



DEPARTMENT OF THE ARMY  
ST. LOUIS DISTRICT CORPS OF ENGINEERS  
1222 SPRUCE STREET  
ST. LOUIS, MISSOURI 63103-2833

REPLY TO  
ATTENTION OF

OCT 23 2014

CEMVS-EC-H

MEMORANDUM FOR Commander, Mississippi Valley Division (CEMVD-RB-W/  
Mr. Chuck Shadie), 1400 Walnut Street, Vicksburg, MS 39181

SUBJECT: 2014 Revision of the Low Water Reference Plane (LWRP) for the Middle  
Mississippi River

1. A review of the LWRP was conducted. This effort is summarized in the following paragraphs.
2. The procedure for recalculating LWRP was principally laid out in a memo from R.H. Resta, Chief, Engineering Division, Lower Mississippi Valley Division (LMVED-WH), dated 21 March 1975, with the subject "1974 Low Water Reference Plane". The procedure is written in the memo as follows:
  - a. Determine the 97 percent duration discharge at each gaging station on the Mississippi River, where data are available, for the period 1954 through 1973.
  - b. From discharge rating curves for each gaging station, determine the stage corresponding to this discharge for each year during the 10-year period 1964 through 1973.
  - c. Average the stages obtained for each gaging station to establish the 1974 LWRP at the gage.
  - d. Use the 1974 LWRP stage at each gaging station and the latest low water profile to shape the LWRP profile between gaging stations. Adjacent Districts should coordinate the LWRP at District boundaries.
3. The above procedure was followed as interpreted for the below re-calculation with one deviation; whereas the lower districts have based their revised LWRP's on a 97% exceedance discharge based on a period beginning in 1954 to present, the St. Louis District Hydrologic & Hydraulics Branch has used 1967 to present. The different period chosen was selected as encompassing the time that the entire

CEMVS-EC-H

SUBJECT: 2014 Revision of the Low Water Reference Plane (LWRP) for the Middle Mississippi River

Missouri River reservoir system was completed and in full operation. The following is a description of the procedure used:

a. Flow: Field measurement discharges from the period 1 January 1967 to 31 December 2013 were used to determine the 97% exceedance discharge at each of the rated gaging stations (St. Louis, Chester, and Thebes) in the St. Louis District. The 97% exceedance discharges are shown below:

St. Louis	66,800 cfs
Chester	69,450 cfs
Thebes	74,590 cfs

b. Stage: These 97% exceedance discharges were used to determine a stage for each year for the period 2004 to 2013 at each station. This was done by first developing rating curves for each of the ten years at each station using the field measurement discharges and historic daily stages. These curves were developed instead of using pre-existing curves because historical curves have not previously been archived for the full ten year period; these curves will be archived going forward for use in the next LWRP update. The stage for the 97% discharge was then determined for each of the ten years at each station. This required extrapolation or interpolation, which was done by fitting a trendline based on the relationship between stage and discharge. Extrapolation was necessary as the stage corresponding to the 97% exceedance discharge was not commonly reached in the given ten year period. Once the stages for each year for a specific gage were calculated, they were averaged. The resulting stages for each year and the average stages at each station are indicated below:

Year	St. Louis @ 66,800 cfs	Chester @ 69,450 cfs	Thebes @ 74,590 cfs
2004	-2.2	-0.3	6.5
2005	-2.7	-0.2	4.8
2006	-2.9	-0.3	4.8
2007	-2.7	-0.5	4.8
2008	-4.3	-1.4	4.5
2009	-3.5	-0.5	4.9
2010	-4.6	-0.6	2.9
2011	-2.8	-0.6	4.9
2012	-2.7	0.1	5.1
2013	-3.1	0.4	6.1
Averages	-3.2	-0.4	4.9

CEMVS-EC-H

SUBJECT: 2014 Revision of the Low Water Reference Plane (LWRP) for the Middle Mississippi River

c. Profile Development: The average stage for the 97% exceedance discharge at each of the gaging stations were plotted along with the low water profile collected from 10 September 2012 to 14 September 2012 and the low water profile generated from the bankline of the low water LIDAR collected 5, 12, 13, 15, and 23 December 2012. From the observed profile and the LIDAR, a third profile combining the elements of the two, adjusting to minimize the difference from the control points, and with other corrections (a flat slope coming out of the lower end of the Chain of Rocks Canal and a slope change to match the MVM 2007 LWRP) was generated as the proposed 2014 LWRP.

4. A comparison was made between the 1956-1957 LWRP and the proposed 2014 LWRP.

	River Mile	Published 1956-1957 LWRP	Proposed 2014 LWRP	Change from Published to Proposed
Mel Price TW	200.5	0.8	0.8	0.0
Locks 27 Upper	185.3	396.0	396.0	0.0
Locks 27 Lower	185.1	379.5	376.7	-2.8
St. Louis	180.0		-3.2	0.3
St. Louis	179.6	-3.5		0.3
Engineers Depot	176.8	-3.9	-4.0	-0.1
Jefferson Barracks	168.7			
		-4.9	-7.7	-2.8
Brickeys	136	-1.6	-3.6	-2.0
Little Rock Landing	125.5			
		135.4	135.5	0.1
Chester	109.9	-0.7	-0.4	0.3
Red Rock Landing	94.1			
		1.8	2.1	0.3
Grand Tower	81.9	3.4	3.8	0.4
Moccasin Springs	66.3	3.9	3.7	-0.2
Cape Girardeau	52.1	5.3	5.4	0.1
Grays Point	46.3	5.1	5.1	0.0
Thebes	43.7	4.8	4.9	0.1
Commerce	39.5	0.3	-0.3	-0.6
Price Landing	28.2	-6.7	-5.0	1.7
Thompson Landing	20.2			
		9.0	9.9	0.9
Bird's Point	2.0	3.4	5.5	2.1

CEMVS-EC-H

SUBJECT: 2014 Revision of the Low Water Reference Plane (LWRP) for the Middle Mississippi River

The largest differences (more than  $\pm 1$  foot) between the 1956-57 LWRP and the 2014 LWRP are near the following locations:

a. Locks 27 Tailwater (-2.8 feet): The decision was made to flatten the LWRP upstream from the St. Louis gage. This decision was based upon actual observed gage data that show instances where the slope between these gage approaches 0 feet during certain unexplained events. This typically occurs simultaneously as vessels begin bumping the river bottom and dredging is required near the entrance to Locks 27 at Mile 183. There are ongoing studies that will be used to analyze this situation.

b. Jefferson Barracks (-2.8 feet) and Brickeys (-2.0 feet): Inconsistencies near these gages were observed during the 2012 low water event as compared to gages upstream and downstream. The water surface reached 0 LWRP at these gages well before 0 LWRP was reached at St. Louis and Chester. This adjustment corrects those inconsistencies and better represents the measured profile.

c. Prices Landing (+1.7 feet): The 1956-57 LWRP contained an unusual dip near this gage that was not supported by the 2012 low water profile. The 2014 LWRP was raised at this location to remove this dip and provide a more realistic water surface.

d. Birds Point (+2.1): The LWRP was raised at the lower end of the Middle Mississippi River in order to tie into the Memphis District's 2007 LWRP at the confluence.

5. The 1956-1957 LWRP, the 2012 low water profile, and the proposed 2014 LWRP are shown in the enclosure.

6. The 2014 LWRP elevations and stages will be published in both NGVD 29 and NAVD 88 vertical datums.

7. The proposed 2014 LWRP was presented to the St. Louis District's Chief, Engineering and Construction Division; Chief, Operations Division; the District's Dredging Project Manager, and the Chief, Water Control Operations on 8 August 2014 for their concurrence.

CEMVS-EC-H

SUBJECT: 2014 Revision of the Low Water Reference Plane (LWRP) for the Middle Mississippi River

8. It is recommended that the proposed 2014 LWRP as shown on the enclosure be adopted throughout the St. Louis District.

FOR THE COMMANDER:

Encl



DAVID BUSSE, P.E.  
Chief, Engineering and  
Construction Division

Cc:

Operations Division:

Lou Dell Orco(CEMVS-OD)

Dennis Fenske(CEMVS-OD-X)

Lance Engle (CEMVS-OD-D)









