

Effectiveness of the Phosphorus Restrictions from Phase I of the James River

TMDL

Phase I of the James River TMDL lead to a rule related to phosphorus discharges into the James River and its tributaries. Table 6 shows the allowed concentrations of wastewater municipal discharges before and after the rule. We evaluated this rule's impact by running the model three times for a 30 year period of generated weather for various sets of releases from the WWTP in the James River Basin, everything else being the same:

1. baseline conditions (pre 2000)
2. interim conditions (2004)
3. final conditions (2007)

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The impact was quantified by comparing the average annual load of phosphorus at the outlet of each tributary of the James River: the upper James River, Wilson Creek, Finley River, and Flat Creek (Table 1). The impact is the most sensitive at the outlet of Wilson Creek; for other tributaries, the impact of phosphorus removal on the average annual phosphorus stream load is minimal even though the phosphorus released from the waste water treatment plants has been reduced by 90%. The reason is that most of the phosphorus loading in these tributaries comes from surface runoff, non point sources.

Table 1. Average annual total phosphorus stream loads for different stages of wastewater treatment from the plants in the James River Basin, everything else being the same.

Reach	Relevant WWTP	Pre 2000	2004	2007
Average annual Total P loads (kg)				
Wilson Creek	Springfield	425600	85810	85810
Upper James	Rogerville, Freemont Hills, English Village	88410	81580	81530
Finley River	Nixa, Ozark, Seymour, MDOC, Fordland, Sparta	78740	70360	69830
Crane Creek	Crane, Clever	57170	56450	56350
Flat Creek	Cassville, Exeter/Washburn	144290	141460	140240
James outlet ¹	All	778400	489200	487100
Change in average annual Total P load relative to pre-2000 conditions				
Wilson Creek	Springfield		-80%	-80%
Upper James	Rogerville, Freemont Hills, English Village		-8%	-8%
Finley River	Nixa, Ozark, Seymour, MDOC, Fordland, Sparta		-11%	-11%
Crane Creek	Crane, Clever		-1%	-1%
Flat Creek	Cassville, Exeter/Washburn		-2%	-3%
James outlet ¹	All		-37%	-37%

¹ The results at the outlet of the watershed should be taken carefully since the model's results are questionable in the main stem of the James River.

These relative changes may seem smaller than what has been measured since 1999 in the James River Basin and in Table Rock Lake, which indicate higher reductions of phosphorus

concentrations and loadings. However, phosphorus loadings estimated from measurements reflect the management in the watershed and the weather during these years. The southwest region of Missouri has experienced a drought since 2000 which causes a reduction of all pollutants loadings other than direct discharges to the streams. Figure 1 describes how annual precipitation varies across the James River Basin since 1971. While there is no long term trend, there is a shorter term cycle in the precipitation. Hence, the 2000-2005 precipitation was almost 15% or 7 inches (200 mm) less than the 1993-1998 precipitation. As often the case, relative changes in precipitation translate in greater relative changes in runoff, and sediment and pollutant loadings. In fact, if we use measured weather instead of generated weather, the changes in phosphorus loadings are more important (Table 2).

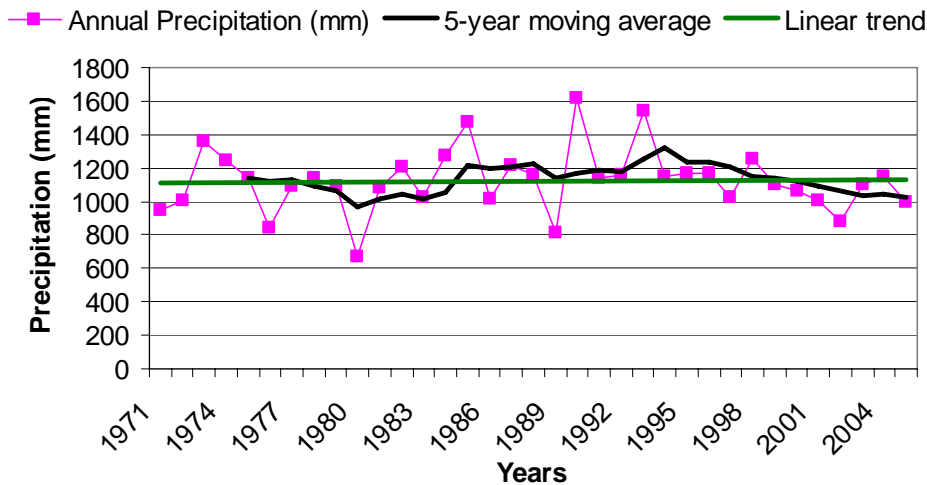


Figure 1. Annual precipitation in the James River Basin from 1971 to 2005.

Table 2. Predicted change of total phosphorus stream loads in 2000-2005 relative to 1993-1998, assuming 2007 rule requirements were implemented in 2000.

Reach	Relevant WWTP	Av. annual load (kg)		Relative change
		1993-1998	2000-2005	
Wilson Creek	Springfield	439250	80397	-82%
Upper James	Rogerville, Freemont Hills, English Village	96997	68135	-30%
Finley River	Nixa, Ozark, Seymour, MDOC, Fordland, Sparta	87137	55860	-36%
Crane Creek	Crane, Clever	63057	40980	-35%
Flat Creek	Cassville, Exeter/Washburn	195662	153477	-22%
James outlet ¹	All	873367	443300	-49%

¹ The results at the outlet of the watershed should be taken carefully since the model's results are questionable in the main stem of the James River.

In other words, the drought that has occurred during the recent years has accentuated what appears to be the result of the phosphorus removal of treated effluent. A key implication is that, should it start raining again in more “normal” amounts, we expect the phosphorus concentrations and loadings in the James River and to Table Rock Lake to increase. However, we do not expect them to reach the pre-2000 levels.