

# **Attachment B: Supporting Research**

**September 21, 2021**

## **Research Review Phase of the IRC Lagoon Management Plan: Update 4**

### **1. Marinas and Boat Ramps (Part 2)**

Marinas and boat ramps are heavily used throughout the Indian River Lagoon (Lagoon) by the local community and visitors for boating purposes. Boating in the Lagoon is an enjoyable activity for many, but it comes with responsibilities and regulations that must be adhered to in order to protect the natural resources present. Rules and regulations vary from the state-level to the local-level depending on specific county and city ordinances in place. It is important for boaters to be aware of these regulations when boating or mooring out on the Lagoon.

Derelict and abandoned vessels can have negative impacts to the Lagoon environment. These vessels are capable of harming habitat, leaking pollutants into the surrounding environment, and can be dangerous to other boaters if the vessel has sunk. A 2016 study (A. Turner and A. Rees) found that the materials most commonly observed with abandoned vessels were paints, plastics, timber, expanded-extruded polystyrene and masonry, and items logged included ropes, tires, canisters, electronic equipment, and a variety of metal objects. As these materials leech into the waterways, they can act as sources of pollution to sediments, organisms, and the water.

The Florida Fish and Wildlife Conservation Commission (FWC) monitors vessels at risk of becoming derelict within the Lagoon. The process of classifying a vessel as derelict can be initiated from state, county, and local law enforcement officers. From there, the FWC officer may determine that the vessel is derelict, at risk, or neither derelict or at risk, and will follow proper protocols as established by Florida Statute (F.S.). A vessel is considered at risk of becoming derelict if: the vessel is taking on or has taken on water without an effective means to dewater; spaces on the vessel that are designed to be enclosed are incapable of being sealed off or remain open to the elements for extended periods of time; the vessel has broken loose or is in danger of breaking loose from its anchor; the vessel is left stored aground unattended in such a state that would prevent the vessel from getting underway; is listing due to water intrusion; is sunk or partially sunk; or the vessel does not have an effective means of propulsion for safe navigation within 72 hours after the vessel owner or operator receives telephonic or written notice. If after notice is provided the vessel owner or operator is unable to provide a receipt, proof of purchase, or other documentation of having ordered necessary parts for vessel repair the vessel gains derelict status. A person who anchors or moors a vessel at risk of becoming derelict on the waters of the state or allows such a vessel to occupy such waters commits a noncriminal infraction, punishable as provided in F.S. 327.73.

Abandoning a vessel in Florida's waters is considered a crime. Acts by owners who intentionally dump their vessels are considered to be felony offenses. It is illegal to cut a vessel loose and let it drift away. Vessels cannot be sunk and used as artificial reefs without proper state and federal permits. It is also illegal to leave a vessel at a boat ramp, to moor it without proper maintenance, to burn it in open water, or to give it to someone without following the proper protocols of property transfer titles and ownership.

If deemed derelict, law enforcement officers start the process to create a derelict vessel (DV) record in the DV database. At this time, the Department of Highway Safety and Motor Vehicles is notified that a certificate of title may not be issued to any applicant for the vessel. The next steps taken depend if an owner or responsible party is present. If present, the owner receives a citation as described in F.S. 376.12(2) or F.S. 823.11(2). A DV notification letter is prepared to be given to the owner along with a DV rights packet. A DV cannot be stickered as such until the owner receives a citation, DV Notification Letter, and DV Notification of Rights Packet. This starts the 21-day count to removal authorization. If the owner or responsible party is not present, law enforcement officers must search the DV in attempts to identify the owner. If an owner is identified using information obtained, then the above documents will be mailed and the 21-day count begins after the officer receives certified mail that the owner received the documents. If an owner or responsible party cannot be identified after searching, a DV Notice Sticker may be issued and the 21-day count to removal begins. Law enforcement officers have 90 days to complete the preceding steps, and may request an additional 90 day extension if good cause can be shown.

The DV owner may request an administrative hearing from the General Counsel's office anytime during the 21-day count. Additional steps cannot be taken until after the hearing, which determines whether a DV maintains its derelict status or not. If any facts regarding the vessel's derelict condition changes during this period, a new DV investigation must be initiated. If no administrative hearing is requested and the vessel still maintains its DV status, then a final approval for removal of the DV may be requested. This final approval moves up the law enforcement agency, and any additional questions deemed have a 14-day window of requiring update before the final removal letter may be issued. Once approved, removal letters may be sent to county and/or municipal authorities whose waters the DV is located in.

FWC's Boating and Waterways, Derelict Vessel Program offers removal grants to counties and municipalities which covers 100% of all removal costs. Applications are accepted on a continuing basis without deadlines as long as funding is available and is awarded on a first come, first served basis. This money may be used to remove DVs tied to public and private property that are there without the consent of the property owner. Vessels owned by the property owner and marinas are not eligible to use this funding. This grant acts as a reimbursement grant, with funding given to the grantee after they use their own funds to remove the DVs.

After the removal of the DVs, law enforcement officers send out a Derelict Vessel Repayment Demand Letter to the owner of the DV, and contacts the Department of Highway Safety and Motor Vehicles to suspend all future registrations of vessels or vehicles by the owner until full payments are received.

Law enforcement officers are able to relocate or remove DVs from public waters if the vessel obstructs or threatens to obstruct navigation in any way that is deemed a danger to the environment, property, or persons. In this scenario, officers are held harmless for any damages to the DV resulting from the relocation or removal. Florida has no salvage laws and is considered a title state, and failures to comply could result in fines or jail time. Counties or municipalities that take part in the DV removal process must show proof of disposal at a landfill once the DV process is complete.

Under Florida boating laws, it is legal for boaters to moor in the Lagoon outside of the Intracoastal Waterway and outside of permitted mooring fields. Local governments may regulate anchoring within the marked boundaries of permitted mooring fields. Local governments may also regulate the mooring of live-aboard vessels that meet the legal definition (F.S. 327.02) for a live-aboard vessel: a) any vessel used solely as a residence and not for navigation; b) any vessel represented as a place of business, or a professional or other commercial enterprise; or c) any vessel for which a declaration of domicile has been filed. Full-time, active boaters who sleep on their boats with no permanent residence on land are not considered live-aboard under these laws. F.S. 327.4109 limits anchored or moored vessels not within 150 feet of any marina, boat ramp, boatyard, or other vessel launching or loading facility; not within 300 feet of a superyacht repair facility; and not within 100 feet outward from the marked boundary of a public mooring field or a lesser distance if approved by the commission upon request of a local government within which the mooring field is located. However, a vessel may anchor or moor within these restriction zones if the vessel suffers a mechanical failure that poses an unreasonable risk of harm to the vessel or persons onboard for up to 5 business days, or until the vessel is repaired, whichever occurs first. Imminent or existing weather conditions in the vicinity of the vessel pose an unreasonable risk of harm to the vessel or persons onboard (in the case of tropical storms or hurricanes). Weather conditions are deemed no longer a risk when the tropical storm or hurricane warning affecting the area has expired.

Various local ordinances are in place throughout Indian River County's boundaries in regards to vessels:

- Indian River Shores Section 100.38 discusses boat mooring within the town's boundaries. No vessel may be anchored or moored in the waters of the town for a period of 24 hours or more except when vessels are legally moored or tied to a dock or mooring with the permission of the dock or mooring owner. In the case of a vessel being disabled in town waters, it may be anchored or moored for a period of excess of 24 hours only with a permit which may be obtained from the office of the town manager. No vessel or watercraft of any kind of an unsightly appearance, or in badly deteriorated condition, shall be moored or tied up at any place within the town.
- The City of Vero Beach ordinances (Chapter 46) state that any vessel wishing to use the city marina for mooring must use the assigned mooring and obtain a 30-day permit which must be renewed and updated every 30-days after issuance. If a vessel is left unoccupied for 72 hours and/or applicable mooring fees are more than one month overdue, then the vessel will be considered abandoned.
- The City of Sebastian ordinances (Chapter 110) prohibits watercraft speeds greater than "slowdown minimum wake" within 150 feet of a mooring vessel. It prohibits mooring to private seawalls, docks, or beach on private property without permission of the owner. Permanent live-aboards are not allowed in waterways in the jurisdiction of the City of Sebastian. Transient live-aboards are permitted within the City of Sebastian within any commercial marina within city limits that maintains moorings and/or slips at docks for transient live-aboards. These facilities should provide litter receptacles and marine station pump-out facilities as required by the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection (FDEP).
- Indian River County ordinances (Section 932.07) acknowledge the mooring of vessels in waterways. These ordinances state that vessels should not be regularly moored along any shore

without consent of the riparian land owner. Regularly moored vessels shall not be used as live-aboard vessels, offices, or commercial enterprises except in commercial marinas with approval and facilities for that purpose. Regularly moored watercraft should be kept in seaworthy condition when not in a permitted repair area. The mooring of live-aboard vessels in commercial marinas shall be limited to boat slips designated for live-aboard vessels as shown on an approved site plan.

Boating has become a widespread activity throughout the Lagoon, but there are rules and local ordinances in place that need to be respected by those utilizing boats. Boats are foreign objects introduced to the Lagoon environment, and they can have negative impacts if they are not properly cared for and disposed of. The County has various local ordinances in place to discourage the improper operation of vessels within the Lagoon. The County also takes an active role in the removal of derelict vessels from the Lagoon and Sebastian River, regardless of municipal boundaries. The County should continue to work with FWC officers throughout the removal process and apply for removal grants and subsequently remove derelict vessels as funding is available. The County also needs to stay up to date on derelict vessel and mooring rules and regulations as they change within the state. As previously recommended, the County should also stay up to date on the various services marinas offer throughout the County's Lagoon area and continue to work with regulatory agencies to assure that boaters have appropriate resources to adequately maintain their vessels without improper discharges into the Lagoon.

## **2. Onsite Sewage Treatments and Disposal Systems (OSTDS)**

OSTDS, or septic systems, are one form of waste treatment that can be utilized by homes throughout Florida. However, improper maintenance of OSTDSs can lead to detrimental impacts on the surrounding environment. Alternate options to OSTDSs include connections to a sewer system where available or upgrading OSTDS to enhanced treatment systems. This is especially important for homeowners within sensitive watersheds, such as the Lagoon's watershed. People are continually moving to Florida, and homes should be adequately equipped to not impact the resources around them when possible.

OSTDS are underground wastewater treatment structures used in areas that are not connected to centralized sewer systems. OSTDS typically consist of a septic tank and a drainfield, or soil absorption field. OSTDS require routine maintenance but are often overlooked by homeowners until a problem arises. A malfunctioning OSTDS can be identified by wastewater backing up into household drains; bright green, spongy grass on the drainfield, especially during dry weather; pooling water or muddy soil around your OSTDS; and/or a strong odor around the septic tank and drainfield. Older OSTDS drainfields may be located too close or even within the water table, reducing or eliminating the zone of treatment and not allowing for oxidation of nitrogen. Regular maintenance of an OSTDS is much cheaper when compared to repairing or replacing a malfunctioning system. The type and design of OSTDS varies based on factors such as household size, soil type, site slope, lot size, proximity to sensitive water bodies, weather conditions, and/or local regulations. All OSTDS permitting (installation/repair) is done by the local Florida Department of Health in the County (DOH-Indian River).

Even properly functioning OSTDS have the ability to impact nearby water sources, as they rely on dispersion and dilution to remove nitrogen. Properly working OSTDS have significant nutrient discharges

when located in close proximity to surface water and/or are densely located. The extent of the impact can be compounded depending on how frequently the OSTDS is maintained and if it is used properly. OSTDS primarily have the potential to impact shallow potable wells used in drinking water or irrigation and surface water. Many homeowners with OSTDS also have private wells they use to withdraw groundwater for their drinking water supply. If an OSTDS is not working properly and is located too close to a drinking water well, contaminants from wastewater can end up in the drinking water through groundwater transport. OSTDS can impact nearby surface waters because of the connection of groundwater to surface water. FDEP has estimated that the Lagoon receives approximately 60% of its nutrient inputs from groundwater sources, so malfunctioning OSTDS have the ability to negatively impact inputs into the Lagoon.

Studies show that phosphorus is almost completely contained within a functioning OSTDS, meaning the liquid effluent leaving a properly functioning OSTDS is not a significant source of phosphorus contamination into the Lagoon. Nitrogen, especially in the nitrate form, is a concern because of its solubility in water and its ability to migrate in effluent plumes. OSTDS generally remove only 10% to 40% of the total nitrogen. There is a measurable and significant concentration of nitrate within an OSTDS' percolation plume. Nitrogen in the effluent is only reduced to acceptable levels by dispersion, dilution, and reduction/decay. This is achieved if the flow path of the effluent is long enough in distance and time for the additional reduction/removal to occur prior to entering an adjacent surface water. A conventional OSTDS is capable of nearly complete removal of suspended solids, biodegradable organic compounds, and fecal coliforms if properly designed, sited, installed, operated, and maintained. However, other pollutants found in wastewater can be a concern to groundwater and downstream water bodies, such as nutrients (nitrogen and phosphorus), pathogenic parasites, bacteria and viruses, toxic organic compounds, and metals.

Changing environmental factors also continually compromise OSTDS with the Lagoon basin. Sea level rise, changing rain patterns, and elevated water tables all threaten the integrity of OSTDS and will increase the likelihood of their contributions of nutrients and pathogens to the groundwater. One way to decrease the impacts from OSTDS to the environment is for governments and homeowners to participate in septic to sewer conversions (S2S), or to provide incentives for upgrades of traditional OSTDS to more advanced OSTDS. For example Brevard County passed a local ordinance in 2018 that requires alternative OSTDS on properties located on the barrier island and within identified zones along the Lagoon.

In 2017, the County's Utilities Department conducted a County-wide study ranking communities whose OSTDS are suspected of causing the most harm to the environment (<https://www.ircgov.com/utilities/S2S/>). Many homes within the County were developed prior to 1983 when major changes in state rules and regulations in regards to OSTDS went into effect. This means those older systems are more likely to introduce contaminants into the environment. This study found there to be approximately 30,369 OSTDS in the County. This study ranked 325 communities based on their likelihoods to contribute negatively to the Lagoon ecosystem based on the following factors: population density, proximity to surface waters, flood plain, depth to ground water table, soil condition, age of surface water management system, and age of existing OSTDS. The costs to convert these communities over to centralized sewer are extensive and can be categorized as Capital Improvement Projects. The cost

also fluctuates based on the type of system theoretically installed and whether or not the County's centralized sewer infrastructure exists in close proximity to the community. Costs associated with these conversions may be supplemented by grants from state and federal agencies.

The County has completed S2S projects to help protect the Lagoon. In 2017, the Sebastian Septic to Sewer Phase 1 was completed. This involved abandoning OSTDS and connecting the parcels to centralized sewer. Funding was provided from the County, St Johns River Water Management District (SJRWMD), and the Florida Department of Economic Opportunity (DEO). In 2019, the West Wabasso Septic to Sewer Phase 2 was completed. Funding was provided by the County, SJRWMD, FDEP, and the Indian River Lagoon National Estuary Program (IRLNEP).

The Indian River County 2030 Comprehensive Plan identifies a sanitary sewer sub-element in Chapter 3A of the document. This document identifies:

- existing and projected demand and need for sanitary sewer facilities based on the County's population, existing and future land use, capacity of existing facilities, and any future changes to these facilities
- identifies the operational responsibilities, geographic service areas and levels of services provided by each facility
- identifies those areas where public sewer will and will not be provided
- identifies environmentally sound methods of disposing of treated wastes and sludge from treatment plants.

DOH-Indian River identifies the challenges in permitting OSTDS installations due to:

- a wet season water table of less than 10 inches
- the presence of restrictive low permeable soil strata
- platted or recorded parcels less than ½ acre
- setbacks from surface waters and/or wells

Within the County, it is estimated that the average life of a properly functioning residential OSTDS (including drainfield) is 19 years and that of a commercial system is 10 years.

An OSTDS maintenance program, if required, could reduce OSTDS failures and associated adverse impacts; however, such a program would be costly and difficult to implement. In the future, the focus of the County and the DOH-Indian River should be on providing public education programs on the proper use, inspection, and maintenance of OSTDS. According to the United States Department of Agriculture's Soil Conservation Service, Soil Survey, most of the County's soil has severe limitations for the use of OSTDS. Combined with the County's high wet season water table, this creates a high potential for groundwater and surface water contamination problems from even properly functioning OSTDS. Since 1983, for new construction, the DOH has required that the bottom of drainfields be at least 24 inches above the wet season water table. Also, a 75 foot separation requirement must be met between wells and/or waterbodies and OSTDS.

The County should continue to allow the voluntary expansion of the regional sanitary sewer system to existing developments within the urban service area. Additionally, the County must determine under what conditions to pursue mandatory connections on existing developments especially in areas that impact the Lagoon and in areas less than ¼ acre in size. Some parcels recorded or platted prior to 1972 are only 0.11 acres, making it difficult to repair OSTDS to code, and the density of these systems does not allow enough space for the dilutions and dispersion of nitrogen and other contaminants. A major portion of the cost of service expansion to existing subdivisions is funded through assessments. However, some residents have objected to the costs of such assessments in the past. The County should establish criteria to differentiate between areas where retrofitting is required or where central sewer is deemed to be available or where OSTDS permit repairs are allowed. Because of the cost of retrofitting within the urban service area, the most appropriate criteria to use to identify areas to retrofit are those with increased health risks and increased groundwater and/or surface water contamination risks. Environmentally sensitive zones within the County, in regards to septic tanks, are identified as areas within 500 feet of aquifer recharge zones, within 500 feet of any public water supply well, and/or within 500 feet of the Lagoon, Sebastian River, or any body of water that drains into them. The most effective and efficient way to correct the problem is to connect these households to the regional system, but that comes with other challenges such as what to do with increased biosolids and reuse water leaving the wastewater treatment facility.

The County's Comprehensive Plan identifies various objectives for the County. One objective stated is by 2025, at least 60% of all existing units in the County's service area will be connected to the County's regional sanitary sewer system. This will be an increase from 52.7% in 2017. By 2028, the County shall provide sanitary sewer service to at least 5 subdivisions identified as posing a disproportionately high potential negative impact on the Lagoon water quality. This plan includes wording such that annual inspections of OSTDS shall be conducted that are associated with heavy commercial, industrial, and manufacturing or equivalent uses. The County shall continue to identify and pursue opportunities for state and federal funding for the improvement and expansion of utility services including S2S conversion projects and sewer connections. The plan states the use of OSTDS for new developments will be prohibited unless they meet certain criteria that deem septic as allowable, such as development size and proximity to centralized sewer. Recommendations and steps forward for Lagoon improvement shall reflect those identified in the County's Comprehensive Plan.

### **3. Stormwater**

The County's Stormwater Division is tasked with reducing, to the maximum extent possible, the pollution of the Lagoon caused by stormwater runoff and base groundwater flow. The Division is also responsible for helping the County implement federally mandated National Pollutant Discharge Elimination System (NPDES) permit goals. These goals are accomplished through design, construction, and operation of regional stormwater pollution removal systems; education; and fertilizer, sediment, and erosion control enforcement monitoring.

Stormwater primarily flows to the Lagoon via the Sebastian River and the three relief canals in the County. The canals are located with one in the northern portion of the County, one in the central portion of the County, and one in the Southern portion of the County. These canals are monitored by various

entities for water quality and flow parameters routinely, with the County collecting water samples once a week dating back to 2014. All three canals discharge directly into the Lagoon and collectively represent the majority of stormwater flow into the Lagoon. County designed, built, and maintained treatment facilities are located on the Main and South relief canals, with the development of a new stormwater facility for the North Relief Canal currently underway, each of which provide treatment to the stormwater before it enters the Lagoon.

PC Main Screening System began operation in August 2008 and cost \$5.3 million to construct. It removes floating and suspended material from the Main Relief Canal, preventing the material from entering the Lagoon. Using a series of self-cleaning bar screens, PC Main removes particles from the water that are as small as 1/16<sup>th</sup> inch in diameter, about the thickness of the wire in a paperclip. Along with huge quantities of trash and debris that have the potential to harm the Lagoon, PC Main removes thousands of pounds of aquatic plants from the Main Relief Canal each year. If not removed from the canal, the plants would reach the Lagoon and die, contributing to muck formation on the Lagoon's bottom and releasing nitrogen and phosphorus that have been assimilated into their tissues. By preventing debris, trash, and freshwater aquatic plants from entering the Lagoon, PC Main provides significant benefit to the Lagoon's ecosystem. PC Main also has two sedimentation basins in the canal bottom which aid in the removal of sediment and mucky material from the water each year.

Egret Marsh Stormwater Park and Wildlife Sanctuary began operation in April 2010 and cost \$7.3 million to construct. It removes dissolved nutrients (nitrogen and phosphorus) from stormwater drawn in from the Lateral D Canal before the treated water is discharged back to the Indian River Farms Water Control District's (IRFWCD) Lateral C Canal that flows into the Main Relief Canal and discharges to the Lagoon. Approximately 8 to 10 million gallons of canal water are treated in this park daily. Egret Marsh's treatment system includes a 4.6 acre algal turf scrubber (ATS)<sup>™</sup> that removes much of the water's nitrogen and phosphorus load. Additional nutrient quantities are removed when the water flows through a large downstream polishing pond system and a created wetland before reentering the canal system. Egret Marsh is also a dedicated wildlife sanctuary and is home to many reptiles, mammals, and birds. This park is closed to the public, but tours may be scheduled for those interested.

Osprey Marsh Stormwater Park began operation in Spring 2015. It was designed by the County's Stormwater Division and is operated by the County's Division of Utility Services. Osprey Marsh removes dissolved nutrients from South Relief Canal water and from the South County Water Treatment Plant's reverse osmosis brine discharge before the water flows to the Lagoon or to the adjacent Osprey Acres Stormwater Park for further treatment. Approximately 10 million gallons per day of stormwater and up to 1.5 million gallons per day of brine are treated by this facility. The treatment train includes a 4.6 acre ATS that removes much of the water's nitrogen and phosphorus. Additional nutrients are removed in a polishing pond and a created wetland.

Osprey Acres Stormwater Park and Nature Preserve began operation in August 2019 and is a 83.7 acre facility that boasts a range of natural Florida ecosystems. Originally slated for more than 400 home parcels, Osprey Acres was bought by the County to preserve the ecosystems present and to aide in further treatment of stormwater and brine discharge water before these waters enter the Lagoon. Special treatment cells and a constructed serpentine flowway filters the stormwater blend by removing excess



nutrients through biological activity. Waters for treatment come from both the adjacent Osprey Marsh Stormwater Park and untreated South Relief Canal water. This park is open to the public.

The County is currently working on the creation of Moorhen Marsh Low Energy Aquatic Plant System (LEAPS)™. This system, when constructed and online, will treat water from the North Relief Canal before it reaches the Lagoon, thereby functioning to remove excess nitrogen and phosphorus from the stormwater. This will be achieved using aquatic plants to remove nutrients and settleable suspended solids. The plants uptake dissolved nutrients in their roots and are stored for use. The nutrients will be removed from the system by harvesting the plants as needed. It is estimated that this project will remove approximately 10,854 pounds per year of total nitrogen and 1,515 pounds per year of total phosphorus.

Many of the County's stormwater projects are unique, first-of-their-kind parks intended to treat stormwater before reaching the Lagoon. The success of these parks is reflected in nitrogen and phosphorus concentrations in the water that enters the Lagoon through the IRFWCD stormwater drainage canals. Water levels through these canals fluctuates based on the wet versus dry seasons and water management activities performed by IRFWCD on upstream weirs. Continued education is needed for homeowners to understand proper practices to keep harmful materials from flowing into the stormwater drains that lead to canals. The County stormwater treatment parks provide treatment to otherwise untreated stormwater in the County that would be left to go to tide in the Lagoon. Ongoing maintenance is needed at these parks to maintain their levels of efficiency in nutrient removal. Additional information about the County's Stormwater Division and their impacts to the County can be found at [www.ircgov.com/publicworks/stormwater](http://www.ircgov.com/publicworks/stormwater).

#### **4. Water Consumption**

Water is a necessity not only for humans but for ecosystems throughout Florida, including the Indian River Lagoon (the Lagoon). Water supplies need to be sustainable for future needs as populations and demand continue to increase throughout the County and state-wide. It is also important to remember that any water consumed and sent down toilets and drainpipes on residential and commercial properties must be treated and disposed, with limited options for disposal of the treated wastewater. There are numerous actions that can be taken to protect this limited resource, from a regional-scale to an individual-scale.

The Lagoon is an estuary composed of brackish water, or water that is saltier than fresh water, but not as salty as sea water. While the oceans cover approximately 70% of the Earth's surface with quantities of water that are generally not considered as threatened by consumption rates or use, increasing levels of the oceans will be observed in the future as sea levels rise in the area. These impacts will not only be felt by increased salinity levels in the Lagoon, but also by saltwater intrusion into Florida's aquifer system. As the source for much of the water used throughout Florida, the current and future state of the aquifer system remains a great concern. As more and more people move to Florida, the demand for increased water supplies will force agencies to look for alternative water supplies to meet these increases.

The St Johns River Water Management District's (SJRWMD) publishes annually a Survey of Annual Water Use which categorizes the volumes of water used within its boundaries which include part of or all of 18 Florida Counties in northeast and east-central Florida. The 2020 report highlighted some

encouraging news, with a 1 percent decrease in water use over a 5 year average, but that value does also reflect a 4% higher use than was reported in 2019. While this is promising for water consumption and the success of conservation methods, it also may be inaccurate to assume this will be an on-going trend as rainfall plays an integral role in the need for water. While the County receives more rainfall when compared to other regions within the Lagoon, rainfall levels are showing a decreasing trend when compared to historical numbers. It is expected that the region will experience longer periods of drought due to the effects of climate change into the future. The amount of rainfall received each year is also included in the water use reports from SJRWMD.

The greatest demand for water use throughout the SJRWMD in 2020 was for public supply purposes at 53% of the demand. In a 10-year period, public water supply demands have decreased by 3% while the population served has increased by 19%. This is due to factors such as conservation, less landscape irrigation with potable water, and increases in multifamily housing occupancy. Agriculture represented the second largest demand on water district wide in 2020. As of 2020, within the County, the greatest water demand was identified as agricultural self-supply at 62% or 48.91 million gallons per day (mgd), followed by public supply at making up 24% of the average daily water demand, or 18.76 mgd. Agriculture's use within the County increased from 2019 to 2020 by more than 33%, while the public supply use saw a 2.5% decrease.

With limited resources of water available, water conservation measures can be taken at small-scales for individual homeowners, as well as at large-scales for larger entities and municipalities. Several state agencies have numerous handouts and informational links to water saving methods for homeowners. This includes the Florida Friendly Landscaping Program which encourages homeowners to: water your lawn only when it needs it; water your landscape plants only when they need it; use a rain gauge to see how much water your plants get naturally; group plants with similar water needs; water less in cooler months; water in the early morning; follow all local watering restrictions; properly calibrating your irrigation system; and maintaining your irrigation system. Inside the home, homeowners can check faucets and pipes for leaks, use your dishwasher and washing machine only for full loads, and minimize use of kitchen sink garbage disposal units. Outside the home, homeowners can add mulch to reduce rates of evapotranspiration, harvest rain in cisterns, choose native, drought tolerant plants, check hoses and sprinkler connections for leaks, plant native plants on slopes, irrigate your lawn with reclaimed water, and not water the lawn in rainy weather.

SJRWMD has watering restrictions in place to ensure the efficient use of water for landscape irrigation. The seasonal restrictions specify the time when watering may occur, the amount of water that may be applied, and the days when watering may occur for residential and nonresidential locations. Homes with odd numbered or no address can water on Wednesdays and Saturdays during daylight saving time (DST) which is the second Sunday in March until the first Sunday in November, and on Saturdays only during Eastern Standard Time (EST) which is the first Sunday in November until the second Sunday in March. Homes with even numbered addresses can water on Thursdays and Sundays during DST and on Sundays only during EST. Nonresidential properties can water on Tuesdays and Fridays during DST and on Tuesdays only during EST. Water only when needed and not between 10am and 4pm and for no more than one hour per zone. These restrictions apply to private wells, ground or surface water, and water

from public and private utilities. There are various local governments that have adopted local ordinances incorporating the provisions of SJRWMD's rule. The County, nor its municipalities, are listed as choosing to participate in a local ordinance program at this time. The County follows the Water Management District's protocols for water shortage conditions when that exists in the County. Local ordinances may be beneficial for the County to explore in order to show support for water conservation practices during all times of the year. SJRWMD's watering restrictions apply regardless of whether a local government has adopted an ordinance.

On a larger water conservation scale, SJRWMD offers an abandoned artesian well plugging program. This program is designed to assist well owners in complying with their permits and Florida laws that require well owners to control discharges from artesian wells by properly plugging the wells and otherwise limiting the flow to only the amount of water needed for intended use. An artesian well is a well that has been drilled into an aquifer in a location where the underground pressure is great enough for the water to rise inside the well. In some cases, the water is under enough pressure to rise from the aquifer to the land's surface without using a pump. These wells can potentially waste millions of gallons of water per day and may also act as a conduit for sources of contaminants to enter the aquifer. Free-flowing wells within the Lagoon basin contribute to sheet-flowing water over the land which is capable of transporting nutrients into the Lagoon and its tributaries. Properly abandoning a well helps prevent these impacts from occurring. Costs to abandon a well can vary depending on the size and depth of the well and the plugging method required, but it generally costs several thousand dollars to properly abandon a well.

The County participates in the well capping cost share program with SJRWMD. This program is a 50-50 cost share between the County and SJRWMD. Between 2017 and 2020, the County participated in the plugging of 11 wells within the Lagoon basin in coordination with SJRWMD. This saved approximately 2,229 million gallons per year of water wasted from free-flowing wells in total. This also saved additional nitrogen and phosphorus concentrations from reaching the Lagoon through runoff of these wells. The County is currently working with the Florida Department of Environmental Protection (FDEP) on a way to recognize the County's well plugging efforts as part of its goal at meeting the Total Maximum Daily Load (TMDL) reductions required under the FDEP's Central Indian River Lagoon Basin Management Action Plan. The County should continue to play an active role in this cost share program to save millions of gallons of groundwater from being wasted, and their downstream impacts to the Lagoon and its watershed.

The actions including Senate Bill 64-Reclaimed Water, the Central Indian River Lagoon Basin Management Action Plan, and the Clean Waterways Act provide additional restrictions on nutrient discharge and discharge of treated wastewater to the Lagoon and were directed to further aid in the restoration of the Lagoon and other waterbodies in the State of Florida. Many people don't think of water conservation from the wastewater perspective, but every drop of water that goes down the drain needs to be treated and ultimately discharged somewhere. Currently, treated wastewater from the County's regional Advanced Wastewater Treatment Facilities discharges into the County's reclaimed water system, a treatment wetland, or rapid infiltration basins (RIBs). Septic to sewer projects and increasing population in the County translates to increased wastewater flows, while restrictions on discharges will further tax the existing wastewater infrastructure and require new alternatives. Wastewater discharges to the Lagoon must be eliminated by 2032; however, other options not directly discharging to the Lagoon may

still impact the Lagoon by increased nutrient flows via groundwater. Options for additional treated wastewater disposal include rapid infiltration and absorption fields, restricted and public access irrigation, potable reuse, and deep well injection. Water conservation will play a critical role in reducing the cost of these infrastructure projects and reducing the impacts from water disposal on the Lagoon.

Water consumption, and the associated conservation efforts are extremely important to the long-term health of the Lagoon. Freshwater supplies contribute to the Lagoon's hydrology, and the more water homeowners and regional projects save, the better for sustaining future needs and reduced impacts on the Lagoon. As technologies change and conservation practices become easier to implement, the more the residents, businesses and the County can do in their efforts in protecting these resources. The County should continue and enhance education on water conservation from small scale to large scale practices. The County should continue to promote the SJRWMD water restrictions and educate the residents and businesses within the County on proper practices specific to the time of year. The County could also consider creating incentive programs for homeowners to convert to water saving practices in their homes. Individual water consumption is often overlooked in the health of the Lagoon, but wasting this resource can have untold consequences to the Lagoon's present and future health.

## **5. Sustainability and Resiliency (Part 2)**

Sustainability and resiliency are terms often misunderstood as buzz-words used throughout the world today. In the context of the Lagoon, sustainable can be defined as the ability of the Lagoon to survive in the future, environmentally, socially, and economically. Resilience is defined as the ability of the Lagoon to prepare for threats, absorb impacts, recover and adapt following persistent stress or a disruptive event (Science of the Environment, February 2018). Together, these terms are used in the creation of proactive approaches to ensure the long-term future of the Lagoon. Sustainable and resilient actions can occur on a large scale, regional scale, or on a homeowner-level scale. The Lagoon is a valuable financial, ecological, and recreational asset, and benefits the County receives from it are far more than its mere presence as an estuary in our backyard.

According to the Treasure Coast and East Central Florida Regional Planning Council's 2016 Indian River Lagoon Economic Valuation Update Report, the economic value of the Lagoon on a Lagoon-wide scale in 2016 was estimated at \$7.6 billion annually with a return of \$33 to every \$1 invested. If restoration does not occur within the next decade, it is estimated that 4 billion dollars' worth of damage will occur to the ecosystem. As mentioned in the previous update, the costs of proactive projects to improve the Lagoon and improvements to existing projects to make them resilient and sustainable into the future will be large, but the returns on investment are proven when it comes to the economic benefits of the Lagoon. Grants may help offset some of these costs, but commitment of all the stakeholders to the Lagoon is needed to enact the changes needed to ensure the Lagoon's survival.

Management of the Lagoon's resources is being impacted by climate stressors felt throughout the Lagoon region today and will continue into the future. These stressors include changes in annual air and water temperatures, precipitation patterns, intensity of storms, ocean acidification, and sea level rise. Identifying these risks associated with climate change can help improve resiliency of communities into the future. The United States Environmental Protection Agency (USEPA) Climate Ready Estuaries Program

has identified 10 steps to help programs identify, analyze, prioritize, and reduce their climate risks. These steps fall under one of two activity categories: risk-based vulnerability assessment or action plan – determining a course of action. The 10 steps are:

- Risk-based vulnerability assessment
  1. Communication and consultation
  2. Establishing the context for the vulnerability assessment
  3. Risk identification
  4. Risk analysis
  5. Risk evaluation: comparing risks
- Action plan
  6. Establishing the context for the action plan
  7. Risk evaluation: deciding on a course
  8. Finding and selecting adaptation actions
  9. Preparing and implementing an action plan
  10. Monitoring and review

This process identifies options. More detailed work will need to be done before any action is implemented. Once this has been completed, tracking the status of risks to the community will need to occur in order to proactively plan for actions and projects to help encourage the sustainability of the community.

The Indian River Lagoon National Estuary Program (IRLNEP) has completed a Vulnerability Assessment and Action Plan for the Lagoon basin. The Vulnerability Assessment identified reduction in water clarity, lowering of DO, and elevating Chlorophyll (a) as the objectives at greatest risk from climate stressors in the water column and biodiversity, seagrass, rare and other species, and fisheries as the greatest risk from climate stressors for natural resources.

Planning for a sustainable community is a complex process that involves numerous factors. The IRLNEP Comprehensive Conservation and Management Plan (CCMP) identifies eight critical factors for smart city initiatives:

1. Management and organization
2. Technology
3. Governance
4. Policy context
5. People and communities
6. Economy
7. Built infrastructure
8. Natural environment

These eight factors can be used to determine the preparedness of communities in the face of a sustainability and resiliency decisions into the future. These factors, along with others, such as a changing climate and increased populations, will impact the success of communities into new decades with new challenges. The Natural Resources Defense Council defines smart cities in the urban context as more

efficient, sustainable, equitable, and livable cities. This document estimated that the County will grow by 17.6% between 2018 and 2030. Planning for sustainability and resiliency must take into account needs required for future growth and the potential impacts to surface water quality this growth might affect.

Long-term success in the face of sustainability and resiliency requires the County to have the abilities to adapt, as well as proactively plan for the protection of the resources the Lagoon provides and the Lagoon itself. The Lagoon is an economic benefit, and moneys put towards the restoration of the ecosystem will be beneficial to the County's economy. In order to maximize investment, infrastructure projects, designed to last 20 or 50 years and beyond, will need to address future conditions of the system and impacts to the Lagoon under those conditions in their design and implementation. These approaches may need to be applied retroactively to older systems, as well as factored into new systems throughout the County. The County would benefit from completing the Climate Ready Estuaries 10 step program to understand future challenges and needs that need to be addressed and timescales appropriate to ensure resiliency and the continued sustainability of restorative measures. The County would also benefit from considering the applicability of the eight factors for smart city initiatives to properly tackle future growth and change. Resiliency is a complex and delicate balance to meet the future needs of the County with the health of the Lagoon, but with restoration, changing technologies, and proactive planning, it and sustainability of these future resilient initiatives can be met and carried over to future generations.