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RIVER GEOMORPHOLOGY CD, PART 1

River Geomorphology Appendix

SEDVEG Model

[See the Murphy et al. (2006) report in section A of the River Geomorphology Appendix in the River Geomorphology CD, Part 2, for a description of the SEDVEG model, and section C of the River Geomorphology Appendix above for model input and output data for EIS alternatives.]

GEOMORPHOLOGY APPENDIX

Index

A. Foundation Reports for the Central Platte River Geomorphology Study

1. Provides historic information on mean annual flows, peak flows, and effective flows, and estimates of historic sediment transport:

Randle, T.J., and M.A. Samad (2003). "Platte River flow and sediment transport between North Platte and Grand Island, Nebraska (1895-1999)". Bureau of Reclamation, Technical Service Center, Sedimentation and River Hydraulics Group. Denver, Colorado. 60 p.

2. Addresses impacts of development on flow and sediment transport from the 1800s to the present including flow consumption and groundwater impacts. Also considers climate effects and provides background information on geology and Platte River morphology in geologic time. The processes of degradation and incision, grain size coarsening, vegetation impacts on sediment transport, and the concept of continuum of channel pattern are introduced with respect to the Central Platte River.

Murphy, P.J., T.J. Randle, L.M. Fotherby, and J.A. Daraio, 2004. "Platte River channel: history and restoration". Bureau of Reclamation, Technical Service Center, Sedimentation and River Hydraulics Group, Denver, Colorado, 167 p.

3. Data report presenting cross section measurements of the Central Platte River noting locations of degradation, aggradation and stable river conditions.

Holburn, E.R., L.M. Fotherby, T.J. Randle and D. Carlson (2006), "Trends of degradation and aggradation along the central Platte River, Nebraska 1985 – 2005", Bureau of Reclamation, Technical Service Center, Sedimentation and River Hydraulics Group. Denver, Colorado.

4. The one-dimensional sediment transport model of the Central Platte Habitat (SedVeg Gen3) is described, including model history, program code, input cross sections and parameters, output for present conditions and summaries of modeled future trends. Sensitivity and calibrations to past and present conditions, and an evaluation of the model are also included.

Murphy, P.J., L.M. Fotherby, and R.K. Simons (2006). "Platte River Sediment Transport and Vegetation Model" Bureau of Reclamation, Technical Service Center. Denver, Colorado.

B. Notes on the Geomorphic Conceptual Model

The geomorphic study of the Central Platte River has acquired more detail since the Draft Environmental Impact Study (DEIS). Table A-G-1 outlines key points and shifts in approach associated with the land plan, resulting from further studies of river geomorphic processes.

Table A-G-1. Chronological Development of Geomorphic Land Plan Concepts

Year	Report/ Summary	Focus of Geomorphic Study	Primary Factors*	Secondary Factors*	Primary Land Plan Restoration Methods	Secondary Land Plan Restoration Methods
2003	Randle & Samad	Wide river with sand bars	Flow Sediment load Grain size Vegetation		Clear vegetation Level islands (to augment sand and widen river)	Consolidate flows Identify **negative** effects from some bridges & revetments~
2003	DEIS					
2004	Murphy et al.					
2005	Holburn et al.	Braided river	Flow Sediment load Topography	Slope Vegetation Grain size	Identify **positive** effects from some bridges & revetments~ Consolidate flows Augment sand	Develop alternative sand augmentation methods & a master plan Lower banks and level islands (to widen river and augment sand) Clear vegetation
2005	FEIS					
2006	Murphy et al.					

* Factors affecting river channel form, and subsequently habitat for Whooping Crane, Least Tern and Piping Plover

The flow chart shown in Figure A-G-1 illustrates the steps for developing a feasible restoration program. Restoration actions originate from a geomorphic conceptual model of the river. The conceptual model is based on available field data and is consistent with geomorphic theory. Proposed land and water plans, are in turn, consistent with the geomorphic model that describes ongoing processes and trends. A numerical model, which has the significant geomorphic processes incorporated into the program code, is used to test the proposed restoration actions. Because numerical modeling is cost and time effective, this step allows a wider range of options to be evaluated and improves the quality of the implemented restoration program. The last box in the flow chart (figure A-G-1) represents field testing of the most promising restoration actions. Under the adaptive management plan, restoration actions are tested in small steps in the field. If the actions produce the desired degree of success, implementation of these actions is expanded within the framework of the Program. As shown in the flow chart, feedback from any succeeding step can revise and improve the conceptual model, the land and water plans, and the numerical model(s). The FEIS presents the geomorphic conceptual model and the restoration actions that have survived iterations through numerical modeling. Under the Adaptive Management Plan in the First Increment of the Program, continued iterations of the flow paths in Figure A-G-1 are anticipated.

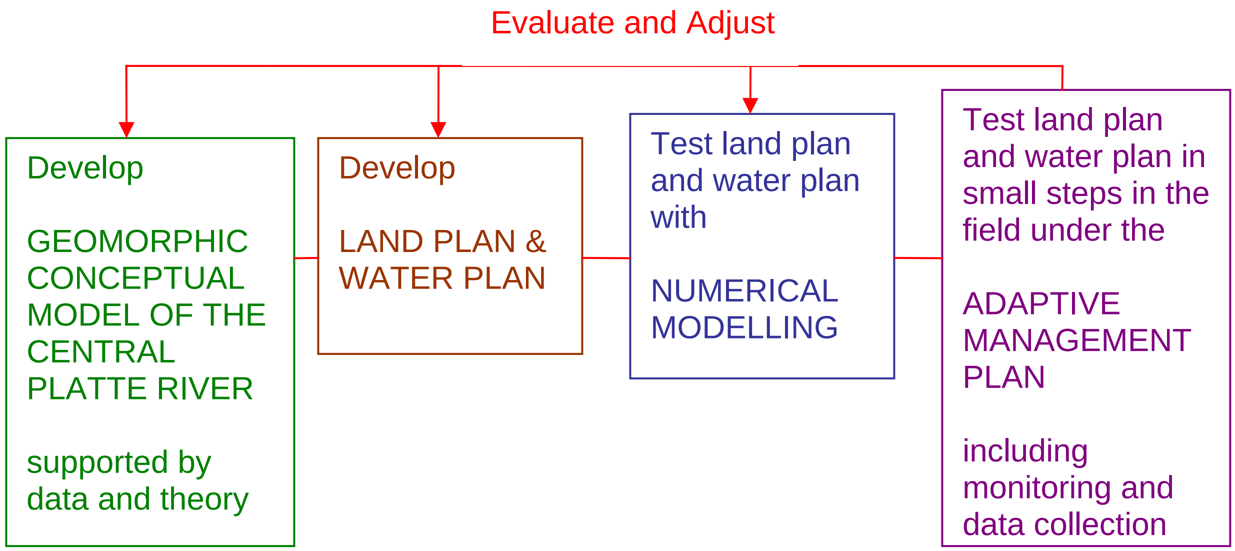

Figure A-G-1. Methods of evaluating the impacts of land and water plans (restoration efforts) on the river form.

C. Output from the Central Platte River 1-Dimensional Sediment Transport Model

The evaluation of alternatives in Chapter 5 of the FEIS was aided in some sections by output from the 1-D sediment transport model, SEDVEG Gen3 that incorporates vegetation processes and the land and water actions of the Program. The SEDVEG Gen3 code and Central Platte River model are described in the Technical Report:

Murphy, P.J., L.M. Fotherby, and R.K. Simons (2006). "Platte River Sediment Transport and Vegetation Model" Bureau of Reclamation, Technical Service Center. Denver, Colorado.

Murphy et al. (2006) is available in electronic format in Volume III of the FEIS. The output data used in the FEIS from SEDVEG Gen3, including Present Conditions and the alternatives, Governance Committee, Full Water Leasing, Wet Meadow, and Water Emphasis, are available in compressed electronic format in Volume III of the FEIS.

D. Supporting Data for Changes in River Width (Chapter 2)

The observed response to reductions in Platte River mean annual flows and peak flows in the twentieth century, was a narrowing of the active channel width from North Platte to Grand Island, Nebraska. Measured values are presented in Table A-G-2. The earliest channel-width data is from the first land surveys in the 1860s and pre-dates the first USGS topographic surveys at the turn of the century. The average channel widths for the 1860s period are from the original township, range, and section surveys of the General Land Office (Peake et al., 1985). The channel width from both these surveys would include some wooded islands, too small to survey, so the actual un-vegetated width has been estimated as less by different investigators (See Chapter 2- Vegetation Expansion). A set of county property maps, showing the acreage and ownership of land along the Platte River, was prepared between 1905 and 1920. These maps showed all river islands with economic value. Average channel widths from the subsequent years (1938, 1957, 1983, and 1998) were determined from aerial photographs. The average widths from aerial photographs do not include any wooded islands. The 1983 widths were measured after the occurrence of a peak flow earlier that year.

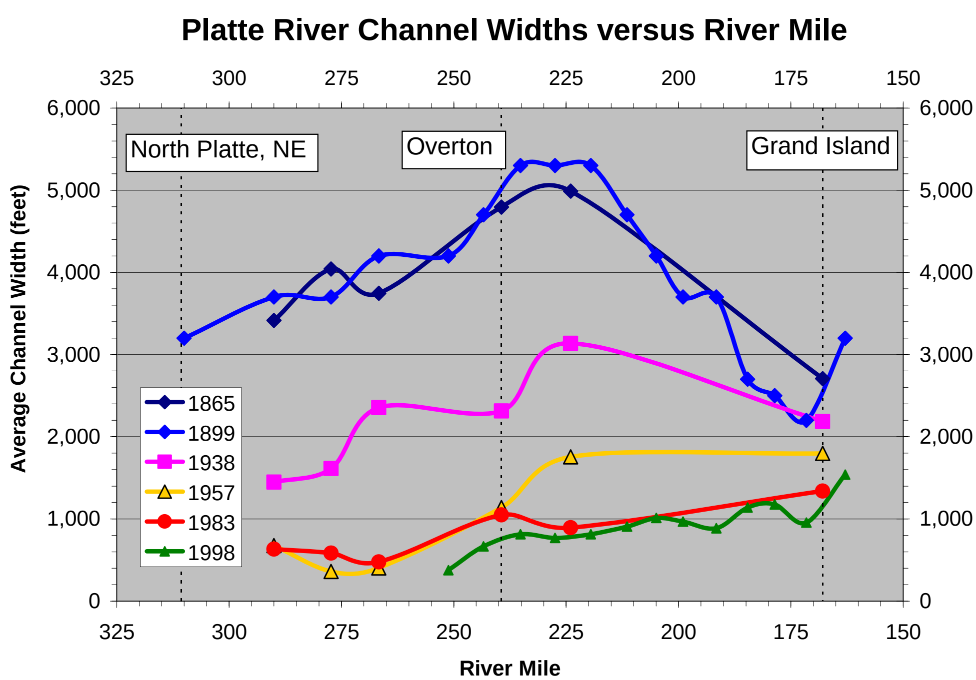

Figure A-G-2. Reductions in unvegetated channel width in the central Platte River. Distance along the Platte River is denoted as river mileage beginning at Plattemouth, Nebraska (River Mile 0) and increasing in the upstream direction.

The 1898 and 1998 average channel widths were calculated at the Platte River EIS Office in Lakewood Colorado using the 1898 to 1902 USGS maps (figure A-G-2) and GIS coverage of 1998 aerial photos (Friesen et al., 2000). Measurements of channel area in 1998 and 1898 were made of entire bridge segment areas (13) in the habitat study area between Lexington and Chapman, Nebraska (see Geographic Markers table, Chapter 4). Areas were then divided by longitudinal channel length per bridge segment for average channel width. The 1898 values at four upstream areas: North Platte, Brady, Gothenburg and Cozad, are section measurements.

Based on maps from the 1860s and aerial photographs from 1938, 1957, and 1983, Peake et al. (1985) provided estimates of the channel area, produced on a USGS 7.5-minute quadrangle map base. The reach lengths were measured from USGS 1:24,000 scale topographic maps corresponding to the areas reported in Peake et al (1985). An estimate of average channel width in the vicinity of the gage station was determined by dividing channel area by reach length.

Table A-G-2. Historic un-vegetated or active channel widths of the Platte River as measured from historic maps and aerial photography.

River Mile	Platte River location	1865[P] Average channel width (feet)	1899[EIS] Average channel width (feet)	1938[P] Average channel width (feet)	1957[P] Average channel width (feet)	*1983[P] Average channel width (feet)	1998[EIS] Average channel width (feet)
166	near Grand Island, NE	2,710	2,500	2,190	1,800	1,340	1,250
224	near Odessa, NE	4,990	5,300	3,140	1,760	890	790
239	near Overton, NE	4,800	5,300	2,310	1,140	1,050	740
266	near Cozad, NE	3,750	4,200	2,360	400	480	
277	near Gothenburg, NE	4,040	3,700	1,610	360	580	
290	near Brady, NE	3,420	3,700	1,450	680	630	

[*] 1983 widths are measured after the occurrence of a major peak flow event earlier that year.
[P] Channel areas from Peake et al., 1985.
[EIS] Channel areas from Platte River EIS Office in Lakewood, Colorado.

E. Supporting Data for Changes in Slope (Chapter 2)

Figure A-G-3 presents bed slope values of the Central Platte River, beginning at the Johnson-2 Return in the South Channel of Jeffreys Island. The profile is constructed from the thalweg elevations of 1989 surveyed cross sections. The average spacing of the cross sections is 1.5 miles. Platte river flows are diverted by a dike from the entrance of the South Channel of Jeffreys Island, to the entrance of the North Channel of Jeffreys Island. The dike was constructed by a private landowner. Subsequently, bed erosion in the South Channel of Jeffreys Island at the Johnson-2 Return is not dampened by sediment inputs from upstream flows, and the slope at the Johnson-2 Return (RM 247) is 0.0008 ft per ft. The slope increases in the downstream direction, reaching 0.0012 ft per ft at Overton. Downstream of Overton, the slope of the central Platte River is generally 0.0012 ft per ft.

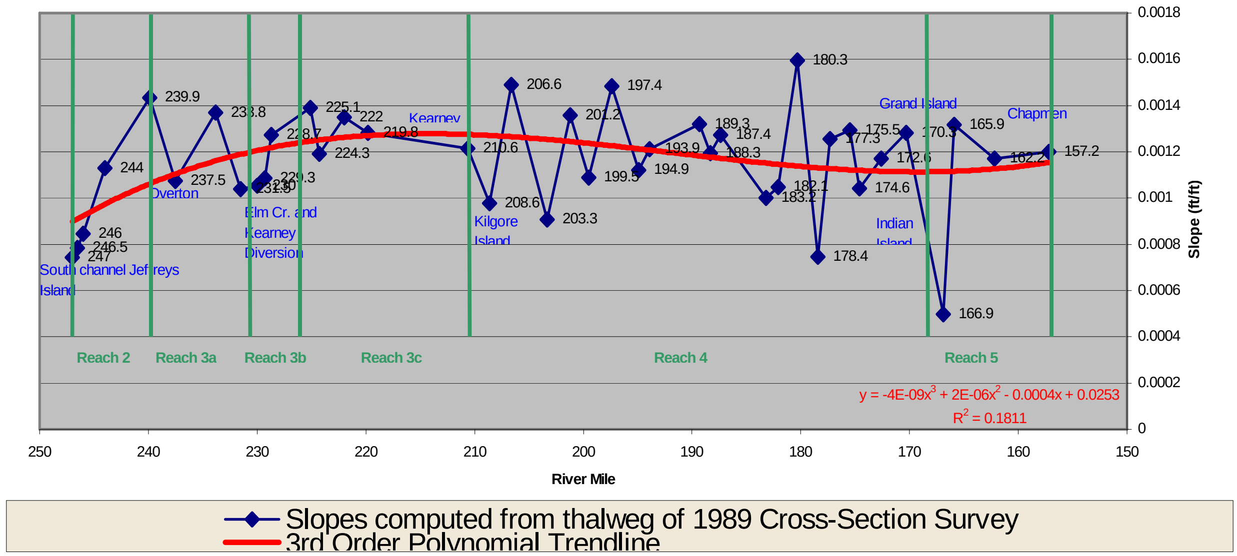

Figure A-G-3 Slope values for the Central Platte River measured to the downstream surveyed cross section.