Appendix N

Qualitative Induced Shoaling Analysis

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The continuing loss of coastal wetlands in Louisiana has led to a call for more Mississippi River diversions of water, nutrients and sediment to at least offset the continuing losses, if not to regain some of the lost wetlands. Natural and man-made diversions have been in place for some time now, both upstream and downstream of the proposed site at RM 60 AHP. Several more are in the study and design stage. The diversion of significant quantities of river sediments and water typically leads to unintended consequences, in that the diverted water and sediment concentrations are not in the same proportion as in the river. The typical response is sedimentation and shoaling in the main river downstream of the diversion. In the receiving diversion channel, sedimentation or erosion could take place, depending on a variety of factors. Complex analytical or physical models are needed to gain insight into what the impacts of a diversion might be. However, such modeling has not yet been done for the White Ditch project.

The proposed White Ditch Diversion will be located on the inside of a bend in the river at about RM 60 AHP. This location currently exhibits shoaling and sand deposition tendencies. If the design of the diversion encourages the entrance of significant sand concentrations, downstream sand deposition could be minimal on a year-round basis in the Mississippi channel. Diverting significant amounts of sand is important in that deposition downstream of a diversion will consist primarily of sand particles, as silts and clays tend to stay in suspension until the velocity approaches zero.

The current operating plan for the White Ditch Diversion is limited to a diversion pulse of 35,000 cfs in March–April of each year, during the normal high flow period of the Mississippi River, and a diversion of 1,000 cfs the rest of the year. This flowrate may not be experienced over the full 60 day period. The proposed 35,000 cfs diversion will be the largest man-made diverted flow for wetland building on the Lower Mississippi River, but the one to two month duration will be a modifying factor. The diversion should approximate five percent or less of the main channel flow for most years. Although some deposition in the downstream channel will occur, the one to two month duration should result in minimal shoaling, especially in the navigation channel. Although the peak monthly sediment concentration normally occurs in March, the peak monthly water discharge occurs in April with high flows typically continuing into May and later. When the diversion is reduced to 1,000 cfs, some of this deposition will be re-suspended by the Mississippi flow and carried on downstream in the following months. On an annual basis, the net gain in downstream deposition could be minimal. Specific sediment transport studies for the White Ditch Diversion are required to better address the amount of deposition expected.

A brief review of available technical information along with a general literature search on diversions and sediment effects yielded little hard technical information on this subject. The greatest amount of this type effort has been performed by the Corps of Engineers over the past 20 years. White Ditch has not been addressed, but other, similar diversions may be reviewed for applicability to White Ditch. Past sediment transport studies on the impacts of diversions for the entire Lower Mississippi reach were described in a report by the Corps of Engineers[i] The study found that a diversion up to 15,000 cfs had no measurable impact on downstream deposition, so only the March–April diversion pulse would affect the Mississippi. The study utilized the

HEC-6[ii] computer program to evaluate the impacts of various actual and proposed diversions both upstream and downstream of New Orleans. The three potential future diversion sites and discharges examined for sedimentation impacts included: Fort Jackson (15,000 cfs), Bohemia (100,000 cfs) and Myrtle Grove (15,000 cfs). The latter is across the river from the location of White Ditch Diversion. Although Bohemia was only to be operated during a 3–4 year frequency flood or rarer, its operation resulted in the most deposition over a simulated 96 year period of record (75,000 cubic yards dredged annually). The total annual maximum increase from the three diversions was 105,000 cubic yards requiring dredging. The White Ditch Diversion dredging requirements should be a small fraction of this total. The study also found that deposition in the Pilottown anchorage caused by the diversions took many years to reach this location. The further upstream the diversion, the more years required to impact the Pilottown anchorage and adjacent areas. In addition, the study highlighted the importance of diverting a large amount of sand. If the diverted flow contained more than 50% of the river's normal sand concentration, channel changes near Head of Passes were small. If the sand concentration diverted was less than 50% of the normal river concentration, channel changes were significantly greater at Head of Passes.

An ongoing study of the impact of West Bay Diversion on downstream deposition in the anchorage area is in the draft phase. West Bay is a year-round flow diversion of 20,000 cfs just upstream of Head of Passes[iii], although flows approaching 30,000 cfs through the diversion have been recorded. Future increased diversions at West Bay could reach 50,000 cfs, although the Breaux Task Force has voted to close the project (possibly by the end of 2010) due to excessive shoaling downstream[iv]. A Corps draft report has concluded that West Bay is responsible for 15–55%[v] of the shoaling in the anchorage area near Head of Passes. As the White Ditch Diversion would only operate at flows in this range for one to two months of the year, the project would increase shoaling in the anchorage area by a fraction of West Bay totals, perhaps 2–10%. It would also take many years for the impact to reach Pilottown, since the White Ditch diversion is about 60 river miles upstream.

An additional consideration will be the sedimentation that may take place in interior distribution channels after the flow is diverted. The March discharge will be directed into marsh and open water areas and the portion of the diverted sediment load that is sand will settle quickly when the flow velocity decreases. If it is desired for the sand load to be carried well away from the diversion point, the diversion channel(s) must be carefully designed to maintain the velocity necessary to keep the sand load in suspension. Similarly, silts and clays will begin depositing as velocities approach zero, so the diversion channel design should minimize the creation of eddies or areas of low velocity.

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[i] Corps of Engineers, July 2000. Mississippi River Sediment, Nutrient and Freshwater Redistribution Study, pp 147-151.
[ii] Corps of Engineers Hydrologic Engineering Center computer program HEC-6. Scour and Deposition in Rivers and Reservoirs, 1993
[iii] Louisiana Coastal Wetlands Conservation and Restoration Task Force, West Bay Sediment Diversion (MR-04), Project Status
[iv] New Orleans Times-Picayune, Jan 21, 2010
[v] New Orleans Times-Picayune, Dec 8, 2009