BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for certificate to provide wastewater service in Charlotte County by Environmental Utilities, LLC	Docket No. 20240032-SU

DIRECT TESTIMONY

OF

BRIAN E. LAPOINTE, Ph.D.

on behalf of

Environmental Utilities, LLC

Q. Please state your, name profession and address.

A. Brian Edward Lapointe, environmental science, 313 Matthew Quay Way, Fort Pierce, FL 34946

Q. State briefly your educational background and experience.

A. Following graduation from Palm Beach High School in 1969, I received a B.A. degree in Biology from Boston University (1973), a M.S. degree in Environmental Science from the University of Florida (1979), and a Ph.D. in Biology from the University of South Florida (1982). Following a short postdoc with the University of Florida in 1982, I became employed with the Harbor Branch Oceanographic Institute (HBOI) in Fort Pierce, FL, in January 1983 but was based on Big Pine Key where I performed field studies involving growth of macroalgae (seaweeds) and nutrient dosing experiments. That research in the early 1980s led to my first septic tank study sponsored by Monroe County in the Florida Keys. I became a research professor in 2007 when HBOI became part of Florida Atlantic University (FAU). During my 42-year professional career, I have been the lead investigator of numerous studies of nutrient pollution and harmful algal blooms in south Florida and various locations around the wider Caribbean region. I currently have 139 publications (Research Gate), 12,559 citations to my papers, and an h-index of 58 (Google Scholar). My past research, along with other water quality studies, have led to water policy decisions to improve wastewater infrastructure in Florida, including construction of a municipal sewer system and advanced wastewater treatment in the Florida Keys.

Q. Have you previously appeared and presented testimony before any regulatory bodies?

A. Yes, I have provided testimony in Florida Division of Administrative Hearings involving the need for a wastewater infrastructure upgrade in the Florida Keys and establishment of nutrient criteria in south Florida.

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to present the Report I prepared titled "Science Supports a Septic-to-Sewer Conversion on the Barrier Islands of Charlotte County, Florida" and to address other environmental issues that may arise.

Q. Please summarize the major points in your Report.

A. My report provides an overview of peer-reviewed research, technical reports, and other relevant information that collectively support a science-based decision to sewer Knight Island, Don Pedro Island, and Little Gasparilla Island in Charlotte County, FL. These islands are estimated to have had 273 septic systems installed between 1920 and 1979, 792 from 1980 to 2000, and 230 between 2000 and 2016, for a total of 1,295 units. Conventional septic systems are not designed to remove nutrient pollutants such as nitrogen and phosphorus (or many other contaminants) from their effluent and studies have documented how they contaminate groundwaters and adjacent surface waters. The nutrient pollution, especially nitrogen, results in eutrophication, harmful algal blooms, reduced dissolved oxygen (hypoxia) and seagrass loss. Conventional septic systems also do not provide disinfection of pathogens in the wastewater effluent. The public health and environmental problems posed by the aging high-density septic systems on these islands is exacerbated by the low elevation sandy soils, high groundwater levels, and proximity to surface waters. The nitrogen loading from these septic systems is estimated to contribute 34,425 lbs of nitrogen to groundwaters on the barrier islands that discharge into surrounding coastal waters. Nutrient loadings from septic systems are also known to support proliferation of jellyfish in subtropical coastal waters, as well as red tides, and macroalgae (seaweeds) blooms that over time lead to hypoxia (low dissolved oxygen) and seagrass loss. Based on the scientific evidence in my report, a sewer upgrade project is justified and will benefit residents on the island who depend on good water quality to support their home values, local economy and quality of life.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring one exhibit. Exhibit BEL-1 which is the aforementioned Report which was Exhibit D-1 in the Application.

Q. Does that conclude your direct testimony?

A. Yes, it does.

Science Supports a Septic-to-Sewer Conversion on the Barrier Islands of Charlotte County, Florida

Evidence of eutrophication in Gasparilla Sound: macroalgae overgrowth and *Cassiopea* jellyfish in seagrass beds.

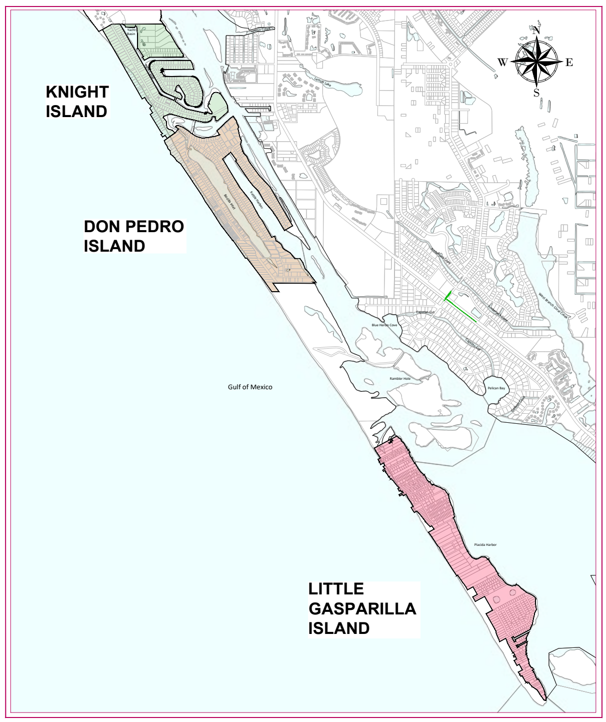
Prepared by:

Brian E. Lapointe, Ph.D.

February 2, 2024

Introduction

The purpose of this report is to provide published scientific research and background information to support a proposed wastewater infrastructure upgrade on the barrier islands of Charlotte County, including Little Gasparilla Island, Don Pedro Island, and Knight Island (Figure 1). Some of the science presented here was also used to support the recent passage of the "Clean Waterways Act" (Senate Bill 712, section 403.067(7)(a)9., Florida Statutes), which was signed by Governor Ron DeSantis in June 2020 and provided rules for remediating septic systems, including septic-to-sewer conversions.



KEYMAP

Figure 1. Map showing proposed septic-to-sewer project for Knight Island, Don Pedro Island, and Little Gasparilla Island in Charlotte County (provided by Giffels-Webster Engineers, Inc., Englewood, FL)

With the steady urbanization in Charlotte County and the barrier islands in recent decades, the demands for land, water, housing, transportation, boating, and recreational fishing presented challenges for sustainable growth. Management actions were needed to balance the unique natural resources with human needs. In 1995, the Charlotte Harbor National Estuary Program (CHNEP, now called the Coastal & Heartland National Estuary Partnership) was established and designated to protect Dona & Roberts Bays, Lemon Bay, Charlotte Harbor, Pine Island Sound, the Caloosahatchee estuary, and Estero Bay as "estuaries of national significance" and their watershed – a 4,700 square-mile watershed extending from Venice to Bonita Springs. At that time, Charlotte Harbor was considered healthy but by 1999 Charlotte Harbor was listed as expressing high levels of eutrophic (nutrient enriched) conditions, including elevated levels of chlorophyll *a* (phytoplankton biomass) and low dissolved oxygen (DO; Bricker et al., 1999). When algal blooms die, they turn into organic detritus, which bacteria eat and use up DO while doing so. This is called biochemical oxygen demand (BOD); the high BOD in turn lowers the DO in the water to unhealthy levels (Mallin et al., 2006). Eutrophication can lower the biodiversity of a system directly, through oxygen depletion, or indirectly, though compounding effects of excess nutrients in supporting harmful algal blooms (HABs; Howarth et al., 2000). The seasonal hypoxia that occurs in Charlotte Harbor (Turner et al., 2006) is a growing threat to biodiversity and ecosystem health, such as the endangered juvenile small tooth sawfish that have an affinity for well-oxygenated water (Poulakis et al., 2011). Additionally, segments of Charlotte Harbor are listed on the United States Environmental Protection Agency (USEPA) 303d list as impaired for nutrients, dissolved oxygen (DO), chlorophyll *a*, bacteria in shellfish, and mercury in fish tissue. The CHNEP completed its first Comprehensive Conservation and Management Plan (CCMP) in 2000, a non-regulatory list of cooperative actions needed to protect and restore the estuary and its watershed. In 2019, the CCMP was updated and included Water Quality Improvement Action Plan 4. "to reduce wastewater pollution" through 4.2 "continue to inventory and map septic systems in the CHNEP area; support conversion of septic systems to centralized sanitary sewer systems; support increased sanitary sewer capacity to handle new inflows from conversions; encourage regular maintenance and inspection of septic systems; encourage evaluation and adoption of new nitrogen-reducing septic system technology." This CCMP was approved by the CHNEP partners, which includes all seven counties in the Charlotte Harbor watershed.

Background

The current necessity for septic-to-sewer conversions to restore and protect Charlotte Harbor's waterways has a long history. In 1972 the Federal Clean Water Act (PL92-500) became law, presenting an ambitious policy for improving and protecting surface water and groundwater quality within the United States. The national goal included within the law was *"that the discharge of pollutants into the navigable waters be eliminated by 1985."* Provisions within Section 201 of PL92-500 included federal funding of a portion of capital costs for upgrading of wastewater treatment facilities. By referencing confined disposal of pollutants and in-place sources in Section 201, review and revisions to septic system policy was contemplated as a target for upgrading to "achieve the goals of this Act."

By the mid-1970s, concerns of septic system pollution extended beyond direct impact on human health and included investigations into nutrient impacts upon the growing problem of lake eutrophication. In 1972, the National Eutrophication Survey (NES, 1975) was initiated by the USEPA to help in their required reporting of the condition of the nation's water quality per PL92-500. Nutrient sources included as part of the NES loading assessment included septic tanks within 100 feet for Florida lakes, with total nitrogen input to lakes estimated to at 9.38 pounds of nitrogen/person/year (Bicki et al., 1984). Clearly, it was recognized at that time that septic tanks were involved in water quality degradation through eutrophication of surface waters.

As facility plans were being developed for Section 201, the issue of replacing septic systems through connection with regional type wastewater collection and treatment systems became a significant component of the planning process. In January 1977, the United States Environmental

Protection Agency issued a report to Congress on waste disposal practices and their effects on groundwater (USEPA, 1977). Their assessment of the influence of septic tanks was clearly stated on page 194: *"it should be noted that septic tank density of greater than 40/sq. mi designates a region of potential contamination problems."* The suggestion here is that when septic systems are used at a density at or above 16 acres per septic system, cautionary review of the potential water quality impacts is vital. As Section 201 programs began to take shape, it was becoming clear that dismantling septic systems through the expansion of regional wastewater treatment systems was important to protection of surface water quality.

In 1983, a decision was made in Florida to establish new criteria for septic tank densities and installation through the Water Quality Assurance Act (Ch 83-310 Florida Law). Touted as a major legislative accomplishment, it was praised by Hopping and Preston (1983) in their review of the Act as *"the single most important environmental law passed by the Florida Legislature during the last ten years."* However, the Act denied permitting authority to the Florida Department of Environmental Protection, or FDEP – known as the Florida Department of Environmental Regulation (FDER) in 1983 and transferred authority to the Florida Department of Health (FDOH), known as the Florida Department of Health and Rehabilitative Services or FDHRS in 1983. It also provided density allowances for new septic tanks of 1,500 gallons per day per acre when private wells served as the drinking water source and 2,500 gallons per day per acre when public water supply serves as the drinking water source. In both cases, a 75-foot setback from surface waters was required—considerably less than that suggested by the NES. In the FDOH standards as noted in 64E-6 FAC *Standards for Onsite Sewage Treatment and Disposal Systems* (previously 10D-6 FAC), Table 1 pg. 16, the average residential flow is identified at about 300 gallons per day. In effect, the allowable density became 5 to 8 residential septic systems per acre. This far exceeded the density of ~ 1 per acre suggested within the published scientific literature (Bicki et al., 1984; Mallin, 2013) and basically provided a means for septic system proliferation throughout Florida. While the Act did require sewer hook-up within 365 days after notification of availability of a sewerage system, there was no expressed urgency for such systems to be constructed. Rather connection was to occur with "*eventual construction and utilization of a sewerage system*" with no time restraints imposed.

In areas lacking municipal wastewater collection and treatment, steady population growth in Florida has relied heavily on the use of septic systems. Since 1970, over 2.6 million septic systems have been in service or placed in service within the State of Florida; currently, ~ 39% of Floridians rely on septic systems and the effluent from these systems exceeds the flows from the current water reuse production in the State (Badruzzaman et al., 2012). As a result, septic systems have become a widespread pollution source in Florida's groundwaters and surface waters. Recent studies in Charlotte Harbor demonstrated this, finding significant nutrient, biological oxygen demand (BOD), chemical, pharmaceutical, and microbial pollution of groundwaters and surface waters at watershed septic densities as low as 0.8/acre (Lapointe et al., 2016; Brewton et al., 2022; Tyre et al., 2023).

Environmental Impacts of Septic Systems and Human Waste

Population growth without adequate wastewater infrastructure has increased nutrient and microbial pollution of Florida's estuaries and coastal waters, accelerating the problems of coastal eutrophication and HABs. Since the 1980s, increasing evidence has demonstrated that septic systems can be the primary source of nitrogen (N, ammonium and nitrate) and phosphorus (P, total phosphorus, or SRP, soluble reactive phosphorus) pollution in Florida's urbanized estuaries and coastal waters. Studies in the Florida Keys (Lapointe et al., 1990; Lapointe and Clark, 1992; Lapointe et al., 1994; Lapointe and Matzie, 1996), Indian River Lagoon (Lapointe and Krupa, 1995a,b; Lapointe et al., 2015; Herren et al., 2021; Lapointe et al., 2023), St. Lucie Estuary (Lapointe et al., 2012; Lapointe et al., 2017), and Charlotte Harbor (Lapointe and Bedford, 2007; Yentsch et al., 2008; Lapointe et al., 2016; Brewton et al., 2022; Tyre et al., 2023) have shown that septic systems result in nutrient enrichment of groundwaters and adjacent surface waters. This is because conventional septic systems are not designed to remove biologically reactive nutrients such as ammonium and SRP from their effluent, especially in areas with high groundwater levels, porous sandy soils, and proximity to surface waters (USEPA, 2002). In these environments, the highly reactive ammonium in septic tank effluent has limited capacity for bacterial nitrification to nitrate, diminishing the ability for microbial denitrification of nitrate to inert atmospheric N_2 gas. Accordingly, denitrification removes limited amounts of N from septic effluent in sandy, porous media (20-25%; Costa et al., 2002).

Because septic systems have been used in high densities in many low-lying coastal areas such as the barrier islands of Charlotte County, ammonium loading from their use is a widespread driver of worsening HABs and eutrophication. There is a well-known chemical technique that uses the stable nitrogen isotope values ($\delta^{15}N$) of HABs or macroalgae to determine the source of the N feeding the blooms. In coastal Charlotte County the $\delta^{15}N$ values closely match the source values of human waste (+ 5 to + 20 o/oo) rather than fertilizers or natural N_2 fixation (< +3 o/oo). These $\delta^{15}N$ source-tracking studies have included macroalgae, brown tides and cyanobacterial blooms in the Indian River Lagoon (Lapointe and Krupa, 1995a,b; Lapointe et al., 2015; Herren et al., 2021; Brewton and Lapointe, 2023; Lapointe et al., 2023), blue-green algae blooms in the St. Lucie Estuary (Lapointe et al., 2017) and red tides, blue-green algae, and red drift macroalgae in the lower Charlotte Harbor region (Figure 2; Lapointe and Bedford, 2007; Yentsch et al., 2008; Brewton et al., 2022; Tyre et al. 2023).

The growing HAB problem in southwest Florida is also related to the fact that very low ammonium concentrations (~10 to14 parts per billion, or < 1 % of septic effluent) are known to support algal blooms in N-limited estuaries and coastal waters such as Charlotte Harbor (Lapointe, 1997; Lapointe and Bedford, 2007). The high P concentrations in southwest Florida's surface waters has long been known to support red tides (*Karenia brevis*; Ketchum and Keen, 1948; Slobodkin, 1953; Odum, 1953). Some 50 years ago Doig and Martin (1974) also showed that ammonium enrichment greatly stimulated Florida red tides and is considered the preferred N source for red tides (Steidinger et al., 1998). These seminal studies explain why Florida red tide blooms have become 13 to18-fold more abundant as human population growth has occurred in southwest Florida between the 1950s and 1990s (Brand and Compton, 2007). Although *Karenia brevis* occurs naturally in the Gulf of Mexico, increasing runoff of nitrogen from septic systems, especially following hurricanes such as Ian in 2022 (Figure 3), contribute to bloom development in nearshore waters (Brand and Compton, 2007; Lapointe and Bedford, 2007; Yentsch et al., 2008; Brewton et al., 2022).

Poorly functioning septic systems are also a documented source of fecal microbial pollution to groundwaters and surface waters in Charlotte Harbor. Lipp et al. (2002) collected monthly water and quarterly sediment samples that were analyzed for fecal coliform bacteria, enterococci, *Clostridium perfringens*, and coliphage. Fecal indicator organisms were generally concentrated in areas of low salinity and high densities of septic systems; this pollution became widespread during wet weather in the late fall and winter of 1997 and 1998, when enteroviruses were found in 75% of the samples. More recent studies between 2017 and 2020 in North Fort Myers showed that septic system pollution of groundwaters was coupled to surface waters by monitoring dissolved nutrients, stable nitrogen isotopes, fecal indicator bacteria, human molecular markers (HF-183) and chemical tracers (sucralose, carbamazepine, acetaminophen (Brewton et al., 2022).

Figure 2. Examples of harmful algal blooms in the Charlotte Harbor estuary and coastal waters. Left, red drift macroalgae bloom. Right, toxic blue-green algae bloom (*Microcysis aeruginosa*).

A wider follow-up study by Tyre et al. (2023) showed that septic system pollution of surface waters was widespread, with 50% of the water samples being positive for the human fecal bacteria molecular marker HF-183, and 68%-100% of the particulate organic matter (POM) and macroalgae, respectively, indicating a human waste source. The presence of only 1% of human wastewater in warm coastal waters can lead to increased virulence and 100 to 1000-fold higher concentrations of *Vibrio vulnificus*, increasing the chance of infections (Conrad and Harwood, 2022). Positive correlations have also been observed between *V. vulnificus* and fecal bacteria (Blackwell and Oliver, 2008). Between 2000 and 2021, an average of 35 *V. vulnificus* infections were reported in Florida each year and these accounted for 78% of the deaths associated with vibriosis during this period (Brumfield et al., 2023). Following Hurricane Ian that made landfall in Charlotte Harbor on September 28 2022 and brought anomalously heavy rainfall, high winds and storm surge, there were 74 reported cases of *V. vulnificus* infections, with 17 confirmed deaths in 2022; furthermore, 38 of the cases and 11 vibriosis-associated deaths were attributed to the storm, accounting for nearly double the amount for that time of year (Brumfield et al., 2023).

Septic System Monitoring and Research in Charlotte County During 2016

In 2016, Charlotte County supported Florida Atlantic University-Harbor Branch Oceanographic Institute (PI B. E. Lapointe) to analyze historical water quality data relating to nutrient and bacterial pollution of groundwaters and surface waters in Port Charlotte to better understand the environmental impacts of septic systems (Lapointe et al., 2016). Existing long-term data from the area relating to nutrient and microbial pollution of groundwaters, surface waters, and stormwater focused primarily on State and County datasets. In addition, reconnaissance sampling for nutrients and tracers of human waste pollution (sucralose, $\delta^{15}N$) was conducted to identify the relative importance of septic tank effluent compared to other sources of nutrient pollution, such as fertilizers.

Multiple lines of evidence showed that septic systems are a primary source of human waste pollution in Charlotte Harbor. Increases in human population correlated strongly with rising concentrations of N, P, chlorophyll *a* (a measure of phytoplankton biomass) and fecal coliform bacteria in the historical surface water data, illustrating how wastewater pollution from increasing population growth is negatively impacting the health of Charlotte Harbor. High concentrations of total N, ammonia, nitrate, biochemical oxygen demand, and fecal bacteria were found in surface waters downgradient of septic systems. Additionally, the limited vertical

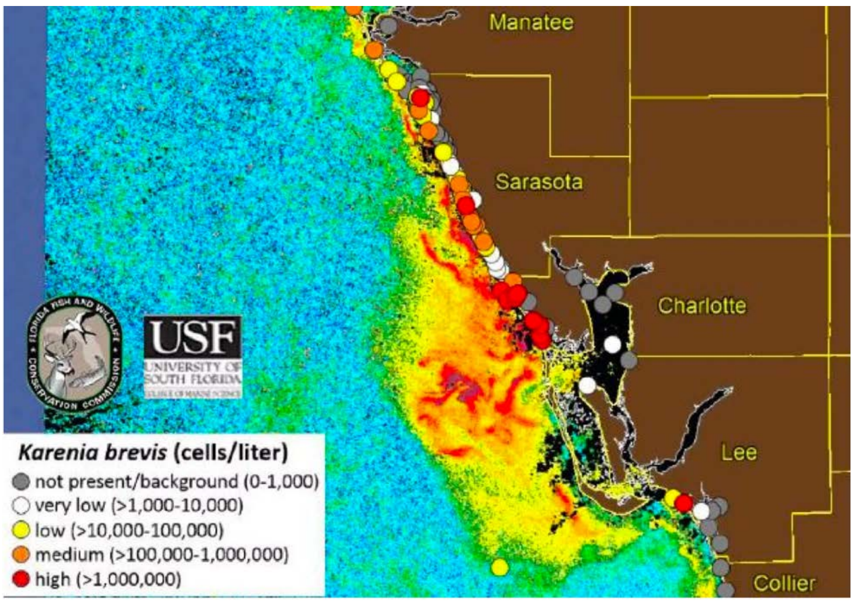


Figure 3. Red tide bloom (*Karenia brevis*) along the barrier islands in Charlotte County in November 2022 following runoff from Hurricane Ian.

separation between the ground surface and seasonally high-water table (< 3 ft.) in the Springs Lakes area made the hydrology inappropriate for septic systems and creates a situation where maintaining the required distance (greater than 2 feet) is not possible, especially during the wet season. The USEPA (2002) clearly states that 2-5 ft of aerated soil above the water table is required for pollutant treatment, especially in sandy, coastal soils. The monitoring well data suggested that 71% of the septic drainfields in study area would be in violation of the FAC requirements (Figure 4), which has serious implications for the contamination of groundwater and surface water by septic system effluent during the wet season (Bicki and Brown, 1990; USEPA, 2002).

A septic system source of the surface water nutrient pollution was clearly evidenced during our targeted reconnaissance groundwater sampling in 2016 using stable nitrogen isotopes ($\delta^{15}N$) and the artificial sweetener, sucralose, as human tracers. Aqueous $\delta^{15}N$ values for ammonia and nitrate ranged above +10.15 ‰, indicating enriched values well above that of fertilizers (< +2 ‰) and typical of human waste (Lapointe et al., 2015; Barile, 2018; Brewton et al, 2022; Tyre et al., 2023). $\delta^{15}N$ values in macroalgae tissue and primary consumers (oysters and a hydroid) collected at surface water sites within the Charlotte Harbor system were also enriched to values of +5 to +7 ‰, further indicating human waste as the primary nitrogen source impacting nearshore food webs (Cabana and Rasmussen, 1996). As the artificial sweetener sucralose is not naturally present in the environment or used by wildlife, its presence in the residential groundwater monitoring wells (> 10 µg/L) and surface waters (> 3 µg/L) clearly indicated contamination from septic tank effluent.

Florida Department of Environmental Protection Numeric Nutrient Criteria and water quality standards were exceeded in the historical and reconnaissance data. Historical data for Charlotte County showed that over many years surface waters have intermittently exceeded current standards for nutrients, chlorophyll *a*, and fecal coliforms resulting in impairments to these water bodies. Specifically, in the East and West Spring Lake Wastewater Pilot Program area, annual means of nitrogen were similar to criteria for surface waters, while groundwaters were in exceedance; fecal coliform levels were also high. In the reconnaissance sampling, standards were exceeded at all sites for Total N, at El Jobean and Ackerman for *Enterococci*, at El Jobean for Total P, and at Yacht Club for chlorophyll *a*.

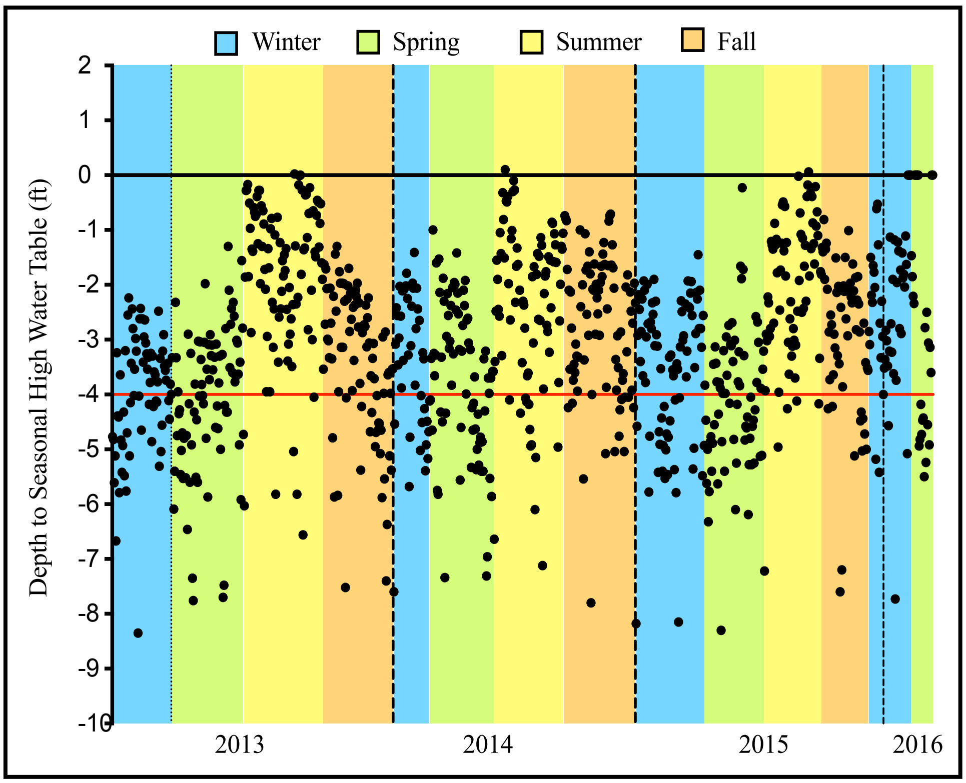


Figure 4. Depth from ground surface to the seasonal high water table (feet) displayed by season and year at groundwater monitoring well sites in Charlotte County (n=947), showing requirements according to Florida Administrative Code (FAC); ground level is at 0 (represented by the x-axis), the minimum required depth from the ground to the drainfield is 1 foot of cover, and the minimum depth between the bottom of the drainfield to the seasonal high water table is 2 feet (red horizontal line). All black points above the red line are in violation of the FAC (62E-6).

Septic Systems on Barrier Islands of Charlotte County

Although the previous research in Port Charlotte conducted by Florida Atlantic University-Harbor Branch Oceanographic Institute in 2016 did not include sampling on the barrier islands in Charlotte County, environmental factors on these barrier islands would similarly prevent the proper functioning of septic systems. High water tables, porous sandy soils, high densities of septic systems, and proximity to surface waters prevent proper functioning of septic systems (USEPA, 2002). The Charlotte County Master Wastewater Plan (Jones Edmunds, 2017) ranked sewer project areas from 1 to 5 based on environmental scoring criteria that included proximity to surface waters and a nitrogen loading impact factor. For proximity to surface waters, a score of 5 represents areas of Charlotte County that are less than 100 feet from surface water bodies and are hydraulically connected to Charlotte Harbor; the top score of 1 represents > 900 feet to a surface water body. The barrier islands had a score of 5 (the worst). Similarly, the nitrogen loading impact factor was 5 for areas on the barrier islands, indicating that they contribute 40 to 65 lbs. of N/acre/year. This N load is similar to an estimated value of 60.2 lbs of N/acre/year based on 1468 accounts x 9.38 lbs N/person/year x 2.5 persons/account, which totals 34,425 lbs of N/year for all three islands (septic system density of ~ 2.56/acre). Based on the environmental assessments, the impact score for three barrier islands averaged 5 (Figure 5), making these islands a high priority for a septic-to-sewer conversion.

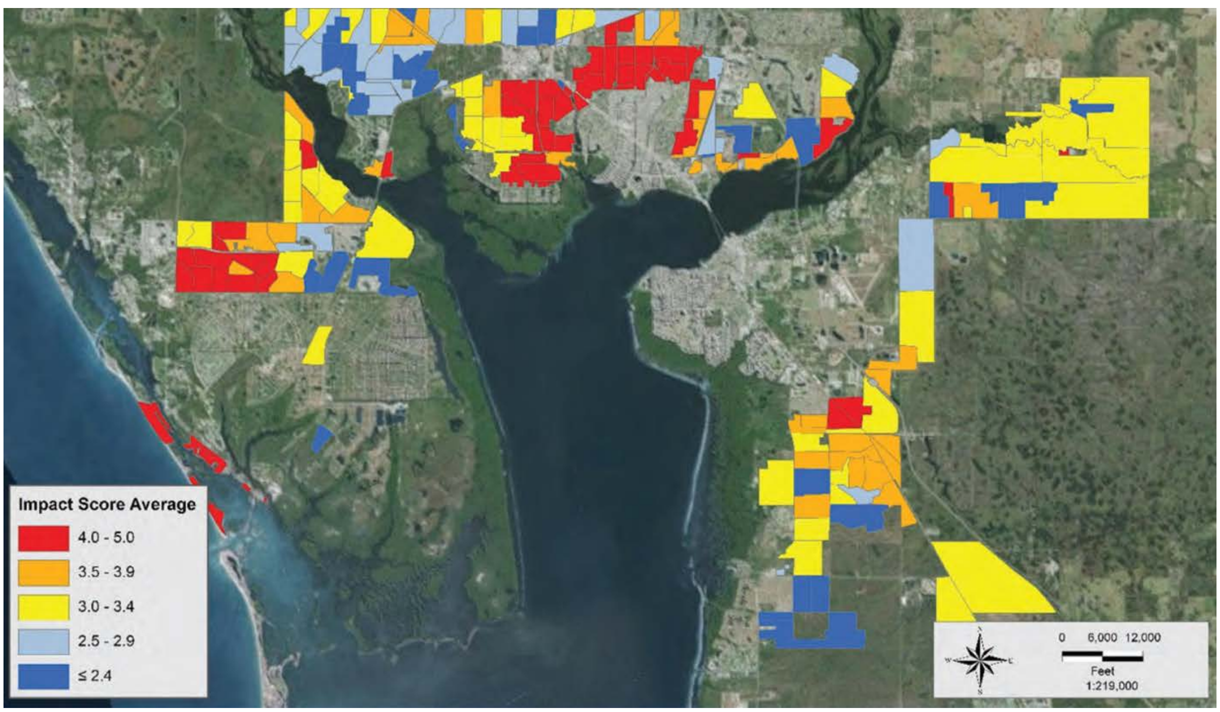


Figure 5. The average environmental impact score for each sewer project area in Charlotte County. Sixty-one project areas had average impact scores above 4, including the barrier islands. From the Jones Edmunds (2017) Charlotte County Sewer Master Plan (Figure 4-6).

Worsening water quality and seagrass die-off in Lemon Bay and Gasparilla Sound/Cape Haze are symptomatic of eutrophication from the increasing impacts of human waste from surrounding watersheds, including the barrier islands. In Lemon Bay, seagrass remained relatively stable between 1982 and 2016 after which seagrass acreage began to decline. Between 2018 and 2022

Lemon Bay lost 655 acres of seagrass, representing a 17% loss overall (CHNEP.org). Lemon Bay has also experienced a trend of increasing Total N and has been verified as impaired for nutrients (upper bay and north segment) and bacteria (upper and lower bay; CHNEP.org). In Gasparilla Sound/Cape Haze, total seagrass acreage also declined between 2018 and 2022; 1,112 acres were lost representing a 16% loss in acreage overall. Gasparilla Sound/Cape Haze is also experiencing a trend of increasing Total N and has been verified as impaired for nutrients and bacteria. An Outstanding Florida Water (OFW) is a designated waterbody worthy of special protection because of its natural attributes. Currently, Cape Haze Aquatic Preserve, Gasparilla Sound-Charlotte Harbor Aquatic Preserve, Gasparilla Island State Recreation Area, Lemon Bay Estuarine System, Lemon Bay Aquatic Preserve, and Don Pedro Island State Recreation Area are OFW's that are not currently meeting water quality standards (CHNEP.org).

The reason for the recent seagrass decline in Lemon Bay and Gasparilla Sound/Cape Haze is complex but includes nutrient runoff from land as well as prolonged red tide and algae blooms in this area (CHNEP, 2023). Gasparilla Sound contains some of the densest seagrass beds in the area, which can be symptomatic of initial seagrass growth responses to external nutrient subsidies prior to die-off from excess nutrients, eutrophication, algal blooms, and low-light stress (Greening et al., 2014; Lapointe et al., 2021). Other symptoms of nutrient enrichment in Lemon Bay and Gasparilla Sound/Cape Haze include macroalgal blooms (e.g., cover photo of report) in the seagrass beds, which are well known to result from leaching of nutrients from septic systems (Lapointe et al., 1994; Lapointe et al., 2015, 2023; Barile, 2018). The HABs following the 2005 hurricane season in southwest Florida included both red tide (*Karenia brevis*) and the cyanobacterium *Lyngbya majuscula;* experimental N additions consistently stimulated *K. brevis* biomass, and both N and P additions stimulated *L. majuscula* (Paerl et al., 2008). Blooms of *Lyngbya* have worsened in Charlotte Harbor in recent years and form floating "blobs" on the surface and foul shorelines as they decompose (Figure 6).

Figure 6. Blooms of the cyanobacterium *Lyngbya* sp. in Charlotte Harbor, May 2019.

Another symptom of increasing nutrient pollution in Gasparilla Sound/Cape Haze is the recent appearance of the upside-down jellyfish *Cassiopea*. This jellyfish contains symbiotic zooxanthellae algae, whose growth can be stimulated by nutrient enrichment, hence it is considered a bioindicator of nutrient enrichment. *Cassiopea* became abundant in seagrass beds in eutrophic canals and nearshore waters of the Florida Keys impacted by septic systems in the 1980s and 1990s

(Lapointe et al., 1990; Lapointe et al., 1994). In the Bahamas, Stoner et al. (2011, 2014) demonstrated that *Cassiopea* were 95% more abundant in human-impacted coastal areas and that high densities reduced the richness of benthic fauna. Stoner et al. (2022) performed experimental studies that showed the body mass of *Cassiopea* in nutrient enriched waters increased an average of 0.24%/day, compared to ambient water where the jellyfish were reduced in size.

Barrier islands in Florida typically have shallow surficial aquifers with sandy soils that can become nutrient enriched by use of septic systems. The barrier islands in Charlotte County have two types of sand, with soil profiles generally a mix of Canaveral fine sand and St. Augustine fine sand down to 80 inches depth (Soil Conservation Service). High ammonium concentrations averaging 43 µM (n=35) and 28.6 µM (n = 86) were found in shallow groundwaters in sandy soils at distances of 57 m (185 feet) and 86 m (280 feet) downgradient from septic systems, respectively, on Saint Georges Island (Corbett et al., 2002). Similarly high ammonium concentrations would be expected to occur in septic-impacted shallow groundwaters along the sandy shorelines on the barrier islands in Charlotte County. These elevated ammonium concentrations would be transported via submarine groundwater discharge into surrounding surface waters that have much lower ammonium concentrations of ~ 1 µM (Lapointe and Bedford, 2007), resulting in significant nutrient enrichment and worsening coastal eutrophication and HABs as noted above.

In addition to nutrient pollution, septic systems are also a source of emerging pollutants and endocrine disruptors in South Florida. Heavily populated areas not served by municipal wastewater collection present a high risk of human contaminants to groundwaters and surface waters. Widespread occurrence of steroid hormones, personal care products, and pharmaceuticals are increasingly reported in South Florida’s coastal waters. Caffeine, sucralose, Diethyl-m-toluamide (DEET) and carbamazepine are frequently detected in surface water samples, indicating extensive wastewater intrusion (Ng et al., 2021). Active pharmaceutical ingredients have been found in detectable and quantifiable levels in plasma of bull sharks in the wastewater-impacted Caloosahatchee River (Gelsleichter and Szabo, 2013). A recent study by Florida International University and Bonefish & Tarpon Trust scientists analyzed 93 bonefish from South Florida for 104 commonly prescribed pharmaceuticals. All bonefish contained pharmaceuticals with a total of 59 pharmaceuticals found, averaging 7 pharmaceuticals per bonefish (BTT, 2023). The study’s results provide more evidence to support the ongoing need for a significant investment in Florida’s wastewater infrastructure.

Conclusions

A septic-to-sewer conversion on Charlotte County’s barrier islands is a critical wastewater infrastructure upgrade that will provide environmental and human health benefits for years to come. The aging septic systems on the barrier islands were estimated to include 273 units installed between 1920 and 1979, 792 from 1980 to 2000, and 230 between 2000 and 2016 (Jones Edmunds, 2017). The public health and environmental problems posed by septic systems of Charlotte County in high-density, low-lying sandy soils with high groundwater levels in proximity to surface waters have been known for decades (Keller et al., 2019). A large body of scientific and background research provides sound scientific support for the conversion project, which is estimated to remove 34,425 lbs of wastewater N/year from the barrier islands. Recent modeling studies showed a 90% reduction in N loading from groundwaters to surface waters in

Charlotte County would occur some 8-10 years following septic-to-sewer conversion (Buszka and Reeves, 2021). The proposed infrastructure upgrade complies with the Charlotte County Master Sewer Plan (Jones Edmund, 2017) and is supported by the Charlotte County Board of County Commissioners (Resolution number 2023-155) and the CHNEP. Therefore, this project is necessary and will greatly benefit residents on the barrier islands who depend on good water quality to support their home values, local economy and quality of life.

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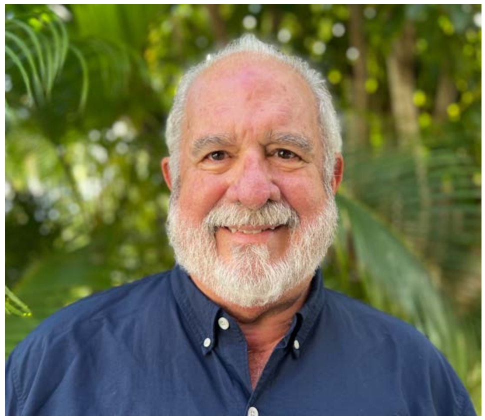

Dr. Brian Lapointe is a Research Professor with Florida Atlantic University-Harbor Branch Oceanographic Institute in Fort Pierce, FL. For over four decades, Brian's research has focused on the impacts of land-based nutrient pollution on water quality, harmful algal blooms, and the health of seagrass and coral reef ecosystems. His research has been supported by the National Science Foundation, United States Environmental Protection Agency, United States Navy, National Oceanic and Atmospheric Administration, National Aeronautics and Atmospheric Administration, Florida Department of Environmental Protection, South Florida Water Management District, Sarasota Bay National Estuary Program, Indian River Lagoon National Estuary Program, John D. and Catherine T. MacArthur Foundation, Herbert W. Hoover Foundation, Loxahatchee River Environmental Control District, and various city and county governments in Florida. Brian has published 138 papers (Research Gate) and four book chapters. His research has provided critical data and information used by policymakers to improve wastewater and stormwater treatment to protect Florida's vital aquatic resources.

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing prefiled testimony has been furnished by E-mail to the following parties this 23rd day of August, 2024:

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