

Nitrogen and Phosphorus in Reuse and Potable Water

Position Paper by Sam Young

The intent of this paper is informational based on City provided data to identify point source contamination of primarily Nitrogen, but note since Irma we have seen a dramatic rise in Phosphorus as well. Much of the content is directed towards Nitrogen since this particular nutrient has exceeded FDEP standards for two years in row, which now places Marco Island as an impaired waterbody.

The current state of excess nutrients has impaired our water quality and increased turbidity (cloudiness from suspended algae). This has also killed off what sea grass meadows we used to have in our bays and canals. The native sea grass is a nursery for small fish and crustaceans and a food source for manatees. A healthy water body will allow sea grass to grow and flourish as has been witnessed and calculated by the Tampa Bay Project, the gold standard for reviving a once lifeless marine ecosystem. Attaining a water quality that is clean and clear enough to allow seagrass to grow and flourish should be our litmus test as to success in mitigating our current impairment for nutrients. This viewpoint is shared with most all marine environmental science.

So what about Nitrogen? Nitrogen became notable many years ago with what is called "Blue Baby" syndrome. Blue baby syndrome is a condition some babies are born with or develop early in life. It's characterized by an overall skin color with a blue or purple tinge, called [cyanosis](#). Does this lend itself to making a case our canals have too much nitrogen? I don't think so.

This bluish appearance is most noticeable where the skin is thin, such as the lips, earlobes, and nail beds. Blue baby syndrome, while not common, can occur due to several congenital (meaning present at birth) heart defects or environmental or genetic factors. It is very toxic is high concentration to both adults, children and infants.

The once rare occurrences of Red Tide have become much more prevalent and the last place in Florida to have red tide this winter was just south of Marco Island. Red Tide is a naturally occurring organism that lives on excessive nutrients. It can flourish just on higher than allowable Nitrogen or Phosphorous. Red Tide has been the main cause for the drastic fish, birds, dolphin and manatee kills in the Gulf of Mexico including around Marco Island.

"Nitrate is a form of Nitrogen found in most fertilizers, manure, and liquid waste discharged from septic tanks. Natural bacteria in soil can convert available atmospheric nitrogen into

nitrate. Rain or irrigation water can carry nitrate down through the soil into groundwater. Your drinking water may contain nitrate if your well draws from this groundwater.

Nitrate is an acute contaminant. That means one exposure can affect a person's health.” Washington State Department of Health.

There is a great deal of information available on the Internet, below is just one link from the Florida Department of Health that you may find of interest, and I would urge you look even further on your own. <http://www.floridahealth.gov/environmental-health/drinking-water/nitrates.html>

Recognizing this health threat motivated the FDEP to set a standard to eliminate Blue Baby Syndrome by lowering the allowable Total Nitrogen to 10 mg/L for both potable and non-potable water. Still high in my personal opinion as compared to allowable levels in our waterways of 0.3 mg/L.

So how does this relate to Marco Island? The following table illustrates the amounts of pure Nitrogen and Phosphorous released onto our island. The Calculations were done by Professional Engineer, Mr. Dave Rasmussen, a Marco resident.

2018 Marco City Water Usage and Impacts on Nitrogen and Phosphorous From Irrigation

Total Potable Water From Marco Utility-Gallons	3,000,000,000
Water Returned to Utility as Sewage	729,000,000
Potable (Drinking Water) Disposed of On Land	2,271,000,000
Sewage Effluent Sold as Reuse Water-Gallons	729,000,000

Total Nitrogen Mg/Liter	12.37	75,298	Total Pounds Spread on Ground From Reuse
Total Phosphorus Mg/Liter	3.71	22,570	Total Pounds Spread on Ground From Reuse

Potable Water Spread on Ground Gallons	2,271,000,000
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Total Nitrogen Mg/Liter	0.7	13,266	Total Pounds Spread on Ground From Potable
Total Phosphorous Mg/Liter	0.75	14,214	Total Pounds Spread on Ground From Potable

Grand Totals Spread on Ground From All Water Sources-Pounds

Nitrogen	88,564 pounds	Before Any Fertilizer is Added!
Phosphorous	36,783 pounds	

The totals are staggeringly high! Just to put it into common terms, a 20 lb. bag of 10-0-10 fertilizer (First number represents Nitrogen, second number represents Phosphorus, and the third number represents Potassium) the **85,564** pounds produced in total nitrogen spread onto our island by Reuse and Potable water is equivalent to **42,782** 20lb bags of 10-0-10 fertilizer.

As mentioned, ZERO Phosphorus is allowed in Fertilizer, yet we manage to spread **36,783**lbs through irrigation alone. I would also note that since Irma, our water test data shows very elevated levels of Phosphorous just looking at last November's test data. So, we have Phosphorous compounding our already high Nitrogen numbers. Ridding the island of Phosphorous is far more problematic requiring dredging of years of contaminated muck from the carbon loading in canals where tidal flushing is very poor.

But ridding our island of most of the manmade and intentionally applied Nitrogen, is doable.

So where does it all go? The attached map dated 6-30-2015 depicts where all the Reuse, highlighted in pink, (Non-Potable) irrigation water goes. Primarily the beach side Condos, hotels, Golf Courses, medians and City property. Reuse water is used to irrigate the median from the Jolley Bridge and north to Mainsail Dr., which borders Rookery Bay. I have often seen, as many of you have, the effect of wind on irrigation; it sprays all over the roadways where the rain then washes the deposits into curbside drains connected to our waterways. Many golf courses border our waterways. HOA's from Condo Associations have free access to reuse water and determine how much and how often it is used. The same can be said of the Golf Courses. What is our City's irrigation schedule for City owned medians and swales, and is it appropriate? Single Family Homeowners irrigate as well, and we do have some guidelines but are they enforced or are the homeowners aware of what is the proper amount of irrigation should take place?

What we do know is that the City's Water and Sewer Department has three types of wells; deep injection, monitoring wells that verify leakage from Deep injection wells, and "ASR" wells that are reserve wells to access potable water when needed in dry periods. Last year, The City pumped 63 million gallons of reuse water into the deep injection wells. So, can "Additional water treatment can turn all the high nutrient reuse into water matching potable or cleaner waterway specifications?" The answer from the City stated they "agreed." So we'll leave it to City staff to determine what can be done to mitigate Nitrogen and Phosphorous in our current reuse water. Hopefully, we'll have some answers at the March 18th Water Quality Workshop.

Add to the equation the use of Fertilizer applied by landscapers at all residential and city owned property on top of this nutrient rich water, with Reuse Water already being a high carrier of Nitrogen and Phosphorous. I would suggest areas using City provided Reuse Water, severely restrict or eliminate adding additional Fertilizer.

I am not a scientist on Best Management Practices's for managing the amount of potable and non-potable water. Therefore, we should defer to unbiased experts. It is my hope that this position paper offers up hard data on two problems that face our waterways; Nitrogen and Phosphorous. I would also hope that by partnering with the University of Florida, their experts can provide guidance as to how we can best manage all sources of nutrients placed on our island.

As pointed out nearly two years ago by Harry Phillips, Biologist of the City of Cape Coral and manager of Cape Coral's "Adopt a Canal" program, "what makes your lawn green, also makes your canal water green."