Recommended Policy:
Treated Municipal Wastewater Assimilation in Natural
Wetlands in Coastal Louisiana

T. K. Henkel, Ph.D. Wetland Ecologist
J. A. Lopez, Ph.D. Coastal Scientist
B. K. Skaggs, Ph.D. Water Quality Scientist

Background
The Lake Pontchartrain Basin Foundation (LPBF) has been active in the Lake Pontchartrain region and southern Louisiana, improving the water quality and restoring and protecting the coastal habitats since its inception in the late 1980s. LPBF has a history of success in improving water quality of the Pontchartrain Basin, having effectively worked to remove water bodies from the impaired water bodies list, including Lake Pontchartrain itself. LPBF remains dedicated to further improving the water quality and vigilant to new sources of impairments. LPBF also has a storied history of developing, maintaining, and enhancing partnerships to accomplish common water quality and wetland protection goals in the basin. To that end, with the following recommendations, LPBF is fulfilling its mission to “restore the Pontchartrain Basin for the benefit of this and future generations.” As always, the Foundation seeks to partner and work with all stakeholders to advance scientific data collection, policy advocacy, and preservation of Louisiana’s most populated basin.

In 2006, LPBF included a recommendation for wastewater assimilation projects in our “Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin.” In addition to making this recommendation, we began to study these projects in our basin. In 2010, LPBF hosted a workshop that discussed the Hammond Wastewater Assimilation project. In 2016, LPBF hosted a second workshop that presented research topics related to the performance and functioning of wastewater assimilation in natural wetland systems in southern Louisiana. The latter workshop had over 100 attendees and provided a platform for a wide range of opinions and discussion of several projects. LPBF makes the following recommendations (revised from our recommendation made in 2011 on this topic) based on the workshops, data collection, and several decades of experience regarding water quality and wetlands in southern Louisiana. This directive is consistent with, but supersedes, LPBF’s request in 2010 to not allow new wastewater projects to discharge into natural freshwater marsh.

Issue Definition
The assumed principal benefits of allowing the discharge of treated wastewater into natural wetlands are to: 1.) prevent the intrusion of saltwater into freshwater habitats, 2.) provide nutrients from wastewater effluents to accelerate the growth of vegetation, and 3.) to provide a cost-savings to the municipalities that elect to modify their wastewater treatment systems for wetland discharge.

LPBF asserts that there are several key considerations in re-evaluating the practice of discharging treated municipal wastewater effluent to natural wetlands. First, displacing saline waters from these habitats is typically cited as a need for the wetlands as part of projects. Permitted assimilation projects’ discharges range from 0.2 to 12.4 cubic feet per second (cfs); yet, these volumes are eclipsed by orders of magnitude by diversion projects and typical stormwater pump stations in the

* Records of both workshops may be found at: http://saveourlake.org/lpbf-programs/coastal/technical-reports
region (See Table 1). LPBF notes that the scale of existing wetland assimilation projects is dwarfed by freshwater and sediment diversion projects; in Louisiana permitted and proposed diversions range from 8,000 to 75,000 cfs. Stormwater pump stations are designed to discharge a significant volume of freshwater to surface water and/or wetlands (Table 1). Of the four pump stations listed in Table 1 (120 cfs to 10,000 cfs), only the Gore Pump Station discharges into wetlands. In addition, diversions and pump stations are designed and operated as pulsed, whereas assimilation projects discharge water continuously, which can have negative impacts to the wetland hydroperiod. Based on this data, treated wastewater discharges may not displace saline water at these low discharge volumes.

The Louisiana Department of Environmental Quality (LDEQ) has noted that wetland assimilation projects are designed for the assimilation of wastewater effluents, and not for the treatment of effluent. However, a review of all permitted projects shows that nine (9) of eleven (11) projects allow for higher discharge of Biological Oxygen Demand (BOD$_5$) and Total Suspended Solids (TSS) than for facilities discharging to surface waters (Table 1). When comparing permitted levels for BOD and TSS for facilities that discharge into surface water versus those that discharge into wetlands, for projects of similar size, it is apparent that projects discharging into wetlands are relying on the wetland for treatment, not merely nutrient assimilation (See Table 1).

Table 1: Comparison of discharge volumes between wetland assimilation permits, surface discharge permits, pump stations, and river diversion projects. Also included is a comparison of pollution loading rates between surface water and assimilation projects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Discharge Volume</th>
<th>Permitted Discharge; Ave. Monthly Concentration (mg/l)</th>
<th>Calculated Loading Rates (lbs/day)</th>
<th>Permitted Discharge; Max Weekly Concentration (mg/l)</th>
<th>Calculated Loading Rates (lbs/day)</th>
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<td>Treatment Plants Discharging into Wetlands</td>
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</table>

a Million Gallons per Day
b Cubic Feet per Second
c Biological Oxygen Demand
d Total Suspended Solids
e Gallons per Day
Prolonged or excessive nutrient loading may adversely affect the assimilation area, with organic decomposition and loss of root matter contributing to decreasing soil stability and shearing \[^3\]. Recent research suggests that nitrogen enrichment accelerates plant decomposition in freshwater marsh \[^4\]. Other work also indicates that wastewaters are appreciably higher in total nitrogen, and proportions of ammonia-nitrogen (NH\(_3\)), and total Kjeldahl nitrogen (TKN)\[^5\]. While the point can be made that Mississippi River diversion projects would allow for the discharge of total nitrogen, the bulk of the nutrient load is primarily in the oxidized forms of inorganic nitrogen: nitrite (NO\(_2^-\)) and nitrate (NO\(_3^-\))\[^6\]. Additionally, diversions have engineering controls in place to allow puling, limiting the influx of nutrients and hydrologic inundation. Diversions are designed to allow wetlands time to assimilate excess nutrients before receiving additional load. Currently, only one Louisiana wetland assimilation project, City of Mandeville, is permitted with limits on the discharge of NH\(_3\) nitrogen into the assimilation area.

Lastly, no data could be located that addresses the potential benefit of cost-savings to the municipalities using wetland assimilation. Although there is speculation that municipalities would benefit from decreased operation or treatment costs due to the relaxed permit levels, no study was found that investigated whether those costs savings were actually realized after operation began, and continued over the life of the project. Also, tradeoffs between cost savings to the taxpayer and potential degradation of local wetlands that provide many ecosystem services, including flood water storage and storm surge risk reduction, should be considered.

**Recommendations**

*LPBF recommends that Louisiana agencies not permit any new projects discharging treated municipal wastewater into natural wetlands, including both marsh and forested wetlands.*

New wastewater assimilation projects discharging into natural wetlands should not be permitted due to the following concerns:

- Natural wetlands are subject to natural hydrologic fluctuations (water levels) in open natural wetland systems, due to rain events, tides, storm surge etc., which cannot be predicted or managed and therefore, may compromise optimum conditions for assimilation\[^7, 8\].

- Continuous discharge of municipal wastewater and the subtle natural topography of typical south Louisiana wetlands make it difficult to predict and manage for the correct micro-hydrology and variable hydrograph in receiving wetland areas\[^9-12\]; prolonged or continuous flooding often results\[^13, 14\].

- Wetland deterioration to open water, reduced plant growth rates, and undesirable shifts in species composition may result\[^13, 14\].

- Negative impacts to freshwater marsh from wastewater assimilation projects in Louisiana have been evident since approximately 2010, but longer-term projects are now indicating possible negative impacts to forested wetlands\[^3, 13\].

- When discharge is pulsed between two wetlands as a solution to continuous discharge into one wetland, it is unclear if sufficient dry down (no-flow) periods are adequately allocated. Dry down, under natural conditions, generally occurs seasonally in wetlands. Therefore, if water is pulsed between two wetlands, one wetland will receive discharge at a time of year when it
historically was seldom inundated. Splitting the flow is not assurance that the proper hydrologic regime can be executed. In addition, if there are other negative consequences associated with the discharge, having two receiving areas may expand the problem\(^7-12\).

- Wastewater treatment practices predominately utilize chlorination as a disinfection technology. Free chlorine combines with organic molecules and results in toxic compounds of known and unknown chemical composition \(^15-21\). Chlorinated effluents may be lethal or mutagenic to aquatic species, as evidenced with Whole Effluent Toxicity (WET) and other biological assays.

- Dechlorination technologies (sodium sulfite, sulfur dioxide, sodium thiosulfate, etc.) have been employed to remove free chlorine prior to the discharge of effluents to the environment. However, removal of free chlorine by dechlorination does not sufficiently remove combined chlorine and residual toxicity from effluents\(^22-24\).

- There are unknown and known constituents in treated municipal wastewater that are not studied, often not treated, and are discharged into the environment. These include pharmaceuticals and personal care products (PPCPs) and endocrine disrupting compounds (EDCs), pathogens, etc. (e.g. \(^25-28\)). Wastewater facilities that utilize secondary treatment and chlorination technologies do not sufficiently deactivate the biological activity of these compounds\(^29-31\).

**Future assimilation of wastewater should consider using traditional tertiary wastewater treatment methods and/or constructed wetland systems in lieu of natural wetlands.**

Constructed wetlands are advantageous because of tighter controls on water both entering and exiting the wetland, direct management of vegetative communities, and the ability to specifically design features to meet the project goals\(^32, 33\). As stated in *Constructed Wetlands for Water Quality Improvement*, “It has been recognized for some time that natural wetland ecosystems do not always function efficiently for purposes of permanent storage or controlled discharge of nutrients or pollutants.”\(^32\) In addition, constructed wetlands can still provide some of the ecological benefits, including wildlife habitat, which natural wetlands provide and can provide opportunities for water reuse\(^34\). Some constructed wetlands have proven cost-savings to municipalities when compared to traditional sewage treatment methods.\(^33\)

**Existing Wastewater Assimilation Projects**

There are some existing assimilation projects and LPBF recognizes that switching these projects over to traditional treatment or constructed wetlands may not be feasible in the near-term. LPBF recommends the following changes in management, regulation, control, and data collection for existing wastewater assimilation projects:

- All projects should be evaluated on a site-by-site basis by state agencies or independent contractors to the state. This should include:
  - Compliance history
  - A scientific and engineering evaluation of the wetland site and treatment plant
  - A financial review of the project; including Financial Assurance, the cost of proper sampling plans, and whether the cost savings promised to the public are realized.
Independent reviews should be the basis for future management decisions and permitting of existing projects; including the possibility of assimilation design modifications, or abandonment of the project.

Treatment plants associated with wastewater assimilation projects should treat the discharge to levels required for discharge into surface water. Discharge may need to be pulsed between assimilation wetland(s) and an open water body, to protect wetlands against extended periods of inundation. The current permitting structure may need to be altered to accommodate separate discharges to both the wetland and surface water. Therefore, effluent should be treated to the same standards, at a minimum, as those discharged to surface water.

Treatment plants must be closely monitored for regulatory compliance and proper corrective actions or penalties should be enforced for non-compliance.

Assimilation regulations set by regulatory agencies should be revisited and may need to be amended after consulting with appropriate experts. Possible regulatory changes may include, but are not limited to:

- Correctly define the project assimilation area so nutrient loading rates are accurate and reflect project conditions.
- Sampling plans should be expanded to include additional samples of wetland system beyond three (3) sampling locations. The number of sampling locations should be more randomly selected and reflect the size and scale of the assimilation area (I.E. X number of acres = Y number of plots) in both forested and herbaceous wetlands. Sampling site locations should be selected with statistical software or other similar method.
- Dis-allow 20% reduction in above-ground productivity after 5 years. If these projects are beneficial to stressed wetlands, above-ground productivity should, at a minimum, revert to baseline conditions after an acceptable acclimation period. Under this justification, allowing 20% reduction in above-ground productivity is unacceptable.
- Revision of above-ground productivity sampling protocols. For emergent marsh, currently, only 0.3 m² total is required to be assessed (5, 0.06 m² plots) to determine if above-ground productivity is affected, regardless of the size of the assimilation area. Plot number should be scaled as stated above. Additionally, since the proposed methodology is destructive sampling (plant harvest), then 1 m² plots where percent cover by species is assessed (non-destructive sampling), should be required in order to determine shifts in species composition.
- Monitoring needs to be conducted using independent science, for instance, Environmental Impact Statements, (EIS), baseline sampling, project design and post-project sampling should not all be conducted by the same entity.
- All projects discharging to wetlands as receiving streams shall monitor for Whole Effluent Toxicity (WET), regardless of the volume of the discharge.
- Investigate the fate, transport, and environmental impact of wastewater constituents that are not sufficiently removed or biologically inactivated by wastewater treatment processes discharged to wetlands. These emergent concerns include pharmaceutical and personal care products (PCPPs), and endocrine disrupting compounds (EDCs). Similarly, alternative pathogen indicators beyond fecal coliform should be used to assess viral and bacterial pathogens that are discharged to the assimilation wetland. While these emergent concerns are also a consideration for the discharge of wastewater to surface waters, the dilution volume in wetland systems can be considerably less.
Require the use of advanced oxidants and disinfection technologies beyond chlorination. Wastewater should be disinfected with technologies that do not increase the toxicity of the discharged effluents. Additionally, consideration should be given to technologies that reduce the biological activity of PPCPs and EDCs. 

- Develop a plan for remediation of current or future impacts to assimilation wetlands, including identifying who is financially responsible for remediation.
- All receiving wetlands need proper signage identifying the nature of the site and any hazards associated with the discharges in the area.

Literature Cited


