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CHALLENGING MINDS, CHANGING LIVES

Commentary

Complying the EPA Regulation of Wastewater Treatment Utilizing Ecosystem Services of Natural Wetlands as a Component of Wastewater Treatment System in Economically Depressed Communities in Mississippi

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A Description of Wastewater Treatment Regulation Compliance in Mississippi

Poorly treated wastewaters have been causing environmental damages in the ambient environment, and challenging human health in society (Day et al, 2004; Kim and Aga, 2007; Schaub and Oshiro, 2000). Every point-source polluter in the US, including the State of Mississippi, should have its own NPDES (National Pollutant Discharge Elimination System) permit, and monitored by its State Agencies (For example, Mississippi Dept. of Environmental Quality). State of Mississippi has been recording higher levels of NPDES permit violations than national average and neighboring states in complying with the water pollution regulation by the Clean Water Act, mainly due to dilapidated community water treatment system in poor communities across the State (Table 1). For example, the EPA found multiple permit violations in the municipal wastewater treatment facilities in the City of Jackson in 2014. The violations included discharge without permit, sewer overflows, violations of reporting requirements, and others. Additionally, partially treated wastewater at the facilities flowed into the Pearl River. The City of Jackson was asked to establish a consent decree with the EPA in improving the city's wastewater infrastructure (Pullen, 2014).

If permit violations are reported, the problems should be fixed. However, the economically depressed communities in the State have not complied with the regulations effectively, causing harms to the human health, and the aquatic ecosystems including freshwater fishes (e.g., catfish, which is a favorite food to local people), due to difficulties in securing funds for upgrading wastewater treatment system in their communities (Locke, 2004, New York Times 2009). We argue that utilizing natural wetlands would be an alternative to increasing the compliance rate, while reducing financial burden for the State of Mississippi.

Table 1. NPDES violations (per 100 facilities) in the Four Southern States in 2009

State	Violations
Alabama	41.8
Georgia	6.7
Louisiana	23.3
Mississippi	53.9

(Source: New York Times. 2009. Clean Water Act Violations: The enforcement record)

An Alternative: Wetland Assimilation

Wetland assimilation provides the same services as conventional methods in improving wastewater quality, while having positive impacts on wetlands. Suspended solids and nutrients in wastewater increase net primary productivity, which leads to increased organic soil formation. Turbid wastewater becomes cleaner in passing through the wetlands, due to physical settling of suspended solids in wastewater. Nitrogen compounds and Phosphorus compounds dissolved in municipal wastewaters can be buried in the sediments of impacted wetlands or assimilated and stored by plants, causing fertilizer effects, which increase net primary productivity – the net flux of carbon from the atmosphere into green plants per unit time – of impacted green plants inside wetlands. Nitrogen has additional path of transforming nitrogen compounds into N_2 gas (denitrification process). Thus natural wetlands contribute to improving wastewater quality to meet the EPA water permit regulations (Day et al., 2004).

Due to the benefits of improving wastewater quality with lower financial costs than conventional civil engineering methods (for example, sand filtration method), the EPA has been recommending the wetland methods as an alternative to costly advanced treatment engineering methods, following the Clean Water Act, in which the wetlands method is allowed to be a best practical control technology currently available (BPT) (Ko et al., 2012). When reviewing the water permit applications, the EPA considers costs and benefits associated with the proposed technologies in determining the BPT.

Further, the EPA regional officers review the following items when reviewing the wastewater treatment applications/plans:

(1) All identified pollutants that may be present within a wastewater stream to be impacted;
(2) Mean and maximum quantities of wastewater to be discharge, with its frequencies and volumes of discharge;
(3) State-level regulations, facility size, and location and type of discharge;
(4) Assessment of additional treatment requirements after secondarily treatment;
(5) Report of ecological baseline study- an environmental impact statement – for the proposed engineering projects.

The State of Louisiana is one of the states in the US which utilize the positive functions of wetlands as a component of municipal wastewater system (Ko et al., 2012). The EPA has delegated its NPDES program to the State of Louisiana. Table 2 shows a list of communities which have been adopting the natural wetlands as a component of their municipal wastewater systems.

Table 2. Municipalities using natural wetlands assimilation in Louisiana

Municipality	Parish	Design capacity (MGD*)
Amelia	St. Mary	0.90
Mandeville	St. Tammany	0.60
Broussard	Lafayette	0.75
Luling	St. Charles	3.20
Thibodaux	Lafourche	4.00
Breaux Bridge	St. Martin	1.27
Mandeville	St. Tammany	4.00
Riverbend Oxidation Pond	St. Bernard	0.47
City of St. Martinville	St. Martin	1.50
Tchefuncta Club Estates	St. Tammany	0.16

*million-gallon-per-day.
(Source: Ko et al., 2012)

Free natural energies such as sunlight control the assimilation function of wetlands, contrary to electricity and oil dependent conventional methods, resulting in significant financial and energy savings. Ko et al. (2004) reported that the City of Breaux Bridge would save $2.6 million over the 20-year lifetime by adopting the wetlands treatment project. The economic savings would be significant for the small city with about 8,000 residents. They have been complying with the EPA NPDES regulations without significant expenditures which would be required, if a conventional civil engineering method (for example, sand filtration) were adopted.

Based on the case studies of wetlands assimilation projects in Louisiana, applicability of wetlands assimilation and associated economic benefits in the State of Mississippi should be explored. When considering the high level of NPDES violations and economically challenging local economies across the State, wetland assimilation, which does not require significant capital cost and annual operation and maintenance cost, can be an important factor in complying with the environmental regulations.

As of 2008, 1,437 NPDES permits were issued for the wastewater treatment plants in State of Mississippi, with 53.9% violation rate, requiring more concentrated efforts of improving wastewater quality in the State. Utilizing natural wetlands as a component of wastewater treatment system has been providing multiple benefits to the natural environment and economic savings to local communities: water quality improvement, increased vegetation productivity, surface accretion, and carbon sequestration (Day et al, 2004). Wetland assimilation is way of adopting natural services for sustainable human communities with reduced financial costs, while improving environmental quality of natural ecosystem surrounding human communities.

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