



Study Plan Meeting Outcomes

Project:	Loup River Hydroelectric Project FERC Project No. 1256		
Subject:	Study Plan Goals, Objectives, and Activities		
Meeting Date:	May 27-28, 2009, 8:30 am – 5:00 pm	Meeting Location:	Holiday Inn Express, Columbus, NE
Revisions Noted by:	HDR		

The Study Plan Meeting held on May 27-28, 2009, included the following discussions:

- Review of progress related to Studies 8-11 (for which the study activities were discussed in preceding meetings);
- Review of the previously agreed upon (during the April 21, 2009, Study Plan Meeting) study goals and objectives for Studies 1-5 and 7;
- Detailed discussion of the activities for Studies 1, 2, 4, 5, 6, and 7;
- Introduction and comprehensive discussion of Studies 12 and 13.

During meeting discussions, the agencies and organizations in attendance discussed whether the goals, objectives, and activities, as stated in the Proposed Study Plan (PSP), along with applicable updates presented by the District, met the needs for data collection related to each study resource, including information needed for evaluation of impacts on species (both aquatic species and threatened and endangered species). Through discussion and revision, consensus was reached on the majority of the goals, objectives, and activities for the Studies listed below. Based on these discussions and revisions, the goals, objectives, and activities, as proposed by the District, are stated below and will be incorporated into the District's Revised Study Plan.

Details of the discussion can be found in the Study Plan Meeting transcript, which is posted to the Project website at: <http://www.loup.com/relicense/html/agencymeetingsresources.html>.

Study Plan 1: Sedimentation

Goal(s):

The goal of the sedimentation study is to determine the effect, if any, that Project operations have on stream morphology and sediment transport in the Loup River bypass reach and in the lower Platte River. In addition, the goal is to compare the availability of sandbar nesting habitat for interior least terns (*Sterna antillarum*) and piping plovers (*Charadrius melodus*) to their respective populations and to compare the general habitat characteristics of the pallid sturgeon (*Scaphirhynchus albus*) in multiple locations (unchanged from PSP).

Objectives and Associated Activities:

Objective 1: To characterize sediment transport in the Loup River bypass reach and in the lower Platte River through effective discharge calculations (PSP Objective 2).

Activities:

- Update sediment budget utilizing existing data sources (PSP Objective 1).
- Generate collective sediment discharge curves at gage stations (unchanged activity from PSP).

- Determine Sediment Transport Indicators: Effective Discharge and Total Sediment Transport [including sub-daily calculations and evaluation of wet and dry cycles (dependent on available data)] (revised activity 5/27-28).

Objective 2: To characterize stream morphology in the Loup River bypass reach and in the lower Platte River by reviewing existing literature on channel aggradation/degradation and cross sectional changes over time (PSP Objective 3).

Activities:

- Utilize existing literature to characterize stream morphology (unchanged activity from PSP).
- Compare effective discharges, cross sectional changes, and associated stream characteristics (unchanged activity from PSP).

Objective 3: To determine if a relationship can be detected between sediment transport parameters and interior least tern and piping plover nest counts (as provided by NGPC) and productivity measures (as provided by TPCP) (5/27-28 revision to PSP Objective 4).

Activities:

- Plot and evaluate nest count and productivity data (number of fledglings per adult pair) against sediment transport indicators [including evaluation of wet and dry cycles (dependent on available data)] (5/27-28 revised activity).
- Perform a regression analysis on plotted data (unchanged activity from PSP).
- Examine trends (unchanged from PSP).

Objective 4: To evaluate whether sandbar availability is limiting interior least tern and piping plover numbers on the lower Platte River (4/21 revision to PSP Objective 5).

During the May 27, 2009, Study Plan Meeting, it was determined that this objective, and all associated activities, is not required for Project relicensing and will not be included in the District's Revised Study Plan.

Objective 5: To determine if sediment transport is a limiting factor for pallid sturgeon habitat in the lower Platte River below the Elkhorn River (PSP Objective 6).

Activities:

- Determine if the Project is affecting sediment transport (unchanged activity from PSP).
- If the Project is affecting sediment transport: Determine extent using effective discharge calculations and aggradation/degradation analysis (unchanged activity from PSP).
- If the Project is affecting sediment transport: Compare to habitat characteristics of other rivers used by the pallid sturgeon, channel catfish, and flathead catfish to determine if changes in sediment transport would affect species use of the lower Platte River (5/27-28 revised activity).

Objective 6: To investigate the relationship between sedimentation and ice jam flooding (PSP Objective 7).

During the May 27, 2009, Study Plan Meeting, it was determined that this objective, and all associated activities, is not required as part of Study 1, as these items will be addressed under Study 12, Ice Jam Flooding on the Loup River, Objective 2.

Study Plan 2: Hydrocycling

Goal(s):

The goal of the hydrocycling study is to determine if Project hydrocycling operations benefit or adversely affect the habitat used by interior least terns, piping plovers, and pallid sturgeon in the lower Platte River. The physical effects of hydrocycling will be quantified and compared to alternative conditions (unchanged from PSP).

Objectives and Associated Activities:

Objective 1: To compare the sub-daily Project hydrocycling operation values (maximum and minimum flow and stage) to daily values (mean flow and stage). In addition to same-day comparisons, periods of weeks, months, and specific seasons of interest to protected species will be evaluated to characterize the relative degrees of variance between hydrocycling (actual) and alternative conditions in the study area (PSP Objective 2).

Activities:

- Conduct a gage analysis using existing USGS and NDNR flow and stage data to accurately determine the timing, frequency, rate of change, travel time, and magnitude of sub-daily flow and stage changes attributable to Project hydrocycling at established gage locations in the Tailrace Canal and the lower Platte River (PSP Objective 1).
- Develop and plot hydrographs for the Project and alternative conditions (unchanged activity from PSP).

Objective 2: To determine the potential for nest inundation due to both hydrocycling and alternative conditions (4/21 revision to PSP Objective 3).

Activities:

- Determine highest flow event (primary benchmark event) occurring each spring between interior least tern and piping plover arrival and the initiation of egg laying for both species (revised activity).
- Identify subsequent flow events that are equal to or greater than the primary benchmark event and occur after initiation of egg laying and before the re-nesting period for both species (secondary benchmark events) (revised activity).
- Identify subsequent flow events that are equal to or greater than the largest secondary benchmark event and occur after initiation of egg laying in the re-nesting period for both species (tertiary benchmark events) (revised activity).
- Identify subsequent flow events that are equal to or greater than the largest tertiary benchmark event that occur during the second re-nesting period for both species (quaternary benchmark events) (revised activity).
- Evaluate frequency of occurrence of flow events that equal or exceed the primary, secondary, and tertiary benchmark flow events for each nesting and re-nesting season for both species (revised activity).
- Evaluate Project operations relative to benchmark flows (unchanged activity from PSP).

Objective 3: To assess effects, if any, of hydrocycling on sediment transport parameters (see Study 1.0, Sedimentation) (PSP Objective 4).

Activities:

- Determine sediment transport indicators (effective discharge and total sediment transport) for Project and alternative condition sub-daily hydrographs (unchanged activity from PSP).

Objective 4: To identify material differences in potential effects on habitat of the interior least tern, piping plover, and pallid sturgeon (PSP Objective 5; revised 4/21 and 5/27-28).

Activities:

- Examine effects of hydrocycling/pulsing operations to tern and plover nesting sites on other rivers and compare to conditions resulting from District operations (unchanged activity from PSP).
- Review conditions on other rivers with hydrocycling/pulsing operations and compare to the lower Platte River below the Elkhorn River confluence to determine potential differences in pallid sturgeon habitat and use (revised activity).

Study Plan 3: Water Temperature in the Platte River

During the April 21, 2009, Study Plan Meeting, Study Plan 3 was determined to be unnecessary for Project relicensing and will not be included in the District's Revised Study Plan.

Study Plan 4: Water Temperature in the Loup River Bypass Reach

Goal(s):

The goal of the study of water temperature in the Loup River bypass reach is to determine if Project operations (flow diversion) materially affect water temperature in the Loup River bypass reach with particular emphasis between the Diversion Weir and the confluence of Beaver Creek with the Loup River (4/21 revision from PSP; unchanged 5/27-28).

Objectives and Associated Activities:

Objective 1: To estimate the relationship between flow in the Loup River bypass reach, ambient air temperature, water temperature, relative humidity, and cloud cover (4/21 revision to PSP Objective 5; unchanged 5/27-28).

Activities:

- Coordinate with USGS to install temperature sensors in the Loup River at the Diversion Weir and in the Loup River bypass reach at USGS Gage 06793000, Loup River near Genoa, NE (PSP Objective 1).
- Collect and review ambient air temperature data at the National Weather Service (NWS) atmospheric station located at Genoa (PSP Objective 2).
- Collect and review relative humidity and solar radiation at the weather station at Mead, Nebraska (4/21 new activity; unchanged 5/27-28).
- Collect and review flow data at USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE (PSP Objective 3).
- Obtain a short-term sampling (3-7 days) of water temperature data in the bypass reach near Columbus to confirm that temperatures are not significantly higher than in the primary study reach (diversion to Beaver Creek) (5/27-28 new activity).
- Develop plots and identify general patterns and distinguish trends (revision to PSP Objective 4).

Objective 2: To describe and quantify the relationship, if any, between diversion of water into the Loup Power Canal and water temperature in the Study Reach of the Loup River bypass reach (PSP Objective 6).

Activities:

- Perform regression analyses on each described plot to determine relationships between water temperature, ambient air temperature, flow, relative humidity, and solar radiation (unchanged activity from PSP).
- Establish a predictive relationship that can be used to predict during what conditions the water quality temperature standard may be exceeded (unchanged activity from PSP).

Study Plan 5: Flow Depletion and Flow Diversion

Goal(s):

The goals of the flow depletion and flow diversion study are to determine if Project operations result in a flow depletion on the lower Platte River and to what extent the magnitude, frequency, duration, and timing of flows affect the Loup River bypass reach. The results will be used to determine if the Project operations relative to flow depletion and flow diversion adversely affect the habitat used by interior least tern and piping plover populations, the fisheries, and the riverine habitat in the Loup River bypass reach and the lower Platte River (unchanged from PSP).

Objectives and Associated Activities:

Objective 1: To determine the net consumptive losses associated with Project operations compared to alternative conditions (PSP Objective 2).

Activities:

- Collect gage and atmospheric data (unchanged activity from PSP).
- Quantify flow depletion in the Loup Power Canal, regulating reservoirs, and Loup River bypass reach by calculating consumptive use (using evaporation and evapotranspiration) and making a comparison to alternative conditions (PSP Objective 1).

Objective 2: To use current and historic USGS gage rating curves to evaluate change in stage in the Loup River bypass reach during Project operations and compare against alternative hydrographs (PSP Objective 4).

Activities:

- Use existing gage data to develop flood frequency and flow duration curves in the Loup River bypass reach for current Project operations and for alternative operations (PSP Objective 3).
- Quantify the stage in the Loup River bypass reach at Genoa and Columbus (unchanged activity from PSP).

Objective 3: To evaluate historic flow trends on the Loup and Platte rivers since Project inception (PSP Objective 5).

Activities:

- USGS gages on the Loup River at Genoa and Columbus and USGS gages on the Platte River at Duncan and North Bend will be evaluated to determine if there has been a general decline of flows in the Loup and Platte rivers (unchanged activity from PSP).

- A USGS report (Ginting, Zelt, and Linard, 2008) will be used to assess flow depletions in the Platte River (unchanged activity from PSP).

Objective 4: To determine the extent of interior least tern and piping plover nesting on the Loup River above and below the Diversion Weir (PSP Objective 6).

Activities:

- Compare nest counts and productivity measures for the Loup River upstream and downstream of the diversion and identify significant differences (5/27-28 revised activity).
- Examine aerial images for appropriate reaches of the Loup River, both upstream and downstream of the diversion, to identify and compare habitat parameters following methodology utilized by Kirsch in 1996 (5/27-28 revised activity).
- Plot recorded nesting sites (from given years) and productivity measures above and below the diversion (5/27-28 revised activity).
- Identify habitat requirements from habitat study reports (unchanged activity from PSP).
- Compare observed conditions to habitat requirements (unchanged activity from PSP).

Objective 5: To determine Project effects, if any, of consumptive use on fisheries and habitat on the lower Platte River downstream of the Tailrace Canal (4/21 new objective; unchanged 5/27-28).

Activities:

- Use net consumptive use analysis from Objectives 1 and 2 to determine if the Project results in depletions to the lower Platte River (unchanged activity from PSP).
- Correlate these findings with effects (adverse or beneficial) on fisheries and riverine habitat (unchanged activity from PSP).

Objective 6: To determine the relative significance of the Loup River bypass reach to the overall Loup River fishery (PSP Objective 7).

Activities:

- Use existing NGPC fish sampling data to compare seasonal fishery dynamics in the Loup River both above and below the Diversion Weir (5/27-28 revised activity).

Study Plan 6: Fish Sampling

During the May 27-28, 2009, Study Plan Meeting, the District stated that it does not intend to perform fish sampling in the Loup Power Canal for the following reasons:

- Canal fishery has previously been identified by NGPC as excellent ;
- No concerns have been raised related to the quality of the canal fishery;
- No issues were identified in Scoping Document 2 related to canal fisheries;
- Specific canal fish sampling information is not needed for the license application.

However, the District will cooperate with NGPC to provide access for future NGPC-performed sampling, independent of Project relicensing. All attendees were agreeable to this approach. Study Plan 6 will not be included in the District's Revised Study Plan.

Study Plan 7: Fish Passage

Goal(s):

The goal of the fish passage study is to determine if a useable pathway exists for fish movement upstream and downstream of the Diversion Weir (4/21 revised; unchanged 5/27-28).

Objectives and Associated Activities:

Objective 1: To evaluate the hydraulic flow, velocity, and stage parameters at the Diversion Weir and Sluice Gate Structure (unchanged from PSP).

Activities:

- Review stage and discharge data available at nearby USGS gage stations (USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE) (PSP Objective 2).
- Collect hydraulic information, including surveying river cross sections at the upstream and downstream face of the Headworks and recording headwater and tailwater elevations at the Diversion Weir (PSP Objective 3).
- Review flow duration curves at the Diversion Weir (PSP Objective 5).

Objective 2: To determine whether fish pathways exist over the Diversion Weir, through the Sluice Gate Structure, or by other means (PSP Objective 7).

Activities:

- Review literature to determine velocity and depth criteria for upstream fish passage at the Diversion Weir (PSP Objective 4).
- Develop a hydraulic model to determine the flow split between the Diversion Weir and sluice gates for a range of flows (PSP Objective 6).
- Calculate the percent of time during the migration season that the Diversion Weir is a barrier to upstream fish movement (5/27-28 new activity).

Study Plan 12: Ice Jam Flooding on the Loup River

Goal(s):

The goal of the study of ice jam flooding on the Loup River is to determine if the operation of the Loup Power Canal has a material effect on the formation of ice jams or a material effect on the severity of flooding caused by ice jams in the Loup River bypass reach (5/27-28 revised from PSP).

Objectives and Associated Activities:

Objective 1: To characterize the available information and its relevance to performing a quantitative or qualitative analysis (5/27-28 revised from PSP).

Activities:

- Collect and review NDNR ice reports for the Loup River (unchanged activity from PSP).
- Collect flow and temperature data (water and air) (unchanged activity from PSP).
- Review historic ice jam and related flood information (unchanged activity from PSP).
- Review Project operations relative to ice jam flood events (unchanged activity from PSP).
- Coordinate with USACE (or other) regarding the suitability of the available data for performing a quantitative or qualitative analysis (new activity established subsequent to PSP and agreed upon 5/27-28).

- Research existing literature on stream morphology in the Loup River Bypass Reach and review literature on the link between sediment and frazil ice transport and incorporate the results of the Sedimentation Study in making that analysis (5/27-28 new activity)

Objective 2: Use available information to determine if a relationship can be found between Project operations and the occurrence or severity of ice jam flooding in the Loup River bypass reach (5/27-28 revised).

Activities:

- Update July 1994 USACE report tables and graphs relative to the Loup River bypass reach (unchanged activity from PSP).
- Plot flows in the Loup Power Canal and Loup River bypass reach from November to April of each year and compare them to ice observation records (5/27-28 revised).
- Incorporate the results of the sedimentation study relative to river morphology changes to assess potential effects if any on ice and water transport (5/27-28 new activity).

Study Plan 13: PCB Sampling at the Settling Basin

In response to USFWS scoping comments requesting PCB sampling in the Loup Power Canal, the District provided Response 3.0 – Water Quality Evaluation in its PSP. In Response 3.0, the District stated its intention not to perform any PCB sampling and provided appropriate justification, including the stated support of NDEQ in this decision.

In Scoping Document 2, and based on USFWS comment, FERC identified dredging in the Settling Basin as the only Project operation that could potentially result in the resuspension and transport of PCBs or as a potential pathway for exposure to interior least terns (via forage fish discharged on the North Sand Management Area and assuming that PCBs are present in the Settling Basin sediment and/or forage fish tissue).

In response to Scoping Document 2 and subsequent to submittal of the PSP, the District prepared a study plan specific to PCB sampling in the Settling Basin. The goals, objectives, and activities associated with this study plan were presented during the May 28, 2009, Study Plan Meeting. Based on meeting discussion, and overall lack of support for the study, the District has rescinded the study as presented on May 28, 2009. Instead, the District will coordinate with NDEQ, and provide funding as necessary, to perform fish tissue PCB sampling upstream of the Columbus Powerhouse, in addition to NDEQ's regularly scheduled fish tissue PCB sampling of the Tailrace Canal at the U.S. Highway 30 bridge.