Sediment Augmentation

Whooping crane habitat is dependent upon the wide, shallow channels associated with braided channel morphology exhibited by the central Platte River. The upper reaches are currently transitioning from braided and anastomosed to a wandering planform, largely in response to altered land-use and hydrology. The direct implications of this planform shift make it difficult to maintain adequate whooping crane habitat, as the active portion of the channel narrows, deepens and moves laterally downstream at nominal rates. This phenomenon is most obvious in the south channel near Lexington, just downstream of the Johnson-2 (J-2) hydropower return. This clearwater return has been in operation for nearly 75 years is attributed to approximately 20 ft of incision over this time and these impacts continue to migrate in the downstream direction at rates which are highly dependent on return flows.

In response to these implications, the Program has moved forward with full-scale sediment augmentation in an attempt to ultimately halt the continuing degradation and associated loss of habitat within the AHR. By augmenting alluvial material, we hope to reduce or eliminate the current sediment deficit and re-establish a more appropriate dynamic equilibrium necessary to maintain the braided channel morphology necessary for whooping cranes.

Where we have been:

To reach this point, extensive monitoring and modeling have shown the average annual deficit to be on the order of 100,000 tons per year, with very high (25,000 to 250,000 tons) annual variability (HDR Engineering, Inc. 2011). This dynamic variability is validated by the Program's 2009–2014 system-scale monitoring data which illustrate aggradation and degradation trends to be highly dependent on hydrology. Based on the revised HEC6T model (Tetra Tech, Inc. 2015), the reach-scale deficit in the south channel is on the order of 55,000 tons. This deficit is obvious by the resulting incision (~20 ft high banks) and armoring of the channel, which is largely attributed to clearwater return flows from the J-2 hydropower return.

Between 2006 and 2013, 7 pilot-scale sediment augmentation efforts were implemented between the Plum Creek and Cottonwood Ranch Complexes totaling approximately 400,000 tons of sediment. These experiments provided valuable insight into cost and efficiency of various approaches. Combined with knowledge gained from these studies and general agreement from the ISAC in terms of volume, location, and direction of augmentation, we began full-scale sediment augmentation in 2016.

To address the ongoing sediment deficit, we set an augmentation target of 60,000 tons per year and targeted an 18-year supply along the high banks near the J-2 return. To be able to augment in this area, working agreements were executed between the Program, CNPPID and Joe Jeffrey, the landowner to the south. In fall of 2017, with permits ready and a contractor selected, we cut off the upstream-most meander in the channel by excavating a pilot channel through an abandoned terrace and constructed a berm to shift the river to the north and mobilize sediment. 60,000 tons was augmented to the main channel and 20,000 tons of sediment was augmented into the abandoned meander.

In fall of 2018, we moved downstream with the same target of 60,000 tons and a more passive approach. By cutting down the next downstream bar, we are able to keep the sediment source on the adjacent high terraces on the left bank and encourage some deposition from upstream sources. Augmentation was

timed with long flow releases from CNPPID to take advantage of efficient transport of material which is working as designed.

We have now completed 2 years of full-scale sediment augmentation and construction activities during 2018 has recently concluded. This year's augmentation totaled approximately 60,000 tons of sediment to compliment the 80,000 tons augmented during the fall of 2017. The design approach for both years targeted 60,000 tons of immediate augmentation, while encouraging the channel to continue to erode material out of the high terrace (north bank) on Jeffrey Island.

September 2018 drone photo overlooking the 2017 (background) and 2018 (foreground) augmentation sites in the vicinity of the J-2 return.

Regular monitoring is being conducted twice a year through system-scale remote sensing efforts and at varying intervals using GPS and drone surveys and will continue through the life of this project. This monitoring has shown these efforts have immediately halted the lateral erosion, filled in deep pools at bends, and is continually widening the channel. 2017 and 2018 return flows have been relatively constant, which has distributed sediment rather evenly with no visible adverse effects. The upstream portion of the project area is armoring up with gravel, downstream sandbars are starting to dissect, and lower vegetated terraces are beginning to erode.

Where we are going:

The overall project is currently going very well. We have been able to execute tough access agreements and permits and grade out projects efficiently and cleanly and for relatively low costs, but we also have a somewhat limited supply of sediment at the current project site. Approximately 10% of the allotted sediment has been augmented to date, and at this rate, we are on track with the 18-year design life for this project. Pending any negative findings, we will continue to augment in a downstream direction with one more major grading site targeted in this upstream reach before moving downstream to the Plum Creek Complex.

We will continue to monitor ground conditions and channel response with LiDAR data, topographic and drone-surveys, and stage loggers. Development of remote sensing-based monitoring has shown promising results with respect to quantification of aggradation and degradation and we are flying this this reach twice a year in tandem with acquisition of aerial imagery. In January, we will have 3 complete sets of data to calculate and verify augmentation volume, identify aggradation and degradation trends, and identify changes in channel width and slope. We currently are also collecting and analyzing validation data to more completely quantify uncertainty surrounding the bathymetric LiDAR data. These data will allow us to

interpret the movement and influence of the augmented material and better inform future augmentation efforts. By 2022, we will have five years of bi-annual monitoring data and likely a variety of discharge volumes to better evaluate the efficacy of this management action.