Technical Report M48

VICTORIA BEND HYDRAULIC SEDIMENT RESPONSE MODEL INVESTIGATION

LOWER MISSISSIPPI RIVER MILES 600 - 590

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INTRODUCTION

The U.S. Army Corps of Engineers, St. Louis District, conducted a sedimentation study of the Lower Mississippi River between Miles 600 and 590 near Rosedale, Mississippi. The purpose of the study was to evaluate river engineering design alternatives with the goal of alleviating repetitive channel maintenance dredging and/or improving the navigation alignment through Victoria Bend (mile 596 to 594).

The study was conducted between July 2009 and March 2010 using a physical hydraulic sediment response (HSR) model. Mr. Peter Russell, Hydraulic Engineer, performed the model study under direct supervision and guidance from Mr. Robert Davinroy, Chief, River Engineering for the St. Louis District.

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BACKGROUND

1. Study Reach

The study comprised a 10-mile stretch of the Middle Mississippi River, between Miles 600 and 590 near Rosedale, Mississippi. Plate A1 shows the location and vicinity maps of the study reach.

2. Problem Description

A major change in the Mississippi River at Victoria Bend occurred between River Miles 596 and 594, sometime between the winter of 2002 and the summer of 2003. This change resulted in the formation of an extensive middle bar that completely buried large portions of the existing bendway weirs along the left descending bank (LDB) of Victoria Bend. As a result, the Vicksburg District has performed repetitive channel maintenance dredging. Plate A2 shows the location of past dredge cuts and highlights dike and weir construction between 1995 and 2004.

3. Study Purpose and Goals

The purpose of the HSR model study was to evaluate different structural design alternatives with a goal of developing a reliable navigation channel and reducing the repetitive channel maintenance dredging experienced in Victoria Bend.

4. River Morphology and Recent Changes in the Victoria Bend Study Reach.

Plate A3 shows historical planforms of the Mississippi River in the study reach since 1933. The present day planform has been influenced by various channel improvement measures over the years, including revetments, dikes and bendway weirs (see plate A4). Plate A5 highlights bankline changes between the 2003 and 2008 aerial photos.

Plates B1 – B6 show 1994 - 2002 hydrographic surveys of the Victoria Bend study reach. The date and river stage during each of the surveys are shown on plate A7. The bendway weirs in Victoria Bend were constructed in 1995. The bathymetry through Victoria Bend between 1995 through 2002 was comparable of typical observed channel responses of other bendway weirs in sharp radius bends. Up until the later part of 2002, the thalweg was located along the LDB. The bendway weirs in Victoria Bend were performing as designed, incurring deposition along the outside of the bend and scour along the inside of the bend off the tips of the structures. The alignment of the bend was improved for navigation. However, it was the intent of the Vicksburg District to further improve navigation conditions through the bend, and a plan for extensions of the bendway weirs was discussed for several years (Coleman, MVK, 2010).

Leading up to 2002, there were two major construction efforts taking place in the bend immediately upstream of Victoria Bend in the vicinity of the mouth of the White River, Mile 599. These efforts included construction of the Big Island Bendway Weirs (Memphis District) and construction of the Montgomery Point Lock and Dam (Little Rock District). Both construction efforts changed or had some effect on the sediment response of the river above Victoria Bend.

In the case of the Big Island Bendway Weirs, during and immediately after construction (2002), more sediment was transported along the inside of the bend as expected, between Miles 599.9 and 598. This dramatically improved navigation conditions along the outside of the bend.

In the case of the lock and dam construction just upstream of the mouth of the White River, excavation of a pilot channel and work area footprint was required at the start of construction. To achieve these measures, construction dredging was employed. Between 1997 and 1998, approximately 1,000,000 cubic yards of material was excavated during construction (Eggburn, Little Rock District, Shaw, Luhr Bros 2010). This material was discharged directly into the thalweg of the Mississippi River at the bottom of a 100-foot scour hole at Mile 599 R (immediately off the RDB). The thalweg disposal was monitored and surveys showed that the hole never filled up from the disposal (Shaw 2010). Instead, there was enough transport energy in the river to immediately keep the material moving downstream. Where this material eventually settled was an unknown, but there was a high probability that it ended up in the downstream crossing at Mile 596.5.

The thalweg disposal material consisted primarily of earthen floodplain clay, silt, and sand (Eggburn, Shaw 2010). It should be noted that the earthen clay material is not typical of the normal courser sand that is normally transported in the river.

Plates B7 through B19 are hydrographic surveys of the river between 2004 and 2009. The date and river stage during each of the surveys are also shown on Plate A7. As observed in the 2004 survey, a large middle bar developed through Victoria Bend. Over the years all surveys show the bar has changed in configuration, but has shown no signs of leaving, and seems to have stabilized over the last 3 years.

There are several reasons why this bar may have developed. First, during the Spring of 2002, a major flood event took place on the river. Stages reached 45.8 feet on the Helena, Arkansas gage on May 25, 2002 (Plate A2). There have been greater floods in the past, but what made this event unique was the extremely quick and steady recession. The stage fell 45 feet by August 13, 2002, the quickest steady fall on record. It has been well documented that the greatest amount of sediment deposition within that channel usually occurs on the recession limb of the hydrograph. This quick, dramatic recession, combined with the thalweg disposal of earthen material and the construction of bendway weirs at Big Island, may have produced the middle bar at Victoria Bend. In addition, the fact that the majority of thalweg disposal contained clay, may have contributed to the non-erosive characteristics and continued stability of the middle bar observed in the recent hydrographic surveys.

HSR MODEL DESCRIPTION

A photo of the Victoria Bend Hydraulic Sediment Response (HSR) model is shown on plate A6. The model encompassed Miles 604 to 588. After entrance and exit conditions in the model were developed, the actual study reach was located between Miles 600 to 593.

1. Scales and Bed Materials

The model employed a horizontal scale of 1 inch = 1,000 feet, or 1:12000, and a vertical scale of 1 inch = 60 feet, or 1:960, for a 12.5 to 1 distortion ratio of linear scales. This distortion supplied the necessary forces required for the simulation of sediment transport conditions similar to those observed in the prototype. The bed material was granular plastic urea, Type II, with a specific gravity of 1.40.

2. Appurtenances

The HSR model planform insert was constructed using 2008 and 2003 high-resolution aerial photography of the study reach. The insert was mounted on a standard HSR model flume. The riverbanks of the model were constructed from dense polystyrene foam, and modified during calibration with clay. The hydraulic flume was mounted on adjustable feet, which controlled the slope of the model. The measured slope of the insert and flume was approximately 0.012 inch/inch. River training structures in the model were made of galvanized steel mesh. Non-erodible characteristics of the middle bar were made of rough scour pad material.

Flow into the model was regulated by customized computer hardware and software interfaced with an electronic control valve and submersible pump. This interface automatically controlled the flow of water and sediment into the model. Discharge was monitored by a magnetic flow meter interfaced with the customized computer software.

Water stages were checked with a mechanical three- dimensional point digitizer. Resultant bed configurations were measured and recorded with a three-dimensional laser scanner.

HSR MODEL TESTS

1. Model Calibration

The calibration of the model involved the adjustment of water discharge, sediment volume, model slope, and entrance conditions of the model. These parameters were refined until the measured bed response of the model was similar to that of the river.

HSR Model Operation

In all model tests, steady state flow was simulated in the channel. This served as the average design energy response of the river. Because of the constant variation experienced in the prototype, this steady state flow was used to theoretically analyze the ultimate expected sediment response. The flow was held steady at a constant flow rate of 1.37 gallons per minute in the Mississippi River and 0.14 gallons per minute in the White River for all design alternatives tested. An important factor during the modeling process was the establishment of an equilibrium condition of sediment transport. The steady flow in the model simulated an average energy condition representative of the river's channel forming flow and sediment transport potential at bank full stage.

2. Base Test

The model was calibrated to pre 2002 conditions prior to the large middle bar deposit in Victoria Bend. Plate C1a shows the resultant bed configuration of the model base test. The bathymetry was compared to a number of surveys observed between 1994 and 2002. Comparative results showed the following trends:

The thalweg developed in the model off the RDB at the confluence with the White River at Mile 597.5, and crossed over to the LDB near Mile 597. The thalweg remained along the LDB through Victoria Bend. Deposition developed within the bendway weir field and scour developed off the end of the weirs similar to what was observed in the hydrographic surveys. The remnant historical ACM revetment hump (confirmed from prior multibeam survey) at Mile 595 observed in the hydrograph surveys was not simulated in the model, therefore the model was deeper in this area.

Between 594 and the end of the model, there was a tendency for the thalweg to develop along the RDB. This trend was not observed in the river surveys. The model was adjusted later during the “reference tests” so that the thalweg developed along the LDB similar to what was observed in the river. This trend remained throughout all other testing.

After satisfactory base test conditions were developed in the model, numerous tests were performed in an attempt to replicate the development of the large middle bar deposit that occurred after 2002. Tests included introducing additional bed load from both the Mississippi and White Rivers, adding additional roughness to the Victoria Bend Weirs, molding the bar as a standing condition out of model sediment, making slight modifications to the banks upstream above Mile 597, and combinations thereof. All of these tests were performed with the Big Island Bendway Weirs in place upstream. Results showed that no measures in the model could produce the formation of the middle bar. Even after artificially molding the middle bar in place in the model with sediment, all remnants of the bar disappeared completely after several minutes of steady state discharge. All tests showed that the middle bar eroded away and the pre 2002 bathymetric condition of the bend re-developed.

3. Reference Test

As stated previously, there is the possibility that a fair amount of the thalweg disposal from the White River construction may have helped form the middle bar in the river. Earthen clay can introduced binding qualities to the sediment. Because of the nature of the mobile bed material used in the model, it was not possible to simulate the effect of the clay disposal and its effect on the non-erodible characteristic of the middle bar. The recent hydrographic surveys of 2006 through 2009 show that the middle bar has remained in essentially the same configuration, indicating that the bar contains a fair amount of non erodible characteristics. Therefore, a non-erodible reference test was developed to attempt to simulate existing conditions..

Plate C1b defines the resultant bed configuration of the model's "reference test". A non erodible middle bar was created within Victoria Bend (outlined in green). The reference test was run and compared with the hydrographic surveys between 2004 to 2009. In particular, special attention was devoted to observing the response of the river noted in the dredge surveys of 2004 through 2008 (Plates B14 to B19). The focus of the model was to simulate the tendency for the formation of the dominant point bar along the RDB through Victoria Bend and the development of the thalweg "gut" immediately off the RDB side of the middle bar. These trends were achieved. Model distortion however caused more scour to develop at the upstream head of the middle bar than what was observed in the dredge surveys. The reference test also included the introduction of a dike placed across the entrance to the Old White River cut-off to control exaggerated scour at this side channel entrance and provide more favorable trends in the model downstream. This dike was later taken out and tested as a last alternative to study the effects in the downstream crossing (Plate D1).

4. Design Alternative Tests

The model testing alternative process consists of installing different training structures in an attempt to alter the bathymetry and velocity distribution for improvement. The first 14 alternative tests assumed a non-erodible middle bar at Victoria Bend and were directly comparable to the "reference test". All tests examined traditional river training structures with a design height of +15 feet LWRP.

Alternatives 15-34 were stand-alone tests where the non-erodible middle bar was removed. These alternatives investigated a combination of different bankline realignments and traditional river training structures through Victoria Bend. It should be realized that all of these realignments assumed that portions of the middle bar in the river would either erode away naturally over time, or would be manually removed via hydraulic dredging to the established realignment. The design of all of the alignments in the model represented a dike top elevation of +30 LWRP.

The summary of all alternatives are as follows:

Alternative 1
(Plate C2)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct L-Dike	597.2L	250 x 1000	15
Construct Dike	596.85 R	630	15
Construct Dike	596.75 L	540	15
Construct Dike	596.35 L	500	15
Construct Dike	596.1 L	540	15
Construct Dike	595.9 L	400	15

Alternative 2
(Plate C3)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct L-Dike	597.2L	250 x 1000	15
Construct Dike	596.85 R	630	15
Construct Dike	596.75 L	540	15
Construct Dike	596.35 L	500	15
Construct Dike	596.1 L	540	15
Construct Dike	595.9 L	400	15
Shorten Dike	596.0 R	-450	

Alternative 3
(Plate C4)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct L-Dike	597.2L	250 x 1,000	15
Construct Dike	596.85 R	630	15
Construct Dike	596.75 L	540	15
Construct Dike	596.35 L	500	15
Construct Dike	596.1 L	540	15
Construct Dike	595.9 L	400	15
Construct Dike	595.6L	980	15
Shorten Dike	596.0 R	-450	
Shorten Dike	595.4 R	-780	

Alternative 4
(Plate C5)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike		7,450	15
Construct Dike	595.75 L	960	15
Construct Dike	595.5 L	1,750	15
Construct Dike	595.0 L	1,500	15

Alternative 5
(Plate C6)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike		7,450	15
Construct Dike	595.9 L	515	15
Construct Dike	595.75 L	960	15
Construct Dike	595.5 L	1,750	15
Construct Dike	595.0 L	1,500	15
Shorten Dike	595.4 R	1,000	

Alternative 6
(Plate C7)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike		7,450	15
Construct Dike	595.9 L	515	15
Construct Dike	595.75 L	960	15
Construct Dike	595.5 L	1,750	15
Construct Dike	595.0 L	1,500	15
Shorten Dike	596.0 R	550	
Shorten Dike	595.4 R	1,000	

Alternative 7
(Plate C8)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike		7,450	15
Construct Dike	596.3 L	420	15
Construct Dike	596.1 L	500	15
Construct Dike	595.9 L	515	15
Construct Dike	595.75 L	960	15
Construct Dike	595.5 L	1,750	15
Construct Dike	595.0 L	1,500	15
Shorten Dike	596.0 R	550	
Shorten Dike	595.4 R	1,000	

Alternative 8
(Plate C9)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike		7,450	15
Construct Dike	596.9 L	430	15
Construct Dike	596.6 L	560	15
Construct Dike	596.3 L	420	15
Construct Dike	596.1 L	500	15
Construct Dike	595.9 L	515	15
Construct Dike	595.75 L	960	15
Construct Dike	595.5 L	1,750	15
Construct Dike	595.0 L	1,500	15
Shorten Dike	596.0 R	550	
Shorten Dike	595.4 R	1,000	

Alternative 9
(Plate C10)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	598 L	7,300	15

Alternative 10
(Plate C11)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	598 L	7,300	15
Construct Dike	595.6 L	915	15
Construct Dike	595.4 L	1,575	15
Construct Dike	595.0 L	1,350	15

Alternative 11
(Plate C12)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	598 L	7,300	15
Construct Dike	597.0 L	480	15
Construct Dike	596.6 L	500	15
Construct Dike	595.6 L	915	15
Construct Dike	595.4 L	1,575	15
Construct Dike	595.0 L	1,350	15

Alternative 12
(Plate C13)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	2,000	15
Construct Realignment Dike	595.5 L	1,500 x 2,900	15

Alternative 13
(Plate C14)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	2,000	15
Construct Realignment Dike	595.5 L	1,500 x 2,900	15
Shorten Dike	595.4 R	1,150	

Alternative 14
(Plate C15)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	2,000	15
Construct Realignment Dike	595.5 L	1,500 x 2,900	15
Shorten Dike	596.0 L	980	
Shorten Dike	595.4 R	1,150	

Alternative 15
(Plate C16)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	8,500	30

Alternative 16
(Plate C17)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	8,500	30
Shorten Dike	595.4 R	990	

Alternative 17
(Plate C18)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	11,200	30
Shorten Dike	595.4 R	990	

Alternative 18
(Plate C19)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	8,600	30
Shorten Dike	595.4 R	1,100	

Alternative 19
(Plate C20)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	596 L	8,600	30
Construct Dike	597.0 L	510	15
Construct Dike	596.8 L	560	15
Construct Dike	596.4 L	550	15
Shorten Dike	596.0 R	1,150	
Shorten Dike	595.4 R	1,100	

Alternative 20
(Plate C21)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	7,780	30

Alternative 21
(Plate C22)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	7,800	30

Alternative 22
(Plate C23)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	7,800	30
Extend Existing Weir	595.3 L	230	-25
Extend Existing Weir	595.2 L	340	-25
Extend Existing Weir	595.1 L	440	-25
Extend Existing Weir	594.8 L	280	-25

Alternative 23
(Plate C24)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	7,800	30
Construct Dike	597.1 L	500	15
Construct Dike	596.8 L	530	15
Construct Dike	596.4 L	560	15
Construct Dike	596.2 L	700	15
Construct Dike	595.9 L	800	15
Construct Dike	595.7 L	1,350	15
Construct Dike	595.5 L	1,600	15
Construct L-Dike	595.2 L	1,600 + 2,250	15
Construct Dike	594.9 L	800	15

Alternative 24
(Plate C25)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	8,100	30

Alternative 25
(Plate C26)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	8,200	30
Construct Weir	595.2 L	870	-25
Construct Weir	595.1 L	880	-25
Construct Weir	594.8 L	700	-25

Alternative 26
(Plate C27)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	8,200	30
Construct Dike	597 L	430	15
Construct Dike	596.8 L	530	15
Construct Dike	596.6 L	580	15
Construct Dike	596.4 L	580	15
Construct Dike	596.1 L	500	15
Construct Dike	595.9 L	430	15
Construct Dike	595.6 L	930	15
Construct Dike	595.25 L	920	15
Construct Dike	595 L	1,240	15
Construct Weir	595.3 L	600	-25
Construct Weir	595.2 L	870	-25
Construct Weir	595.1 L	880	-25
Construct Weir	594.8 L	700	-25
Shorten Dike	596.0 R	1,000	
Shorten Dike	594.4 R	1,100	

Alternative 27
(Plate C28)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	8,200	30
Construct Dike	597 L	430	15
Construct Dike	596.8 L	530	15
Construct Dike	596.6 L	580	15
Construct Dike	596.4 L	580	15
Construct Dike	596.1 L	500	15
Construct Dike	595.9 L	430	15
Construct Dike	595.6 L	930	15
Construct Dike	595.25 L	920	15
Construct Dike	595 L	1,100	15
Construct Realignment Dike	596 L	7,700	15

Alternative 28
(Plate C29)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	5,200	30

Alternative 29
(Plate C30)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	5,200	30
Construct Weir	595.3 L	570	-25
Construct Weir	595.2 L	940	-25
Construct Weir	595.1 L	930	-25
Construct Weir	594.8 L	530	-25

Alternative 30
(Plate C31)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	5,200	30
Construct L-Dike	595.7 L	2,220	15
Construct Dike	595.9 L	860	15
Construct Dike	595.5 L	1,050	15
Construct Dike	595.3 L	1,000	15
Construct Dike	595 L	950	15

Alternative 31
(Plate C32)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	10,100	30

Alternative 32
(Plate C33)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	10,100	30
Construct Weir	595.6 L	930	-25
Construct Weir	595.4 L	1,400	-25
Construct Weir	595.2 L	1,030	-25
Construct Weir	595 L	1,000	-25

Alternative 33
(Plate C34)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	10,500	30

Alternative 34
(Plate C35)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Construct Realignment Dike	595.5 L	17,000	30

Old White River Cutoff
Dike Removed
(Plate D1)

Structure Modifications	Location (River Mile)	Dimensions (Feet)	LWRP (Feet)
Deconstruct Dike	597.9R	2500 removed	30

CONCLUSIONS

1. Evaluation and Summary of the Model Tests

Criteria used to evaluate the design alternative tests included navigation channel alignment and bathymetry. All tests were qualitative in nature considering the limitations of the model and the unknowns in the actual river.

The addition of dikes upstream of Victoria Bend along the LDB (Alternatives 1, 2, and 3) increased depths above the bend but did not improve alignment or eliminate the point bar formation downstream at Mile 595. Any of these alternatives may be considered as good measures to consider in the future because recent trends (2008 & 2009) showed shoaling (0 to -10 LWRP) in the middle of the channel between RM 597 and Victoria Bend.

Alternatives 4 through 14, the addition of a combination of low elevation realignment dikes (+15 LWRP) and tie-in dikes across the assumed non-erodible bar within Victoria Bend showed some improvement on depth and width of the adjacent navigation channel. However, the channel alignment showed no improvement because of the development of a point bar formation an extremely abrupt alignment at Mile 594.8.

Alternatives 15 through 19 contained relatively straight bankline realignments (+30 LWRP). All of these alternatives did not eliminate the point bar formation and resulting severe alignment observed at Mile 594.8.

Alternatives 20, 21, 22, 24, 25, 32, 33, 34, and 35 showed that more curved bankline alignments (+30 LWRP) produced smoother navigation channel alignments through Victoria Bend.

The last alternative (Plate D1) showed that the navigation channel shoaled in the crossing without this structure in place in the model. The addition of some type of closure at the Old White River Cutoff may improve navigation depth in the crossing between Mile 597 and 596.

2. Recommendations

The most promising results of all the alternative tests were measures utilizing curved bankline realignments at +30 LWRP through Victoria Bend. It should be noted that these solutions developed in the model with no non-erodible middle bar present. To construct these measures in the actual river and reduce costs, hydraulic construction dredging should be considered. This would remove portions of the existing middle bar that are non-erodible and provide fill for any of the preferred bankline realignments, thus saving on the cost of rock construction.

A closure structure at the mouth of the White River cutoff is recommended to address shoaling conditions experienced in the crossing upstream of Victoria Bend. Upstream dikes along the LDB are recommended if closure structure construction is not possible.

3. Interpretation of Model Test Results

In the interpretation and evaluation of the results of the tests conducted, it should be remembered that the results of these model tests were qualitative in nature. Any hydraulic model, whether physical or numerical, is subject to biases introduced as a result of the inherent complexities that exist in the prototype (river). Anomalies in actual hydrographic events, such as prolonged periods of high or low flows are not reflected in these results, nor are complex physical phenomena, such as the existence of underlying rock formations or other non-erodible variables. Flood flows were not simulated in this study.

This model study was intended to serve as a tool for the river engineer to guide in assessing the general trends that could be expected to occur in the actual river from a variety of imposed design alternatives. Measures for the final design may be modified based upon engineering knowledge and experience, real estate and construction considerations, economic and environmental impacts, or any other special requirements.

FOR MORE INFORMATION

For more information about Hydraulic Sediment Response modeling or the Applied River Engineering Center, please contact Robert Davinroy or Peter Russell at:

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APPENDIX OF PLATES

C1b Reference Test
C2 Alternative 1
C3 Alternative 2
C4 Alternative 3
C5 Alternative 4
C6 Alternative 5
C7 Alternative 6
C8 Alternative 7
C9 Alternative 8
C10 Alternative 9
C11 Alternative 10
C12 Alternative 11
C13 Alternative 12
C14 Alternative 13
C15 Alternative 14
C16 Alternative 15
C17 Alternative 16
C18 Alternative 17
C19 Alternative 18
C20 Alternative 19
C21 Alternative 20
C22 Alternative 21
C23 Alternative 22
C24 Alternative 23
C25 Alternative 24
C26 Alternative 25
C27 Alternative 26
C28 Alternative 27
C29 Alternative 28

C30 Alternative 29

C31 Alternative 30

C32 Alternative 31

C33 Alternative 32

C34 Alternative 33

C35 Alternative 34

D1 Old White River Cutoff Dike Removed