. Load Duration Curve for the Coyote Creek Monitoring Station 384115.

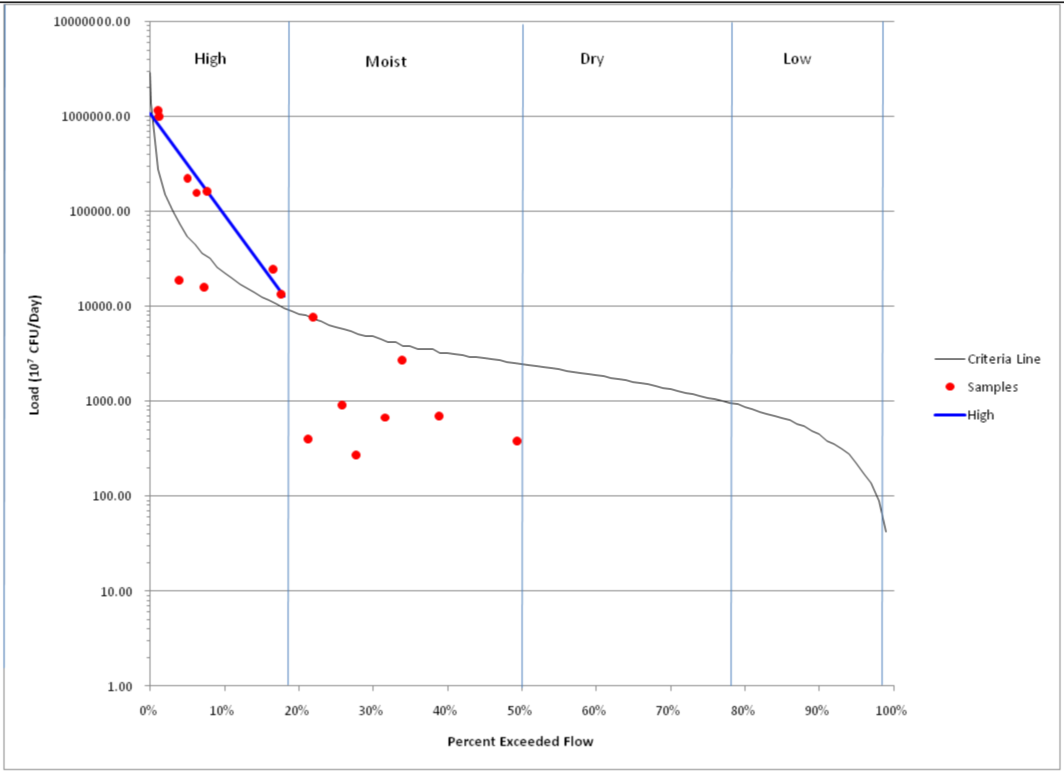

Figure 10. Load Duration Curve for the Elm Creek Monitoring Station 385086.

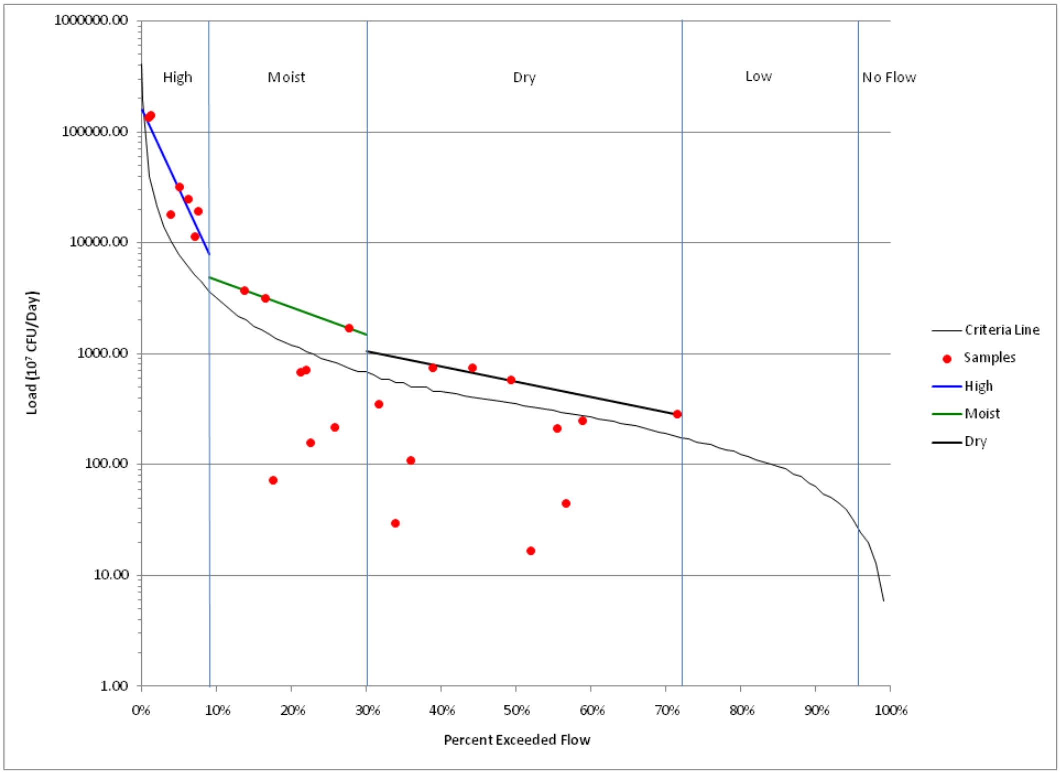

Figure 11. Load Duration Curve for the Willow Creek Monitoring Station 385085.

5.4 Loading Sources

The most significant sources of total fecal coliform bacteria loading remain nonpoint source pollution originating from livestock. Based on the data available, the general focus of BMPs and load reductions for the listed segments should be on unpermitted animal feeding operations and "hobby farms" within close proximity of the Knife River tributaries.

One of the more important concerns regarding nonpoint sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, four flow regimes (i.e., high flow, moist condition, dry condition and low flow) were selected to represent the hydrology of the watershed (Figure 7).

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to fecal coliform loading. Animals grazing in the riparian area contribute total fecal coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, moist/dry and low flows (Table 13). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and medium impact at moist/dry flows (Table 13). Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for total fecal coliform bacteria contamination.

Table 13. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Non-Point Sources	Flow Regime		
	High Flow	Moist/Dry Conditions	Low Flow
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA) regulations require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." The margin of safety (MOS) can be either incorporated into conservative assumptions used to develop the TMDL (implicit) or added as a separate component of the TMDL (explicit).

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 200 CFU/100 mL, a ten percent explicit margin of safety was used for this TMDL. The MOS was calculated as ten percent of the TMDL. In other words ten percent of the TMDL is set aside from the load allocation as a MOS. The ten percent MOS was derived by taking the difference between the points on the load duration curve using the 200 CFU/100 mL standard and the curve using the 180 CFU/100 mL.

6.2 Seasonality

Section 303(d)(1)(C) of the Clean Water Act and associated regulations require that a TMDL be established with seasonal variations. The Knife River tributaries TMDL addresses seasonality because the flow duration curve was developed using 20 years of USGS gage data encompassing 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season from May 1 to September 30 and controls will be designed to reduce fecal coliform loads during the seasons covered by the standard.

7.0 TMDL

Table 14 provides an outline of the critical elements of the fecal coliform bacteria TMDL. TMDLs for Brush Creek segment ND-10130201-036-S_00, Coyote Creek segment ND-10130201-037-S_00, Elm Creek segment ND-10130201-045-S_00 and Willow Creek segment ND-10130201-046-S_00 are represented in Tables 15-18, respectively. The TMDLs provide a summary of average daily loads and waste loads by flow regime necessary to meet the water quality target (i.e. TMDL). The TMDLs for each segment and flow regime provide an estimate of the existing daily load, an estimate of the average daily loads necessary to meet the water quality target (i.e. TMDL load). The TMDL for each listed segment includes a load allocation from known nonpoint sources and a ten percent margin of safety.

While there were no exceedences of the 200 CFU/100 mL fecal coliform standard for the dry flow and low flow regimes for segment ND-06339500-045-S_00 and low flow regimes for segments ND-06339500-036-S_00, ND-06339500-037-S_00 and ND-06339500-046-S_00, a TMDL load has been provided for each of these flow regimes as a guide to future watershed management. Based on available data, it can be assumed that these segments of the Knife River tributaries are currently meeting the water quality standard for those flow regimes.

It should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

Table 14. TMDL Summary for the Knife River Tributaries.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	Fecal Coliform Bacteria	See Section 2.1
TMDL Target	200 CFU/100 mL	Based on North Dakota water quality standards
Significant Sources	Nonpoint Source Contributions	Loads are a result of nonpoint sources (i.e., rangeland, pasture land, etc.)
MOS	Explicit	10 percent

The TMDLs for each segment and flow regime provide

The TMDL can be described by the following equation**:**

TMDL = LC = WLA + LA + MOS, where:

LC = loading capacity, or the greatest loading a waterbody can receive without violating water quality standards;
WLA = wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;
LA = load allocation, or the portion of the TMDL allocated to existing or future nonpoint sources;
MOS = margin of safety, or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of loading capacity.

Table 15. Fecal Coliform Bacteria TMDL (10^7 CFUs/day) for Brush Creek Waterbody ND-10130201-036-S_00 as Represented by Site 384114 (Brush Creek).

Flow Regime	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load	27,441	6,124	1,211	
TMDL	7,908	1,483	534	109[1]
WLA	0	0	0	No load reduction necessary
LA	7,117	1,335	481	
MOS	791	148	53	

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 16. Fecal Coliform Bacteria TMDL (10^7 CFUs/day) for Coyote Creek Waterbody ND-10130201-037-S_00 as Represented by Site 384115 (Coyote Creek).

Flow Regime	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load	260,445	12,013	4,079	
TMDL	51,555	7,890	2,127	377[1]
WLA	0	0	0	No load reduction necessary
LA	4,6399	7,101	1,914	
MOS	5,156	789	213	

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 17. Fecal Coliform Bacteria TMDL (10^7 CFUs/day) for Elm Creek Waterbody ND-10130201-045-S_00 as Represented by Site 385086 (Elm Creek).

Flow Regime	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load	117,380			
TMDL	25,644	3,847[1]	1,667[1]	513[1]
WLA	0	No load reduction necessary	No load reduction necessary	No load reduction necessary
LA	23,080			
MOS	2,564			

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 18. Fecal Coliform Bacteria TMDL (10^7 CFUs/day) for Willow Creek Waterbody ND-10130201-046-S_00 as Represented by Site 385085 (Willow Creek).

Flow Regime	High Flow	Moist Condition	Dry Condition	Low Flow
Existing Load	35,425	2,689	547	
TMDL	9,103	1,229	341	100[1]
WLA	0	0	0	No load reduction necessary
LA	8,193	1,106	307	
MOS	910	123	34	

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

8.0 ALLOCATION

There are no known point sources impacting the watershed, therefore, the entire total fecal coliform load for this TMDL was allocated to nonpoint sources in the watershed. The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, upland grazing).

To achieve the TMDL targets identified in the report will require the wide spread support and voluntary participation of landowners and residents in the immediate watershed as well as those living upstream. The TMDLs described in this report are a plan to improve water quality by implementing best management practices through non-regulatory approaches. "Best management practices" (BMPs) are methods, measures, or practices that are determined to be a reasonable and cost effective means for a land owner to meet nonpoint source pollution control needs," (USEPA, 2001). This TMDL plan is put forth as recommendations for what needs to be accomplished for the listed tributaries of the Knife River, and associated watersheds in this TMDL to restore and maintain their recreational uses. Water quality monitoring should continue in order to measure BMP effectiveness and determine through adaptive management if loading allocation recommendations need to be adjusted.

Nonpoint source pollution is the largest contributor to elevated total fecal coliform bacteria levels in the listed tributaries of the Knife River watershed. The fecal coliform samples and load duration curve analysis of the impaired reaches identified the high, moist condition and in some cases dry condition regimes as the time of fecal coliform bacteria exceedences of the 200 CFU/100 mL target. To reduce NPS pollution for the high, moist, and dry condition flow regimes, specific BMPs are described in Section 8.1 that will mitigate the effects of total fecal coliform bacteria loading to the impaired reach.

Controlling nonpoint sources is an immense undertaking requiring extensive financial and technical support. Provided that technical/financial assistance is available to stakeholders, these BMPs have the potential to significantly reduce total fecal coliform loading to the Knife River tributaries. The following describe in detail those BMPs that will reduce total fecal coliform bacteria levels in the impaired tributaries of the Knife River watershed.

8.1 Livestock Management Recommendations

Livestock management BMPs are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock, erosion from poorly managed grazing, land and riparian areas can be a significant source of fecal coliform bacteria loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody because of livestock. These specific BMPs are known to reduce nonpoint source pollution from livestock. These BMPs include:

<u>Livestock exclusion from riparian areas</u>- This practice is established to remove livestock from grazing riparian areas and watering in the stream. Livestock exclusion is accomplished through fencing. A reduction in stream bank erosion can be expected by minimizing or eliminating hoof trampling. A stable stream bank will support vegetation that will hold banks in place and serve a secondary function as a filter from nonpoint source runoff. Added vegetation will create aquatic habitat and shading for macroinvertebrates and fish. Direct deposit of fecal matter into the stream and stream banks will be eliminated as a result of livestock exclusion by fencing.

<u>Water well and tank development</u>- Fencing animals from stream access requires and alternative water source. Installing water wells and tanks satisfies this need. Installing water tanks provides a quality water source and keeps animals from wading and defecating in streams. This will reduce the probability of pathogenic infections to livestock and the public.

<u>Prescribed grazing</u>- This practice is used to increase ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resource Conservation Service (NRCS)

recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency, and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil water for plant growth, and better manure distribution and increased rate of decomposition, (NRCS, 1998). In a study by Tiedemann et al. (1988), as presented by USEPA (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 19) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month, with water developments and fencing, bacteria levels were reduced significantly.

Table 19. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Grazing Strategy		Geometric Mean Fecal Coliform Count
Strategy A:	Ungrazed	40/L
Strategy B:	Grazing without management for livestock distribution; 20.3 ac/AUM.	150/L
Strategy C:	Grazing with management for livestock distribution: fencing and water developments; 19.0 ac/AUM	90/L
Strategy D:	Intensive grazing management, including practices to attain uniform livestock distribution and improve forage production with cultural practices such as seeding, fertilizing, and forest thinning; 6.9 ac/AUM	950/L

<u>Waste management system</u>- Waste management systems can be effective in controlling up to 90 percent of fecal coliform loading originating from confined animal feeding areas (Table 20). A waste management system is made up of various components designed to control nonpoint source pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water from the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

Table 20. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

Practice[b] Category	Runoff[c] Volume	Total[d] Phosphorus (%)	Total[d] Nitrogen (%)	Sediment (%)	Fecal Coliform (%)
Animal Waste System[e]	-	90	80	60	85
Diversion System[f]	-	70	45	NA	NA
Filter Strips[g]	-	85	NA	60	55
Terrace System	-	85	55	80	NA
Containment Structures[h]	-	60	65	70	90

NA = Not Available.
a Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.
b Each category includes several specific types of practices.
c - = reduction; + = increase; 0 = no change in surface runoff.
d Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N, and nitrate-N.
e Includes methods for collecting, storing, and disposing of runoff and process-generated wastewater.
f Specific practices include diversion of uncontaminated water from confinement facilities.
g Includes all practices that reduce contaminant losses using vegetative control measures.
h Includes such practices as waste storage ponds, waste storage structures, waste treatment lagoons.

8.2 Other Recommendations

Vegetative Filter Strip – Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, fecal coliform bacteria to streams. The effectiveness of filter strips and other BMPs in reducing fecal coliform bacteria can be quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993), suggest that vegetative filter strips are capable of removing up to 55 percent of fecal coliform bacteria loading to rivers and streams (Table 20). The ability of the filter strip to reduce contaminants is dependent on field slope, filter strip slope, erosion rate, amount and particulate size distribution of sediment delivered to the filter strip, density and height of vegetation, and runoff volume associated with erosion producing events (NRCS, 2001).

Septic System – Septic systems provide an economically feasible way of disposing of household wastes where other means of waste treatment are unavailable (e.g., public or private treatment facilities). The basis for most septic systems involves the treatment and distribution of household wastes through a series of steps involving the following:

1. A sewer line connecting the house to a septic tank
2. A septic tank that allows solids to settle out of the effluent
3. A distribution system that dispenses the effluent to a leach field
4. A leaching system that allows the effluent to enter the soil

Septic system failure occurs when one or more components of the septic system do not work properly and untreated waste or wastewater leaves the system. Wastes may pond in the leach field and ultimately run off directly into nearby streams or percolate into groundwater. Untreated septic system waste is a potential source of nutrients (nitrogen and phosphorus), organic matter, suspended solids, and fecal coliform bacteria. Land application of septic system sludge, although unlikely, may also be a source of contamination.

Septic system failure can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002).

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDL for the Knife River and a request for comment was mailed to participating agencies, partners, and to those who requested a copy. Those included in the mailing of a hard copy were as follows:

- Mercer County Soil Conservation District;
- Mercer County Water Resource Board;
- Natural Resource Conservation Service (State Office); and
- US Environmental Protection Agency, Region VIII

In addition to mailing or emailing copies of this TMDL for the listed waterbodies of the Knife River watershed to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at: http://www.health.state.nd.us/WQ/sw/Z2_TMDL/TMDLs_Under_PublicComment/B_Under_Public_Comment.htm.

A 30 day public notice soliciting comment and participation was also published in the Hazen Star (Mercer County) and Center republican (Oliver County).

As part of its normal review, a public notice review was received from the US EPA Region VIII (Appendix F). No comments were received from any other agency, organization or individual.

10.0 MONITORING

As stated previously, it should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

To ensure that the best management practices (BMPs) and technical assistance that were implemented as part of the Section 319 Knife River Watershed Restoration Project were successful in reducing fecal coliform bacteria loadings to levels prescribed in this TMDL, water quality monitoring was conducted in accordance with an approved Quality Assurance Project Plan (QAPP). As prescribed in the QAPP (NDDoH, 2003), monitoring was conducted for all variables that were causing impairments to the beneficial uses of the waterbody. These included, but were not limited to fecal coliform bacteria. Sampling began in May 2001 and continued through September 2009.

11.0 TMDL IMPLEMENTATION STRATEGY

In response to the Knife River Watershed Assessment and in anticipation of this completed TMDL, local sponsors successfully applied for and received Section 319 funding for the Knife River (Nine Townships) Watershed Restoration Project. Beginning in October 2001, local sponsors provided technical assistance and implementing BMPs designed to reduce fecal bacteria loadings and to help restore the beneficial uses of the Knife River (i.e., recreation). As part of the watershed restoration project, water quality data were collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing fecal coliform bacteria loadings. A QAPP (NDDoH, 2003) was developed as part of this watershed restoration project that detailed the how, when and where monitoring were conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are analyzed, watershed restoration efforts will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

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Appendix A
Fecal Coliform Bacteria Data Collected for the Listed Knife River Tributaries

Brush Creek (384114)

Date	Concentration (CFUs/100mL)
5/2/2001	10
5/7/2001	50
5/16/2001	10
5/21/2001	10
5/29/2001	360
6/5/2001	570
6/13/2001	410
6/18/2001	450
7/2/2001	300
7/24/2001	120
7/31/2001	140
8/13/2001	10
9/5/2001	90
5/9/2002	10
5/16/2002	110
5/22/2002	10
5/28/2002	440
6/4/2002	470
6/10/2002	2400
6/17/2002	70
6/26/2002	70
7/9/2002	100
5/18/2005	1000
6/9/2005	800
7/11/2005	210
7/25/2005	250
8/2/2005	420

Date	Concentration (CFUs/100mL)
5/4/2008	20
5/12/2008	40
5/19/2008	80
5/20/2008	50
5/27/2008	710
6/2/2008	500
6/9/2008	2000
6/16/2008	900
6/23/2008	730
6/30/2008	800
7/8/2008	420
5/4/2009	10
5/6/2009	10
5/11/2009	10
5/26/2009	400
5/27/2009	270
6/1/2009	1000
6/9/2009	690
6/22/2009	700
6/29/2009	240
7/1/2009	160
7/6/2009	90
7/15/2009	230
7/21/2009	200
7/28/2009	210
8/4/2009	150
8/12/2009	2300
8/18/2009	180
8/25/2009	20
8/31/2009	50
9/8/2009	990
9/16/2009	80
9/22/2009	210
9/30/2009	190

Coyote Creek (384115)

Date	Concentration (CFUs/100mL)
5/2/2001	10
5/7/2001	10
5/16/2001	10
5/21/2001	10
5/29/2001	10
6/5/2001	250
6/13/2001	270
6/18/2001	120
7/2/2001	280
7/24/2001	180
7/31/2001	190
8/13/2001	360
9/5/2001	10
5/9/2002	10
5/16/2002	260
5/22/2002	10
5/28/2002	20
6/4/2002	20
6/10/2002	800
6/17/2002	40
7/9/2002	930
5/18/2005	780
6/9/2005	800
7/11/2005	270
7/25/2005	800
8/2/2005	270

Date	Concentration (CFUs/100mL)
5/4/2008	10
5/12/2008	10
5/19/2008	300
5/20/2008	160
5/27/2008	480
6/2/2008	340
6/9/2008	230
6/16/2008	460
6/23/2008	800
6/30/2008	3000
5/4/2009	10
5/6/2009	10
5/11/2009	10
5/26/2009	1500
5/27/2009	330
6/1/2009	40
6/9/2009	130
6/22/2009	70
6/29/2009	20
7/1/2009	30
7/6/2009	150
7/15/2009	400
7/21/2009	80
7/28/2009	30
8/4/2009	20
8/12/2009	30
8/18/2009	80
8/25/2009	10
8/31/2009	10
9/8/2009	70
9/16/2009	20
9/22/2009	20
9/30/2009	10

Willow Creek (385085)

Date	Concentration (CFUs/100mL)
5/7/2001	30
5/16/2001	130
5/21/2001	40
6/13/2001	200
6/18/2001	800
7/2/2001	10
7/24/2001	800
7/31/2001	50
5/9/2002	10
5/22/2002	30
6/10/2002	720
6/17/2002	90
6/26/2002	260
5/18/2005	960
6/9/2005	800
7/11/2005	440
7/25/2005	30

Elm Creek (385086)

Date	Concentration (CFUs/100mL)
5/2/2001	30
5/7/2001	50
5/16/2001	10
5/21/2001	300
5/29/2001	140
6/5/2001	360
6/13/2001	130
6/18/2001	650
7/2/2001	440
7/24/2001	800
7/31/2001	330
8/13/2001	10
5/9/2002	120
5/16/2002	360
5/22/2002	110
5/28/2002	30
6/4/2002	310
6/10/2002	800
6/17/2002	450
6/26/2002	10
7/9/2002	40
5/18/2005	800
6/9/2005	800
7/11/2005	400
7/25/2005	320
8/2/2005	180

Appendix B
Mean Daily Discharge Data for the Knife River at Golden Valley (USGS Site 06339500) (January 1, 1989 – October 11, 2009)

Knife River at Golden Valley (384131)

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/1/1989	4.4	2/14/1989	2.1	3/30/1989	458	5/13/1989	14
1/2/1989	4.3	2/15/1989	2.1	3/31/1989	385	5/14/1989	13
1/3/1989	4.5	2/16/1989	2	4/1/1989	246	5/15/1989	12
1/4/1989	4.7	2/17/1989	2	4/2/1989	169	5/16/1989	12
1/5/1989	4.9	2/18/1989	1.9	4/3/1989	154	5/17/1989	14
1/6/1989	4.9	2/19/1989	1.9	4/4/1989	139	5/18/1989	12
1/7/1989	4.6	2/20/1989	1.9	4/5/1989	109	5/19/1989	11
1/8/1989	4.4	2/21/1989	1.9	4/6/1989	108	5/20/1989	9.9
1/9/1989	4.2	2/22/1989	2	4/7/1989	103	5/21/1989	9.1
1/10/1989	4	2/23/1989	2	4/8/1989	111	5/22/1989	8.5
1/11/1989	3.8	2/24/1989	2.1	4/9/1989	99	5/23/1989	8.4
1/12/1989	3.8	2/25/1989	2.2	4/10/1989	79	5/24/1989	9.9
1/13/1989	3.7	2/26/1989	2.1	4/11/1989	68	5/25/1989	13
1/14/1989	3.6	2/27/1989	2.1	4/12/1989	60	5/26/1989	11
1/15/1989	3.5	2/28/1989	2	4/13/1989	54	5/27/1989	10
1/16/1989	3.5	3/1/1989	2	4/14/1989	50	5/28/1989	10
1/17/1989	3.6	3/2/1989	1.9	4/15/1989	44	5/29/1989	31
1/18/1989	3.8	3/3/1989	1.9	4/16/1989	37	5/30/1989	66
1/19/1989	4.1	3/4/1989	1.8	4/17/1989	31	5/31/1989	258
1/20/1989	4.1	3/5/1989	1.7	4/18/1989	28	6/1/1989	199
1/21/1989	4	3/6/1989	1.7	4/19/1989	25	6/2/1989	129
1/22/1989	4.2	3/7/1989	1.9	4/20/1989	25	6/3/1989	80
1/23/1989	4.4	3/8/1989	2.5	4/21/1989	23	6/4/1989	53
1/24/1989	4.4	3/9/1989	3.5	4/22/1989	22	6/5/1989	49
1/25/1989	4.2	3/10/1989	6	4/23/1989	19	6/6/1989	34
1/26/1989	4.1	3/11/1989	124	4/24/1989	19	6/7/1989	25
1/27/1989	4	3/12/1989	235	4/25/1989	17	6/8/1989	20
1/28/1989	4.1	3/13/1989	201	4/26/1989	19	6/9/1989	17
1/29/1989	4.2	3/14/1989	250	4/27/1989	139	6/10/1989	13
1/30/1989	4.2	3/15/1989	558	4/28/1989	317	6/11/1989	11
1/31/1989	4	3/16/1989	420	4/29/1989	333	6/12/1989	11
2/1/1989	3.8	3/17/1989	250	4/30/1989	396	6/13/1989	9.9
2/2/1989	3.5	3/18/1989	160	5/1/1989	255	6/14/1989	9.2
2/3/1989	3.2	3/19/1989	120	5/2/1989	148	6/15/1989	8.3
2/4/1989	3	3/20/1989	60	5/3/1989	96	6/16/1989	8.3
2/5/1989	2.8	3/21/1989	40	5/4/1989	67	6/17/1989	8.1
2/6/1989	2.6	3/22/1989	52	5/5/1989	49	6/18/1989	8.1
2/7/1989	2.4	3/23/1989	45	5/6/1989	39	6/19/1989	7.5
2/8/1989	2.3	3/24/1989	52	5/7/1989	33	6/20/1989	6.7
2/9/1989	2.2	3/25/1989	60	5/8/1989	28	6/21/1989	5.6
2/10/1989	2.1	3/26/1989	106	5/9/1989	26	6/22/1989	5.5
2/11/1989	2.1	3/27/1989	180	5/10/1989	21	6/23/1989	5.8
2/12/1989	2.2	3/28/1989	313	5/11/1989	18	6/24/1989	5.8
2/13/1989	2.2	3/29/1989	536	5/12/1989	15	6/25/1989	5.2

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
6/26/1989	5.3	8/9/1989	0.8	9/22/1989	1.1	11/5/1989	4.2
6/27/1989	5.4	8/10/1989	0.77	9/23/1989	1.1	11/6/1989	4.8
6/28/1989	5.4	8/11/1989	0.85	9/24/1989	1.1	11/7/1989	5.2
6/29/1989	5.6	8/12/1989	1.4	9/25/1989	1.1	11/8/1989	5
6/30/1989	5.6	8/13/1989	1.3	9/26/1989	1.1	11/9/1989	4.8
7/1/1989	5	8/14/1989	1.2	9/27/1989	1.1	11/10/1989	5
7/2/1989	38	8/15/1989	1.1	9/28/1989	1.1	11/11/1989	5.2
7/3/1989	110	8/16/1989	1	9/29/1989	1.1	11/12/1989	5.4
7/4/1989	56	8/17/1989	1	9/30/1989	1.2	11/13/1989	5.2
7/5/1989	34	8/18/1989	1	10/1/1989	1.1	11/14/1989	5
7/6/1989	21	8/19/1989	0.95	10/2/1989	1.2	11/15/1989	4.5
7/7/1989	15	8/20/1989	0.92	10/3/1989	1.4	11/16/1989	3.8
7/8/1989	12	8/21/1989	0.92	10/4/1989	1.4	11/17/1989	3
7/9/1989	8.1	8/22/1989	0.96	10/5/1989	1.6	11/18/1989	3.2
7/10/1989	6.8	8/23/1989	1	10/6/1989	1.6	11/19/1989	4
7/11/1989	6.3	8/24/1989	1	10/7/1989	1.7	11/20/1989	4.7
7/12/1989	6.1	8/25/1989	3.7	10/8/1989	1.9	11/21/1989	5.1
7/13/1989	5.9	8/26/1989	6	10/9/1989	2.1	11/22/1989	4.8
7/14/1989	6.1	8/27/1989	4.7	10/10/1989	2.2	11/23/1989	4.2
7/15/1989	5.7	8/28/1989	10	10/11/1989	2.2	11/24/1989	4.4
7/16/1989	5.2	8/29/1989	15	10/12/1989	2.1	11/25/1989	4.6
7/17/1989	5.2	8/30/1989	16	10/13/1989	2.3	11/26/1989	4.4
7/18/1989	5.9	8/31/1989	14	10/14/1989	2.8	11/27/1989	4
7/19/1989	7.6	9/1/1989	9	10/15/1989	3	11/28/1989	3.5
7/20/1989	6.6	9/2/1989	6.8	10/16/1989	2.8	11/29/1989	3.3
7/21/1989	5.2	9/3/1989	5.9	10/17/1989	2.6	11/30/1989	3.4
7/22/1989	3.8	9/4/1989	4.8	10/18/1989	2.8	12/1/1989	3.6
7/23/1989	3.2	9/5/1989	3.1	10/19/1989	2.7	12/2/1989	3.5
7/24/1989	2.8	9/6/1989	2.3	10/20/1989	2.6	12/3/1989	3.7
7/25/1989	2.4	9/7/1989	1.8	10/21/1989	2.5	12/4/1989	4
7/26/1989	2.4	9/8/1989	2	10/22/1989	2.4	12/5/1989	4.2
7/27/1989	2.4	9/9/1989	2.8	10/23/1989	2.5	12/6/1989	4
7/28/1989	2.5	9/10/1989	3.5	10/24/1989	2.7	12/7/1989	3.6
7/29/1989	2.2	9/11/1989	3	10/25/1989	3.2	12/8/1989	3.2
7/30/1989	1.9	9/12/1989	2.4	10/26/1989	3.5	12/9/1989	3.3
7/31/1989	1.8	9/13/1989	2	10/27/1989	3.4	12/10/1989	2.9
8/1/1989	1.6	9/14/1989	1.6	10/28/1989	3.8	12/11/1989	2.5
8/2/1989	1.5	9/15/1989	1.1	10/29/1989	4.2	12/12/1989	2.2
8/3/1989	1.3	9/16/1989	1.1	10/30/1989	4	12/13/1989	2
8/4/1989	1.2	9/17/1989	1.1	10/31/1989	3.8	12/14/1989	1.7
8/5/1989	1	9/18/1989	1.1	11/1/1989	3.5	12/15/1989	1.4
8/6/1989	0.92	9/19/1989	1.1	11/2/1989	3.2	12/16/1989	1.2
8/7/1989	0.84	9/20/1989	1.1	11/3/1989	3.4	12/17/1989	1
8/8/1989	0.84	9/21/1989	1	11/4/1989	3.8	12/18/1989	0.85

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
12/19/1989	0.65	2/3/1990	0.7	3/21/1990	16	5/6/1990	8.7
12/20/1989	0.5	2/4/1990	0.9	3/22/1990	13	5/7/1990	7.3
12/21/1989	0.4	2/5/1990	1.1	3/23/1990	11	5/8/1990	6.4
12/22/1989	0.3	2/6/1990	1.4	3/24/1990	10	5/9/1990	5.5
12/23/1989	0.25	2/7/1990	1.8	3/25/1990	11	5/10/1990	5
12/24/1989	0.4	2/8/1990	2	3/26/1990	13	5/11/1990	5
12/25/1989	0.6	2/9/1990	1.9	3/27/1990	15	5/12/1990	4.6
12/26/1989	1	2/10/1990	2.1	3/28/1990	14	5/13/1990	4.4
12/27/1989	1.4	2/11/1990	2.3	3/29/1990	13	5/14/1990	4.1
12/28/1989	2	2/12/1990	2.6	3/30/1990	12	5/15/1990	5.7
12/29/1989	2.5	2/13/1990	2.4	3/31/1990	12	5/16/1990	5
12/30/1989	2.8	2/14/1990	2.1	4/1/1990	13	5/17/1990	4.2
12/31/1989	2.7	2/15/1990	1.9	4/2/1990	12	5/18/1990	4.1
1/1/1990	2.6	2/16/1990	1.6	4/3/1990	11	5/19/1990	4.1
1/2/1990	2.6	2/17/1990	1.4	4/4/1990	11	5/20/1990	4.2
1/3/1990	2.5	2/18/1990	1.4	4/5/1990	10	5/21/1990	4.6
1/4/1990	2.3	2/19/1990	1.5	4/6/1990	10	5/22/1990	4.5
1/5/1990	2	2/20/1990	1.7	4/7/1990	10	5/23/1990	4.5
1/6/1990	2.1	2/21/1990	2	4/8/1990	10	5/24/1990	4.2
1/7/1990	2.3	2/22/1990	2.4	4/9/1990	10	5/25/1990	4.6
1/8/1990	2.4	2/23/1990	3.1	4/10/1990	9.6	5/26/1990	11
1/9/1990	2.6	2/24/1990	2.9	4/11/1990	9.3	5/27/1990	281
1/10/1990	3.1	2/25/1990	3.5	4/12/1990	9	5/28/1990	235
1/11/1990	2.9	2/26/1990	4.8	4/13/1990	9.3	5/29/1990	110
1/12/1990	2.6	2/27/1990	5	4/14/1990	9.6	5/30/1990	67
1/13/1990	2.5	2/28/1990	5.2	4/15/1990	10	5/31/1990	43
1/14/1990	2.6	3/1/1990	6.2	4/16/1990	11	6/1/1990	31
1/15/1990	2.5	3/2/1990	7.8	4/17/1990	11	6/2/1990	23
1/16/1990	2.4	3/3/1990	8.3	4/18/1990	10	6/3/1990	19
1/17/1990	2.3	3/4/1990	8.2	4/19/1990	9.2	6/4/1990	17
1/18/1990	2.1	3/5/1990	8	4/20/1990	8.4	6/5/1990	14
1/19/1990	1.8	3/6/1990	7.8	4/21/1990	7.8	6/6/1990	11
1/20/1990	1.6	3/7/1990	7.6	4/22/1990	8.1	6/7/1990	9
1/21/1990	1.7	3/8/1990	7.8	4/23/1990	8.7	6/8/1990	8.2
1/22/1990	1.9	3/9/1990	8.3	4/24/1990	9	6/9/1990	7.9
1/23/1990	2.1	3/10/1990	10	4/25/1990	9.3	6/10/1990	7.5
1/24/1990	2.1	3/11/1990	13	4/26/1990	11	6/11/1990	6.9
1/25/1990	2	3/12/1990	15	4/27/1990	11	6/12/1990	6.6
1/26/1990	2.2	3/13/1990	13	4/28/1990	12	6/13/1990	6.4
1/27/1990	2.2	3/14/1990	11	4/29/1990	13	6/14/1990	6
1/28/1990	2.3	3/15/1990	10	4/30/1990	14	6/15/1990	6.6
1/29/1990	2.4	3/16/1990	13	5/1/1990	13	6/16/1990	7.2
1/30/1990	2	3/17/1990	16	5/2/1990	11	6/17/1990	15
1/31/1990	1.6	3/18/1990	20	5/3/1990	10	6/18/1990	19
2/1/1990	1.1	3/19/1990	16	5/4/1990	9.3	6/19/1990	152

2/2/1990	0.85	3/20/1990	18	5/5/1990	9.9	6/20/1990	106
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
6/21/1990	75	8/6/1990	0.29	9/21/1990	1.6	11/6/1990	3.5
6/22/1990	59	8/7/1990	0.21	9/22/1990	1.7	11/7/1990	3.5
6/23/1990	43	8/8/1990	0.13	9/23/1990	1.6	11/8/1990	3.5
6/24/1990	31	8/9/1990	0.08	9/24/1990	1.4	11/9/1990	3.5
6/25/1990	25	8/10/1990	0.07	9/25/1990	1.3	11/10/1990	3.6
6/26/1990	20	8/11/1990	0.1	9/26/1990	1.1	11/11/1990	3.7
6/27/1990	18	8/12/1990	0.13	9/27/1990	1.2	11/12/1990	3.6
6/28/1990	31	8/13/1990	0.16	9/28/1990	2.5	11/13/1990	3.6
6/29/1990	33	8/14/1990	0.16	9/29/1990	1.3	11/14/1990	3.7
6/30/1990	38	8/15/1990	0.16	9/30/1990	1	11/15/1990	3.7
7/1/1990	113	8/16/1990	0.14	10/1/1990	0.95	11/16/1990	3.6
7/2/1990	125	8/17/1990	0.13	10/2/1990	0.85	11/17/1990	3.6
7/3/1990	63	8/18/1990	0.12	10/3/1990	0.71	11/18/1990	3.5
7/4/1990	37	8/19/1990	0.15	10/4/1990	0.69	11/19/1990	3.5
7/5/1990	25	8/20/1990	0.18	10/5/1990	0.72	11/20/1990	3.1
7/6/1990	19	8/21/1990	0.21	10/6/1990	0.76	11/21/1990	3.4
7/7/1990	15	8/22/1990	0.26	10/7/1990	0.8	11/22/1990	3.3
7/8/1990	11	8/23/1990	0.27	10/8/1990	0.8	11/23/1990	3
7/9/1990	9.3	8/24/1990	100	10/9/1990	0.8	11/24/1990	3
7/10/1990	8.7	8/25/1990	113	10/10/1990	0.82	11/25/1990	2.5
7/11/1990	16	8/26/1990	19	10/11/1990	1	11/26/1990	2.7
7/12/1990	44	8/27/1990	7	10/12/1990	2	11/27/1990	2.7
7/13/1990	26	8/28/1990	3.7	10/13/1990	3.5	11/28/1990	2.8
7/14/1990	13	8/29/1990	2.5	10/14/1990	4.2	11/29/1990	2.9
7/15/1990	8.8	8/30/1990	1.8	10/15/1990	4	11/30/1990	3.4
7/16/1990	6.7	8/31/1990	1.3	10/16/1990	4	12/1/1990	3.2
7/17/1990	5.9	9/1/1990	0.77	10/17/1990	4	12/2/1990	2.9
7/18/1990	4.3	9/2/1990	0.57	10/18/1990	4	12/3/1990	3
7/19/1990	3.4	9/3/1990	0.48	10/19/1990	4	12/4/1990	3.1
7/20/1990	2.6	9/4/1990	0.39	10/20/1990	4	12/5/1990	3
7/21/1990	2.1	9/5/1990	243	10/21/1990	4	12/6/1990	3.1
7/22/1990	1.7	9/6/1990	101	10/22/1990	4	12/7/1990	3.3
7/23/1990	1.5	9/7/1990	30	10/23/1990	4	12/8/1990	3.5
7/24/1990	1.3	9/8/1990	21	10/24/1990	4	12/9/1990	3.6
7/25/1990	1	9/9/1990	13	10/25/1990	4	12/10/1990	3.7
7/26/1990	0.83	9/10/1990	8.6	10/26/1990	3.9	12/11/1990	3.8
7/27/1990	0.96	9/11/1990	6.3	10/27/1990	3.5	12/12/1990	4
7/28/1990	0.84	9/12/1990	4.9	10/28/1990	3.8	12/13/1990	4
7/29/1990	0.7	9/13/1990	3.6	10/29/1990	3.8	12/14/1990	3.9
7/30/1990	0.64	9/14/1990	2.9	10/30/1990	3.3	12/15/1990	3.5
7/31/1990	0.58	9/15/1990	2.3	10/31/1990	3.3	12/16/1990	3.2
8/1/1990	0.54	9/16/1990	1.8	11/1/1990	3.5	12/17/1990	2.9
8/2/1990	0.46	9/17/1990	1.5	11/2/1990	3.5	12/18/1990	3
8/3/1990	0.4	9/18/1990	1.4	11/3/1990	3.3	12/19/1990	2.4

8/4/1990	0.36	9/19/1990	1.3	11/4/1990	3.5	12/20/1990	2.4
8/5/1990	0.33	9/20/1990	1.6	11/5/1990	3.6	12/21/1990	1.6

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
12/22/1990	1	2/6/1991	3.3	3/24/1991	8.3	5/9/1991	9.6
12/23/1990	0.8	2/7/1991	3.2	3/25/1991	9.3	5/10/1991	9.6
12/24/1990	0.6	2/8/1991	3.1	3/26/1991	7.2	5/11/1991	9.2
12/25/1990	0.5	2/9/1991	3	3/27/1991	7.2	5/12/1991	9
12/26/1990	0.2	2/10/1991	2.9	3/28/1991	8	5/13/1991	8.5
12/27/1990	0.25	2/11/1991	2.8	3/29/1991	9	5/14/1991	8
12/28/1990	0.24	2/12/1991	2.6	3/30/1991	8.8	5/15/1991	7.5
12/29/1990	0.23	2/13/1991	2.5	3/31/1991	9	5/16/1991	7.2
12/30/1990	0.2	2/14/1991	2.4	4/1/1991	10	5/17/1991	7
12/31/1990	0.21	2/15/1991	2.4	4/2/1991	10	5/18/1991	6.5
1/1/1991	0.23	2/16/1991	2.4	4/3/1991	11	5/19/1991	6
1/2/1991	0.24	2/17/1991	2.4	4/4/1991	11	5/20/1991	6
1/3/1991	0.25	2/18/1991	2.3	4/5/1991	10	5/21/1991	5.5
1/4/1991	0.25	2/19/1991	2.3	4/6/1991	10	5/22/1991	5.2
1/5/1991	0.25	2/20/1991	2.2	4/7/1991	9.5	5/23/1991	5
1/6/1991	0.26	2/21/1991	2.2	4/8/1991	9	5/24/1991	5
1/7/1991	0.26	2/22/1991	2.1	4/9/1991	8.5	5/25/1991	5
1/8/1991	0.26	2/23/1991	2	4/10/1991	8.5	5/26/1991	7
1/9/1991	0.25	2/24/1991	2	4/11/1991	8.5	5/27/1991	9
1/10/1991	0.25	2/25/1991	2	4/12/1991	8.2	5/28/1991	8
1/11/1991	0.26	2/26/1991	2	4/13/1991	8.5	5/29/1991	7.5
1/12/1991	0.3	2/27/1991	2	4/14/1991	8.5	5/30/1991	7
1/13/1991	0.5	2/28/1991	2.1	4/15/1991	8.5	5/31/1991	7
1/14/1991	0.7	3/1/1991	2.5	4/16/1991	8.8	6/1/1991	7.2
1/15/1991	0.9	3/2/1991	3.5	4/17/1991	9	6/2/1991	7
1/16/1991	1.2	3/3/1991	5	4/18/1991	8.8	6/3/1991	11
1/17/1991	1.5	3/4/1991	6.8	4/19/1991	11	6/4/1991	20
1/18/1991	1.4	3/5/1991	6	4/20/1991	11	6/5/1991	19
1/19/1991	1.3	3/6/1991	5	4/21/1991	11	6/6/1991	16
1/20/1991	1.3	3/7/1991	5.5	4/22/1991	11	6/7/1991	13
1/21/1991	1.4	3/8/1991	7	4/23/1991	11	6/8/1991	10
1/22/1991	1.5	3/9/1991	10	4/24/1991	11	6/9/1991	8
1/23/1991	1.6	3/10/1991	15	4/25/1991	11	6/10/1991	7
1/24/1991	1.7	3/11/1991	13	4/26/1991	11	6/11/1991	6
1/25/1991	1.8	3/12/1991	12	4/27/1991	9.7	6/12/1991	5.2
1/26/1991	1.9	3/13/1991	11	4/28/1991	9.9	6/13/1991	5
1/27/1991	2	3/14/1991	11	4/29/1991	10	6/14/1991	5
1/28/1991	2.1	3/15/1991	10	4/30/1991	9.8	6/15/1991	5.5
1/29/1991	2.1	3/16/1991	8.6	5/1/1991	9.9	6/16/1991	5
1/30/1991	2.1	3/17/1991	9.7	5/2/1991	10	6/17/1991	4.8
1/31/1991	2.2	3/18/1991	11	5/3/1991	10	6/18/1991	4.5
2/1/1991	2.2	3/19/1991	19	5/4/1991	10	6/19/1991	4
2/2/1991	2.3	3/20/1991	12	5/5/1991	9.9	6/20/1991	4.5

2/3/1991	2.5	3/21/1991	10	5/6/1991	10	6/21/1991	6
2/4/1991	3	3/22/1991	7.8	5/7/1991	10	6/22/1991	15
2/5/1991	3.5	3/23/1991	9.6	5/8/1991	9.8	6/23/1991	25
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
12/25/1991	2.8	2/9/1992	10	3/26/1992	16	5/11/1992	6.1
12/26/1991	2.3	2/10/1992	7.4	3/27/1992	15	5/12/1992	5.6
12/27/1991	2.6	2/11/1992	4	3/28/1992	15	5/13/1992	5.2
12/28/1991	3	2/12/1992	2.8	3/29/1992	15	5/14/1992	4.6
12/29/1991	3.3	2/13/1992	2.3	3/30/1992	14	5/15/1992	4.4
12/30/1991	2.1	2/14/1992	2.8	3/31/1992	12	5/16/1992	4.2
12/31/1991	2.3	2/15/1992	2.3	4/1/1992	11	5/17/1992	5.4
1/1/1992	2.3	2/16/1992	2.8	4/2/1992	11	5/18/1992	6.1
1/2/1992	2.7	2/17/1992	3.3	4/3/1992	11	5/19/1992	6.1
1/3/1992	2.8	2/18/1992	3.5	4/4/1992	10	5/20/1992	5.4
1/4/1992	2.8	2/19/1992	3.5	4/5/1992	9.9	5/21/1992	5
1/5/1992	3	2/20/1992	1.3	4/6/1992	9.7	5/22/1992	3.6
1/6/1992	2.7	2/21/1992	1.5	4/7/1992	9.4	5/23/1992	3.1
1/7/1992	2.8	2/22/1992	2.6	4/8/1992	9.6	5/24/1992	2.6
1/8/1992	2.4	2/23/1992	1.8	4/9/1992	9.3	5/25/1992	2.4
1/9/1992	2.1	2/24/1992	1.7	4/10/1992	9.9	5/26/1992	2.4
1/10/1992	2.8	2/25/1992	3	4/11/1992	11	5/27/1992	2.2
1/11/1992	3	2/26/1992	2.8	4/12/1992	10	5/28/1992	1.9
1/12/1992	2.9	2/27/1992	3.1	4/13/1992	9.6	5/29/1992	2
1/13/1992	3	2/28/1992	6.8	4/14/1992	9.9	5/30/1992	1.8
1/14/1992	3.3	2/29/1992	16	4/15/1992	9.9	5/31/1992	1.8
1/15/1992	2	3/1/1992	30	4/16/1992	9.3	6/1/1992	1.9
1/16/1992	1.7	3/2/1992	64	4/17/1992	9.9	6/2/1992	1.3
1/17/1992	1.4	3/3/1992	80	4/18/1992	9.9	6/3/1992	1.3
1/18/1992	1.2	3/4/1992	84	4/19/1992	8.7	6/4/1992	1.1
1/19/1992	1.5	3/5/1992	89	4/20/1992	7.6	6/5/1992	1
1/20/1992	1.3	3/6/1992	78	4/21/1992	7	6/6/1992	1
1/21/1992	1.5	3/7/1992	71	4/22/1992	22	6/7/1992	0.93
1/22/1992	2.6	3/8/1992	62	4/23/1992	15	6/8/1992	0.92
1/23/1992	2.3	3/9/1992	32	4/24/1992	12	6/9/1992	0.85
1/24/1992	1.1	3/10/1992	35	4/25/1992	13	6/10/1992	0.8
1/25/1992	1.3	3/11/1992	47	4/26/1992	13	6/11/1992	0.77
1/26/1992	1.5	3/12/1992	37	4/27/1992	12	6/12/1992	0.74
1/27/1992	1.2	3/13/1992	32	4/28/1992	13	6/13/1992	0.47
1/28/1992	1.8	3/14/1992	28	4/29/1992	13	6/14/1992	0.98
1/29/1992	3	3/15/1992	25	4/30/1992	13	6/15/1992	2.6
1/30/1992	3.8	3/16/1992	27	5/1/1992	11	6/16/1992	5
1/31/1992	3.5	3/17/1992	22	5/2/1992	11	6/17/1992	4.6
2/1/1992	3.7	3/18/1992	25	5/3/1992	9	6/18/1992	4
2/2/1992	4.1	3/19/1992	20	5/4/1992	7.8	6/19/1992	3.8
2/3/1992	5	3/20/1992	18	5/5/1992	7	6/20/1992	4
2/4/1992	5.8	3/21/1992	18	5/6/1992	6.8	6/21/1992	4.1

2/5/1992	11	3/22/1992	17	5/7/1992	5.6	6/22/1992	4.8
2/6/1992	15	3/23/1992	18	5/8/1992	5.2	6/23/1992	5.1
2/7/1992	18	3/24/1992	18	5/9/1992	5.4	6/24/1992	4.7
2/8/1992	16	3/25/1992	17	5/10/1992	5.4	6/25/1992	3.9
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
6/26/1992	3.2	8/11/1992	0.55	9/26/1992	0.11	11/11/1992	2.7
6/27/1992	2.8	8/12/1992	0.39	9/27/1992	0.14	11/12/1992	2.8
6/28/1992	2.1	8/13/1992	0.28	9/28/1992	0.13	11/13/1992	2.9
6/29/1992	1.7	8/14/1992	0.16	9/29/1992	0.13	11/14/1992	3.1
6/30/1992	1.6	8/15/1992	0.07	9/30/1992	0.15	11/15/1992	2.8
7/1/1992	1.9	8/16/1992	0.03	10/1/1992	0.18	11/16/1992	2.8
7/2/1992	2	8/17/1992	0	10/2/1992	0.16	11/17/1992	2.8
7/3/1992	2.2	8/18/1992	0	10/3/1992	0.03	11/18/1992	3
7/4/1992	2.2	8/19/1992	0	10/4/1992	0	11/19/1992	3.3
7/5/1992	1.8	8/20/1992	0	10/5/1992	0	11/20/1992	3.3
7/6/1992	1.8	8/21/1992	0	10/6/1992	0	11/21/1992	3.3
7/7/1992	2.1	8/22/1992	0	10/7/1992	0	11/22/1992	3.4
7/8/1992	3	8/23/1992	0.02	10/8/1992	0	11/23/1992	3.5
7/9/1992	3.4	8/24/1992	0.13	10/9/1992	0.03	11/24/1992	3.4
7/10/1992	3.6	8/25/1992	0.18	10/10/1992	0.06	11/25/1992	3.5
7/11/1992	3.2	8/26/1992	0.28	10/11/1992	0.1	11/26/1992	3.7
7/12/1992	3.1	8/27/1992	0.32	10/12/1992	0.13	11/27/1992	3.9
7/13/1992	3.1	8/28/1992	0.19	10/13/1992	0.13	11/28/1992	4.2
7/14/1992	3.3	8/29/1992	0.01	10/14/1992	0.17	11/29/1992	4.3
7/15/1992	3	8/30/1992	0	10/15/1992	0.21	11/30/1992	4.2
7/16/1992	2.8	8/31/1992	0.01	10/16/1992	0.21	12/1/1992	4.1
7/17/1992	2.8	9/1/1992	0.03	10/17/1992	0.23	12/2/1992	4.3
7/18/1992	2.3	9/2/1992	0.07	10/18/1992	0.31	12/3/1992	4.4
7/19/1992	1.7	9/3/1992	0.03	10/19/1992	0.7	12/4/1992	4.6
7/20/1992	1.2	9/4/1992	0.03	10/20/1992	0.96	12/5/1992	4.6
7/21/1992	1	9/5/1992	0.1	10/21/1992	1.1	12/6/1992	4.9
7/22/1992	1	9/6/1992	0.1	10/22/1992	1.2	12/7/1992	5.2
7/23/1992	0.91	9/7/1992	0.1	10/23/1992	1.3	12/8/1992	5.3
7/24/1992	0.84	9/8/1992	0.08	10/24/1992	1	12/9/1992	5.4
7/25/1992	0.72	9/9/1992	0.1	10/25/1992	0.79	12/10/1992	5.6
7/26/1992	0.65	9/10/1992	0.08	10/26/1992	0.81	12/11/1992	5.8
7/27/1992	0.62	9/11/1992	0.09	10/27/1992	0.89	12/12/1992	6.1
7/28/1992	0.51	9/12/1992	0.11	10/28/1992	0.92	12/13/1992	5.9
7/29/1992	0.47	9/13/1992	0.14	10/29/1992	0.91	12/14/1992	5.8
7/30/1992	0.51	9/14/1992	0.15	10/30/1992	0.84	12/15/1992	5.6
7/31/1992	1.4	9/15/1992	0.15	10/31/1992	0.85	12/16/1992	5.3
8/1/1992	1.7	9/16/1992	0.14	11/1/1992	1.4	12/17/1992	5.2
8/2/1992	1.1	9/17/1992	0.15	11/2/1992	1.9	12/18/1992	5
8/3/1992	0.96	9/18/1992	0.15	11/3/1992	2.2	12/19/1992	4.9
8/4/1992	0.6	9/19/1992	0.18	11/4/1992	2.2	12/20/1992	4.7
8/5/1992	0.44	9/20/1992	0.22	11/5/1992	2.2	12/21/1992	4.6

8/6/1992	0.49	9/21/1992	0.19	11/6/1992	2.2	12/22/1992	4.5
8/7/1992	0.63	9/22/1992	0.15	11/7/1992	2	12/23/1992	4.4
8/8/1992	0.65	9/23/1992	0.11	11/8/1992	2	12/24/1992	4.1
8/9/1992	0.5	9/24/1992	0.09	11/9/1992	2.2	12/25/1992	4.2
8/10/1992	0.44	9/25/1992	0.09	11/10/1992	2.5	12/26/1992	4.4

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
12/27/1992	4.1	2/11/1993	2.6	3/29/1993	72	5/14/1993	7.4
12/28/1992	3.8	2/12/1993	2.8	3/30/1993	72	5/15/1993	7.5
12/29/1992	3.5	2/13/1993	2.9	3/31/1993	64	5/16/1993	9.4
12/30/1992	3.1	2/14/1993	3	4/1/1993	54	5/17/1993	9.2
12/31/1992	2.8	2/15/1993	3.1	4/2/1993	48	5/18/1993	7.7
1/1/1993	2.6	2/16/1993	3	4/3/1993	44	5/19/1993	6.5
1/2/1993	2.4	2/17/1993	2.9	4/4/1993	39	5/20/1993	5.9
1/3/1993	2.2	2/18/1993	3.1	4/5/1993	32	5/21/1993	5.6
1/4/1993	2.1	2/19/1993	3	4/6/1993	32	5/22/1993	5.7
1/5/1993	1.9	2/20/1993	2.9	4/7/1993	32	5/23/1993	5.9
1/6/1993	1.8	2/21/1993	2.8	4/8/1993	31	5/24/1993	6.6
1/7/1993	1.7	2/22/1993	2.9	4/9/1993	29	5/25/1993	7
1/8/1993	1.6	2/23/1993	3	4/10/1993	38	5/26/1993	6.4
1/9/1993	1.5	2/24/1993	2.8	4/11/1993	44	5/27/1993	6.1
1/10/1993	1.3	2/25/1993	2.7	4/12/1993	47	5/28/1993	6.3
1/11/1993	1.1	2/26/1993	2.5	4/13/1993	50	5/29/1993	7
1/12/1993	1.1	2/27/1993	2.6	4/14/1993	40	5/30/1993	12
1/13/1993	1.2	2/28/1993	2.5	4/15/1993	34	5/31/1993	14
1/14/1993	1.3	3/1/1993	2.2	4/16/1993	30	6/1/1993	11
1/15/1993	1.3	3/2/1993	2	4/17/1993	27	6/2/1993	12
1/16/1993	1.4	3/3/1993	10	4/18/1993	25	6/3/1993	13
1/17/1993	1.4	3/4/1993	85	4/19/1993	23	6/4/1993	16
1/18/1993	1.4	3/5/1993	600	4/20/1993	20	6/5/1993	15
1/19/1993	1.5	3/6/1993	1000	4/21/1993	19	6/6/1993	13
1/20/1993	1.4	3/7/1993	1500	4/22/1993	18	6/7/1993	18
1/21/1993	1.4	3/8/1993	1400	4/23/1993	19	6/8/1993	224
1/22/1993	1.5	3/9/1993	900	4/24/1993	20	6/9/1993	302
1/23/1993	1.5	3/10/1993	400	4/25/1993	50	6/10/1993	169
1/24/1993	1.6	3/11/1993	280	4/26/1993	58	6/11/1993	140
1/25/1993	1.7	3/12/1993	180	4/27/1993	50	6/12/1993	106
1/26/1993	1.8	3/13/1993	110	4/28/1993	41	6/13/1993	68
1/27/1993	1.8	3/14/1993	99	4/29/1993	33	6/14/1993	42
1/28/1993	1.8	3/15/1993	65	4/30/1993	28	6/15/1993	28
1/29/1993	2.2	3/16/1993	44	5/1/1993	19	6/16/1993	20
1/30/1993	2.3	3/17/1993	38	5/2/1993	16	6/17/1993	15
1/31/1993	2.2	3/18/1993	30	5/3/1993	14	6/18/1993	12
2/1/1993	2.2	3/19/1993	25	5/4/1993	10	6/19/1993	9.7
2/2/1993	2.2	3/20/1993	22	5/5/1993	7.8	6/20/1993	7.9
2/3/1993	2.4	3/21/1993	19	5/6/1993	7.1	6/21/1993	8
2/4/1993	2.4	3/22/1993	18	5/7/1993	7.6	6/22/1993	6.7

2/5/1993	2.4	3/23/1993	17	5/8/1993	8.1	6/23/1993	5.7
2/6/1993	2.4	3/24/1993	16	5/9/1993	9.3	6/24/1993	4.9
2/7/1993	2.5	3/25/1993	16	5/10/1993	8.8	6/25/1993	4
2/8/1993	2.4	3/26/1993	30	5/11/1993	8.7	6/26/1993	3.5
2/9/1993	2.5	3/27/1993	79	5/12/1993	9	6/27/1993	2.8
2/10/1993	2.6	3/28/1993	71	5/13/1993	8.6	6/28/1993	2.4

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
6/29/1993	3.8	8/14/1993	8.5	9/29/1993	3.8	11/14/1993	6.7
6/30/1993	7.5	8/15/1993	7.5	9/30/1993	3.8	11/15/1993	6.1
7/1/1993	6.4	8/16/1993	6.5	10/1/1993	3.5	11/16/1993	6.3
7/2/1993	16	8/17/1993	6	10/2/1993	3.5	11/17/1993	6.1
7/3/1993	27	8/18/1993	5.5	10/3/1993	3.4	11/18/1993	6.2
7/4/1993	69	8/19/1993	5.2	10/4/1993	3.4	11/19/1993	6.3
7/5/1993	147	8/20/1993	5.2	10/5/1993	3.3	11/20/1993	6.5
7/6/1993	234	8/21/1993	5.2	10/6/1993	3.3	11/21/1993	6.5
7/7/1993	102	8/22/1993	5.2	10/7/1993	3.5	11/22/1993	6.1
7/8/1993	74	8/23/1993	5.2	10/8/1993	3.4	11/23/1993	5.8
7/9/1993	100	8/24/1993	5.2	10/9/1993	3.3	11/24/1993	5.8
7/10/1993	84	8/25/1993	5.2	10/10/1993	3	11/25/1993	5.8
7/11/1993	63	8/26/1993	5	10/11/1993	3.2	11/26/1993	6.3
7/12/1993	106	8/27/1993	5	10/12/1993	3.3	11/27/1993	7.2
7/13/1993	80	8/28/1993	5	10/13/1993	3.5	11/28/1993	8
7/14/1993	78	8/29/1993	5	10/14/1993	3.6	11/29/1993	8.4
7/15/1993	51	8/30/1993	6	10/15/1993	3.5	11/30/1993	8.5
7/16/1993	42	8/31/1993	5.2	10/16/1993	5	12/1/1993	8.7
7/17/1993	207	9/1/1993	5.2	10/17/1993	5.5	12/2/1993	8.7
7/18/1993	148	9/2/1993	4.8	10/18/1993	4.1	12/3/1993	8.9
7/19/1993	114	9/3/1993	4.6	10/19/1993	3.7	12/4/1993	7.6
7/20/1993	58	9/4/1993	4.4	10/20/1993	3.1	12/5/1993	7.6
7/21/1993	69	9/5/1993	4.2	10/21/1993	3.1	12/6/1993	7.6
7/22/1993	356	9/6/1993	4.2	10/22/1993	3.8	12/7/1993	6.5
7/23/1993	613	9/7/1993	4.2	10/23/1993	4.3	12/8/1993	6.3
7/24/1993	613	9/8/1993	5.2	10/24/1993	4.4	12/9/1993	6.4
7/25/1993	660	9/9/1993	5	10/25/1993	4.8	12/10/1993	6.5
7/26/1993	831	9/10/1993	5	10/26/1993	6.6	12/11/1993	6.8
7/27/1993	811	9/11/1993	3.9	10/27/1993	5.3	12/12/1993	7
7/28/1993	863	9/12/1993	3.8	10/28/1993	5	12/13/1993	7
7/29/1993	522	9/13/1993	3.7	10/29/1993	5	12/14/1993	7
7/30/1993	295	9/14/1993	3.7	10/30/1993	4.5	12/15/1993	7
7/31/1993	321	9/15/1993	3.7	10/31/1993	4.3	12/16/1993	7
8/1/1993	271	9/16/1993	3.6	11/1/1993	4.5	12/17/1993	7.1
8/2/1993	140	9/17/1993	3.6	11/2/1993	4.6	12/18/1993	7.4
8/3/1993	100	9/18/1993	3.5	11/3/1993	5.5	12/19/1993	7.6
8/4/1993	60	9/19/1993	3.5	11/4/1993	7.3	12/20/1993	7.6
8/5/1993	35	9/20/1993	3.5	11/5/1993	7.1	12/21/1993	7.8
8/6/1993	25	9/21/1993	3.9	11/6/1993	6	12/22/1993	7.8

8/7/1993	15	9/22/1993	3.9	11/7/1993	5.8	12/23/1993	7.8
8/8/1993	11	9/23/1993	3.8	11/8/1993	5.8	12/24/1993	7.8
8/9/1993	8	9/24/1993	3.9	11/9/1993	5.8	12/25/1993	7.8
8/10/1993	6	9/25/1993	3.8	11/10/1993	5.9	12/26/1993	7.8
8/11/1993	5.5	9/26/1993	3.8	11/11/1993	6.1	12/27/1993	7.8
8/12/1993	7	9/27/1993	3.8	11/12/1993	6.2	12/28/1993	7.5
8/13/1993	10	9/28/1993	3.8	11/13/1993	6.8	12/29/1993	7

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
12/30/1993	6.8	2/14/1994	2.1	4/1/1994	59	5/17/1994	11
12/31/1993	6.6	2/15/1994	2.2	4/2/1994	63	5/18/1994	9.7
1/1/1994	6.2	2/16/1994	2.1	4/3/1994	72	5/19/1994	9.8
1/2/1994	6	2/17/1994	2.1	4/4/1994	79	5/20/1994	12
1/3/1994	5.8	2/18/1994	2.1	4/5/1994	73	5/21/1994	12
1/4/1994	5.5	2/19/1994	2	4/6/1994	69	5/22/1994	11
1/5/1994	5.2	2/20/1994	1.9	4/7/1994	62	5/23/1994	15
1/6/1994	5	2/21/1994	1.9	4/8/1994	60	5/24/1994	20
1/7/1994	5.2	2/22/1994	1.8	4/9/1994	63	5/25/1994	23
1/8/1994	5.2	2/23/1994	1.7	4/10/1994	63	5/26/1994	26
1/9/1994	5.4	2/24/1994	1.6	4/11/1994	64	5/27/1994	20
1/10/1994	5.4	2/25/1994	1.5	4/12/1994	62	5/28/1994	16
1/11/1994	5.5	2/26/1994	1.8	4/13/1994	61	5/29/1994	14
1/12/1994	5.6	2/27/1994	2	4/14/1994	62	5/30/1994	13
1/13/1994	5.7	2/28/1994	2.3	4/15/1994	57	5/31/1994	11
1/14/1994	5.8	3/1/1994	2.6	4/16/1994	50	6/1/1994	9.7
1/15/1994	5.8	3/2/1994	2.8	4/17/1994	42	6/2/1994	8.9
1/16/1994	5.8	3/3/1994	2.7	4/18/1994	37	6/3/1994	8.4
1/17/1994	5.8	3/4/1994	3.1	4/19/1994	32	6/4/1994	7.9
1/18/1994	5.8	3/5/1994	4.2	4/20/1994	28	6/5/1994	7.2
1/19/1994	5.8	3/6/1994	40	4/21/1994	26	6/6/1994	6.8
1/20/1994	5.8	3/7/1994	200	4/22/1994	23	6/7/1994	6.2
1/21/1994	6	3/8/1994	80	4/23/1994	22	6/8/1994	14
1/22/1994	6.2	3/9/1994	30	4/24/1994	21	6/9/1994	20
1/23/1994	6.4	3/10/1994	20	4/25/1994	21	6/10/1994	27
1/24/1994	6.4	3/11/1994	15	4/26/1994	20	6/11/1994	76
1/25/1994	6	3/12/1994	100	4/27/1994	20	6/12/1994	360
1/26/1994	5.5	3/13/1994	350	4/28/1994	19	6/13/1994	472
1/27/1994	4.5	3/14/1994	500	4/29/1994	19	6/14/1994	245
1/28/1994	4	3/15/1994	620	4/30/1994	20	6/15/1994	148
1/29/1994	2.7	3/16/1994	650	5/1/1994	20	6/16/1994	97
1/30/1994	2.2	3/17/1994	600	5/2/1994	21	6/17/1994	73
1/31/1994	2.7	3/18/1994	550	5/3/1994	22	6/18/1994	141
2/1/1994	3.4	3/19/1994	450	5/4/1994	22	6/19/1994	118
2/2/1994	3.9	3/20/1994	420	5/5/1994	21	6/20/1994	74
2/3/1994	2.5	3/21/1994	400	5/6/1994	19	6/21/1994	52
2/4/1994	2.3	3/22/1994	385	5/7/1994	17	6/22/1994	38
2/5/1994	2.1	3/23/1994	309	5/8/1994	16	6/23/1994	29

2/6/1994	2	3/24/1994	228	5/9/1994	16	6/24/1994	24
2/7/1994	1.9	3/25/1994	165	5/10/1994	15	6/25/1994	20
2/8/1994	1.7	3/26/1994	136	5/11/1994	14	6/26/1994	17
2/9/1994	1.6	3/27/1994	117	5/12/1994	13	6/27/1994	16
2/10/1994	1.7	3/28/1994	95	5/13/1994	13	6/28/1994	15
2/11/1994	1.8	3/29/1994	69	5/14/1994	12	6/29/1994	14
2/12/1994	1.9	3/30/1994	68	5/15/1994	12	6/30/1994	13
2/13/1994	2	3/31/1994	60	5/16/1994	11	7/1/1994	11
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/2/1994	9.7	8/17/1994	1.9	10/2/1994	3.9	11/17/1994	8
7/3/1994	8.5	8/18/1994	1.9	10/3/1994	4	11/18/1994	7.9
7/4/1994	8.4	8/19/1994	1.9	10/4/1994	4	11/19/1994	7.6
7/5/1994	8.1	8/20/1994	1.9	10/5/1994	4.3	11/20/1994	7.4
7/6/1994	8	8/21/1994	1.8	10/6/1994	20	11/21/1994	7.4
7/7/1994	8.3	8/22/1994	1.7	10/7/1994	101	11/22/1994	7
7/8/1994	8.2	8/23/1994	1.7	10/8/1994	268	11/23/1994	6.6
7/9/1994	7.4	8/24/1994	1.6	10/9/1994	229	11/24/1994	6.4
7/10/1994	6.7	8/25/1994	1.6	10/10/1994	102	11/25/1994	6.2
7/11/1994	6.3	8/26/1994	1.6	10/11/1994	69	11/26/1994	6.2
7/12/1994	6	8/27/1994	1.6	10/12/1994	51	11/27/1994	6.2
7/13/1994	5.5	8/28/1994	1.6	10/13/1994	40	11/28/1994	6
7/14/1994	5.1	8/29/1994	1.6	10/14/1994	28	11/29/1994	6
7/15/1994	4.7	8/30/1994	1.5	10/15/1994	24	11/30/1994	6
7/16/1994	4.7	8/31/1994	1.5	10/16/1994	26	12/1/1994	6
7/17/1994	4.9	9/1/1994	1.4	10/17/1994	224	12/2/1994	6.3
7/18/1994	4.9	9/2/1994	1.3	10/18/1994	485	12/3/1994	6
7/19/1994	4.6	9/3/1994	1.3	10/19/1994	692	12/4/1994	5.8
7/20/1994	4.2	9/4/1994	1.6	10/20/1994	444	12/5/1994	5.7
7/21/1994	4.1	9/5/1994	1.7	10/21/1994	232	12/6/1994	5.5
7/22/1994	4.3	9/6/1994	1.6	10/22/1994	134	12/7/1994	5.5
7/23/1994	4.6	9/7/1994	1.7	10/23/1994	87	12/8/1994	5.4
7/24/1994	4	9/8/1994	1.6	10/24/1994	57	12/9/1994	5.3
7/25/1994	3.3	9/9/1994	1.7	10/25/1994	38	12/10/1994	5.4
7/26/1994	2.9	9/10/1994	1.5	10/26/1994	30	12/11/1994	5.1
7/27/1994	2.9	9/11/1994	1.5	10/27/1994	24	12/12/1994	4.6
7/28/1994	3	9/12/1994	1.5	10/28/1994	21	12/13/1994	4.3
7/29/1994	3	9/13/1994	1.8	10/29/1994	18	12/14/1994	4
7/30/1994	2.8	9/14/1994	2.1	10/30/1994	16	12/15/1994	4.1
7/31/1994	2.8	9/15/1994	29	10/31/1994	15	12/16/1994	4.3
8/1/1994	2.7	9/16/1994	27	11/1/1994	13	12/17/1994	4.3
8/2/1994	2.7	9/17/1994	169	11/2/1994	13	12/18/1994	4.6
8/3/1994	3	9/18/1994	83	11/3/1994	12	12/19/1994	4.7
8/4/1994	3.3	9/19/1994	38	11/4/1994	11	12/20/1994	4.9
8/5/1994	2.9	9/20/1994	21	11/5/1994	10	12/21/1994	5
8/6/1994	2	9/21/1994	15	11/6/1994	10	12/22/1994	4.7
8/7/1994	1.4	9/22/1994	13	11/7/1994	11	12/23/1994	4.6

8/8/1994	1.6	9/23/1994	10	11/8/1994	10	12/24/1994	4.4
8/9/1994	1.9	9/24/1994	8.7	11/9/1994	9.1	12/25/1994	4.4
8/10/1994	2	9/25/1994	7	11/10/1994	8.7	12/26/1994	4.4
8/11/1994	2	9/26/1994	6.1	11/11/1994	8.8	12/27/1994	4.2
8/12/1994	2	9/27/1994	5.2	11/12/1994	8.8	12/28/1994	4.2
8/13/1994	2.3	9/28/1994	4.2	11/13/1994	8.7	12/29/1994	4.2
8/14/1994	2.5	9/29/1994	4	11/14/1994	8.6	12/30/1994	4.2
8/15/1994	2	9/30/1994	3.5	11/15/1994	8.2	12/31/1994	4.1
8/16/1994	1.9	10/1/1994	3.5	11/16/1994	8.1	1/1/1995	4.2
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/2/1995	3.9	2/17/1995	14	4/4/1995	45	5/20/1995	75
1/3/1995	3.4	2/18/1995	10	4/5/1995	51	5/21/1995	91
1/4/1995	2.7	2/19/1995	20	4/6/1995	49	5/22/1995	94
1/5/1995	2.7	2/20/1995	200	4/7/1995	40	5/23/1995	62
1/6/1995	2.6	2/21/1995	400	4/8/1995	33	5/24/1995	41
1/7/1995	2.5	2/22/1995	1100	4/9/1995	29	5/25/1995	30
1/8/1995	2.6	2/23/1995	1400	4/10/1995	27	5/26/1995	27
1/9/1995	2.7	2/24/1995	800	4/11/1995	24	5/27/1995	34
1/10/1995	3	2/25/1995	500	4/12/1995	23	5/28/1995	36
1/11/1995	3.2	2/26/1995	380	4/13/1995	23	5/29/1995	38
1/12/1995	3.1	2/27/1995	300	4/14/1995	22	5/30/1995	37
1/13/1995	3	2/28/1995	330	4/15/1995	29	5/31/1995	38
1/14/1995	3	3/1/1995	270	4/16/1995	41	6/1/1995	40
1/15/1995	3	3/2/1995	200	4/17/1995	89	6/2/1995	45
1/16/1995	2.9	3/3/1995	180	4/18/1995	118	6/3/1995	38
1/17/1995	2.8	3/4/1995	170	4/19/1995	110	6/4/1995	30
1/18/1995	2.8	3/5/1995	155	4/20/1995	84	6/5/1995	24
1/19/1995	2.7	3/6/1995	150	4/21/1995	67	6/6/1995	20
1/20/1995	2.7	3/7/1995	140	4/22/1995	56	6/7/1995	16
1/21/1995	2.7	3/8/1995	140	4/23/1995	48	6/8/1995	15
1/22/1995	2.8	3/9/1995	135	4/24/1995	41	6/9/1995	16
1/23/1995	2.9	3/10/1995	145	4/25/1995	38	6/10/1995	15
1/24/1995	3	3/11/1995	250	4/26/1995	36	6/11/1995	13
1/25/1995	2.9	3/12/1995	1000	4/27/1995	33	6/12/1995	11
1/26/1995	2.9	3/13/1995	900	4/28/1995	30	6/13/1995	11
1/27/1995	3	3/14/1995	600	4/29/1995	27	6/14/1995	11
1/28/1995	3	3/15/1995	450	4/30/1995	26	6/15/1995	10
1/29/1995	3	3/16/1995	260	5/1/1995	26	6/16/1995	8.9
1/30/1995	3	3/17/1995	230	5/2/1995	27	6/17/1995	7.8
1/31/1995	3	3/18/1995	200	5/3/1995	26	6/18/1995	6.5
2/1/1995	3.1	3/19/1995	150	5/4/1995	27	6/19/1995	5.7
2/2/1995	3.3	3/20/1995	125	5/5/1995	26	6/20/1995	5.8
2/3/1995	3.3	3/21/1995	110	5/6/1995	28	6/21/1995	6.5
2/4/1995	3.3	3/22/1995	90	5/7/1995	33	6/22/1995	6.5
2/5/1995	3.5	3/23/1995	80	5/8/1995	43	6/23/1995	7.6
2/6/1995	5	3/24/1995	75	5/9/1995	255	6/24/1995	8.7

2/7/1995	10	3/25/1995	70	5/10/1995	558	6/25/1995	8.2
2/8/1995	16	3/26/1995	50	5/11/1995	524	6/26/1995	7.3
2/9/1995	13	3/27/1995	35	5/12/1995	311	6/27/1995	6.3
2/10/1995	12	3/28/1995	31	5/13/1995	209	6/28/1995	5.3
2/11/1995	11	3/29/1995	30	5/14/1995	238	6/29/1995	4.8
2/12/1995	10	3/30/1995	29	5/15/1995	418	6/30/1995	4.4
2/13/1995	10	3/31/1995	29	5/16/1995	283	7/1/1995	4.3
2/14/1995	9	4/1/1995	32	5/17/1995	217	7/2/1995	4.5
2/15/1995	11	4/2/1995	37	5/18/1995	163	7/3/1995	5
2/16/1995	20	4/3/1995	48	5/19/1995	110	7/4/1995	11

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/5/1995	14	8/20/1995	5.6	10/5/1995	4.8	11/20/1995	6.3
7/6/1995	9.5	8/21/1995	4.9	10/6/1995	4.3	11/21/1995	6.3
7/7/1995	32	8/22/1995	4.2	10/7/1995	4.9	11/22/1995	6.3
7/8/1995	61	8/23/1995	3.8	10/8/1995	4.9	11/23/1995	6.3
7/9/1995	32	8/24/1995	9.4	10/9/1995	4.8	11/24/1995	6.2
7/10/1995	24	8/25/1995	12	10/10/1995	4.1	11/25/1995	6.4
7/11/1995	50	8/26/1995	34	10/11/1995	4.4	11/26/1995	6.5
7/12/1995	40	8/27/1995	122	10/12/1995	4.5	11/27/1995	5.9
7/13/1995	37	8/28/1995	161	10/13/1995	4.8	11/28/1995	6.1
7/14/1995	30	8/29/1995	138	10/14/1995	4.9	11/29/1995	6.3
7/15/1995	25	8/30/1995	81	10/15/1995	4.6	11/30/1995	6.2
7/16/1995	24	8/31/1995	53	10/16/1995	4.6	12/1/1995	6.1
7/17/1995	91	9/1/1995	37	10/17/1995	4.7	12/2/1995	7.2
7/18/1995	153	9/2/1995	28	10/18/1995	5.2	12/3/1995	6.5
7/19/1995	160	9/3/1995	20	10/19/1995	6.4	12/4/1995	7
7/20/1995	167	9/4/1995	15	10/20/1995	5.5	12/5/1995	6.2
7/21/1995	104	9/5/1995	13	10/21/1995	4.5	12/6/1995	5.4
7/22/1995	66	9/6/1995	13	10/22/1995	6.4	12/7/1995	4.6
7/23/1995	44	9/7/1995	12	10/23/1995	6.9	12/8/1995	4
7/24/1995	33	9/8/1995	11	10/24/1995	6.1	12/9/1995	3.5
7/25/1995	26	9/9/1995	9.6	10/25/1995	5.5	12/10/1995	3
7/26/1995	20	9/10/1995	8.7	10/26/1995	5.5	12/11/1995	3.5
7/27/1995	17	9/11/1995	7	10/27/1995	5.6	12/12/1995	3.7
7/28/1995	14	9/12/1995	6.3	10/28/1995	6.3	12/13/1995	3.8
7/29/1995	13	9/13/1995	5.6	10/29/1995	5.6	12/14/1995	3.9
7/30/1995	11	9/14/1995	5.3	10/30/1995	6.3	12/15/1995	4
7/31/1995	12	9/15/1995	5.1	10/31/1995	7	12/16/1995	4.1
8/1/1995	14	9/16/1995	4.9	11/1/1995	7	12/17/1995	4.2
8/2/1995	12	9/17/1995	4.3	11/2/1995	6	12/18/1995	4.3
8/3/1995	9.6	9/18/1995	3.9	11/3/1995	6.1	12/19/1995	4.4
8/4/1995	8.3	9/19/1995	3.5	11/4/1995	5.9	12/20/1995	4.5
8/5/1995	7.4	9/20/1995	3.3	11/5/1995	5.8	12/21/1995	4.6
8/6/1995	6.3	9/21/1995	3	11/6/1995	5.8	12/22/1995	4.7
8/7/1995	5.4	9/22/1995	2.8	11/7/1995	5.8	12/23/1995	5
8/8/1995	4.7	9/23/1995	2.9	11/8/1995	5.6	12/24/1995	4.9

8/9/1995	4.3	9/24/1995	3.1	11/9/1995	5.6	12/25/1995	5
8/10/1995	3.8	9/25/1995	3.2	11/10/1995	5.4	12/26/1995	5
8/11/1995	3.3	9/26/1995	3.1	11/11/1995	4.7	12/27/1995	5
8/12/1995	3.2	9/27/1995	3	11/12/1995	4.5	12/28/1995	4.8
8/13/1995	3.4	9/28/1995	3.1	11/13/1995	4.7	12/29/1995	4.7
8/14/1995	3.7	9/29/1995	3	11/14/1995	5	12/30/1995	4.6
8/15/1995	5.4	9/30/1995	2.4	11/15/1995	5.3	12/31/1995	4.7
8/16/1995	5.6	10/1/1995	1.9	11/16/1995	5.8	1/1/1996	4.3
8/17/1995	5.1	10/2/1995	2.2	11/17/1995	6.1	1/2/1996	4
8/18/1995	4.4	10/3/1995	2.7	11/18/1995	6.1	1/3/1996	3.5
8/19/1995	6	10/4/1995	3.7	11/19/1995	6.3	1/4/1996	3

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/5/1996	2.6	2/20/1996	400	4/6/1996	16	5/22/1996	35
1/6/1996	2.4	2/21/1996	380	4/7/1996	20	5/23/1996	31
1/7/1996	8	2/22/1996	370	4/8/1996	110	5/24/1996	29
1/8/1996	15	2/23/1996	340	4/9/1996	500	5/25/1996	27
1/9/1996	20	2/24/1996	300	4/10/1996	3000	5/26/1996	25
1/10/1996	22	2/25/1996	200	4/11/1996	1000	5/27/1996	24
1/11/1996	23	2/26/1996	150	4/12/1996	500	5/28/1996	22
1/12/1996	24	2/27/1996	100	4/13/1996	250	5/29/1996	21
1/13/1996	23	2/28/1996	70	4/14/1996	190	5/30/1996	20
1/14/1996	22	2/29/1996	60	4/15/1996	150	5/31/1996	20
1/15/1996	21	3/1/1996	50	4/16/1996	110	6/1/1996	24
1/16/1996	8	3/2/1996	40	4/17/1996	90	6/2/1996	27
1/17/1996	4	3/3/1996	30	4/18/1996	74	6/3/1996	25
1/18/1996	3.3	3/4/1996	21	4/19/1996	62	6/4/1996	23
1/19/1996	2.7	3/5/1996	15	4/20/1996	54	6/5/1996	21
1/20/1996	2.5	3/6/1996	12	4/21/1996	50	6/6/1996	20
1/21/1996	2.2	3/7/1996	10	4/22/1996	47	6/7/1996	19
1/22/1996	1.9	3/8/1996	7.6	4/23/1996	46	6/8/1996	21
1/23/1996	1.7	3/9/1996	6	4/24/1996	45	6/9/1996	18
1/24/1996	1.6	3/10/1996	5	4/25/1996	45	6/10/1996	16
1/25/1996	1.4	3/11/1996	70	4/26/1996	46	6/11/1996	15
1/26/1996	1.3	3/12/1996	250	4/27/1996	46	6/12/1996	13
1/27/1996	1.2	3/13/1996	2100	4/28/1996	47	6/13/1996	12
1/28/1996	1.2	3/14/1996	1000	4/29/1996	48	6/14/1996	11
1/29/1996	1.2	3/15/1996	400	4/30/1996	48	6/15/1996	13
1/30/1996	1.1	3/16/1996	200	5/1/1996	48	6/16/1996	13
1/31/1996	1	3/17/1996	110	5/2/1996	48	6/17/1996	12
2/1/1996	1	3/18/1996	80	5/3/1996	48	6/18/1996	11
2/2/1996	1	3/19/1996	60	5/4/1996	49	6/19/1996	14
2/3/1996	1	3/20/1996	50	5/5/1996	50	6/20/1996	12
2/4/1996	1.2	3/21/1996	45	5/6/1996	53	6/21/1996	10
2/5/1996	5	3/22/1996	39	5/7/1996	52	6/22/1996	9.7
2/6/1996	45	3/23/1996	34	5/8/1996	49	6/23/1996	13
2/7/1996	350	3/24/1996	30	5/9/1996	46	6/24/1996	14

2/8/1996	600	3/25/1996	27	5/10/1996	44	6/25/1996	17
2/9/1996	1100	3/26/1996	24	5/11/1996	43	6/26/1996	18
2/10/1996	1200	3/27/1996	22	5/12/1996	42	6/27/1996	16
2/11/1996	900	3/28/1996	20	5/13/1996	43	6/28/1996	14
2/12/1996	600	3/29/1996	19	5/14/1996	40	6/29/1996	18
2/13/1996	440	3/30/1996	18	5/15/1996	39	6/30/1996	15
2/14/1996	200	3/31/1996	17	5/16/1996	39	7/1/1996	15
2/15/1996	100	4/1/1996	16	5/17/1996	38	7/2/1996	13
2/16/1996	60	4/2/1996	16	5/18/1996	38	7/3/1996	12
2/17/1996	40	4/3/1996	16	5/19/1996	40	7/4/1996	10
2/18/1996	35	4/4/1996	15	5/20/1996	37	7/5/1996	9.6
2/19/1996	40	4/5/1996	15	5/21/1996	37	7/6/1996	10

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/7/1996	10	8/22/1996	4.4	10/7/1996	8.8	11/22/1996	5.6
7/8/1996	10	8/23/1996	4.3	10/8/1996	8	11/23/1996	5.4
7/9/1996	9.4	8/24/1996	4.1	10/9/1996	7	11/24/1996	5.3
7/10/1996	8.8	8/25/1996	3.7	10/10/1996	6.9	11/25/1996	5.2
7/11/1996	8.3	8/26/1996	3.6	10/11/1996	6.9	11/26/1996	5
7/12/1996	7.9	8/27/1996	3.4	10/12/1996	7	11/27/1996	6
7/13/1996	7.5	8/28/1996	3.6	10/13/1996	7.3	11/28/1996	6.6
7/14/1996	7.1	8/29/1996	3.5	10/14/1996	8.1	11/29/1996	6.4
7/15/1996	7.4	8/30/1996	3.4	10/15/1996	7.4	11/30/1996	7
7/16/1996	7.8	8/31/1996	3.3	10/16/1996	6.9	12/1/1996	7.2
7/17/1996	8.6	9/1/1996	3.4	10/17/1996	6.8	12/2/1996	7.5
7/18/1996	9.6	9/2/1996	3.3	10/18/1996	6.7	12/3/1996	7.3
7/19/1996	8.6	9/3/1996	3.4	10/19/1996	6.6	12/4/1996	7
7/20/1996	11	9/4/1996	3.3	10/20/1996	6.5	12/5/1996	6.6
7/21/1996	13	9/5/1996	3.3	10/21/1996	7	12/6/1996	6
7/22/1996	26	9/6/1996	3.3	10/22/1996	7.6	12/7/1996	6
7/23/1996	21	9/7/1996	3.4	10/23/1996	7.8	12/8/1996	5.8
7/24/1996	13	9/8/1996	3.7	10/24/1996	7.9	12/9/1996	7
7/25/1996	9.9	9/9/1996	3.6	10/25/1996	8	12/10/1996	7.8
7/26/1996	8.8	9/10/1996	3.3	10/26/1996	8	12/11/1996	8.2
7/27/1996	7.8	9/11/1996	3.3	10/27/1996	8.6	12/12/1996	8.4
7/28/1996	7.6	9/12/1996	3.3	10/28/1996	8.8	12/13/1996	8.6
7/29/1996	6.8	9/13/1996	3	10/29/1996	9.5	12/14/1996	8.8
7/30/1996	6.1	9/14/1996	3.4	10/30/1996	8	12/15/1996	9
7/31/1996	5.6	9/15/1996	3.5	10/31/1996	7.6	12/16/1996	8.5
8/1/1996	6	9/16/1996	3.5	11/1/1996	7.4	12/17/1996	8.2
8/2/1996	6.2	9/17/1996	3.3	11/2/1996	7	12/18/1996	8
8/3/1996	6.8	9/18/1996	3.7	11/3/1996	6.4	12/19/1996	7.7
8/4/1996	7.2	9/19/1996	5.1	11/4/1996	6.6	12/20/1996	7.4
8/5/1996	7	9/20/1996	11	11/5/1996	6.5	12/21/1996	6.4
8/6/1996	5.7	9/21/1996	14	11/6/1996	6.5	12/22/1996	5.6
8/7/1996	5.5	9/22/1996	19	11/7/1996	6.9	12/23/1996	5
8/8/1996	5.2	9/23/1996	25	11/8/1996	7	12/24/1996	4.4

8/9/1996	19	9/24/1996	18	11/9/1996	7.4	12/25/1996	4.1
8/10/1996	34	9/25/1996	13	11/10/1996	7.8	12/26/1996	4
8/11/1996	24	9/26/1996	10	11/11/1996	8.2	12/27/1996	3.9
8/12/1996	20	9/27/1996	10	11/12/1996	8.3	12/28/1996	3.9
8/13/1996	16	9/28/1996	13	11/13/1996	8.5	12/29/1996	3.8
8/14/1996	12	9/29/1996	14	11/14/1996	8.2	12/30/1996	3.8
8/15/1996	9.9	9/30/1996	13	11/15/1996	8	12/31/1996	3.7
8/16/1996	8.7	10/1/1996	10	11/16/1996	7.6	1/1/1997	3.7
8/17/1996	7.2	10/2/1996	9.7	11/17/1996	7.2	1/2/1997	5
8/18/1996	5.8	10/3/1996	9.2	11/18/1996	6.8	1/3/1997	7
8/19/1996	5.5	10/4/1996	8.8	11/19/1996	6.5	1/4/1997	9.6
8/20/1996	5.3	10/5/1996	9	11/20/1996	6	1/5/1997	11
8/21/1996	4.8	10/6/1996	11	11/21/1996	5.8	1/6/1997	9.4

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/7/1997	8.6	2/22/1997	13	4/9/1997	35	5/25/1997	28
1/8/1997	8	2/23/1997	15	4/10/1997	28	5/26/1997	27
1/9/1997	7.4	2/24/1997	14	4/11/1997	27	5/27/1997	27
1/10/1997	7	2/25/1997	13	4/12/1997	29	5/28/1997	27
1/11/1997	6.4	2/26/1997	12	4/13/1997	75	5/29/1997	26
1/12/1997	6	2/27/1997	11	4/14/1997	65	5/30/1997	26
1/13/1997	5.6	2/28/1997	10	4/15/1997	87	5/31/1997	25
1/14/1997	5.2	3/1/1997	9	4/16/1997	90	6/1/1997	32
1/15/1997	5	3/2/1997	8.4	4/17/1997	270	6/2/1997	32
1/16/1997	4.7	3/3/1997	8	4/18/1997	1030	6/3/1997	33
1/17/1997	4.5	3/4/1997	7.6	4/19/1997	1540	6/4/1997	33
1/18/1997	4.3	3/5/1997	7.4	4/20/1997	1410	6/5/1997	31
1/19/1997	4.1	3/6/1997	7.3	4/21/1997	925	6/6/1997	30
1/20/1997	4	3/7/1997	8	4/22/1997	615	6/7/1997	27
1/21/1997	4.3	3/8/1997	9	4/23/1997	435	6/8/1997	26
1/22/1997	5	3/9/1997	11	4/24/1997	360	6/9/1997	25
1/23/1997	4.4	3/10/1997	13	4/25/1997	305	6/10/1997	22
1/24/1997	3.8	3/11/1997	15	4/26/1997	260	6/11/1997	21
1/25/1997	3.8	3/12/1997	17	4/27/1997	225	6/12/1997	17
1/26/1997	3.8	3/13/1997	20	4/28/1997	200	6/13/1997	16
1/27/1997	3.8	3/14/1997	25	4/29/1997	185	6/14/1997	16
1/28/1997	3.7	3/15/1997	20	4/30/1997	160	6/15/1997	15
1/29/1997	3.7	3/16/1997	35	5/1/1997	130	6/16/1997	15
1/30/1997	3.7	3/17/1997	80	5/2/1997	105	6/17/1997	14
1/31/1997	4	3/18/1997	200	5/3/1997	100	6/18/1997	14
2/1/1997	4.5	3/19/1997	450	5/4/1997	90	6/19/1997	13
2/2/1997	7	3/20/1997	1100	5/5/1997	80	6/20/1997	12
2/3/1997	7.5	3/21/1997	3500	5/6/1997	71	6/21/1997	11
2/4/1997	8	3/22/1997	6000	5/7/1997	67	6/22/1997	11
2/5/1997	7.8	3/23/1997	5200	5/8/1997	63	6/23/1997	11
2/6/1997	7.5	3/24/1997	4000	5/9/1997	55	6/24/1997	12
2/7/1997	7.6	3/25/1997	3500	5/10/1997	53	6/25/1997	13

2/8/1997	7.5	3/26/1997	2500	5/11/1997	49	6/26/1997	174
2/9/1997	7.3	3/27/1997	1800	5/12/1997	45	6/27/1997	187
2/10/1997	7.1	3/28/1997	1400	5/13/1997	41	6/28/1997	95
2/11/1997	7	3/29/1997	1000	5/14/1997	39	6/29/1997	62
2/12/1997	6.6	3/30/1997	740	5/15/1997	38	6/30/1997	47
2/13/1997	6.2	3/31/1997	560	5/16/1997	33	7/1/1997	37
2/14/1997	6	4/1/1997	436	5/17/1997	31	7/2/1997	48
2/15/1997	6	4/2/1997	333	5/18/1997	31	7/3/1997	50
2/16/1997	6.2	4/3/1997	261	5/19/1997	30	7/4/1997	444
2/17/1997	7	4/4/1997	180	5/20/1997	30	7/5/1997	930
2/18/1997	8	4/5/1997	125	5/21/1997	29	7/6/1997	578
2/19/1997	9	4/6/1997	75	5/22/1997	29	7/7/1997	263
2/20/1997	10	4/7/1997	60	5/23/1997	29	7/8/1997	161
2/21/1997	12	4/8/1997	41	5/24/1997	28	7/9/1997	109

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/10/1997	86	8/25/1997	9.4	10/10/1997	9.8	11/25/1997	13
7/11/1997	151	8/26/1997	8.7	10/11/1997	10	11/26/1997	14
7/12/1997	134	8/27/1997	8.4	10/12/1997	11	11/27/1997	14
7/13/1997	102	8/28/1997	9	10/13/1997	12	11/28/1997	14
7/14/1997	96	8/29/1997	8.8	10/14/1997	11	11/29/1997	14
7/15/1997	130	8/30/1997	8.7	10/15/1997	10	11/30/1997	14
7/16/1997	108	8/31/1997	8.6	10/16/1997	10	12/1/1997	14
7/17/1997	367	9/1/1997	7.9	10/17/1997	10	12/2/1997	14
7/18/1997	262	9/2/1997	7.7	10/18/1997	10	12/3/1997	14
7/19/1997	147	9/3/1997	7.6	10/19/1997	11	12/4/1997	13
7/20/1997	100	9/4/1997	7.6	10/20/1997	10	12/5/1997	12
7/21/1997	83	9/5/1997	7.6	10/21/1997	10	12/6/1997	12
7/22/1997	76	9/6/1997	7.9	10/22/1997	11	12/7/1997	11
7/23/1997	76	9/7/1997	9.2	10/23/1997	11	12/8/1997	11
7/24/1997	65	9/8/1997	8.1	10/24/1997	12	12/9/1997	12
7/25/1997	49	9/9/1997	7.8	10/25/1997	11	12/10/1997	12
7/26/1997	36	9/10/1997	7.8	10/26/1997	10	12/11/1997	12
7/27/1997	29	9/11/1997	7.3	10/27/1997	10	12/12/1997	11
7/28/1997	25	9/12/1997	7.3	10/28/1997	11	12/13/1997	11
7/29/1997	22	9/13/1997	7.3	10/29/1997	11	12/14/1997	11
7/30/1997	20	9/14/1997	7.3	10/30/1997	12	12/15/1997	12
7/31/1997	19	9/15/1997	7.3	10/31/1997	11	12/16/1997	13
8/1/1997	18	9/16/1997	7.4	11/1/1997	11	12/17/1997	13
8/2/1997	16	9/17/1997	7.6	11/2/1997	11	12/18/1997	13
8/3/1997	15	9/18/1997	7.6	11/3/1997	11	12/19/1997	13
8/4/1997	14	9/19/1997	7.6	11/4/1997	11	12/20/1997	13
8/5/1997	13	9/20/1997	11	11/5/1997	12	12/21/1997	13
8/6/1997	12	9/21/1997	27	11/6/1997	11	12/22/1997	13
8/7/1997	12	9/22/1997	18	11/7/1997	12	12/23/1997	14
8/8/1997	12	9/23/1997	13	11/8/1997	12	12/24/1997	14
8/9/1997	11	9/24/1997	11	11/9/1997	12	12/25/1997	14

8/10/1997	11	9/25/1997	10	11/10/1997	13	12/26/1997	14
8/11/1997	10	9/26/1997	9.7	11/11/1997	11	12/27/1997	14
8/12/1997	10	9/27/1997	9.3	11/12/1997	11	12/28/1997	13
8/13/1997	9.5	9/28/1997	9.3	11/13/1997	12	12/29/1997	13
8/14/1997	9.2	9/29/1997	9.3	11/14/1997	11	12/30/1997	13
8/15/1997	9.6	9/30/1997	8.8	11/15/1997	12	12/31/1997	13
8/16/1997	9.5	10/1/1997	9	11/16/1997	12	1/1/1998	14
8/17/1997	9.9	10/2/1997	8.6	11/17/1997	11	1/2/1998	14
8/18/1997	9.9	10/3/1997	9.3	11/18/1997	12	1/3/1998	14
8/19/1997	9.8	10/4/1997	9.3	11/19/1997	13	1/4/1998	13
8/20/1997	9.8	10/5/1997	9.1	11/20/1997	13	1/5/1998	13
8/21/1997	9.8	10/6/1997	9.1	11/21/1997	12	1/6/1998	12
8/22/1997	9.7	10/7/1997	9.2	11/22/1997	13	1/7/1998	12
8/23/1997	9.6	10/8/1997	9.6	11/23/1997	13	1/8/1998	11
8/24/1997	9.5	10/9/1997	9.7	11/24/1997	13	1/9/1998	9.3

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/10/1998	7.4	2/25/1998	19	4/12/1998	77	5/28/1998	12
1/11/1998	7.2	2/26/1998	18	4/13/1998	70	5/29/1998	9.4
1/12/1998	6.8	2/27/1998	18	4/14/1998	63	5/30/1998	9.1
1/13/1998	6.6	2/28/1998	17	4/15/1998	57	5/31/1998	9.1
1/14/1998	6.4	3/1/1998	16	4/16/1998	51	6/1/1998	8.7
1/15/1998	6.4	3/2/1998	15	4/17/1998	48	6/2/1998	9.1
1/16/1998	6.3	3/3/1998	15	4/18/1998	45	6/3/1998	8.9
1/17/1998	6.2	3/4/1998	14	4/19/1998	41	6/4/1998	8.4
1/18/1998	6	3/5/1998	13	4/20/1998	36	6/5/1998	8.5
1/19/1998	5.9	3/6/1998	13	4/21/1998	33	6/6/1998	8.3
1/20/1998	6	3/7/1998	13	4/22/1998	30	6/7/1998	7.8
1/21/1998	5.9	3/8/1998	12	4/23/1998	27	6/8/1998	7.9
1/22/1998	5.8	3/9/1998	12	4/24/1998	24	6/9/1998	9.6
1/23/1998	5.7	3/10/1998	12	4/25/1998	23	6/10/1998	10
1/24/1998	5.6	3/11/1998	12	4/26/1998	23	6/11/1998	11
1/25/1998	5.6	3/12/1998	11	4/27/1998	24	6/12/1998	11
1/26/1998	5.5	3/13/1998	12	4/28/1998	24	6/13/1998	11
1/27/1998	5.6	3/14/1998	12	4/29/1998	23	6/14/1998	12
1/28/1998	5.7	3/15/1998	13	4/30/1998	20	6/15/1998	13
1/29/1998	5.8	3/16/1998	14	5/1/1998	18	6/16/1998	14
1/30/1998	5.9	3/17/1998	14	5/2/1998	17	6/17/1998	19
1/31/1998	6	3/18/1998	15	5/3/1998	17	6/18/1998	35
2/1/1998	6	3/19/1998	16	5/4/1998	18	6/19/1998	358
2/2/1998	6.1	3/20/1998	17	5/5/1998	18	6/20/1998	834
2/3/1998	6.2	3/21/1998	18	5/6/1998	19	6/21/1998	828
2/4/1998	6.2	3/22/1998	20	5/7/1998	19	6/22/1998	794
2/5/1998	6.2	3/23/1998	25	5/8/1998	19	6/23/1998	411
2/6/1998	6.3	3/24/1998	40	5/9/1998	21	6/24/1998	226
2/7/1998	6.8	3/25/1998	56	5/10/1998	20	6/25/1998	155
2/8/1998	7.6	3/26/1998	80	5/11/1998	19	6/26/1998	113

2/9/1998	8	3/27/1998	110	5/12/1998	18	6/27/1998	90
2/10/1998	9	3/28/1998	150	5/13/1998	19	6/28/1998	60
2/11/1998	9.4	3/29/1998	160	5/14/1998	21	6/29/1998	47
2/12/1998	10	3/30/1998	170	5/15/1998	23	6/30/1998	39
2/13/1998	11	3/31/1998	250	5/16/1998	25	7/1/1998	33
2/14/1998	12	4/1/1998	220	5/17/1998	25	7/2/1998	29
2/15/1998	13	4/2/1998	200	5/18/1998	24	7/3/1998	25
2/16/1998	14	4/3/1998	180	5/19/1998	21	7/4/1998	22
2/17/1998	15	4/4/1998	163	5/20/1998	19	7/5/1998	21
2/18/1998	16	4/5/1998	152	5/21/1998	18	7/6/1998	20
2/19/1998	17	4/6/1998	151	5/22/1998	17	7/7/1998	20
2/20/1998	18	4/7/1998	146	5/23/1998	16	7/8/1998	22
2/21/1998	19	4/8/1998	138	5/24/1998	16	7/9/1998	25
2/22/1998	19	4/9/1998	121	5/25/1998	15	7/10/1998	30
2/23/1998	20	4/10/1998	106	5/26/1998	14	7/11/1998	35
2/24/1998	19	4/11/1998	89	5/27/1998	13	7/12/1998	40
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/13/1998	40	8/28/1998	48	10/13/1998	47	11/28/1998	113
7/14/1998	35	8/29/1998	36	10/14/1998	51	11/29/1998	113
7/15/1998	30	8/30/1998	27	10/15/1998	46	11/30/1998	95
7/16/1998	27	8/31/1998	23	10/16/1998	83	12/1/1998	71
7/17/1998	25	9/1/1998	18	10/17/1998	109	12/2/1998	64
7/18/1998	20	9/2/1998	15	10/18/1998	142	12/3/1998	57
7/19/1998	18	9/3/1998	13	10/19/1998	105	12/4/1998	47
7/20/1998	15	9/4/1998	11	10/20/1998	87	12/5/1998	30
7/21/1998	11	9/5/1998	9.7	10/21/1998	62	12/6/1998	30
7/22/1998	10	9/6/1998	8.6	10/22/1998	44	12/7/1998	31
7/23/1998	9.3	9/7/1998	7.6	10/23/1998	34	12/8/1998	30
7/24/1998	8.5	9/8/1998	6.8	10/24/1998	28	12/9/1998	25
7/25/1998	7.9	9/9/1998	6.3	10/25/1998	24	12/10/1998	21
7/26/1998	7.7	9/10/1998	6.1	10/26/1998	21	12/11/1998	20
7/27/1998	7.2	9/11/1998	6.3	10/27/1998	19	12/12/1998	18
7/28/1998	6.5	9/12/1998	7.2	10/28/1998	18	12/13/1998	17
7/29/1998	6.4	9/13/1998	11	10/29/1998	18	12/14/1998	17
7/30/1998	13	9/14/1998	9.9	10/30/1998	17	12/15/1998	17
7/31/1998	13	9/15/1998	8.7	10/31/1998	17	12/16/1998	16
8/1/1998	9.9	9/16/1998	8.1	11/1/1998	17	12/17/1998	15
8/2/1998	14	9/17/1998	8	11/2/1998	17	12/18/1998	15
8/3/1998	13	9/18/1998	9.9	11/3/1998	18	12/19/1998	14
8/4/1998	17	9/19/1998	9.6	11/4/1998	18	12/20/1998	14
8/5/1998	20	9/20/1998	9	11/5/1998	21	12/21/1998	13
8/6/1998	20	9/21/1998	7.9	11/6/1998	22	12/22/1998	13
8/7/1998	20	9/22/1998	7.2	11/7/1998	21	12/23/1998	12
8/8/1998	15	9/23/1998	7.1	11/8/1998	20	12/24/1998	12
8/9/1998	11	9/24/1998	7.1	11/9/1998	21	12/25/1998	12
8/10/1998	8.5	9/25/1998	6.8	11/10/1998	25	12/26/1998	11

8/11/1998	7.3	9/26/1998	6.8	11/11/1998	21	12/27/1998	11
8/12/1998	6.2	9/27/1998	6.7	11/12/1998	22	12/28/1998	11
8/13/1998	6	9/28/1998	6.7	11/13/1998	22	12/29/1998	10
8/14/1998	7.3	9/29/1998	6.8	11/14/1998	21	12/30/1998	9.6
8/15/1998	8	9/30/1998	6.6	11/15/1998	23	12/31/1998	9.2
8/16/1998	9.7	10/1/1998	6.3	11/16/1998	24	1/1/1999	9
8/17/1998	9.2	10/2/1998	6.2	11/17/1998	28	1/2/1999	8.8
8/18/1998	43	10/3/1998	5.8	11/18/1998	25	1/3/1999	8.6
8/19/1998	200	10/4/1998	7.3	11/19/1998	36	1/4/1999	8.4
8/20/1998	122	10/5/1998	21	11/20/1998	47	1/5/1999	8.3
8/21/1998	125	10/6/1998	28	11/21/1998	48	1/6/1999	8.2
8/22/1998	129	10/7/1998	79	11/22/1998	48	1/7/1999	8
8/23/1998	99	10/8/1998	67	11/23/1998	45	1/8/1999	7.9
8/24/1998	121	10/9/1998	94	11/24/1998	68	1/9/1999	7.9
8/25/1998	150	10/10/1998	90	11/25/1998	91	1/10/1999	7.8
8/26/1998	140	10/11/1998	73	11/26/1998	111	1/11/1999	7.7
8/27/1998	73	10/12/1998	57	11/27/1998	123	1/12/1999	7.6
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/13/1999	7.6	2/28/1999	500	4/15/1999	91	5/31/1999	37
1/14/1999	7.5	3/1/1999	1000	4/16/1999	72	6/1/1999	35
1/15/1999	7.5	3/2/1999	1500	4/17/1999	67	6/2/1999	32
1/16/1999	7.4	3/3/1999	1800	4/18/1999	64	6/3/1999	30
1/17/1999	7.4	3/4/1999	1500	4/19/1999	61	6/4/1999	30
1/18/1999	7.4	3/5/1999	1000	4/20/1999	57	6/5/1999	28
1/19/1999	7.3	3/6/1999	600	4/21/1999	54	6/6/1999	34
1/20/1999	7.2	3/7/1999	400	4/22/1999	51	6/7/1999	35
1/21/1999	7.1	3/8/1999	300	4/23/1999	48	6/8/1999	31
1/22/1999	7.2	3/9/1999	260	4/24/1999	46	6/9/1999	30
1/23/1999	7.3	3/10/1999	220	4/25/1999	44	6/10/1999	28
1/24/1999	7.3	3/11/1999	200	4/26/1999	42	6/11/1999	27
1/25/1999	7.4	3/12/1999	180	4/27/1999	40	6/12/1999	30
1/26/1999	7.5	3/13/1999	210	4/28/1999	37	6/13/1999	30
1/27/1999	7.5	3/14/1999	270	4/29/1999	36	6/14/1999	29
1/28/1999	7.4	3/15/1999	648	4/30/1999	33	6/15/1999	27
1/29/1999	7.3	3/16/1999	1680	5/1/1999	31	6/16/1999	26
1/30/1999	7.3	3/17/1999	2140	5/2/1999	30	6/17/1999	25
1/31/1999	7.5	3/18/1999	1730	5/3/1999	30	6/18/1999	22
2/1/1999	7.7	3/19/1999	1350	5/4/1999	36	6/19/1999	20
2/2/1999	7.8	3/20/1999	853	5/5/1999	39	6/20/1999	19
2/3/1999	7.9	3/21/1999	523	5/6/1999	75	6/21/1999	18
2/4/1999	7.9	3/22/1999	449	5/7/1999	78	6/22/1999	16
2/5/1999	8	3/23/1999	339	5/8/1999	146	6/23/1999	14
2/6/1999	8.2	3/24/1999	247	5/9/1999	171	6/24/1999	14
2/7/1999	8.3	3/25/1999	195	5/10/1999	163	6/25/1999	13
2/8/1999	8.4	3/26/1999	165	5/11/1999	245	6/26/1999	15
2/9/1999	8.5	3/27/1999	148	5/12/1999	367	6/27/1999	12

2/10/1999	8.6	3/28/1999	131	5/13/1999	473	6/28/1999	14
2/11/1999	8.8	3/29/1999	115	5/14/1999	388	6/29/1999	14
2/12/1999	9	3/30/1999	106	5/15/1999	281	6/30/1999	14
2/13/1999	10	3/31/1999	103	5/16/1999	272	7/1/1999	13
2/14/1999	12	4/1/1999	114	5/17/1999	282	7/2/1999	15
2/15/1999	15	4/2/1999	125	5/18/1999	364	7/3/1999	17
2/16/1999	17	4/3/1999	83	5/19/1999	288	7/4/1999	18
2/17/1999	19	4/4/1999	85	5/20/1999	248	7/5/1999	17
2/18/1999	23	4/5/1999	80	5/21/1999	193	7/6/1999	15
2/19/1999	22	4/6/1999	78	5/22/1999	136	7/7/1999	13
2/20/1999	23	4/7/1999	109	5/23/1999	104	7/8/1999	12
2/21/1999	21	4/8/1999	190	5/24/1999	85	7/9/1999	11
2/22/1999	20	4/9/1999	220	5/25/1999	71	7/10/1999	10
2/23/1999	23	4/10/1999	210	5/26/1999	62	7/11/1999	9.3
2/24/1999	24	4/11/1999	160	5/27/1999	54	7/12/1999	8.8
2/25/1999	23	4/12/1999	150	5/28/1999	47	7/13/1999	8.1
2/26/1999	50	4/13/1999	127	5/29/1999	42	7/14/1999	7.6
2/27/1999	200	4/14/1999	106	5/30/1999	40	7/15/1999	7.2

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/16/1999	6.9	8/31/1999	12	10/16/1999	11	12/1/1999	13
7/17/1999	6.6	9/1/1999	11	10/17/1999	11	12/2/1999	14
7/18/1999	6.4	9/2/1999	11	10/18/1999	12	12/3/1999	13
7/19/1999	6.2	9/3/1999	13	10/19/1999	12	12/4/1999	12
7/20/1999	6	9/4/1999	16	10/20/1999	12	12/5/1999	13
7/21/1999	20	9/5/1999	17	10/21/1999	12	12/6/1999	13
7/22/1999	15	9/6/1999	15	10/22/1999	11	12/7/1999	13
7/23/1999	11	9/7/1999	14	10/23/1999	11	12/8/1999	13
7/24/1999	8	9/8/1999	15	10/24/1999	11	12/9/1999	12
7/25/1999	7	9/9/1999	16	10/25/1999	11	12/10/1999	11
7/26/1999	49	9/10/1999	18	10/26/1999	10	12/11/1999	11
7/27/1999	73	9/11/1999	24	10/27/1999	11	12/12/1999	11
7/28/1999	49	9/12/1999	25	10/28/1999	11	12/13/1999	11
7/29/1999	34	9/13/1999	21	10/29/1999	10	12/14/1999	11
7/30/1999	24	9/14/1999	18	10/30/1999	10	12/15/1999	10
7/31/1999	16	9/15/1999	17	10/31/1999	10	12/16/1999	10
8/1/1999	12	9/16/1999	16	11/1/1999	11	12/17/1999	9.8
8/2/1999	9.8	9/17/1999	16	11/2/1999	12	12/18/1999	9.8
8/3/1999	8	9/18/1999	15	11/3/1999	12	12/19/1999	9.7
8/4/1999	7.4	9/19/1999	13	11/4/1999	12	12/20/1999	9.7
8/5/1999	6.8	9/20/1999	12	11/5/1999	11	12/21/1999	9.6
8/6/1999	6.3	9/21/1999	12	11/6/1999	11	12/22/1999	9.5
8/7/1999	5.9	9/22/1999	12	11/7/1999	11	12/23/1999	9.6
8/8/1999	5.6	9/23/1999	11	11/8/1999	11	12/24/1999	9.5
8/9/1999	5.3	9/24/1999	11	11/9/1999	11	12/25/1999	9.4
8/10/1999	5	9/25/1999	10	11/10/1999	11	12/26/1999	9.3
8/11/1999	4.8	9/26/1999	10	11/11/1999	11	12/27/1999	9.4

8/12/1999	15	9/27/1999	10	11/12/1999	12	12/28/1999	9.5
8/13/1999	38	9/28/1999	9.5	11/13/1999	12	12/29/1999	9.4
8/14/1999	127	9/29/1999	9.5	11/14/1999	12	12/30/1999	9.3
8/15/1999	112	9/30/1999	9	11/15/1999	12	12/31/1999	9.2
8/16/1999	174	10/1/1999	9	11/16/1999	14	1/1/2000	9.1
8/17/1999	86	10/2/1999	8.5	11/17/1999	14	1/2/2000	9
8/18/1999	65	10/3/1999	8	11/18/1999	14	1/3/2000	9.1
8/19/1999	117	10/4/1999	8.5	11/19/1999	13	1/4/2000	9.2
8/20/1999	147	10/5/1999	9	11/20/1999	14	1/5/2000	9.4
8/21/1999	103	10/6/1999	9.5	11/21/1999	14	1/6/2000	9.5
8/22/1999	62	10/7/1999	11	11/22/1999	13	1/7/2000	9.3
8/23/1999	41	10/8/1999	12	11/23/1999	12	1/8/2000	9.2
8/24/1999	29	10/9/1999	11	11/24/1999	12	1/9/2000	9.1
8/25/1999	24	10/10/1999	11	11/25/1999	14	1/10/2000	9
8/26/1999	20	10/11/1999	11	11/26/1999	13	1/11/2000	8.9
8/27/1999	17	10/12/1999	12	11/27/1999	13	1/12/2000	8.8
8/28/1999	14	10/13/1999	13	11/28/1999	12	1/13/2000	8.9
8/29/1999	13	10/14/1999	13	11/29/1999	13	1/14/2000	9
8/30/1999	12	10/15/1999	12	11/30/1999	13	1/15/2000	9.2

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/16/2000	9.4	3/2/2000	300	4/17/2000	22	6/2/2000	14
1/17/2000	9.1	3/3/2000	250	4/18/2000	24	6/3/2000	13
1/18/2000	9	3/4/2000	200	4/19/2000	26	6/4/2000	14
1/19/2000	8.8	3/5/2000	150	4/20/2000	30	6/5/2000	13
1/20/2000	8.7	3/6/2000	100	4/21/2000	32	6/6/2000	14
1/21/2000	8.8	3/7/2000	85	4/22/2000	32	6/7/2000	15
1/22/2000	8.9	3/8/2000	80	4/23/2000	33	6/8/2000	14
1/23/2000	8.8	3/9/2000	51	4/24/2000	34	6/9/2000	17
1/24/2000	8.9	3/10/2000	55	4/25/2000	35	6/10/2000	16
1/25/2000	8.7	3/11/2000	52	4/26/2000	37	6/11/2000	14
1/26/2000	8.5	3/12/2000	39	4/27/2000	34	6/12/2000	12
1/27/2000	8.3	3/13/2000	34	4/28/2000	33	6/13/2000	16
1/28/2000	8.8	3/14/2000	36	4/29/2000	31	6/14/2000	25
1/29/2000	8.9	3/15/2000	27	4/30/2000	27	6/15/2000	26
1/30/2000	9	3/16/2000	24	5/1/2000	24	6/16/2000	29
1/31/2000	9	3/17/2000	24	5/2/2000	22	6/17/2000	28
2/1/2000	8.9	3/18/2000	25	5/3/2000	19	6/18/2000	34
2/2/2000	8.9	3/19/2000	25	5/4/2000	17	6/19/2000	33
2/3/2000	9	3/20/2000	27	5/5/2000	17	6/20/2000	34
2/4/2000	9.1	3/21/2000	25	5/6/2000	18	6/21/2000	32
2/5/2000	9.2	3/22/2000	28	5/7/2000	18	6/22/2000	28
2/6/2000	9	3/23/2000	30	5/8/2000	23	6/23/2000	27
2/7/2000	8.8	3/24/2000	30	5/9/2000	22	6/24/2000	26
2/8/2000	8.7	3/25/2000	27	5/10/2000	30	6/25/2000	27
2/9/2000	8.2	3/26/2000	26	5/11/2000	33	6/26/2000	23
2/10/2000	7.8	3/27/2000	26	5/12/2000	39	6/27/2000	20

2/11/2000	7.5	3/28/2000	24	5/13/2000	40	6/28/2000	19
2/12/2000	7.3	3/29/2000	23	5/14/2000	43	6/29/2000	17
2/13/2000	7.2	3/30/2000	22	5/15/2000	40	6/30/2000	16
2/14/2000	7	3/31/2000	21	5/16/2000	37	7/1/2000	15
2/15/2000	7.1	4/1/2000	20	5/17/2000	33	7/2/2000	14
2/16/2000	7	4/2/2000	20	5/18/2000	29	7/3/2000	16
2/17/2000	7.1	4/3/2000	20	5/19/2000	26	7/4/2000	17
2/18/2000	7.4	4/4/2000	19	5/20/2000	25	7/5/2000	16
2/19/2000	7.8	4/5/2000	19	5/21/2000	23	7/6/2000	19
2/20/2000	8	4/6/2000	18	5/22/2000	22	7/7/2000	19
2/21/2000	8.9	4/7/2000	18	5/23/2000	21	7/8/2000	25
2/22/2000	9.3	4/8/2000	17	5/24/2000	19	7/9/2000	34
2/23/2000	10	4/9/2000	17	5/25/2000	17	7/10/2000	38
2/24/2000	25	4/10/2000	16	5/26/2000	14	7/11/2000	49
2/25/2000	200	4/11/2000	16	5/27/2000	15	7/12/2000	50
2/26/2000	450	4/12/2000	16	5/28/2000	14	7/13/2000	35
2/27/2000	500	4/13/2000	16	5/29/2000	14	7/14/2000	50
2/28/2000	450	4/14/2000	21	5/30/2000	13	7/15/2000	58
2/29/2000	400	4/15/2000	22	5/31/2000	12	7/16/2000	35
3/1/2000	425	4/16/2000	21	6/1/2000	14	7/17/2000	23

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/18/2000	18	9/2/2000	0.42	10/18/2000	4.4	12/3/2000	7.2
7/19/2000	14	9/3/2000	0.61	10/19/2000	4.2	12/4/2000	7.4
7/20/2000	11	9/4/2000	0.8	10/20/2000	4.3	12/5/2000	7.2
7/21/2000	9.1	9/5/2000	1.1	10/21/2000	4.1	12/6/2000	6.8
7/22/2000	7.5	9/6/2000	1.3	10/22/2000	4.2	12/7/2000	6.7
7/23/2000	6.5	9/7/2000	1.2	10/23/2000	4.5	12/8/2000	7.1
7/24/2000	5.6	9/8/2000	1.2	10/24/2000	4.5	12/9/2000	7.1
7/25/2000	4.7	9/9/2000	1.4	10/25/2000	4.6	12/10/2000	7
7/26/2000	3.9	9/10/2000	1.3	10/26/2000	5.3	12/11/2000	6.6
7/27/2000	3.3	9/11/2000	1.3	10/27/2000	5.3	12/12/2000	6.2
7/28/2000	2.9	9/12/2000	1.2	10/28/2000	5.6	12/13/2000	4.9
7/29/2000	2.4	9/13/2000	1.1	10/29/2000	7	12/14/2000	4.4
7/30/2000	2.4	9/14/2000	1.1	10/30/2000	6.6	12/15/2000	4.1
7/31/2000	2	9/15/2000	1.2	10/31/2000	7.1	12/16/2000	3.8
8/1/2000	1.8	9/16/2000	1.4	11/1/2000	11	12/17/2000	3.1
8/2/2000	1.7	9/17/2000	1.8	11/2/2000	19	12/18/2000	2.6
8/3/2000	2.4	9/18/2000	1.5	11/3/2000	24	12/19/2000	2.5
8/4/2000	2.1	9/19/2000	1.3	11/4/2000	37	12/20/2000	2.4
8/5/2000	1.9	9/20/2000	1.2	11/5/2000	41	12/21/2000	2.4
8/6/2000	1.8	9/21/2000	1.4	11/6/2000	54	12/22/2000	2.2
8/7/2000	1.6	9/22/2000	2.3	11/7/2000	38	12/23/2000	2.2
8/8/2000	1.5	9/23/2000	2.6	11/8/2000	18	12/24/2000	2.1
8/9/2000	1.3	9/24/2000	2.6	11/9/2000	28	12/25/2000	2.1
8/10/2000	1.1	9/25/2000	2.9	11/10/2000	22	12/26/2000	2
8/11/2000	1.1	9/26/2000	2.9	11/11/2000	15	12/27/2000	2

8/12/2000	0.98	9/27/2000	2.9	11/12/2000	12	12/28/2000	2.1
8/13/2000	0.86	9/28/2000	2.9	11/13/2000	10	12/29/2000	2.2
8/14/2000	0.91	9/29/2000	2.9	11/14/2000	8.8	12/30/2000	2.1
8/15/2000	0.81	9/30/2000	3.1	11/15/2000	8.2	12/31/2000	2
8/16/2000	0.72	10/1/2000	3.3	11/16/2000	8.1	1/1/2001	2.3
8/17/2000	0.66	10/2/2000	3.4	11/17/2000	7.6	1/2/2001	2.4
8/18/2000	0.63	10/3/2000	3.1	11/18/2000	7.1	1/3/2001	2.5
8/19/2000	0.59	10/4/2000	3	11/19/2000	7.1	1/4/2001	2.6
8/20/2000	0.55	10/5/2000	3	11/20/2000	6.8	1/5/2001	2.7
8/21/2000	0.58	10/6/2000	3.5	11/21/2000	6.5	1/6/2001	2.9
8/22/2000	0.53	10/7/2000	4	11/22/2000	5.8	1/7/2001	3
8/23/2000	0.43	10/8/2000	3.5	11/23/2000	5.6	1/8/2001	3.2
8/24/2000	0.42	10/9/2000	3.5	11/24/2000	5.7	1/9/2001	3.4
8/25/2000	0.41	10/10/2000	3.6	11/25/2000	5.9	1/10/2001	3.3
8/26/2000	0.41	10/11/2000	3.7	11/26/2000	5.9	1/11/2001	3.6
8/27/2000	0.47	10/12/2000	3.9	11/27/2000	6.1	1/12/2001	3.4
8/28/2000	0.53	10/13/2000	4.1	11/28/2000	6.7	1/13/2001	3.3
8/29/2000	0.43	10/14/2000	4.4	11/29/2000	6.8	1/14/2001	3.2
8/30/2000	0.41	10/15/2000	4.7	11/30/2000	6.8	1/15/2001	3
8/31/2000	0.35	10/16/2000	4.4	12/1/2000	6.9	1/16/2001	2.8
9/1/2000	0.36	10/17/2000	4.3	12/2/2000	7.1	1/17/2001	2.6

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/18/2001	2.7	3/5/2001	4.6	4/20/2001	49	6/5/2001	9
1/19/2001	2.5	3/6/2001	55	4/21/2001	43	6/6/2001	13
1/20/2001	2.6	3/7/2001	120	4/22/2001	39	6/7/2001	14
1/21/2001	2.7	3/8/2001	160	4/23/2001	37	6/8/2001	13
1/22/2001	2.6	3/9/2001	930	4/24/2001	36	6/9/2001	12
1/23/2001	2.7	3/10/2001	1200	4/25/2001	36	6/10/2001	16
1/24/2001	2.8	3/11/2001	1500	4/26/2001	33	6/11/2001	25
1/25/2001	2.8	3/12/2001	1650	4/27/2001	30	6/12/2001	20
1/26/2001	2.7	3/13/2001	1710	4/28/2001	28	6/13/2001	24
1/27/2001	2.6	3/14/2001	1750	4/29/2001	28	6/14/2001	66
1/28/2001	2.5	3/15/2001	1600	4/30/2001	28	6/15/2001	163
1/29/2001	2.6	3/16/2001	1290	5/1/2001	26	6/16/2001	913
1/30/2001	2.5	3/17/2001	960	5/2/2001	23	6/17/2001	970
1/31/2001	2.4	3/18/2001	850	5/3/2001	20	6/18/2001	908
2/1/2001	2.3	3/19/2001	740	5/4/2001	18	6/19/2001	767
2/2/2001	2.2	3/20/2001	630	5/5/2001	17	6/20/2001	585
2/3/2001	2.2	3/21/2001	520	5/6/2001	20	6/21/2001	579
2/4/2001	2.1	3/22/2001	410	5/7/2001	19	6/22/2001	500
2/5/2001	2.1	3/23/2001	290	5/8/2001	17	6/23/2001	270
2/6/2001	2.1	3/24/2001	244	5/9/2001	17	6/24/2001	169
2/7/2001	2	3/25/2001	215	5/10/2001	17	6/25/2001	118
2/8/2001	2	3/26/2001	187	5/11/2001	16	6/26/2001	82
2/9/2001	2.1	3/27/2001	136	5/12/2001	16	6/27/2001	58
2/10/2001	2.1	3/28/2001	95	5/13/2001	15	6/28/2001	44

2/11/2001	2.2	3/29/2001	78	5/14/2001	14	6/29/2001	34
2/12/2001	2.2	3/30/2001	64	5/15/2001	13	6/30/2001	26
2/13/2001	2.1	3/31/2001	54	5/16/2001	13	7/1/2001	21
2/14/2001	2.1	4/1/2001	50	5/17/2001	16	7/2/2001	17
2/15/2001	2	4/2/2001	46	5/18/2001	14	7/3/2001	14
2/16/2001	2.1	4/3/2001	44	5/19/2001	13	7/4/2001	12
2/17/2001	2.2	4/4/2001	48	5/20/2001	11	7/5/2001	11
2/18/2001	2.1	4/5/2001	54	5/21/2001	11	7/6/2001	9.4
2/19/2001	2.2	4/6/2001	72	5/22/2001	10	7/7/2001	8.8
2/20/2001	2	4/7/2001	121	5/23/2001	8.9	7/8/2001	8.5
2/21/2001	2	4/8/2001	191	5/24/2001	8.4	7/9/2001	8.1
2/22/2001	1.9	4/9/2001	289	5/25/2001	8.4	7/10/2001	6.9
2/23/2001	1.8	4/10/2001	431	5/26/2001	7.9	7/11/2001	6.6
2/24/2001	1.8	4/11/2001	363	5/27/2001	7.7	7/12/2001	6.7
2/25/2001	1.7	4/12/2001	323	5/28/2001	7.1	7/13/2001	7.3
2/26/2001	1.6	4/13/2001	278	5/29/2001	6.7	7/14/2001	6.4
2/27/2001	1.7	4/14/2001	195	5/30/2001	8.5	7/15/2001	6.2
2/28/2001	1.8	4/15/2001	141	5/31/2001	8.6	7/16/2001	6
3/1/2001	1.7	4/16/2001	108	6/1/2001	7.6	7/17/2001	5.8
3/2/2001	1.8	4/17/2001	83	6/2/2001	7.2	7/18/2001	12
3/3/2001	2	4/18/2001	67	6/3/2001	6.5	7/19/2001	11
3/4/2001	2.1	4/19/2001	56	6/4/2001	6.5	7/20/2001	7.9

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/21/2001	9	9/5/2001	2.9	10/21/2001	6.2	12/6/2001	8.9
7/22/2001	122	9/6/2001	3	10/22/2001	6.4	12/7/2001	8.8
7/23/2001	239	9/7/2001	3.4	10/23/2001	6.2	12/8/2001	8.7
7/24/2001	175	9/8/2001	3.7	10/24/2001	6.5	12/9/2001	8.7
7/25/2001	168	9/9/2001	3.9	10/25/2001	6.6	12/10/2001	8.8
7/26/2001	101	9/10/2001	4.2	10/26/2001	6.5	12/11/2001	9
7/27/2001	114	9/11/2001	4.4	10/27/2001	6.7	12/12/2001	9
7/28/2001	148	9/12/2001	4.4	10/28/2001	7	12/13/2001	8.8
7/29/2001	661	9/13/2001	4.7	10/29/2001	7.2	12/14/2001	8.7
7/30/2001	428	9/14/2001	7.8	10/30/2001	7	12/15/2001	8.8
7/31/2001	237	9/15/2001	8.5	10/31/2001	7.4	12/16/2001	8.8
8/1/2001	141	9/16/2001	7.9	11/1/2001	7.8	12/17/2001	8.9
8/2/2001	90	9/17/2001	8.1	11/2/2001	8.9	12/18/2001	8.9
8/3/2001	61	9/18/2001	7.7	11/3/2001	8.5	12/19/2001	8.8
8/4/2001	60	9/19/2001	8.1	11/4/2001	7.8	12/20/2001	8.3
8/5/2001	55	9/20/2001	7.7	11/5/2001	7.6	12/21/2001	8
8/6/2001	36	9/21/2001	7.5	11/6/2001	7.5	12/22/2001	7.9
8/7/2001	25	9/22/2001	6.8	11/7/2001	7.8	12/23/2001	7.2
8/8/2001	19	9/23/2001	6.3	11/8/2001	9	12/24/2001	6.3
8/9/2001	14	9/24/2001	6.5	11/9/2001	10	12/25/2001	5.8
8/10/2001	11	9/25/2001	6.7	11/10/2001	11	12/26/2001	5.4
8/11/2001	9.4	9/26/2001	6.3	11/11/2001	11	12/27/2001	5.3
8/12/2001	8.1	9/27/2001	6.3	11/12/2001	11	12/28/2001	5.2

8/13/2001	7.4	9/28/2001	6.5	11/13/2001	9.9	12/29/2001	5.1
8/14/2001	6.5	9/29/2001	5.8	11/14/2001	9.6	12/30/2001	5.1
8/15/2001	6.2	9/30/2001	5.5	11/15/2001	9.4	12/31/2001	5
8/16/2001	6.1	10/1/2001	5.4	11/16/2001	9.1	1/1/2002	5
8/17/2001	5.3	10/2/2001	5	11/17/2001	8.9	1/2/2002	5.1
8/18/2001	4.8	10/3/2001	5	11/18/2001	8.7	1/3/2002	5.1
8/19/2001	4.4	10/4/2001	4.7	11/19/2001	8.6	1/4/2002	5.1
8/20/2001	4.2	10/5/2001	4.4	11/20/2001	8.8	1/5/2002	5.3
8/21/2001	4.3	10/6/2001	4.4	11/21/2001	9.1	1/6/2002	5.5
8/22/2001	4.2	10/7/2001	4.5	11/22/2001	9.3	1/7/2002	5.7
8/23/2001	4.1	10/8/2001	4.7	11/23/2001	9.6	1/8/2002	5.9
8/24/2001	3.9	10/9/2001	4.5	11/24/2001	9.7	1/9/2002	6.1
8/25/2001	3.6	10/10/2001	4.5	11/25/2001	9.6	1/10/2002	6.5
8/26/2001	3.5	10/11/2001	4.6	11/26/2001	9.4	1/11/2002	7
8/27/2001	3.4	10/12/2001	5	11/27/2001	8.6	1/12/2002	7.3
8/28/2001	3.3	10/13/2001	5.2	11/28/2001	8.6	1/13/2002	7.5
8/29/2001	3.3	10/14/2001	5.5	11/29/2001	8.6	1/14/2002	7.7
8/30/2001	3.2	10/15/2001	5.5	11/30/2001	8.6	1/15/2002	7.7
8/31/2001	3.2	10/16/2001	5.5	12/1/2001	8.6	1/16/2002	7.8
9/1/2001	3.2	10/17/2001	5.2	12/2/2001	8.7	1/17/2002	7.8
9/2/2001	3.1	10/18/2001	5.4	12/3/2001	8.7	1/18/2002	7.8
9/3/2001	2.9	10/19/2001	5.5	12/4/2001	8.8	1/19/2002	7.7
9/4/2001	2.9	10/20/2001	5.7	12/5/2001	8.9	1/20/2002	7.7

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/21/2002	7.8	3/8/2002	6.1	4/23/2002	60	6/8/2002	3.1
1/22/2002	7.8	3/9/2002	6.3	4/24/2002	55	6/9/2002	22
1/23/2002	7.8	3/10/2002	6.3	4/25/2002	55	6/10/2002	136
1/24/2002	7.8	3/11/2002	6.4	4/26/2002	58	6/11/2002	498
1/25/2002	7.7	3/12/2002	6.6	4/27/2002	50	6/12/2002	1210
1/26/2002	7.6	3/13/2002	6.9	4/28/2002	44	6/13/2002	737
1/27/2002	7.6	3/14/2002	7.4	4/29/2002	39	6/14/2002	373
1/28/2002	7.4	3/15/2002	7.7	4/30/2002	35	6/15/2002	208
1/29/2002	7	3/16/2002	8	5/1/2002	30	6/16/2002	148
1/30/2002	6.8	3/17/2002	8.6	5/2/2002	25	6/17/2002	111
1/31/2002	6.3	3/18/2002	7.5	5/3/2002	23	6/18/2002	85
2/1/2002	6.1	3/19/2002	8	5/4/2002	20	6/19/2002	66
2/2/2002	6.1	3/20/2002	9.1	5/5/2002	19	6/20/2002	57
2/3/2002	6.2	3/21/2002	9.9	5/6/2002	19	6/21/2002	45
2/4/2002	6.3	3/22/2002	10	5/7/2002	19	6/22/2002	38
2/5/2002	6.4	3/23/2002	9.4	5/8/2002	21	6/23/2002	34
2/6/2002	6.6	3/24/2002	8.4	5/9/2002	25	6/24/2002	31
2/7/2002	6.9	3/25/2002	8.8	5/10/2002	26	6/25/2002	31
2/8/2002	7.3	3/26/2002	9.4	5/11/2002	26	6/26/2002	32
2/9/2002	7.5	3/27/2002	17	5/12/2002	30	6/27/2002	37
2/10/2002	7.5	3/28/2002	40	5/13/2002	35	6/28/2002	43
2/11/2002	7.5	3/29/2002	60	5/14/2002	37	6/29/2002	61

2/12/2002	7.5	3/30/2002	58	5/15/2002	45	6/30/2002	44
2/13/2002	7.4	3/31/2002	55	5/16/2002	45	7/1/2002	36
2/14/2002	7.3	4/1/2002	65	5/17/2002	42	7/2/2002	26
2/15/2002	7.3	4/2/2002	170	5/18/2002	37	7/3/2002	20
2/16/2002	7.3	4/3/2002	130	5/19/2002	31	7/4/2002	17
2/17/2002	7.2	4/4/2002	95	5/20/2002	24	7/5/2002	14
2/18/2002	7.1	4/5/2002	75	5/21/2002	18	7/6/2002	12
2/19/2002	7.1	4/6/2002	65	5/22/2002	14	7/7/2002	11
2/20/2002	7	4/7/2002	55	5/23/2002	13	7/8/2002	9.6
2/21/2002	6.8	4/8/2002	53	5/24/2002	11	7/9/2002	12
2/22/2002	6.6	4/9/2002	50	5/25/2002	9.2	7/10/2002	12
2/23/2002	6.5	4/10/2002	50	5/26/2002	7.8	7/11/2002	11
2/24/2002	6.1	4/11/2002	50	5/27/2002	7	7/12/2002	10
2/25/2002	6	4/12/2002	52	5/28/2002	6.5	7/13/2002	12
2/26/2002	5.9	4/13/2002	53	5/29/2002	6.1	7/14/2002	12
2/27/2002	5.8	4/14/2002	52	5/30/2002	5.2	7/15/2002	10
2/28/2002	5.7	4/15/2002	50	5/31/2002	4.6	7/16/2002	8.3
3/1/2002	5.6	4/16/2002	45	6/1/2002	3.7	7/17/2002	13
3/2/2002	5.4	4/17/2002	45	6/2/2002	3.6	7/18/2002	16
3/3/2002	5.5	4/18/2002	48	6/3/2002	4	7/19/2002	12
3/4/2002	5.5	4/19/2002	50	6/4/2002	4	7/20/2002	23
3/5/2002	5.6	4/20/2002	49	6/5/2002	3.6	7/21/2002	62
3/6/2002	5.8	4/21/2002	50	6/6/2002	3.5	7/22/2002	144
3/7/2002	5.9	4/22/2002	56	6/7/2002	3.4	7/23/2002	95

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/24/2002	76	9/8/2002	6	10/24/2002	8	12/9/2002	5.5
7/25/2002	84	9/9/2002	5.3	10/25/2002	8.3	12/10/2002	5.5
7/26/2002	54	9/10/2002	4.7	10/26/2002	8.5	12/11/2002	5.4
7/27/2002	38	9/11/2002	4.2	10/27/2002	9.1	12/12/2002	5.6
7/28/2002	33	9/12/2002	3.7	10/28/2002	9.4	12/13/2002	5.5
7/29/2002	40	9/13/2002	3.3	10/29/2002	11	12/14/2002	5.6
7/30/2002	43	9/14/2002	3.1	10/30/2002	10	12/15/2002	5.9
7/31/2002	34	9/15/2002	2.9	10/31/2002	10	12/16/2002	6
8/1/2002	27	9/16/2002	2.7	11/1/2002	9.6	12/17/2002	6.3
8/2/2002	19	9/17/2002	2.4	11/2/2002	9.1	12/18/2002	6.8
8/3/2002	15	9/18/2002	2.2	11/3/2002	9	12/19/2002	7.1
8/4/2002	13	9/19/2002	2.4	11/4/2002	9	12/20/2002	7
8/5/2002	12	9/20/2002	2.3	11/5/2002	8.9	12/21/2002	6.7
8/6/2002	11	9/21/2002	2.2	11/6/2002	8.8	12/22/2002	6.5
8/7/2002	9.2	9/22/2002	2.3	11/7/2002	8.9	12/23/2002	6.3
8/8/2002	9.7	9/23/2002	2.5	11/8/2002	8.9	12/24/2002	6.1
8/9/2002	9.5	9/24/2002	3	11/9/2002	8.8	12/25/2002	5.7
8/10/2002	8	9/25/2002	3	11/10/2002	8.9	12/26/2002	5.3
8/11/2002	6.5	9/26/2002	3.4	11/11/2002	8.9	12/27/2002	4.7
8/12/2002	5.5	9/27/2002	3.1	11/12/2002	8.9	12/28/2002	5.1
8/13/2002	7.7	9/28/2002	3.3	11/13/2002	9.3	12/29/2002	5.7

8/14/2002	23	9/29/2002	3.8	11/14/2002	9.9	12/30/2002	5.9
8/15/2002	23	9/30/2002	4.1	11/15/2002	10	12/31/2002	5.9
8/16/2002	16	10/1/2002	3	11/16/2002	10	1/1/2003	5
8/17/2002	12	10/2/2002	2.3	11/17/2002	11	1/2/2003	5
8/18/2002	11	10/3/2002	2.2	11/18/2002	10	1/3/2003	5.6
8/19/2002	13	10/4/2002	2	11/19/2002	9.6	1/4/2003	6
8/20/2002	11	10/5/2002	3.1	11/20/2002	9.4	1/5/2003	6.4
8/21/2002	8.6	10/6/2002	3.5	11/21/2002	9.3	1/6/2003	6.8
8/22/2002	7.6	10/7/2002	5.9	11/22/2002	11	1/7/2003	7
8/23/2002	6.2	10/8/2002	3.3	11/23/2002	10	1/8/2003	7.2
8/24/2002	5.6	10/9/2002	1.9	11/24/2002	7.4	1/9/2003	7.4
8/25/2002	5.4	10/10/2002	2.9	11/25/2002	7.9	1/10/2003	7.3
8/26/2002	19	10/11/2002	3.3	11/26/2002	7.4	1/11/2003	7.2
8/27/2002	33	10/12/2002	3.7	11/27/2002	7.1	1/12/2003	7.1
8/28/2002	41	10/13/2002	4.4	11/28/2002	7.3	1/13/2003	7
8/29/2002	36	10/14/2002	4.9	11/29/2002	7.7	1/14/2003	6.9
8/30/2002	25	10/15/2002	5.6	11/30/2002	7	1/15/2003	6.8
8/31/2002	24	10/16/2002	5.5	12/1/2002	7.2	1/16/2003	6.7
9/1/2002	22	10/17/2002	6.2	12/2/2002	7.1	1/17/2003	6.5
9/2/2002	19	10/18/2002	6.8	12/3/2002	6.5	1/18/2003	6.4
9/3/2002	14	10/19/2002	8.5	12/4/2002	5.9	1/19/2003	6.2
9/4/2002	12	10/20/2002	7.4	12/5/2002	5.1	1/20/2003	6.1
9/5/2002	11	10/21/2002	6.7	12/6/2002	5.1	1/21/2003	5.9
9/6/2002	8	10/22/2002	8	12/7/2002	5.5	1/22/2003	5.8
9/7/2002	6.6	10/23/2002	8.2	12/8/2002	5.6	1/23/2003	5.6

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/24/2003	5.5	3/11/2003	4.7	4/26/2003	28	6/11/2003	14
1/25/2003	5.5	3/12/2003	4.7	4/27/2003	23	6/12/2003	21
1/26/2003	5.4	3/13/2003	4.8	4/28/2003	21	6/13/2003	15
1/27/2003	5.5	3/14/2003	6.9	4/29/2003	19	6/14/2003	13
1/28/2003	5.5	3/15/2003	517	4/30/2003	17	6/15/2003	12
1/29/2003	5.6	3/16/2003	1630	5/1/2003	16	6/16/2003	15
1/30/2003	5.6	3/17/2003	2400	5/2/2003	15	6/17/2003	35
1/31/2003	5.5	3/18/2003	1920	5/3/2003	14	6/18/2003	76
2/1/2003	5.4	3/19/2003	1430	5/4/2003	14	6/19/2003	107
2/2/2003	5.3	3/20/2003	2150	5/5/2003	15	6/20/2003	61
2/3/2003	5.1	3/21/2003	1610	5/6/2003	17	6/21/2003	43
2/4/2003	5.1	3/22/2003	975	5/7/2003	17	6/22/2003	33
2/5/2003	5.1	3/23/2003	450	5/8/2003	23	6/23/2003	26
2/6/2003	5.1	3/24/2003	250	5/9/2003	41	6/24/2003	19
2/7/2003	5.1	3/25/2003	226	5/10/2003	50	6/25/2003	17
2/8/2003	5.1	3/26/2003	233	5/11/2003	91	6/26/2003	14
2/9/2003	5.1	3/27/2003	199	5/12/2003	112	6/27/2003	12
2/10/2003	5.1	3/28/2003	176	5/13/2003	123	6/28/2003	11
2/11/2003	5	3/29/2003	157	5/14/2003	131	6/29/2003	9.6
2/12/2003	5	3/30/2003	133	5/15/2003	115	6/30/2003	8.5

2/13/2003	5	3/31/2003	120	5/16/2003	108	7/1/2003	7.4
2/14/2003	5	4/1/2003	70	5/17/2003	86	7/2/2003	6.9
2/15/2003	5.1	4/2/2003	59	5/18/2003	73	7/3/2003	7.3
2/16/2003	5.1	4/3/2003	54	5/19/2003	61	7/4/2003	8.2
2/17/2003	5.1	4/4/2003	52	5/20/2003	48	7/5/2003	7.9
2/18/2003	5.1	4/5/2003	46	5/21/2003	41	7/6/2003	6.7
2/19/2003	5	4/6/2003	45	5/22/2003	37	7/7/2003	6
2/20/2003	5	4/7/2003	43	5/23/2003	32	7/8/2003	5.6
2/21/2003	5	4/8/2003	41	5/24/2003	29	7/9/2003	6.1
2/22/2003	5	4/9/2003	40	5/25/2003	24	7/10/2003	6.3
2/23/2003	5	4/10/2003	39	5/26/2003	21	7/11/2003	5.9
2/24/2003	5	4/11/2003	38	5/27/2003	19	7/12/2003	5.8
2/25/2003	5.1	4/12/2003	37	5/28/2003	17	7/13/2003	4.8
2/26/2003	5.1	4/13/2003	39	5/29/2003	14	7/14/2003	4.6
2/27/2003	5.1	4/14/2003	38	5/30/2003	13	7/15/2003	4.4
2/28/2003	5.1	4/15/2003	34	5/31/2003	11	7/16/2003	4
3/1/2003	5.1	4/16/2003	34	6/1/2003	10	7/17/2003	3.8
3/2/2003	5	4/17/2003	34	6/2/2003	10	7/18/2003	3.7
3/3/2003	5	4/18/2003	32	6/3/2003	10	7/19/2003	6.3
3/4/2003	4.9	4/19/2003	30	6/4/2003	8.9	7/20/2003	6.5
3/5/2003	4.8	4/20/2003	28	6/5/2003	8.2	7/21/2003	5.2
3/6/2003	4.7	4/21/2003	29	6/6/2003	8	7/22/2003	4.6
3/7/2003	4.6	4/22/2003	30	6/7/2003	8.3	7/23/2003	3.9
3/8/2003	4.6	4/23/2003	29	6/8/2003	8.1	7/24/2003	3.5
3/9/2003	4.6	4/24/2003	28	6/9/2003	8.6	7/25/2003	3.4
3/10/2003	4.7	4/25/2003	30	6/10/2003	10	7/26/2003	3.2
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/27/2003	3.1	9/11/2003	8.9	10/27/2003	7.5	12/12/2003	5
7/28/2003	3	9/12/2003	7.2	10/28/2003	8	12/13/2003	5
7/29/2003	3	9/13/2003	9.6	10/29/2003	8.2	12/14/2003	5
7/30/2003	2.9	9/14/2003	22	10/30/2003	8	12/15/2003	5
7/31/2003	2.7	9/15/2003	20	10/31/2003	8.2	12/16/2003	5
8/1/2003	2.5	9/16/2003	14	11/1/2003	8.5	12/17/2003	4.8
8/2/2003	2.4	9/17/2003	10	11/2/2003	8.9	12/18/2003	4.6
8/3/2003	2.2	9/18/2003	7.3	11/3/2003	9.3	12/19/2003	4.6
8/4/2003	2.4	9/19/2003	5.6	11/4/2003	9.5	12/20/2003	4.5
8/5/2003	2.4	9/20/2003	5	11/5/2003	9.1	12/21/2003	4.4
8/6/2003	2.5	9/21/2003	4.1	11/6/2003	8.7	12/22/2003	4.5
8/7/2003	2.6	9/22/2003	5.3	11/7/2003	9.1	12/23/2003	4.7
8/8/2003	2.5	9/23/2003	6.6	11/8/2003	8.8	12/24/2003	4.3
8/9/2003	2.7	9/24/2003	5.3	11/9/2003	8.8	12/25/2003	4
8/10/2003	3	9/25/2003	4.6	11/10/2003	8.7	12/26/2003	3.8
8/11/2003	3.2	9/26/2003	4.4	11/11/2003	8.7	12/27/2003	3.6
8/12/2003	2.9	9/27/2003	4.1	11/12/2003	9.1	12/28/2003	3.7
8/13/2003	2.6	9/28/2003	4.4	11/13/2003	8.8	12/29/2003	4.1
8/14/2003	2.1	9/29/2003	4.5	11/14/2003	8.9	12/30/2003	4.4

8/15/2003	1.6	9/30/2003	4.2	11/15/2003	8.9	12/31/2003	4.5
8/16/2003	1.5	10/1/2003	4.2	11/16/2003	8.8	1/1/2004	4.4
8/17/2003	1.4	10/2/2003	4.1	11/17/2003	8.7	1/2/2004	4.2
8/18/2003	1.2	10/3/2003	4.5	11/18/2003	8.7	1/3/2004	3.9
8/19/2003	1.2	10/4/2003	4.6	11/19/2003	9.1	1/4/2004	3.6
8/20/2003	1.1	10/5/2003	4.5	11/20/2003	10	1/5/2004	3.3
8/21/2003	0.92	10/6/2003	4.4	11/21/2003	9.4	1/6/2004	3
8/22/2003	0.87	10/7/2003	4.8	11/22/2003	8.7	1/7/2004	2.9
8/23/2003	0.88	10/8/2003	5	11/23/2003	8.3	1/8/2004	2.9
8/24/2003	0.83	10/9/2003	5.8	11/24/2003	7.7	1/9/2004	3.1
8/25/2003	0.89	10/10/2003	5.6	11/25/2003	7.1	1/10/2004	3.5
8/26/2003	0.67	10/11/2003	6.7	11/26/2003	6.8	1/11/2004	3.8
8/27/2003	0.58	10/12/2003	6.3	11/27/2003	6.4	1/12/2004	4.2
8/28/2003	0.46	10/13/2003	6.2	11/28/2003	6.1	1/13/2004	4.4
8/29/2003	0.47	10/14/2003	5.7	11/29/2003	5.7	1/14/2004	4.5
8/30/2003	0.65	10/15/2003	4.2	11/30/2003	5.8	1/15/2004	4.8
8/31/2003	1	10/16/2003	6.7	12/1/2003	6.1	1/16/2004	5.1
9/1/2003	2.2	10/17/2003	5	12/2/2003	6	1/17/2004	5.4
9/2/2003	1.3	10/18/2003	4.8	12/3/2003	6	1/18/2004	5.7
9/3/2003	1	10/19/2003	5.7	12/4/2003	6	1/19/2004	5.6
9/4/2003	1.4	10/20/2003	5.9	12/5/2003	6	1/20/2004	5.2
9/5/2003	1.4	10/21/2003	5.9	12/6/2003	5.9	1/21/2004	5.2
9/6/2003	1.4	10/22/2003	5.7	12/7/2003	5.8	1/22/2004	4.8
9/7/2003	1.5	10/23/2003	6	12/8/2003	5.8	1/23/2004	4.6
9/8/2003	1.7	10/24/2003	6.7	12/9/2003	5.8	1/24/2004	4.9
9/9/2003	1.8	10/25/2003	7.1	12/10/2003	5.5	1/25/2004	4.5
9/10/2003	3.7	10/26/2003	5.9	12/11/2003	5.1	1/26/2004	4.3

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/27/2004	4.1	3/13/2004	1030	4/28/2004	21	6/13/2004	12
1/28/2004	3.9	3/14/2004	740	4/29/2004	19	6/14/2004	16
1/29/2004	3.7	3/15/2004	606	4/30/2004	18	6/15/2004	13
1/30/2004	3.5	3/16/2004	513	5/1/2004	17	6/16/2004	9.9
1/31/2004	3.5	3/17/2004	575	5/2/2004	16	6/17/2004	8.4
2/1/2004	3.4	3/18/2004	499	5/3/2004	16	6/18/2004	7.4
2/2/2004	3.4	3/19/2004	500	5/4/2004	15	6/19/2004	6.6
2/3/2004	3.3	3/20/2004	526	5/5/2004	14	6/20/2004	6.4
2/4/2004	3.1	3/21/2004	487	5/6/2004	13	6/21/2004	9.6
2/5/2004	3.5	3/22/2004	442	5/7/2004	13	6/22/2004	9.6
2/6/2004	3.6	3/23/2004	390	5/8/2004	13	6/23/2004	8.9
2/7/2004	3.8	3/24/2004	330	5/9/2004	13	6/24/2004	8
2/8/2004	4	3/25/2004	287	5/10/2004	12	6/25/2004	6.9
2/9/2004	4.4	3/26/2004	246	5/11/2004	12	6/26/2004	6.3
2/10/2004	4.4	3/27/2004	350	5/12/2004	12	6/27/2004	6.3
2/11/2004	4.2	3/28/2004	664	5/13/2004	12	6/28/2004	6.1
2/12/2004	4.5	3/29/2004	516	5/14/2004	12	6/29/2004	5.6
2/13/2004	4.7	3/30/2004	346	5/15/2004	12	6/30/2004	5.1

2/14/2004	4.6	3/31/2004	261	5/16/2004	12	7/1/2004	5.1
2/15/2004	5.1	4/1/2004	186	5/17/2004	12	7/2/2004	9.2
2/16/2004	5.4	4/2/2004	136	5/18/2004	11	7/3/2004	7.7
2/17/2004	5.3	4/3/2004	102	5/19/2004	12	7/4/2004	5.2
2/18/2004	5.3	4/4/2004	80	5/20/2004	12	7/5/2004	4.8
2/19/2004	5.3	4/5/2004	67	5/21/2004	11	7/6/2004	4.8
2/20/2004	5.4	4/6/2004	54	5/22/2004	11	7/7/2004	4.9
2/21/2004	5.4	4/7/2004	46	5/23/2004	11	7/8/2004	6.2
2/22/2004	5.8	4/8/2004	41	5/24/2004	12	7/9/2004	6.9
2/23/2004	6.2	4/9/2004	37	5/25/2004	13	7/10/2004	7.1
2/24/2004	7	4/10/2004	35	5/26/2004	13	7/11/2004	6.5
2/25/2004	7.8	4/11/2004	35	5/27/2004	13	7/12/2004	6.3
2/26/2004	8.1	4/12/2004	34	5/28/2004	13	7/13/2004	5.9
2/27/2004	8.5	4/13/2004	31	5/29/2004	13	7/14/2004	5.2
2/28/2004	22	4/14/2004	29	5/30/2004	14	7/15/2004	4.9
2/29/2004	32	4/15/2004	27	5/31/2004	14	7/16/2004	4.9
3/1/2004	66	4/16/2004	26	6/1/2004	14	7/17/2004	5.5
3/2/2004	166	4/17/2004	25	6/2/2004	13	7/18/2004	5.4
3/3/2004	75	4/18/2004	26	6/3/2004	13	7/19/2004	5.1
3/4/2004	60	4/19/2004	26	6/4/2004	13	7/20/2004	5
3/5/2004	66	4/20/2004	27	6/5/2004	19	7/21/2004	4.6
3/6/2004	69	4/21/2004	26	6/6/2004	29	7/22/2004	3.7
3/7/2004	64	4/22/2004	26	6/7/2004	16	7/23/2004	3.2
3/8/2004	65	4/23/2004	27	6/8/2004	11	7/24/2004	2.6
3/9/2004	125	4/24/2004	26	6/9/2004	8.7	7/25/2004	2.5
3/10/2004	1320	4/25/2004	24	6/10/2004	8.9	7/26/2004	2.1
3/11/2004	2660	4/26/2004	23	6/11/2004	11	7/27/2004	1.8
3/12/2004	1400	4/27/2004	22	6/12/2004	14	7/28/2004	1.9

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
7/29/2004	1.9	9/13/2004	3	10/29/2004	10	12/14/2004	6.2
7/30/2004	2.1	9/14/2004	3.2	10/30/2004	17	12/15/2004	6.3
7/31/2004	2.2	9/15/2004	3.5	10/31/2004	21	12/16/2004	6.5
8/1/2004	2.4	9/16/2004	3.8	11/1/2004	41	12/17/2004	6.3
8/2/2004	2.2	9/17/2004	3.7	11/2/2004	56	12/18/2004	6
8/3/2004	2	9/18/2004	3.3	11/3/2004	42	12/19/2004	5.7
8/4/2004	1.8	9/19/2004	3.3	11/4/2004	36	12/20/2004	5
8/5/2004	2.2	9/20/2004	3.4	11/5/2004	33	12/21/2004	4.3
8/6/2004	2.4	9/21/2004	3.3	11/6/2004	27	12/22/2004	3.8
8/7/2004	2.7	9/22/2004	3.8	11/7/2004	20	12/23/2004	3.3
8/8/2004	3.7	9/23/2004	4	11/8/2004	15	12/24/2004	3
8/9/2004	4.1	9/24/2004	4.3	11/9/2004	13	12/25/2004	3.1
8/10/2004	4.7	9/25/2004	3.6	11/10/2004	11	12/26/2004	3.1
8/11/2004	4.2	9/26/2004	3.5	11/11/2004	9.7	12/27/2004	3.2
8/12/2004	4.9	9/27/2004	3.4	11/12/2004	8.8	12/28/2004	3.3
8/13/2004	9.6	9/28/2004	3	11/13/2004	8.1	12/29/2004	3.1
8/14/2004	8.2	9/29/2004	3	11/14/2004	7.6	12/30/2004	2.9

8/15/2004	6.3	9/30/2004	3	11/15/2004	7	12/31/2004	2.8
8/16/2004	5.7	10/1/2004	3	11/16/2004	7	1/1/2005	2.6
8/17/2004	5.1	10/2/2004	2.9	11/17/2004	7	1/2/2005	2.4
8/18/2004	4.1	10/3/2004	2.7	11/18/2004	6.9	1/3/2005	2.3
8/19/2004	3.7	10/4/2004	2.7	11/19/2004	6.9	1/4/2005	2.1
8/20/2004	3.2	10/5/2004	2.4	11/20/2004	7.1	1/5/2005	2
8/21/2004	2.7	10/6/2004	2.4	11/21/2004	6.9	1/6/2005	2
8/22/2004	2.4	10/7/2004	2.6	11/22/2004	7.9	1/7/2005	1.9
8/23/2004	2.4	10/8/2004	2.8	11/23/2004	6.7	1/8/2005	1.9
8/24/2004	2.5	10/9/2004	3	11/24/2004	6.7	1/9/2005	1.8
8/25/2004	2.4	10/10/2004	3	11/25/2004	7.3	1/10/2005	1.7
8/26/2004	2.3	10/11/2004	3.4	11/26/2004	7.9	1/11/2005	1.7
8/27/2004	3.7	10/12/2004	3.1	11/27/2004	7.6	1/12/2005	1.6
8/28/2004	6.4	10/13/2004	3.1	11/28/2004	7.4	1/13/2005	1.6
8/29/2004	9.6	10/14/2004	4.3	11/29/2004	7.3	1/14/2005	1.5
8/30/2004	8.2	10/15/2004	3.5	11/30/2004	7.2	1/15/2005	1.5
8/31/2004	5.6	10/16/2004	3.3	12/1/2004	7	1/16/2005	1.4
9/1/2004	4.2	10/17/2004	3.3	12/2/2004	6.9	1/17/2005	1.4
9/2/2004	3.4	10/18/2004	3.7	12/3/2004	7	1/18/2005	1.5
9/3/2004	3.1	10/19/2004	4.9	12/4/2004	7	1/19/2005	1.5
9/4/2004	3.1	10/20/2004	5	12/5/2004	6.6	1/20/2005	1.6
9/5/2004	3.1	10/21/2004	4.7	12/6/2004	6.4	1/21/2005	1.7
9/6/2004	2.8	10/22/2004	5	12/7/2004	6.4	1/22/2005	1.6
9/7/2004	2.6	10/23/2004	5.3	12/8/2004	6.3	1/23/2005	1.7
9/8/2004	2.6	10/24/2004	6.5	12/9/2004	6.3	1/24/2005	2
9/9/2004	2.3	10/25/2004	7.3	12/10/2004	6.5	1/25/2005	2.6
9/10/2004	2.1	10/26/2004	6.8	12/11/2004	6.6	1/26/2005	3.5
9/11/2004	2.3	10/27/2004	6.6	12/12/2004	6.5	1/27/2005	4.3
9/12/2004	2.5	10/28/2004	6.7	12/13/2004	6.3	1/28/2005	4.2

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
1/29/2005	4.1	3/16/2005	21	5/1/2005	8.6	6/16/2005	78
1/30/2005	4	3/17/2005	20	5/2/2005	7.9	6/17/2005	64
1/31/2005	4.1	3/18/2005	20	5/3/2005	7.7	6/18/2005	51
2/1/2005	4.5	3/19/2005	19	5/4/2005	8.2	6/19/2005	88
2/2/2005	5	3/20/2005	18	5/5/2005	7.3	6/20/2005	172
2/3/2005	5.8	3/21/2005	17	5/6/2005	6.4	6/21/2005	196
2/4/2005	8	3/22/2005	17	5/7/2005	5.9	6/22/2005	126
2/5/2005	12	3/23/2005	21	5/8/2005	7.7	6/23/2005	103
2/6/2005	11	3/24/2005	23	5/9/2005	8.7	6/24/2005	71
2/7/2005	10	3/25/2005	24	5/10/2005	18	6/25/2005	66
2/8/2005	9.4	3/26/2005	30	5/11/2005	134	6/26/2005	121
2/9/2005	8.6	3/27/2005	95	5/12/2005	89	6/27/2005	127
2/10/2005	8.1	3/28/2005	185	5/13/2005	64	6/28/2005	107
2/11/2005	8.4	3/29/2005	183	5/14/2005	50	6/29/2005	628
2/12/2005	8.6	3/30/2005	263	5/15/2005	43	6/30/2005	725
2/13/2005	9	3/31/2005	468	5/16/2005	53	7/1/2005	652

2/14/2005	9.4	4/1/2005	293	5/17/2005	63	7/2/2005	453
2/15/2005	9.8	4/2/2005	179	5/18/2005	105	7/3/2005	314
2/16/2005	9.3	4/3/2005	118	5/19/2005	103	7/4/2005	213
2/17/2005	9	4/4/2005	85	5/20/2005	104	7/5/2005	192
2/18/2005	8.7	4/5/2005	63	5/21/2005	324	7/6/2005	142
2/19/2005	8.4	4/6/2005	50	5/22/2005	450	7/7/2005	103
2/20/2005	8	4/7/2005	38	5/23/2005	616	7/8/2005	77
2/21/2005	8.2	4/8/2005	32	5/24/2005	302	7/9/2005	58
2/22/2005	8.3	4/9/2005	28	5/25/2005	170	7/10/2005	44
2/23/2005	8.4	4/10/2005	23	5/26/2005	104	7/11/2005	35
2/24/2005	8.4	4/11/2005	21	5/27/2005	73	7/12/2005	29
2/25/2005	8.5	4/12/2005	21	5/28/2005	54	7/13/2005	24
2/26/2005	8.5	4/13/2005	19	5/29/2005	41	7/14/2005	21
2/27/2005	8.6	4/14/2005	18	5/30/2005	33	7/15/2005	18
2/28/2005	8.7	4/15/2005	17	5/31/2005	27	7/16/2005	18
3/1/2005	8.8	4/16/2005	17	6/1/2005	26	7/17/2005	14
3/2/2005	8.9	4/17/2005	16	6/2/2005	77	7/18/2005	13
3/3/2005	9.7	4/18/2005	17	6/3/2005	207	7/19/2005	12
3/4/2005	11	4/19/2005	16	6/4/2005	445	7/20/2005	11
3/5/2005	12	4/20/2005	16	6/5/2005	227	7/21/2005	9.7
3/6/2005	14	4/21/2005	15	6/6/2005	135	7/22/2005	8.8
3/7/2005	16	4/22/2005	14	6/7/2005	169	7/23/2005	8.8
3/8/2005	16	4/23/2005	13	6/8/2005	709	7/24/2005	8.3
3/9/2005	17	4/24/2005	13	6/9/2005	778	7/25/2005	7.9
3/10/2005	23	4/25/2005	13	6/10/2005	458	7/26/2005	7.9
3/11/2005	27	4/26/2005	11	6/11/2005	390	7/27/2005	7.8
3/12/2005	29	4/27/2005	11	6/12/2005	245	7/28/2005	7.6
3/13/2005	25	4/28/2005	10	6/13/2005	171	7/29/2005	7.4
3/14/2005	23	4/29/2005	9.5	6/14/2005	130	7/30/2005	7.2
3/15/2005	22	4/30/2005	9	6/15/2005	100	7/31/2005	6.8

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
8/1/2005	6.3	9/16/2005	1.7	11/1/2005	6.9	12/17/2005	7.5
8/2/2005	6.1	9/17/2005	1.9	11/2/2005	6.9	12/18/2005	6.1
8/3/2005	6	9/18/2005	2.2	11/3/2005	6.6	12/19/2005	5.5
8/4/2005	5.8	9/19/2005	2	11/4/2005	6.6	12/20/2005	5.2
8/5/2005	5.6	9/20/2005	1.9	11/5/2005	8.8	12/21/2005	5
8/6/2005	6	9/21/2005	2	11/6/2005	8.5	12/22/2005	5.6
8/7/2005	6.1	9/22/2005	2	11/7/2005	7.7	12/23/2005	6.1
8/8/2005	6.2	9/23/2005	2	11/8/2005	8.2	12/24/2005	6.9
8/9/2005	5.6	9/24/2005	2.2	11/9/2005	7.3	12/25/2005	8.1
8/10/2005	6.4	9/25/2005	1.9	11/10/2005	7.4	12/26/2005	9.1
8/11/2005	7.8	9/26/2005	1.7	11/11/2005	7.7	12/27/2005	9.9
8/12/2005	7.3	9/27/2005	2.1	11/12/2005	10	12/28/2005	11
8/13/2005	6.4	9/28/2005	2.1	11/13/2005	16	12/29/2005	11
8/14/2005	5.9	9/29/2005	2.3	11/14/2005	17	12/30/2005	11
8/15/2005	5.4	9/30/2005	2.6	11/15/2005	20	12/31/2005	11

8/16/2005	4.9	10/1/2005	2.9	11/16/2005	22	1/1/2006	12
8/17/2005	6.4	10/2/2005	2.8	11/17/2005	26	1/2/2006	12
8/18/2005	5.6	10/3/2005	2.3	11/18/2005	25	1/3/2006	13
8/19/2005	5.4	10/4/2005	2.1	11/19/2005	25	1/4/2006	13
8/20/2005	4.7	10/5/2005	7.5	11/20/2005	24	1/5/2006	14
8/21/2005	4.2	10/6/2005	12	11/21/2005	23	1/6/2006	13
8/22/2005	3.8	10/7/2005	15	11/22/2005	20	1/7/2006	12
8/23/2005	3.4	10/8/2005	16	11/23/2005	19	1/8/2006	12
8/24/2005	3.4	10/9/2005	16	11/24/2005	16	1/9/2006	12
8/25/2005	3.1	10/10/2005	23	11/25/2005	16	1/10/2006	11
8/26/2005	2.5	10/11/2005	24	11/26/2005	16	1/11/2006	11
8/27/2005	2	10/12/2005	35	11/27/2005	15	1/12/2006	11
8/28/2005	1.8	10/13/2005	43	11/28/2005	13	1/13/2006	11
8/29/2005	1.6	10/14/2005	53	11/29/2005	12	1/14/2006	11
8/30/2005	1.4	10/15/2005	45	11/30/2005	11	1/15/2006	11
8/31/2005	1.3	10/16/2005	48	12/1/2005	9.9	1/16/2006	12
9/1/2005	1.2	10/17/2005	46	12/2/2005	9.2	1/17/2006	11
9/2/2005	1.2	10/18/2005	38	12/3/2005	8.9	1/18/2006	10
9/3/2005	1.3	10/19/2005	30	12/4/2005	8.4	1/19/2006	10
9/4/2005	3.2	10/20/2005	23	12/5/2005	7.6	1/20/2006	11
9/5/2005	1.7	10/21/2005	20	12/6/2005	6.6	1/21/2006	11
9/6/2005	1.4	10/22/2005	17	12/7/2005	6.2	1/22/2006	11
9/7/2005	1.5	10/23/2005	14	12/8/2005	5.7	1/23/2006	10
9/8/2005	1.4	10/24/2005	12	12/9/2005	6	1/24/2006	11
9/9/2005	1.4	10/25/2005	10	12/10/2005	7.8	1/25/2006	12
9/10/2005	1.5	10/26/2005	9.5	12/11/2005	9.6	1/26/2006	13
9/11/2005	1.4	10/27/2005	8.9	12/12/2005	11	1/27/2006	14
9/12/2005	1.5	10/28/2005	8.3	12/13/2005	10	1/28/2006	15
9/13/2005	1.8	10/29/2005	8.1	12/14/2005	9.9	1/29/2006	17
9/14/2005	1.8	10/30/2005	7.7	12/15/2005	9.5	1/30/2006	19
9/15/2005	1.9	10/31/2005	7.4	12/16/2005	9	1/31/2006	21
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
2/1/2006	22	3/19/2006	42	5/4/2006	23	6/19/2006	10
2/2/2006	24	3/20/2006	39	5/5/2006	21	6/20/2006	12
2/3/2006	27	3/21/2006	31	5/6/2006	20	6/21/2006	11
2/4/2006	29	3/22/2006	27	5/7/2006	19	6/22/2006	8.6
2/5/2006	26	3/23/2006	24	5/8/2006	18	6/23/2006	7
2/6/2006	22	3/24/2006	22	5/9/2006	17	6/24/2006	7.2
2/7/2006	18	3/25/2006	21	5/10/2006	14	6/25/2006	7.8
2/8/2006	16	3/26/2006	23	5/11/2006	13	6/26/2006	7.1
2/9/2006	14	3/27/2006	27	5/12/2006	12	6/27/2006	6
2/10/2006	13	3/28/2006	30	5/13/2006	12	6/28/2006	5
2/11/2006	13	3/29/2006	46	5/14/2006	11	6/29/2006	3.9
2/12/2006	12	3/30/2006	102	5/15/2006	10	6/30/2006	3.6
2/13/2006	11	3/31/2006	200	5/16/2006	9.6	7/1/2006	3.4
2/14/2006	10	4/1/2006	304	5/17/2006	9.2	7/2/2006	3

2/15/2006	9.5	4/2/2006	226	5/18/2006	8.4	7/3/2006	2.5
2/16/2006	9.3	4/3/2006	166	5/19/2006	7.8	7/4/2006	2.2
2/17/2006	8.4	4/4/2006	113	5/20/2006	7.4	7/5/2006	2
2/18/2006	8.2	4/5/2006	96	5/21/2006	8	7/6/2006	1.9
2/19/2006	8	4/6/2006	78	5/22/2006	8.8	7/7/2006	1.7
2/20/2006	8.3	4/7/2006	62	5/23/2006	8.6	7/8/2006	1.4
2/21/2006	8.5	4/8/2006	52	5/24/2006	10	7/9/2006	1.2
2/22/2006	9	4/9/2006	44	5/25/2006	11	7/10/2006	1.1
2/23/2006	8.5	4/10/2006	35	5/26/2006	13	7/11/2006	1
2/24/2006	8.2	4/11/2006	30	5/27/2006	12	7/12/2006	0.92
2/25/2006	8.5	4/12/2006	25	5/28/2006	11	7/13/2006	1.1
2/26/2006	8.8	4/13/2006	22	5/29/2006	34	7/14/2006	0.96
2/27/2006	9	4/14/2006	19	5/30/2006	60	7/15/2006	0.83
2/28/2006	9.2	4/15/2006	17	5/31/2006	43	7/16/2006	0.73
3/1/2006	9	4/16/2006	15	6/1/2006	32	7/17/2006	0.62
3/2/2006	9	4/17/2006	14	6/2/2006	24	7/18/2006	0.42
3/3/2006	9.2	4/18/2006	19	6/3/2006	18	7/19/2006	0.31
3/4/2006	9.4	4/19/2006	35	6/4/2006	15	7/20/2006	0.39
3/5/2006	9.8	4/20/2006	142	6/5/2006	13	7/21/2006	0.57
3/6/2006	10	4/21/2006	194	6/6/2006	11	7/22/2006	0.58
3/7/2006	11	4/22/2006	235	6/7/2006	9.2	7/23/2006	0.53
3/8/2006	12	4/23/2006	276	6/8/2006	7.8	7/24/2006	0.46
3/9/2006	14	4/24/2006	206	6/9/2006	7.3	7/25/2006	0.4
3/10/2006	16	4/25/2006	134	6/10/2006	7.1	7/26/2006	0.26
3/11/2006	18	4/26/2006	97	6/11/2006	7.2	7/27/2006	0.22
3/12/2006	19	4/27/2006	75	6/12/2006	7.5	7/28/2006	0.19
3/13/2006	22	4/28/2006	59	6/13/2006	7.2	7/29/2006	0.18
3/14/2006	50	4/29/2006	47	6/14/2006	7.2	7/30/2006	0.19
3/15/2006	85	4/30/2006	40	6/15/2006	7.6	7/31/2006	0.18
3/16/2006	75	5/1/2006	34	6/16/2006	7.1	8/1/2006	0.13
3/17/2006	64	5/2/2006	29	6/17/2006	6.6	8/2/2006	0.12
3/18/2006	56	5/3/2006	27	6/18/2006	6.4	8/3/2006	0.11

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
8/4/2006	0.11	9/19/2006	0.94	11/4/2006	4.6	12/20/2006	3.4
8/5/2006	0.1	9/20/2006	1	11/5/2006	5.9	12/21/2006	3.4
8/6/2006	0.07	9/21/2006	1	11/6/2006	5.2	12/22/2006	3.3
8/7/2006	0.05	9/22/2006	1.8	11/7/2006	5.2	12/23/2006	3.3
8/8/2006	0.04	9/23/2006	2.9	11/8/2006	5.6	12/24/2006	3.3
8/9/2006	0.04	9/24/2006	2.9	11/9/2006	5	12/25/2006	3.3
8/10/2006	0.04	9/25/2006	2.2	11/10/2006	4.1	12/26/2006	3.4
8/11/2006	0.06	9/26/2006	2.3	11/11/2006	4.7	12/27/2006	3.4
8/12/2006	0.06	9/27/2006	2.3	11/12/2006	5.6	12/28/2006	3.5
8/13/2006	0.33	9/28/2006	1.9	11/13/2006	6.3	12/29/2006	3.6
8/14/2006	0.43	9/29/2006	1.9	11/14/2006	5.7	12/30/2006	3.8
8/15/2006	0.44	9/30/2006	2.2	11/15/2006	4.6	12/31/2006	4.2
8/16/2006	0.46	10/1/2006	2.4	11/16/2006	5.1	1/1/2007	4.4

8/17/2006	0.46	10/2/2006	2.3	11/17/2006	5.5	1/2/2007	5
8/18/2006	0.52	10/3/2006	2.3	11/18/2006	5	1/3/2007	5
8/19/2006	0.52	10/4/2006	2.7	11/19/2006	4.8	1/4/2007	4.9
8/20/2006	0.49	10/5/2006	3	11/20/2006	4.9	1/5/2007	4.8
8/21/2006	0.48	10/6/2006	2.4	11/21/2006	5.3	1/6/2007	4.8
8/22/2006	0.65	10/7/2006	2.4	11/22/2006	5.7	1/7/2007	4.8
8/23/2006	1.5	10/8/2006	3	11/23/2006	6.3	1/8/2007	4.8
8/24/2006	4.1	10/9/2006	4.1	11/24/2006	6	1/9/2007	4.7
8/25/2006	3.6	10/10/2006	2	11/25/2006	5.6	1/10/2007	4.5
8/26/2006	2.5	10/11/2006	1.7	11/26/2006	5.4	1/11/2007	4.1
8/27/2006	1.4	10/12/2006	2	11/27/2006	5.1	1/12/2007	3.9
8/28/2006	1	10/13/2006	2.3	11/28/2006	4.7	1/13/2007	3.6
8/29/2006	0.7	10/14/2006	2.1	11/29/2006	3.8	1/14/2007	3.4
8/30/2006	0.46	10/15/2006	2.1	11/30/2006	3.3	1/15/2007	3
8/31/2006	0.42	10/16/2006	2.3	12/1/2006	3.1	1/16/2007	2.9
9/1/2006	0.38	10/17/2006	2.9	12/2/2006	2.8	1/17/2007	2.8
9/2/2006	0.43	10/18/2006	3.1	12/3/2006	2.7	1/18/2007	2.6
9/3/2006	0.41	10/19/2006	3.3	12/4/2006	2.7	1/19/2007	2.5
9/4/2006	0.33	10/20/2006	3.1	12/5/2006	2.7	1/20/2007	2.4
9/5/2006	0.33	10/21/2006	3.6	12/6/2006	2.7	1/21/2007	2.2
9/6/2006	0.3	10/22/2006	3.6	12/7/2006	2.6	1/22/2007	2.1
9/7/2006	0.34	10/23/2006	3.6	12/8/2006	2.6	1/23/2007	2.1
9/8/2006	0.31	10/24/2006	3.6	12/9/2006	2.6	1/24/2007	2.2
9/9/2006	0.27	10/25/2006	3.9	12/10/2006	2.7	1/25/2007	2.3
9/10/2006	0.36	10/26/2006	4.7	12/11/2006	2.9	1/26/2007	2.1
9/11/2006	0.42	10/27/2006	4.5	12/12/2006	3.1	1/27/2007	1.9
9/12/2006	0.4	10/28/2006	3.8	12/13/2006	3.4	1/28/2007	1.8
9/13/2006	0.44	10/29/2006	3.5	12/14/2006	3.5	1/29/2007	1.7
9/14/2006	0.47	10/30/2006	4.1	12/15/2006	3.5	1/30/2007	1.6
9/15/2006	0.46	10/31/2006	4.2	12/16/2006	3.5	1/31/2007	1.4
9/16/2006	0.46	11/1/2006	4.3	12/17/2006	3.5	2/1/2007	1.3
9/17/2006	0.49	11/2/2006	4.3	12/18/2006	3.5	2/2/2007	1.3
9/18/2006	0.76	11/3/2006	4.3	12/19/2006	3.5	2/3/2007	1.2
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
2/4/2007	1.1	3/22/2007	47	5/7/2007	8.7	6/22/2007	13
2/5/2007	1.1	3/23/2007	50	5/8/2007	5.3	6/23/2007	11
2/6/2007	1	3/24/2007	36	5/9/2007	4.5	6/24/2007	8.5
2/7/2007	1	3/25/2007	28	5/10/2007	3.9	6/25/2007	7.3
2/8/2007	0.99	3/26/2007	23	5/11/2007	4.1	6/26/2007	6.5
2/9/2007	0.98	3/27/2007	21	5/12/2007	25	6/27/2007	5.9
2/10/2007	0.97	3/28/2007	19	5/13/2007	46	6/28/2007	5.2
2/11/2007	0.96	3/29/2007	23	5/14/2007	37	6/29/2007	4.8
2/12/2007	0.95	3/30/2007	24	5/15/2007	30	6/30/2007	4.3
2/13/2007	0.95	3/31/2007	24	5/16/2007	26	7/1/2007	3.9
2/14/2007	0.95	4/1/2007	25	5/17/2007	66	7/2/2007	4.3
2/15/2007	0.95	4/2/2007	27	5/18/2007	42	7/3/2007	9

2/16/2007	0.95	4/3/2007	29	5/19/2007	28	7/4/2007	13
2/17/2007	0.95	4/4/2007	28	5/20/2007	22	7/5/2007	13
2/18/2007	0.95	4/5/2007	27	5/21/2007	18	7/6/2007	10
2/19/2007	1	4/6/2007	27	5/22/2007	14	7/7/2007	8.4
2/20/2007	1.1	4/7/2007	26	5/23/2007	11	7/8/2007	7.1
2/21/2007	1.3	4/8/2007	24	5/24/2007	8.6	7/9/2007	6.5
2/22/2007	1.6	4/9/2007	21	5/25/2007	7	7/10/2007	6.1
2/23/2007	2.2	4/10/2007	21	5/26/2007	9.6	7/11/2007	5.8
2/24/2007	3.6	4/11/2007	21	5/27/2007	7.4	7/12/2007	5.4
2/25/2007	6	4/12/2007	19	5/28/2007	6.9	7/13/2007	4.7
2/26/2007	8	4/13/2007	18	5/29/2007	8	7/14/2007	4.3
2/27/2007	9.6	4/14/2007	19	5/30/2007	17	7/15/2007	3.8
2/28/2007	8.3	4/15/2007	21	5/31/2007	45	7/16/2007	3.4
3/1/2007	6	4/16/2007	28	6/1/2007	57	7/17/2007	3.2
3/2/2007	4.5	4/17/2007	31	6/2/2007	89	7/18/2007	4.3
3/3/2007	3.4	4/18/2007	33	6/3/2007	102	7/19/2007	5.4
3/4/2007	4.6	4/19/2007	28	6/4/2007	102	7/20/2007	4.6
3/5/2007	6.5	4/20/2007	42	6/5/2007	98	7/21/2007	3.5
3/6/2007	10	4/21/2007	54	6/6/2007	97	7/22/2007	2.9
3/7/2007	16	4/22/2007	44	6/7/2007	107	7/23/2007	2.5
3/8/2007	30	4/23/2007	36	6/8/2007	88	7/24/2007	2.1
3/9/2007	70	4/24/2007	27	6/9/2007	74	7/25/2007	1.8
3/10/2007	250	4/25/2007	21	6/10/2007	75	7/26/2007	1.5
3/11/2007	400	4/26/2007	17	6/11/2007	57	7/27/2007	1.4
3/12/2007	800	4/27/2007	14	6/12/2007	53	7/28/2007	1.2
3/13/2007	600	4/28/2007	12	6/13/2007	81	7/29/2007	1
3/14/2007	470	4/29/2007	9.7	6/14/2007	78	7/30/2007	0.93
3/15/2007	370	4/30/2007	9	6/15/2007	47	7/31/2007	0.83
3/16/2007	318	5/1/2007	8	6/16/2007	33	8/1/2007	0.67
3/17/2007	266	5/2/2007	6.4	6/17/2007	26	8/2/2007	0.58
3/18/2007	189	5/3/2007	5	6/18/2007	23	8/3/2007	0.54
3/19/2007	116	5/4/2007	4.2	6/19/2007	19	8/4/2007	0.49
3/20/2007	106	5/5/2007	4.2	6/20/2007	16	8/5/2007	0.51
3/21/2007	97	5/6/2007	7.4	6/21/2007	15	8/6/2007	1.2

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
8/7/2007	0.71	9/22/2007	0.97	11/7/2007	2.6	12/23/2007	1
8/8/2007	0.68	9/23/2007	0.9	11/8/2007	2.6	12/24/2007	0.99
8/9/2007	0.89	9/24/2007	0.8	11/9/2007	2.5	12/25/2007	0.99
8/10/2007	1.3	9/25/2007	0.67	11/10/2007	2.5	12/26/2007	0.98
8/11/2007	1.6	9/26/2007	0.55	11/11/2007	2.6	12/27/2007	0.97
8/12/2007	1.4	9/27/2007	0.77	11/12/2007	2.5	12/28/2007	0.97
8/13/2007	1.3	9/28/2007	1.1	11/13/2007	2.4	12/29/2007	0.96
8/14/2007	0.92	9/29/2007	0.92	11/14/2007	2.4	12/30/2007	0.96
8/15/2007	0.92	9/30/2007	0.65	11/15/2007	2.5	12/31/2007	0.95
8/16/2007	1.2	10/1/2007	0.57	11/16/2007	2.6	1/1/2008	0.95
8/17/2007	1.3	10/2/2007	0.73	11/17/2007	2.6	1/2/2008	1

8/18/2007	1.4	10/3/2007	0.66	11/18/2007	2.7	1/3/2008	1.2
8/19/2007	1.4	10/4/2007	0.78	11/19/2007	2.8	1/4/2008	1.3
8/20/2007	1.6	10/5/2007	0.93	11/20/2007	2.8	1/5/2008	1.3
8/21/2007	1.5	10/6/2007	0.97	11/21/2007	2.7	1/6/2008	1.2
8/22/2007	1.4	10/7/2007	1.1	11/22/2007	2.6	1/7/2008	1.2
8/23/2007	1.4	10/8/2007	1.3	11/23/2007	2.7	1/8/2008	1.2
8/24/2007	1.4	10/9/2007	1.4	11/24/2007	2.9	1/9/2008	1.1
8/25/2007	1.3	10/10/2007	1.5	11/25/2007	2.7	1/10/2008	1.1
8/26/2007	1.2	10/11/2007	1.8	11/26/2007	2.6	1/11/2008	1.1
8/27/2007	1	10/12/2007	2	11/27/2007	2.4	1/12/2008	1.1
8/28/2007	0.83	10/13/2007	2.2	11/28/2007	2.2	1/13/2008	1.1
8/29/2007	0.86	10/14/2007	2.1	11/29/2007	2.1	1/14/2008	1
8/30/2007	0.83	10/15/2007	2	11/30/2007	2	1/15/2008	1
8/31/2007	0.8	10/16/2007	2.1	12/1/2007	1.9	1/16/2008	1
9/1/2007	0.8	10/17/2007	2.4	12/2/2007	1.8	1/17/2008	0.98
9/2/2007	0.79	10/18/2007	2.9	12/3/2007	1.7	1/18/2008	0.96
9/3/2007	0.78	10/19/2007	2.6	12/4/2007	1.6	1/19/2008	0.94
9/4/2007	0.77	10/20/2007	4.1	12/5/2007	1.5	1/20/2008	0.92
9/5/2007	0.75	10/21/2007	2.9	12/6/2007	1.4	1/21/2008	0.9
9/6/2007	0.83	10/22/2007	2.5	12/7/2007	1.3	1/22/2008	0.88
9/7/2007	0.9	10/23/2007	2.5	12/8/2007	1.2	1/23/2008	0.87
9/8/2007	1.1	10/24/2007	2.2	12/9/2007	1.2	1/24/2008	0.94
9/9/2007	1.2	10/25/2007	2.2	12/10/2007	1.1	1/25/2008	1
9/10/2007	1.5	10/26/2007	2	12/11/2007	1.1	1/26/2008	0.92
9/11/2007	1.2	10/27/2007	2	12/12/2007	1.1	1/27/2008	0.82
9/12/2007	1.1	10/28/2007	2.9	12/13/2007	1.1	1/28/2008	0.77
9/13/2007	1	10/29/2007	2.3	12/14/2007	1.1	1/29/2008	0.72
9/14/2007	0.95	10/30/2007	2.2	12/15/2007	1.1	1/30/2008	0.69
9/15/2007	0.9	10/31/2007	1.9	12/16/2007	1.1	1/31/2008	0.66
9/16/2007	0.92	11/1/2007	1.8	12/17/2007	1.2	2/1/2008	0.64
9/17/2007	0.92	11/2/2007	2	12/18/2007	1.2	2/2/2008	0.6
9/18/2007	0.87	11/3/2007	2	12/19/2007	1.2	2/3/2008	0.58
9/19/2007	0.92	11/4/2007	2.2	12/20/2007	1.2	2/4/2008	0.56
9/20/2007	0.95	11/5/2007	2.1	12/21/2007	1.1	2/5/2008	0.53
9/21/2007	0.98	11/6/2007	2.3	12/22/2007	1	2/6/2008	0.51

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
2/7/2008	0.49	3/24/2008	6	5/9/2008	3.9	6/24/2008	7.4
2/8/2008	0.46	3/25/2008	7	5/10/2008	5.1	6/25/2008	8.1
2/9/2008	0.44	3/26/2008	8.8	5/11/2008	6.1	6/26/2008	13
2/10/2008	0.43	3/27/2008	10	5/12/2008	6.4	6/27/2008	202
2/11/2008	0.41	3/28/2008	9.5	5/13/2008	6.4	6/28/2008	119
2/12/2008	0.39	3/29/2008	9	5/14/2008	6.8	6/29/2008	130
2/13/2008	0.38	3/30/2008	8.7	5/15/2008	6.6	6/30/2008	80
2/14/2008	0.39	3/31/2008	8.4	5/16/2008	6.1	7/1/2008	55
2/15/2008	0.4	4/1/2008	9.5	5/17/2008	6	7/2/2008	35
2/16/2008	0.36	4/2/2008	11	5/18/2008	4.2	7/3/2008	23

2/17/2008	0.34	4/3/2008	12	5/19/2008	3.9	7/4/2008	17
2/18/2008	0.32	4/4/2008	13	5/20/2008	3.8	7/5/2008	13
2/19/2008	0.31	4/5/2008	14	5/21/2008	4	7/6/2008	10
2/20/2008	0.3	4/6/2008	15	5/22/2008	3.7	7/7/2008	7.3
2/21/2008	0.33	4/7/2008	16	5/23/2008	3.9	7/8/2008	6.5
2/22/2008	0.38	4/8/2008	15	5/24/2008	5	7/9/2008	5.4
2/23/2008	0.43	4/9/2008	13	5/25/2008	6.1	7/10/2008	4.2
2/24/2008	0.41	4/10/2008	14	5/26/2008	7.1	7/11/2008	3.4
2/25/2008	0.4	4/11/2008	16	5/27/2008	6.8	7/12/2008	2.7
2/26/2008	0.42	4/12/2008	17	5/28/2008	6.3	7/13/2008	2
2/27/2008	0.44	4/13/2008	18	5/29/2008	5.6	7/14/2008	1.6
2/28/2008	0.46	4/14/2008	17	5/30/2008	5.2	7/15/2008	1.3
2/29/2008	0.47	4/15/2008	16	5/31/2008	5.1	7/16/2008	1
3/1/2008	0.46	4/16/2008	17	6/1/2008	7.1	7/17/2008	0.78
3/2/2008	0.45	4/17/2008	18	6/2/2008	5.6	7/18/2008	0.71
3/3/2008	0.43	4/18/2008	17	6/3/2008	9.5	7/19/2008	0.87
3/4/2008	0.42	4/19/2008	16	6/4/2008	15	7/20/2008	1.3
3/5/2008	0.41	4/20/2008	16	6/5/2008	12	7/21/2008	147
3/6/2008	0.4	4/21/2008	14	6/6/2008	18	7/22/2008	116
3/7/2008	0.37	4/22/2008	13	6/7/2008	20	7/23/2008	55
3/8/2008	0.35	4/23/2008	12	6/8/2008	18	7/24/2008	34
3/9/2008	0.42	4/24/2008	11	6/9/2008	19	7/25/2008	27
3/10/2008	0.5	4/25/2008	11	6/10/2008	19	7/26/2008	21
3/11/2008	0.72	4/26/2008	11	6/11/2008	21	7/27/2008	15
3/12/2008	1	4/27/2008	10	6/12/2008	28	7/28/2008	11
3/13/2008	2	4/28/2008	10	6/13/2008	27	7/29/2008	7.9
3/14/2008	3	4/29/2008	9.5	6/14/2008	27	7/30/2008	6
3/15/2008	4	4/30/2008	8.5	6/15/2008	25	7/31/2008	4.7
3/16/2008	5	5/1/2008	7.7	6/16/2008	26	8/1/2008	3.7
3/17/2008	6	5/2/2008	6.5	6/17/2008	28	8/2/2008	3.2
3/18/2008	5.5	5/3/2008	6.5	6/18/2008	26	8/3/2008	2.7
3/19/2008	5	5/4/2008	5.8	6/19/2008	24	8/4/2008	2.5
3/20/2008	6	5/5/2008	4.8	6/20/2008	18	8/5/2008	2.1
3/21/2008	7	5/6/2008	4.4	6/21/2008	13	8/6/2008	1.9
3/22/2008	8	5/7/2008	4.2	6/22/2008	9.5	8/7/2008	1.6
3/23/2008	6.5	5/8/2008	4	6/23/2008	8.3	8/8/2008	1.4

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
8/9/2008	1.2	9/24/2008	0.44	11/9/2008	8	12/25/2008	0.44
8/10/2008	1.1	9/25/2008	0.46	11/10/2008	7.6	12/26/2008	0.41
8/11/2008	1.3	9/26/2008	0.54	11/11/2008	7.8	12/27/2008	0.44
8/12/2008	1.4	9/27/2008	0.52	11/12/2008	7.8	12/28/2008	0.48
8/13/2008	1.8	9/28/2008	0.58	11/13/2008	7.9	12/29/2008	0.53
8/14/2008	1.6	9/29/2008	0.55	11/14/2008	8	12/30/2008	0.52
8/15/2008	1.6	9/30/2008	0.47	11/15/2008	7.8	12/31/2008	0.51
8/16/2008	1.1	10/1/2008	0.36	11/16/2008	7.7	1/1/2009	0.5
8/17/2008	0.72	10/2/2008	0.16	11/17/2008	7.8	1/2/2009	0.49

8/18/2008	0.63	10/3/2008	0.09	11/18/2008	8	1/3/2009	0.48
8/19/2008	0.62	10/4/2008	0.14	11/19/2008	7.7	1/4/2009	0.49
8/20/2008	0.56	10/5/2008	0.22	11/20/2008	7.2	1/5/2009	0.5
8/21/2008	0.47	10/6/2008	0.34	11/21/2008	6.8	1/6/2009	0.5
8/22/2008	1.3	10/7/2008	0.42	11/22/2008	6.3	1/7/2009	0.5
8/23/2008	2.1	10/8/2008	0.83	11/23/2008	5.8	1/8/2009	0.51
8/24/2008	1.4	10/9/2008	1	11/24/2008	5.4	1/9/2009	0.57
8/25/2008	0.92	10/10/2008	1.1	11/25/2008	4.8	1/10/2009	0.61
8/26/2008	0.71	10/11/2008	0.98	11/26/2008	4.5	1/11/2009	0.64
8/27/2008	0.46	10/12/2008	1.6	11/27/2008	4.2	1/12/2009	0.65
8/28/2008	0.28	10/13/2008	2.7	11/28/2008	3.8	1/13/2009	0.66
8/29/2008	0.18	10/14/2008	3.2	11/29/2008	3.8	1/14/2009	0.69
8/30/2008	0.16	10/15/2008	2.7	11/30/2008	3.6	1/15/2009	0.75
8/31/2008	0.18	10/16/2008	2.8	12/1/2008	3.6	1/16/2009	0.91
9/1/2008	0.18	10/17/2008	3.1	12/2/2008	3.6	1/17/2009	0.95
9/2/2008	0.18	10/18/2008	2.8	12/3/2008	3	1/18/2009	0.99
9/3/2008	0.15	10/19/2008	2.7	12/4/2008	2.6	1/19/2009	1
9/4/2008	0.35	10/20/2008	3.2	12/5/2008	2.2	1/20/2009	1.1
9/5/2008	0.81	10/21/2008	4.5	12/6/2008	2.2	1/21/2009	1
9/6/2008	1.1	10/22/2008	5.6	12/7/2008	2.3	1/22/2009	0.95
9/7/2008	0.71	10/23/2008	6.4	12/8/2008	2.3	1/23/2009	0.89
9/8/2008	0.58	10/24/2008	6.1	12/9/2008	2.4	1/24/2009	0.83
9/9/2008	0.61	10/25/2008	6.4	12/10/2008	2.4	1/25/2009	0.82
9/10/2008	0.6	10/26/2008	6	12/11/2008	2.3	1/26/2009	0.82
9/11/2008	0.54	10/27/2008	5.3	12/12/2008	2.1	1/27/2009	0.81
9/12/2008	0.48	10/28/2008	5.2	12/13/2008	1.9	1/28/2009	0.81
9/13/2008	0.53	10/29/2008	5	12/14/2008	1.5	1/29/2009	0.89
9/14/2008	0.58	10/30/2008	5.3	12/15/2008	1.2	1/30/2009	1
9/15/2008	0.55	10/31/2008	5.4	12/16/2008	0.96	1/31/2009	1.5
9/16/2008	0.52	11/1/2008	5.5	12/17/2008	0.78	2/1/2009	1.9
9/17/2008	0.5	11/2/2008	5.7	12/18/2008	0.7	2/2/2009	2.5
9/18/2008	0.48	11/3/2008	6.3	12/19/2008	0.67	2/3/2009	2.7
9/19/2008	0.45	11/4/2008	7	12/20/2008	0.64	2/4/2009	2.6
9/20/2008	0.4	11/5/2008	8.2	12/21/2008	0.59	2/5/2009	2.5
9/21/2008	0.35	11/6/2008	8.6	12/22/2008	0.54	2/6/2009	2.6
9/22/2008	0.45	11/7/2008	8.9	12/23/2008	0.5	2/7/2009	2.7
9/23/2008	0.48	11/8/2008	8.5	12/24/2008	0.47	2/8/2009	3

Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
2/9/2009	2.9	3/27/2009	437	5/12/2009	50	6/27/2009	66
2/10/2009	2.9	3/28/2009	317	5/13/2009	54	6/28/2009	124
2/11/2009	2.8	3/29/2009	270	5/14/2009	51	6/29/2009	140
2/12/2009	2.7	3/30/2009	210	5/15/2009	55	6/30/2009	74
2/13/2009	2.7	3/31/2009	180	5/16/2009	50	7/1/2009	50
2/14/2009	2.6	4/1/2009	150	5/17/2009	45	7/2/2009	38
2/15/2009	2.6	4/2/2009	129	5/18/2009	43	7/3/2009	31
2/16/2009	2.6	4/3/2009	131	5/19/2009	39	7/4/2009	27

2/17/2009	2.6	4/4/2009	130	5/20/2009	37	7/5/2009	24
2/18/2009	2.6	4/5/2009	127	5/21/2009	35	7/6/2009	21
2/19/2009	2.5	4/6/2009	125	5/22/2009	35	7/7/2009	202
2/20/2009	2.2	4/7/2009	138	5/23/2009	32	7/8/2009	150
2/21/2009	2.1	4/8/2009	188	5/24/2009	30	7/9/2009	70
2/22/2009	2	4/9/2009	450	5/25/2009	53	7/10/2009	54
2/23/2009	1.9	4/10/2009	1260	5/26/2009	76	7/11/2009	44
2/24/2009	1.7	4/11/2009	1780	5/27/2009	95	7/12/2009	77
2/25/2009	1.6	4/12/2009	4610	5/28/2009	98	7/13/2009	235
2/26/2009	1.5	4/13/2009	8040	5/29/2009	96	7/14/2009	180
2/27/2009	1.4	4/14/2009	7390	5/30/2009	85	7/15/2009	125
2/28/2009	1.3	4/15/2009	4960	5/31/2009	67	7/16/2009	89
3/1/2009	1.4	4/16/2009	2970	6/1/2009	54	7/17/2009	69
3/2/2009	1.4	4/17/2009	1490	6/2/2009	44	7/18/2009	57
3/3/2009	1.5	4/18/2009	800	6/3/2009	40	7/19/2009	49
3/4/2009	1.4	4/19/2009	550	6/4/2009	36	7/20/2009	42
3/5/2009	1.5	4/20/2009	400	6/5/2009	31	7/21/2009	36
3/6/2009	1.6	4/21/2009	299	6/6/2009	31	7/22/2009	31
3/7/2009	1.5	4/22/2009	244	6/7/2009	34	7/23/2009	27
3/8/2009	1.4	4/23/2009	213	6/8/2009	39	7/24/2009	24
3/9/2009	1.3	4/24/2009	186	6/9/2009	37	7/25/2009	21
3/10/2009	1.2	4/25/2009	156	6/10/2009	37	7/26/2009	20
3/11/2009	1.2	4/26/2009	138	6/11/2009	38	7/27/2009	18
3/12/2009	1.3	4/27/2009	126	6/12/2009	39	7/28/2009	17
3/13/2009	1.4	4/28/2009	112	6/13/2009	37	7/29/2009	17
3/14/2009	1.6	4/29/2009	107	6/14/2009	35	7/30/2009	17
3/15/2009	1.8	4/30/2009	105	6/15/2009	32	7/31/2009	17
3/16/2009	2.3	5/1/2009	96	6/16/2009	149	8/1/2009	16
3/17/2009	6	5/2/2009	88	6/17/2009	251	8/2/2009	15
3/18/2009	30	5/3/2009	84	6/18/2009	109	8/3/2009	15
3/19/2009	150	5/4/2009	79	6/19/2009	68	8/4/2009	14
3/20/2009	750	5/5/2009	75	6/20/2009	52	8/5/2009	14
3/21/2009	4000	5/6/2009	70	6/21/2009	49	8/6/2009	14
3/22/2009	12000	5/7/2009	63	6/22/2009	63	8/7/2009	14
3/23/2009	6000	5/8/2009	58	6/23/2009	93	8/8/2009	14
3/24/2009	3500	5/9/2009	54	6/24/2009	88	8/9/2009	15
3/25/2009	1800	5/10/2009	51	6/25/2009	107	8/10/2009	16
3/26/2009	754	5/11/2009	50	6/26/2009	81	8/11/2009	13
Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)	Date	Flow (CFS)
8/12/2009	15	8/27/2009	12	9/11/2009	13	9/26/2009	7.4
8/13/2009	13	8/28/2009	11	9/12/2009	15	9/27/2009	7.2
8/14/2009	13	8/29/2009	11	9/13/2009	14	9/28/2009	7
8/15/2009	12	8/30/2009	10	9/14/2009	15	9/29/2009	6.5
8/16/2009	12	8/31/2009	10	9/15/2009	14	9/30/2009	6.3
8/17/2009	24	9/1/2009	9.6	9/16/2009	13	10/1/2009	7.1
8/18/2009	21	9/2/2009	9.5	9/17/2009	12	10/2/2009	7.4

8/19/2009	20	9/3/2009	9.3	9/18/2009	11	10/3/2009	7.6
8/20/2009	19	9/4/2009	9.4	9/19/2009	10	10/4/2009	7.5
8/21/2009	17	9/5/2009	9.4	9/20/2009	9.5	10/5/2009	8.5
8/22/2009	16	9/6/2009	9	9/21/2009	8.8	10/6/2009	13
8/23/2009	15	9/7/2009	8.8	9/22/2009	8.5	10/7/2009	11
8/24/2009	14	9/8/2009	12	9/23/2009	8.2	10/8/2009	11
8/25/2009	13	9/9/2009	13	9/24/2009	7.9	10/9/2009	10
8/26/2009	13	9/10/2009	11	9/25/2009	7.7	10/10/2009	11
						10/11/2009	12

Appendix C
Land Use Quarter/Quarter Assesment

Land Use/Quarter Quarter Selection Process

Introduction

Land Use surveys are performed to obtain a general characterization of land use/land management conditions in a specific watershed. The information obtained is used to provide direction for local groups to make management decisions which improve water quality within that watershed. Water quality and riparian data are used in conjunction with the land use data to determine land management needs.

Land Use Type Determination

A CD-ROM, provided by Dath Mita, NDSU Extension GIS Remote Sensing Specialist, is used to determine the land use type in a given area. The CD was compiled by the USDA National Agricultural Statistics Service (NASS) and the NDSU Extension Service. Each CD contains a rasterized Cropland data layer image of ND.

The color categorized image is created by using Landsat 5 & 7 satellite data for ND. The image colors have been labeled as specific crop types for the cultivated cropland areas of the state. The non-cropland areas are broadly defined to complete the area coverage. For the cropland areas and categories, the performance statistics and the accuracy levels and measurements for the categorization are considerably more meaningful than for non-cropland areas and categories.

The Landsat satellite has a 185 km swath width with a 16 day repeat coverage. There are 7 imaging bands per sensor. They include 3 Visible, 1 Near Infrared, 2 Short-wave Infrared, and 1 thermal Infrared. These bands have a 30 m resolution, with the exception of the thermal IR which has a resolution of 120 m. There is potential in the future for 2 m categorized coverages which would significantly increase the accuracy of the images and land use acreage estimations. The Landsat satellite requires cloud free scan dates and must be done on a contiguous same date coverage.

The ND Landsat image is loaded into Arcview 3.2a. An outline of the watershed boundary is placed over the image. The different color categories of cropped/tilled land are changed to one unique color, and the range and grass land categories are changed to one unique color. The image then represents 2 major categories of land use, Cropped/Tilled and Range. Pixels are 30 m by 30 m in size, which results in a fairly high confidence level of land use type depicted by the colors.

Random Selection Process

Arcview 3.2a is used to randomly select the quarter-quarters (QQ's). Initially, all QQ points are placed within the boundaries of the watershed (i.e. 4,832 for Deep Creek). A random selection script, downloaded from the ESRI website, is then used to randomly select from the total set of QQ points. The script creates a random selection of features based on a percentage of the total number of features (for example: a random sample of 5% of the QQ's within a watershed boundary).

A percentage of the total number of QQ's is selected, with an end goal of 130 to 145 randomly chosen sites. The number of sites chosen will depend on watershed size and proportional amounts of land use type. The map is then enlarged and 30 to 45 of those sites are deleted that do not fall within the appropriate land use type (i.e. cropped/tilled). Since the map image is not extremely precise, there are randomly selected sites that fall into questionable land use areas. These questionable QQ's, and the most obvious, are among the 30 to 45 sites that are deleted out of this set. Only 100 of the most certain land use site types (i.e. Cropped/tilled) in question are left remaining.

After the 100 sites are selected, 50% of those are selected to be used as the main set of 50 samples. Five sets of 10 randomly selected over-samples are then created from the remaining 50. This is done by selecting 20% of the remaining 50, then 25% of the remaining 40, 33.333% of the remaining 30, 50% of the remaining 20, and the last 10 are used as the 5th set. All selections are made randomly using the same Arcview script described above.

The above procedure is then repeated for the remaining land use type (i.e. Rangeland). A minimum of 50 sites was chosen as "N" to ensure the highest level of statistical validity, yet taking into consideration man power and budget limitations for collecting the data.

Documenting Data collected

Upon random selection of the 40 acre QQ assessment sites, information on current land management practices will be collected by local project/field office staff for a minimum of 50 Crop, and 50 Range sites. If for any reason data can not be collected on all of the first set of 50 sites, the over-sample sites will be used to obtain an N of at least 50. If over-sample site groups are used to reach an N of 50, data must be collected (or at least attempted to be) on all ten of the sites in the over-sample group.

A field worksheet will be completed for each QQ assessment site. This information will be entered into the North Dakota Department of Health Land Use database for statistical analysis and interpretation.

North Dakota Department of Health - Land Use Assessment
Cropland Field Worksheet

Unit Location Information

Information Needed	Input Options	Site Information
Project Code:	RNDEEP	*Defaults To Your Project*
Watershed ID:	Example: CC for Coyote Creek	*Defaults To Your Watershed ID*
Unit ID:	Example: 1290480111	*Automatically populates*
Township:	129 - 164	
Range:	48 - 106	
Section:	1 - 36	
Qtr:	NE(1), NW(2), SW(3), SE(4)	
Qtr of Qtr:	NE(1), NW(2), SW(3), SE(4)	
Land Use Category:	Cropland or Range/Pasture	
Land Ownership:	Private, Federal Public, State Public, or Non-profit	

General Site Information Page

Information Needed	Input Options	Site Information
Are man-made Field Drains Present?	Yes/No	
Major non-ag activities present?	Examples: Gravel Pit, Farmstead, Urban, etc	
Wetland acres within unit?	0 - 40	
Are wetlands protected by buffer?	Yes, No, Not Applicable	
Severest level of water erosion?	Rill, Ephemeral, Gully, None	
Is Wind Erosion Evident?	Yes/No	
Erosion Control Practices Installed?	List conservation practices applied on this QQ unit. Examples: Grassed waterways, Wind barriers, etc.	
Comments box!	**Place any comments here!**	

Water Erosion Page

Information Needed	Input Options	Site Information
R:Rainfall Factor-County Specific	NRCS/SCD OFFICE Section I.. NRCS/SCS Field Office Technical Guide (USLE)	
K Soil Erodibility Factor		
LS: Slope/Slope Length Ratio		
C: Cropping Management Factor		
P: Support Practice Factor		
A: Product	Product of Other Factors of the USLE **A=(RKLSCP)**	
Dominant Soil Type:	Information in County Soil Survey Maps	
Previous Years Crop:	Indicate previous years crop: Examples: Alfalfa, Corn	

	for Grain, Small Grain, Sunflower, Fallow, Other	
Current Year Crop:	Examples: Flax, Potatoes, Corn Silage, Beets, etc.	
Fall Tillage System:	Examples: Chemical, Chisel, Clean Plow, Harrow, Disk, No Till, Spike, Undercut, Other	
% Residue in the Fall:	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100	
Spring Tillage System:	Examples: Chemical, Chisel, Clean Plow, Harrow, Disk, No Till, Spike, Undercut, Other	
% Residue After Spring Planting:	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100	
Average Slope Length:	25 - 1000 field measurement in feet of longest unbroken slope on unit	
Average Percent Slope:	0.2 - 20 field measurement in percent (%) # feet rise / 100 ft of longest slope	
Are post-harvest crop residues used for livestock grazing?	Yes, No	
If ephemeral streams present, are they impacted by the current tillage practices.	Yes, No, Not Applicable	

Wind Erosion Page

Information Needed	Input Options	Site Information
I: Soil Erodibility Index	NRCS/SCD Office Section I NRCS/SCS Field Office Technical Guide (Predicting Wind Erosion)	
K: Ridge Roughness Factor		
C: Climatic Factor		
V: Vegetative Factor		
L (feet):	Unsheltered distance (in feet) along prevailing wind direction {1 - 4000 ft}. County Soil Survey Maps.	
E: Product	**E = f(IKCLV)** f indicates functional relationships	
Angle of Deviation:	Angle of tillage relative to prevailing winds (County specific)	
Ridge Height (inches):	in inches - from valley to crest	
Ridge Width (inches):	in inches - from crest to crest of ridges	

North Dakota Department of Health - Land Use Assessment
Range/Pasture Field Worksheet

Unit Location Information

Information Needed	Input Options	Site Information
Project Code:	RNDEEP	*Defaults To Your Project*
Watershed ID:	Example: CC for Coyote Creek	*Defaults To Your Watershed ID*
Unit ID:	Example: 1290480111	*Automatically populates*
Township:	129 - 164	
Range:	48 - 106	
Section:	1 - 36	
Qtr:	NE(1), NW(2), SW(3), SE(4)	
Qtr of Qtr:	NE(1), NW(2), SW(3), SE(4)	
Land Use Category:	Cropland or Range/Pasture	
Land Ownership:	Private, Federal Public, State Public, or Non-profit	

General Site Information Page

Information Needed	Input Options	Site Information
Are man-made Field Drains Present?	Yes/No	
Major non-ag activities present?	Examples: Gravel Pit, Farmstead, Urban, etc	
Wetland acres within unit?	0 - 40	
Are wetlands protected by buffer?	Yes, No, Not Applicable	
Severest level of water erosion?	Rill, Ephemeral, Gully, None	
Is Wind Erosion Evident?	Yes/No	
Erosion Control Practices Installed?	List conservation practices applied on this QQ unit. Examples: Prescribed grazing, Cross Fencing, Range seeding, etc.	
Comments box!	**Place any comments here!**	

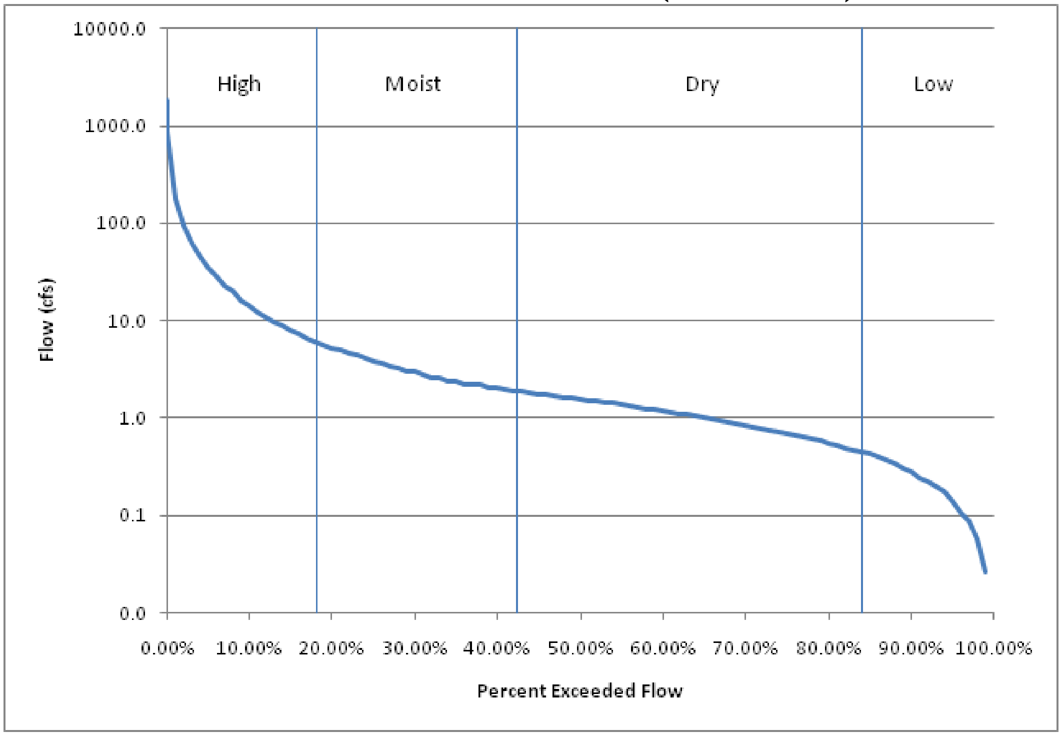
Range/Pasture Information Page

Information Needed	Input Options	Site Information
Livestock Trailing Evident?	(1) No livestock trailing evident. (2) Erosion is not evident within livestock trails. (3) Erosion is evident within livestock trails.	
Grass Root Structure?	(1) 75% Sod Forming, 25% Bunch Grass. (2) 26% to 50% Sod Forming Grasses. (3) 50% to 74% Sod Forming Grasses. (4) 75% Bunch Grass, 25% Sod Forming Grass.	
Invader Plant Species Coverage?	(1) 0 to 5% Land Area Covered. (2) 5-15% Land Area Covered.	

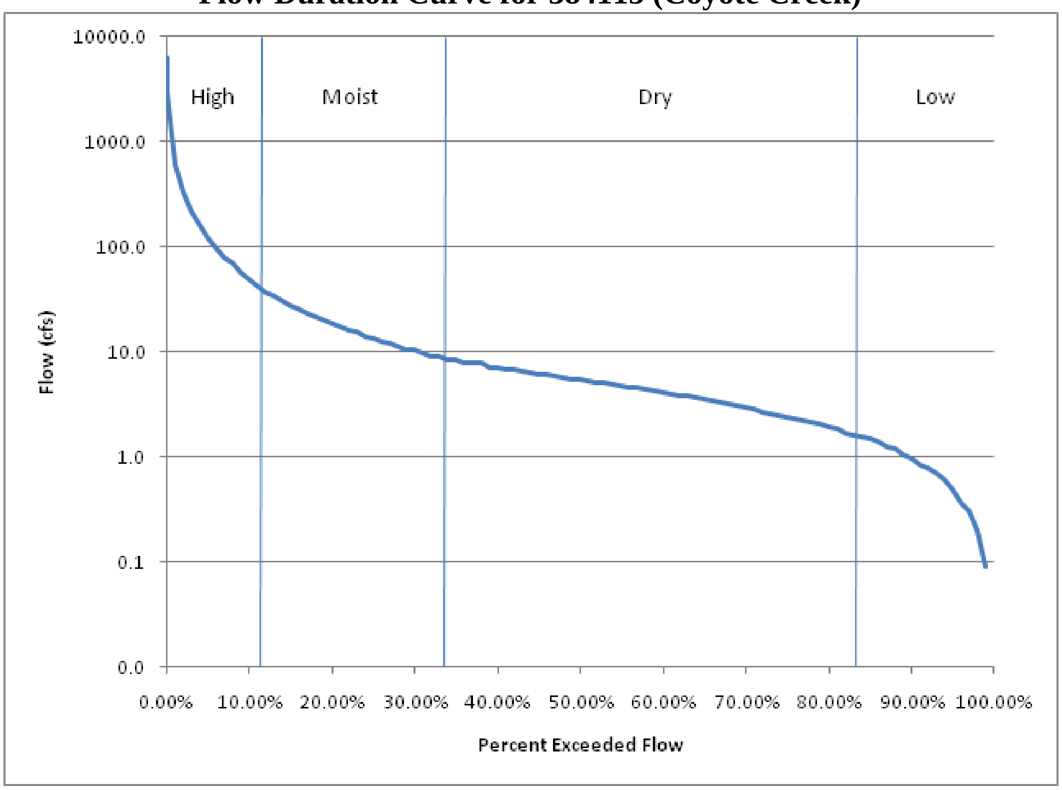
	(3) 15-25% Land Area Covered. (4) >25% Land Area Covered.	
Dominant Invader Plant Species?	Examples: Absinth wormwood, Canada thistle, Curly dock, Curlycup gumweed, Goatsbeard, Leafy spurge, Sweetclover, None Present, Unidentified	
Increaser Plant Species Coverage?	(1) 0-5% Land Area Covered. (2) 5-15% Land Area Covered. (3) 15-25% Land Area Covered. (4) >25% Land Area Covered.	
Dominant Increaser Plant Species?	Examples: Ball cactus, Cudweed sagewort, Fringed sagewort, Goldenrods, Green sagewort, Prairie coneflower, Prairie rose, Prairie thistle, Prairie smoke, Buckbrush, Silverberry, Silver sagebrush, Western yarrow, None Present, Unidentified	
Historic grazing patter?	Heavy Use, Light Use, or Spot Grazing.	
If stream, are current grazing practices causing channel instability. i.e. down-cutting, eroding banks, over-utilized riparian vegetation, etc	Yes, No, NA	
Average Standing Litter Height?	(1) 0-2 inches. (2) 2-5 inches. (3) 5-8 inches. (4) >8 inches.	
Percent Ground Cover?	(1) <30% (2) 30% to 69% (3) 70% to 90% (4) 90% to 100%	
Livestock Water Source?	Stream, Dugout, Stock Dam, Lake, Wetland, Well, Spring, Other, Unknown, None.	
Plant Species Diversity?	(1) < 5 Different Plant Species. (2) 5-15 Different Plant Species. (3) 15-30 Different Plant Species. (4) 30 + Different Plant Species.	
What is the approximate total acreage of the pasture in which the Qtr Qtr unit is part of?	List number of acres.	
Is there evidence of concentrated livestock winter feeding on the unit?	Yes, No	

Appendix D
Flow Duration Curves for Sites 384114, 384115, 385086, and 385085

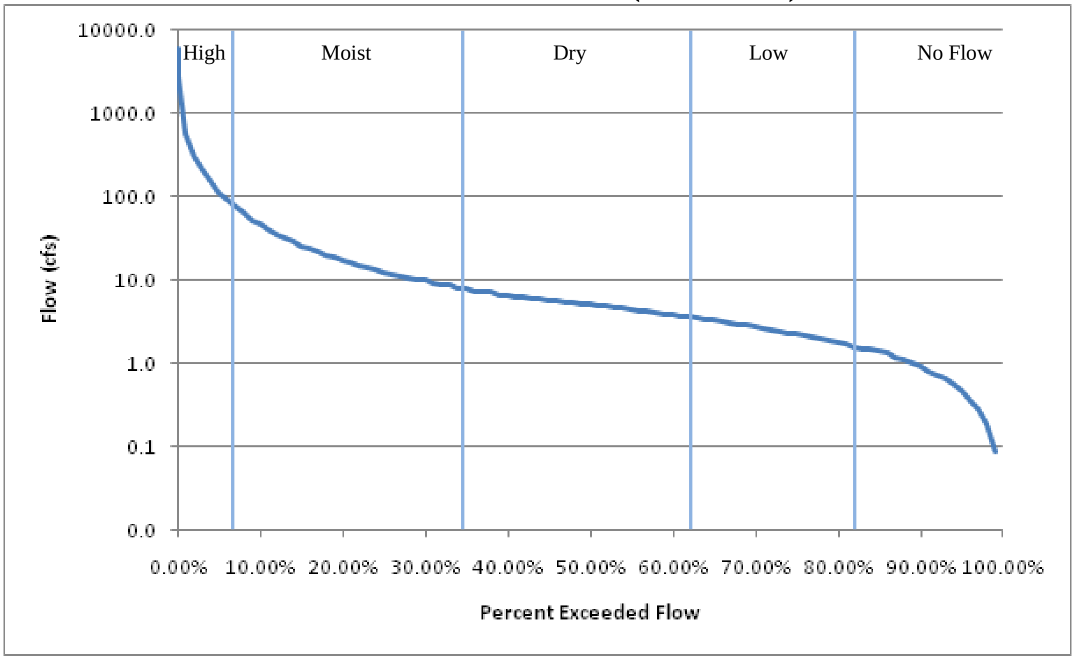
Flow Duration Curve for 384114 (Brush Creek)



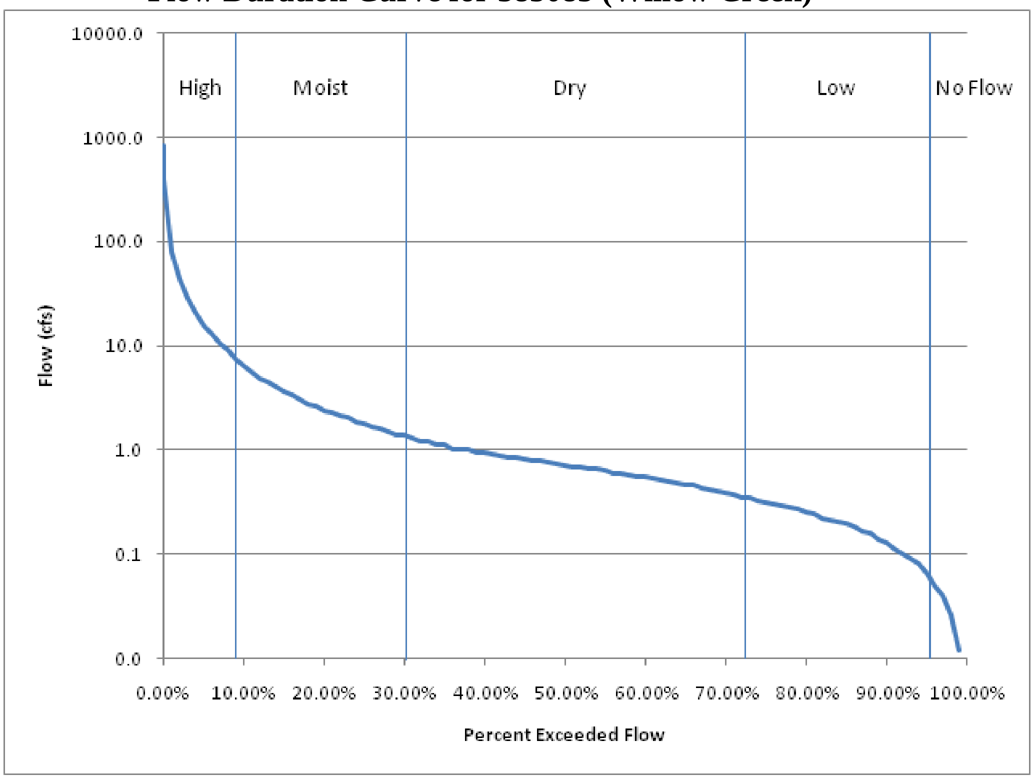
Flow Duration Curve for 384115 (Coyote Creek)



Flow Duration Curve for 385086 (Elm Creek)

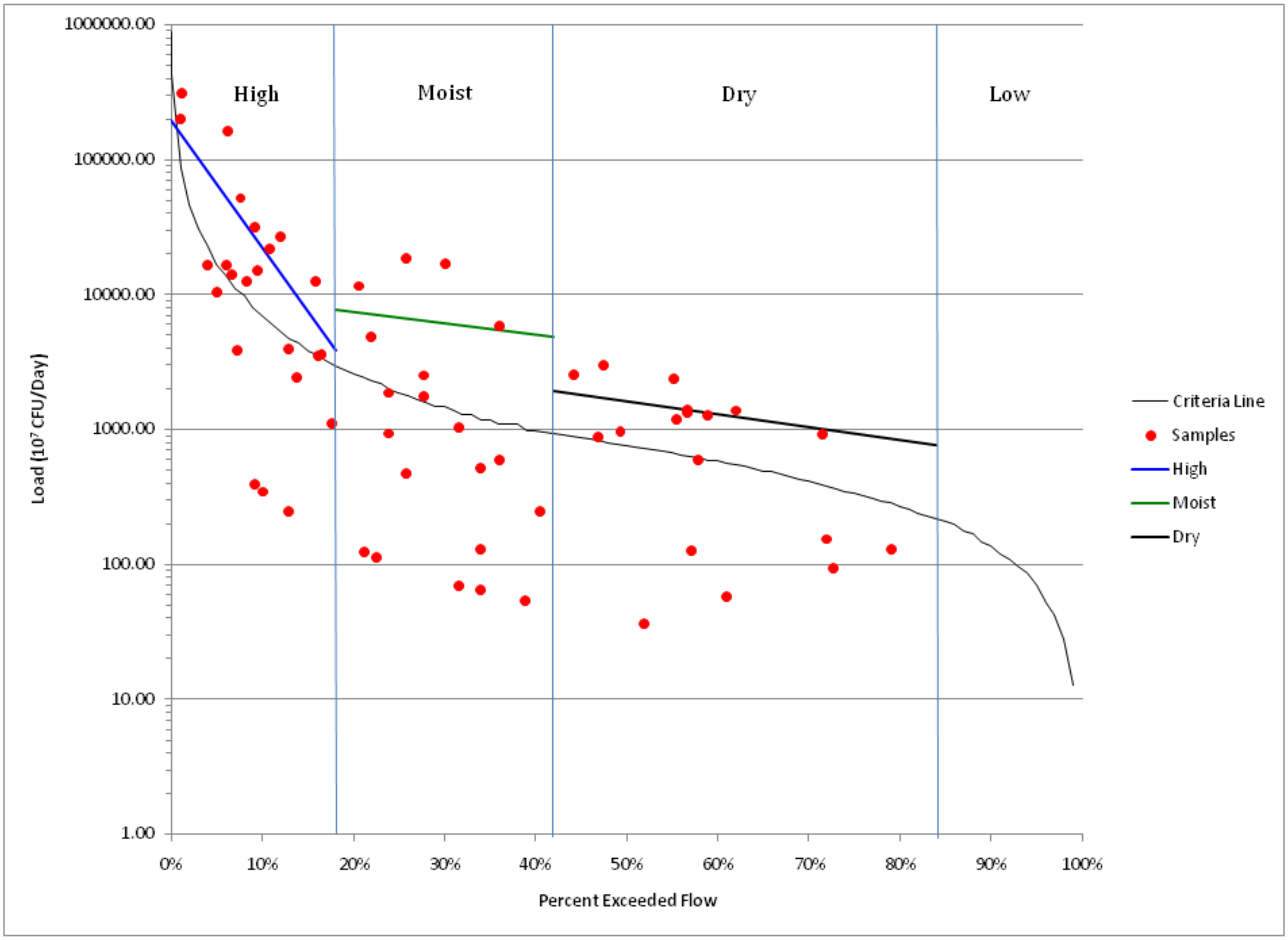


Flow Duration Curve for 385085 (Willow Creek)



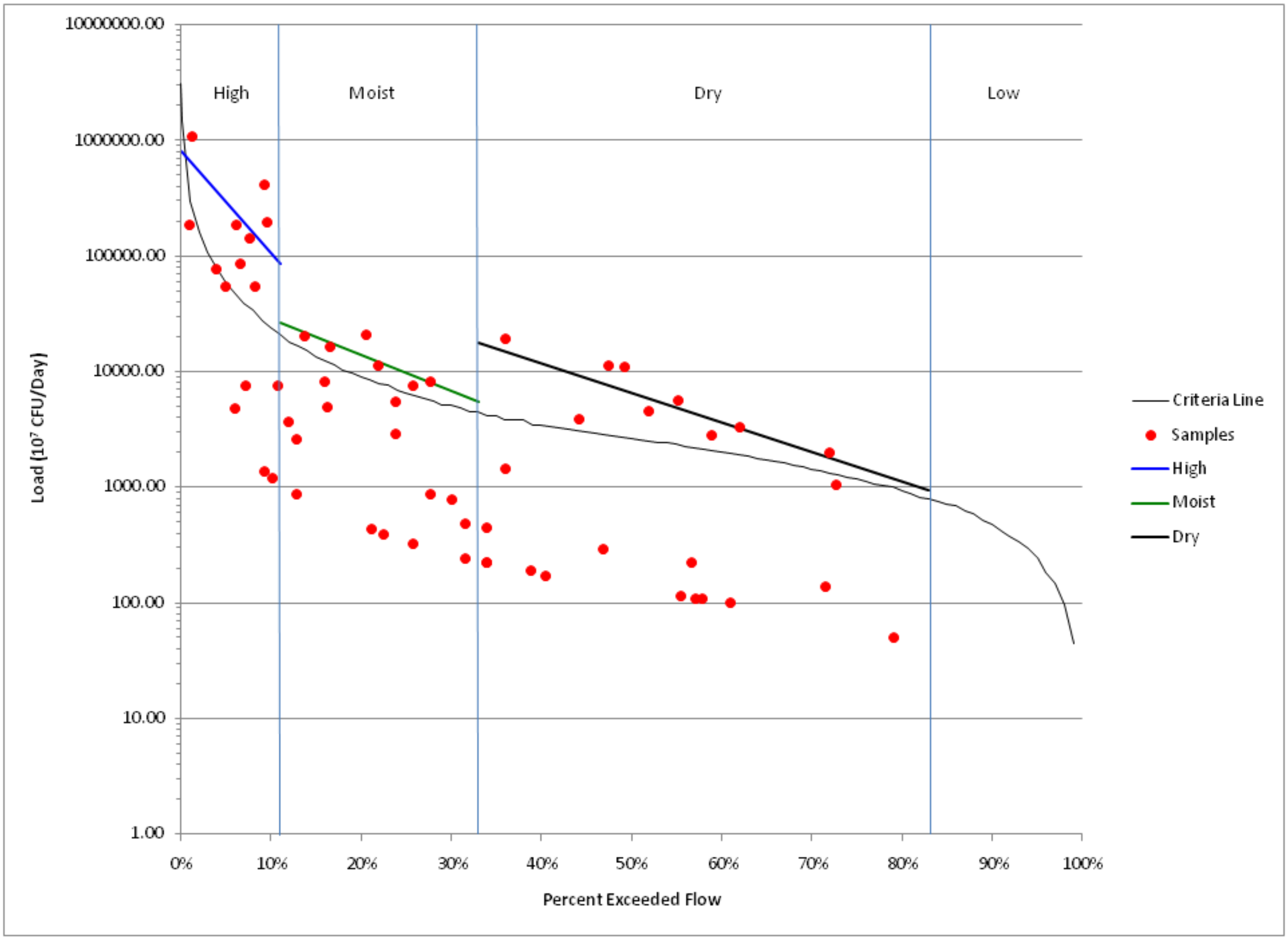
Appendix E
Load Duration Curves, Estimated Existing Loads, TMDL Targets and Percentage of Reduction Required for Sites 384114, 384115, 385086, and 385085

Load Duration Curve for 384114



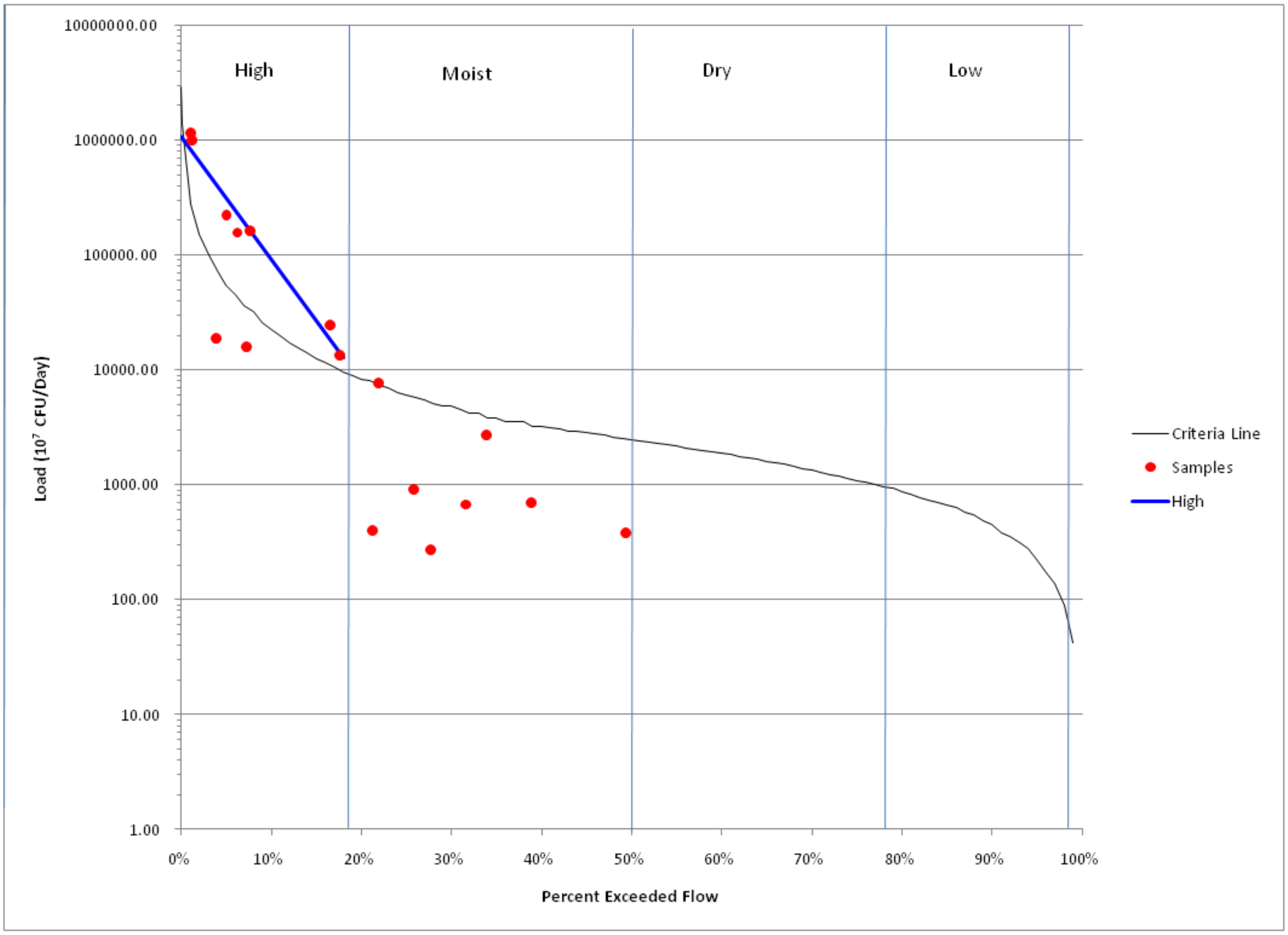
	Median Percentile	Load (10^7 CFU/Day) Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	9.01%	27440.56	7908.38	65.66	1801843.10	519291.71	71.18%
Moist	30.00%	6124.03	1482.82	87.60	536464.60	129895.09	75.79%
Dry	63.00%	1210.77	533.82	153.30	185610.28	81833.91	55.91%
			Total	307	2523918	731021	71.04%

Load Duration Curve for 384115



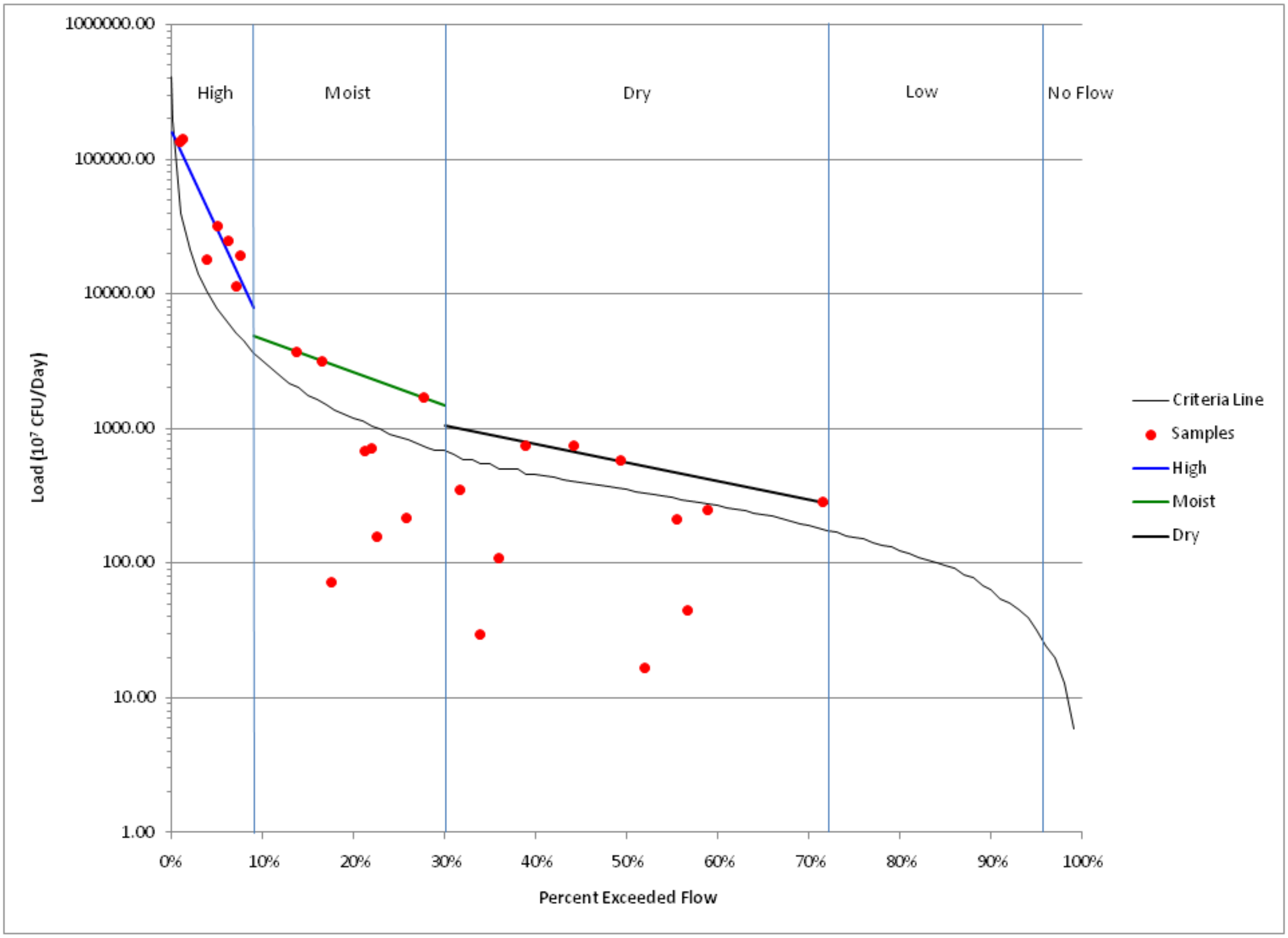
	Median Percentile	Load (10^7 CFU/Day) Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	5.51%	260445.4	51554.5	40.1	10447375.3	2068033.2	80.21%
Moist	22.00%	12013.1	7890.3	80.3	964650.5	633588.7	34.32%
Dry	58.00%	4079.0	2126.9	182.5	744412.5	388167.0	47.86%
			Total	303	12156438	3089789	74.58%

Load Duration Curve for 385086



	Median Percentile	Load (10^7 CFU/Day) Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	9.01%	117379.7	25643.5	65.7	7707560.5	1683841.9	78.15%
			Total	66	7707560	1683842	78.15%

Load Duration Curve for 385085



	Load (10^7 CFU/Day)						
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.51%	35424.7	9102.5	32.8	1162407.2	298683.7	74.30%
Moist	19.50%	2688.9	1228.8	76.7	206107.6	94190.0	54.30%
Dry	51.00%	546.7	341.3	153.3	83804.8	52327.8	37.56%
			Total	263	1452320	445201	69.35%

Appendix F
US EPA Region VIII Public Notice Review

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria TMDLs for the Knife River Tributaries in Mercer County, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**September 9, 2010**
Review Date:	**September 16, 2010**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final review only):

- ☐ Approve
- ☐ Partial Approval
- ☐ Disapprove
- ☐ Insufficient Information

Approval Notes to Administrator:

This document provides a standard format for EPA Region 8 to provide comments to state TMDL programs on TMDL documents submitted to EPA for either formal or informal review. All TMDL documents are evaluated against the minimum submission requirements and TMDL elements identified in the following 8 sections:

1. Problem Description
   1.1.. TMDL Document Submittal Letter
   1.2. Identification of the Waterbody, Impairments, and Study Boundaries
   1.3. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
   4.1. Data Set Description
   4.2. Waste Load Allocations (WLA)
   4.3. Load Allocations (LA)
   4.4. Margin of Safety (MOS)
   4.5. Seasonality and variations in assimilative capacity
5. Public Participation
6. Monitoring Strategy
7. Restoration Strategy
8. Daily Loading Expression

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant**.** A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's minimum submission requirements relative to that section, a brief summary of the EPA reviewer's findings, and the reviewer's comments and/or suggestions. Use of the verb "must" in the minimum submission requirements denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable.

This review template is intended to ensure compliance with the Clean Water Act and that the reviewed documents are technically sound and the conclusions are technically defensible.

1. Problem Description

A TMDL document needs to provide a clear explanation of the problem it is intended to address. Included in that description should be a definitive portrayal of the physical boundaries to which the TMDL applies, as well as a clear description of the impairments that the TMDL intends to address and the associated pollutant(s) causing those impairments. While the existence of one or more impairment and stressor may be known, it is important that a comprehensive evaluation of the water quality be conducted prior to development of the TMDL to ensure that all water quality problems and associated stressors are identified. Typically, this step is conducted prior to the 303(d) listing of a waterbody through the monitoring and assessment program. The designated uses and water quality criteria for the waterbody should be examined against available data to provide an evaluation of the water quality relative to all applicable water quality standards. If, as part of this exercise, additional WQS problems are discovered and additional stressor pollutants are identified, consideration should be given to concurrently evaluating TMDLs for those additional pollutants. If it is determined that insufficient data is available to make such an evaluation, this should be noted in the TMDL document.

1.1 TMDL Document Submittal Letter

When a TMDL document is submitted to EPA requesting formal comments or a final review and approval, the submittal package should include a letter identifying the document being submitted and the purpose of the submission.

Minimum Submission Requirements.

☒ A TMDL submittal letter should be included with each TMDL document submitted to EPA requesting a formal review.

☒ The submittal letter should specify whether the TMDL document is being submitted for initial review and comments, public review and comments, or final review and approval.

☐ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute**.** The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The public notice draft Knife River tributaries fecal coliform TMDLs were submitted to EPA for review via an email from Mike Ell, NDDoH on September 9, 2010. The email included the draft TMDL document and a request to review and comment on the TMDL document.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied. Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

☒ The TMDL document should clearly identify the pollutant and waterbody segment(s) for which the TMDL is being established. If the TMDL document is submitted to fulfill a TMDL development requirement for a waterbody on the state's current EPA approved 303(d) list, the TMDL document submittal should clearly identify the waterbody and associated impairment(s) as they appear on the State's/Tribe's current EPA approved 303(d) list, including a full waterbody description, assessment unit/waterbody ID, and the priority ranking of the waterbody. This information is necessary to ensure that the administrative record and the national TMDL tracking database properly link the TMDL document to the 303(d) listed waterbody and impairment(s).

☒ One or more maps should be included in the TMDL document showing the general location of the waterbody and, to the maximum extent practical, any other features necessary and/or relevant to the understanding of the TMDL analysis, including but not limited to: watershed boundaries, locations of major pollutant sources, major tributaries included in the analysis, location of sampling points, location of discharge gauges, land use patterns, and the location of nearby waterbodies used to provide surrogate information or reference conditions. Clear and concise descriptions of all key features and their relationship to the waterbody and water quality data should be provided for all key and/or relevant features not represented on the map

☒ If information is available, the waterbody segment to which the TMDL applies should be identified/geo-referenced using the National Hydrography Dataset (NHD). If the boundaries of the TMDL do not correspond to the Waterbody ID(s) (WBID), Entity_ID information or reach code (RCH_Code) information should be provided. If NHD data is not available for the waterbody, an alternative geographical referencing system that unambiguously identifies the physical boundaries to which the TMDL applies may be substituted.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Knife River watershed is a 247,000 acre watershed located in Mercer and portions of Morton, Oliver and Dunn Counties, in south western North Dakota. The listed Knife River tributary segments are: 1) Brush Creek and tributaries (61.06 miles; ND-10130201-036-S_00); 2) Coyote Creek from its confluence with Beaver Creek downstream to its confluence with the Knife River (17.24 miles; ND-10130201-037-S_00); 3) Elm Creek and tributaries (137.89 miles; ND-10130201-045-S_00); and 4) Willow Creek and tributaries (29.54 miles; ND-10130201-046-S_00). The Knife River is part of the larger Missouri River basin in the Knife sub-basin (HUC 10130201). These segments are listed as impaired for fecal coliform bacteria and are a high priority for TMDL development.

The designated uses for Knife River tributary segments are based on the Class III stream classification in the ND water quality standards (NDCC 33-15-02.1-09).

COMMENTS: None.

1.3 Water Quality Standards

TMDL documents should provide a complete description of the water quality standards for the waterbodies addressed, including a listing of the designated uses and an indication of whether the uses are being met, not being met, or not assessed. If a designated use was not assessed as part of the TMDL analysis (or not otherwise recently assessed), the documents should provide a reason for the lack of assessment (e.g., sufficient data was not available at this time to assess whether or not this designated use was being met).

Water quality criteria (WQC) are established as a component of water quality standard at levels considered necessary to protect the designated uses assigned to that waterbody. WQC identify quantifiable targets and/or qualitative water quality goals which, if attained and maintained, are intended to ensure that the designated uses for the waterbody are protected. TMDLs result in maintaining and attaining water quality standards by determining the appropriate maximum pollutant loading rate to meet water quality criteria, either directly, or through a surrogate measurable target. The TMDL document should include a description of all applicable water quality criteria for the impaired designated uses and address whether or not the criteria are being attained, not attained, or not evaluated as part of the analysis. If the criteria were not evaluated as part of the analysis, a reason should be cited (e.g. insufficient data were available to determine if this water quality criterion is being attained).

Minimum Submission Requirements:

☒ The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)).

Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.

☒ The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.

☒ If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Knife River tributary segments addressed by the TMDL document are impaired based on fecal coliform concentrations impacting the recreational uses. All four tributary segments are Class III streams. The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. Also, the quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses. Numeric criteria for fecal coliforms and E. coli in North Dakota, Class III streams have been established and are presented in the excerpted Table 12 shown below. Discussion of additional applicable water quality standards for the Knife River and its tributaries can be found on pages 9 – 10 of the TMDL.

Table 12. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class III Streams.

Parameter	Water Quality Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

[1] **Expressed as a geometric mean of representative samples collected during any consecutive 30-day period.**
[2] **No more than 10 percent of samples collected during any consecutive 30-day period shall individually exceed the standard.**

COMMENTS: None.

2. Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination.

It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddeness, stream morphology, up-slope conditions and a measure of biota).

Minimum Submission Requirements:

☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained.

Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.

☐ When a numeric TMDL target is established to ensure the attainment of a narrative water quality criterion, the numeric target, the methodology used to determine the numeric target, and the link between the pollutant of concern and the narrative water quality criterion should all be described in the TMDL document. Any additional information supporting the numeric target and linkage should also be included in the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The water quality target for these TMDLs are based on the numeric water quality standards for fecal coliform bacteria based on the recreational beneficial use for the Knife River tributary segments. The targets for the Knife River tributary segments are the fecal coliform standard expressed as the 30-day geometric mean of 200 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the targets will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standard.

North Dakota currently has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the next triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for these TMDLs and the resulting load allocations are believed to be protective of the E. coli standard as well. The department will assess attainment of the E. coli standard through additional monitoring consistent with the state's water quality standards and beneficial use assessment methodology.

COMMENTS: None.

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each significant source (or source category) should be identified and quantified to the maximum practical extent. This may be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach may be appropriate. The approach should be clearly defined in the document.

Minimum Submission Requirements:

☒ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.

☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.

☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.

☒ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2007 National Agricultural Statistics Service (NASS) data. The dominant land use in the Knife River watershed is grassland/rangeland. According to the 2007 NASS land survey data, approximately 76 percent of the landuse in the watershed is grassland/rangeland, 18 percent is cropland and the remaining 6 percent is wetlands, water, woods, and urban. The majority of the crops grown consist of spring wheat, barley and oats.

Within the listed segments of the Knife River tributaries there are no point sources permitted through the North Dakota Pollutant Discharge Elimination System (NPDES) Program. Dwellings located within the watershed utilize septic waste systems.

There are three medium (<1,000 cattle) and one small (<400 cattle) permitted animal feeding operations (AFOs) which allow zero discharge, and no confined feeding operations (CAFOs) within the watershed. Unpermitted animal feeding operations and "hobby farms" are also present in the Knife River watershed, but their number and location are unknown.

The listed tributary segments of the Knife River are experiencing fecal coliform bacteria pollution from non point sources in the watershed. With agriculture being the predominant land use, farms and ranches are located throughout the watershed. Livestock production is a dominant agricultural practice in the watershed. The North Dakota Agricultural Statistics Service indicates that out of 53 counties in North Dakota Morton County, Dunn County, Mercer County, and Oliver County ranked 1st, 2nd, 9th, and 17th in livestock production, respectively.

Wildlife may also contribute to the fecal coliform bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife is nomadic with fewer numbers concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

Septic system failure might also contribute to the fecal coliform bacteria in the water quality samples. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing.

COMMENTS: None.

4. TMDL Technical Analysis

TMDL determinations should be supported by a robust data set and an appropriate level of technical analysis**.** This applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader.

A TMDL analysis determines the maximum pollutant loading rate that may be allowed to a waterbody without violating water quality standards. The TMDL analysis should demonstrate an understanding of the relationship between the rate of pollutant loading into the waterbody and the resultant water quality impacts. This stressor → response relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and load allocations needs to be clearly articulated and supported by an appropriate level of technical analysis. Every effort should be made to be as detailed as possible, and to base all conclusions on the best available scientific principles.

The pollutant loading allocation is at the heart of the TMDL analysis. TMDLs apportion responsibility for taking actions by allocating the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways, such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or division of responsibility.

The pollutant loading allocation that will result in achievement of the water quality target is expressed in the form of the standard TMDL equation:

$$TMDL = \sum LAs + \sum WLAs + MOS$$

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = The portion of the Load Capacity allocated to the Margin of safety.

Minimum Submission Requirements:

☒ A TMDL must identify the loading capacity of a waterbody for the applicable pollutant, taking into consideration temporal variations in that capacity. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

☒ The TMDL document should describe the methodology and technical analysis used to establish and quantify the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

☒ It is necessary for EPA staff to be aware of any assumptions used in the technical analysis to understand and evaluate the methodology used to derive the TMDL value and associated loading allocations. Therefore, the TMDL document should contain a description of any important assumptions (including the basis for those assumptions) made in developing the TMDL, including but not limited to:

(1) the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
(2) the distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) a presentation of relevant information affecting the characterization of the pollutant of concern and its allocation to sources such as population characteristics, wildlife resources, industrial activities etc…;
(4) present and future growth trends, if taken into consideration in determining the TMDL and preparing the TMDL document (e.g., the TMDL could include the design capacity of an existing or planned wastewater treatment facility);

(5) an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

☒ The TMDL document should contain documentation supporting the TMDL analysis, including an inventory of the data set used, a description of the methodology used to analyze the data, a discussion of strengths and weaknesses in the analytical process, and the results from any water quality modeling used. This information is necessary for EPA to review the loading capacity determination, and the associated load, wasteload, and margin of safety allocations.

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

☐ Where both nonpoint sources and NPDES permitted point sources are included in the TMDL loading allocation, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document must include a demonstration that nonpoint source loading reductions needed to implement the load allocations are actually practicable [40 CFR 130.2(i) and 122.44(d)].

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Knife River watershed TMDLs describe how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segments.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) listed waterbodies, LDCs were developed for each of the tributary segments at monitoring sites 385085, 385086, 384114 and 384115. All sites were sampled weekly or when flow conditions were present during the recreation season. The LDCs were derived using the 200 CFU/100 mL TMDL target (i.e., state water quality standard), the daily flow records, and the observed fecal coliform data collected from each site (see Figure 7 of the TMDL document).

Flows for the watershed were estimated by utilizing the Drainage-Area Ratio Method developed by the USGS. The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site is hydrologically similar to the stream gauging station used as an index. Drainage area for the ungauged sites 384114, 384115, 385086, and 385085, and index station 06339500 was determined through GIS using digital elevation models. Streamflow data for the index station 06339500 was obtained from the USGS Water Science Center website. The index station streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station.

Four flow regimes (i.e., High Flow, Moist Condition, Dry Condition, and Low Flow) were selected to represent the hydrology of the listed segments when applicable (see Figures 8 - 11 in the TMDL). The load duration curves plot the allowable fecal coliform load (using the 200 CFU/100 mL standard) across the four flow regimes. Single grab sample fecal coliform concentrations were converted to loads by multiplying by flow and a conversion factor to produce CFU/day values. Each value was plotted individually on the load duration curves. Values falling above the curves indicate exceedances of the TMDL at that flow value while values falling below the curves indicate attainment of the TMDLs at that flow.

To estimate the required percent reductions in loading needed to achieve the TMDL, a linear regression line through the fecal coliform load data above the TMDL curve in each flow regime was plotted. The required percent reductions needed under the four regimes were determined using the linear regression line.

The LDCs represent flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the Knife River tributary segments covered by the TMDL document, the LDCs are dynamic expressions of the allowable load for any given daily flow. Loading capacities were derived from this approach for the both listed segments at each flow regime. Tables 15 - 18 show the loading capacity load (i.e., TMDL load) for the listed tributary segments of the Knife River.

COMMENTS: None.

4.1 Data Set Description

TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis. An inventory of the data used for the TMDL analysis should be provided to document, for the record, the data used in decision making. This also provides the reader with the opportunity to independently review the data. The TMDL analysis should make use of all readily available data for the waterbody under analysis unless the TMDL writer determines that the data are not relevant or appropriate. For relevant data that were known but rejected, an explanation of why the data were not utilized should be provided (e.g., samples exceeded holding times, data collected prior to a specific date were not considered timely, etc…).

Minimum Submission Requirements:

☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.

☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Knife River tributaries TMDL data description and summary are included in the Available Data section, in tables throughout the document and in the data tables in Appendix A. Recent water quality monitoring was conducted in 2001, 2002, 2005, 2008 and 2009 at sites 384114 and 384115 and in 2001, 2002 and 2005 at sites 385085 and 385086. The data set also includes 20 plus years of flow records from USGS gauging site 06339500. The flow data, along with the TMDL targets, were used to develop the fecal coliform load duration curves for the impaired tributary segments of the Knife River.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

Waste Load Allocations represent point source pollutant loads to the waterbody. Point source loads are typically better understood and more easily monitored and quantified than nonpoint source loads. Whenever practical, each point source should be given a separate waste load allocation. All NPDES permitted dischargers that discharge the pollutant under analysis directly to the waterbody should be identified and given separate waste load allocations. The finalized WLAs are required to be incorporated into future NPDES permit renewals.

Minimum Submission Requirements:

☒ EPA regulations require that a TMDL include WLAs for all significant and/or NPDES permitted point sources of the pollutant. TMDLs must identify the portion of the loading capacity allocated to individual existing and/or future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit. If no allocations are to be made to point sources, then the TMDL should include a value of zero for the WLA.

☒ All NPDES permitted dischargers given WLA as part of the TMDL should be identified in the TMDL, including the specific NPDES permit numbers, their geographical locations, and their associated waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: Within the listed segments of the Knife River tributaries there are no point sources permitted through the North Dakota Pollutant Discharge Elimination System (NPDES) Program. Dwellings located within the watershed utilize septic waste systems.

There are three medium (<1,000 cattle) and one small (<400 cattle) permitted animal feeding operations (AFOs) which allow zero discharge, and no confined feeding operations (CAFOs) within the watershed. Unpermitted animal feeding operations and "hobby farms" are also present in the Knife River watershed, but their number and location are unknown.

COMMENTS: None.

4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:

☒ EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.

☒ Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2007 National Agricultural Statistics Service (NASS) data. The dominant land use in the Knife River watershed is grassland/rangeland. According to the 2007 NASS land survey data, approximately 76 percent of the landuse in the watershed is grassland/rangeland, 18 percent is cropland and the remaining 6 percent is wetlands, water, woods, and urban. The majority of the crops grown consist of spring wheat, barley and oats. The TMDL listed tributary segments of the Knife River are experiencing fecal coliform bacteria pollution from nonpoint sources in the watershed. With agriculture being the predominant land use, farms and ranches are located throughout the watershed. Livestock production is a dominant agricultural practice in the watershed.

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to fecal coliform bacteria loading. Animals grazing in the riparian area contribute fecal coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, medium and low flows. In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and under moist conditions at moderate flows. Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for total fecal coliform bacteria contamination.

Source specific data are limited so an aggregate LA is assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table.

Table 13. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Non-Point Sources	Flow Regime		
	High Flow	Moist/Dry Conditions	Low Flow
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

COMMENTS: None.

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL. The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

☒ TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

- ☐ <u>If the MOS is implicit</u>, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.
- ☒ <u>If the MOS is explicit</u>, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Knife River tributary TMDLs include explicit MOSs for the listed segments derived by calculating 10 percent of the loading capacity. The explicit MOSs for the Knife River segments are included in Tables 15 - 18 of the TMDL document.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary based on seasonal considerations. Therefore, it is appropriate that the TMDL analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

☒ The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variability as a factor. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in fecal coliform loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the TMDLs are seasonal since the fecal coliform criteria are in effect from May 1 to September 30, therefore the TMDLs are only applicable during that period.

COMMENTS: None.

5. Public Participation

EPA regulations require that the establishment of TMDLs be conducted in a process open to the public, and that the public be afforded an opportunity to participate. To meaningfully participate in the TMDL process it is necessary that stakeholders, including members of the general public, be able to understand the problem and the proposed solution. TMDL documents should include language that explains the issues to the general public in understandable terms, as well as provides additional detailed technical information for the scientific community. Notifications or solicitations for comments regarding the TMDL should be made available to the general public, widely circulated, and clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for approval, a copy of the comments received by the state and the state responses to those comments should be included with the document.

Minimum Submission Requirements:

☒ The TMDL must include a description of the public participation process used during the development of the TMDL (40 C.F.R. §130.7(c)(1)(ii)).

☐ TMDLs submitted to EPA for review and approval should include a summary of significant comments and the State's/Tribe's responses to those comments.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The TMDL document includes a summary of the public participation process that has occurred. It describes the opportunities the public had to be involved in the TMDL development process. Copies of the draft TMDL document were mailed to stakeholders in the watershed during public comment. Also, the draft TMDL document was posted on NDoDH's Water Quality Division website, and a public notice for comment was published in local newspapers.

COMMENTS: None.

6. Monitoring Strategy

TMDLs may have significant uncertainty associated with the selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL document to articulate the means by which the TMDL will be evaluated in the field, and to provide for future supplemental data that will address any uncertainties that may exist when the document is prepared.

Minimum Submission Requirements:

☒ When a TMDL involves both NPDES permitted point source(s) and nonpoint source(s) allocations, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring.

☒ Under certain circumstances, a phased TMDL approach may be utilized when limited existing data are relied upon to develop a TMDL, and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but may be necessary to support a rationale for approving the TMDL. http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: To insure that the best management practices (BMPs) and technical assistance that are implemented as part of the Section 319 Knife River Watershed Restoration Project are successful in reducing fecal coliform bacteria, as well as E. coli loadings, to levels necessary to meet water quality standards prescribed in this TMDL, water quality monitoring is being conducted in accordance with an approved Quality Assurance Project Plan (QAPP). As prescribed in the QAPP, weekly monitoring is being conducted at two sites for fecal coliform and E. coli bacteria. Sampling began in May 2001 and will continue through September 2011.

COMMENTS: None.

7. Restoration Strategy

The overall purpose of the TMDL analysis is to determine what actions are necessary to ensure that the pollutant load in a waterbody does not result in water quality impairment. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document. During the TMDL analytical process, information is often gained that may serve to point restoration efforts in the right direction and help ensure that resources are spent in the most efficient manner possible. For example, watershed models used to analyze the linkage between the pollutant loading rates and resultant water quality impacts might also be used to conduct "what if" scenarios to help direct BMP installations to locations that provide the greatest pollutant reductions. Once a TMDL has been written and approved, it is often the responsibility of other water quality programs to see that it is implemented. The level of quality and detail provided in the restoration strategy will greatly influence the future success in achieving the needed pollutant load reductions.

Minimum Submission Requirements:

☒ EPA is not required to and does not approve TMDL implementation plans. However, in cases where a WLA is dependent upon the achievement of a LA, "reasonable assurance" is required to demonstrate the necessary LA called for in the document is practicable). A discussion of the BMPs (or other load reduction measures) that are to be relied upon to achieve the LA(s), and programs and funding sources that will be relied upon to implement the load reductions called for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Allocation section (Section 8.0) of the TMDL document includes a list of BMPs that are recommended to meet the TMDL loads. Local sponsors in the watershed have successfully applied for and received Section 319 funding for the Knife River Watershed Restoration Project. Beginning in October 2001, local sponsors have been providing technical assistance and implementing BMPs designed to reduce fecal bacteria loadings and to help restore the beneficial uses of the Knife River and its tributaries (i.e., recreation). As the watershed restoration project progresses, water quality data are collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing fecal coliform bacteria loadings. A QAPP has also been developed as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

There are no significant permitted point sources in the watershed contributing to the bacteria load, so it's not necessary to fully document reasonable assurance demonstrating that the nonpoint source loadings are practicable.

COMMENTS: None.

8. Daily Loading Expression

The goal of a TMDL analysis is to determine what actions are necessary to attain and maintain WQS. The appropriate averaging period that corresponds to this goal will vary depending on the pollutant and the nature of the waterbody under analysis. When selecting an appropriate averaging period for a TMDL analysis, primary concern should be given to the nature of the pollutant in question and the achievement of the underlying WQS. However, recent federal appeals court decisions have pointed out that the title TMDL implies a "daily" loading rate. While the most appropriate averaging period to be used for developing a TMDL analysis may vary according to the pollutant, a daily loading rate can provide a more practical indication of whether or not the overall needed load reductions are being achieved. When limited monitoring resources are available, a daily loading target that takes into account the natural variability of the system can serve as a useful indicator for whether or not the overall load reductions are likely to be met. Therefore, a daily expression of the required pollutant loading rate is a required element in all TMDLs, in addition to any other load averaging periods that may have been used to conduct the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

☒ The document should include an expression of the TMDL in terms of a daily load. However, the TMDL may also be expressed in temporal terms other than daily (e.g., an annual or monthly load). If the document expresses the TMDL in additional "non-daily" terms the document should explain why it is appropriate or advantageous to express the TMDL in the additional unit of measurement chosen.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Knife River fecal coliform TMDL document includes daily loads expressed as colonies per day for the listed tributary segments of the river. The daily TMDL loads are included in TMDL section (Section 7.0) of the document.

COMMENTS: None.