LOUP POWER DISTRICT
"SERVING YOU ELECTRICALLY"
GENERAL OFFICE
2404 15th Street
P.O. Box 988
Columbus, NE 68602-0988
Phone:
402/564-3171
Fax:
402/564-0970

***Via Electronic Filing***

May 11, 2011

Honorable Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: Loup River Hydroelectric Project
SISR Meeting Comments
FERC Project No. 1256
Docket 1256-029

Dear Secretary Bose,

Loup River Public Power District (Loup Power District or District) herein electronically files its responses to comments received on the Second Initial Study Results (SISR) Meeting Summary and the Second Initial Study Report for relicensing the Loup River Hydroelectric Project, FERC Project No. 1256 (Project). The District is the owner, operator, and original licensee of the Project. The existing license was effective on December 1, 1982, for a term ending April 15, 2014. Loup Power District is utilizing the Integrated Licensing Process (ILP) for this relicensing effort.

In accordance with 18 CFR §5.15, the District presented the Second Initial Study Results to FERC and other relicensing participants during the Second Initial Study Results Meeting held on February 23 and 24, 2011. After the meeting, comments were received the following:

- Commission Staff
- U.S. Fish and Wildlife Service
- Nebraska Game and Parks Commission

Attached please find the District's responses to the comments received on the SISR. Reponses to each agency's comments are provided separately in Attachments A through C, respectively. No comments were received on the SISR Meeting Summary.

If you have any questions regarding the District's responses, or any information provided by the District, please contact me at (402) 564-3171 ext. 268.

Respectfully Submitted,

Neal D. Suess
President/CEO
Loup Power District

Attachments

May 11, 2011

# Attachment A

## District response to Commission Staff comments on the Second ISR dated April 8, 2011.

## District General Comments

District responses to each of the Commission's April 8 comments are provided below. Because most of the comments relate to the fundamental question of whether hydraulic dredging and hydrocycling adversely impact habitat, the District believes that the following general comment is appropriate to all or most of the Commission's comments:

General Comment 1 – Body of Evidence on Project Impacts on Morphology

The District believes that in wording its comments, FERC seeks to understand what impact hydraulic dredging of sediments at the Project Diversion Weir and hydrocycling at the Columbus Powerhouse for optimal power production, has on habitat. The District also believes that it has demonstrated that the appropriate (and FERC approved) measure of impacts on habitat is properly interpreted through measures of Project impacts on river morphology.

The District performed several separate analyses in the Sedimentation and Hydrocycling studies. These analyses included:

- review of existing literature which identified conclusions of dynamic equilibrium by USACE and others
- sediment transport and parameter calculations
- sediment budget development, including sediment yield adjustments
- specific gage analyses (by the District and USGS)
- regime analysis (by the District and others).

Separately, the results of these analyses provide useful insights into the state of the rivers' morphology. However, when all of the District's analyses from both studies are compiled; they culminate in a complete body of evidence which consistently and irrefutably demonstrates the following:

- the supply of sediment by far exceeds the capacity (not supply limited even with continued hydraulic dredging);
- both the Loup River bypass reach and lower Platte River are in dynamic equilibrium;
  both the Loup River bypass reach and the lower Platte River are well seated in the braided morphology regime for flow hydrographs of all operating scenarios.

1. **Comments on Studies 1.0, 2.0, and 5.0 Goals and Methodology Discussion**
   **Commission Comment 1**
   "Studies 1.0, 2.0, and 5.0 reference an Attachment A, Cross-Section Surveys – Ungaged Sites. Attachment A includes plots of the cross sections for five ungaged sites - two sites on the Loup River and three sites on the Platte River. Cross sections were surveyed either two or three times (depending on the location), to assess changes in the cross sections of the rivers over time. The cross-sectional information obtained from the surveys was used in hydraulic modeling, characterization of the stream morphology, and for calculating sediment transport indicators.

   "When we reviewed the plotted cross sections, we noticed a difference between the position of one or both of the end points (bank stations) used for measuring the cross sections. For example, at Site 3, XS 6, we observed that the cross section surveyed in September appeared to be about 6 percent wider than the same cross section surveyed in May. At the study results meeting, we asked whether the difference between measurements for XS 6 represented a widening of the channel through erosion of the river banks. Loup Power District explained that end points of the cross sections were not monumented so location of the bank stations of subsequent survey(s) may differ from previous survey(s). We need to better understand the possible differences in the cross section that result from variations in the bank station locations. Therefore, please describe how the locations of the bank stations were determined and the expected accuracy of the method used to determine the locations for subsequent survey(s). In addition, please describe how the coordinates of the points along the cross sections were obtained. Lastly, please discuss how the survey accuracy would affect assessment of changes in the cross section of the river over time."

   **District Response**
   A GPS grade survey instrument (Leica GS09 GNSS) was used to perform the survey. The vertical and horizontal tolerances for this equipment are approximately 1 centimeter. The cross section endpoints were established using the latitude and longitude in the GPS equipment. Based on a review of the survey points, and the equipment tolerances, it was determined that the points as reported are accurate. Regarding cross section 6 at site 3, it appears that some bank erosion did occur on the left bank, most likely resulting from the large flow event that moved through the reach after the May survey. However, on the right bank, the end point elevation for the May survey was approximately 5 feet lower in May than in August. This suggests that the survey performed in May did not extend to the actual high bank. The August and September surveys showed no difference in the cross section endpoints. All differences in cross-section width that may be attributed to bank erosion or accretion, occurred upstream of the Project Tailrace Return. There were negligible changes in the cross-section widths at locations

downstream of the Tailrace Return. This suggests that Project return flows had no impact on bank erosion or accretion based on the cross section-measurements. The most important data are the "in channel" elevation differences, which indicate unconstrained and dynamic bed material re-distribution typical of braided systems.

**Commission Comment 2**

"Further, while studies 1.0, 2.0, and 5.0 are separately defined by the Commission's study plan determination, the effects of each process on project resources are inextricably linked. You discuss the effects of hydrocycling on sediment transport parameters in section 4.5 of study 2.0, as well as sediment indicators in relation to current and the no-diversion scenarios in section 4.6.4 of study 5.0. However, in both cases the discussion is limited to the modeling parameters and geometric relationships. The results of sedimentation transport, hydrocycling, and water diversion do not exist in isolation, and therefore, the results of each individual study could have cumulative impacts on select resources (i.e., piping plovers and interior least terns). As such, please provide a summary that synthesizes the results of the aforementioned studies to discuss how the results obtained from each study has the potential to collectively impact the presence, absence, and/or nesting success of piping plovers and interior least terns."

**District Response**

The District understands the need to evaluate the total Project effects in relation to environmental resources, particularly threatened or endangered species. As such, it has been the District's intent to provide a summary of all study results and other information gathered for each species in the Draft License Application (to be filed November 18, 2011) as well as in the Draft Biological Assessment to be included with the Draft License Application. Based on the Commission's request, the District will also provide a summary related to each species in the Updated Study Report to be filed on August 26, 2011.

## 2. Comments on Study 1.0, Sedimentation

**Commission Comment 1**

"In the Initial Study Report, dated August 26, 2010, Loup Power District identified Study 1.0, Sedimentation as substantially complete and included the Sedimentation Study Report as Appendix A. The Second Initial Study Report, dated February 11, 2011, provided additional analyses and included an Addendum to the Sedimentation Study, identified as Appendix A. However, the Sedimentation Addendum did not integrate the results included in the earlier Sedimentation Study Report. Because data and analysis for the tasks are included in two separate documents, it is difficult for us to review and interpret the methodology and results for the entire Sedimentation Study. Therefore, the Updated Study Report, which is scheduled to be filed by August 26, 2011, should be prepared as a stand-alone comprehensive document that consolidates the new

and previously filed information to clearly address the stated objectives for the Sedimentation Study."

**District Response**
The District will prepare a single sedimentation report that includes all analyses from the First and Second Initial Study Reports as well as analyses that are currently ongoing. This all-inclusive report will be filed on August 26, 2011, unless analysis from additional study determinations is still ongoing, in which case the report will be filed upon completion of the additional analysis.

**Commission Comment 2**
"In our "Determination on Requests for Modifications to the Loup River Hydroelectric Project Study Plan," dated December 20, 2010, we required that two referenced publications, which are either out-of-print or not otherwise in general circulation, be included with the Updated Study Report. These two documents should be filed with the Commission so that that may be entered into the record and, therefore, be available for our use in the proceeding and for agency and stakeholder review. Additionally, all publications that are out of general circulation and were referenced subsequent to the Initial Study Report should also be filed with the Commission so that that may be entered into the record. Please note that if you also provide various documents to other interested entities about the project, you should also file these documents with the Commission to ensure they will be put in the public files for the project and so that staff will also be kept aware of any pertinent issues relating to environmental resources that could be affected by the proposed project."

**District Response**
The District filed the following supplemental information with the Commission on April 21, 2011:

- Trends in Channel Gradation in Nebraska Streams, 1913-95; U.S. Geological Survey Water-Resources Investigations Report 99-4103 (Chen, Rus, and Stanton, 1999)
- Platte River Basin, Nebraska, Level B Study; "Land Conservation and Sedimentation"; Missouri River Basin Commission; September 1975
- 2001 Piping Plover and Least Tern Census – Nebraska; Nebraska Game and Parks Commission (Dinan, John J. 2001)
- 2001 International Piping Plover Census; U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center (Ferland, C.L., and S.M. Haig, 2002)

**Commission Comment 3**

"In our Study Plan Determination for the project issued on August 26, 2009, we required that Loup Power District prepare a sediment budget. The sediment budget would: (a) characterize sediment production and routing through river reaches in the project area; (b) describe the relative importance of various sediment sources; and (c) provide a basic framework to evaluate the relative magnitude of project effects on sediments. The sediment (budget) equation is based on continuity and is expressed as:

$$I + \Delta S = O$$

where I is input, $\Delta S$ is change in storage, and O is output.

"The sediment budget is constructed for discrete "cells" or segments along the length of the river, with boundaries corresponding to important changes. For each cell, inputs generally include sediment carried from upstream, point source contributions, and sediment contributed from the watershed. Changes in storage typically include erosion or deposition within the stream channel or floodplain. Outputs can include point source withdrawals and sediment transported downstream from the cell.

"Your sediment budget results presented in the "Sedimentation Addendum" (dated February 11, 2011) do not provide continuity. It does not appear to us that the cell-to-cell interaction of the sediment budget is currently linked in a cumulative, downstream direction. As a result, the net sediment contribution (or deficits caused by project dredging) from upstream reaches (cells) are not being factored into the subsequent downstream cells. Further, it does not appear to us that you have included the sediment flux resulting from floodplain and in-channel storage as a factor in the sediment budget.

"For us to assess the potential cumulative effects of the project on aquatic and riparian habitat, please revise your sediment budget, as appropriate[1], to ensure that continuity is satisfied and sediment flux resulting from floodplain and channel storage is factored into all cells of the sediment budget.

"In addition, please revise the sediment budget data presented in table 5.1 and figures 5-1 and 5-2 of the Sedimentation Addendum so that they include every "node" or "process" within the sediment budget, and each node or process contains all the input information necessary to allow us to make a full examination

[1] Please provide the revised sediment budget to us in an Excel-format spreadsheet that contains all formulas, data, and results in a modifiable format. Include any and all related hydraulic computational spreadsheets or any ancillary analyses used to drive the sediment budget.

of the budget's components and variables. Please revise the aforementioned table and figures to include:

a. the total annual volume of sediment contributed by each source; and
b. the annual sediment flux for all other sources and sinks in the reach (cell)."

**District Response**

The District developed a sediment budget as required in the Study Plan Determination (SPD) and included the results in Section 5.3 of the Updated Initial Study Report. The District's sediment budget was developed based on the methodology described in the Revised Study Plan (RSP) and the modifications noted by the Commission in the SPD as noted below:

RSP:

> "An updated sediment budget will be determined based on the sediment budget and sediment yield analysis completed by the Missouri River Basin Commission in September 1975. In that report, the Platte River Basin was divided into subwatersheds, one of which was the Loup River Basin. Annual sediment yields for each subwatershed were calculated by determining the sediment production from all erosion processes (sheet and rill, gully, and streambank). The sediment yield analysis was then used to create an annual sediment supply available to the river system."
>
> "Since 1975, various studies have provided updated sediment yield estimates on the sediment budget completed by the Missouri River Basin Commission. Information from these studies will be used to revise the sediment budget as appropriate. Updated information includes the sediment transported upstream of the Loup River confluence at Duncan (U.S. Department of the Interior, Bureau of Reclamation, August 2004) and District dredge records, which are recorded and summarized annually."
>
> "The results of the sediment budget will be compared to the total sediment transport calculation described below to assist in determining whether the reach is "flow limited" or "supply limited" for each flow period or alternative analyzed." (RSP (pp. 1-18 & 1-19).

SPD:

> "Therefore as part of Task 2, the District shall adjust the sediment yield calculated for the Loup River and its tributaries downstream of the project's diversion dam as well as the Project's tailrace based on

> documented reductions in dredged material from the project's settling basin." (SPD, page 6)
>
> "At all sites (USGS gage and non-USGS gage sites), the District shall compare the capacity of the flows for total bed material transport to the sediment budget updated under Task 2 and make a determination as to whether the rivers at the sites are currently in states of dynamic equilibrium, degradation, or aggradation." (SPD pp. 10-11, paraphrased for brevity).

The above language makes it clear that the use of the phrase "sediment budget," at least at this reference, is in regard to sediment yield. The paragraph states that the "adjusted budget" would be compared with the capacity of the flows for total bed material transport, which was performed. The District's proposed sediment budget methodology in the RSP did not mention nor include use of the continuity equation, nor did the Commission's SPD specify its use. Furthermore, the phrase, "sediment budget" is not commonly likened in the literature to routing of sediment using the continuity equation. Literature citations regarding sediment budgets generally include comparisons of yield with total bed material transport calculations but do not involve reach-by-reach routing of sediment using the continuity equation. Instead, the term "sediment budget" has a supply/demand connotation, referring to whether the supply matches the transport capacity. Its use in the literature does not normally incorporate details of how the transport occurs through the system or where the sediment is ultimately disposed.

Therefore, the District interprets the Commission's reference to the continuity equation to be a request for additional analysis. As stated in FERC's comments, the method requires knowledge of sediment carried from upstream of the study area (both on the Loup and Platte Rivers), point source contributions, and sediment contributed from the watershed between the study sites. Data for evaluating these important input parameters for a continuity equation analysis do not exist. Earlier discussions with FERC and USFWS of incorporating tributary sources of sediment in the study plan ended when FERC did not require this as a study revision in their SPD. The District believes that evaluations of non-point sources, which are even more complex and time-consuming processes, should be considered nonessential on the same basis.

Applications of the continuity equation require the user to select a time increment for step-by-step solutions of the equation. Applications with river flow and sediment transport data generally use daily time increments, allowing the user to accumulate them over time in order to obtain annual and average annual balances. The April 8, 2011 letter requests that the District supply tables and figures showing the total annual volume of sediment contributed by each source and the

annual sediment flux for all other sources and sinks in the reaches. Data collection or generation to perform this using either daily, monthly, seasonal, or in particular annual, inputs was not included in the study plan and is not readily available.

The District believes that by requesting the continuity equation analysis, FERC seeks to understand what impact hydraulic dredging of sediments at the Project Diversion Weir has on habitat, as measured by analyses of sediment supply and demand and river morphology. The District believes that the "body of evidences" described in General Comment 1 above addresses this concern. All of the data from sediment transport calculations, aerial photo interpretations, sediment yield calculations, independent plots of bed profiles and cross sections, conclusions regarding dynamic equilibrium by the District and other investigators, and data on use by the species show that the supply of sediment by far exceeds the capacity of flows to change the braided river morphology under all operating scenarios.

## 3. Comments on Study 5.0, Flow Depletion and Flow Diversion

**Commission Comment 1**

"In section 1.1.2, you state that the last survey for interior least terns and piping plovers on the Loup River was conducted by Nebraska Public Power District in June 2009 and by the U.S. Fish and Wildlife Service (FWS) in 2010. The 2009 data was included in the information filed with the Commission on December 13, 2010. Please also file the FWS' 2010 bird survey data with the Commission to update the record."

**District Response**

The District has requested and received the updated database of bird survey data from the Nebraska Game and Parks Commission (NGPC) that includes the 2010 survey data that has been provided to NGPC to date. However, the District was informed by NGPC that they have not received the 2009 or 2010 Loup River survey data from USFWS; therefore, the District has requested the 2009 and 2010 data from USFWS. The District will file the additional data with the commission when it is received.

**Commission Comment 2**

"Table 1-1 outlines the distribution and abundance of interior least terns based on the 2005 surveys conducted by the U.S. Army Corps of Engineers. However, after staff review of the reference material listed, we were unable to locate the source of the numbers listed for total adults and colonies reported in the table. Further, the percentages generated for the "Loup River % of Nebraska Total" seem incorrect based on the accompanying numbers provided for both adults and colonies in the table. Please explain what numbers are being used to generate these percentages in Table 1-1, or where the percentages are located in the reference material."

**District Response**

Upon review of the Commission's comment regarding Table 1-1 from the Flow Depletion and Flow Diversion Study, the District realized that the table contained typographical and footnote errors. The District has provided a corrected Table 1-1 below (corrections noted with yellow highlight). Although there were typographical errors in the original table (as included in the study report), the conclusion provided in the text that the significance of the Loup River to the overall recovery of the interior least tern is minimal remains valid. As shown by the corrected values, the Loup River constitutes less than 10 percent of the total interior least tern population in Nebraska and less than 0.5 percent of the total population.

**Table 1-1. Comparative Analysis of Interior Least Tern Range-wide Survey Data**

| | 2005 | |
|---|---|---|
| | Adults | Colonies |
| Total[1] | 17,591 | 489 |
| Nebraska Total[2] | 1,071 | 51 |
| Loup River[3] | 73 | 2 |
| North Loup River[4] | 14 | 2 |
| Lower Platte River[5] | 381 | 15 |
| | | |
| Loup River % of Total Population | 0.42% | 0.41% |
| Loup River % of Nebraska Total | 6.82% | 3.92% |

Source: Lott, C.A., November 2006, Distribution and Abundance of the Interior Population of the Least Tern (*Sternula antillarum*), 2005. U.S. Army Corps of Engineers. EDRC/EL TR-06-13.

Notes:

1 Total bird numbers are for breeding population surveys only. For more information, see Lott, November 2006 summaries.

2 Nebraska total includes birds counted at both on- and off-river habitat throughout Nebraska, but does not include birds counted on the Missouri River within the Nebraska boundaries.

3 Loup River total includes birds counted at both on- and off-river habitat.

4 North Loup River total includes only birds counted at off-river habitat. No birds were documented on-river.

5 Lower Platte River total includes birds counted at both on- and off-river habitat.

Because of the typographical errors found in Table 1-1, the District also reviewed the data in Table 1-2 and identified two instances in which numbers in the table were transposed between 1991 and 2001. The District has provided a corrected Table 1-2 below (corrections noted with yellow highlight).

**Table 1-2. Comparative Analysis of International Piping Plover Census Data**

| | 1991 | | 1996 | | 2001 | | 2006 | |
|---|---|---|---|---|---|---|---|---|
| | Adults | Pairs | Adults | Pairs | Adults | Pairs | Adults | Pairs |
| Total[1] | 5,482 | 2,441 | 5,913 | 2,668 | 5,945 | 2,747 | 8,092 | 3,516 |
| NGP&PC Total | 3,467 | 1,486 | 3,284 | 1,377 | 2,953 | 1,291 | 4,662 | 1,879 |
| Nebraska Total[2] | 398 | 139 | 366 | 155 | 308 | 133 | 909 | 341 |
| Loup River | 14 | 5 | 29 | 6 | 21 | 7 | 19 | 3 |
| North Loup River | 10 | 5 | 4 | 1 | 2 | 1 | 12 | 0 |
| Lower Platte River | 67 | 20 | 53 | 23 | 62 | 21 | 52 | 2 |
| | | | | | | | | |
| Loup River % of Total Population | 0.26% | 0.20% | 0.49% | 0.22% | 0.35% | 0.25% | 0.23% | 0.09% |
| Loup River % of NGP&PC Total | 0.40% | 0.34% | 0.88% | 0.44% | 0.71% | 0.54% | 0.41% | 0.16% |
| Loup River % of Nebraska Total | 3.52% | 3.60% | 7.92% | 3.87% | 6.82% | 5.26% | 2.09% | 0.88% |

Sources: Dinan, John J., 2001, "2001 Piping Plover and Least Tern Census – Nebraska," NGPC.
Elliott-Smith, E., S.M. Haig, and B.M. Powers, 2009, Data from the 2006 International Piping Plover Census, U.S. Geological Survey Data Series 426.
Ferland, C.L., and S.M. Haig, 2002, 2001 International Piping Plover Census, USGS, Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon.
Haig, S.M., and J.H. Plissner, 1993, "Distribution and Abundance of Piping Plovers: Results and Implications of the 1991 International Census," *Condor* 95:145-156.
Plissner, J.H., and S.M. Haig, 2000, Status of a Broadly-Distributed Endangered Species: Results and Implications of the Second International Piping Plover Census, *Canadian Journal of Zoology* 78:1-12.

Notes:

[1] Total bird numbers are for breeding population surveys only. For more information, see Piping Plover Census summaries.

[2] Nebraska total includes birds counted in both on- and off-river habitat throughout Nebraska and includes the Missouri River within the Nebraska boundaries.

**Commission Comment 3**

"The study clearly identifies cross-sectional measurements that were taken at sites both upstream and downstream of the diversion weir. Yet, it was difficult for us to discern which sites (if any) are located on the Platte River below the Loup River confluence and above the project tailrace. These three reaches are listed in the Director's Study Plan Determination as sites that are required to be studied. Please clarify or explain any variances to the Study Plan, which in this instance, appears to only include the collection of cross-sectional data from two stream reaches (i.e., those located above and below the diversion weir)."

**District Response**

The District conducted cross-section surveys at Site 3 (lower Platte River downstream of the Loup River confluence and upstream of the Tailrace Return) per the Study Plan Determination, as noted in Section 3 of the Second Initial Study Report (SISR). Additionally, the District included Site 3 in the HEC-RAS analysis to identify the percent exposed channel width at this Site. However, this information was not included in the District's SISR because the District's evaluation of habitat for the Flow Depletion and Flow Diversion Study focused on a comparison between Sites 1 and 2 (Loup River upstream and downstream of the Diversion Weir) since those two sites provide the most direct comparison of the effects of flow diversion on flow depletion. The District did not perform comparative analysis with Site 3 because Site 3 is located on the Platte River and is affected by incoming Platte River flows and other factors not associated with Project operations, thus the Site 3 information was omitted from the SISR. The District has provided the percent exposed channel width for Site 3 in the following table. Note that the years of analysis for Site 3 are different than those used for Sites 1 and 2 because the wet/dry/normal classification is different for the Platte and Loup rivers.

**Percentage of Exposed Channel Width**
**Site 3, Lower Platte River downstream of the Loup River confluence and upstream of the Tailrace Return**

| Calendar Year of Analysis | Low Flow (75% Exceedance) | | | | Medium Flow (50 % Exceedance) | | | | High Flow (25% Exceedance) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current Operations | | No Diversion Condition | | Current Operations | | No Diversion Condition | | Current Operations | | No Diversion Condition | |
| | Early Summer | Late Summer | Early Summer | Late Summer | Early Summer | Late Summer | Early Summer | Late Summer | Early Summer | Late Summer | Early Summer | Late Summer |
| 2006 (Dry) | 66% | 73% | 23% | 23% | 46% | 58% | 16% | 18% | 24% | 25% | 13% | 17% |
| 2009 (Normal) | 28% | 31% | 13% | 17% | 19% | 19% | 10% | 15% | 13% | 17% | 7% | 11% |
| 2008 (Wet) | 24% | 25% | 13% | 17% | 20% | 20% | 11% | 16% | 13% | 17% | 8% | 11% |

**Commission Comment 4**
"Lastly, staff was unable to locate two of the references cited for Table 1-2, specifically: Dinan, John J., 2001; and Ferland, C.L., and S.M. Haig, 2002. Please file these references with the Commission as described above in Study 1.0, paragraph 2."

**District Response**
The District filed the following supplemental information with the Commission on April 21, 2011:

- Trends in Channel Gradation in Nebraska Streams, 1913-95; U.S. Geological Survey Water-Resources Investigations Report 99-4103 (Chen, Rus, and Stanton, 1999)
- Platte River Basin, Nebraska, Level B Study; "Land Conservation and Sedimentation"; Missouri River Basin Commission; September 1975
- 2001 Piping Plover and Least Tern Census – Nebraska; Nebraska Game and Parks Commission (Dinan, John J., 2001)
- 2001 International Piping Plover Census; U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center (Ferland, C.L., and S.M. Haig, 2002)

## Attachment B

**District response to U.S. Fish and Wildlife Service (USFWS) comments on the Second ISR, dated April 7, 2011.**

### District General Response 1 – Project Effects to Federally Listed Species

The District believes that any opinion regarding affect to species is premature at this time. The studies requested by FERC with regard to the District's relicensing are not yet complete; therefore, USFWS does not yet have all of the scientific and commercial data that the District is compiling. Furthermore, it is the District's understanding that a "may adversely affect" determination is a term legally reserved for the Federal action agency pursuant to the ESA (16 U.S.C. 1531 et seq.) – in this case FERC. Therefore, the District respectfully disagrees with USFWS' determination that the Project "may adversely affect" whooping crane, interior least tern, piping plover, and pallid sturgeon.

The District, as FERC's Designated non-Federal Representative for informal consultation under Section 7 of the Endangered Species Act, will prepare a biological assessment that will consider all available information and make an affect determination to be submitted to USFWS. This determination will include an assessment of the results of the analysis from all of the studies prepared for relicensing, results of studies prepared by others, and other scientific data available about the species, including migratory patterns, habitat ranges, and population dynamics. The District looks forward to coordinating with USFWS during preparation of the Biological Assessment.

### District General Response 2 – Long-Term Effects

The relicensing process requires evaluations of proposed conditions against existing conditions – not existing or proposed conditions against pre-Project conditions. USFWS' reference to "long-term change in the channel morphology of the Loup River bypass reach" implies that their stated "may adversely affect" determination [a term legally reserved for the Federal action agency pursuant to the ESA (16 U.S.C. 1531 et seq.) – in this case FERC] is based on a comparison of pre-Project conditions – a comparison outside the purview of the relicensing process. If the phrase "long-term change" is a reference to the future, the District's studies show that no morphological changes have occurred in the 25 year (and longer) study period. The specific gage analysis, sediment transport indicators, and regime analyses all show that the Loup River bypass reach channel is in dynamic equilibrium and well seated in the braided river regime, and this would not change under the District's proposal to continue existing operating conditions. Because there is no trend toward a change in morphology, the proposed relicensing of the Project would not impact morphology or instream habitat suitability.

Cumulative effects, which will consider past, present, and reasonably foreseeable future actions, will be evaluated with Project effects as part of the license application.

1. **Comments on Project Effects to Whooping Crane**

   **USFWS Comment 1**

   "The Service has determined that Project operations may adversely affect the whooping crane (*Grus americana*) within the bypass area of the Loup River. Adverse effects include a long-term change in the channel morphology of the Loup River bypass reach and Project diversion-related effects to instream habitat suitability."

   **District Response**

   The District believes that USFWS' determination of "may adversely affect" is premature as noted in District General Response 1. Additionally, the District interprets USFWS' use of the phrase "long-term effects" as referencing a comparison to pre-Project conditions, which the District believes is outside the purview of relicensing as noted in the District General Response 2.

   Additionally, the District provides the following information: 1) whooping cranes do not inhabit the Project Boundary, 2) there are only three recorded whooping crane sightings on the Loup River or its tributaries, 3) the population of the western (natural) flock of whooping cranes has increased exponentially since 1940, and 4) results of the Flow Depletion and Flow Diversion Study indicate that the Loup River does not contain preferred whooping crane roosting habitat either above or below the Project Diversion Weir. Details on these statements are as follows:

   1) There are no documented whooping crane sightings in the Project Boundary (NGPC, October 2, 2008). The nearest point of the Project Boundary lies approximately 35 miles east of the USGS-delineated whooping crane primary migration corridor, an area in which 82 percent of all confirmed post-1949 sightings in Nebraska occur (USGS, August 3, 2006). USGS determined the primary migration corridor through Nebraska to be between 100 and 120 miles wide by plotting all of the confirmed sightings in the state during the last 30 years and drawing straight lines to enclose 70 to 100 percent of the sightings at each latitude (USGS, August 3, 2006). USGS goes on to state that "the remaining sightings [outside of the primary migration corridor] are primarily to the west [of the primary migration corridor]." As stated previously, the Project Boundary is 35 miles east of the primary migration corridor.

   2) Documented whooping crane sightings on the Loup River and its tributaries include (NGPC, October 2, 2008):

- 2006 – documented sighting of an isolated family group of whooping cranes on the Loup River, approximately 8 miles upstream of the Diversion Weir (NGPC, October 2, 2008). This sighting was an isolated occurrence during the spring migration season.
- 1999 – confirmed sighting during fall migration near Fullerton, Nebraska, on the Loup River.
- 1996 – confirmed sighting near Belgrade, Nebraska, on the Cedar River.

Whooping cranes do not typically frequent the study area and are usually found on the central Platte River, west of Grand Island, Nebraska. However, in 2010, an isolated family group of whooping cranes was sighted on the lower Platte River upstream of Rogers, Nebraska (approximately 21 miles downstream of the Project Tailrace Return (USFWS, 2010).

3) The population of the western (natural) whooping crane flock has increased from 22 whooping cranes in 1940 to 279 whooping cranes in 2011 (Journey North, May 10, 2011). This represents an increase of 1,168%. The District notes that the decline of the species occurred primarily prior to the period of Project operation which began in 1938 and that the species increase is coincident with the period of Project operation (although the District in no way implies that the population increase is linked to Project operations).

4) Results of Study 5.0 Flow Depletion and Flow Diversion related to whooping crane roosting habitat indicate that the unobstructed widths and shallow water channel percentages of the Loup River both upstream and downstream of the Diversion Weir are outside of the range observed at whooping crane roost sites in Nebraska as shown in the following table.

| | Unobstructed Width Feet | Shallow Water Percentage |
|---|---|---|
| Nebraska Range | 1,165 to 2,625 | 40 |
| Upstream of the Diversion | 1,050 to 1,077 | 34 to 38 |
| Downstream of the Diversion | 652 to 669 | 20 to 30 |

Additionally, the average percentages of the channel upstream (11 to 24 percent) and downstream of the Diversion Weir (10 to 16 percent) that

consisted of shallow water/wet sand are both well below the 40 percent of the channel with shallow water depths that have been noted at preferred whooping crane roost sites in Nebraska.

**USFWS Comment 2**

"Diversion of water at the Project diversion has resulted in long-term effects to the channel morphology in the Loup River bypass reach. Study sites upstream of the Project diversion have wider channel widths compared to study sites downstream of diversion (see General Comment 1). Differences in channel widths are relatively stable with less than 3 percent change for the five years of evaluated data (Table 5-7, SISR Flow Depletion/Diversion). This reduction in channel width for the Loup River bypass reach constrains maximum "wetted widths" (or inundated channel width) (see General Comment 2). Study sites upstream have a larger percentage of mid-channel bars in comparison to downstream sites which have a higher proportion of point bars. Mid-channel bars provide roosting habitat (i.e., water less than 0.8 feet) that is higher in suitability compared to point pars (see General Comment 3)."

**District Response**

The District interprets USFWS' use of the phrase "long-term effects" as referencing a comparison to pre-Project conditions, which the District believes is outside the purview of relicensing as noted in District General Response 2.

In response to USFWS' comments on channel and wetted widths upstream and downstream of the Diversion Weir, and to the incidence of mid-channel versus point bars, see the District's responses to USFWS General Comments 2 and 3 below. The differences being addressed in these comments are due to different flow hydrographs passing through each location. The District acknowledges the differences but believes that the studies show that both channels are in dynamic equilibrium. USFWS acknowledges that the different channel conditions are "relatively stable." Because no trend toward a different morphology is occurring nor will occur under the District's proposed operating scenario (current operations), the proposed scenario cannot impact morphology, habitat, or its suitability.

The District notes that while more mid-channel bars were observed upstream of the Diversion Weir in the photo interpretation, other factors linked to whooping crane habitat are also different between upstream and downstream of the Diversion Weir:

- There are more sandbars upstream of the Diversion Weir than downstream, but they are smaller in size; therefore, downstream bars have a higher percentage of bare sand area per river mile and bare sand area per sandbar.

- There is a higher percentage of vegetation on sandbars downstream than on those upstream of the diversion.
- Downstream sandbars have an overall higher percentage of shallow water/wet sand per river mile.

Based on these results, there are both positive and negative conditions relative to potential whooping crane habitat when comparing upstream and downstream conditions. Furthermore, as noted in the District's response to Whooping Crane Comment 1 above, unobstructed widths (another important feature of whooping crane roost sites) both upstream and downstream of the Diversion Weir, are less than the minimum observed widths at whooping crane roost sites in Nebraska.

As identified in the SISR, this analysis is based on the available aerial imagery and represents a snap-shot in time and the observed conditions on that day.

**USFWS Comment 3**

"Information provided by the SISR has been helpful in quantifying long-term changes in the channel morphology. Outside of effective (or dominant) discharge and transport capacity, the SISR provides no information that explains differences in channel morphology for the Loup River upstream of the Project diversion and within the bypass reach. It was identified in the February 24, 2011, SISR meeting transcript that, in absence of diverted water, the Loup River bypass area would have similar characteristics as the Loup River upstream of the diversion (Page 153, Lines 23-25 and Page 154, Lines 1-9). The Service has proposed modifications in the Proposed Modifications to Studies section of this document. Service recommendations for a longitudinal (spatial) comparison of all Loup River study sites would be essential in quantitatively assessing how differences in effective (or dominant) discharge would explain differences in channel morphology."

**District Response**

See the District's General Response 2 above in reference to the use of the phrase long-term effects and/or changes.

The District agrees with USFWS that the cross sections and other data in the SISR accurately disclose differences in channel and hydraulic characteristics upstream and downstream of the Diversion Weir, although not all of their conclusions are corroborated.

However, the District disagrees that the differences are not explained. As clearly shown in the SISR, the differences are primarily the result of changes in the flow hydrographs resulting from the Diversion Weir. Nothing in the SISR or earlier reports suggests that these characteristics would be expected to be the same. As noted in earlier reports and presentations, sediment transport and morphology are

related to the flow hydrographs, and different flow hydrographs produce different transport and morphological results.

Two close-proximity, similar areas experiencing different hydrographs acting on the same medium (river bed and banks) would be expected to, and did, produce different channel and hydraulic characteristics. Ample rather than "no" explanations of the differences in sediment transport, morphology, channel geometry, channel hydraulics, and other parameters at the two locations have been provided. In particular, the cross sections and hydraulic model results readily document the differences.

With regard to the comment about changes expected under the no diversion condition, it is not only intuitively but morphologically correct that under the no diversion condition, the Loup River bypass reach would over time develop characteristics similar to the upstream location. The District refers USFWS to the SISR statement on page 79, 3rd paragraph, where in comparing channel characteristics, the statement is made, "As expected the Width, Depth, and Velocity below the diversion weir would be different [than existing] under the no diversion option due to increased flow rates." Additional text is provided in SISR Study 5.0, paragraphs 3 through 5 on page 79 in Study 5.0 Flow Depletion and Flow Diversion.

With regard to the proposed modifications to studies described in Whooping Crane Comment 3, the SISR already performed and included the longitudinal (spatial) analysis of the Loup River study sites (see SISR Study 5.0, Tables 5-11 through 5-14). The tables and supporting text show that the observed (and reported) differences in channel geometries are consistent with the effective and dominant discharges resulting from the combination of different flow hydrographs acting in shaping the channel differently at each location. The morphology at each site is in dynamic equilibrium.

Based on the above, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

**USFWS Comment 4**

"SISR results have also indicated that flow changes in Loup River bypass affect channel metrics used as indices for whooping crane habitat. The Service supports the use of the SISR variables channel width with water less than 0.8 feet recognizing its limitations in addressing all habitat suitability indices (see General Comment 3). When compared to the Current Operation condition, the No Diversion condition improves shallow water habitat at relatively lower flows while decreasing shallow water habitat at higher flows (see General Comment 3). Maximum channel width with water less than 0.8 feet is also constrained by the

channel's maximum wetted channel widths (see General Comment 3). Based on information from General Comment 2, the No Diversion condition provides for wider wetted widths at Study Site 2 compared to the Current Operations condition. In summary, changes in flow bypass would result in both positive and negative effects to whooping crane habitat suitability criteria."

**District Response**

The differences between the no diversion condition and current operations for flow bypass are well within the range of flows that occur in the Loup River bypass reach under existing conditions. Under current operations, flows that are associated with the no diversion condition can, and do occur. For example, the median discharge for a normal year under the no diversion condition occurs annually, on average, 10 percent of the time under current operations. Therefore, a range of conditions for shallow water habitat for whooping crane exists under current operations. The District believes that because USFWS concludes that "changes in bypass flows would result in both positive and negative effects on whooping crane habitat suitability criteria," the conclusion in Whooping Crane Comment 1, that "Project operations may adversely affect the whooping crane within the bypass area of the Loup River," is neither scientifically sound nor appropriate. See also the District's General Response 1 regarding USFWS' comparison of pre-Project conditions with current operations, and District General Response 2 regarding their premature opinion on adverse effects.

2. **Comments on Project Effects to Interior Least Tern and Piping Plover**

**USFWS Comment 1**

"The Service has determined that Project operations may adversely affect the Interior least tern (*Sternula antillarum*) and piping plover (*Charadrius melodus*) within the bypass area of the Loup and Platte rivers. Diversion of water at the Project diversion has resulted in long-term effects to the channel morphology of the Loup River and Platte River bypass reach. Project diversion may also increase the probability of high temperature exceedances which may affect the food source for least terns. Project hydrocycling operations may also increase the risk of least tern and piping plover nest and chick mortality from water inundation. Limitations in the Sedimentation and Hydrocycling methods limit the Service's ability to discern Project sediment and hydrocycling effects to channel habitat, sandbar formation, and sandbar permanence."

**District Response**

The District believes that USFWS' determination of "may adversely affect" is premature as noted in District General Response 1. Additionally, the District interprets USFWS' use of the phrase "long-term effects" as referencing a comparison to pre-Project conditions, which the District believes is outside the purview of relicensing as noted in the District General Response 2.

**USFWS Comment 2**
"Diversion of water at the Project diversion has resulted in long-term effects to the channel morphology of the Loup River and Platte River bypass reach. Study sites upstream of the Project diversion have wider channel widths compared to study sites downstream of diversion (see General Comment 1). This reduction in channel width for the Loup River bypass reach constrains maximum wetted channel widths (see General Comment 2). Study sites upstream of the Project diversion also have a larger percentage of mid-channel bars in comparison to downstream sites which have a higher proportion of point bars (see General Comment 3). Study Site 3, located within the Platte River bypass area, has narrower channels compared to study sites downstream of the Project's tailrace return (see General Comment 4)."

**District Response**
See the District's General Response 2 above in reference to the use of the phrase "long-term effects."

Interior least tern and piping plover Comment 2 contains two categories of USFWS' comments that are nearly identical to topics addressed in response to USFWS's Whooping Crane Comment 2, namely, channel and wetted width differences across the Diversion Weir site and incidence of mid-channel versus point bars. The District's response to each was presented in our responses to USFWS's Whooping Crane Comment 2 as well as in our responses to General Comments 2 and 3 below. In reference to the comparison of channel widths at Sites 3 and 4, the District refers USFWS to the District's response to USFWS' General Comment 4 below.

**USFWS Comment 3**
"Project temperature-related events are addressed in the Interior least tern section because of the potential for catastrophic fish kills affecting least tern food availability. Exceedances of the Nebraska Department of Environmental Quality water quality standard to support warm water aquatic life (i.e., 90 degrees Fahrenheit) represent an increased risk for fish kills. Table 5-16 of the SISR - Temperature clearly shows the relationship between flow and the probability of temperature exceedances. Subsequent multivariate approaches add too much variability to their analyses which diminishes any relationship between flow and water temperature exceedances. To address limitations to the temperature methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document. The Service supports SISR conclusions that it is difficult to predict the relationship between streamflow and temperature at the Platte bypass area because of the influence of Platte River streamflow. The Service is still concerned about how streamflow could affect probability of

temperature exceedances in the Platte River bypass area, but recognizes that there is a limited ability for studies to quantify effects with a within the time constrained study period."

**District Response**
The District acknowledges that three fish kills have been documented in the Loup River bypass reach; however, the District disagrees with the use of the word "catastrophic" to describe these incidents. Neither the NGPC reports nor the NDEQ reports use the term catastrophic.

Furthermore, the District provides the following information related to the fish kills that have occurred to provide perspective on each incident:

- July 1995 – report indicates an "unknown" number of fish died
- July 1999 – report indicates "large numbers of mixed species"
- July 2004 – report indicates that 15 channel catfish, 14 minnows, and 1 river carpsucker died, for a total of 30 fish.

USFWS references Table 5-16 (District assumes USFWS meant Figure 5-16) as clearly showing the relationship between flow and temperature exceedances. Figure 5-16 shows the Sinokrot and Gulliver analysis specifically requested by USFWS. The District disagrees with USFWS' conclusion that the Sinokrot and Gulliver method established a correlation between low flows and water temperature excursions. The District believes that the exceedance probability results support the District's conclusion that there is not a significant relationship between low flows and water temperature excursions. For example, using linear interpolation between the data points on the exceedance probability plots at Merchiston (Figure 5-3), the 75 percent exceedance flow rate is 2,000 cfs, while at Genoa (Figure 5-16), the 75 percent exceedance flow rate is approximately 120 cfs. If flow was a primary factor in water temperature, the District would expect a 2,000 cfs flow to have a percent exceedance of approximately 13 percent at Merchiston, rather than a 75 percent.

Furthermore, as noted in their comment, USFWS originally supported the multivariate analysis proposed by the District (USFWS June 24, 2009, p. 13). The District analyzed hourly data, daily maximum data, and all data above 63degree F by using linear regression, multiple regression, and logistic regression. The logistic regression was specifically chosen to reduce variability as the 75th percentile range of maximum daily water temperature readings (88.55 degree F) was used as the cut point to code the daily maximum water temperature values for a binary contrast. All values below the 75th percentile range (n = 59) received a contrast code of 0, and all values above the cut point (n = 19) received a contrast

code of 1. By reducing the data down to a binary 1 or 0, objections to 'variability' are addressed.

Based on the above and additional information provided in relation to USFWS' proposed methods provided below in USFWS Comment 3 – Conduct Temperature Analysis for Platte River Bypass Area, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

**USFWS Comment 4**

"Project hydrocycling operations may directly affect individuals via nest inundation. The Service has enclosed a review of by Joel Jorgensen, Nongame Bird Program Manager of the Nebraska Game and Parks Commission (NGPC), Objective 2 methods. In the review, Mr. Jorgensen identifies several shortcomings of the SISR nest inundation analysis. After reviewing Mr. Jorgensen's review, the Service has identified two shortcomings that affect the SISR method's ability to accurately model the potential for nest inundation. The model incorrectly assumes that the high flow event February 1 through April 25 sets the peak stage for nest inundation. The model also incorrectly assumes that all birds nest on bars at a single, uniform elevation. The inclusion of these assumptions, some of which were originally promoted by the Service, could not pass a validation test using recently collected nesting data. The Service supports the alternate methods developed by Mr. Jorgensen because the proposed methods represent a means of addressing the shortcomings in the prior assumptions. By evaluating inundation risk based on incremental ranges of potential nest elevations, the alternate methods is better able to predict nest inundation risks associated with hydrocycling."

**District Response**

As noted in their comment, USFWS based their comments related to nest inundation on the analysis provided by Joel Jorgensen, NGPC. Mr. Jorgensen's analysis is also provided in NGPC's comments dated April 11, 2011. Since USFWS' comments are identical to those raised by NGPC, the District refers USFWS to the District's response to NGPC comments in Attachment C.

**USFWS Comment 5**

"It is currently not known if Project hydrocycling operations affect nesting habitat via sandbar erosion. Limitations in the hydrocycling methods also limit the Service's ability of to discern Project hydrocycling effects to sandbar formation and permanence. Hydrocycling has resulted in exposed channels widths in the Platte River that were narrower downstream from the tailrace than what was calculated for run-of-river operations (SISR Hydrocycling, page 40). However, this effect is likely the result of a fixed bed analysis evaluating only changes in river stage associated with hydrocycling. It is difficult for the Service to assess sandbar erosion rates for Study Site 3 because a June peak flow redistributed

sandbars between cross-section measurement dates. The redistribution of sandbars eliminates any ability to assess sandbar erosion rates at Study Site 3. Since Study Site 3 represents a no hydrocycling condition, it is difficult to compare erosion rates of sandbars at Study Site 3 to Study Sites 4 and 5. To address limitations to the hydrocycling methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document."

**District Response**

The District believes that the data and analyses provided to date are adequate for a determination of whether hydrocycling affects habitat. All the study reaches are well seated within standard definitions of braided rivers, and sandbar formation and permanence (or lack of) are the results of physical processes operating in any braided river. Sandbars and channel braids are constantly shifting in location and geometry, which is shown in the cross sections taken as part of this study. The District notes that USFWS' reference to "permanence" of sandbars is misleading because permanent sandbars are subject to vegetative establishment, resulting in formation of islands. Additionally it is high flows, which the District does not affect, that can remove vegetation from islands.

The District notes that the statement "exposed channel widths in the Platte River were narrower downstream from the tailrace than what was calculated for run-of-river" is not correct. The SISR states that the modeled ***percentage*** of exposed channel width was less under current operations, at Sites 4 and 5.

The cross-section data clearly documents the dynamic and rapid response of sediments in the active channel to flows passing through each reach. Shifts in braid locations and the sandbar sizes and rates of sandbar erosion and re-construction, are readily evident in the data. The data also show that these highly mobile sandbar erosion and re-construction conditions occur under discharge hydrograph conditions far less than those USFWS has stated as being needed for maintenance of the morphology and habitat.

Cross-section data at Site 3 showed similar dynamic impacts of flows on channel geometry as Site 4. Since Site 3 experienced essentially the same high flows as Site 4 it is not clear why USFWS cannot assess bar erosion rates at that site in order to evaluate the run-of-river condition.

The sediment transport indicators revealed that the effective and dominant discharges downstream of the Tailrace Return under hydrocycling conditions at Site 4 were slightly greater than under run-of-river operations. Because the relationship between equilibrium active channel width and these indicators ($Q_e$ and $Q_d$) is upward sloping, the equilibrium channel widths would be, and are, greater under current operations.

See also the District's responses USFWS Comment 1 – Expand Platte River One Dimensional HEC-RAS Modeling to Include July. Based on the above, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

**USFWS Comment 6**

"Project diversion operations may not affect sediment balance at the Loup River bypass area. The 1,445,000 tons of sediment removed by dredging operations is similar to the 1,480,000-ton sediment surplus at Study Site 2 (See General Comment 5). Total sediment transported downstream of the Project diversion is equivalent to sediment transported from upstream of the diversion. This similarity may imply that Project does not affect the Loup River sediment balance although Project effects to physical habitat exist via the reduction in effective discharge in the Loup River bypass area."

**District Response**

The District acknowledges that the data show that Project operations do not affect the sediment balance in the Loup River bypass reach. Because this comment and General Comment 5 – Loup River Sediment Transport refer to sediment "surplus" at Site 2, the District has composed its response under General Comment 5 – Loup River Sediment Transport.

**USFWS Comment 7**

"Project diversion operations have resulted in sediment deficits at the Project's tailrace return. The cumulative sediment deficit as a result of Project flow diversion and hydrocycling operations is approximately 1,606,000 tons per year (see General Comment 6). The volumes of sediment deficit, assuming a bulk density of sand at 1.9 tons per cubic yard (Kinzel, 2009) is 845,263 cubic yards of sediment per year. This represents 845,263 cubic yards of sediment that is removed from the available sediment supply (i.e., riverbed and sandbars) near the Project tailrace return on a yearly basis. Limitations in the Sedimentation methods limit the Service's ability to discern Project sediment-related effects channel habitat. One sedimentation study product was the longitudinal (spatial) comparison of all sites on the Loup and lower Platte River study sites starting at the most upstream site on each river, and progressing downstream. The Service has determined that a longitudinal comparison of sediment transport, as represented in Table 5-1 of the Sedimentation Addendum, is not adequate in relating sediment transport effects to channel morphology. To address limitations to the sedimentation methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document."

**District Response**

As discussed in the District's response to USFWS General Comment 6, the District notes that the no diversion and run-of-river conditions are mutually exclusive (i.e., if the District is not diverting water, they will be unable to hydrocycle); therefore, the effects cannot be accumulated, as is implied in the 1,606,000 tons per year value USFWS uses. Because this comment and General Comment 6 refer to a sediment "deficit" at Site 4, the District has composed its response under General Comment 6 below.

Based on the facts presented in its response to General Comment 6, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

## 3. Comments on Project Effects to Pallid Sturgeon

**USFWS Comment 1**

"The Service has determined that the Project hydrocycling operations may adversely affect the pallid sturgeon (*Scaphirhynchus albus*). The SISR evaluated Project hydrocycling effects to on the pallid sturgeon suitable habitat as defined by Peters and Parham (2008). The Service would like to note that the applied microhabitat metric of Percentage of Suitable Pallid Sturgeon Habitat (Sturgeon Habitat) is not truly habitat unless it is available to the species. Parham (2007) identified that the lower Platte River is generally unconnected at discharge rates below 4,400 cubic feet per second (cfs) and rapidly becomes connected as discharges reaches 6,300 cfs. The river can be considered fully connected at a discharge of 8,100 cfs. Conclusions from the Lower Platte River Stage Change Study also validate conclusions from Parham (2007). The Lower Platte River Stage Change Study identified Run and Plunge habitats (i.e., pallid sturgeon microhabitat) are mostly connected across the width of the river at 6,000 cfs (HDR et a1., 2009). Discharges less than 6,000 cfs may lower water elevations enough to limit access for pallid sturgeon since they will not or cannot move through Flat or Slackwater habitat. In summary, Sturgeon Habitat identified in the SISR may not represent habitat that is accessible by the species."

**District Response**

The District believes that USFWS' determination of "may adversely affect" is premature as noted in District General Response 1.

The District concurs that connectivity plays an important role in accessing any habitat that may be available to the pallid sturgeon. However, it is important to note that the Lower Platte River Stage Change Study identified Run and Plunge Habitat as pallid sturgeon habitat solely based on depth and velocity. From simple depth and velocity information, the study made the assumption that Flat or Slackwater habitat may not be used by pallid sturgeon. However, these areas (as defined in the Lower Platte River Stage Change Study) have been found to

provide foraging areas (Hurley et al., 2004; USFWS, 1993) and movement pathways for the pallid sturgeon (Peters and Parham 2007; Mark Pegg, personal communication). It is also important to note that the Lower Platte River Stage Change Study scope did not include connectivity or temporal availability issues.

**USFWS Comment 2**

"The Service used information in the Hydrocycling Attachment J of the SISR to evaluate Project effects to connectivity of Sturgeon Habitat using connectivity thresholds developed by Parham (2007). Optimal habitat represents fully connected habitat at 8,100 cfs and is equivalent to Sturgeon Habitat at 27-percent or higher. Habitat with moderate connectivity occurs when flow is greater or equal to 6,300 cfs but less than 8,100 cfs (i.e., Sturgeon Habitat ≥ 24-percent but < 27-percent). Habitat with a minimum level of connectivity occurs when flow is greater or equal to 4,400 cfs but less than 6,300 cfs (i.e., Sturgeon Habitat ≥ 15-percent but < 24-percent). Habitat that is completely unconnected occurs when discharge falls below 4,400 cfs (Sturgeon Habitat < 15%)."

"The Service applied levels of Optimal Connectivity, Moderate Connectivity, Minimum Connectivity, and No Connectivity to Current Operations and Run-of-River Operations values using data from Tables 5-18 through 5-29 in the SISR Hydrocycling Section. The Service developed the following classification system to compare changes in connectivity for Current and Run-of-River Operations.

"1 = No Connectivity for Current and Run-of-River Operations
2 = No Connectivity Current Operations, Minimum Connectivity Run-of-River Operations
3 = Minimum Connectivity Current and Run-of-River Operations
4 = Minimum Connectivity Current Operations and Moderate Connectivity Run-of-River Operations
5 = Moderate Connectivity Current and Run-of-River Operations
6 = Moderate Connectivity Current Operations and Optimal Connectivity Run-of-River Operations
7 = Optimal Connectivity Current and Run-of-River Operations
8 = Minimum Connectivity Current Operations and Optimum Connectivity Run-of-River Operations"

"Results of the pallid sturgeon habitat connectivity evaluation are in Tables 1 through 12 of this document. Project effects to pallid sturgeon habitat connectivity are infrequent during the winter months of December and January. Project effects to pallid sturgeon habitat connectivity during the low flow months of July through October are primarily limited to the Ashland and Louisville study sites. The most prominent Projects effects to connectivity occur from February through June and in November. For certain months, Projects effects to connectivity occur upstream to Study Site 4. Additionally for the months of March, April, May, June, and November, there is some level of connectivity at

Study Site 4 for the Run-of-River operations, but this connectivity is not present at Study Site 3. These losses of connectivity at Study Site 3 could imply Project diversions potentially affecting pallid sturgeon habitat in the Platte River Bypass area."

**District Response**

The District concurs that pallid sturgeon will utilize habitat that is available if they can access it, but USFWS has not provided analysis that shows that run-of-river operations would improve the habitat available to the pallid sturgeon, especially above the Elkhorn confluence. Furthermore, the District notes that as flows naturally start to decline in the stream during the summer months, pallid sturgeon will move out of the Platte River into deeper waters (i.e. the Missouri River). The District notes that to date, there have been no reported cases of pallid sturgeon mortality due to stranding within the Study Area.

The District also recognizes that connectivity will increase as higher discharges increase connectivity pathways within the lower Platte River. Parham (2007) define connectivity as

> "…like a large maze with no "solutions" (fully connected paths) at low discharges. As discharge increases more paths are provided at the beginning of the maze starting at the confluence of the Platte River with the Missouri River and increase access upriver longitudinally. The paths through the maze increase as additional areas become connected at higher discharge until a path is "optimized" from the mouth of the Platte River to the mouth of the Elkhorn River."

Based on this definition, more pathways become available as discharge increases. As conditions become favorable, pallid sturgeon and other fish will utilize the sections of the river that contain habitat suitable for them. As flow increases and connectivity increases, fish will migrate into and out of the area. However, the District disagrees with USFWS' analysis of connectivity for the following reasons.

First, the District would like to note that USFWS' analysis used minimum percent suitable habitat (thus minimum flows), rather than average or maximum percent suitable habitat. The District notes that analysis of average or maximum percent suitable habitat would yield different results that would likely indicate equal or more connectivity under current operations than under run-of-river operations.

Second, the District questions the validity of the Peters and Parham (P&P) connectivity analysis. The P&P connectivity analysis is based on information from aerial photo interpretation for years ranging from 1993 through 2002. Table 10.3 in Chapter 10 of P&P (2008) lists the data that was used to develop the P&P

connectivity equation (Equation 10.6) which USFWS in turn used to identify their flow rates for optimal, moderate, and minimal connectivity. The District notes that although Equation 10.6 may yield full connectivity at 8,100 cfs, the data in Table 10.3 identify full connectivity at much lower discharges. Table 10.3 of the report includes data for 29 contiguous segments of the Platte River with discharges ranging from 0 to 21,000 cfs, of those 29 segments, 20 are listed as being 100 percent connected representing flows from 5,610 cfs to 21, 000 cfs. Furthermore, there were only 4 segments with discharges above 5,610 that are listed as less than 100 percent connected (connectivity values of 72.3, 92.7, 96.6, and 91.1). Additionally, the 5 segments with discharges less than 5,610 had connectivity values as shown in the following table.

**Connectivity vs. Discharge**

| Discharge (cfs) | Percent Connected |
|---|---|
| 0 | 0 |
| 1,440 | 13.8 |
| 2,450 | 19.3 |
| 2,840 | 13.5 |
| 4,080 | 31.2 |

Source: Table 10.3, Peters and Parham (2008)

The District believes that the raw data points used by P&P to develop Equation 10.6 illustrate fully connected habitat at much lower discharges than noted by USFWS in their connectivity analysis. Based on this information, the District believes USFWS' connectivity analysis is not valid.

**USFWS Comment 3**

"The pallid sturgeon may also be affected by Project bypass operations. Study Site 3, located within the Platte River bypass area, has narrower channels compared to study sites downstream of the Project's tailrace return (see General Comment 4). This reduction in channel area reduces the proportionate area of pallid sturgeon habitat. Additionally, sediment deficits at the tailrace return (see General Comment 6) may also affect habitat suitability for the pallid sturgeon. However, aforementioned limitations in Sedimentation methods limit the Service's ability to assess how sediment deficits at the project's tailrace affects pallid surgeon habitat. To address limitations to the sedimentation methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document."

**District Response**
The District has demonstrated that sediment is not a limiting factor, there is no sediment deficit, and that the river is in a dynamic equilibrium at all locations (see District Response to USFWS General Comment 6). Furthermore, the District notes that, primarily due to lack of discharge, Pallid sturgeon habitat has been shown to be limited above the Elkhorn confluence regardless of current operations or run-of-river operations. However, the District does not dispute that diversion of Loup River flows into the Loup Power Canal has reduced flow in the Platte River bypass reach. This reduction of flow, not a narrower channel, likely results in the loss of "minimal connectivity" in the Platte River bypass reach in March through June under minimum flow conditions.

Based on the above, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

4. **Comments on Project Effects to Fish and Wildlife Coordination Act Resources**
"FWCA requires consultation with the Service and State fish and wildlife agency for the purpose of giving equal consideration to fish and wildlife resources in the planning, implementation, and operation of federal and federally funded, permitted, or licensed water resource development projects. The FWCA requires that federal agencies take into consideration the effect that water related projects may have on fish and wildlife resources, to take action to avoid impact to these resources, and to provide for the enhancement of these resources. While Project temperature-related events are addressed in the Interior least tern section because of the potential for catastrophic fish kills, Project effects to fish habitat are addressed under FWCA."

**USFWS Comment 1**
"Table 13 summarizes of number years from April through September that the mean monthly flow is categorized as Fair, Poor, or Degraded. Table 13 represents a tabular version of Figures 5-14 to 5-19 which summarizes the percent of tota1 categorized as Fair, Poor, or Degraded for the 56 year period of record from 1954 to 2009. There are large differences in the proportion of Fair, Poor, or Degraded conditions for each of the respective months when comparing Site 1 to Genoa. The percentage of years categorized as Fair, Poor, or Degraded for the months from April though June ranged from 0 to 1.8 percent for Site 1 while percentages at Genoa ranged from 37.5 to 48.2 percent. From July through September, the percentage of years categorized as Fair, Poor, or Degraded ranged from 1.8 to 19.6 percent for Site 1 while percentages at Genoa ranged from 71.4 to 82.1 percent. Most notably, approximately half of the years at Genoa were categorized as degraded for the months of July though September."

**District Response**
The information presented by USFWS is included in the SISR and no comments are needed at this time.

**USFWS Comment 3**
"Table 14 summarizes of number years from October through March that the mean monthly flow is categorized as Fair, Poor, or Degraded. Table 14 also summarizes the percent of total categorized as Fair, Poor, or Degraded for the 56 period of record. There is an obvious difference in October when the Site 1 has zero years in a degraded condition while Genoa has 46.4% of the years categorized as degraded. The percentage of years categorized as Fair, Poor, or Degraded for the months from November though March ranged from 0 to 1.8 percent for Site 1 while percentages at Genoa ranged from 0 to 16.1 percent."

**District Response**
The information presented by USFWS is included in the SISR and no comments are needed at this time.

**USFWS Comment 4**
"Limitations in the Flow Depletion/Diversion methods limit the Service's ability to discern Project's flow diversion effects to the fish community in the Platte River bypass area because of the absence of a No Diversion condition Study Site 3. The Platte River near Duncan is not a surrogate for a No Diversion condition, so a comparison of the study site near Duncan to the Study Site 3 – Current Operation is inadequate in identifying Project diversion effects to the fish community. To address limitations to the Flow Depletion/Diversion methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document."

**District Response**
This comment is addressed under "Comments on Proposed Modifications to Studies" USFWS Comment 4 – Conduct Montana Method for No Diversion Alternative in the Platte River Bypass Area.

**USFWS Comment 5**
"The Service has determined that continued District operations would continue to impact the fish community for the bypass area of the Loup River and possibly the bypass area of the Platte River. While the SISR identify the July through October as the months of severe degradation for the Loup River, the Service also considers the months of April through June being severely impacted by Project diversions. The Service does not support the SISR conclusion that fish habitat is available both above and below the weir based on results of the NGPC fish data collection report (NGPC, June 1997 and April 1998). Fish sampling occurred in 1996 and

1997 which represented the 19.40 and 7.46 exceedance levels, respectively, for mean annual discharge using a 66-year period of record (Attachment C of the SISR Sedimentation Addendum). In other words, NGPC sampled during years when flows were relatively high within the 66-year period of record. The Service cautions the application of NGPC collected data within SISR conclusions."

**District Response**

The District acknowledges that 1996 and 1997 were wet years for the Loup River at Genoa gage; however, the District notes that the exceedance probability for 1997 was 8.96, rather than 7.46 as noted by USFWS.

The District concurs that the NGPC studies should not be used to make definitive statements about fish population upstream and downstream the Diversion Weir. However, although the study was only performed for two years, it provides an idea of what type of habitat is available upstream and downstream the Diversion Weir. The District would like to emphasize that fish community structure, rather than condition of fish population, can be taken from the NGPC studies. The NGPC two-year study illustrated that similar fish were using the river upstream and downstream the Diversion Weir, which helps to show that similar fish habitat is available.

The District also notes that diversion of water into the Loup Power Canal has created an excellent fishery that is highly used by anglers throughout the east-central region of Nebraska, a fact that has not been disputed by any agencies. The District suggests the combined fishery of the Loup Power Canal and the Loup River bypass reach has resulted in more fish habitat and better overall conditions for sport fishing than would exist if water was not diverted into the Loup Power Canal.

5. **General Comments on ISR and SISR**

**USFWS General Comment 1 – Loup River Channel Widths**

"The SISR has identified differences in channel width when comparing river reach upstream of the district diversion versus conditions in the Loup River bypass reach. A comparison of average channel widths from Table 5-7 (Study 5.0) shows that channel widths at locations upstream of the diversion (Mean 1,061 feet ± SD 8 feet) are wider than locations downstream (Mean 664 feet± SD 8 feet). A similar conclusion was derived from Table 5-10 (Study 5.0) with channel width at Site 1 of 825 feet exceeding widths of 640 feet at Site 2. Outside of effective (or dominant) discharge and transport capacity, the SISR provides no information that explains differences in channel morphology for the Loup River upstream of the Project diversion and within the bypass reach. It was identified in the February 24, 2011, SISR meeting transcript that, in absence of diverted water, the Loup

River bypass area would have similar characteristics as the Loup River upstream of the diversion (Page 153, Lines 23-25 and Page 154, Lines 1-9)."

**District Response**
General Comment 1 addresses three topics requiring the District's response: differences in channel width, differences in channel morphology in the Loup River, and the no diversion condition for the Loup River bypass reach. These topics have been addressed in the District's response to USFWS' Whooping Crane Comments 2 and 3 and Tern and Plover Comments 1 and 2.

**USFWS General Comment 2 – Loup River Wetted Channel Widths**
"The SISR has identified differences in wetted channel width when comparing river reach upstream of the district diversion versus conditions in the Loup River bypass reach. Figure 5-11 in the SISR Flow Depletion/Flow Diversion identified wider wetted widths for the No Diversion condition for all Loup River bypass areas (i.e., Study Site 2, Genoa Study Site, and Columbus Study Site). Table 15 is a revision to Table 5-10 in the SISR Flow Depletion/Flow Diversion. Percent of exposed channel was converted to wetted width (i.e. percent of width inundated by flow). An evaluation of HEC-RAS data was preferred to the aerial interpretation because of its ability to model No Diversion conditions in the bypass reach. A comparison of the Current Operation condition to No Diversion condition for Study Site 2 shows an increase in average wetted channel widths with a corresponding increase in streamflow under the No Diversion condition.

A comparison of wetted channel Site 1 to Site 2-No Diversion in Table 15 shows narrower channel widths associated with Site 2 result in narrower wetted widths. Average wetted widths for the Site 1 dry, normal, and wet time period are greater than the average channel width for Site 2. As demonstrated in General Comment 1, differences in channel width are consistent when comparing study sites upstream and downstream of the Project diversion. Figure 5-11 in the SISR Flow Depletion/Flow Diversion also shows that the No Diversion condition for study sites in the Loup Bypass area have the same streamflow as Study Site 1 but do not have the ability to achieve comparable wetted widths."

**District Response**
The cross-section data provided by the District reveals the extreme variability in cross-section geometry that occurs over relatively short periods of time, so once-in-time snap-shots should not be the basis for conclusions in this regard. Transverse bars are highly subject to dissection into multiple mid-channel bars even during low flow periods (Smith, 1971).

The cross sections that were taken in 2010, as shown in Attachment A of Study 1.0 Sedimentation in the SISR, reveal that the width of the channel at Site 2 is

narrower than at Site 1. Figure 5-11 also shows that for a given discharge, Site 2 has a narrower wetted width than Site 1. The no diversion condition results shown in Figure 5-11 represent HEC-RAS model output using "no diversion" flows through the "current operations" shaped channel. As the USFWS has pointed out, the HEC-RAS model is a fixed bed model and therefore the no diversion wetted widths for Site 2 are lower than the wetted widths at Site 1. The no diversion scenario was modeled as if the Project diversion were suddenly shut down, and analysis was based on the immediate aftermath, for a relatively short (geomorphologically) period of time.

**USFWS General Comment 3 – Loup River Instream Flow and Habitat Suitability**

"Page 101 of the SISR Flow Depletion/Diversion identifies the limitations of the analysis when assessing whooping crane suitable habitat. The analysis did not factor in conditions such as unobstructed view from bank to bank, location and configuration of the shallow water areas, presence or absence of vegetation, proximity to human development and feeding sites, and potential for predation. The predominance of point bars for the Loup River bypass area, as identified in the imagery review section of the SISR Flow Depletion/Diversion, would indicate that the available shallow water habitat would be located next to the inside bends (i.e., tips of point bars). Submerged point bars, compared to submerged mid-channel bars, would have shallow water habitat that is closer to visual obstructions and would have an increased likelihood of land predator access.

"The Service has identified important relationships between instream flow and channel width with water depths of 0.8 foot or less. Table 16 compares the increase (or decrease) in Channel Width with Water Depths of 0.8 Foot or Less when comparing the Current Operations condition to No Diversion condition for the Loup River bypass area only. The No Diversion condition increases the amount of shallow water habitat at lower flows (i.e., 75-percent exceedance) but decreases the amount of shallow water habitat at higher flows (i.e., 25-percent exceedance). The No Diversion condition shows the greatest increase in shallow water habitat for the dry year of 2006 but the greatest decrease in shallow water habitat for the wet year of 2008. Keep in mind that the increases and decreases in shallow water habitat due to flow is relative based on the positioning of this habitat adjacent to point bars. Similar to discussions in General Comment 2, reduced channel widths for the Loup River downstream also constrains channel width with water depths of 0.8 foot or less (Table 5-19, SISR Flow Depletion/Diversion).

"Similar to the whooping crane habitat evaluation, indices used to assess least tern and piping plover habitat may not address all factors used to identify suitable habitat. The evaluation of exposed channel area (Figure 5-11 in the SISR Flow

Depletion/Flow Diversion) does not address all suitability criteria discussed on Table 4-5 of the SISR Flow Depletion/Flow Diversion. The sandbar position upstream of the Project diversion compared to position downstream would affect least tern and piping plover habitat suitability. The higher percentage of point bars downstream of the diversion provides less suitable habitat conditions for the least tern and piping plover because both species select for mid-channel bars for nesting. Point bars represent habitat that is easily accessed by land predators compared to mid-channel bars that have flowing water around its perimeter. Mid-channel sandbars would also be located further from visual obstructions such as woody riparian vegetation compared to point bars."

**District Response**

The District's analysis of increases and decreases in shallow water habitat for the SISR were based on the cross sections taken at Sites 1 and 2. These cross sections did not indicate point bars verses mid-channel bars, nor assess the habitat suitability for whooping crane, interior least terns, or piping plover. Increases and decreases in shallow water habitat are a function of channel width, channel depth, distribution of material within the channel, and how flows change the sandbar and channel characteristics (elevations) based on those parameters. The cross-section data reveals that this is a highly dynamic system, with significant changes occurring over relatively short periods of time. Analysis of other habitat suitability criteria was accomplished via aerial interpretation.

See the District's response to USFWS Whooping Crane Comment 2 for additional information related to whooping crane habitat suitability.

Additionally, as discussed in the SISR, the limited amount of documented nesting on the Loup River upstream or downstream of the Diversion Weir combined with the documented differences in habitat parameters (specifically valley width) support the conclusion that the Loup River is a less desirable portion of the Platte River valley for nesting.

**USFWS General Comment 4 – Platte River Instream Flow and Habitat Suitability**

"An understanding of Project diversion effects to the Platte River bypass area is less evident. A study of aerial imagery was not conducted for the Platte River bypass area. The Study Site 3 in the bypass portion of the Platte River was consistently narrower than Study Sites downstream of the Project's tailrace return (Table 17) which uses cross-section information from page 39 and 40 from the SISR Hydrocycling.

"The Service in an October 20, 2010, letter ranked the sedimentation studies based on criteria of importance to the fish and wildlife species under our authorities.

The Service has ranked the longitudinal comparison of geomorphic characteristics from cross-sections as the most important of all of the sedimentation studies. A longitudinal comparison of sediment transport, as represented in Table 5-1 of the Sedimentation Addendum, is not adequate in relating sediment transport effects to channel geomorphic features. To address limitations to the sedimentation methods, the Service has proposed modifications in the Proposed Modifications to Studies section of this document."

**District Response**

The District notes that a study of aerial imagery for Site 3 was not included in the RSP, nor was it required by FERC in the SPD. Therefore, Site 3 was not included in the aerial imagery review.

The SISR already performed and included the longitudinal (spatial) analysis of the Platte River Study Sites 1, 2, and 3 (see SISR Tables 5-11 through 5-14, pg. 72 of the Study 5.0 Flow Depletion and Flow Diversion), Sites 3, 4, and 5 (Tables 5-9 through 5-12 on pg. 59 and Figure 5-15 of Study 2.0 Hydrocycling ), and all sites (Study 1.0 Sedimentation Addendum Figures 5-1 and 5-2). The table and supporting text shows that the observed (and reported) differences in channel geometries are consistent with the effective and dominant discharges resulting from the combination of different flow hydrographs acting in shaping the channel differently at each location. The morphology at each site is in dynamic equilibrium.

The sediment supply to all study sites is "virtually unlimited" (USACE, 1990). Differences in transport capacity and total sediment transported at successive downstream study sites should not be used to draw conclusions regarding "surplus" or "deficit" conditions, nor should they by used to draw conclusions regarding aggradation or degradation trends. Two successive sites having different effective or dominant discharge values can co-exist and remain "in regime" if each is in dynamic equilibrium, which is the case here. Major rivers like the Platte and Loup generally exhibit increasing values of the sediment transport parameters in the downstream direction, which was also documented in the SISR.

See also the District's responses to General Comment 6 and USFWS Comment 2 – Conduct Longitudinal (Spatial) Comparisons of All Loup and Platte River Sites below.

Based on the above, the District believes that USFWS' "Proposed Modifications to Studies" are unnecessary.

**USFWS General Comment 5 – Loup River Sediment Transport**
"Table 5-11 of the SISR – Flow Depletion/Flow Diversion identified sediment transport capacity for Study Site 2 was 890,000 and 2,370,000 tons per year for the Current Operation condition and the No Diversion condition, respectively. This equates to sediment transport surplus of approximately 1,480,000 tons per year because sediment transport capacity is lost due to flow diverted into the project canal. According to Table 4-3 of the ISR – Sedimentation, approximately 2,005,000 tons per year of sediment is hydraulically dredged from the Project settling basin of which 560,000 tons of sediment per year is returned to the Loup River via the South Sand Management Area. Net sediment removed from the Loup River system by the Project's dredging operation is 1,445,000 tons per year. The 1,445,000 tons of sediment removed by dredging operations is remarkably similar to the 1,480,000-ton sediment surplus at Study Site 2 which implies that total sediment transported downstream of the Project diversion is equivalent to sediment transported from upstream of the diversion (i.e., Project does not affect the Loup River sediment balance)."

**District Response**
The District acknowledges that the Project does not affect the Loup River sediment balance and that net amount of sediment hydraulically dredged is similar in magnitude to USFWS's calculated "surplus" at Site 2. Although not defined, it appears that USFWS' term "surplus" was calculated as the difference in normal-year (2005) transport capacities at Site 2 for the current and no diversion condition.

Table 5-11 of the SISR – Flow Depletion/Flow Diversion references values for 2005, which are intended to represent normal hydraulic years. Values from Table 5-14 would be more appropriate to use as those values cover a longer time period and include wet, dry, and normal years. This is especially important when comparing 1985-2009 values from Table 4-3 of the ISR – Sedimentation.

The District believes that USFWS is mistaken in comparing sediment transport capacities in order to conclude that a "surplus" exists here, in the same way that they conclude that a "deficit" exists at Site 4 in General Comment 6. USFWS' estimate of the "surplus" at Site 2, based on transport capacity calculations, should instead be based on MRBC yield estimates. In both cases a "surplus" exists, but it should be understood that the primary cause of, and magnitude of, the surplus is the watershed yield to the sites. Other than the net hydraulically dredged amounts, all sediment produced by the watershed above Site 1 reaches Site 2. In either case (MRBC versus differences in transport capacity) the amounts of sediment hydraulically dredged do not affect the sediment balance at Site 2 downstream of the Diversion Weir.

The adjusted MRBC sediment yield estimates, rather than transport capacities, should be used in assessing any "surplus" or "deficits." Reaches having different transport capacities and effective discharge values can be still be (and are) in a state of dynamic equilibrium (no long-term aggradation or degradation). While the District believes that indirect estimates of yield like those in the MRBC report should not be used to assess whether a river is aggrading or degrading, they are very appropriate for assessing the question of whether the river is 'flow' versus 'supply' limited (surplus versus deficit). The surplus of sediment being supplied to both Sites 1 and 2 originates from the watersheds and even with hydraulic dredging, ample amounts reach both sites. All the calculations and the other elements of the body of evidence reveal that no shortages exist of sediment being supplied to all the study sites.

With regard to the reduction in effective and dominant discharges at Site 2, the reductions are the direct result of the reductions in the downstream hydrograph due to Project Diversion Weirs, and as shown in the SISR, they essentially match Site 1 values in the no diversion condition. For current operations, the channel geometry is consistent with the dominant discharge (which along with other body of evidence data provided, indicate a state of dynamic equilibrium), and the braided morphology, which defines the habitat, is well seated in a braided river regime. Neither of the alternative operating conditions adversely impacts the acknowledged sediment balance or braided morphologic regime (which provides the habitat).

**USFWS [General] Comment 6 – Platte River Sediment Transport**

"Attachment J of the SISR – Flow Bypass/F10w Diversion projected sediment transport for Study Site 3 and Study Site 4. Cumulative sediment transport for Study Site 3 averaged 1,040,000 tons for years 2003 to 2009. Cumulative sediment transport for Study Site 4 averaged is 2,553,000 tons. Sediment transport at Study Site 4 is 1,493,000 tons higher then Study Site 3. The sediment transport deficit using the Seasonal data (i.e., May 1st through August 15th) is 452,571 tons per year using the 2003 to 2009 average. The 1,493,000-ton increase in sediment transport at Study Site 4 represents a sediment deficit because the higher sediment transport is due to flow inputs from the Project's tailrace return. The sediment deficit of 1,493,000 tons at Study Site 4 is similar to the 1,480,000-ton sediment surplus at Study Site 2. In other words, sediment deficits at the Project tailrace return can be attributed to sediment dredged at the Project diversion.

"Attachment J of the SISR – Flow Bypass/Flow Diversion projected sediment transport based on Current Operations and Run-of-River Operations. Cumulative sediment transport for Run-of-River Operations at Study Site 4 averaged 2,440,000 tons for years 2003 to 2009. Cumulative sediment transport for Current

Operations at Study Site 4 averaged 2,553,000 tons. Therefore, hydrocycling operations, in the study represented as Current Operations, result in an 113,000-ton increase in sediment transport. The 113,000-ton increase in sediment transport at Study Site 4 is represented as a sediment deficit because hydrocycled flow comes from the Project's tailrace return. The sediment transport deficit using the Seasonal data (i.e., May 1st through August 15th) is 30,714 tons per year using the 2003 to 2009 average.

"The cumulative sediment deficits as a result of Project flow diversion and hydrocycling operations is approximately 1,606,000 tons per year – the sum of 1,493,000 and 113,000. The volumes of sediment deficit, assuming a bulk density of sand at 1.9 tons per cubic yard (Kinzel, 2009) is 845,263 cubic yards of sediment per year. This represents 845,263 cubic yards of sediment that is removed from the available sediment supply (i.e., riverbed and sandbars) near the Project tailrace return on a yearly basis."

**District Response**

First, the District notes a typographical error in USFWS' comments: the cumulative sediment transport for current operations at Ungaged Site 4 is 2,533,000 tons per year as a result, the remainder of the calculated numbers are incorrect as well.

The District believes that USFWS is mistaken in comparing sediment transport capacities in order to conclude that either a "deficit" (General Comment 6) or a "surplus" (General Comment 5) exists. USFWS is basing the alleged "deficit" at Site 4 on transport capacity calculations rather than by comparing transport capacities with MRBC yield estimates. For all alternative operations, the transport capacity at Site 4 does not exceed the adjusted sediment yield at Site 4, so no deficit exists. Other than the net dredged amounts, all sediment produced by the watershed above Site 3 reaches Sites 3 and 4. As noted in the District's response to General Comment 5, the amounts of sediment hydraulically dredged do not affect the sediment balance at Site 2 downstream of the Diversion Weir. Further, upstream water management activities in the Platte basin influence hydrology and channel morphology at all Platte River study sites.

The adjusted MRBC sediment yield estimates, rather than transport capacities, should be used in assessing any "surplus" or "deficits." The adjusted MRBC sediment yields significantly exceed the transport capacity at all of the study sites, including Sites 3 and 4, so there is no "deficit." Reaches having different transport capacities and effective discharge values can still be (and are) in a state of dynamic equilibrium (no long-term aggradation or degradation). While the District believes that indirect estimates of yield like those in the MRBC report should not be used to assess whether a river is aggrading or degrading, they are

very appropriate for assessing the question of whether the river is 'flow' versus 'supply' limited (surplus versus deficit). The surplus of sediment being supplied to both Sites 3 and 4 originates from the watersheds and even with hydraulic dredging, ample amounts reach both sites. All the calculations and the other elements of the body of evidence reveal that no shortages exist of sediment being supplied to all the study sites, so there are no deficits.

With regard to the increase in effective and dominant discharges at Site 4, these are the direct result of the increase in the downstream hydrograph due to Project return flows, and as shown in the SISR, they closely match Site 3 values in the no diversion condition. For current operations, the channel geometry at both sites is consistent with the dominant discharge (which, along with other body of evidence data provided, indicate a state of dynamic equilibrium), and the braided morphology, which defines the habitat, is well seated in a braided river regime.

An increase (or decrease) in transport capacity does not equate to channel degradation (or aggradation) or other adverse morphological impacts. This is a misunderstanding evident in several of USFWS' comments. Instead, the channel morphologies upstream and downstream of the Tailrace Return were shown to be in dynamic equilibrium with sediment supplies, and the channel geometries were found to match equilibrium values associated with the respective dominant discharges. The District's studies, as well as other studies cited in the ISR and SISR, show that the entire system is in a state of dynamic equilibrium.

Indirect estimates of yield like those in the MRBC report should not be used to assess whether a river is aggrading or degrading but are appropriate for assessing the question of whether the river is 'flow' versus 'supply' limited. The sediment budget analysis revealed that neither of Sites 3 or 4 are supply limited. Ample sediments to supply the capacity demand are either being delivered to the sites or in such great abundance locally that no net degradation is occurring. In a related study of the entire river, USACE (1990, p. 5) concluded that "Bed material transport for the [Platte] river was found to be capacity limited with a virtually unlimited source."

The District notes that the no diversion and run-of-river conditions are mutually exclusive (i.e., if the District is not diverting water, they will be unable to hydrocycle); therefore, the effects cannot be accumulated, as is implied in the 1,606,000 tons per year value USFWS uses.

**USFWS [General] Comment 7 – Consideration of Regime Theory Analyses**
"USFWS agrees that Regime theory is a useful technology to determine potential changes in stream morphology. However, with the lack of hydrologic and geomorphologic data for the Loup River at Columbus and other locations, actual

streambed measurements are more useful in determining changes in stream morphology. As stated in the February 24, 2011, SISR meeting transcript, a braided plan form and represent river conditions representing various ranges of suitability for federally listed species (page 137, line 12 through page 139, line 8)."

**District Response**

Regime theory is not only useful in assessing changes in stream morphology, it is the standard of the industry (see references cited in the ISR). By definition, a braided stream that is in a state of dynamic equilibrium is constantly changing its cross section geometry, so even a large number of cross-section and streambed measurements taken over several years' time would not be as effective in assessing changes in morphology.

Many rivers and many years of study went into developing the regime charts used by the District. The body of scientific literature supports the validity of the charts. The combination of dominant discharge and hydraulic slope used in these charts has been demonstrated to be the best indicators of morphology.

On the other hand, the District is not aware of any prevailing literature that suggests that measurements of channel and streambed geometry can be used to assess either the state of existing, or potential changes in, overall morphology.

## 6. Comments on Proposed Modifications to Studies

### USFWS Comment 1 – Expand Platte River One Dimensional HEC-RAS Modeling to Include July

"The Service originally proposed the development of a steady-state one dimensional (1-D) HEC-RAS model to better understand the effects of hydrocycling on sandbar erosion. The Service, in a June 24, 2009, letter originally proposed that cross section surveys be measured during the 1st week of March, 1st week of May, 1st week of July, and the 1st week of August. The Service considered these time frames for cross-sectional measurements as a necessary means of collecting enough data to assess erosion rates when considering the variable timing of peak flows. In the Final Study Determination, timing of cross-sectional measurements was reduced to the first week in May and the first week in August.

"The Service has found that the timing intensity for the 2010 cross-sectional measurements is inadequate in measuring erosion rates. Streamflow at the North Bend streamgage for the 2010 calendar year peaked on June 14. Table 4.4 of the SISR – Hydrocycling shows the survey dates for the cross-sectional measurements. Two of the three measurement dates for Study Site 3 occurred

prior to the peak flow of June 14. It is difficult to measure sandbar erosion rates for Study Site 3 because it is likely that the June 14 peak flow redistributed sandbars between measurement dates. Since Study Site 3 represents a no hydrocycling condition, it is difficult to compare erosion rates of sandbars at Study Site 3 to Study Sites 4 and 5. The Service recommends the measurement of cross-sections in 2011 for the first week in May, first week in July, and first week in August. The addition of July measurement would allow for post-peak flow comparison of erosion rates if a mid to late June peak flow is observed in 2011.

1) Proposed changes in methods were not a result of material changes in the law or regulations.
2) Approval of Service revised methods would be needed to fully address goals and objectives of the study plan. The Service has determined that cross-sectional measurements collected in 2010 is inadequate in assessing erosion rates of sandbars above and below the Project tailrace return.
3) The proposed change in methods is necessary to allow for post-peak flow comparison of erosion rates if a mid to late June peak flow is observed in 2011. A survey during the first week in July and the first week in August would allow for two time periods post June peak flow.
4) Service proposed modification was not a result of significant changes in the project proposal or was not a result of the availability of significant new information material to the study objectives.
5) In absence of the proposed study modification, it is unknown if the existing study satisfies study criteria in § 5.9(b) of the Integrated License Application Process. Service proposed modification to the study would better enable FERC and the Service to conduct section 7 requirements under ESA."

**District Response**

The District believes that USFWS' proposal to "Expand Platte River One Dimensional HEC-RAS Modeling to Include July" is unnecessary. USFWS made the request based on the supposition that only one of three cross-sections surveys at Site 3 (upstream of the Tailrace Return) were taken after the peak flow that occurred on June 14. USFWS references Table 4-4 from Study 2.0 Hydrocycling, regarding survey dates. The District notes that USFWS referenced the incorrect table regarding when surveys were taken. Table 4-4 notes the discharges that were used to calibrate the HEC-RAS model; the District used the flows from the Spring and Fall surveys at each site to calibrate the HEC-RAS model. The District directs USFWS to Table 4-1 that identifies the dates that cross sections were taken at each location; this table identifies surveys at Site 3 on May 2/3, August 11, and September 29. The District also notes that per the SPD (pg. 17), FERC determined that cross-sectional measurements were not necessary in July and only required surveys pre- and post-nesting.

The District reminds USFWS that the purpose of the cross-sectional measurements was for use in calibrating the HEC-RAS model. The District does not believe that USFWS has provided sufficient evidence that cross-sectional measurements collected in 2010 were inadequate. See the District's Response to Tern and Plover Comment 5.

**USFWS Comment 2 – Conduct Longitudinal (Spatial) Comparisons of All Loup and Platte River Sites**

"Page 11 of FERC's Final Study Determination identified the additional analyses required to address Sedimentation Objective 2.

> Using the findings on the current state of river morphology at each site, the District shall make longitudinal (spatial) comparisons of all sites on the Loup and lower Platte Rivers starting at the most upstream site on each river, and progressing downstream. In performing this spatial analysis, the District shall ensure that it uses cross-sectional geomorphic data from the USGS gage sites that are reasonably comparable to the cross-sectional geomorphic data taken at the non-USGS sites (i.e., the data taken at both USGS gage and non-USGS gage sites shall be obtained as close in time as possible).

"Page 30 of the SISR – Sedimentation Addendum identified that a longitudinal comparison was not conducted because it was determined that the Loup Bypass reach and lower Platte River was in dynamic equilibrium. However, the FERC's Final Study Determination required a longitudinal comparison of cross-sectional geomorphic data regardless of whether the river is/is not in dynamic equilibrium. Although it was not entirely clear as to what represented a longitudinal comparison in the Final Study Determination, the Service has determined that a longitudinal comparison of sediment transport, as represented in Table 5-1 of the Sedimentation Addendum, is not adequate in relating sediment transport effects to channel morphology.

"Page 1-22 of the Revised Study Plan - Sedimentation identified the following study commitment:

> In addition, the channel morphology associated with the effective discharges will be calculated according to the methodology described in Leopold and Maddock (1953) and Karlinger et al. (1983). Leopold and Maddock developed general stream morphology relationships between effective discharge and channel characteristics, and Karlinger et al. (1983) calibrated and applied Parker's regime equations (similar to Leopold and Maddock's) to the central Platte River. Channel characteristics include channel cross

sectional area changes, width changes, channel aggradation/degradation changes, and the rate at which these changes, if any, occur over time.

"This commitment was partially fulfilled in the ISR and SISR. The above channel characteristics (i.e., channel cross sectional area changes, width changes, channel aggradation/degradation changes, and the rate at which these changes, if any, occur over time) associated with gaged sites were provided, in part, as attachments to the ISR - Sedimentation. Attachment J of the SISR provided limited channel characteristic information for ungaged sites on the Platte River. The Service recommends that channel characteristic information be performed for ungaged sites for the Loup River and the Platte River. The Service also requests that all channel characteristic information for the Loup and the Platte River be presented as longitudinal (spatial) comparisons of all sites on the Loup and lower Platte Rivers starting at the most upstream site on each river, and progressing downstream.

1) Proposed changes in methods were not a result of material changes in the law or regulations.
2) Approval of Service revised methods would be needed to fully address goals and objectives of the study plan. The Service's October 20, 2010, comments on the ISR identified the longitudinal comparison of study sites as the highest ranked study to address Project affects to channel morphology. The Service has determined that a longitudinal comparison of sediment transport, as represented in Table 5-1 of the Sedimentation Addendum, is not adequate in relating sediment transport effects to channel morphology.
3) The proposed change in methods was not made earlier because the Service assumed that the SISR would include a comprehensive longitudinal (spatial) comparison of all sites on the Loup and lower Platte Rivers starting at the most upstream site on each river, and progressing downstream.
4) Service proposed modification was not a result of significant changes in the project proposal or was not a result of the availability of significant new information material to the study objectives. The Service assumed that the SISR would include a comprehensive longitudinal (spatial) comparison of all sites on the Loup and lower Platte Rivers starting at the most upstream site on each river, and progressing downstream.
5) In absence of the proposed study modification, it is unknown if the existing study satisfies study criteria in § 5.9(b) of the Integrated License Application Process. Service proposed modification to the study would better enable FERC and the Service to conduct section 7 requirements under ESA."

**District Response**
The District believes that USFWS' proposal to "Conduct Longitudinal (Spatial) Comparisons of All Loup and Platte River Sites" is unnecessary.

The District has performed and included the requested longitudinal (spatial) analysis of the Platte River study Sites 1, 2, and 3 (see SISR Tables 5-11 through 5-14, page 72 of the Study 5.0 Flow Depletion and Flow Diversion) and Sites 3, 4, and 5 (Tables 5-9 through 5-12 on page 59 and Figure 5-15 of Study 2.0 Hydrocycling ). The table and supporting text shows that the observed (and reported) differences in channel geometries are consistent with the differences in effective and dominant discharges resulting from the different flow hydrographs acting in shaping the channel differently at each location. The morphology at each site is consistent with the sediment transport parameters and in dynamic equilibrium.

The District would like to clarify statements on page 30 of the SISR Sedimentation Addendum as referenced by USFWS. District did not state "that a longitudinal comparison was not conducted because it was determined that the Loup Bypass reach and lower Platte River was in dynamic equilibrium." The text on page 30 is as follows:

> "…if the current condition morphology analysis indicates that the Loup River bypass reach and lower Platte River are in dynamic equilibrium, or are not supply limited based on the adjusted yields and sediment transport capacity calculations, then no alternatives relative to sediment augmentation would be evaluated."

As noted above, the District completed the longitudinal (spatial) analysis of the gaged and ungaged sites on the Loup and Platte rivers. Additionally, the District arrived at the conclusion that the Loup River Bypass reach and lower Platte River are in dynamic equilibrium.

Rivers in dynamic equilibrium are defined as "being in regime," which is the subject of Leopold and Maddock as well as the paper by Karlinger et al. cited by USFWS. Because the effective and dominant discharges are accepted as indicators of the flows that do the most work in shaping the channel, the District's W, D, and V charts (derived from numerous USGS measurements at the effective discharge rates) provide accurate measures of the "regime" conditions obtained by entering the dominant discharge into each relationship. The District, as well as other investigators referenced in the ISR and SISR, adopted this methodology for developing relationships between effective discharge and "regime" channel characteristics that would be associated with those discharge values. Other than attempting to calibrate Parker's regime equations, the District's methods match

not only those of Karlinger et al. (1983) but also other investigator's choices of methods cited in the ISR and SISR.

Other 1980's USGS reports published as companion reports to Karlinger et al. used procedures matching those used by the District, particularly effective discharge. One of Karlinger's colleagues at the USGS (Kircher, 1981) determined effective discharges for the North Platte, South Platte, and Central Platte Rivers. He concluded (p. 25), "Changes in the channel characteristics of the Platte River can be examined by considering the effective discharge at each site. The formation and maintenance of channel cross-sectional characteristics are accomplished by sediment movement; and, as defined earlier, the water discharge that transports the most sediment is the effective discharge. Therefore, a direct relationship exists between [regime] channel size and effective discharge. If effective discharge is changed because of hydrologic changes, then a similar direction of change in channel cross-sectional area could be expected."

Based on Kircher's and other investigators' work cited in the ISR and SISR, the District appropriately selected the effective discharge method rather than Parker's method to provide relationships among discharge and regime channel dimensions. The single, once-in-time attempt by the USGS (Karlinger) to calibrate Parker's equation (which was originally derived for gravel bed rivers) in a sand bed river was not adopted as a useful tool by any subsequent investigation of regime conditions in the Platte River system. Karlinger notes that Parker's method assumes a uniform channel bed with center depth equaling maximum depth, which is not physically relevant anywhere in the Platte River. Further, he found that vegetation on the banks limited the width and depth combinations provided by Parker's equations, and the method may be "inappropriate" if there is constraining vegetation.

Instead of applying Parker's equation in any other studies of regime in the Platte system, the resource agencies adopted and confirmed the same regime methods employed by the District (see for example, USACE, 1990, Kircher, 1981). Parker's original method was developed for gravel-bed streams, and even Karlinger discusses the difficulty of calibrating it, along with its limitations, for use on sand-bed, braided rivers.

**USFWS Comment 3 – Conduct Temperature Analysis for Platte River Bypass Area**

"The Service recommends a simpler approach of assessing flow-related effects at Merchiston and at Genoa. The Service recommends a table listing the maximum daily temperature and corresponding flow for both study sites. In addition to the table, the Service recommends a summary of the number of days above 90° F for each respective location on a month-by-month basis. Proposed methods are

similar to those conducted by Sinokrot and Gulliver (2000). In the study, the authors stated "the occurrence of these high water temperatures can be reduced with an increased in-stream flow." Because times of missing temperature data occurred during low flow conditions in the Loup River bypass area, the Service recommends another year of temperature monitoring within the Loup River at Merchiston and Genoa.

1) Proposed changes in methods were not a result of material changes in the law or regulations.
2) Approval of Service revised methods would be needed to fully address goals and objectives of the study plan. Because the probability of thermal temperature exceedances at Merchiston and Genoa were conducted independently, there is no evaluation of the No Diversion condition for the Loup Bypass area that relates streamflow to temperature exceedances.
3) The proposed change in methods was not made earlier because the Service needed a stepwise means of addressing temperature-related effects of flow bypass. Now it is determined that there is a relationship between Loup River streamflow and temperature exceedances in the Loup River bypass area, Service proposed methods would allow for an estimation of No Diversion condition effects on probability of temperature exceedances.
4) Service proposed modification was not a result of significant changes in the project proposal or was not a result of the availability of significant new information material to the study objectives. The Service proposal reflects slight alterations as to how the data is organized.
5) In absence of the proposed study modification, it is unknown if the existing study satisfies study criteria in § 5.9(b) of the Integrated License Application Process. Service proposed modification to the study would better enable FERC and the Service to conduct section 7 requirements under ESA."

**District Response**

The District believes that USFWS' proposal to "Conduct Temperature Analysis for Platte River Bypass Area" is unnecessary.

USFWS requested a table listing of the maximum daily temperature and corresponding flow for both study sites. USFWS also requested a summary of days above 90 degrees F. The District has provided this information in tables at the end of this document:

The District believes that USFWS' proposal to conduct another year of temperature monitoring at Merchiston and Genoa is unnecessary. USFWS makes this recommendation based on the statement "because times of missing temperature data occurred during low flow conditions in the Loup River bypass

area." The District acknowledges in the SISR that temperature data was missing during a portion of the study period at both Merchiston and Genoa; however, the District disputes USFWS' assertion that the missing data occurred during low flow conditions.

At Merchiston, flow data was missing from June 27 through June 30; since temperature exceedances at Merchiston are not related to flow diversion, the District believes that this data gap is insignificant. At Genoa, flow data was missing from June 11 through July 18, a time period that corresponded with the highest flows of the summer. The District acknowledges that even though this period experienced high flows, there was a period of 2 days from July 3 to July 4 when flows were less than 500 cfs. However, the District believes that the water temperature data gap during this period is also insignificant to the analysis since maximum ambient temperatures during this period were 84.4 degrees F and 80.7 degrees F. The District notes that the analysis in Study 4.0 Water Temperature in the Project Bypass Reach clearly shows that water temperature is highly correlated to ambient temperature, as such, relatively low ambient temperatures during these 2 days of low flows would not substantially alter the conclusions of the study.

Additionally, USFWS notes that "because the probability of thermal temperature exceedances at Merchiston and Genoa were conducted independently, there is no evaluation of the No Diversion condition for the Loup Bypass area that relates streamflow to temperature exceedances." The District notes that the statistical analysis of water temperature exceedances above the Diversion Weir at Merchiston was intended to be a surrogate for a no diversion condition. Furthermore, the only way to analyze a synthetic no diversion hydrograph at Genoa would be to use the relationships established between water temperature and ambient temperature, soil temperature, etc in Study 4.0 – Water Temperature in the Project Bypass Reach. Therefore, the District believes that the analysis conducted in Study 4.0 – Water Temperature in the Project Bypass Reach is sufficient to provide information related to a no diversion condition and no additional analysis is warranted.

USFWS notes that "Service proposed methods would allow for an estimation of No Diversion condition effects on probability of temperature exceedances." The District is unclear what methods USFWS is proposing to evaluate the no diversion condition. The District interpretation of USFWS' proposed method includes two components: preparation of tables showing raw data (provided above) and conducting a second year of temperature data collection. The District does not see the relationship between these two requests and evaluation of a no diversion condition.

In their justification of this study modification request, USFWS also asserts that "now it is determined that there is a relationship between Loup River streamflow and temperature exceedances in the Loup River bypass area," The District assumes USFWS makes this assertion based on the results of the exceedance probability analysis presented in the SISR. The District disagrees with USFWS' conclusion that this method established a correlation between low flows and water temperature excursions. The District believes that the exceedance probability results support the District's conclusion that there is not a significant relationship between low flows and water temperature excursions. For example, using linear interpolation between the data points on the Sinokrot and Gulliver exceedance probability plots at Merchiston from Study 4.0 (Figures 5-3 and 5-16), the 75 percent exceedance flow rate is 2,000 cfs, while at Genoa, the 75 percent exceedance flow rate is approximately 120 cfs. If flow was a primary factor in water temperature, the District would expect a 2,000 cfs flow to have a percent exceedance of approximately 13 percent, rather than a 75 percent.

**USFWS Comment 4 – Conduct Montana Method for No Diversion Alternative in the Platte River Bypass Area**

"The Service recommends a Montana Method evaluation for the No Diversion condition of the Platte River bypass area. The Service has determined that a comparison of results at the Duncan study site to results at Study Site 3 does not provide an adequate evaluation of the No Diversion condition. An evaluation of the No Diversion condition is critical in understanding Project diversion-related effects to the Platte River bypass area.

1) Proposed changes in methods were not a result of material changes in the law or regulations.
2) Approval of Service revised methods would be needed to fully address goals and objectives of the study plan. An evaluation of the No Diversion condition is critical in understanding Project diversion-related effects to the Platte River bypass area.
3) The proposed change in methods was not made earlier because the Service assumed that the study plan would include an evaluation of the No Diversion condition for the Platte River bypass area.
4) Service proposed modification was not a result of significant changes in the project proposal or that significant new information material to the study objectives has become available. The Service assumed that the study plan would include an evaluation of the No Diversion condition for the Platte River bypass area.
5) In absence of the proposed study modification, it is unknown if the existing study satisfies study criteria in § 5.9(b) of the Integrated License Application Process. Service proposed modification to the study would better enable FERC and the Service to conduct section 7 requirements under ESA."

**District Response**
The District believes that USFWS' Proposal to "Conduct Montana Method for No Diversion Alternative in the Platte River Bypass Area" is unnecessary.

As presented in the SISR, the Montana Method bases flow requirements on the assumption that a percentage of mean annual flow is needed to maintain a healthy stream environment. To say it another way, the Montana Method is intended to provide guidelines for minimum instream flows based on the average of flows that a stream experiences throughout the year, essentially assuming that the average flows provide a representation of the habitat that supports aquatic life in the stream during "normal" flow conditions. Thus evaluating habitat conditions using the Montana Method is essentially comparing a stream to itself and does not require comparison to other locations.

Furthermore, the District notes that the Montana Method evaluation of habitat at the Duncan gage, clearly illustrates that flows are degraded on the Platte River upstream of the Loup River confluence and that habitat conditions as predicted by the Montana Method are generally improved at Site 3. To support this assertion, the District reviewed the monthly Montana Method analysis presented in Attachment K of Study 5.0 – Flow Depletion and Flow Diversion and identified the number of months during the period of record when flow conditions were better at Duncan than at Site 3 and vice versa:

- Months Duncan conditions were more favorable than Site 3: 10
- Months Site 3 conditions were more favorable than Duncan: 49

The District also notes that during the period of record evaluated (1954 to 2009), the Platte River contributed an average of 64 percent of the total flows at Site 3 each year. Based on all of the above, the District does not believe additional analysis is warranted.

## References


16 U.S.C. 1531 et seq. Endangered Species Act.

HDR, MEI, The Flatwater Group, and UNL. December 2009. Lower Platte River Stage Change Study Final Protocol Implementation Report.

Hurley, K. L., R. J. Sheehan, R.C. Heidinger, P.S. Wills, and B. Clevenstine. 2004. Habitat Use by Middle Mississippi River Pallid Sturgeon. Transactions of the American Fisheries Society. 133: 1033-1041.

Journey North. May 10, 2011. Whooping Crane Western (Natural) Flock Population Graph. http://www.learner.org/jnorth/images/graphics/crane/PopulationWFlock.jpg

Karlinger, M.R., T.R. Eschner, R.F. Hadley, and J.E. Kircher. 1983. "Relation of Channel-Width Maintenance to Sediment Transport and River Morphology: Platte River, South-Central Nebraska." USGS Professional Paper 1277-E.

Kinzel, P.J., 2009. Channel morphology and bed sediment characteristics before and after habitat enhancement activities in the Uridil Property, Platte River, Nebraska, water years 20052008: U.S. Geological Survey Open-File Report 2009-1147, 23

Kircher, J.E. 1981. "Sediment Transport and Effective Discharge of the North Platte, South Platte, and Platte Rivers in Nebraska," USGS Open File Report 81-53.

Leopold, Luna B., and Thomas Maddock, Jr. 1953. "The Hydraulic Geometry of Stream Channels and Some Physiographic Implications." USGS Professional Paper 252.

NGPC. June 1997. Angler Use and Fish Community Dynamics in the Middle Loup and Loup River Basins and Sherman Reservoir. Annual Progress Report (March - November 1996). Fisheries Division.

NGPC. April 1998. Angler Use and Fish Community Dynamics in the Middle Loup and Loup River Basins and Sherman Reservoir. Annual Progress Report (March - November 1997). Fisheries Division.

NGPC. October 2, 2008. Personal communication (email) from Krystal Stoner, Environmental Analyst Supervisor, Nebraska Natural Heritage Program, Nebraska Game and Parks Commission, to Melissa Marinovich, Environmental Scientist, HDR.

Parham, James E. 2007. "Hydrologic Analysis of the Lower Platte River from 1954-2004, with special emphasis on habitats of the Endangered Least Tern, Piping Plover, and Pallid Sturgeon." Nebraska Game and Parks Commission. Lincoln, Nebraska.

Peters, Edward J., and James E. Parham. 2008. "Ecology and Management of Sturgeon on the Lower Platte River, Nebraska." Nebraska Technical Series Number 18. Nebraska Game and Parks Commission. Lincoln, Nebraska.

Sinokrot, Bashar A., and Guliver, G.S. 2000. In-stream flow impact on river water temperatures. J of Hydraulic Research 38(5):339-350.

Smith, N.D., 1971. "Transverse Bars and Braiding in the Lower Platte River, Nebraska," Geological Society of America Bulletin, v. 82, pp. 3407-3420, December.

U.S. Army Corps of Engineers. July 1990. Platte River Cumulative Impacts Analysis. Report No. 5. Special Studies Unit, River & Reservoir Section, Hydrologic Engineering Branch, Engineering Division, USACE-Omaha.

U.S. Fish and Wildlife Service. 1993. Pallid Sturgeon Recovery Plan. U.S. Fish and Wildlife Service, Bismarck, North Dakota. 55pp.

U.S. Fish and Wildlife Service. June 24, 2009. Comments on the District's Proposed Study Plan, as revised at the May 27-28, 2009 Study Plan Meeting.

U.S. Fish and Wildlife Service. 2010. Whooping Crane Sighting Database.

U.S. Geological Survey. August 3, 2006. "Platte River Ecology Study: Whooping Cranes." Northern Prairie Wildlife Research Center. http://www.npwrc.usgs.gov/resource/habitat/plriveco/wcranes.htm.

## Daily Temperature and Flow at Genoa and Merchiston

| Date | Maximum Air Temperature Degrees F | Genoa Maximum Water Temperature Degrees F | Merchiston Maximum Water Temperature Degrees F | Genoa Mean Daily Flow (cfs) | Merchiston Mean Daily Flow (cfs) |
|---|---|---|---|---|---|
| 6-May | 61.8 | 59.7 | 63.0 | 98 | 1966 |
| 7-May | 53.5 | 59.2 | 58.5 | 256 | 2204 |
| 8-May | 57.3 | 64.9 | 61.9 | 232 | 2160 |
| 9-May | 59.6 | 61.2 | 59.4 | 304 | 2272 |
| 10-May | 51.5 | 55.8 | 56.3 | 133 | 2281 |
| 11-May | 52.7 | 55.0 | 54.9 | 119 | 2277 |
| 12-May | 46.1 | 52.9 | 53.2 | 105 | 2273 |
| 13-May | 59.2 | 62.4 | 59.4 | 183 | 2631 |
| 14-May | 69.7 | 66.4 | 67.3 | 102 | 2410 |
| 15-May | 70.1 | 67.8 | 68.9 | 103 | 2301 |
| 16-May | 60.9 | 63.7 | 65.1 | 100 | 2148 |
| 17-May | 67.5 | 68.0 | 68.4 | 101 | 2059 |
| 18-May | 74.0 | 73.6 | 73.4 | 343 | 2271 |
| 19-May | 67.7 | 68.2 | 69.1 | 160 | 2278 |
| 20-May | 60.1 | 63.1 | 63.5 | 112 | 2290 |
| 21-May | 74.9 | 74.8 | 73.0 | 143 | 2581 |
| 22-May | 87.4 | 78.6 | 77.4 | 128 | 2606 |
| 23-May | 90.5 | 83.5 | 81.1 | 126 | 2534 |
| 24-May | 88.3 | 82.4 | 80.6 | 105 | 2263 |
| 25-May | 78.5 | 79.0 | 78.3 | 141 | 2129 |
| 26-May | 78.9 | 81.0 | 79.0 | 109 | 2107 |
| 27-May | 85.3 | 82.4 | 80.8 | 152 | 2550 |
| 28-May | 89.2 | 86.0 | 83.5 | 110 | 2998 |
| 29-May | 90.5 | 86.4 | 83.8 | 105 | 2223 |
| 30-May | 72.5 | 77.0 | 79.0 | 105 | 2143 |
| 31-May | 81.7 | 81.1 | 77.7 | 491 | 3269 |
| 1-Jun | 89.1 | 79.2 | 76.3 | 628 | 3822 |
| 2-Jun | 74.5 | 80.8 | 77.2 | 901 | 4065 |
| 3-Jun | 85.2 | 81.5 | 79.3 | 144 | 3058 |
| 4-Jun | 85.5 | 88.5 | 82.9 | 106 | 2860 |
| 5-Jun | 81.7 | 85.5 | 82.0 | 509 | 3283 |
| 6-Jun | 80.1 | 82.9 | 79.2 | 473 | 3307 |
| 7-Jun | 73.7 | 80.2 | 74.5 | 180 | 2904 |
| 8-Jun | 78.7 | 80.8 | 78.1 | 1520 | 4374 |
| 9-Jun | 82.5 | 77.7 | 79.2 | 5790 | 8514 |
| 10-Jun | 80.5 | 76.1 | 77.4 | 5030 | 7704 |
| 11-Jun | 82.0 | | 77.5 | 9030 | 11554 |
| 12-Jun | 78.2 | | 75.9 | 14800 | 17304 |
| 13-Jun | 69.7 | | 72.7 | 25000 | 27414 |
| 14-Jun | 74.0 | | 70.5 | 24100 | 26744 |
| 15-Jun | 75.7 | | 72.7 | 22500 | 25134 |
| 16-Jun | 87.4 | | 77.2 | 13800 | 16604 |
| 17-Jun | 89.9 | | 80.4 | 11300 | 14294 |

| Date | Maximum Air Temperature Degrees F | Genoa Maximum Water Temperature Degrees F | Merchiston Maximum Water Temperature Degrees F | Genoa Mean Daily Flow (cfs) | Merchiston Mean Daily Flow (cfs) |
|---|---|---|---|---|---|
| 18-Jun | 87.4 | | 80.6 | 9570 | 12694 |
| 19-Jun | 81.5 | | 78.8 | 7630 | 10734 |
| 20-Jun | 77.8 | | 76.6 | 7580 | 10344 |
| 21-Jun | 83.4 | | 79.3 | 9830 | 12714 |
| 22-Jun | 87.0 | | 81.7 | 10400 | 13454 |
| 23-Jun | 80.5 | | 80.1 | 10500 | 13344 |
| 24-Jun | 81.7 | | 82.0 | 6360 | 9294 |
| 25-Jun | 92.6 | | 85.5 | 4710 | 7734 |
| 26-Jun | 94.2 | | 88.3 | 3790 | 6884 |
| 27-Jun | 83.9 | | | 3860 | 6674 |
| 28-Jun | 87.0 | | | 3600 | 6214 |
| 29-Jun | 80.1 | | | 2510 | 4644 |
| 30-Jun | 85.0 | | | 2250 | 4144 |
| 1-Jul | 85.2 | | 83.8 | 829 | 3065 |
| 2-Jul | 87.3 | | 82.8 | 597 | 2813 |
| 3-Jul | 84.4 | | 81.0 | 373 | 2549 |
| 4-Jul | 80.7 | | 80.8 | 263 | 2429 |
| 5-Jul | 78.0 | | 79.5 | 1080 | 3716 |
| 6-Jul | 85.1 | | 84.9 | 1890 | 4836 |
| 7-Jul | 77.2 | | 81.7 | 2140 | 5206 |
| 8-Jul | 80.1 | | 78.1 | 2270 | 5466 |
| 9-Jul | 84.2 | | 84.2 | 1650 | 4626 |
| 10-Jul | 87.9 | | 85.5 | 1270 | 4146 |
| 11-Jul | 82.7 | | 82.8 | 2000 | 4986 |
| 12-Jul | 75.1 | | 80.4 | 2270 | 5466 |
| 13-Jul | 90.7 | | 82.9 | 4750 | 7976 |
| 14-Jul | 93.4 | | 86.4 | 5350 | 8686 |
| 15-Jul | 83.0 | | 84.9 | 4410 | 7196 |
| 16-Jul | 90.4 | | 88.3 | 3470 | 5926 |
| 17-Jul | 92.5 | | 90.9 | 2640 | 5076 |
| 18-Jul | 85.5 | | 89.1 | 1850 | 4296 |
| 19-Jul | 84.1 | 86.5 | 85.1 | 1470 | 3966 |
| 20-Jul | 83.2 | 86.5 | 85.3 | 1710 | 4216 |
| 21-Jul | 82.9 | 81.3 | 83.3 | 1647 | 4193 |
| 22-Jul | 90.7 | 90.1 | 87.3 | 1584 | 4020 |
| 23-Jul | 88.7 | 90.9 | 88.7 | 1520 | 3956 |
| 24-Jul | 80.8 | 87.4 | 86.4 | 2510 | 5136 |
| 25-Jul | 82.8 | 87.6 | 85.6 | 2760 | 5256 |
| 26-Jul | 90.1 | 91.9 | 88.2 | 1180 | 3496 |
| 27-Jul | 92.9 | 92.5 | 89.1 | 853 | 3089 |
| 28-Jul | 82.5 | 88.7 | 86.9 | 569 | 2695 |
| 29-Jul | 85.4 | 88.0 | 87.3 | 260 | 2286 |
| 30-Jul | 90.5 | 94.8 | 91.0 | 108 | 2044 |
| 31-Jul | 88.4 | 91.8 | 91.9 | 44 | 1920 |
| 1-Aug | 89.0 | 92.1 | 89.2 | 32 | 1898 |
| 2-Aug | 96.2 | 91.4 | 86.9 | 25 | 1901 |

| Date | Maximum Air Temperature Degrees F | Genoa Maximum Water Temperature Degrees F | Merchiston Maximum Water Temperature Degrees F | Genoa Mean Daily Flow (cfs) | Merchiston Mean Daily Flow (cfs) |
|---|---|---|---|---|---|
| 3-Aug | 86.4 | 89.1 | 88.3 | 135 | 2121 |
| 4-Aug | 85.1 | 86.7 | 87.6 | 331 | 2377 |
| 5-Aug | 84.1 | 86.5 | 86.9 | 290 | 2316 |
| 6-Aug | 88.4 | 88.5 | 87.3 | 473 | 2429 |
| 7-Aug | 90.9 | 90.7 | 88.3 | 582 | 2768 |
| 8-Aug | 94.9 | 93.9 | 91.2 | 1350 | 3686 |
| 9-Aug | 92.1 | 92.3 | 91.8 | 897 | 3103 |
| 10-Aug | 91.9 | 91.0 | 90.0 | 595 | 2701 |
| 11-Aug | 98.1 | 94.3 | 93.2 | 327 | 2363 |
| 12-Aug | 98.2 | 94.6 | 91.8 | 147 | 2113 |
| 13-Aug | 92.6 | 92.3 | 88.5 | 186 | 2192 |
| 14-Aug | 83.8 | 82.9 | 84.0 | 262 | 2328 |
| 15-Aug | 81.5 | 84.4 | 80.8 | 248 | 2344 |
| 16-Aug | 86.2 | 86.5 | 82.9 | 208 | 2154 |
| 17-Aug | 70.7 | 77.5 | 78.8 | 277 | 2273 |
| 18-Aug | 83.9 | 81.5 | 79.3 | 1370 | 3796 |
| 19-Aug | 90.8 | 86.5 | 84.4 | 1710 | 4106 |
| 20-Aug | 86.0 | 87.4 | 85.1 | 1190 | 3476 |
| 21-Aug | 92.4 | 89.6 | 87.6 | 833 | 3019 |
| 22-Aug | 92.3 | 89.8 | 88.0 | 907 | 3143 |
| 23-Aug | 90.1 | 87.1 | | 1420 | 3026 |
| 24-Aug | 78.7 | 82.6 | | 1490 | 2946 |
| 25-Aug | 84.5 | 84.2 | | 1030 | 2476 |
| 26-Aug | 85.0 | 81.7 | | 698 | 2154 |
| 27-Aug | 86.2 | 80.6 | | 1190 | 2496 |
| 28-Aug | 89.7 | 79.7 | | 782 | 2188 |
| 29-Aug | 90.6 | 77.9 | | 531 | 2017 |

## Number of Days with Daily Maximum Water Temperature Above 90 Degrees F

| | Genoa | Merchiston |
|---|---|---|
| May | 0 | 0 |
| June | 0 | 0 |
| July | 6 | 3 |
| August | 9 | 4 |
| Total | 15 | 7 |

# Attachment C

**District response to Nebraska Game and Parks Commission (NGPC) comments on the Second ISR dated April 11, 2011.**

1. **Comments on Study 4.0 – Water Temperature in the Loup River Bypass Reach**

**NGPC Comment 1**
**Relationship between Air temperature and Water Temperature**
"The statistically significant relationship between air and water temperatures reported in the SISR is commonly found in shallow, sand substrate prairie streams which lack significant cover providing shaded areas. Streams like the Loup River and the lower Platte River consistently demonstrate this relationship. This makes air temperature a good indicator for critical water quality issues like thermal stress that leads to fish kills."

**District Response**
This is the same conclusion the District came to after analyzing the data. By using linear regression, multiple regression, and logistic regression on hourly data, daily maximum data, and all data above 63 degrees Fahrenheit (F), the District found that air temperature is not only a good indicator of water temperature, it is also a very good predictor of water temperature exceedances.

**NGPC Comment 2**
**Relationship between Flow and Water Temperature**
"The lack of a statistically significant relationship between stream discharge (flow) and water temperature as analyzed in the SISR is not surprising. The use of hourly discharge and temperature data for the entire period of May through August assures that such an insignificant relationship will be found. Discharge values for the period of record analyzed range from 997 to 28,420 cfs at Merchiston and 30 to 26,400 cfs at Genoa (Table 5.1). Water temperatures ranged from 48 to 93.2 degrees F at Merchiston and 48.2 to 94.8 degree F at Genoa during the same period. As the SISR states water temperatures can vary several degrees on a given day while flow remains relatively constant. This leads to a weak relationship and is further masked by the use of hourly data. Furthermore, the use of such broad temperature ranges and discharge ranges does not address the issue of Project impacts leading to fish kills which almost always occur during periods of high water temperatures and low flows. As the SISR states, "excursions above 90 degrees F occurred only when discharge was less than 5,000 cfs" at the Merchiston site while at Genoa, "excursions above 90 degrees F occurred when discharge were less than 1,500 cfs". Further analyses of the relationship between

flow and water temperature for discharges less than 200 cfs (Figs 5-13 to 5-15) for the Genoa site suggest a more significant negative relationship may occur. Indeed, the examination of the relationship between air and water temperature at extremely low flows (Figs 5-19 through 5-24) suggest a tighter and slightly stronger relationship between these parameters as evidenced by the increase in model $R^2$ values given."

"To further demonstrate the importance of focusing on low flows and high maximum temperatures, the SISR analyzed the probability of exceeding 90 degrees F based on flows. For the Merchiston data (above the diversion, there is a 45% probability of a temperature excursion occurring at flows less than 2,500 cfs and the probability increases as flow declines. For the Genoa data (below the diversion) there is approximately a 60% probability of a temperature excursion occurring at flows less than 150 cfs."

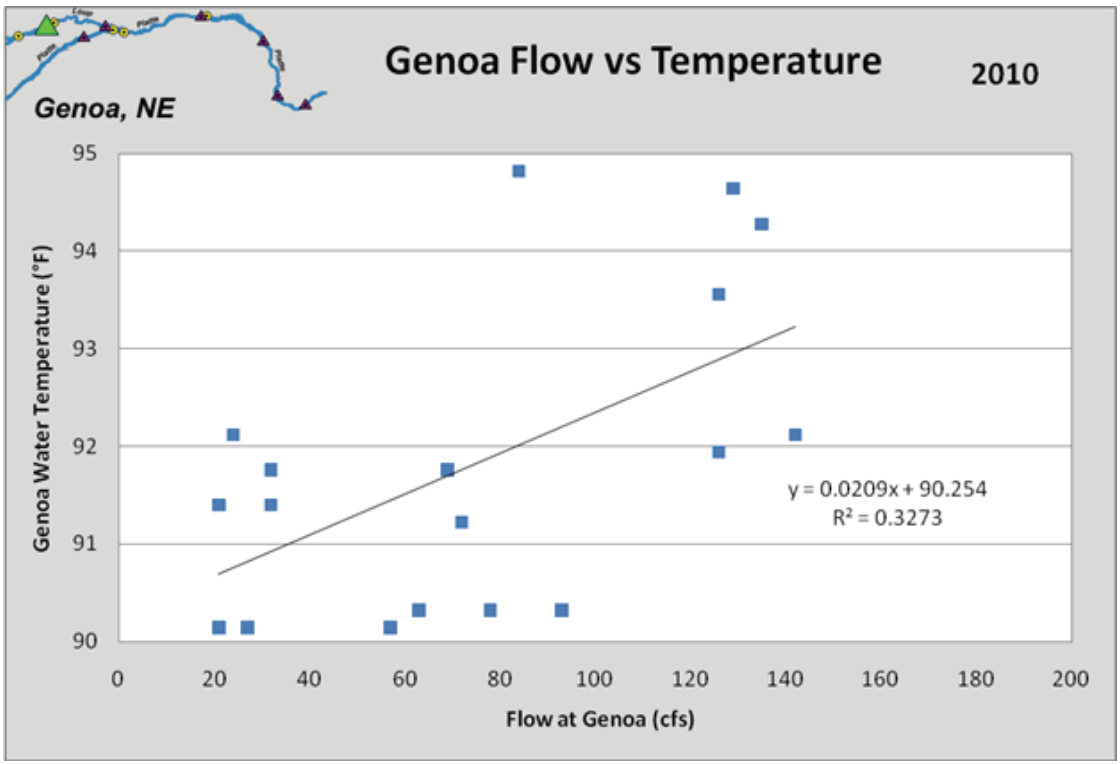
**District Response**

First, the District notes that NGPC is both suggesting that the use of hourly temperature data assures an insignificant relationship when analyzing the entire data set, yet points to a "significant negative relationship" when analyzing hourly data in Figures 5-13 through 5-15. The District believes that the analysis of daily data is inappropriate due to the low number of data points with exceedances (15 days total) and that the more data points available for analysis, the more likely the analysis will identify any relationships that exist.

Furthermore, the District disagrees that the use of hourly discharge and temperature assures an insignificant relationship. If there were a strong relationship, it would be obvious in the analyses. The fact that using hourly discharge and temperature shows no statistically significant relationship means that any possible relationship between flow and temperature would be slight at best. Additionally, the District notes that because the hourly data did not show a statistically significant relationship between flow and water temperature, the District expanded the statistical analyses to more completely address the study goals. The District performed linear regression, multiple linear regression, and multiple logistic regression on the daily maximum temperatures at Genoa and found no statistically significant relationship between flow and water temperature. The District also performed multiple linear regression and multiple logistic regression on a subset of the hourly flow and temperature data (water temperatures above 63 degrees F) and again found no statistically significant relationship between water temperature and flow.

Additionally, a problem with focusing only on water temperatures above 90 degrees F and flows less than 200 cfs is that few events meet these criteria. In the Genoa data set, for example, only 18 records (occurring on 5 separate days),

representing 1.1 percent of the total number of paired hourly observations, contain temperatures above 90 degrees F and flows below 200 cfs. This small sample exhibits a weak linear relationship which accounts for 33 percent of the variance in the sample ($R^2$=0.33). Not only is the relationship weak, it is positive and suggests that as flow increases, temperature also increases, thus increased flow does not significantly mediate water temperature. This is the exact opposite effect NGPC has noted. These trends are shown on the scatter plot below; with n = 18 and degrees of freedom = 16, the relationship could be called statistically significant, but it is not practically significant.




*P value not show as this example is for an illustrative point only, and not an actual statistical significance test.

While the District calculated the exceedance probabilities using Sinokrot and Gulliver's method (Figures 5-3 and 5-16) as requested by USFWS. The District disagrees with the conclusions that NGPC draws from these graphs. The District believes that the Sinokrot and Gulliver results support the District's conclusion that there is not a significant relationship between low flows and water temperature excursions. For example, using linear interpolation between the data points on the Sinokrot and Gulliver exceedance probability plots at Merchiston (SISR Study 2.0 – Hydrocycling, Figure 5-3), the 75 percent exceedance flow rate is 2,000 cfs, while at Genoa (SISR Study 2.0 – Hydrocycling, Figure 5-16), the 75 percent exceedance flow rate is approximately 120 cfs. If flow was a primary factor in water temperature, the District would expect a 2,000 cfs flow to have a percent exceedance of approximately 13 percent at Merchiston, rather than 75

percent. Furthermore, the District notes that the exceedance probability plots have very few data points and it is typically inappropriate to develop conclusions using so few data points.

**NGPC Comment 3**
**Water Temperature Relationships Between Sites**
"The stated conclusions that the relationships between water, soil and air temperatures and flow respond in the same manner between sites on the river is to be expected. However, this conclusion does not directly address the question whether or not there is a difference in the degree of change that might occur between sites dependent upon flow. The synchronous daily oscillations in water temperature that occur between the two sites are a testament to the influence of daily air temperatures and its similarity at both sites. Figures 5-39 through 5-41 demonstrate that as temperatures increase in the river during the warmest portion of the year, the trend is for daily water temperature points at Genoa to increasingly be greater than those at Merchiston. This is seen in both the higher peaks of the daily oscillations as seen in Figure 5-39 as well as the trend towards more points being above the 1:1 Line as seen in Figures 5-40 and 5-41."

**District Response**
The District believes the analyses performed (linear regression, multiple linear regression, and logistic regression on hourly data, hourly data above 63 degrees F, and daily max data) clearly show that synchronous daily fluctuations have an overwhelming influence from ambient air temperature and minimal, if any, influence from flow. With respect to the higher peaks on Figure 5-39 noted by NGPC, there were 15 days that daily max Genoa temperature was above 90 degrees F and 7 days that Merchiston was above 90 degrees F (see table below). Figure 5-39 shows that there are 9 days when the temperature at Genoa is above 90 degrees F and the temperature at Merchiston is not. On 7 of those 9 days, the water temperature at Merchiston was less than 2 degrees F lower than the water temperature at Genoa.

**Number of Days with Daily Maximum Water Temperature Above 90 Degrees F**

| Month | Genoa | Merchiston |
|---|---|---|
| May | 0 | 0 |
| June | 0 | 0 |
| July | 6 | 3 |
| August | 9 | 4 |
| Total | 15 | 7 |

The slope of the regression line on Figure 5-41, using hourly temperature data (errant data removed) with Merchiston on the x-axis and Genoa on the y-axis is 1.025. Although not shown on Figure 5-41, the District calculated the 95 percent confidence interval around the slope of the regression line as 1.017 and 1.035. By using Merchiston as the predictor, if Merchiston is 90 degrees F then the temperature at Genoa could be anywhere from 89.27 to 90.89 degrees F.

Therefore, using hourly data and a 95 percent confidence interval, the analysis shows that there is only a 1 degree F swing of temperature at Genoa around the temperature at Merchiston (90±1 degree F). These differences in temperature, between Genoa and Merchiston, are further reduced when taking into account a 0.36 degree F variability in temperature instrumentation.[1] The combined error of the two instruments can be up to 0.72 degree F, which would almost completely eliminate any actual temperature differences using hourly data.

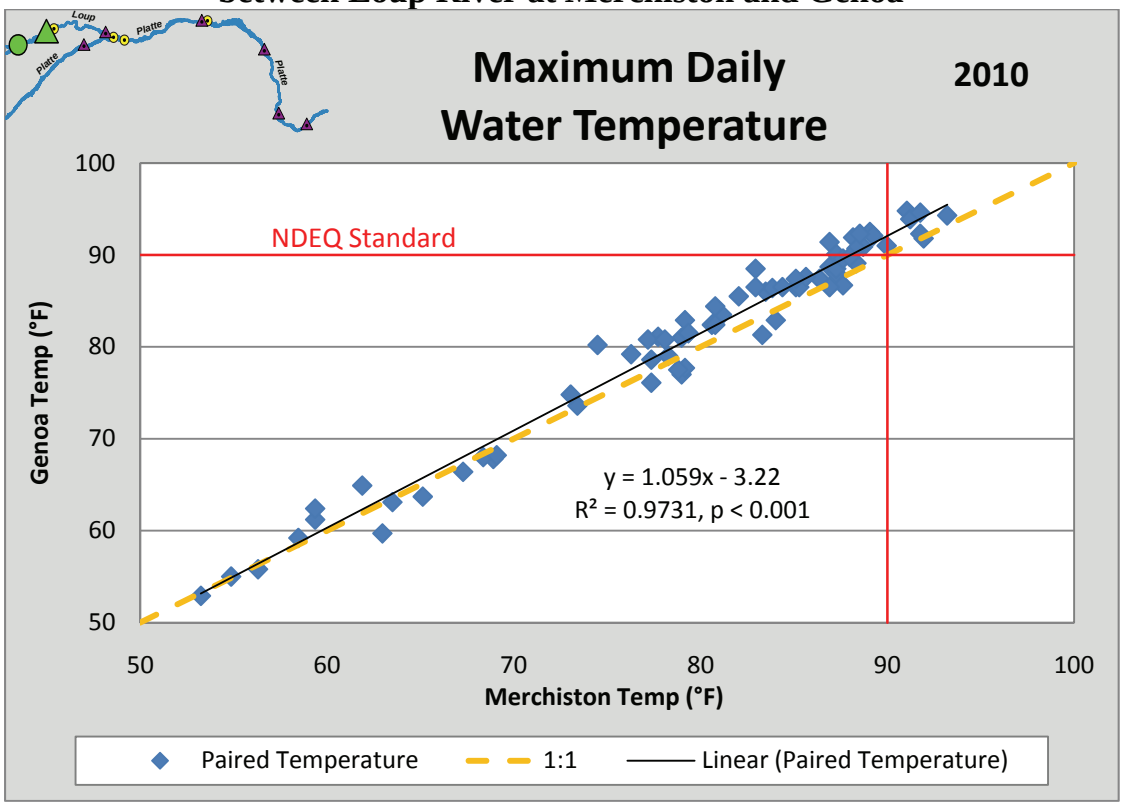
**NGPC Comment 4**
**Water Temperature Relationships Between Sites**
"In a preliminary analysis, NGPC examined the maximum daily water temperatures from the two sites for days exhibiting water temperatures greater than the 90 degree F water quality standard. A total of 13 dates from the 2010 sampling period (May – August) qualified under these constraints. Daily maximum water temperatures at the Genoa site ranged from 1.08 to 4.14 degrees F greater than those measured at Merchiston. In addition, the relationship between daily maximum temperatures differences for the two sites and flow (measured at Genoa) is a negative one. As the flow declines, the difference between daily maximum water temperatures at the two sites increases. This suggests that at these higher temperatures, water temperatures reach a higher maximum on a given day below the diversion than above it. The fact that there is a statistically significant relationship between the recorded water temperatures at the two stations confirms that water temperature is reacting in a similar manner to the changes in air temperature. The absolute difference in daily maximum water temperatures between the two sites at high temperatures and relatively low flows suggests a potential impact due to water diversion."

[1] Design Analysis Associates, Inc. *WaterLOG Thermistor Temperature Probe Model H-377 , Owner's Manual Revision 1.0*. Available at http://waterlog.com/media/pdfs/H-377-Manual-v1-0.pdf.

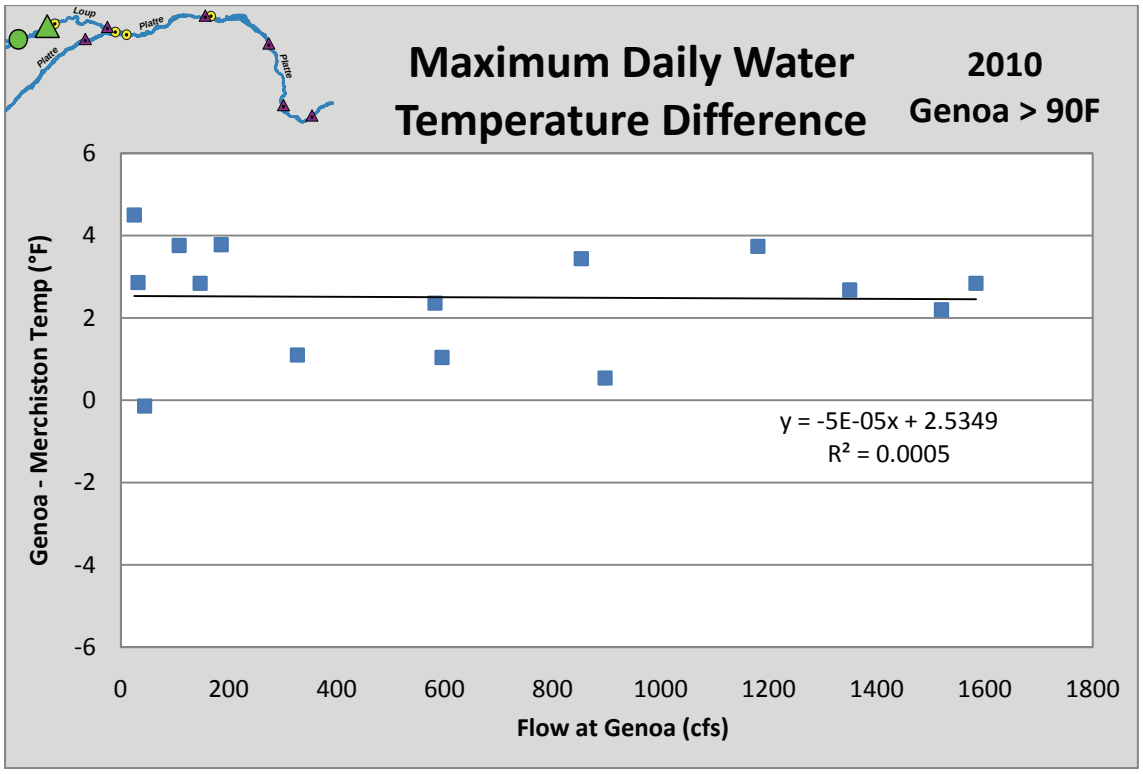
**District Response**

The fact that there is a statistically significant relationship is important, but it is more important that the relationship is near 1:1, as shown in the following graph.

**Maximum Daily Water Temperature Relationship between Loup River at Merchiston and Genoa**

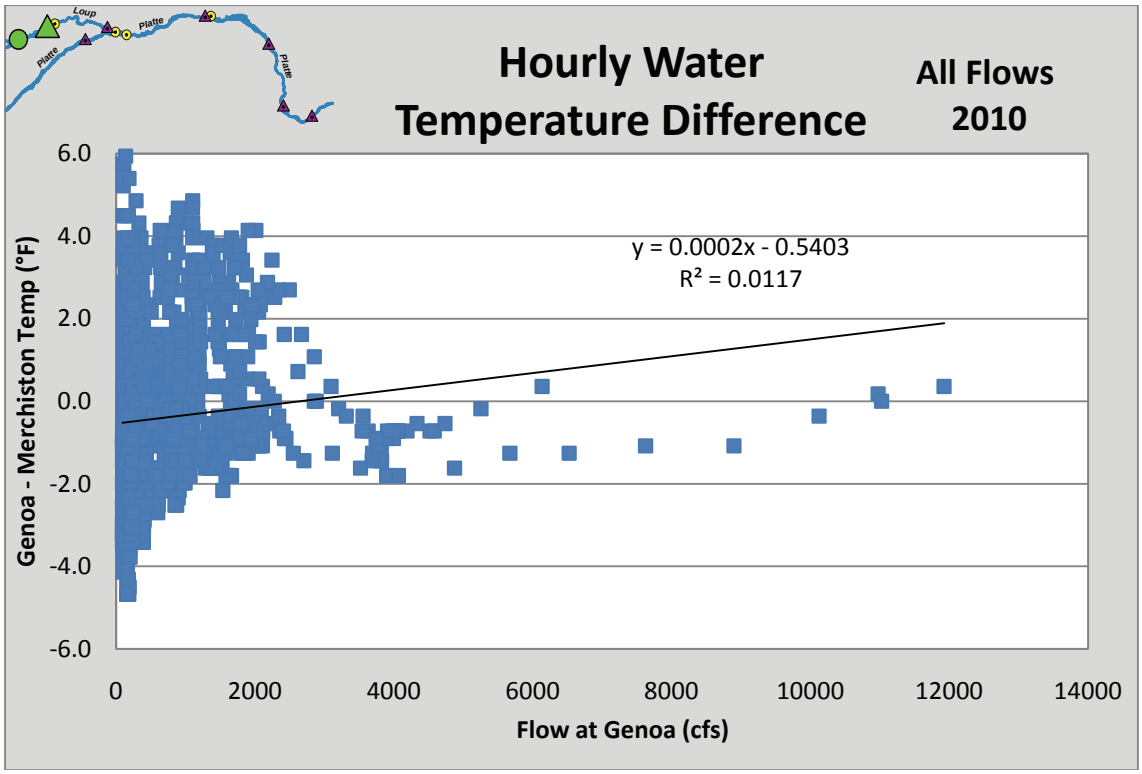


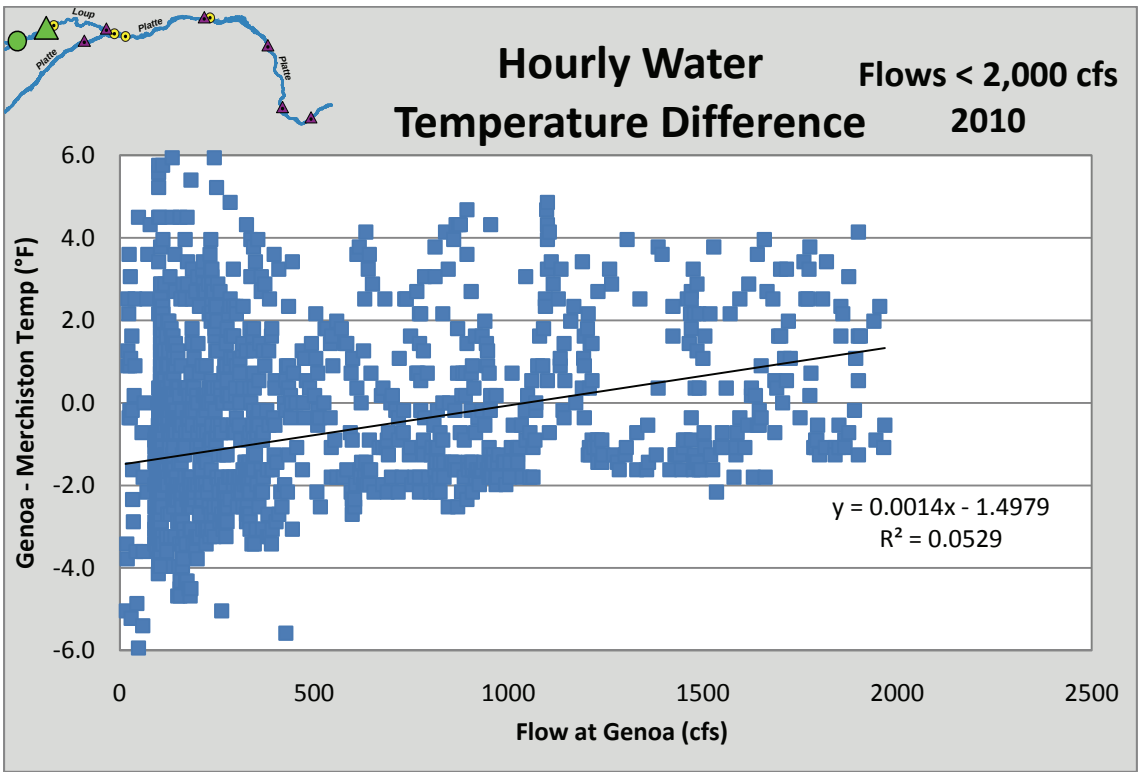

District records show that there were 15 total days that the daily maximum temperature at Genoa was greater than 90 degrees F. Of these 15 days, the difference between Merchiston temperature and Genoa temperature ranged from -0.14 to 4.5 with an average of 2.5. As shown in the graph below, on days with exceedances, the difference between the maximum daily water temperatures does not increase as flow decreases, in fact the difference is nearly constant as indicated by the slope of the regression line.

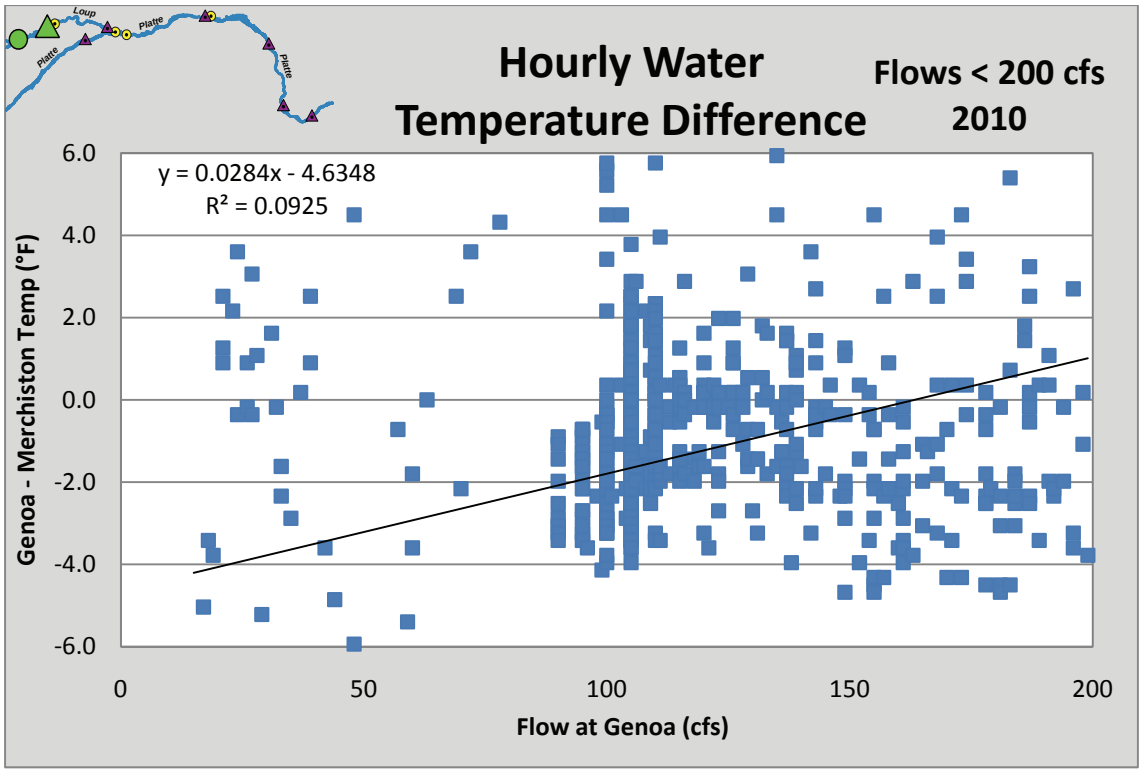



The District's records show that there are 6 total days that the daily maximum temperature at Genoa was greater than 90 degrees F and the flow at Genoa was less than 200 cfs. Of these 6 days, the difference between Merchiston temperature and Genoa temperature ranged from -0.14 to 4.5 with an average of 2.9.

The District created a new dataset for the difference between the daily maximum temperatures at Genoa and the daily maximum temperatures at Merchiston. The mean of that dataset for all flows is 1.47. With an accuracy band of the instrumentation of up to 0.72 degree F, the mean of the differences could be less than one degree F. The graphs below show the difference between temperature at Genoa and Merchiston plotted against flow for all flows, flows less than 2,000 cfs and flows less than 200 cfs. In all three cases, the plots show a wide range of variability in temperature difference between Genoa and Merchiston, both positive and negative. Furthermore, the resulting regression equations exhibit a weak correlation of 9 percent or less.


Hourly Water Temperature Difference
All Flows 2010
y = 0.0002x - 0.5403
R² = 0.0117
Genoa - Merchiston Temp (°F)
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
0
2000
4000
6000
8000
10000
12000
14000
Flow at Genoa (cfs)


Hourly Water Temperature Difference
Flows < 2,000 cfs 2010
y = 0.0014x - 1.4979
R² = 0.0529
Genoa - Merchiston Temp (°F)
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
0
500
1000
1500
2000
2500
Flow at Genoa (cfs)




**NGPC Comment 5**
**Temperature, Flow and Fish Kills**

"This relationship described above seems to have been manifested during Loup River fish kills in 1988 and 1995. On both occasions, catastrophic fish kills occurred below the diversion and upstream of the confluence of Beaver Creek. During the June 20, 1988 fish kill, the water temperature in the Loup River immediately above the headgates diversion was 85 degrees F while the water temperature in the Loup River at the Genoa bridge was 96.8 F. The air temperature at the Monroe weather station was 101 F. River gage flow at Genoa was 13-17 cfs during the fish kill. During the July 1995 fish kill, water temperature in the Loup River below the headgates at the Genoa Bridge was 98 F with a river gage flow of 27 cfs and an air temperature of 104 F. Staff from DNR (at that time Dept of Water Resources) measured a flow of 22.7 cfs on July 13 while conducting the investigation of the fish kill. At that time DNR stated "Personnel at the headgate contend that the Power Canal had been diverting all the flow in the Loup River into the canal for the past couple weeks. It appears to me that a seam leak in the headgates and seepage is what produced the majority of the measured flow (22.7 CFS) in the Loup River."

"In reviewing flow data compared to ambient air temperatures when fish kills did and did not occur, NGPC District staff came to the conclusion that fish kills occurred when river flows below the diversion were less than 50 cfs and air temperatures exceeded 98-100 F. NGPC staff advised LPPD in a letter dated

November 15, 1995 that in order to avert fish kills, NGPC recommended a minimum flow of 50 cfs in the river below the diversion on days when the air temperature exceeded 98 F. This recommendation seemed to become a "gentlemen's agreement" between LPPD headgates operators and NGPC managers to alleviate fish kills below the diversion in summer months. NGPC staff have not investigated a catastrophic fish kill in this reach of river since 1995. This does not imply that fish kills have not occurred since 1995, but certainly no large scale fish kills followed by public reports and phone calls.

**District Response**

Over the course of relicensing, the District has requested and received a variety of data from various resource agencies, including fish kill information from NGPC and the Nebraska Department of Environmental Quality (NDEQ). However, the District does not have any information regarding the fish kill in 1988 other than a reference to the incident in a November 15, 1995 letter from Jeff Schuckman, NGPC to Dennis Bachman, LPD. The information that the District has related to fish kills has been included in all pertinent relicensing documents to date, including the Pre-Application Document (page 5-46) and the Revised Study Plan (page 4-1).

Although, the District acknowledges that three fish kills have been documented in the Loup River bypass reach; the District disagrees with the use of the word "catastrophic" to describe these incidents. Neither the NGPC reports nor the NDEQ reports use the term catastrophic.

The District provides the following information related to the fish kills that have occurred to provide perspective on each incident:

- July 1995 – report indicates an "unknown" number of fish died
- July 1999 – report indicates "large numbers of mixed species" died
- July 2004 – report indicates that 15 channel catfish, 14 minnows, and 1 river carpsucker died, for a total of 30 fish.

The District has no knowledge of where or how temperature data was collected related to any of these incidents. Further, the District notes that the temperature data collected by USGS in 2010 show that for days in which the max daily temperature at Genoa was above 90 degrees F, the largest difference between Genoa temperature and Merchiston temperature was 4.5 degrees F, far less than the 11.8 degrees F difference noted by NGPC in relation to the 1988 fish kill.

As noted by NGPC, in 1995, in response to the NGPC request and the documented fish kills in the Loup River bypass reach, the District began voluntarily allowing for a flow of 50 to 75 cfs in the Loup River bypass reach when ambient air temperatures warrant. However, in 2008, the District suspended this practice due

to water accounting issues raised by the Nebraska Department of Natural Resources (NDNR). The District is currently working with NDNR to resolve these issues.

**NGPC Comment 6**
**Further Recommendations**
"Study 4.0 – Water Temperature in the Loup River Bypass Reach data should be re-analyzed by HDR to determine the extent of any relationship between data for high daily air temperature and high daily water temperature, difference between sites in high daily water temperatures as measured at Merchiston and Genoa, and the effect flow has on this temperature difference (paying particular attention to high daily water temps above 90 F and bypass flows less than 200 cfs). Also, the relationship between flow, maximum daily air temperature and maximum daily water temperature, specifically on those days where the water temperatures are above 90 F and flows are less than 200 cfs, should be re-examined."

"It is also recommended that the temperature study continue for at least one more season to gather additional data concentrated on the warm weather months of June through August and assuring that river water temperatures are collected during low flow periods. Due to the loss of data from temperature loggers for a variety of reasons in 2010, there simply may not be enough data points from the 2010 study to determine significant relationships under low flow, high temperature scenarios."

**District Response**
Contrary to the NGPC assertion, the SISR Study 4.0 Temperature in the Project Bypass Reach did analyze daily maximum temperature at Genoa. The District performed linear regression, multiple linear regression, and multiple logistic regression on the daily maximum temperatures at Genoa and found no statistically significant relationship between flow and water temperature. The District also performed multiple linear regression and multiple logistic regression on a subset (water temperatures above 63 degrees F) of the hourly flow and temperature data and again found no statistically significant relationship between water temperature and flow (see SISR Study 4.0 – Temperature in the Project Bypass Reach, Section 5).

As noted previously in the District's responses to NGPC comments 2, 3 and 4, data collected by USGS in 2010 shows that there were 15 total days that the daily maximum temperature at Genoa was greater than 90 degrees F. Of these 15 days, the difference between the daily maximum Merchiston temperature and daily maximum Genoa temperature ranged from -0.14 to 4.5 with an average of 2.5 degrees F. Our records show that there are 6 total days that the daily maximum temperature at Genoa was greater than 90 degrees F and the flow at Genoa was

less than 200 cfs. Of these 6 days, the difference between Merchiston temperature and Genoa temperature ranged from -0.14 to 4.5 with an average of 2.9 degrees F.

An important point that should be emphasized is that there can be exceedances of the temperature standard at high flows. All of the temperature exceedances at Merchiston occurred during flows that were higher than at Genoa. Additionally, of the 15 total days that the daily maximum temperature at Genoa was greater than 90 degrees F, four of those days occurred when the average daily flow at Genoa was above 1,000 cfs.

Furthermore, the District is concerned that paring down the data set would do two things:

1. Reduce the power of the analysis by reducing the amount of data available and the degrees of freedom, and
2. Alter the dataset to get spurious results by focusing solely on those rare occurrences when flow is less than 200 cfs, ambient air temperature is high, and water temperature is greater than 90 degrees F.

The District believes that NGPC's proposal to conduct another year of temperature monitoring at Merchiston and Genoa is unnecessary and will not lead to conclusions different than those found using the 2010 dataset. NGPC makes this recommendation based on a need to gather temperature data during low flow periods and because of missing temperature data during the 2010 data collection. With respect to assuring that temperature data be gathered during low flow periods, the District notes that temperature data during low flow periods was gathered during 2010 and gathering additional data in 2011 does not guarantee that there will be more data points with high ambient air temperature and low flow.

With regard to missing temperature data, the District acknowledges in the SISR that temperature data was missing during a portion of the study period at both Merchiston and Genoa; however, the District provides the following information to support a conclusion that missing data did not substantially alter the conclusions of the study.

At Merchiston, flow data was missing from June 27 through June 30; since temperature exceedances at Merchiston are not related to flow diversion, the District believes that this data gap is insignificant. At Genoa, flow data was missing from June 11 through July 18, a time period that corresponded with the highest flows of the summer. The District acknowledges that even though this period experienced high flows, there was a period of 2 days from July 3 to July 4 when flows were less than 500 cfs. However, the District believes that the water temperature data gap during this period is also insignificant to the analysis since maximum ambient air temperatures during this period were 84.4 degrees F and

80.7 degrees F. The District notes that the analysis in Study 4.0 Water Temperature in the Project Bypass Reach clearly shows that water temperature is highly correlated to ambient air temperature, as such, relatively low ambient air temperatures during these 2 days of low flows would not substantially alter the conclusions of the study.

Based on the above information, the District believes that NGPC's proposal to conduct additional analysis related to Loup River bypass reach temperature is unnecessary.

**2. Comments on Study 2.0 – Hydrocycling**

**NGPC Comment 1**

"Objective 2 of the Hydrocycling Study was to "To determine the potential for nest inundation due to both hydrocycling (current operations) and run-of-river operations".

"The study was based on developing a conceptual theoretical-predictive model in effort to simplify the complex interrelationships in the Loup-Platte River system. The study, as it was initially devised, has been successfully completed. Now that the modeling component of the study has been completed and presented for review, the results must be validated by comparing it with empirical data. Following a review of the theoretical model results with empirical data, it is clear that the theoretical model bears little resemblance to what is happening in Loup-Platte River system. We take this opportunity to evaluate the theoretical model and identify some of the major problems. Specifically, we identify key assumptions that are unrepresentative on review and require modification if the study results are to be considered useful. These assumptions need to be revised if the study results are to be considered informative."

**District Response**

The nest inundation study concept was developed in coordination with resource agencies and approved in the SPD. The District believes that all parties understood the limitations of the theoretical model when the idea was developed. The District believes that the analysis in the SISR is valid and provides a reasonable comparison of current operations to run-of-river operations.

**NGPC Comment 2**

**Assumptions unrepresentative on review that require revision**

"*Assumption #1* – The analysis uses the highest flow event between 1 February and 25 April in a year as the benchmark flow for the breeding season in that year. While, on the surface this may appear to be a reasonable assumption, it is flawed as it makes the model inputs far too limiting. For example, A) this pre-nesting season sub-daily peak flow may be inadequate, in anyone or even most years, to

create the macro-form sandbar habitat that Interior Least Tern and Piping Plovers use for nesting, B) habitat forming flow events can and do occur outside this period, and, C) birds may be forced to delay the onset of breeding when high flow events occur early in the nesting season. The result is that the Study ignores high flow events that are critically important to terns and plovers and consider flows in the Study that are inconsequential."

**District Response**
The purpose of the inundation study was to determine the potential for nest inundation due to both hydrocycling and run-of-river operations. As such, a theoretical pre-nesting benchmark was used to compare to nesting season flows to identify occurrences in which that value was exceeded. It was not intended to be used to identify habitat forming flows. While a habitat forming flow may create bars, other factors such as dominant and effective discharge, shape the river over time. Therefore, the District believes that flows prior to the nesting season serve as a reasonable indicator of potential habitat available.

**NGPC Comment 3**
**Assumptions unrepresentative on review that require revision**
"*Assumption # 2* – The model assumes that using a single point value for nest distributions is adequate; this means that if a benchmark flow occurs at single value, all nests (the actual variable of interest) also occur at a single benchmark value. In actuality, tern and plover nests are found at a variety of benchmark values. Indeed, the report acknowledges this point on page 24, under the first bullet point where it states:

> *"It is also assumed that nesting can occur above the highest pre-season flow due to preexisting, higher sandbars. If habitat is available, nesting may also occur below this benchmark."*

"While the report states that this point of fact is "assumed", it does not incorporate this assumption into the analysis (in fact, the assumption in the model is that all nests occur at a single point value). This sets up the analysis as an all or nothing question (effectively, a 'straw man') regarding the "possibility" of inundation at run-of-river or current operations. Effectively, the analysis avoids addressing the question of whether nests have a lower or higher *probability* of inundation from current operations compared to run-of-river. There is also a temporal distribution of nests that should be considered in the model."

**District Response**
The District's analysis was set up to determine inundation "events" for both operating conditions, i.e. identifying times when a relative benchmark was exceeded under each condition. The analysis was not intended to identify specific

numbers of inundated nests. Further, the District notes that the same assumption was used for analysis of current operations and the run-of-river operations; thus any the analysis for each condition is affected in the same way. The assumption was thoroughly discussed and agreed to by all parties during study plan development. NGPC interpretation is inconsistent with the intent of the study which is to compare with and without hydrocycling operations.

**NGPC Comment 4**
**Assumptions unrepresentative on review that require revision**
"*Assumption # 3* – The analysis assumes a "60-day period for successful nesting". This is an appropriate choice for Piping Plover; even though "breeding" is a more appropriate term rather than "nesting". More important is that the period in which Least Terns can fledge young is much shorter, approximately 25% shorter or 40-45 days. This is important because many more (4-20 times more) Least Tem pairs than Piping Plover pair have nested on the Lower Platte River in recent decades."

**District Response**
The intent of using a 60-day period for successful breeding was to evaluate whether timing of a benchmark exceedance allowed enough time for re-nesting/breeding before the end of the nesting season. A 60-day period was used for both species and provided a conservative value for interior least terns since, as noted by NGPC, the time required for interior least terns to re-nest and fledge is 45 days.

Based on NGPC's comment, the District has reevaluated the potential for re-nesting for interior least terns as shown in Table 5-7 in the SISR. The initial analysis indicated that exceedances of pre-nesting season benchmarks occurred in 2007, 2008, and 2009. The original analysis indicated that renesting/breeding was only possible in 2007 and 2008 based on benchmark exceedance dates of June 1 and June 14, respectively. In 2009, the last benchmark exceedance occurred on June 28, using a 45-day re-nesting/fledging period, re-nesting also would have been possible in 2009.

**NGPC Comment 5**
**Testing theoretical results with empirical data**
"The opportunity exists to test the model with data collected in 2006–2009 by the Nebraska Game and Parks Commission Nongame Bird Program and the Tern and Conservation Partnership. Nesting data collected was provided to HDR and the District with the expectation that they would be used in their studies. Additionally, preliminary research results were also summarized in the following documents also made available to HDR and the District online:

Brown, M.B., and J.G. Jorgensen. 2010. "2010 Interior Least Tem and Piping Plover monitoring, research, management, and outreach report for the lower Platte River, Nebraska. Joint report of the Tem and Plover Conservation Partnership and the Nebraska Game and Parks Commission Non-game Bird Program, Lincoln, NE.

Brown, M.B., and J.G. Jorgensen. 2009. "2009 Interior Least Tem and Piping Plover monitoring, research, management, and outreach report for the lower Platte River, Nebraska. Joint report of the Tem and Plover Conservation Partnership and the Nebraska Game and Parks Commission Non-game Bird Program, Lincoln, NE.

Brown, M.B., and J.G. Jorgensen. 2008. "208 Interior Least Tem and Piping Plover monitoring, research, management, and outreach report for the lower Platte River, Nebraska. Joint report of the Tern and Plover Conservation Partnership and the Nebraska Game and Parks Commission Non-game Bird Program, Lincoln, NE.

**District Response**

First, although the District does not dispute that the above noted references are currently available online, the District makes the following points regarding the availability of this research:

- The District understands that these reports were posted; however, without notification the District was unaware of their availability. The District would appreciate it if, in the future, when research pertinent to relicensing is underway and/or completed, resource agencies could notify the District.
- Brown, M.B., and J.G. Jorgensen. 2010 – although this document is currently available online, it was not available at the time when the District was developing the SISR.

While the District agrees that the opportunity for comparison with empirical data does exist, the District does not believe that the available nest inundation data can be used for comparison due to the limitations in data collection. For example, nesting sites are not visited on a frequent enough basis to draw definitive conclusions on why a nest was unsuccessful.

**NGPC Comment 6**

**Testing theoretical results with empirical data**

"*Assumption #1* -The analysis uses the highest flow event between 1 February and 25 April in a year as the benchmark flow for the breeding season in that year.

A) This pre-nesting season sub-daily peak flow in most years is likely inadequate in some years to create macro-form sandbar habitat that Interior Least Tem and Piping Plovers use for nesting.

Parham (2007, *Hydrologic Analysis of the lower Platte River from 1954-2004, with special emphasis on habitats of the endangered Least Tern, Piping Plover, and Pallid Sturgeon*) stresses the importance of high flow events. High flows events of a certain magnitude are necessary to create the macro-form sandbars that are used by terns and plovers. Parham (2007) identified 38,170 cubic feet per second (cfs) as the critical threshold necessary to create habitat of sufficient quality for nesting birds. Thus, flow events below this value, especially those well below this value, will be inconsequential in creating sandbars that birds would use for nesting. If sandbars of a certain size and relative elevation are not available, birds may select other sites or even systems for nesting. The Study uses benchmark flows under current operations of 9,077 and 26,523 for the years 2006 and 2007, respectively, in the model analysis. However, the data (in the possession of HDR and LPPD) show that no nesting was observed between river miles 50–103 in those years; a point not recognized by the Study. River Miles 50–103 is the section that includes the LPD diversion return and extends approximately fifty miles downstream from the diversion return.

**District Response**

The District appreciates that nest inundation will not occur if suitable habitat is not available for nesting. However, the District's study made no attempt to determine if suitable habitat was present or absent. The goal of the nest inundation study was "to determine the potential for nest inundation due to both hydrocycling (current operations) and run-of-river operations." It was a theoretical study and was not intended to evaluate the presence, absence, or frequency of actual nesting on the river. As noted in the study, several factors can and do affect nest location selection and success. These factors include nest inundation, predation, human disturbance, and alternative available habitat.

**NGPC Comment 7**

**Testing theoretical results with empirical data**

B) Habitat forming flow events can and do occur outside this period

The highest flow events more often occur outside the pre-nesting season sub-daily peak (benchmark) flow period of 1 February to 25 April. Specifically, only 24% of the annual peak stream flow events occurred during that period at Louisville from 1953–2009 (Figure 1). A similar pattern can be expected throughout the Loup-Platte River system. Furthermore, peak stream flow only occurred in the 1 February to 25 April period during one year (2006) of the study. As noted above, this was a year when no nesting was observed in the portion of the river proximal to the project. Parham (2007) used a moving window analysis and identified the

greatest discharge within 1.5 years of each nesting season as the appropriate habitat-forming flow. Although recent information suggests that, in some instances, macro-form sandbars used for nesting and created by habitat-forming high flow events may persist longer than the 1.5 year period (see Brown and Jorgensen 2010, pages 38–45).

**District Response**

The District acknowledges that peak flow events can and do occur outside the pre-nesting season period used in the inundation study (February 1st to April 25th for piping plovers and February 1st to May 15th for interior least terns). Additionally, the District acknowledges that the highest flow events do occur more often outside the pre-nesting season period on the Platte River at Louisville. However, the District disagrees that a similar pattern can be expected throughout the Loup-Platte River system. A review of the Platte River at North Bend gage, the Platte River at Duncan gage, and the Loup River at Genoa gage (using USGS website annual peak stream flow) reveals that the highest percentage of peak flow events at these gages occur within the flow period of February 1st to April 25th as shown in the following tables.

**Peak Annual Stream Flow (1953 to 2009) – Piping Plover Nesting Season**

| | Loup at Genoa | Platte at Duncan | Platte at North Bend |
|---|---|---|---|
| Feb 1 – Apr 25 | 30 % | 54% | 37% |
| Apr 26-May 31 | 20% | 19% | 19% |
| June | 26% | 19% | 30% |
| July | 5% | 4% | 2% |
| August | 5% | 2% | 7% |
| Sep-Jan | 14% | 2% | 5% |

**Peak Annual Stream Flow (1953 to 2009) – Interior Least Tern Nesting Season**

| | Loup at Genoa | Platte at Duncan | Platte at North Bend |
|---|---|---|---|
| Feb 1 – Apr 25 | 33 % | 59% | 42% |
| Apr 26-May 31 | 17% | 14% | 14% |
| June | 26% | 19% | 30% |
| July | 5% | 4% | 2% |
| August | 5% | 2% | 7% |
| Sep-Jan | 14% | 2% | 5% |

At North Bend, the study captured 56 percent of the peak flows during the pre-nesting and nesting periods for piping plover as defined in the SISR (37 percent pre-nesting and 19 percent during the nesting period).

In addition, for the Study period of 2003 to 2009, the peak discharge occurred during the February 1st to April 25th piping plover time frame three times at the Platte at Duncan gage and once at the Loup at Genoa gage (the two gages affecting flows in the reach considered in the study – Tailrace Return to North Bend).

For the interior least tern nesting season, a review of the gage data shows that the highest percentage of annual peak stream flows occurs between February 1st and May 14th for the Platte River gages at North Bend and Duncan, as well as the Loup at Genoa gage. In addition, at least 50 percent of peak flows occur during the pre-nesting and nesting periods identified in the study. Furthermore, approximately 30 percent of the peak flows at the North Bend gage occur in June,

With respect to the inundation study, during the Study period of 2003 to 2009, the peak discharge occurred during the February 1st to May 14th time frame once at the Platte River at North Bend gage, five times at the Platte River at Duncan gage and twice at the Loup at Genoa gage. At North Bend, the study as presented captured 86 percent of the peak flows (42 percent pre-nesting and 44 percent during the nesting period of May 15-July 1).

**NGPC Comment 8**
**Testing theoretical results with empirical data**

C) Birds may be forced to delay the onset of breeding when high flow events occur early in the nesting season.

This occurs regularly when there are high flow events early in the nesting season. In fact, Least Terns are well adapted to such events. In 2008, a high flow event occurred during late May and early June. Following the high flow event, 150 Interior Least Tern and three Piping Plover nests were located on the Lower Platte River from River Mile 7 to 99 and the earliest initiation date for any nest on the Lower Platte River based on egg-floating data was 16 June. Parham (2007) correctly identified the highest discharge within 1.5 years of each nesting season as the appropriate flow relative to bird nesting, regardless of when it occurred.

**District Response**
The District notes that the inundation study accounted for the fact that onset of breeding can be delayed by high flow events by evaluating the potential for re-

nesting. Furthermore, the District is unclear how the delay of nesting due to high flows is related to Parham's theory regarding the 1.5-year flow as noted by NGPC.

**NGPC Comment 9**
**Testing theoretical results with empirical data**
"*Assumption #2* - The model assumes that using a single point value for nest distributions is adequate; this means that if a benchmark flow occurs at single value, all nests (the actual variable of interest) also occur at a single benchmark value.

"Flow events that create habitat have maximum values, but these values do not represent the relative elevations of the sandbars or of all nests in the system. In 2009, we measured sandbar elevations. Figure 3 shows the benchmarks for individual transects on sandbars where nesting was observed between River Miles 60 and 102. Note: this is not a distribution of nest benchmarks. The graphic only shows that there is a wide range of benchmarks and that the data generally follow a normal distribution. It should be noted that most of the benchmarks in Figure 3 are greater than the Study's 2009 pre-nesting benchmark."

"We were making regular visits to colonies in 2008–2009 and our observations show that inundation events do not necessarily have all or nothing consequences for the birds, as the Study assumes. In 2008, out of 153 nests (150 tern, 3 plover), only one nest was inundated and this was below the Salt Creek confluence. This is notable because Salt Creek flows were responsible for a substantial rise in Platte River levels on approximately 21 July 2008. In 2009, out of 311 (264 tern, 47 plover), 67 were known to be inundated, thus, it was only a partial inundation event. We do not have benchmark information for nests. Importantly, we can isolate the actual high flow event that actually resulted in the inundation of nests (it occurred during the third week of June and is highlighted in Figure 3, which is a graphic provided in the Study report)."

The Figure 3 captions states "Figure 3: 2009 hydrograph from the 2009 study highlighting the high flow event that caused actual nest inundation. The Study results show that the difference in the peak of the current operations was 1122 cfs greater than the run of the river. Hydrocycling **did** inundate nests."

**District Response**
The District agrees that nesting can and does "occur above the highest pre-season flow due to pre-existing, higher sandbars" as noted in the SISR Study 2.0 – Hydrocycling report (pg. 24). The intent of the inundation analysis was not to identify all inundated nests, but to identify the relative difference in inundation between current operations and run-of-river operation. Furthermore, the District notes that the relative range of available habitat, if derived from the assumption

that high flows are creating the habitat, would be comparable under both operating scenarios (current operations and under run-of-river operations).

The District would also like to point out that while most of the benchmarks shown in NGPC's Figure 2 are higher than the pre-nesting season benchmark in study year 2009 (10,400), the highest flow of the season (approximately 15,100 cfs) occurred on June 17. For interior least terns, as shown in NGPC's Figure 3, re-nesting opportunities where available within the 45-day window required to fledge young before the end of the nesting season on August 15.

In the caption for Figure 3, NGPC states that "hydrocycling **did** inundate nests" (emphasis is theirs) and points to a critical flow event that inundated a minimum of 67 nests in 2009. The District believes this statement is misleading. As noted in Figure 3, the June 2009 peak discharge at North Bend under current operations was estimated as approximately 15,100 cfs, as compared to a run-of-river estimate of 14,000 cfs (note that both current operations and run-of-river were based on synthetic hydrographs created for the study). According to the USGS rating curve at North Bend, the difference in stage between 15,100 cfs and 14,000 cfs is 0.13 ft, or 1.5 inches. Furthermore, in reviewing the NGPC data related to nest inundation, the District notes that approximately 18 nests identified as inundated were located upstream of North Bend (RM 99 and RM 90) and the remaining nests identified as inundated were located between Leshara and Ashland. As noted in the District's SISR Study 2.0 Hydrocycling report, the increase in stage associated with hydrocycling is reduced as distance increases downstream from the Tailrace Return. Additionally, sub-basin precipitation in the lower reaches of the Platte River can, and do, contribute to hydrograph fluctuations.

As previously stated, under storm event discharges, the effect of hydrocycling on flow (and stage) decreases with increasing discharges due to standard operating procedures. The differences in flow (and stage) between current operations and run-of-river operations diminish with increased flow and it becomes harder to separate the singular effect of hydrocycling. This is due to many factors, including, sub-basin precipitation events affecting tributary inflow and hydrocycling upstream in the Platte River basin. Therefore, while hydrocycling does result in varying degrees of increased stage, the effect on bird nests is not necessarily a direct relationship.

**NGPC Comment 11**
**Alternative Analysis A**

"Here we provide that an additional analysis be considered. The objective of this analysis is to show the probability that a nest/chick will remain inundation free for a 45-day period during the breeding season over the range of benchmarks. Once this relationship is determined, we will be able to show how average changes in

nesting season maximum peak sub-daily flows (we use the same terminology as the District's hydrocycling study) will change probabilities.

"METHODS

The analysis is for Least Terns only. The 45-day period was selected because this is the time period required for a pair of terns to produce fledged young. Least Terns respond to changing conditions and are flexible in regard to when they initiate nests. We used the complete history (1949-2009) of river flow data from the USGS gage near North Bend. We conducted a moving window analysis for all years for a 45-day inundation free period from 1 May to 15 Aug at benchmark values of 2500, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000. We make no assumptions regarding initial benchmarks because we have no information with which to make an informed decision. The moving window searches for uninterrupted 45-day during the 1 May to 15 Aug period. We used results from the analysis to determine the proportion of years where the benchmark value includes a 45-day inundation free period. We then used Generalized Additive Model (GAM) in Program R to model the relationship between a particular benchmark value and the probability that a benchmark will remain inundation free for 45 days during the 1 May to 15 Aug nesting season. GAMs are extensions of Generalized Linear Models that can be used to evaluate non-linear relationships. We refer to the initial relationship as run of river. Once the initial relationship was determined, we tested how inundation probabilities would change by adding 2,000 cfs to nesting season maximum peak sub-daily flows. In the analysis, based on a review of gage data we chose 2,000 cfs as the amount that hydrocycling increases peak sub-daily flows. This value is referred to as current operations.

"RESULTS

Results of the analysis are shown in Table 1 and Figure 4.

"DISCUSSION

This analysis illustrates that changes in the nesting season maximum peak sub-daily flows will change probability of a 45-day inundation free period during the breeding season. A review of the District's Hydrocycling Study results show that average nesting season maximum peak sub-daily flows were 1289.4 ± 546.7 cfs (range 12.9 – 4452.6) greater for current operations (hydrocycling) than run-of-river operations (no hydrocycling) during the years 2003-09. While the precise value that hydrocycling increases maximum peak sub-daily flows requires additional study, the relationship and the sensitivity of the change in probability of inundation at different flows are what are most important to evaluate. Probability of inundation appears to be most sensitive to increases in nesting season maximum peak sub-daily flows in the mid-range values (7,500 to 12,500 cfs). Inundation probabilities change very little at upper thresholds at the North Bend Gage study

site. The empirical data show that Least Terns rarely nest at some of the lower values (e.g., < 5,000). However, it is impossible to identify a lower threshold at this time."

**District Response**
The concept presented by NGPC in Alternative Analysis A, of identifying the probability of a given benchmark remaining inundation free for a 45-day window (based on interior least terns) is reasonable. However, NGPC's application of the concept is flawed, specifically with respect to current operations. The District provides the following comment on NGPC's assumptions and analysis:

**Run-of-River conditions** - The District developed a synthetic hydrograph for run-of-river conditions and used that for all comparisons to current operations and believes that this provides the best information for comparison ; however, in the absence of a full synthetic hydrograph, such as the one used by the District, use of the mean daily flow is a reasonable assumption for run-of-river.

**Current operations –** NGPC's addition of 2,000 cfs to the mean daily flow across all flows is inappropriate. As show in the synthetic hydrographs used for the inundation analysis (see Figure 5-4 and Appendix I of SISR Study 2.0) the Project's affect on the hydrograph decreases with increasing flows, this is primarily due to standard operating procedure to cease diversion during high flow events to prevent tree limbs and other debris from flowing into the canal system.

**Benchmarks –** It appears that NGPC's analysis added 2,000 cfs to a daily flow to create the current operations discharge, and then compared the current operations value to the run-of-river benchmark to evaluate inundation free periods. It only seems logical that when comparing a current operations hydrograph to a run-of-river benchmark, that current operations would exceed the benchmark more often than would the run-of-river flow (i.e. 2,000 cfs less). The District believes that a separate benchmark should be established for each operating scenario (as was done in the District's analysis).

**Affect of Discharge on Stage** – NGPC's analysis does not account for the fact that as discharge increases, the change in stage decreases; thus, although the hydrocycling flow is relatively consistent, the actual impact on water surface elevation is diminished as base flows increase, as shown in the following table.

**Stage Comparison for NGPC Benchmark Flows at North Bend**

| Flow 1 cfs | Stage feet | Flow 2 cfs | Stage feet | Stage Delta feet | Stage Delta inches |
|---|---|---|---|---|---|
| 2500 | 3.65 | 4500 | 4.23 | 0.58 | 7.0 |
| 5000 | 4.34 | 7000 | 4.73 | 0.39 | 4.7 |
| 7500 | 4.81 | 9500 | 5.11 | 0.30 | 3.6 |
| 10000 | 5.17 | 12000 | 5.42 | 0.24 | 2.9 |
| 12500 | 5.47 | 14500 | 5.68 | 0.21 | 2.5 |
| 15000 | 5.73 | 17000 | 5.92 | 0.18 | 2.2 |
| 17500 | 5.96 | 19500 | 6.13 | 0.17 | 2.0 |
| 20000 | 6.16 | 22000 | 6.31 | 0.15 | 1.8 |

In addition, it is a requirement of the Integrated Licensing Process that requests for studies (or major modifications to studies approved in the Study Plan Determination) shall be qualified using the 7 Study criteria specified by FERC. Also, as emphasized by FERC during the February 23/24 meeting, requests for additional studies or major modifications to completed studies will be held to a higher standard of justification. NGPC's request for a new study does not address the 7 criteria.

**NGPC Comment 12**
**Alternative Analysis B**
"After reviewing results from Analysis A, we conducted a second analysis to refine our understanding of how inundation probabilities are affected by hydrocycling. The objective of Analysis B is to determine whether and how much inundation probabilities change if nesting season maximum peak sub-daily flows are altered by the mean amount (1289.4 cfs) identified in the Hydrocycling Study report.

"METHODS
The analysis is applicable for both Interior Least Terns and Piping Plovers. We used the complete history (1949–2009) of data from the USGS gage near North Bend. We used benchmark values of 7500, 10000, 12500, 15000, 17500, 20000 cfs. We determined whether the benchmark was exceeded at all benchmarks in all years during June and July; we refer to these exceedences as inundation events. Even though tern and plover breeding can and does occur outside of these months, June and July represent the period when breeding activities are at their peak. Thus, this period is critical and inundation events during this period will have the greatest impact on nesting terns and plovers. If high flows that exceed benchmarks occur early in the breeding season, the birds will delay nest initiation

because no habitat is available to them. We only considered an inundation event to have occurred if there was a minimum ten day long period during which flows did not exceed the individual benchmark; this allowed birds to initiate breeding. If flows exceeded benchmarks persistently through the study period and no ten day periods below individual benchmarks occurred, inundation was considered to not have occurred, because there was a low likelihood that birds initiated nesting in the area.

"We determined the proportion of years where inundation events occurred at each benchmark. We then used a Generalized Additive Model (GAM) in Program R to model the relationship between benchmark values and inundation probability. We then adjusted benchmark values by mean difference to represent the difference (1289.4 cfs) in nesting season maximum peak sub-daily flows between current operations and run of river. We then used the GAM to predict values in Program R at the adjusted benchmarks.

"RESULTS
Results are shown in Figures 5-6 and Table 2.

"DISCUSSION
Analysis B produces results similar to Analysis A. Changes in benchmarks as a result of alterations in nesting season maximum peak sub-daily flows affects inundation probabilities. Specifically, increases in nesting season maximum peak sub-daily flows increase the probability of inundation."

"CONCLUSION
Based on the comments above, the Hydrocycling Study should be reexamined by HDR. We show that the greater the change in nesting season maximum peak sub-daily flows due to hydrocycling, the greater the change in the probability of nest inundation. If hydrocycling increases nesting season maximum peak sub-daily flows, nests/chicks are more likely to be inundated. A higher level of inundation occurred in 2009 as a result of hydrocycling.

**District Response**
The District's comments on Alternative Analysis B are the same as Alternative Analysis A relative to the assumptions and analysis by NGPC.

## References

Sinokrot, Bashar A., and Guliver, G.S. 2000. In-stream flow impact on river water temperatures. J of Hydraulic Research 38(5):339-350.