



Impacts of Yazoo Backwater Pump to Downstream Stages **22 November 2019**

Summary

During a high water event on the main stem Mississippi River (MS River), water being impounded in the lower Yazoo River will cause elevated stages to occur on the riverside of Steele Bayou Control Structure. This condition will typically cause the closure of the Steele Bayou Structure to prevent flooding in the South Delta. With the Yazoo Backwater Pump project completed and stages above 87 feet on the protected side of the levee, the pumps will be operated to minimize the effect of interior rainfall ponding. The maximum flow from the proposed pump station is 14,000 cfs which will flow into the Yazoo River from Steele Bayou near river mile 10 on the Yazoo River. To show the effects of the Yazoo Backwater Pump project, the calibrated hydraulic model (HEC-RAS), developed as part of the MR&T flowline assessment, was used and the 2019 high water event run to complete this assessment. During this simulation flows on the Mississippi River at Vicksburg were around 1.84 million cfs, with maximum pumping capacity at 14,000 cfs. Below is a summary of the impact of the additional flow from the pump at various locations downstream of the pump location.

Steele Bayou Riverside

The Steele Bayou Riverside is more specifically the outflow channel from the pump station on the Mississippi River side of the Yazoo Backwater Levee. High stages on the MS River cause flow to back up the Yazoo River. During these conditions, the area on the riverside of Steele Bayou will be significantly inundated. It is during these high stage conditions that this area becomes more representative of a lake than a tributary. This is illustrated by the two different inundations on the map in Figure 2. The green inundation shows low stages on the Mississippi River and thus all water continuing downstream in the main channel and any water on the Yazoo River still within channel banks. The blue inundation shows the previously discussed higher stages along the Mississippi River where water is backing up the Yazoo River from the Mississippi River and filling in all the low lying overbank areas along the Yazoo River thus making this area very representative of a lake. The red inundation is rainfall runoff impounded by the Yazoo Backwater Levee.

Due to this large volume of water present during high Mississippi River stages, the effects from the outflow of a 14,000 cfs pump are minor. When the pumps become operational at an interior elevation of 87 ft, the full pump capacity isn't necessary. The full 14,000 cfs pump capacity won't become necessary until stages are such that interior levels warrant full use of the pump capacity. With the small amount of water introduced into the system from the pumps, when compared to the water in the Mississippi River, the analysis of March 2019 shows a 0.3 feet difference in elevation at this location when comparing model runs with and without the pumps in place. The maximum riverside stage at the Steele Bayou Structure in March 2019 was 100.0' without the pumps but would have been 100.3' with the pumps. Model tolerance for the MR&T flowline assessment HEC-RAS model is approximately plus or minus 0.5 ft. The graphic in the top left hand side of the accompanied map show this 0.3 feet modeled difference for the 2019 flood event.

Mouth of Yazoo River

At higher flows (>1.2 million cfs) along the Mississippi River, water is pushed upstream into the Yazoo River. Some of this water from the Mississippi River enters storage along the southern end of the Yazoo River. The remainder of this water is circulated up the Yazoo River flowing around the Kings Point/Chickasaw area and then enters back into the Mississippi River downstream closer to the Vicksburg gage. Figure 1 below is a graphic of model results showing velocity vectors or directions but what this really helps illustrate is the flow pattern described above where some of the water continues up the Yazoo and the remainder circles around in the lower Yazoo and enters back into the Mississippi River.

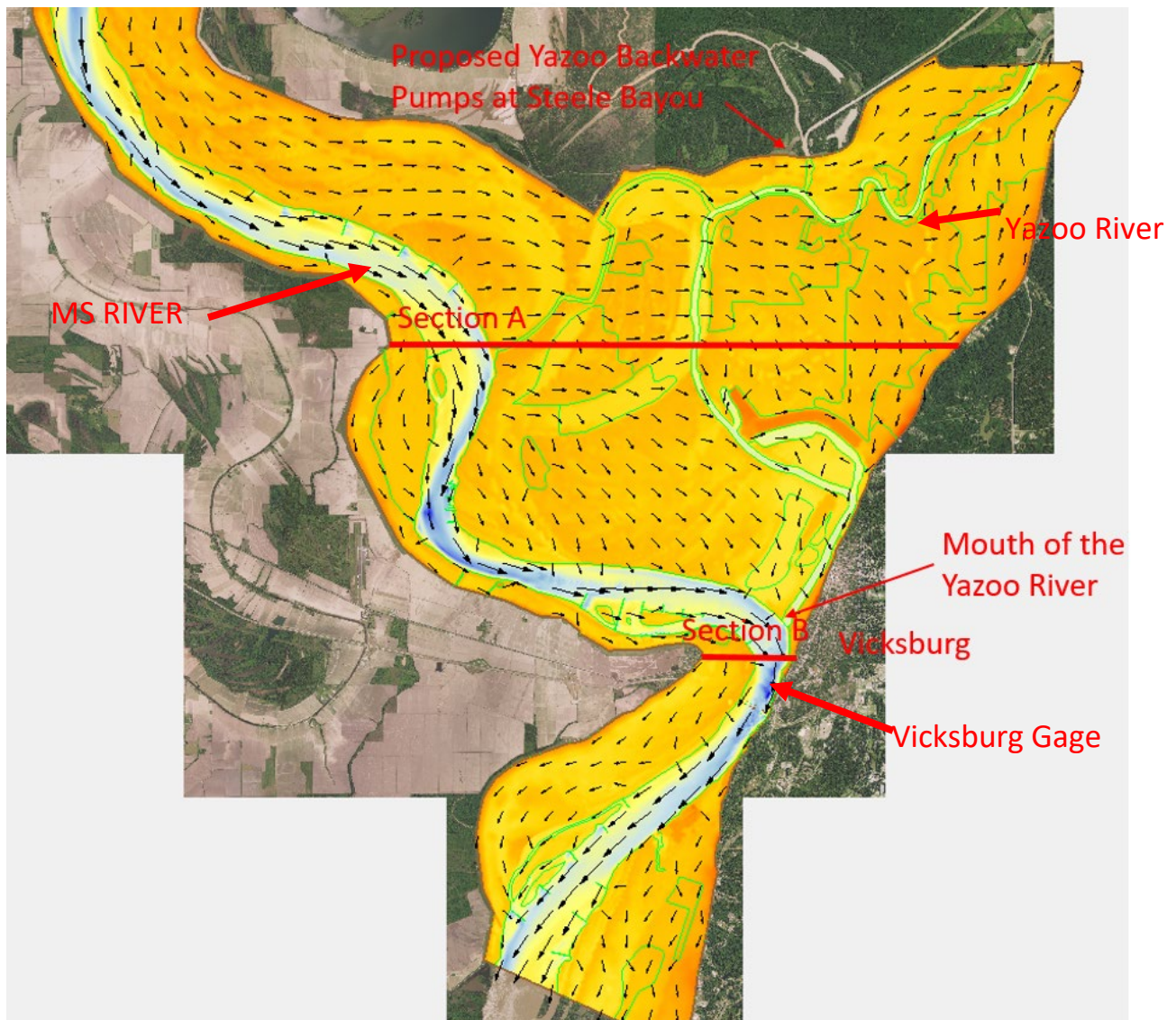


Figure 1: ERDC ADH Model of Flood

Table 1 below shows the hydraulic model output for the 2019 flood event and what would have occurred had the pumps been in place compared to current conditions. This table shows the flow and stage each day for the month of March. The take away here is that even though the pumps would be maximized and pumping 14,000 cfs from the Yazoo Backwater to the Mississippi River, the model does not show an increase of that 14,000 cfs from the pumps.

Instead the model only shows an increase of about 2,000 to 3,000 cfs. This is due to the conditions described in the paragraph above where some of the water goes upstream in the Yazoo River and some of the water circulates around in the lower Yazoo River area thus taking longer to enter back into the Mississippi River. Because of such a small increase in flow coming to the Mouth of Yazoo, there is very little increase in stage when comparing the pump and without pump model runs. The graphic in the bottom left hand side of Figure 2 shows this 0.2 feet modeled difference in elevation for the 2019 flood event.

Mouth of Yazoo				
Date	No Pump (cfs)	Pump (cfs)	No Pump (El.)	Pump (El.)
2/28/2019	107,323	109,476	94.4	94.6
3/1/2019	110,941	113,051	94.9	95.1
3/2/2019	114,179	116,443	95.4	95.6
3/3/2019	117,557	119,953	95.8	96.0
3/4/2019	120,837	123,429	96.2	96.4
3/5/2019	124,099	126,762	96.6 ~ 0.2 ft	96.8
3/6/2019	127,112	129,732	97.0	97.1
3/7/2019	129,717	132,333	97.3	97.4
3/8/2019	131,979	134,596	97.5	97.7
3/9/2019	133,851	136,428	97.7	97.9
3/10/2019	135,179	137,667	97.8	98.0
3/11/2019	135,997	138,462	97.9	98.1
3/12/2019	136,574	139,043	98.0	98.2
3/13/2019	137,069	139,534	98.0	98.2
3/14/2019	137,205	139,667	98.0	98.2
3/15/2019	137,207	139,670	98.0	98.2
3/16/2019	137,139	139,606	98.0	98.2
3/17/2019	137,018	139,490	98.0	98.2
3/18/2019	136,814	139,294	98.0	98.2
3/19/2019	136,555	139,039	98.0	98.1
3/20/2019	136,221	138,703	97.9	98.1
3/21/2019	135,794	138,273	97.9	98.0
3/22/2019	135,264	137,740	97.8	98.0
3/23/2019	134,678	137,153	97.7	97.9
3/24/2019	133,987	136,468	97.7	97.8
3/25/2019	133,227	135,718	97.6	97.7
3/26/2019	132,384	134,902	97.5	97.6
3/27/2019	131,389	133,924	97.3	97.5
3/28/2019	130,180	132,716	97.2	97.4
3/29/2019	128,682	131,205	97.0	97.2
3/30/2019	126,797	129,345	96.8	97.0

Table 1: RAS Model Results for 2019 Flood Near Mouth of Yazoo River

MS River at Vicksburg (Vicksburg Gage)

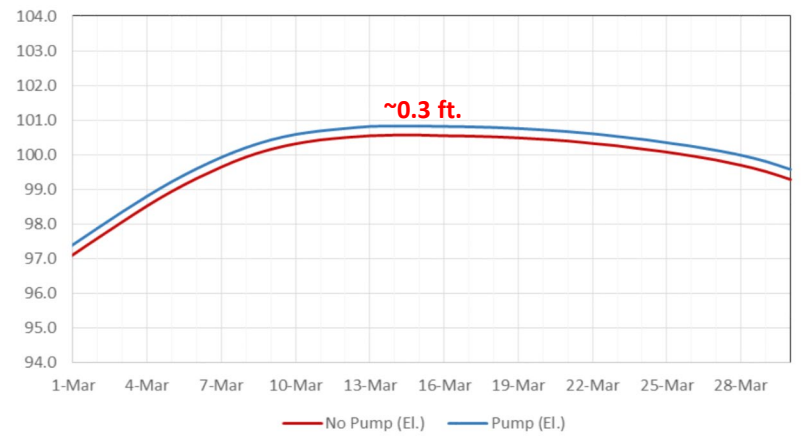
During these higher flows on the Mississippi River, there are minimal impacts at the Vicksburg gage. Section A on Figure 1 shows the width of the river around the Mouth of the Yazoo while Section B shows the river width downstream of the confluence where all the water is back in the Mississippi River channel. The Vicksburg gage is south of Section B as shown in Figure 1 on the previous page, the width of the river during high flows is very wide at the Mouth of the Yazoo (section A on Figure 1). The river reduces back to normal width downstream of the confluence with the Yazoo (section B on Figure 1). The Vicksburg gage is located south of the confluence with the Yazoo River so the same minimal impacts observed along the Yazoo River are seen on the Mississippi. The 0.2 foot increase in water surface with the pumps is illustrated in the graph on the right hand side of the accompanied map.

Model results at all three locations that were studied showed very little increase in water surface elevation. This document detailed how the volume of water coming down the Mississippi River compared to the small volume of water coming from the pumps, some of the water from the pumps going into storage, and the timing of how some of the water circulates around the Mouth of the Yazoo area are all key factors in the small net increase in water surface elevations.

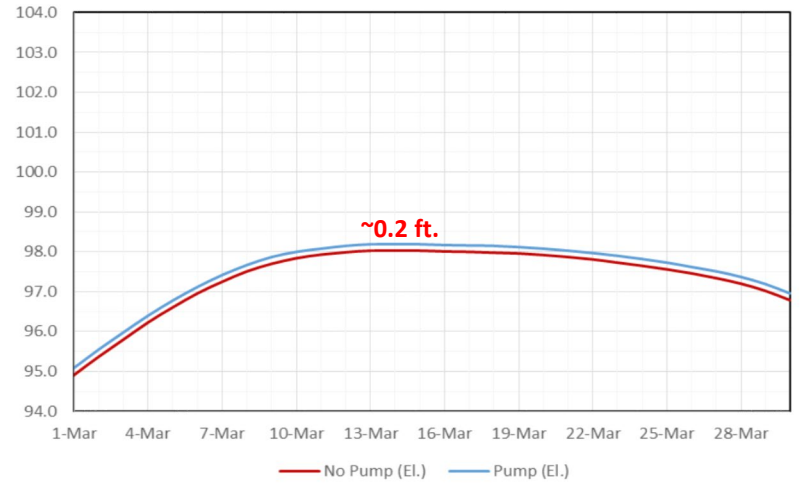


FIGURE 2

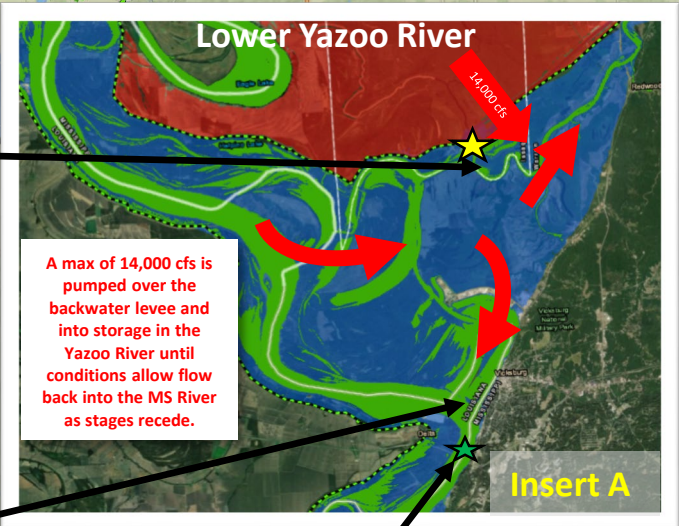
Steele Bayou RS



Mouth of Yazoo River



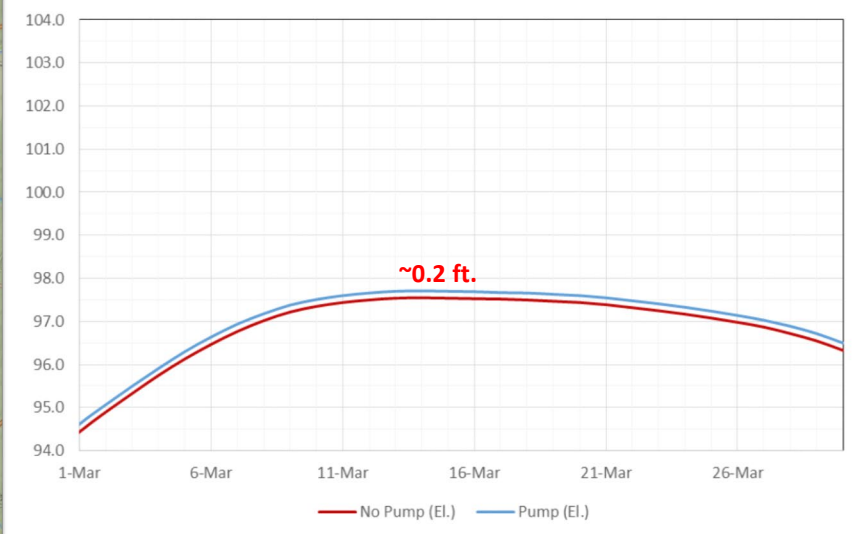
Lower Yazoo River



MS River at Vicksburg 1,840,000 cfs

MS River at Greenville 1,870,000 cfs

Vicksburg Gage



Insert A

Vicksburg

Vicksburg Gage

Analysis completed by Hydraulics Branch, Vicksburg District, utilizing hydrologic and hydraulic (HEC-RAS) models from calibrated Corps Water Management System (CWMS) models for the Mississippi River and Yazoo River basins.

