US Army Corps
of Engineers
Omaha District

Phase I Study: Sedimentation at the Confluence of the Missouri and Musselshell Rivers, Fort Peck Lake, Montana, 1937 to 1998.

Prepared by:

Sedimentation and Channel Stabilization Section
Hydraulic Engineering Branch
Engineering Division
Omaha, Nebraska

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SYNOPSIS

This Phase I study report contains information for the evaluation of the deposition of fluvial sediment at the confluence of the Main Stem Missouri and Musselshell Rivers, Fort Peck Lake, Montana. The information in this document includes raw and graphically displayed data of river channel cross sections, sediment grain size distributions, and the hydraulic elements of average bed, thalweg, channel width, average depth, and channel area for the river systems in the study area. Current sediment density and specific shoreline erosion information is not included in this document. The general trends of the changes in river characteristics over time are discussed. The detailed analyses of the Phase I data will be in the Phase II sedimentation study of this area. An Operation and Maintenance Work Request (OMWR) will be prepared for the Phase II study and submitted with the FY 2003 budget.

The data in this report spans the years from 1937 to 1999. The United States Army Corps of Engineers (USACE) provided databases, files, and memoranda for historic information and range line survey data. The United States Geological Survey (USGS) provided information from databases for suspended sediment loads and summary pages of river gage station sediment sample mechanical analyses results. General observations about the study area are included from a site visit conducted in May 1999. Several data errors were discovered in the databases during the compilation of this report. The corrections of these problems are cited in the text of this report.

rapid rate. The increase in the rate of sedimentation below the constriction point is due mostly to the longer length of the areas of low velocity caused by a focused plume of higher velocity water entering the slower moving water of the lake. Underwater levees may also form adjacent to the higher velocity water plumes and assist in the establishment of areas of sediment deposition adjacent to the river channel. The development of these channels is occurring in the AOC. The hydraulic element data indicates that a channel extended from range line 1995.4 to 2000.1 in 1987. These channels are also visible in the 1997 aerial photographs of the area.

The river channel and submerged bank deposits developing in the AOC will become more pronounced in time as the Musselshell and Main Stem Missouri River deltas completely coalesce and advance downstream to range line 1995.4. The overall decrease in channel depth at range line 1995.4 will require the formation of incised channels in the sediment deposits of the Musselshell and Main Stem Missouri Rivers and the migration of these channels upstream in these river valleys. These portions of the newly developed river channels will eventually meet the river channels migrating downstream from the headwaters of the lake and flood plains will begin to form. The formation of the channels and flood plains in the AOC will not produce better fish habitat or improve boat access in the short term. The flood plains will remain close to the level of the lake and may be eroded during periods of low lake levels. In addition, the newly established channels of the AOC rivers will begin to migrate laterally across the flood plains and may not pass near the Crooked Creek boat ramp. Desired wetland plants and grass may not begin to grow on the flood plains for some time due to the lack of close by seed areas. Therefore, the newly developed flood plains may be initially colonized by noxious weeds.

10. SECTION X -- SUMARY

The AOC rivers will continue to deliver sediment to the Fort Peck Lake. This process is continuous and a given factor for the reservoir and in the AOC. The cursory examination of the data contained in this report indicates the following general trends for the AOC rivers and the Crooked Creek boat ramp.

1. The channel depths of the rivers continue to decrease.

2. The average channel bed elevations of the rivers are increasing expect in the upper reaches of the Musselshell River and Crooked Creek where these channels are down cutting into their flood plains.

3. The river thalweg elevations are generally equal to the average bed elevations, which suggests the development of river channels that are broad and flat, extend to the walls of the river valleys, and lack distinct river channels in the sediment deposits.

4. The average bed and thalweg elevations show slight differences in elevations in the 1970' and 1980's in the upper stretches of the rivers, where these rivers are down cutting and forming meandering channels, and in the immediate vicinities of the natural constriction areas on the Main Stem Missouri River.

5. A meandering channel will develop if the lake elevation is dropped significantly below the top of the sediment deposits. The rivers will establish channels in the exposed sediment deposits as illustrated by the 1961 average bed and thalwegs profiles.

6. Channel width is increasing over time in the Main Stem Missouri River channel and at the mouth of the Musselshell Bay due to shoreline erosion.

7. Channel area is decreasing with time since the rate of sediment deposition is greater than the rate of the increase in channel width by the erosion of the lake shorelines.

8. The Musselshell River and Main Stem Missouri River deltas are coalescing at the mouth of the Musselshell River.

9. The sediment in the AOC contains a larger amount of fine-grained material than is indicated by the mechanical sieve analyses results of sediment samples collected at the USGS gage stations.

10. Previously estimated delta advancement rates and future delta location predictions are incorrect. The Main Stem Missouri River delta may be advancing at a rate three times greater than previously estimated. Delta advancement rates in the Musselshell River and Crooked Creek may be determined from the historic data.

11. The estimates of the useful life of the Crooked Creek boat ramp are incorrect. This boat ramp may not be functional by 2003 due to the design of the boat ramp and the decrease in the depth of the Musselshell bay by sedimentation, especially on the west side of the Musselshell Bay.

12. Access to the west portion of the lake in the L-U Bend will become more difficult from the south side of the Main Stem Missouri River in the near future. The use of this portion of the Fort Peck Lake may be very limited due to access problems for several decades. Access to the river and lake in the AOC will become more hazardous on foot for humans and animals due to the poor bearing capacities of the lake sediment deposits near the shores.

13. The 1999 average beds of the Musselshell River and the Main Stem Missouri River in the AOC may be 2,234 feet and 2,230 feet, respectively. A channel up to 12 feet deep is present at the confluence of these rivers. The Crooked Creek stream valley has been completely filled with sediment to an estimated elevation of 2,234 feet.

14. The Main Stem Missouri River appears to be developing a main channel on the north side of its valley at the confluence of this river with the Musselshell River. The main channel of the Musselshell River is forming on the east side of the Musselshell Bay. Therefore, the Crooked Creek boat ramp will not be near any open river channels in the near future.

15. The installation of channel and sediment control structures will be required to keep the Crooked Creek boat ramp in operation. These structures would need to constrain the river channels and focus the flows of these channels on the Crooked Creek boat ramp area. These structures will be required in the next ten years if this access site is to remain operational. These structures will also assist in reducing the time required for the development of river channels and floodplains in the western portion of the lake and reduce the overall damage of the animal habitat and usable lands in this area.