
WATER TEMPERATURE IN THE LOUP RIVER BYPASS REACH

STUDY 4.0 WATER TEMPERATURE IN THE LOUP RIVER BYPASS REACH..... 4-1

- 1. GOALS AND OBJECTIVES OF STUDY..... 4-1
- 2. RELEVANT RESOURCE MANAGEMENT GOALS 4-2
- 3. BACKGROUND AND EXISTING INFORMATION 4-2
- 4. PROJECT NEXUS 4-4
- 5. STUDY AREA AND STUDY SITES 4-4
- 6. PROPOSED METHODOLOGY 4-4
- 7. CONSULTATION WITH AGENCIES, TRIBES, AND OTHER STAKEHOLDERS..... 4-8
- 8. WORK PRODUCTS..... 4-9
- 9. LEVEL OF EFFORT AND COST 4-10
- 10. SCHEDULE 4-10
- 11. REFERENCES 4-10

LIST OF ATTACHMENTS

- A RESPONSE TO USFWS JUNE 24, 2009, STUDY COMMENTS

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 Loup River bypass reach with particular emphasis between the Diversion Weir and the confluence of Beaver Creek with the Loup River.

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

1. To estimate the relationship between flow in the Loup River bypass reach, ambient air temperature, water temperature, relative humidity, and solar radiation.¹
2. 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 U.S. Geological Survey (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

¹ At the April 21, 2009, Study Plan Meeting, agencies requested that cloud cover be included as a parameter for analysis in this study. Solar radiation is the energy from the sun that is available to warm the atmosphere and water. Clouds reflect some incoming radiation back to space, thereby reducing the amount of radiation that reaches the earth’s surface. However, clouds also re-radiate infrared energy back toward the earth’s surface, thereby moderating the temperature of the lower atmosphere. Because solar radiation is the driving force for temperature and cloud cover can provide both warming and cooling, the District believes that solar radiation is a more appropriate variable to use in this study.

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 characteristics, such as air temperature, relative humidity, and solar radiation, are important factors exerting influence on the temperature of the water in the Loup River bypass reach. Atmospheric data will be collected from the National Weather Service (NWS) station at Genoa during the proposed period of temperature sampling in the Loup River bypass reach. Daily maximum ambient atmospheric temperature data is collected at this station and is available at <http://www.ncdc.noaa.gov/oa/climate/stationlocator.html>.

A second atmospheric station at the Grand Island Airport Weather Station, operated by the National Oceanic and Atmospheric Administration (NOAA), will be used. Data is available through NOAA's National Climate Data Center (NCDC), and electronic hourly observation tables are available that include the following data: sky conditions (cloud cover), air temperature, relative humidity, wind speed, pressure, and precipitation.

Additional atmospheric data will be collected from the High Plains Regional Climate Center at Mead, Nebraska. Mead is the closest reputable atmospheric station that records solar radiation data, which will be used as part of the analysis.

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.

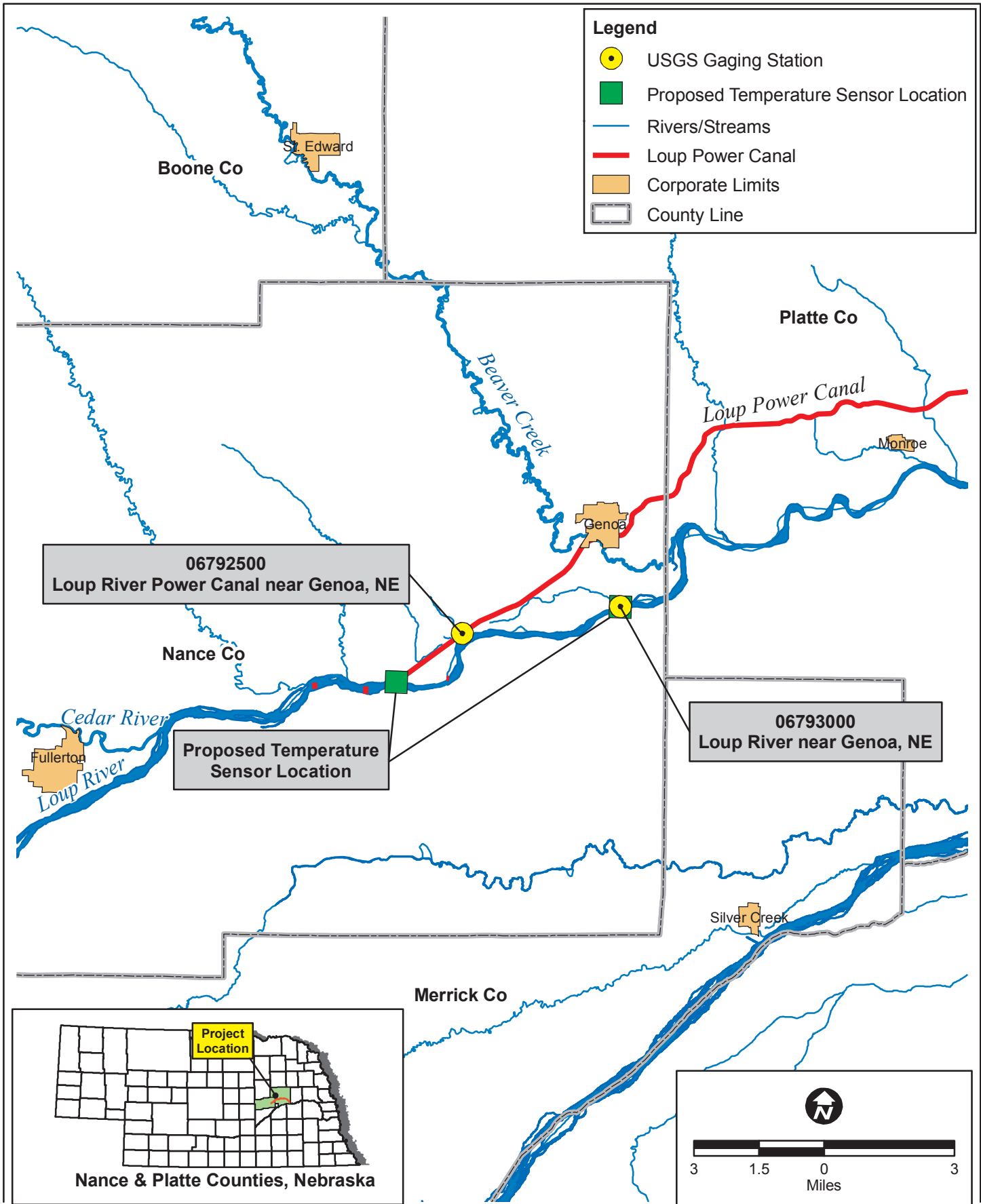
6. PROPOSED METHODOLOGY

“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.

Z:\Projects\Loup_Power_District\37104_LPD_FERC_Relicensing\map_docs\mxd\Loup_Bypass_Temperature_Study_Reach.mxd\july09



Loup River Temperature Study Reach

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

© 2009 Loup River Public Power District

DATE	July 2009
FIGURE	4-1

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 add-in available in Microsoft Excel will be used to provide descriptive statistics, such as count, maximum, mean, minimum, and standard deviation, for the grouped data.

Temperature data will also be collected in the Loup River at Columbus, coincident with NDNR Gage 06794500, Loup River at Columbus, NE.² Once the temperature instrumentation has been installed by USGS at the locations described above, temperature data loggers will be installed at current USGS Gage 06793000, Loup River near Genoa, NE, for a period of approximately 1 week to address issues of instrumentation variability. Then, subsequent to the instrumentation variability check, the probes will be placed coincident with NDNR Gage 06794500, Loup River at Columbus, NE, and will record temperature information for approximately 1 week to 10 days.

A percent probability of exceedance analysis similar to Sinokrot and Gulliver's method will be used to evaluate 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. Two cumulative probability distribution plots will be created, one for the USGS temperature probe location upstream of the Diversion Weir and one for the USGS station on the Loup River near Genoa. Mean daily discharge will be plotted on the y-axis and an exceedance probability on the x-axis. The exceedance probability variable is the number of times the peak daily temperature was above 32°C, divided by the total number of days the temperature was measured, for individual mean daily discharge ranges (for example, 50 to 60 cfs, 61 to 70 cfs, 71 to 80 cfs).

² NDNR reinstated this gage in 2008 at the same location as former USGS Gage 06794500, Loup River at Columbus, NE.

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.
- Estimate a relationship between water temperature in the Study Reach and relative humidity measured at Mead. Plot water temperature in the Study Reach versus relative humidity. 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 solar radiation measured at Mead. Plot water temperature in the Study Reach versus solar radiation. 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.
- Compare data collected from the temperature data loggers at NDNR Gage 06794500, Loup River at Columbus, NE, to the temperature measured by USGS Gage 06793000, Loup River near Genoa, NE, to confirm that the reach above Beaver Creek is the critical reach of the Loup River bypass reach with respect to high temperature (that is, that no significant increases in water temperature occur downstream of Beaver Creek). If the temperature of the water at Columbus is nearly the same or cooler than the temperature at Genoa, then it can be determined that the reach above Beaver Creek is the critical reach with respect to high water temperature. However, if the temperature of the water at Columbus is much higher than the temperature of the water at Genoa, then additional temperature monitoring will be conducted at Columbus for use in developing relationships between flow, water temperature, and ambient conditions at Columbus.

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, relative humidity, and solar radiation 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 has been developed based on discussions with agencies prior to submittal of the PAD and during multiple study plan meetings that followed the submittal of the Proposed Study Plan.

The District presented an overview of the goals, objectives, and activities associated with Study 4.0, Water Temperature in the Loup River Bypass Reach, at the Study Plan Meeting held on April 21, 2009. Additionally, the goals and objectives of the aquatic resources studies, including Study 4.0, were discussed in detail. The meeting was attended by representatives of FERC, NGPC, NDEQ, USFWS, and National Park Service, as well as others. During this meeting, NGPC expressed concern about limiting the analysis to the Loup River bypass reach between the Diversion Weir and Beaver Creek. Instead, NGPC requested that the entire Loup River bypass reach should be analyzed – discussion of specific analyses was tabled until the May 27-28, 2009 Study Plan Meeting. Additionally, there was consensus from agencies to include evaluation of additional weather parameters (relative humidity and cloud cover) in the temperature analysis. These parameters have been incorporated as a result of this meeting.

The District conducted an additional Study Plan Meeting on May 27-28, 2009, to discuss in more depth the specific activities associated with aquatic resources studies, including Study 4.0, Water Temperature in the Loup River Bypass Reach. Most of the attendees at the April 21, 2009, meeting (listed above) also attended this meeting. Discussion specific to this study of water temperature ultimately resulted in the addition of limited, short-term temperature monitoring at Columbus to address concerns expressed by NGPC at the April 21 meeting. No other modifications to the study plan resulted. The discussions from both meetings were documented in meeting transcripts, which are available on the District’s relicensing website (<http://www.loup.com/relicense/html/agencymeetingsresources.html>).

As a follow-up to the May 28, 2009, Study Plan Meeting, the District coordinated with NGPC on June 23, 2009, concerning the methodology for short-term temperature monitoring at Columbus. NGPC agreed that temperature data loggers would be installed near Columbus for approximately 1 week and that this level of investigation would be sufficient for the analysis to determine whether temperatures are significantly higher at Columbus than in the primary study reach (from the Diversion Weir to Beaver Creek).

USFWS provided comments related to Study 4.0, Water Temperature in the Loup River Bypass Reach, in its June 24, 2009, comment letter. The District’s response to these comments is included in Attachment A.

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 \$140,000. 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 Water Temperature in the Loup River Bypass Reach study report will be available in the first quarter of 2011. In addition, the District will prepare a consolidated Initial Study Report for Studies 1.0 through 12.0 that describes progress and results (as appropriate) for each study. In accordance with the District's Process Plan and Schedule, the Initial Study Report will be available in August 2010, and a study meeting will be held within 15 days, per 18 CFR §5.15(c)(2). An Updated Study Report will be available in August 2011 to provide information on progress and results for second season studies (as needed).

11. REFERENCES

Beitinger, Thomas L.; Bennett, Wayne A.; McCauley, Robert W.; Temperature tolerances of North American freshwater fishes exposed to dynamic changes in temperature. *Environmental Biology of Fisheries* 58:237-275, 2000.

NDEQ. July 31, 2006. Nebraska Administrative Code, Title 117, Nebraska Surface Water Quality Standards. Available online at <http://www.deq.state.ne.us/RuleAndR.nsf/pages/117-TOC>.

NDEQ. 2007. “Loup Fish Kills” Excel spreadsheet. Provided by John Bender, NDEQ, on July 3, 2008.

NGPC. February 6, 2009. Letter from Frank Albrecht, Assistant Division Administrator, to Kimberly D. Bose, Secretary, FERC, regarding comments on the Scoping Document and Pre-Application Document.

Attachment A – Response to USFWS June 24, 2009, Study Comments

STUDY 4.0 WATER TEMPERATURE IN THE LOUP RIVER BYPASS REACH RESPONSE TO USFWS JUNE 24, 2009, STUDY COMMENTS

INTRODUCTION

In a letter dated June 24, 2009, the U.S. Fish and Wildlife Service (USFWS) provided comments on the District's Proposed Study Plan (PSP) for the Project, as revised at the May 27-28, 2009, Study Plan Meeting. The District identified two general themes in USFWS's comment letter that the District believes merit a general discussion. These are listed below and are discussed in detail in the sections that follow:

- USFWS provided a number of recommendations for changing the District's proposed methodology. The District maintains that these changes are inconsistent with the National Environmental Policy Act of 1969 (NEPA).
- USFWS provided a number of recommendations for including cumulative effects analysis. The District maintains that these recommendations are inconsistent with NEPA guidance and USFWS's Endangered Species Act of 1973 (ESA) procedures.

USFWS Recommended Changes to Proposed Methodology that are Inconsistent with CEQ's NEPA Guidance

Neither NEPA nor the ESA requires a specific methodology to analyze impacts. The standard for both laws is to conduct an analysis that is adequate for the Federal agency's decision. Whatever methodology is used, it must provide an accurate and complete analysis. The Council on Environmental Quality (CEQ) guidance specifically states that the methodology and information used must avoid speculation about potential impacts and be the best information available. The District maintains that its PSP meets both of these criteria.

Specifically, the District proposes to indirectly analyze impacts on threatened and endangered (T&E) species and the aquatic resources of the Loup River bypass reach and the lower Platte River by evaluating geomorphic stability of these reaches. This will be accomplished by determining if Project operations and alternate operating conditions impact this stability. This methodology is based on the fact that habitat is a direct function of geomorphic conditions. This analysis coupled with the hydrocycling analysis will provide FERC with an analysis of Project operations and alternative conditions that is adequate for its decision.

In a number of comments (noted in specific responses provided below), USFWS criticizes the District's proposed methodology based on the fact that it assesses impacts using an indirect measure rather than a direct measure. The District maintains that determining impacts via indirect methods using many years of historical data is the most appropriate method because the District is not proposing any changes to Project operations as part of the license application. Furthermore, the

District notes that the use of historical data provides the ability to evaluate alternatives under identical conditions, eliminating the effects of externalities in methods proposed by USFWS.

USFWS Made Recommendations on Cumulative Effects that are Inconsistent with CEQ's NEPA Guidance and USFWS's ESA Procedures

In its comment letter, USFWS frequently explains that the District's analysis should not be based on current hydrology, but should be based on projected hydrology derived from reasonably foreseeable effects on the hydrograph. The District's main concern with this comment relates to USFWS's position on how this projected hydrology should be determined.

Per CEQ guidance, the standard methodology for evaluating cumulative effects is to use a historic baseline; to add the effects of past, present, and reasonably foreseeable future actions to that baseline; and then to add the incremental impacts of the proposed action to that total.

Alternatively, it is acceptable to use the existing baseline as representing the cumulative effects of past and present actions, then to add the effects of reasonably foreseeable future actions to that, and then to add the incremental effects of the proposed action to that total. The latter of these two approaches is the one the District has proposed to use. None of the accepted methodologies uses USFWS's recommendation of a projected baseline.

Allied with this concern is USFWS's position for determining what constitutes a reasonably foreseeable future action. CEQ's guidance states that the future action must have progressed far enough in its implementation to have some degree of certainty that it will be implemented. These future actions are to have a specific description and some existing evaluation.

Some of the examples that CEQ's guidance provides to make this judgment of certainty include identified or allocated funding, regulatory applications or approvals, and environmental clearance applications or approvals. The intent of CEQ's guidance is to make sure that future actions that are too speculative to have a high degree of certainty that they will be implemented are not included in the cumulative effects analysis.

USFWS's ESA procedures for determining reasonably foreseeable future actions are even more restrictive. The ESA procedures require that only actions that have completed Section 7 consultation be identified as reasonably foreseeable future actions. The stated rationale for this position is that under the ESA, any future action that could have an impact on a listed species must complete Section 7 consultation before it can be implemented. Therefore, any future action that has not completed Section 7 consultation has not met the reasonably foreseeable definition of certainty.

The District is concerned that USFWS's comments may not be consistent with either CEQ's NEPA guidance or its own ESA guidance because of its recommendation to use a baseline based on future conditions. On the surface, this recommendation appears to be inconsistent with CEQ's baseline and reasonably foreseeable future action guidance as well as USFWS's ESA guidance.

Organization of This Document

USFWS organized its comments by study objective and provided specific comments related to the following seven study criteria, as presented in 18 CFR §5.9(b):

- (1) Describe the goals and objectives of each study proposal and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is a not resource agency, explain any relevant public interest considerations in regard to the proposed study; **(USFWS is a resource agency; therefore, USFWS did not comment on this study criteria.)**
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate filed [sic] season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

This response is also organized by study objective and study criteria. Individual USFWS comments are presented in *italic* font exactly as received. Each comment is followed by the District's response.

USFWS COMMENTS AND DISTRICT RESPONSES

Objective 1: To estimate the relationship between flow in the Loup River bypass reach, ambient air temperature, water temperature, relative humidity, and cloud cover.

Note: In its comment letter, USFWS slightly modified this objective, stating it as “To investigate the relationships between flow in the Loup River bypass reach, ambient air temperature, water temperature, relative humidity, and cloud cover.”

Study Criteria 1 – Goals and Objectives

USFWS Comment

The Service supports Objective 1 as revised in the May 28 and 29 study plan meeting.

District Response

The District appreciates USFWS review and comment.

Study Criteria 2 – Relevant Agency Resource Management Goals

USFWS Comment

The Service supports the inclusion of this objective because potential Project effects to: a) temperature-related effects to least tern forage in the Loup and Platte rivers; and b) temperature-related effects to fish community in the Loup and Platte rivers.

District Response

The District appreciates USFWS review and comment.

Study Criteria 4 – Existing Information and Need for Additional Information

USFWS Comment

The Service recommends additional information to supplement the PSP. The Service supports the 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. The Service recommends the addition of the USGS Gage 06792500, Beaver Creek at Genoa, NE, and USGS Gage 06774000, Platte River near Duncan, NE. The additional streamgage information will assist FERC in segregating Project temperature-related effects on streamflow in the bypass reach from effects to streamflow not related to the Project.

The Service supports the installation of temperature sensors in the Loup River upstream of the Diversion Weir and in the Loup River bypass reach at USGS Gage 06793000, Loup River near Genoa, NE. The Service recommends that the temperature sensor above the Project diversion be located at an upstream segment of the river that is not affected by pooling from the diversion weir. The Service also recommends additional temperature gages for the following locations: a) the Loup River from the Beaver Creek confluence to the Loup mouth; and b) Platte River from the Loup River confluence to the Project tailrace. Service rationale for the additional water temperature sensors is provided in Study Criteria 6.

District Response

The District does not intend to implement these recommendations and provides the following discussion in support of this decision.

Throughout the agency meetings held in the summer of 2008 and the study plan meetings held in 2009, the critical reach for water temperature effects related to fish kills was identified and discussed by the agencies as being from the Diversion Weir downstream to the confluence with Beaver Creek. The District believes that placing temperature probes at the proposed gage locations will allow it to adequately determine if there is a correlation between water temperature and flow or water depth, negating the need to correlate with flow from Beaver Creek or the Platte River.

As noted in the District's study plan, the U.S. Geological Survey (USGS) will assist with temperature probe installation. USGS will provide input regarding mounting locations, and the District will advise USGS of USFWS comments regarding pooling concerns associated with temperature probe locations.

USFWS has indicated its desire for the District to install a temperature probe in the Loup River bypass reach between the Beaver Creek confluence and the Platte River confluence. As discussed and agreed upon in the May 27-28, 2009, Study Plan Meeting, the District will collect temperature data in the Loup River at Columbus as a means to confirm that the water temperature below Beaver Creek is not higher than in the critical reach. If study results in the critical reach show a stronger correlation between flow and/or water depth than to atmospheric temperature, then additional temperature monitoring in the Platte River may be warranted.

Study Criteria 5 – Project Nexus, Study Results, and License Requirements

USFWS Comment

The Project has a direct effect on streamflow in the bypass reach of the Loup and Platte rivers. As written, the associated studies under Objective 1 will provide a baseline evaluation of streamflow and water temperature. Objective 2 will evaluate different action alternative streamflow affects to temperature.

District Response

The District appreciates USFWS review and comment.

Study Criteria 6 – Proposed Methodology

USFWS Comment

The Service views the Projects bypass reach as three separate and discrete study reaches. This first study reach is from the Loup River downstream of the Project diversion to the Beaver Creek confluence. Because Beaver Creek provides inflows that may confound the statistical relationship between Project effects and temperature, it is recommended that the Loup River from the Beaver Creek confluence to the Loup mouth be evaluated as a discrete study reach where temperature-related effects of Beaver Creek streamflow is accounted for when evaluating action alternative streamflow-related effects on temperature. The Platte River from the Loup River confluence to the Project tailrace would be the third discrete study reach. Project-related effects to streamflow in this study segment are confounded by the inflows from the Beaver Creek and the Platte River. The separation of the bypass reach into three study reaches will provide a better understanding of streamflow effects to temperature because each segment has different hydrology for which to compare temperature responses against.

Current methods described in the study plan do not directly test effects of streamflow bypass on temperature. It may be difficult to evaluate alternatives to the existing minimum bypass of 50 to 75 cfs if exceedences of these minimum bypass flows rarely occur. Therefore, the Service strongly suggests changes in Project diversions to directly test the effects of bypassed flows on temperature. If changes in Project operations are not supported by FERC, then the Service proposed supplements to stream gages and temperature sensors would be critical components in evaluating how different flow regimes in each respective study reach will affect water temperature.

The Service supports concepts in Task 3 of the PSP and recommends that applied methods to implement Task 3 should also include methods applied to the central Platte River (Sinokrot and Gulliver 2000). Methods should include percent probability of exceedence of the NDEQ temperature standard and should be applied to all three study reaches. The Service also recommends that the PSP include an evaluation of exceedences of 35°C which represents a critical thermal maximum applied by Sinokrot and Gulliver (2000).

District Response

The District does not intend to implement this recommendation and provides the following discussion in support of this decision.

Neither NEPA nor the ESA requires a specific methodology to analyze impacts. The standard for both laws is to conduct an analysis that is adequate for the Federal agency's decision. The District proposes to analyze flow and air temperature impacts on water temperature in the Loup River bypass reach. This methodology will provide FERC with an analysis that is adequate for its decision.

Furthermore, the District points out that throughout Project scoping and at the study plan meetings held in 2009, the critical reach of the Loup River for water temperature effects was identified to occur between the Diversion Weir and the confluence with Beaver Creek. Furthermore, the District's provided methods were unanimously agreed upon during the May 27-28, 2009, Study Plan Meeting.

The District agreed to collect water temperature data at Columbus as a means to confirm that the reach above Beaver Creek is the critical reach of the Loup River bypass reach with respect to temperature (that is, that no significant increases in water temperature occur downstream of Beaver Creek). If the temperature of the water at Columbus is much higher than the temperature of the water at Genoa, then additional temperature monitoring would be conducted at Columbus for use in developing relationships between flow, water temperature, and ambient conditions at Columbus.

Additionally, the District notes that if water temperature in the Loup River bypass reach is consistently below the state standard, then temperatures above the state standard occurring in the Platte River would likely be due to non-Project related effects from other inputs such as the Platte River upstream of the confluence with the Loup River or the Columbus wastewater treatment plant outfall.

Adjusting Project diversions to directly measure water temperatures of alternative flows is not necessary because the proposed analysis can provide a reasonable result. The flow in the Loup River is not constant, nor is the flow that is diverted from the Loup River to the Loup Power Canal. June, July, and August flow records from 2001 to 2008 from the USGS gage stations on the Loup River near Genoa show that there are a sufficient number of flows in the Loup River bypass reach in the 50 to 300 cfs range (which would be the most critical flow range) to perform regression analysis without the need to extrapolate a possible flow/temperature relationship.

Additionally, over the last 5 years the average flow in the Loup River bypass reach, measured by the USGS gage near Genoa for the combined months of June, July, and August, is approximately 570 cfs with an average maximum flow of approximately 8,600 cfs. If similar flows occur as seen in the past 5 years, there will be ample flow data above 75 cfs with which to perform the proposed analysis.

The District has incorporated a percent probability of exceedance methodology similar to Sinokrot and Gulliver into the District's study plan for Study 4.0, Water Temperature in the Loup River Bypass Reach.

As stated in the District's study plan, the District will use the Nebraska Water Quality Criteria temperature standard of 32°C for evaluation of critical temperatures. This standard was also used by Sinokrot and Gulliver (2000). The District believes 32°C is a more conservative early warning value and will serve the intended purpose and objectives of Study 4.0, Water Temperature in the Loup River Bypass Reach. As stated in their study, Sinokrot and Gulliver used 35°C because this level is "presumed to be a level at which the aquatic biota is more severely stressed than at 32°C."

Study Criteria 7 – Level of Effort and Cost

USFWS Comment

Methods proposed in the PSP do not adequately characterize the Project effects to temperature within the bypass reach. Beaver Creek and the Platte River add flow variability within the Project bypass reach. Service proposed study reaches will segregate the effects of additional Beaver Creek and Platte River effects on streamflow. Service suggested additions to methods are reflective of published, peer reviewed methods for the central Platte River.

District Response

The District does not intend to implement this recommendation and provides the following discussion in support of this decision.

As noted in Objective 1, Study Criteria 6, the District believes that placing temperature probes at the proposed gage locations is adequate to identify Project-related temperature effects in the Loup River Bypass reach. Furthermore, this temperature information will allow the District to adequately determine if there is a correlation between water temperature and flow or water depth, negating the need to correlate with flow from Beaver Creek or the Platte River.

Objective 2: 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.

Study Criteria 1 – Goals and Objectives

USFWS Comment

The Service supports Objective 2 as revised in the May 28 and 29 study plan meeting.

District Response

The District appreciates USFWS review and comment.

Study Criteria 2 – Relevant Agency Resource Management Goals

USFWS Comment

The Service supports the inclusion of this study because of potential Project effects to: a) least tern and piping plover nesting sandbar habitat in the Loup and Platte rivers; b) pallid sturgeon habitat in the Platte River; and c) fish community habitat in the Loup and Platte rivers.

District Response

The District appreciates USFWS review and comment.

Study Criteria 4 – Existing Information and Need for Additional Information

USFWS Comment

The Service recommends additional information to supplement the PSP. Results from the Bypass Reach Objective 2 would be needed to account for reasonably foreseeable effects to the hydrograph that would apply toward all action alternatives.

District Response

The District appreciates USFWS review and comment and offers the following clarification.

The District understands that the evaluation of potential future changes in hydrology (flow depletions or flow increases) related to other reasonably foreseeable future actions will be conducted as part of the cumulative effects analysis included in the license application and environmental assessment. The District does not intend to speculate on future flow scenarios related to other actions as part of the relicensing studies.

In evaluating the cumulative effects of the Project for ESA compliance in relation to other reasonably foreseeable future actions, the District would consult with USFWS to identify those actions that have completed Section 7 consultation. The USFWS evaluation of these other reasonably foreseeable future actions would include identification of impacts, and the District would compare these impacts to the Project's impacts on the same resources and determine if there are overlapping, or cumulative, effects.

Study Criteria 5 – Project Nexus, Study Results, and License Requirements

USFWS Comment

The Project has a direct effect on streamflow in the bypass reach of the Loup and Platte rivers which may affect nesting habitat for the least tern and piping plover in addition to affecting habitat for the fish community. Information collected under Objective 1 should help to differentiate temperature-related effects of action alternatives that have differing streamflow regimes in the bypass reach of the Loup and Platte rivers.

District Response

The District appreciates USFWS review and comment.

Study Criteria 6 – Proposed Methodology

USFWS Comment

The Service recommends that the bypass reach be subdivided into three separate and discrete study reaches. Service also supports changes in Project diversions to directly test the effects of bypassed flows on temperature. It is also recommended that the PSP compare action alternatives effects on temperature in the bypass reach. A comparison of action alternatives should not be based on current hydrology, but on projected hydrology derived from Flow Depletion and Flow Diversion Objective 3.

District Response

The District does not intend to implement this recommendation and references its responses to USFWS comments on Objective 1, Study Criteria 6, and on Objective 2, Study Criteria 4.

Study Criteria 7 – Level of Effort and Cost

USFWS Comment

Methods proposed in the PSP do not adequately characterize the Project effects to temperature within the bypass reach. Beaver Creek and the Platte River add flow variability within the Project bypass reach. Service proposed study reaches will segregate the effects of additional Beaver Creek and Platte River effects on streamflow.

District Response

The District does not intend to implement this recommendation and references its response to USFWS comments on Objective 1, Study Criteria 7.

REFERENCES

18 CFR §5.9(b). Content of study request.

16 USC 1531-1544. Endangered Species Act of 1973, as amended.

42 USC 4321-4347. National Environmental Policy Act of 1969, as amended.

Sinokrot, B.A., and J.S. Gulliver. 2000. "In-stream flow impact on river water temperatures." *Journal of Hydraulic Research*. 38(5):339-349.