

Enclosure 11 Three options considered by Regulatory as viable alternatives to Holliday Sand's October 19, 2009 proposal

		400	399	398	397	396	395	394	393	392	391	390	389 to 379	378	377	376	375	374	373	372	371	370	369	368	367	366	365	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349	348	347	346	345 to 329	328	327	326 to 322	321	320													
NWK's Last Plan	UP to 1.8 M Tons 400-320	~																										~																																					
	UP to 1.3 M Tons 400-328	~																										~																																					
	UP to 0.7 M Tons 400-358 DF	~																										Up to 0.7 M Tons DF 358-353													~																								
															<== Approximately 6 miles above plant													<== Hannibal Rail Bridge 366.1																																					
Holliday's Recent Proposal	UP to 2.5 M Tons 400-320	~																										~																																					
	UP to 1.6 M Tons 400-328	~																										~																																					
	UP to 0.8 M Tons 400-366.1 - Will try DF first	~																										No Tons													Up to 0.5 M Tons 364-353													Up to 0.3 M Tons 353-328											
Option 1	UP to 1.8 M Tons 400-320	~																										~																																					
	UP to 1.6 M Tons 400-328 - DF KCG ≥17	~																										~																																					
	UP to 0.8 M Tons 400-366.1	~																										Up to 0.5 M Tons 366.1-353													~																								
	UP to 0.5 M Tons 400-378	~													Up to 0.5 M Tons 378-366.1													~																																					
Option 2	UP to 1.8 M Tons 400-320	~																										~																																					
	UP to 1.6 M Tons 400-328	~																										~																																					
	UP to 0.8 M Tons 400-366.1 - DF KCG ≥17	~																										Up to 0.5 M Tons 366.1-353 - DF KCG ≥17													~																								
	UP to 0.5 M Tons 400-378	~													Up to 0.5 M Tons 378-366.1													~																																					
Option 3	UP to 1.8 M Tons 400-320	~																										~																																					
	UP to 1.6 M Tons 400-328	~																										~																																					
	UP to 0.8 M Tons 400-366.1	~																										Up to 0.5 M Tons 366.1-353													~																								
	UP to 0.5 M Tons 400-378	~													Up to 0.5 M Tons 378-366.1 - DF KCG ≥17													~																																					

DF = Dike Fields at + 200'

KCG = Kansas City Gage

Enclosure 12 River Engineering Memo of November 5, 2009 assessing the relative risks of Holliday Sand's proposal and Regulatory's alternatives



REPLY TO  
ATTENTION OF

**DEPARTMENT OF THE ARMY**  
CORPS OF ENGINEERS, KANSAS CITY DISTRICT  
700 FEDERAL BUILDING  
601 E 12<sup>TH</sup> STREET  
KANSAS CITY MO 64106-2896

CENWK-ED-H

NOV 5 2009

MEMORANDUM THRU

ED-G  
OD

FOR OD-R

Subject: Missouri River Dredging - River Mile 320 to 400.

1. References and Supporting Documentation for Cessation or Reduction of Dredging in the Kansas City Reach of the Missouri River:

a. Undated Memorandum, Subject: Documentation of Decision to Recommend Quantity Restrictions for Commercial Sand Dredgers Between River Miles 340 and 400 on the Missouri River. The memorandum documents the recommendations of an ad hoc Corps of Engineers committee that convened on 18-19 November 2003.

b. Memorandum dated 3 December 2008, Subject: Visualization of Potential Failure Modes to Federal Levee Projects Due to Degradation of the Missouri River Channel, Kansas City Reach.

c. Memorandum Dated 24 June 2009, Subject: Recommended Sand Dredging Quantity Limit for 2010 in Kansas City Reach.

d. Missouri River Bed Degradation Reconnaissance Study 905(b) approved 24 August 2009.

e. Missouri River Levee Unit L385 Sediment Analysis, Final Report, May 1999

f. Alternative 2. f., Restrictive take by River Mile, dredge dike fields only when Kansas City Gage is at 17 feet or higher. Holiday Sand Options 1, 2, and 3

2. Eight alternative sand dredging permit extension scenarios for the interim period Jan 2010 through Dec 2010 and relative increase in incremental risk of unsatisfactory performance to infrastructure along Missouri River Mile 320 to 400 were developed and are discussed below. Risks discussed below are relative incremental increases to the risk that exists today due to the current state of degradation of the Missouri River. This engineering risk assessment addresses only physical changes to the river and infrastructure. The scenarios are listed in likely order of

increasing risk of unsatisfactory performance to infrastructure. Each of these scenarios outcomes is contingent on future hydrologic conditions. The relative risk for employing these scenarios through December 2010 is based on expert elicitation using subject matter experts within NWK-ED. Expert elicitation is the same process used within USACE to develop risk screening assessments on levees and dams when there is insufficient information available to do a deterministic risk assessment. Since the risks can not be calculated deterministically due to lack of complete information, there is uncertainty in the expert elicitation process.

a. No dredging:

Pro: Removes the added incremental risk associated with dredging during 2010.  
River degradation may stabilize or reduce during a period of no dredging.

b. Dredge inside of bends and within the dike fields of River Mile 328 to 400. Unrestricted location dredging River Mile 320 to 328. Total take 1.3 M Tons.

Pro: Minimize impact on thalweg degradation thereby reducing the incremental increase in risk to the levee system (see paragraph 4 below)

Widens river and increases conveyance thereby reducing additional incremental risk to the levee system.

Impact to levee systems minimal for 12 month dredging period.

Con: May lead to degradation in vicinity of River Mile 320 to 328.

c. Dredge inside of bends and within the dike fields of River Mile 350 to 400. Unrestricted location dredging up to 1.3M Tons between River Miles 350 to 328. Total take 1.3 M Tons between River Miles 328 to 400.

Pro: Moves dredging away from infrastructure

Con: May lead to continued degradation

d. Dredge 650K Tons in thalweg and 650K Tons inside of bends and within dike fields River Mile 320 to 400. Total take 1.3M Tons.

Pro: Reduces incremental risk of potentially dredging all the quantity from the thalweg.

Con: Will likely cause additional incremental degradation within the Kansas City Reach but less than dredging the entire 1.3 M tons from the thalweg.

e. Extension of existing permit for 12 months at 1.3 M tons between River Mile 320 and 400.

Pro: Reduces risk by reducing take to 1.3 M tons.

Con: May lead to continued degradation

Disturbs stability of stream bed

f. Restrictive take by River Mile, dredge dike fields only when Kansas City Gage is at 17 feet or higher. Total take is 1.8 M tons. Within the overall general ranking for this scenario, these 3 options are sub ranked in order of increasing relative risk as follows:

Option 1 Please see reference 1. e., enclosure 1, Holiday Options

Option 2 Please see reference 1. e., enclosure 1, Holiday Options

Option 3 Please see reference 1. e., enclosure 1, Holiday Options

Pro: Reduces risk by reducing take to 1.8 M tons.

Con: May lead to continued degradation  
Disturbs stability of stream bed

g. Holiday Sand and Gravel Company letter of September 10, 2009 to dredge 1.8 M tons in currently authorized areas.

Pro: Reduces risk by reducing take to 1.8 M tons

Con: May lead to continued degradation

h. Extend existing permit with 2.4 M tons in currently authorized areas.

Con: May lead to continued degradation

### 3. Discussion of uncertainties.

a. Considerable uncertainty exists with respect to direct impact of dredging on existing infrastructure in the Kansas City reach. A comprehensive inventory of the infrastructure has not yet been accumulated and the condition of most is unknown. Even the evaluation of Corps constructed levees has not been detailed and comprehensive, but rather it was a cursory spot check of a few obvious locations where the levee is in close proximity to the river bank.

b. It is understood that the degradation has steepened the submerged levee slopes on some levees and the existing configuration in certain locations does not meet existing Corps slope stability criteria. One possible future failure mode is sloughing of the toe in combination with scour leading to loss of levee crest. The problem is very complex and to date a robust engineering evaluation has not been performed. Considerable uncertainty exists with respect to trigger mechanisms and how quickly the failure mode could develop.

c. Comparison of bed material gradations verses dredged material gradations indicate that an insufficient amount of coarse material exists on the surface of the river bed to meet the required dredged material gradations. It is likely that the coarser material is being extracted from deeper, glacial era deposits located under the river bed. Over time, this practice could make the river bed more susceptible to scour during flood events which could aggravate the degradation problem.

d. There is uncertainty in the total amount of annual movable bed load between river miles 328 to 400. Reference 1.e above estimates the total movable bed load to be approximately 1.3 M Tons. This reference is believed to be the most reliable estimate to date and is the basis for recommending a total take of 1.3 M Tons in scenarios 2.b through 2.e.

### 4. Levee Safety Considerations.

a. The final Missouri River Bed Degradation Reconnaissance Study, dated August 2009, has identified signs of channel bed/slope local integrity problems including water intake supply impacts, bank instability, drainage outfall structure damages, local tributary head cutting, bridge and utility crossings, and potential environmental impacts including loss of shallow water habitat areas. Very limited additional evaluation of bed degradation on the levee/floodwall safety was conducted subsequent to the finalization of the Missouri River Bed Degradation Reconnaissance Study.

b. Based on existing conditions, five critical areas were identified within the Kansas City reach of the Missouri River, between river miles 368 and 378. Preliminary assessment of channel bank slope stability in these areas indicates possible impact to levee safety. Specifically, slope stability results in the lower portions of the impacted channel slopes indicate factors of safety that do not meet Corps of Engineers standards.

c. Special condition requirements in the original permit kept dredge activity at least 500 feet from the centerline of federal levees within the Kansas City reach. This condition appears to remain as the absolute minimum safeguard against direct impacts of dredging to the existing levees. However, the 500-foot restriction does not assure levee safety because it does not prevent the loss of channel bed that is occurring on a macro level.

d. The risk communication plan for the proposed future permit extension is not clear. Levee sponsors and others potentially adversely impacted by future dredging activities should be informed and given the opportunity to comment on the permit extension. This recommendation is based on USACE intent to effectively communicate risk and establish public involvement in risk reduction strategies.

5. Recommendation. Based on the scientific and engineering information currently available, and without the information and knowledge from a completed Sand Dredging EIS due to uncontrollable external delays in completing the EIS work, cessation of dredging in the Kansas City reach is the only scenario to have no adverse impacts to affected infrastructure along the river. Additional possible dredging scenarios are provided in paragraph 2 in order of increasing relative risk. ED recommends that dredging quantities in the Kansas City reach for 2010 be limited to the computed bed load of 1.3 M tons. Further, to prevent disruption to the natural stratification of the thalweg and to increase the likelihood of bed load capture, this quantity should only be removed from within the dike fields.

Encl

  
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Kansas City District

CF: OC