7.3 SEDIMENTATION, EROSION, AND ICE PROCESSES

The amount of water in storage in the Mainstem Reservoir System lakes impacts sedimentation (deposition) patterns and shoreline erosion within and upstream from the individual lakes. Differences in releases from the lakes impact the downstream riverbed and bankline erosion and ice processes. This section discusses in qualitative terms the relative effects of the alternatives on these processes. For additional technical analysis, please consult two technical reports on this subject: Aggradation, Degradation, and Water Quality Conditions (Corps, 1994f) and Cumulative Erosion Impacts Analysis (Corps, 1998h).

7.3.1 Sedimentation and Erosion

Mainstem Reservoir System operations have the potential to have a noticeable impact on sedimentation and erosion processes in extreme, short-lived situations. For example, the extreme high releases from Garrison Dam and subsequent flows past Bismarck in the late summer of 1997 resulted in considerable erosion in the Bismarck reach of the river. Obviously, if erosion increases in one location, deposition must increase in another location, in this case, the headwaters of Lake Oahe. Storage losses due to sedimentation will continue at historic rates irrespective of how the Mainstem Reservoir System is operated. Although releases caused erosion, the more dominant factor affecting erosion was the extremely high water volumes (twice normal levels) flowing into the Mainstem Reservoir System in 1997.

In 1995, the Corps initiated an analysis to quantify the potential effects of flows on erosion as part of the Master Manual Review and Update (Study). This analysis examined the data that the Corps has acquired over the last 4 to 5 decades on erosion in four reaches. These reaches are located between Fort Peck Lake and Lake Sakakawea, between Lake Sakakawea and Lake Oahe, between Lake Francis Case and Lewis and Clark Lake, and downstream from Lewis and Clark Lake. Although not addressed specifically in the analysis, the Fort Peck Reservation and the Yankton Reservation are directly related to these reaches. The conclusions of this analysis are summarized in Table 7.3-1. Sedimentation and erosion impacts for all of the alternatives are not addressed specific to individual Reservations, but rather to the reaches as a whole. The most relative conclusions of the erosion analysis are those comparing the CWCP with the past preferred alternative of the 1994 DEIS. Basically, the analysis found no relationship among the annual hydrograph and channel features affected by sediment erosion and deposition. Based on this statement, there appears to be little merit in further discussing the effects of the alternatives on the sediment erosion and deposition processes.

7.3.2 Ice Processes

Ice formation and movement are problems to contend with during the 3 winter months. All of the alternatives have the same minimum flow criteria downstream from Gavins Point Dam (12 thousand cubic feet per second (kcfs) average in winter months). Minimum flows are, therefore, not expected to be a problem among the alternatives. Higher flows tend to create more problems with ice, especially when the flows are transitioning from a lower flow to a higher flow.

Transitioning is a problem in two situations. The first is when ice initially forms but does not completely cross the channel. The movement of pieces of ice in the channel can be impeded, which allows the ice to agglomerate and form an ice bridge across the channel that may restrict flows. Flooding can also be a problem if an ice bridge is too restrictive and does not break up. The second transitioning problem occurs once the ice has completely covered the channel. In such cases, the ice-covered channel may have a limited capacity that prevents an increase of flows. Differences among the alternatives that affect these two transitioning situations are not anticipated.

Table 7.3-1. Erosion study conclusions on erosion and deposition of channel features, additional stabilization, and operational changes.

Feature	Downstream of Fort Peck Lake	Downstream of Lake Sakakawea	Downstream of Lake Francis Case	Downstream of Lewis & Clark Lake
Bank Erosion	Rate of bank erosion in all of the reaches is declining with time. Trends are not indicating that all the banks are stable. Rather, the volume being eroded in one reach will equal the volume being added to the banks in another location.			
Bed Erosion	Approaching equilibrium	Approaching equilibrium	Still in adjustment phase	Factors from both ends of reach keep this reach most active.
Turbidity	Not analyzed	No correlation with flow	Not analyzed	No correlation with flow
Island Size	Not related to flow	Indirectly related	Directly related	Directly related
Sand Bar Size	Not related to flow	Indirectly related	Directly related	Directly related
Chutes/Border Fills	Discussion of these features was limited to changes with time and other channel feature changes and not related to flow.			
Downstream Lake Storage Losses	10 percent from the banks	6 percent from the banks 7 percent from the bed	20 percent from the banks	No downstream lake
Effect of Added Stabilization	Additional stabilization will reduce bank material eroded from the protected area. Based on system variables, such as annual flows, this stabilization will not have any long-term impact on other channel processes.			
Effect of Annual Flow Volumes	For flow conditions greater than the long-term average, analysis indicates that there was less bank erosion, greater island and sandbar densities, greater chute filling and an increase in channel border size, and less channel bed scour (except for Fort Peck reach).			
Comparison of the CWCP Versus the Past Preferred Alternative of the DEIS	The average channel velocities of the two plans are essentially identical; therefore, no significant difference in bank and channel bed erosion is expected even though annual variations in the hydrographs are significant. Annual sediment yields will be about the same. There should be no impact on the turbidity in the water. There should be no significant impact on islands, sandbars, and chutes.			