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STUDY 4.0 WATER TEMPERATURE IN THE LOUP RIVER BYPASS REACH

The Project is located in Nance and Platte counties, where water is diverted from the Loup River and routed through the 35-mile-long Loup Power Canal, which empties into the Platte River near Columbus. The Project includes various hydraulic structures, two powerhouses, and two regulating reservoirs. The portion of the Loup River from the Diversion Weir to the confluence with the Platte River is referred to as the Loup River bypass reach.

According to the Nebraska Department of Environmental Quality (NDEQ), there have been three documented fish kills in the Loup River bypass reach: one in July 1995, one in July 1999, and one in July 2004 (NDEQ, 2007). A combination of low flow and thermal stress are the suspected causes of these fish kills. In 1995, in response to the fish kills in the Loup River bypass reach, the District, in coordination with the Nebraska Game and Parks Commission (NGPC), began voluntarily allowing for a flow of 50 cfs in the Loup River bypass reach when ambient temperature conditions warrant. This voluntary flow was increased to 75 cfs in 2003 based upon discussions and agreements with the NGPC. This flow increase is intended to prevent temperature-related fish mortality from occurring in the Loup River bypass reach.

Water temperature in the Loup River bypass reach was identified as a potential issue for the Project as it is believed to have been a factor in fish kills in the bypass reach. NGPC has identified the portion of the Loup River bypass reach from the Diversion Weir to the confluence with Beaver Creek as the “main affected area for fish kills”(NGPC, February 6, 2009). In this study, this main affected area will be referred to as the Study Reach. The purpose of this study is to evaluate whether, and to what extent, water temperature in the Loup River bypass reach is affected by Project operations.

1. GOALS AND OBJECTIVES OF STUDY

“Describe the goals and objectives of each study proposal and the information to be obtained;” 18 CFR §5.11(d)(1)

The goal of the study of water temperature in the Loup River bypass reach is to determine if Project operations (flow diversion) materially affect water temperature in the Study Reach.

The objectives of the study of water temperature in the Loup River bypass reach are as follows:

1. To coordinate with the U.S. Geologic Survey (USGS) to install temperature sensors in the Loup River at the Diversion Weir and in the Loup River bypass reach at USGS Gage 06793000, Loup River near Genoa, NE.
2. To collect and review ambient air temperature data at the National Weather Service (NWS) atmospheric station located at Genoa.

3. To collect and review flow data at USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE.
4. To analyze the collected ambient air and water temperature and flow data.
5. To estimate the relationship between flow in the Loup River bypass reach, ambient air temperature, and water temperature.
6. To describe and quantify the relationship, if any, between diversion of water into the Loup Power Canal and water temperature in the Study Reach of the Loup River bypass reach.

2. RELEVANT RESOURCE MANAGEMENT GOALS

“Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;” 18 CFR §5.11(d)(2)

Resource agencies with an interest in preventing future fish kills in the Loup River bypass reach are USGS, U.S. Fish and Wildlife Service (USFWS), NGPC, NDEQ, and the Nebraska Department of Natural Resources (NDNR). The Loup River bypass reach has been assigned a warmwater aquatic life designation, as stated in Nebraska Administrative Code, Title 117, Nebraska Surface Water Quality Standards. As with all classified waters in Nebraska, there are water quality standards that are applied to the Loup River bypass reach. NDEQ has set a water quality standard for water temperature in the Loup River bypass reach, which states “For warm waters, the maximum limit is 90°F (32°C).” This standard is applied to all waters in Nebraska with the same warmwater designation and was established to prevent fish mortality events. This temperature value is set below the critical thermal maximum value for the majority of fish species (Beitinger et al., 2000).

3. BACKGROUND AND EXISTING INFORMATION

“Describe existing information concerning the subject of the study proposal, and the need for additional information;” 18 CFR §5.11(d)(3)

3.1 District Operating Procedures

Low flow conditions on the Loup River generally occur during the hot summer months when river flow is reduced by upstream irrigation withdrawals. During these periods, the Project continues to operate normally, utilizing the flow available for diversion and generation. According to District observations, the minimum leakage rate from the Diversion Weir and Sluice Gate Structure is approximately 50 cfs.

Since 1995, the District’s primary Project operating response to hot weather conditions has been to allow for a flow of 50 to 75 cfs in the Loup River bypass reach when conditions warrant. This has been done voluntarily by the District (in accordance with mutual understandings and informal letter agreements with NGPC)

to prevent temperature-related fish mortality from occurring in the Loup River bypass reach. The Headworks Supervisor monitored ambient air temperatures and initiated the reduced flow diversion when air temperature reached 98° Fahrenheit. Previously, on occasion, the District has voluntarily reduced the amount of flow diverted into the Loup Power Canal to provide additional flow in the Loup River bypass reach during hot weather to prevent fish kills based on a request from NGPC. In 2008, the District temporarily suspended this practice due to water accounting issues raised by NDNR. The District is currently working with NDNR to resolve these issues.

3.2 Available Atmospheric Data

Atmospheric data is an important factor exerting influence on the temperature of the water in the Loup River bypass reach. Atmospheric data will be collected from the NWS station at Genoa during the proposed period of temperature sampling in the Loup River bypass reach. Daily maximum ambient atmospheric temperature data is available at this station and can be found at <http://www.ncdc.noaa.gov/oa/climate/stationlocator.html>.

3.3 Available Flow Data

Flow is another important factor exerting influence on the temperature of the water in the Loup River bypass reach. USGS data at the following two locations will provide flow data that will be used for this study:

- USGS Gage 06793000, Loup River near Genoa, NE – Available data for this station includes 30-minute interval data for discharge and gage height.
- USGS Gage 06792500, Loup River Power Canal near Genoa, NE – Available data for this station includes 30-minute interval data for discharge and gage height.

4. PROJECT NEXUS

“Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied;” 18 CFR §5.11(d)(4)

The Project diverts water from the Loup River near Genoa into the Power Canal and then releases diverted water into the Platte River through the Tailrace Canal at Columbus, just downstream of the confluence of the Loup and Platte rivers. The nexus between Project operations and water temperature effects is that a combination of water diversion from the Loup River to the Loup Power Canal and high ambient air temperatures may lead to an exceedance of the 90° F (32°C) water quality standard. This study will evaluate and quantify effects of the Loup Power Canal flow diversion on water temperature in the Study Reach.

5. STUDY AREA AND STUDY SITES

The study area is the aforementioned Study Reach, which begins at the Diversion Weir, located west of Genoa, where water is diverted from the Loup River, and ends at the confluence with Beaver Creek (see Figure 4-1).

There are two study sites within the study area where water temperature data will be collected. The first site will be in the Loup River on the upstream side of the Diversion Weir, and the second site will be at USGS Gage 06793000 on the Loup River near Genoa. In addition, a second USGS gage site, USGS Gage 06792500, Loup River Power Canal near Genoa, NE will be used to estimate flow in the Loup River just upstream of the Diversion Weir.

6. PROPOSED METHODOLOGY

“A detailed description of the study and the methodology to be used;” 18 CFR §5.11(b)(1)

“Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers any known tribal interests;” 18 CFR §5.11(d)(5)

The methodology for the study of water temperature in the Study Reach of the Loup River bypass reach includes three tasks, described below.

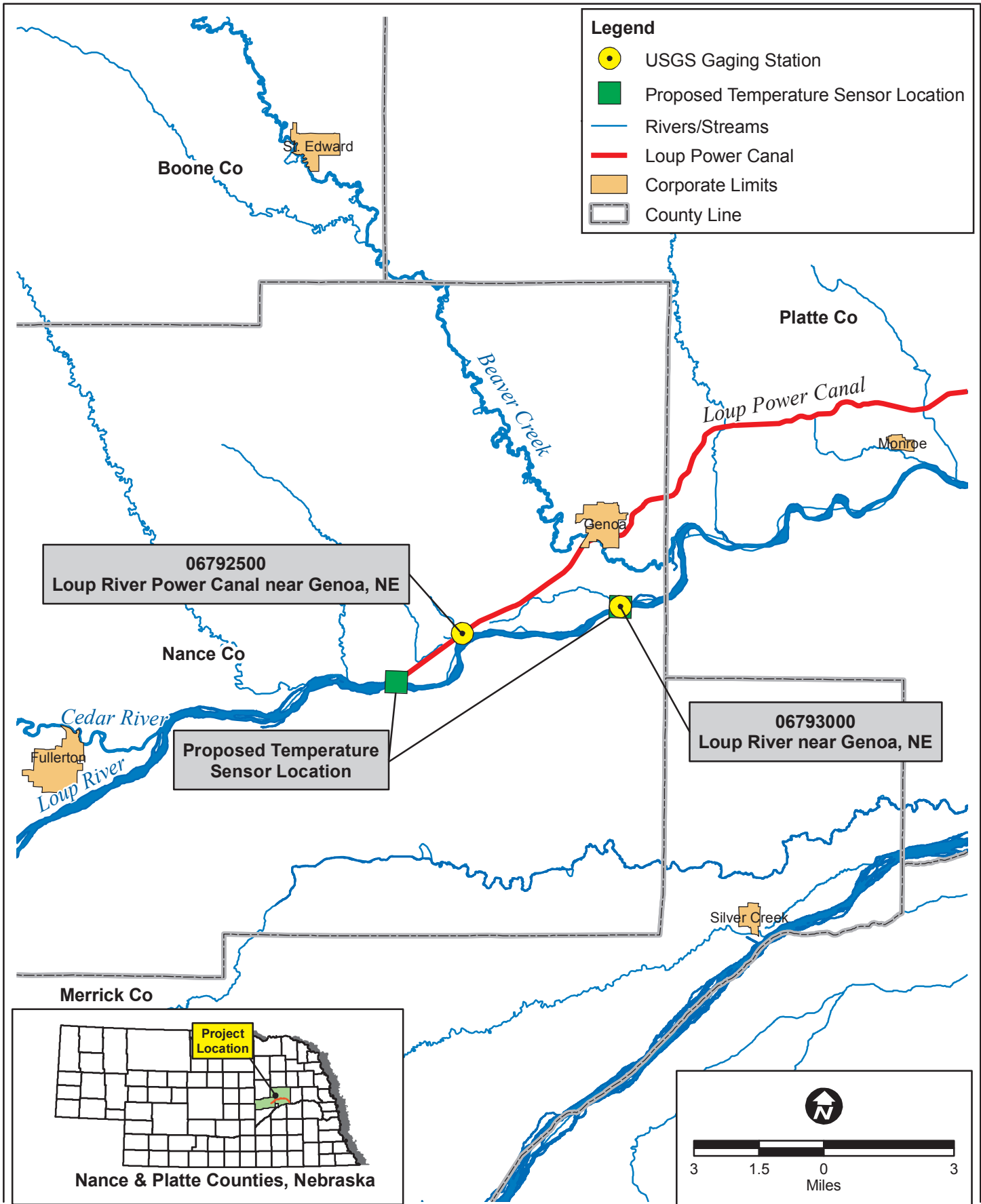
Task 1 USGS Coordination

The District will coordinate with USGS to install temperature sensors at two locations: 1) Loup River at the Diversion Weir, and 2) USGS Gage 06793000 on the Loup River near Genoa. Temperature sensors and recording devices will be installed in the spring of 2010 and will record data from May 1, 2010 through September 30, 2010.

Task 2 Data Collection

Flow data will be obtained from USGS Gage 06793000, Loup River near Genoa, NE, and from USGS Gage 06792500, Loup River Power Canal near Genoa, NE for the May through September time period. Ambient air temperature data will be obtained from the NWS station at Genoa. The data will be organized in a database by day, week, and month, and any data gaps will be described. The descriptive statistics available in Microsoft Excel will be used to provide descriptive statistics, such as count, maximum, mean, minimum, and standard deviation, for the grouped data.

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Loup River Temperature Study Reach

Loup River Hydroelectric Project
 FERC Project No. 1256
 Proposed Study Plan

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DATE	March 2009
FIGURE	4-1

The descriptive statistics information will also note whether the temperature measured at either location exceeded the NDEQ temperature standard of 90°F (32°C) and, if so, how often and by how much.

Task 3 Data Analysis

Data will be plotted to identify general patterns and distinguish trends, as follows:

- Estimate a relationship between flow volume and water temperature upstream of the Diversion Weir. Plot flow derived volume of water in the Loup River measured at the diversion against the temperature of the water in the Loup River measured at the diversion for the period of record. The flow volume upstream of the diversion structure will be estimated based on the USGS gages on the Loup River near Genoa and Loup River Power Canal near Genoa. Regressions will be calculated on hourly data grouped by week and month. A select number of daily plots will also be created. These regressions will also be plotted.
- Estimate a relationship between flow volume and water temperature in the Study Reach. Plot flow derived volume of water in the Study Reach versus water temperature measured at the USGS gage on the Loup River near Genoa for the period of record. Regressions will be calculated on hourly data grouped by week and month. A select number of daily plots will also be created. These regressions will also be plotted.
- Estimate a relationship between water temperature in the Study Reach and water temperature upstream of the Diversion Weir. Plot water temperature in the Study Reach versus water temperature upstream of the Diversion Weir. Regressions will be calculated on hourly data grouped by week and month. A select number of daily plots will also be created. These regressions will also be plotted.
- Estimate a relationship between ambient air temperature and water temperature in the Study Reach. Plot ambient air temperature against the temperature of the water in the Study Reach measured at the USGS gage on the Loup River near Genoa for the period of record. Regressions will be calculated on hourly data grouped by week and month. A select number of daily plots will also be created. These regressions will also be plotted.
- Estimate a relationship between ambient air temperature and water temperature upstream of the Diversion Weir. Plot ambient air temperature against the temperature of the water upstream of the Diversion Weir for the period of record. Regressions will be calculated on hourly data grouped by week and month. A select number of daily plots will also be created. These regressions will also be plotted.

Regression analyses on each described plot will be performed to determine relationships between the water temperature in the Study Reach, ambient air temperature, and flow in the Study Reach.

The first single regression that will be completed will have flow in the Study Reach versus water temperature. The second analysis will have ambient air temperature versus water temperature. The multiple regression analysis will have flow volume in the Study Reach, ambient air temperature, and water temperature upstream of the Diversion Weir as variables versus water temperature in the Study Reach.

Agreements that the District has entered into in the past have been based on the assumption that the first two variables exert more influence on the temperature of the water in the Loup River bypass reach than any other variable.

Once a predictive relationship is established, that relationship can be used to predict during what conditions the water quality temperature standard may be exceeded.

7. CONSULTATION WITH AGENCIES, TRIBES, AND OTHER STAKEHOLDERS

This study plan was developed based on discussions with agencies prior to submittal of the PAD. The District will work with agencies to resolve any issues or concerns during the course of the study plan meetings prior to preparation of the revised study plan.

8. WORK PRODUCTS

“Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results;” 18 CFR §5.11(b)(3)

The intended work product for the study of water temperature in the Loup River bypass reach is a study report. The study report will document the existing relationship between water temperature and flow in the Loup River bypass reach. Along with the study report, a database of the data gathered and used in the analysis will be available.

Updates regarding the study of water temperature in the Loup River bypass reach will be included in the study progress reports to be submitted to FERC in December 2009, March 2010, and June 2010.

9. LEVEL OF EFFORT AND COST

“Describe considerations of level of effort and cost, as applicable.” 18 CFR §5.11(d)(6)

It is estimated that the study of water temperature in the Loup River bypass reach will cost approximately \$110,000. This work will be completed by qualified water resources engineers. The installation and maintenance of the temperature sensors will be completed by USGS.

10. SCHEDULE

“A schedule for conducting the study;” 18 CFR §5.11(b)(2)

“The potential applicant's proposed study plan must also include provisions for the initial and updated study reports and meetings provided for in §5.15.” 18 CFR §5.11(c)

The study of water temperature in the Loup River bypass reach is scheduled to begin in the fourth quarter of 2009, and the final study report is to be submitted in the first quarter of 2011.

11. REFERENCES

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