

Appendix K
Comparing Dredging Requirements with Target
Water Levels and Diversion Flows

Mississippi River Reintroduction to Bayou Lafourche

Comparing Dredging Requirements with Target Water Levels and Diversion Flows

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Introduction

The relationship between dredging, target water levels, and diversion flows is critical to the screening and selection of alternatives to carry forward into the 30 percent design. During the hydraulic analysis for the Phase 1 design, three target water levels were used as boundary conditions - existing, mean low water (MLW), and mean water (MW). The MLW condition represents a rise of approximately 10 inches in the Donaldsonville reach, and the MW condition represents a rise of approximately 42 inches (3.5 feet).

Coupled with the target water levels were allowable diversion flows and dredging depths used to maximize flows in the bayou without exceeding the target water level. The combination of channel alignments (Donaldsonville and Smoke Bend), railroad bridge improvements, check structures, target water levels, dredging templates, and diversion flows resulted in 69 alternatives, which were outlined in Chapter 3, Table 3-5, of the Phase 1 Design Report.

Each of the 69 alternatives includes an estimated dredging quantity (millions of cubic yards [MCY]) defined by the dredging template applied. The dredged quantities were calculated by the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model for the seven dredging templates and are shown in Table 6-1 of the Phase 1 Design Report.

Approach

This technical memorandum applies regression methods, using the HEC-RAS model results from the Phase 1 Design Report, that show continuous relationships among target water level, diversion flow, and dredge quantity. The HEC-RAS model dredge quantities are plotted with the forecasting curves to provide information concerning intermediate water levels, dredge quantities, and diversion flows. The focus of this evaluation was on diversion flows between 1,000 and 2,000 cubic feet per second (cfs) from the suite of 69 alternatives in Table 3-5 of the Phase 1 Design Report.

Dredging Quantity versus Diversion Flow

The first comparison related dredging quantity to diversion flow for the three defined target water levels. Using the HEC-RAS data for each target water level, the dredged quantity for each template was regressed with flow to provide a method of viewing the dredging quantity at intermediate flows between 1,000 and 2,000 cfs.

A graph was developed for each target water level that shows a continuous forecast curve of dredged quantity versus flow. Using Figure 1, the amount of dredging required to achieve a desired diversion flow can be investigated for each target water level.

Dredging Quantity versus Water Level

The next comparison examined the relationship of dredge quantity with target water levels for five flow amounts between 1,000 and 2,000 cfs. The Louisiana Department of Natural Resources (LDNR) provided a matrix in the December 22, 2004, response to the Draft Final Phase 1 Design Report that outlined five flows of interest; 1,000 cfs, 1,250 cfs, 1,500 cfs, 1,750 cfs, and 2,000 cfs. This analysis examined how a change in water level would effect the dredging requirements for any flow between 1,000 and 2,000 cfs.

The LDNR flows of interest were applied to each of the three curves on Figure 1 to compute dredge quantities. The regression equation provided a method of estimating the dredge quantities shown in Table 1. The data for the existing, MLW, and MW quantities in Table 1 were computed using the regression equations for each forecast curve and are based on the HEC-RAS channel modification option for the three target water levels.

TABLE 1
Bayou Lafourche Dredging Matrix – Quantity Projections (MCY), Partial
Mississippi River Reintroduction to Bayou Lafourche – Louisiana Department of Natural Resources

Flow (cfs)	Water Levels in Donaldsonville			
	Existing	MLW (Existing + 10 inches)	Existing + 24 inches	MW (Existing + 42 inches)
1,000	6.01	3.42	–	0.42
1,250	8.11	5.17	–	1.25
1,500	10.35	6.93	–	2.23
1,750	12.72	8.67	–	3.47
2,000	15.21	10.43	–	4.87

Note:

Projections only apply to alternatives that include railroad bridge modification.

Quantities for the target water level in Table 1 defined as existing + 24 inches were not directly available from HEC-RAS because this target water level was not originally selected for evaluation. Because the existing water level (elevation) in Bayou Lafourche is not the same everywhere, a reference existing water level value was required to numerically define the three target water levels. The existing target water level of 8.15 feet at 215 cfs in the subreach upstream of the railroad bridge in Donaldsonville was taken from the HEC-RAS model and used to define this water level.

Table 1 dredge quantities (in MCY) were then regressed against target water levels for each specified flow, providing five forecasting regression equations. Figures 2 and 3 show the five graphs of HEC-RAS model results and forecast curves relating dredge quantity to water level. Each graph is for one of the diversion flows outlined in the LDNR matrix.

Results

The five regression equations from Figures 2 and 3 were used to compute the expected dredge quantity for the target water surface of existing + 24 inches in Table 1. Table 2 shows the results of the regression approach, and completes the LDNR matrix. In addition, Figures 1 and 2 provide LDNR with a method of investigating additional water levels, diversion flows, and dredging quantities within the range of the initial Phase 1 Design Report alternatives.

TABLE 2
 Bayou Lafourche Dredging Matrix – Quantity Projections (MCY), Completed
Mississippi River Reintroduction to Bayou Lafourche – Louisiana Department of Natural Resources

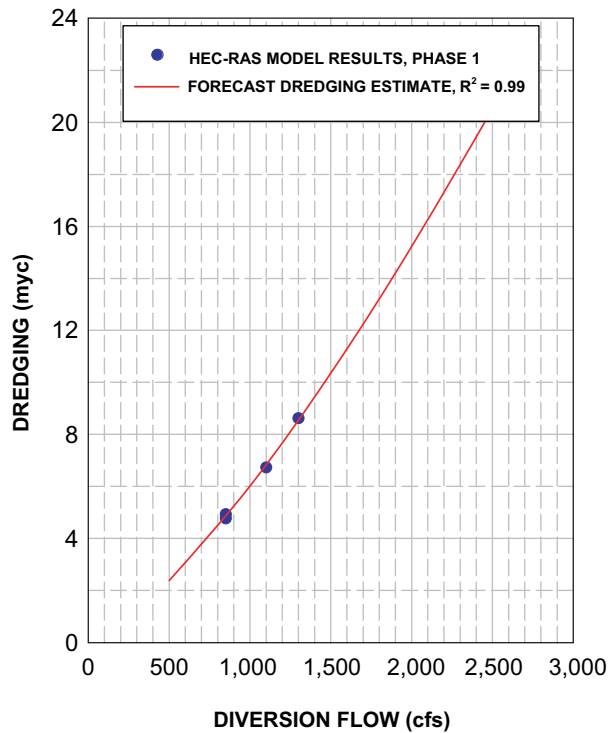
Flow (cfs)	Water Levels in Donaldsonville			
	Existing	MLW (Existing + 10 inches)	Existing + 24 inches	MW (Existing + 42 inches)
1,000	6.01	3.42	1.32	0.42
1,250	8.11	5.17	2.76	1.25
1,500	10.35	6.93	4.02	2.23
1,750	12.72	8.67	5.65	3.47
2,000	15.21	10.43	5.80	4.87

Note:

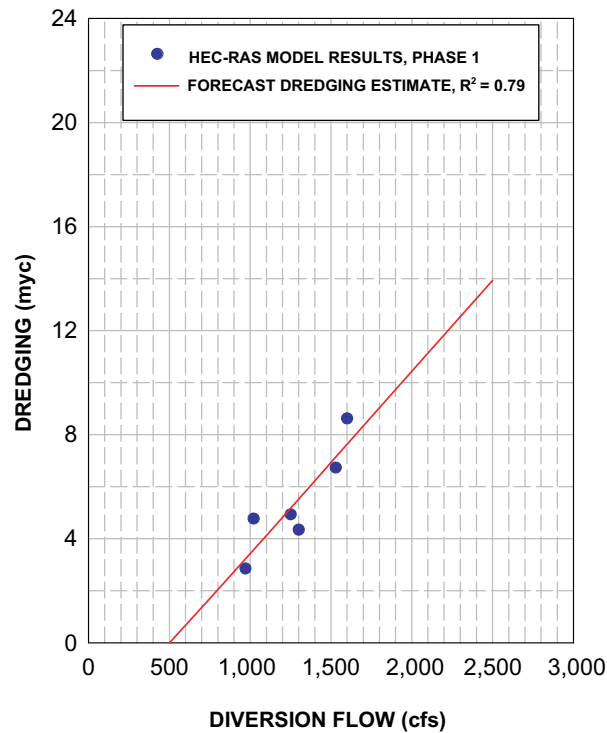
Projections only apply to alternatives that include railroad bridge modification.

The statistical approach using regression tools was based entirely on results from the HEC-RAS model. No additional hydraulic modeling analysis was required. Best-fit regression equations shown on Figures 1 and 2 include the goodness-of-fit (R^2) value for reference. HEC-RAS will be used to refine the dredging template and quantities of the alternatives selected for the 30 percent design.

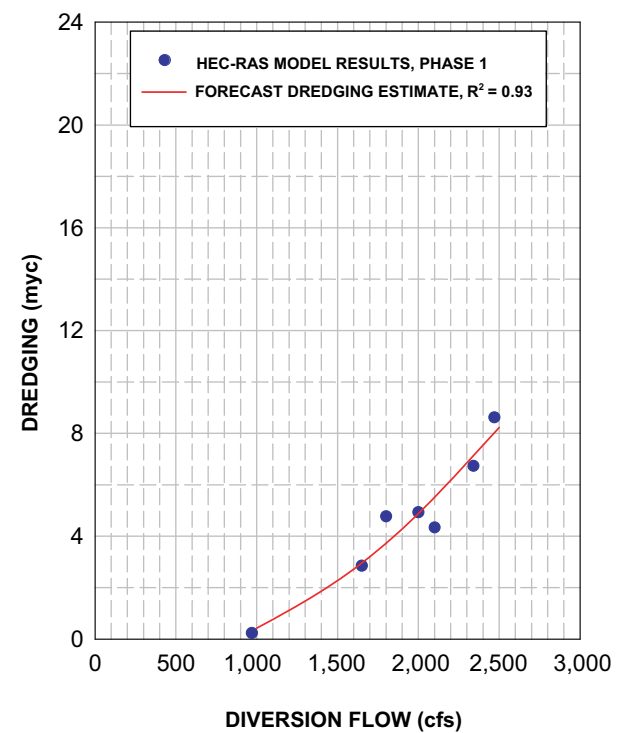
**BAYOU LAFOURCHE DREDGING
EXISTING TARGET WATER LEVEL**



**BAYOU LAFOURCHE DREDGING
MLW TARGET WATER LEVEL**



**BAYOU LAFOURCHE DREDGING
MW TARGET WATER LEVEL**



NOTES:

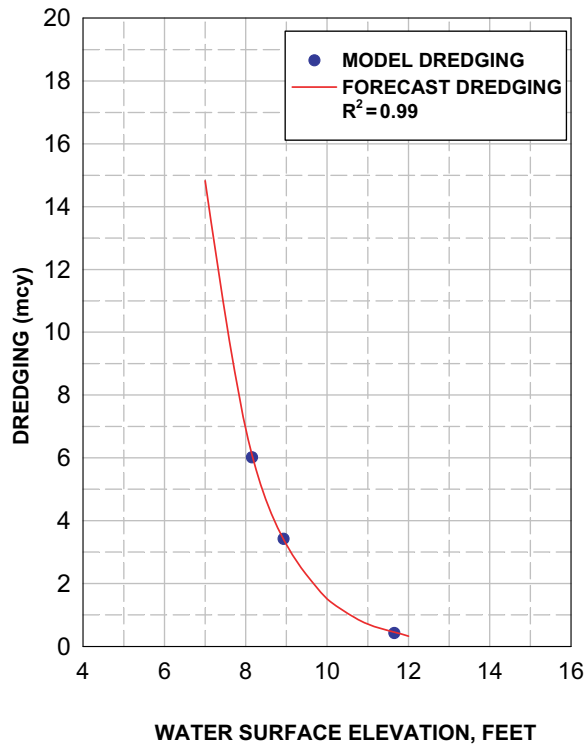
TARGET WATER SURFACES
IN DONALDSONVILLE:

- EXISTING = 8.15 FEET
- MLW = 8.93 FEET
- MW = 11.65 FEET

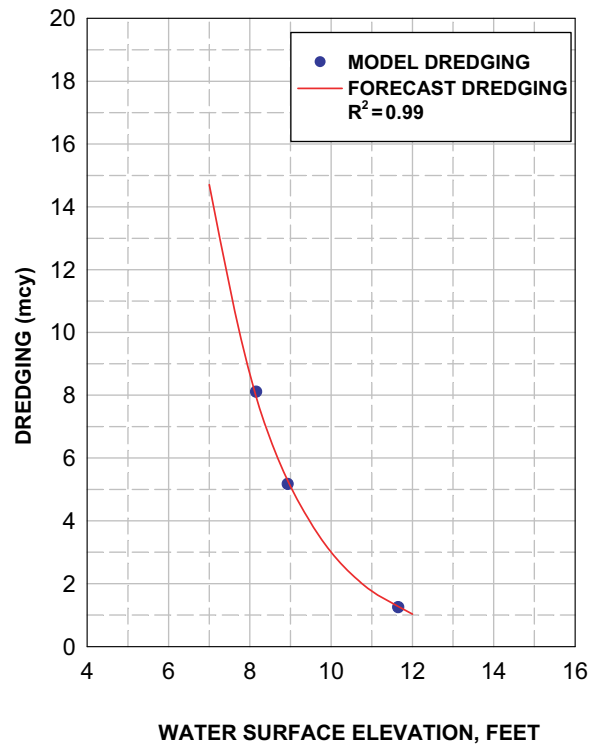
• mcy = MILLIONS OF CUBIC YARDS

**FIGURE 1
DREDGING-FLOW RELATIONSHIPS
FOR EXISTING, MLW AND AW TARGET WATER LEVELS**
MISSISSIPPI RIVER REINTRODUCTION INTO BAYOU LAFOURCHE
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
PHASE 1 DESIGN REPORT

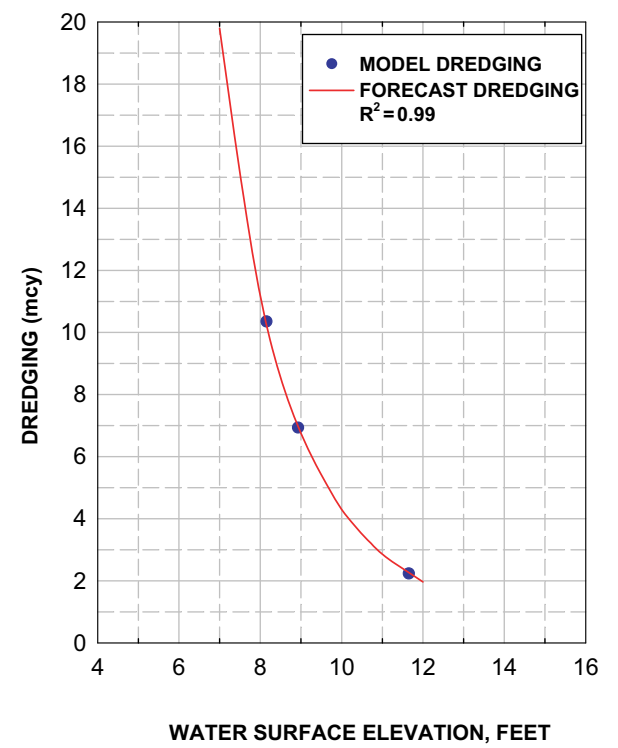
**BAYOU LAFOURCHE DREDGING
FOR 1,000-CFS DIVERSION**



**BAYOU LAFOURCHE DREDGING
FOR 1,250-CFS DIVERSION**



**BAYOU LAFOURCHE DREDGING
FOR 1,500-CFS DIVERSION**



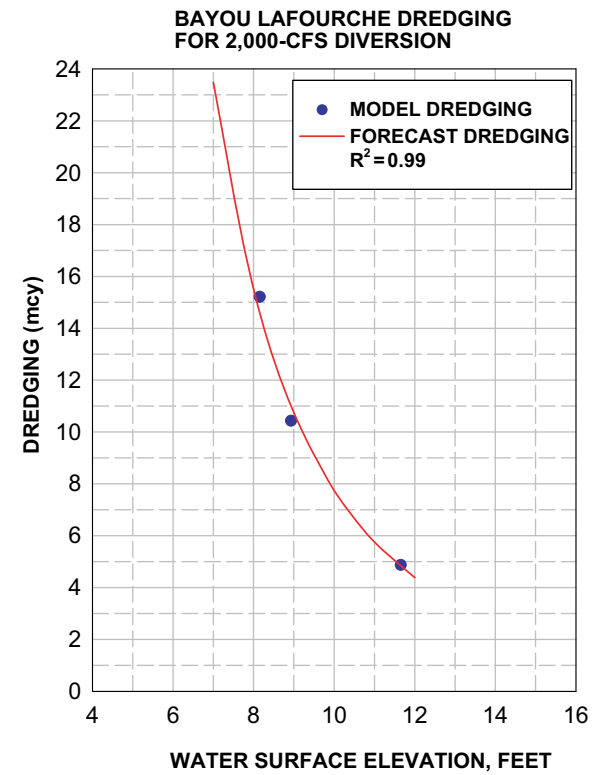
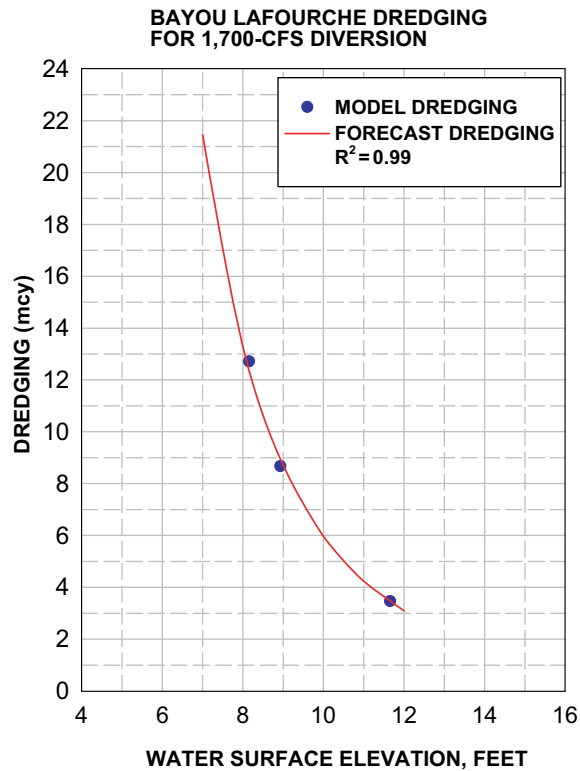
NOTES:

TARGET WATER SURFACES
IN DONALDSONVILLE:

- EXISTING = 8.15 FEET
- MLW = 8.93 FEET
- MW = 11.65 FEET

• mcy = MILLIONS OF CUBIC YARDS

**FIGURE 2
DREDGING-WATER SURFACE RELATIONSHIPS
FOR 1,000 CFS, 1,250 CFS, AND 1,500 CFS**
MISSISSIPPI RIVER REINTRODUCTION INTO BAYOU LAFOURCHE
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
PHASE 1 DESIGN REPORT



NOTES:

TARGET WATER SURFACES
IN DONALDSONVILLE:

- EXISTING = 8.15 FEET
- MLW = 8.93 FEET
- MW = 11.65 FEET
- mcy = MILLIONS OF CUBIC YARDS

FIGURE 3
DREDGING-WATER SURFACE RELATIONSHIPS
FOR 1,750 CFS AND 2,000 CFS
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