Independent Science Advisory Committee (ISAC)

Responses to Questions Posed by the Platte River Recovery Implementation Program (PRRIP) in April 2014

Islands in Platte River near Elm Creek during high flows, Oct 2, 2013.

Submitted to
PRRIP Governance Committee

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The Platte River Recovery Implementation Program (PRRIP or Program) requested written input from the ISAC on six questions. These questions were the focus of discussions during the April 22-24, 2014 ISAC meeting in Omaha, NE. To enable the Program to easily extract ISAC recommendations from our overall discussion of the questions posed to us, we have put our recommendations in **blue bolded** text, and sequentially numbered our responses. These recommendations are contained within the context of the overall discussion of each question so that our rationale is clear.

We would like to add two additional clarifications. First, this report was completed by the ISAC prior to receiving comments from various Program entities on chapters 1 to 3. The report reflects the ISAC's views based on our review of information prior to and during the April 22-24 meeting in Omaha. Second, none of the ISAC responses to the following questions imply any change to the evaluations (number of thumbs up or down) of the big questions in the 2013 State of the Platte Report.

PRRIP Tern and Plover Monitoring

1) Are the data being collected, analyzed, and reported by the Program the correct data to address Big Questions #6 and #7 and their related Tier 1 priority hypotheses?
Reference Documents – 2013 State of the Platte Report (including Appendix C); PRRIP 2012-2013 Tern and Plover Monitoring Report; USGS 2013 Progress Report (Habitat Colonization and Productivity of Least Terns and Piping Plovers Nesting on Central Platte River Sandpits and Sandbars)

Big Question 6 (BQ6) - Does availability of suitable nesting habitat limit tern and plover use and reproductive success on the central Platte River?

The data being collected, analyzed, and reported by the Program are the appropriate data for addressing BQ6, since they are essential to evaluating whether various bird performance measures (numbers of nests and breeding pairs) increase as more habitat is created. With respect to BQ6, the ISAC would like to emphasize 8 points:

1. **The amount of sampling effort and the probability of detecting birds needs to be carefully documented for each year at each site, for the entire time series of information going back to 2007 (as well as continuing into the future), assuming that this can be completed with a reasonable amount of effort.**
2. **If required, appropriate adjustments should be made to estimates of these performance measures to reflect year to year changes in sampling effort.**
3. **Uncertainty estimates should be included for all years' estimates of the number of nests and breeding pairs.** It appears that the inside grid search may be a true census with 100% detectability, while the outside surveys have lower detectability (80-90%?) for each site. Comparing grid search and outside surveys for each habitat sites will provide valuable information on how detectability varies at different sites.
4. The concurrent increase over time in Program nests and Program available habitat for terns and plovers (PRRIP 2013 State of the Platte Report, pg. 23-24) provides the key evidence for the one thumb answer to BQ6. However the observed increasing trend in nests is partly due to very low numbers of tern and plover nests in 2007 and 2008 (apparently zero). The 2007 and 2008 estimates of nests and adults were made from outside the Off Channel Sand and Water (OCSW) areas, and may be 10-20% lower than the estimates which would have been obtained with a grid search. This could change the apparent trend because early data points from 2007 and 2008 would

move higher[1]. The overall increasing trend will likely still be apparent after these adjustments, but could alter correlations between habitat and biological performance measures as well as versus year.

5. The Program can't answer BQ6 for in-channel habitat without having any in-channel habitat; at present it can only answer this question for off-channel habitat. **This limitation should be acknowledged in the discussion of BQ6.**
6. As described in previous ISAC comments (PRRIP 2013 State of the Platte Report, pg. 46), there are other alternative mechanisms which might explain the observed patterns of increased nests and breeding pairs, including: increases in the overall meta-population; decreases in other habitats (e.g., Lake McConaughy) has caused birds to move to the Central Platte; improved predator control in OCSW habitats (rather than increased habitat area) has resulted in improved survival and increased numbers of nests. No reliable region wide population estimates are available to test the first of these three alternative explanations, though it would be helpful to compare population trends in the Central Platte with other locations with population estimates like the Missouri River. **The Program should acknowledge these alternative explanations in the State of the Platte Report and evaluate them to the greatest degree possible given available data.**
7. **The Program should look at multiple spatial scales to learn what makes the best kind of sand pit, so as to use Program resources for OCSW habitats most effectively.** These spatial scales include the sand pit scale, various smaller scales detectable from LIDAR, and finally the microscale using covariates collected within 1 yd^2 of nests (not detectable by LIDAR. It is striking that some sand pits (e.g., Dyer, Bluehole, Broadfoot South, Wild Rose Ranch East) consistently have much higher occupancy rates than others, which could be due to attributes of these pits, and/or historical nesting patterns coupled with high fidelity (pg. 36 of the Tern and Plover Monitoring report). **Before undertaking analyses of the suitability of OCSW habitat, the Program should develop a clear data analysis plan, logically beginning at the largest scales.**
8. **It is prudent for the Program to continue to gather detailed data from OCSW habitats, since these habitats are critical for terns and plover reproduction.** The evidence to date (answers to BQ1 in PRRIP 2013 State of the Platte Report; Chapters 1-3 provided to ISAC for April 22-24 2014 meeting) indicates that creating in-river habitat through the current definition of FSM (as specified in the AMP) is going to be difficult given a number of factors (i.e., the existing flow and sediment transport regime, channel widths, relatively large particle sizes and relative timing of the peak hydrograph and tern / plover nesting periods). The extent of historical nesting by terns and plovers on natural sandbars in the Central Platte River (CPR) remains unclear.

Big Question 7 (BQ7) - Are both suitable in-channel and off-channel nesting habitats required to maintain central Platte River tern and plover populations?

9. The Program can't answer BQ7 without having birds nesting on suitable in-channel habitats, created either naturally or mechanically. The data being collected are sufficient to answer BQ7 (in-channel sand bars are sampled by the Program), but the challenge is that Program-defined suitable in-channel habitat has not persisted. Conditions have been either too dry (bars not isolated by a moat) or too wet (bars washed away). The Program does have data from mechanically created islands, though predation and persistence are continuing challenges. The 2 x 2 design for mechanically building alternative islands (small/large by low/high) near sandpits was

[1] Though zero times 1.1 or 1.2 would still be zero, if the 2007 and 2008 estimates included confidence intervals the best estimate for 2007 and 2008 would be non-zero.

meant to address habitat selection, and could still provide useful data for BQ7, even if FSM fails to create naturally created islands.

If the Program wants to answer BQ7 and test hypothesis TP1[2] in the CPR, it should mechanically create in-channel habitats that persist long enough for birds to nest on them, and manage flows to help maintain moats around these bars. The Program can concurrently proceed with experimental tests of the FSM approach to island creation (i.e., at Elm Ck and Shoemaker Island) at the same time as mechanical creation of islands. FSM-created islands are not a pre-requisite for answering BQ7 and testing hypothesis TP1 - the Program just needs suitable in-river habitats. The evidence to date indicates that it's much more feasible to create and maintain suitable in-river habitat by mechanical approaches than via the current implementation of FSM (as described in the AMP).

10. BQ7 and hypothesis TP1 don't line up very well. Even if the Program could create in-channel habitats and the birds moved there, that doesn't answer whether the birds need both types of habitat. The birds might prefer in-channel habitats, but these habitats could be population sinks due to flooding, predation or other factors. Because in-channel habitats are ephemeral, the Program will continue to require OCSW habitats. Modelling could allow the Program to assess what ratios of habitats would result in what outcomes, given persistence of habitats and survival of birds on each habitat type. Addressing these questions for rivers with different attributes (e.g., timing of peak flows, heights of bars) would be informative. If the model shows that OCSW alone is sufficient for maintaining the populations of terns and plovers for a decade or more, then the Program could reasonably conclude that the river is unnecessary for nesting. The model can also explore other options for creating habitat (e.g., MCM, FSM2 with larger volumes of water and sediment).

    We recommend that the Program address BQ7 and TP1 in a sequence of steps: 1) mechanically create in-river habitats as described under point 9; 2) collect demographic data on both in-river and OCSW habitats; and 3) build population models which incorporate these demographic data as well as information on river dynamics and the costs of creating and maintaining habitats. The Program should use data from both nest surveys and banded birds to help parameterize model assumptions on movement and survival. We further recommend that the Program use this model to assess what ratios of habitats would result in what population outcomes, in both the CPR and the Niobrara River.

    Development of this model should build efficiently upon previous modelling work (e.g., the tern and plover rapid prototyping model, developed originally by Drew Tyre (U. Nebraska); the user-friendly ACCESS version of this model developed by Darcy Pickard and Katherine Bryan (ESSA); Buenau et al. 2013 and is currently being revised as part of the Missouri River Effects Analysis; detailed data recently collected by the Program that can parameterize model functional relationships).

11. **To help the GC make decisions at the end of the First Increment, it would be prudent to expand the biological model described above into a formal decision analysis, incorporating cost estimates recorded by the Program.** A formal decision analysis could evaluate the costs

[2] Hypothesis TP1 states: "In the CPR study area, terns and plovers prefer/do not prefer riverine habitats as described in Land Plan Table 1 and use will/will not increase proportionately to an increase in habitat complexes." (pg. 15 in AMP)

and biological benefits of different mixtures of habitat types over a range of water year scenarios. It is important to continue to track the costs of different types of habitat creation. The ISAC recognizes that in addition to the costs and benefits of different types of habitat, there is a range of values or preferences placed on these habitats by various entities involved in the Program. Sensitivity analyses of a decision analysis framework can be used to explore the effects of different values. For more information on decision analysis please see Peterman and Anderson 1999, Peters and Marmorek 2001, Gregory et al. 2006,

2) Should the Program consider reducing or eliminating monitoring and research procedures such as banding, grid searching, and other intensive data collection methods?
Reference Documents – PRRIP Tern and Plover Monitoring Protocol; 2012-2013 PRRIP Tern and Plover Monitoring Report; USGS 2013 Progress Report

12. The current monitoring and research procedures are generally appropriate. Banding and grid searching should be continued until the Program has established in-channel nesting for 5 years, or has proved that it's infeasible (given Program resources) to create in-channel suitable nesting habitat.

13. The Program should evaluate the explanatory power of the covariates collected at each nest site to estimate nesting success and/or presence/absence., Covariates which have no explanatory power could be dropped from future surveys, saving crew time.

Our rationale for the above recommendations is as follows:

14. These procedures are necessary to ensure that high quality data are collected with sufficient accuracy and precision to answer Big Questions 6, 7 and 10, and to test priority hypotheses T1, P1, TP1 and S1b (see Appendix B in PRRIP 2013 State of the Platte Report).
15. High quality data cost money to acquire, but if such data acquisition is well-focused on key questions affecting management decisions, then these data will be a good investment. The intensively collected bird data (banding, grid searching, etc.) can potentially save far more money than they cost by ensuring that sound management decisions are made on how to best create and maintain habitat for terns, plovers and whooping cranes.
16. If the Program were to stop collecting banding, grid searching and other intensive data, then the Program could not determine the extent to which: 1) new birds are coming into the CPR; 2) birds which nested once in the CPR return to nest again; 3) birds are shifting from non-Program locations in the CPR to Program locations; and/or 4) birds are shifting from OCSW to in-river habitats. Understanding the relative importance of these different mechanisms (they aren't mutually exclusive) will be important to answering BQ7 and TP1 (switching between OCSW and in-river habitats) and also BQ10 (the extent to which Program actions contribute to tern and plover recovery). With respect to BQ10, the Program would be making a greater contribution to the recovery of terns and plovers if mechanisms 1 and 2 were predominant and mechanism 3 were minor, than if mechanism 3 were the primary cause of increased nesting on Program lands (i.e., robbing Peter to pay Paul).
17. Without banding, you would have less precise estimates of survival and fledging rates, which are important to assessing the productivity of different habitats for BQ6 and BQ7, and improving the design of OCSW and in-river habitats in the future.
18. Having both grid searches from inside nesting colonies as well as counts taken from observations outside the colonies ensures that you can estimate the accuracy of outside counts only, which as discussed above under ISAC question 1 (points 1 to 4) is important for answering BQ6.

3) Are you aware of alternative monitoring methods that could deliver the same or better quality data to the Program with reduced effort and at reduced cost?
Reference Documents – PRRIP Tern and Plover Monitoring Protocol; USGS 2013 Progress Report

19. The ISAC is not aware of any alternative monitoring methods which could deliver the same or better quality data to the Program with reduced effort and cost. However, it would be worthwhile for the Program to evaluate the existing data to determine the benefits and costs of alternative approaches.

Three approaches which could be further evaluated by the Program are:

a. evaluating the explanatory power of information at multiple spatial scales, and discontinuing those covariates which are time consuming to collect but have little or no explanatory power for nesting success or presence/absence (discussed under points 7 and 13 above);
b. developing a mark-resight estimate of the population to potentially provide a useful second estimate of the population size (while recognizing that banded birds might not be a random sample); and
c. selecting a subset of high and low count sites with the goal of moving from an attempted census to probability-based statistical sampling

CPR Habitat and Comparison to Other Systems

4) The EDO has evaluated other river systems and compared them to the CPR. Based on our results, do you think the assumptions and methods used to arrive at our results and conclusions seem reasonable? Are we missing something? Given the lack of 'natural' sandbar nesting on the central Platte River, are you aware of better approaches or data to use in these evaluations?
Reference Documents – PRRIP Tern and Plover Habitat Synthesis Papers (Chapters 1, 2, and 3)

20. Overall, the ISAC believes that the assumptions and methods used to arrive at results and conclusions in these three papers were reasonable and a very valuable contribution to the Program. We recommend that the three chapters be kept as separate papers, ideally published as 3 journal articles following internal and external peer review. These articles would introduce the Platte River as a place for testing various hypotheses related to tern and plover habitat / populations, clarify the questions being addressed, gradually build arguments using different lines of evidence, answer those questions to the degree that is possible so far, and include appropriate caveats concerning what aspects of the questions cannot currently be answered. If new evidence is collected which alters the preliminary conclusions, then subsequent articles could be written, reviewed and published.

Some specific comments on each chapter are listed below in point form. ISAC members provided the EDO with more detailed comments on the three papers; the following are our major comments.

Chapter 1

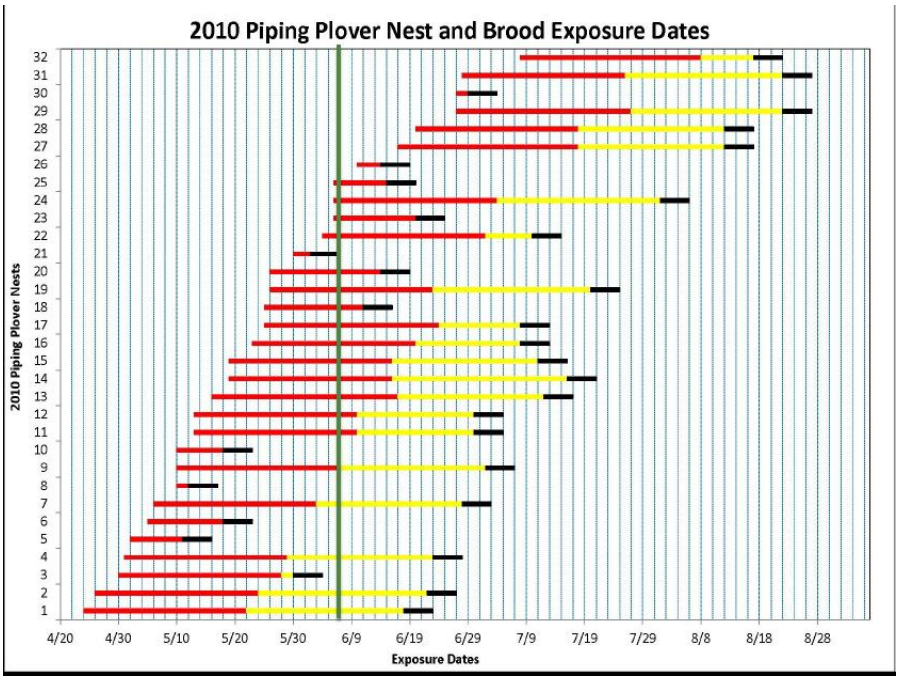
a. **Overall assessment.** This is a refreshing and scientifically defensible analysis. The ISAC agrees with the thrust of the analysis and overall conclusions, and found the arguments to be logical and compelling. Overall, the results of the rapid assessment and sandbar height analyses were not positive indicators for the validity of the Q1.5-driven habitat paradigm in any of the analysis reaches.

b. **Clarity of presentation.** The clarity of the paper could be greatly improved by including: a flowchart explaining the methods; a figure with river stage, bar heights and the distance between the two; more material in appendices; a table defining all variable names; a consistent structure for organize tables so that all metrics move in the same direction with more being better; consistent verb tenses; and shorter sentences.

c. **Geomorphic variability.** You need to demonstrate that the simulation is representative of the geomorphic variability of the system. One way to do this would be to move beyond having just one stage-discharge relationship of whole river (e.g., 25th, median and 75th percentiles of stage-discharge relationships).

d. **Future climate.** Is past climate representative of what we might expect in the future? What would happen in the future under climate change? Acknowledge this in the paper, and also look at the period of record and the range of climatic conditions in that period of record versus those that could be expected in the future.

e. **Visualize ecological implications of hydrology.** Use graphics to clarify the implications of hydrology for nesting success (e.g., run the sequence of years since 1950 with / without successful initiation and show as a figure; overlay the flow patterns for one dry and one wet year with the figure 5 from David Baasch's presentation - shown below). Success in any given year appears to be closely linked to meteorological influences that affect the volume and timing of basin snowmelt and the associated peak runoff, and this key point should be made clear.



f. **Statistical methods.** Improve the regression analyses (logistic regression and/or t-test on 2 different categories of nesting success)

g. **Bar building.** The grain size probably implies that you can't build high bars – it's worth examining this issue in greater detail, examining whether previously published studies showing site to site differences in the ability to build sandbars might be explained by differences in grain size and the proportions of sediment transported as bedload versus wash load or suspended load. It is likely to be more difficult to stack dune heights for in-river bars when grain sizes are larger. It's also worth discussing whether more water would or would not build higher bars – the river

may just get wider rather than deeper. To show that you really needed 13,000 cfs to build higher bars would require a 2D model. Recognizing the duration of flows rather than just Q1.5 would enhance the paper. See point j below.

Chapter 2

h. **Overall assessment.** Generally the ISAC liked this paper best of the three papers. The advantage of looking at other rivers is that it plays out a number of different scenarios (space for time substitution), scenarios which the Program could only accomplish over many decades of manipulations. It thereby provides boundaries on what is possible in the CPR, and where FSM is and isn't possible. This could save the Program considerable time and money.

i. **Clarity of presentation.** See points under b above for Chapter 1. Other points: add actual # nests in CPR to Table 13; divide stream power by stream width; clarify the representativeness of the LPR pictures (all were around hydraulic structures); revise abstract so it is a more succinct summary; change "nest observations" to "observed nest counts" throughout the paper; and briefly identify monitoring methodologies (through either an additional column in Table 7 or a separate table in an appendix).

j. **Bar building.** Further develop arguments around grain size, providing physical explanations of why you need fine grain sizes to build on top of dunes, with reference to appropriate scientific papers. Consider adding the Rouse number to Table 13 to provide a sense for relative significance of suspended load vs bed load, which has implications for bar building (see Richardson et al. 2001).

k. **Context.** It's worth reviewing some of the historical information from pre World War 2 naturalists and historians (King and Hayden, Beacom) and consulting with Paul Johnsgard regarding what is and isn't known about tern and plover use of the CPR. You need to thoroughly defend the sentence that reads: "This narrative appears logical but is largely speculative given that the first recorded tern and plover observations on the central Platte River occurred after World War II (Department of the Interior 2006)."

l. **Describe variability over space and time.** The text implies substantial year-to year variability in numbers of adults/mile within each river section. Wherever the data are available, it would be helpful to provide estimates of variability (e.g. a table showing N, mean, SD, range for each species for each river segment for period of record). This would also be a very useful summary for others. This comment applies to both Tables 6 and 9.

m. **Historical Hydrology.** It might help to clarify the patterns of historical hydrology for the CPR reach and other systems by examining a strategically selected subset of indicators of hydrologic variation (IHA) on both an annual basis and also for relevant time intervals (e.g. nesting season).

Chapter 3

n. **Overall assessment.** The thrust of the arguments in this paper make sense but the clarity and flow of the presentation could be considerably improved.

o. **Clarity of presentation.** See points under b above for Chapter 1. Other points: Table 3 should be better explained, because as stated it is counter-intuitive that habitat availability increases with flow (use a figure to explain this idea); put Niobrara on Figure 8; clarify when you are talking about simple inundation of the bar vs. providing 1.5 feet of free board above the peak stage; create a figure for tern and plover recruitment similar to that used by Mahoney and Rood (1998) for their box model of cotton wood recruitment. It might be clearer to use the phrase "analysis plan" rather than "pathway".

p. **Alternative flow regimes.** Include Figure 21 from your presentation and discuss whether FSM could work if flows were 10,000 to 13,000 cfs. Evaluate the implications of using the same total volume of water differently (e.g., higher/longer peak flows and lower summer flows).

q. **Definitions of "habitat" and "suitable".** Page 5 of Chapter 3 defines the terms "habitat" and "suitable". To avoid long debates about these terms with reviewers, it would be better to simply define "suitable habitat" as a single term based on how the Program has defined it. Suitable tern and plover nesting habitat would, at a minimum, need to: 1) be available frequently enough to support ongoing occupancy, and 2) support a level of reproductive success capable of sustaining a stable to growing subpopulation in the CPR. This view of habitat suitability does not address issues of meta-population dynamics or species' interactions between on- and off-channel habitat types. If you keep the phrase "including survival and reproduction" then please clarify that multiple habitats are necessary to complete tern and plover life cycles.

5) As a technical issue based on synthesis of Program data and recent comparisons between the CPR and other systems, it is starting to appear that implementing the Flow-Sediment-Mechanical (FSM) management strategy will not result in suitable tern and plover nesting habitat as hypothesized. Does this seem to be a reasonable interpretation of Program data and comparative system analyses?

Reference Documents – 2013 State of the Platte Report; PRRIP Tern and Plover Habitat Synthesis Papers (Chapters 1, 2, and 3)

21. Yes, this seems to be a reasonable interpretation of Program data and comparative system analyses, thus far/ to date, where FSM is as described in the Adaptive Management Plan (i.e., F = 3 days of 5,000 to 8,000 cfs at Overton; S=sediment balance).

6) Should the Program subject the PRRIP Tern and Plover Habitat Synthesis chapters to peer review through the Program's approved peer review process?

22. YES, after completion of the manuscripts for reviewers, and following the Program's approved peer review process. In reviewing the Program's peer review process[3], we further recommend that:

a. all documents submitted for peer review should include a cover memo clarifying the scope and context for the documents that are being reviewed;

b. reviewers should be provided with references to the PRRIP website;

[3] Document 14 - PRRIP 2014 Peer Review and Manuscript Development Schedule.pdf

c. Documents to be reviewed should be provided to the peer review panel *prior* to a conference call so they can review the documents beforehand and ask any clarification questions;

References Cited

Buenau, K. E., T. L. Hiller, and A. J. Tyre. 2013. Modelling the effects of river flow on population dynamics of piping plovers (Charadrius melodus) and least terns (Sternula antillarium) nesting on the Missouri River. River Research and Applications DOI: 10.1002/rra.2694.

Gregory, R., L. Failing, P. Higgins. 2006. Adaptive management and environmental decision making: A case study application to water use planning. Ecological Economics 58(2): 434–447

Mahoney, J.M. and S.B. Rood. 1998. Streamflow requirements for cottonwood seedling recruitment—An integrative model. Wetlands 18 (4): 634-645.

Peterman, R. and Anderson, J. 1999. Decision analysis: a method for taking uncertainties into account in risk-based decision making. Human and Ecological Risk Assessment **5**: 231-244.

Peters, C.N. and D.R. Marmorek. 2001. Application of decision analysis to evaluate recovery actions for threatened Snake River spring and summer chinook salmon (Oncorhynchus tshawytscha). Can. J. Fish. Aquat. Sci. 58(12): 2431-2446.

Richardson E.V., D.B. Simons, P.F. Lagasse. 2001. River Engineering for Highway Encroachments: Highways in the River Environment. Completed by Ayres Associates for the Office of Bridge Technology and the National Highway Institute. 646 pp. Available from: http://www.engr.colostate.edu/~bbledsoe/CIVE413/FHWA-NHI-01-004.pdf