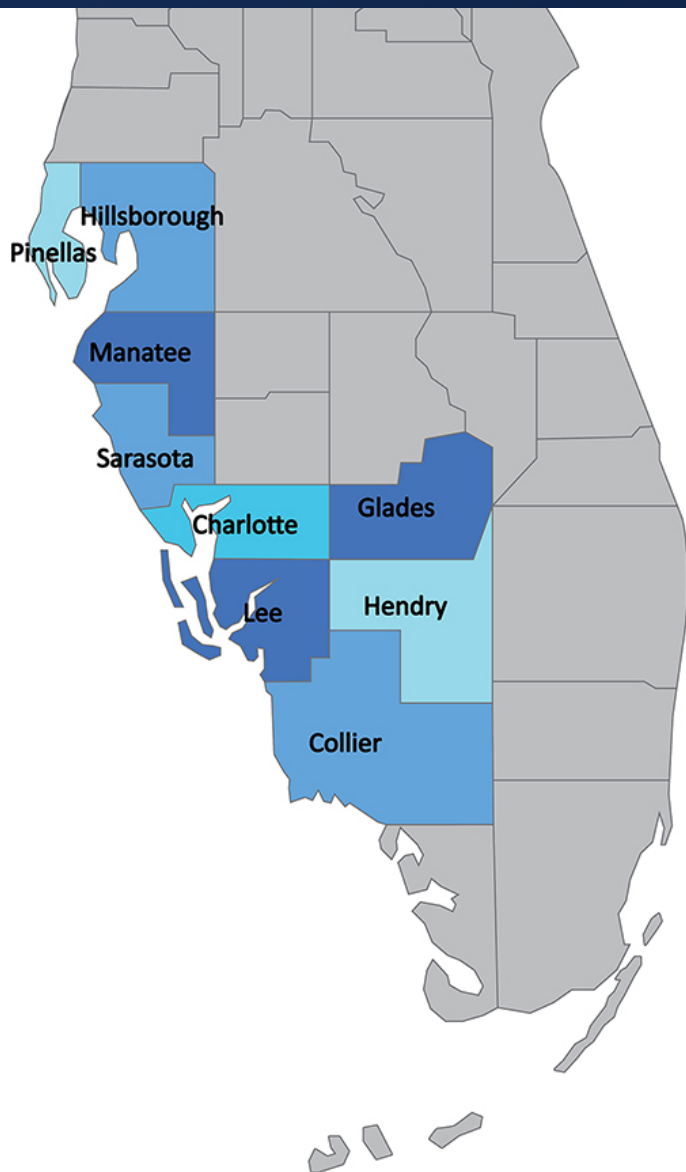


Water Quality Impairment Status and Trends of Southwest Florida Counties

2018-2020



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March 2021



INTRODUCTION

Understanding factors contributing to water quality impairment in Florida is important for determining pollution sources and eventual planning for restoration.

Florida waterbodies are assessed for impairment with respect to their designated uses among five classification categories. The most common classification of Florida surface waters is Class III. The designated uses of Class III waters are “Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife”. The other four waterbody classifications and their designated uses are listed at the Florida Department of Environmental Protection (FDEP) Environmental Assessment and Restoration website.¹

Water quality standards used to evaluate whether a waterbody is attaining its designated use are codified in F.A.C. Chapter 62-302.² The process under which water quality parameters (e.g., copper, nutrients, dissolved oxygen) are defined as impaired, are defined in F.A.C. Chapter 62-303³; for example, 62-303 describes how frequently can a parameter exceed the impairment criteria and over what period of time.

FDEP assesses its comprehensive water quality database annually as new monitoring data become available. Water quality data from each of the state’s five basin groups are then assessed on a staggered five-year cycle. Starting in 2021 FDEP will be shifting to a biennial review of all basin groups, which will result in the entire state being assessed every two years. This change in the statewide assessment cycle should create a more inclusive and timelier annual comprehensive list of verified impairments.

The purpose of this assessment is to summarize water quality impairment in nine southwest Florida counties between 2018 and 2020 using consistent FDEP assessment criteria gathered from FDEP’s annual comprehensive verified list of impaired waters. Annual changes in both the number of waterbodies or waterbody segments impaired and their associated water quality parameters, are important for evaluating restoration programs or projects.

The counties included are Collier, Lee, Charlotte, Sarasota, Manatee, Hillsborough, Pinellas, Hendry and Glades. Assessing water quality impairment on a geo-political basis, such as a county, is relevant in that most state mandated restoration programs, such as Basin Management Action Plans, are implemented primarily by local government stakeholders.

This impairment assessment summary also represents a baseline that can be easily updated from annual FDEP comprehensive verified lists in association with evaluation criteria, such as population growth, that contribute to impairment as presented here. The summary may also provide a basis for evaluating restoration effectiveness by understanding net change in impairment through time. A relatively narrow initial period of record was chosen that would include the latest changes in assessment criteria for added inter-year comparability.

¹ <https://floridadep.gov/dear/water-quality-standards/content/surface-water-quality-standards-classes-uses-criteria>

² <https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-302>

³ <https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-303>

The county summaries presented here should be considered conservative in that some waterbodies or waterbody segments referred to as waterbody ID units or WBIDs may be removed (delisted) annually from the list of verified impaired waters for various reasons. Examples for delisting a WBID as impaired may stem from monitoring data that indicates the waterbody is no longer impaired or there is lack of corroborating causality information to maintain it on the verified impaired list. Such “delisting” examples may be reassessed as verified impaired as more information is gathered through monitoring for those waters not attaining standards. When a WBID that is verified impaired and a restoration program such as a Total Maximum Daily Load (TMDL) is adopted to restore the designated use, that WBID remains impaired but shifts its assessment status to indicate a restoration program has been adopted and attainment of designated use is pending.

ASSESSMENT REGION

There are demographic and spatial component differences among the nine counties included in this assessment, however, there are also similarities. As in much of Florida, each of the seven coastal counties selected here have urban land use as a significant element of the landscape. The coastal counties share the same meteorological conditions with respect to stormwater management (Figure 1).

As another similarity, the coastal counties excluding Pinellas, have westerly flowing rivers that become estuaries that discharge to the Gulf of Mexico and in turn are tidally influenced. Westerly flowing rivers that transverse the coastal counties likely also convey pollutants, from an upstream county to WBIDs assessed in a downstream coastal county. However, in Lee County as one example, Caloosahatchee estuary basin stakeholders are only responsible for restoring nutrient pollution loading identified in the Caloosahatchee estuary FDEP Basin Management Action Plan, almost entirely within Lee County.

Another commonality of the nine counties is that they are largely assessed within FDEP Basin Groups 1-3, enabling more consistent comparability with respect to the FDEP basin group assessment cycle encompassing the 2018-2020 period of record used here. The county with the smallest land area, Pinellas, is the exception where about half the WBIDs are in the FDEP Basin 5 group. In Hendry and

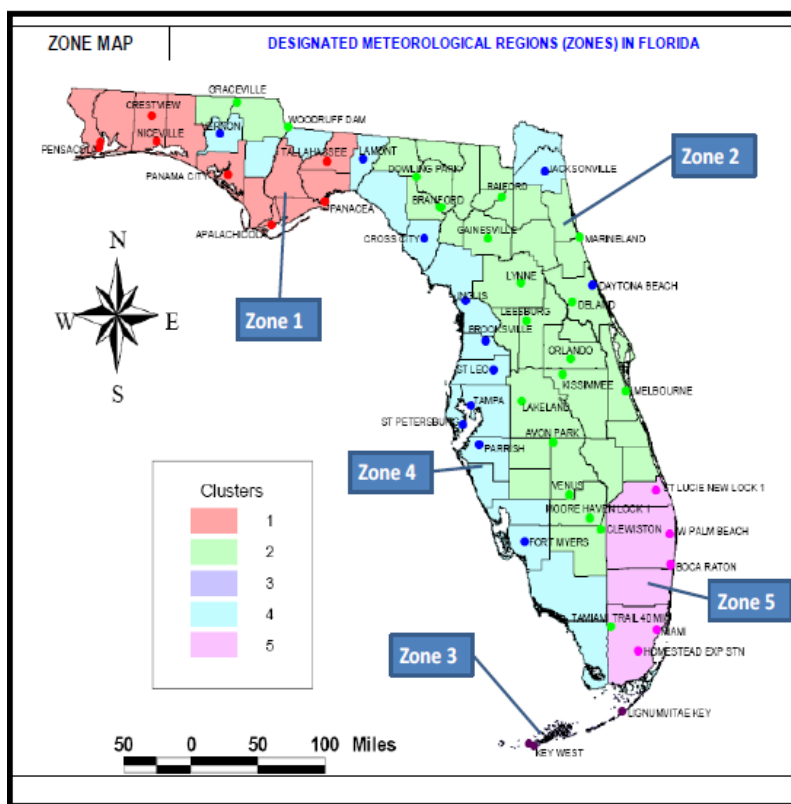


Figure 1. Meteorological zones relevant to stormwater management in Florida.⁴

⁴ <https://fdotresearch.com/2019/07/15/better-together-stormwater-facilities-target-more-than-roadway-runoff/>

Glades counties relatively few WBIDs are identified in FDEP Basin 4 and there were no new impairments added to the Groups 4 or 5 WBIDS within the nine-county group since the 6-3-2020 FDEP comprehensive verified impairments list issued on 6-3-20.

Two inland or non-coastal counties, Hendry and Glades, were selected where land use is dominated by agriculture, providing a comparative contrast to most of the coastal counties dominated by urbanization. Also, Hendry and Glades counties are included as they are within the project area of the Calusa Waterkeeper.

DATA SOURCES

The actual impairment data summarized here were derived from the FDEP statewide comprehensive list of verified impairments issued on 8-1-18, 11-15-19 and 6-3-20. For county population estimates we used the mid-range annual estimate or projection from the University of Florida Bureau of Economic and Business Research (BEBR).⁵

County land area was sourced from USA.com.⁶

Individual county land use information was derived from NOAA's Coastal Change Analysis Program (C-CAP).⁷ NOAA's C-CAP analysis platform enabled consistent methods of intercounty comparisons of net change in area of urban land use and impervious cover between 2001 and 2016. The C-CAP also provided the area in agriculture per county as of 2016. This land use information is relevant to factors contributing to water quality impairment and was presented as the most current and consistently determined land use background information for the counties selected in this summary.

COUNTY DEMOGRAPHICS AND LAND AREA

Among the nine counties assessed, population is largely independent of county land area (Figures 2,3 and 5). As an example, Collier County has the largest land area but the lowest population density of the seven coastal counties, as a result of federal land purchases for conservation (e.g., Big Cypress National Preserve) as one example. Conversely Pinellas County has the smallest land area of the nine counties yet the second highest population and highest population density overall (Figures 2 and 3).

Pinellas County is very urbanized and ranks last among the nine counties with respect to annual population increase since 2018, likely a result of nearing "buildout" (Figure 4). In contrast, Lee, Manatee, Collier and Hillsborough counties ranked highest in the rate of population increase respectively since 2018, representing a higher probability for future increased water quality impairment.⁸ Individual county policies on growth management vary but rapidly increasing impervious areas resulting from high growth rates accelerate stormwater runoff, known to contribute to water

⁵ <https://www.bibr.ufl.edu/population/data>

⁶ <http://www.usa.com/rank/florida-state--land-area--county-rank.htm>

⁷ <https://coast.noaa.gov/digitalcoast/tools/lca.html>

⁸ Liyanage, C.P. and Yamada, K. 2017. Impact of Population Growth on the Water Quality of Natural Water Bodies. Sustainability 2017, 9, 1405; doi:10.3390/su9081405

quality degradation.⁹ Growth related factors as discussed here, become important considerations for understanding the degree and rate of water quality impairment.

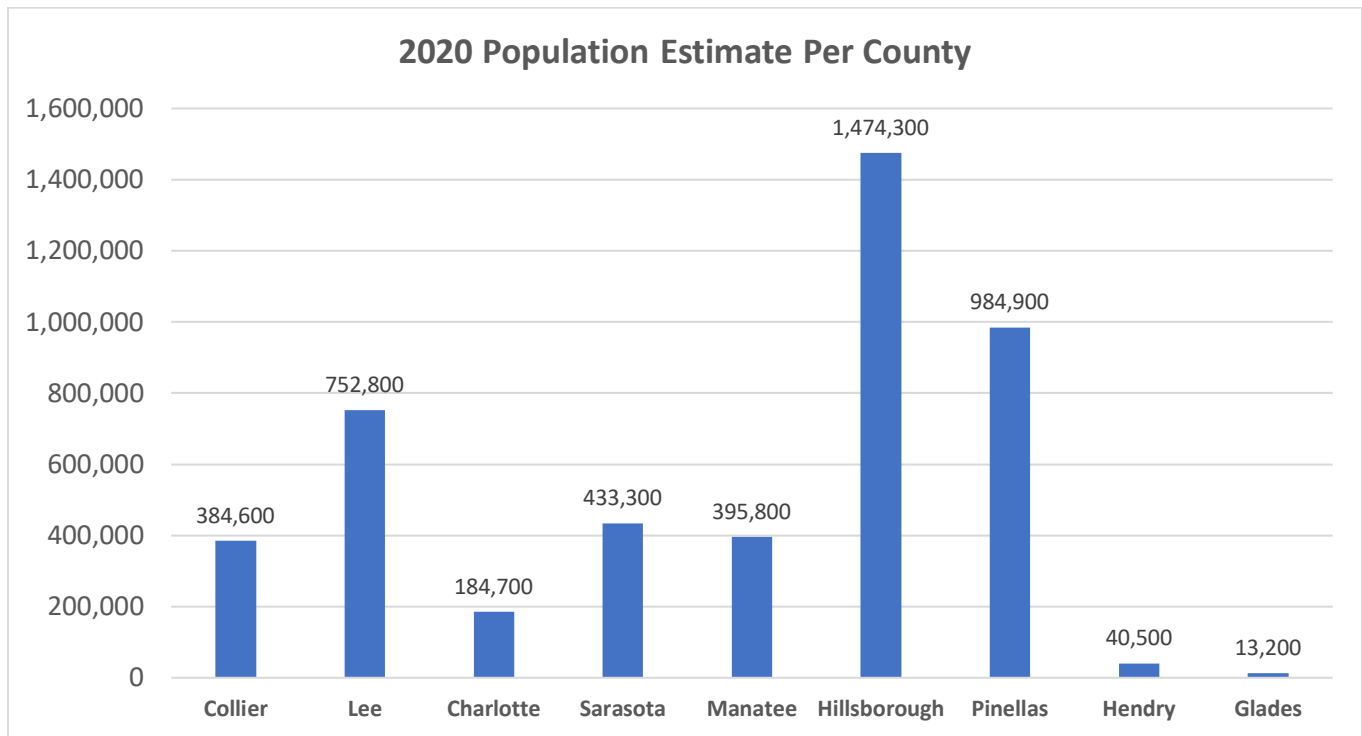


Figure 2. 2020 county population estimates (BEBR).

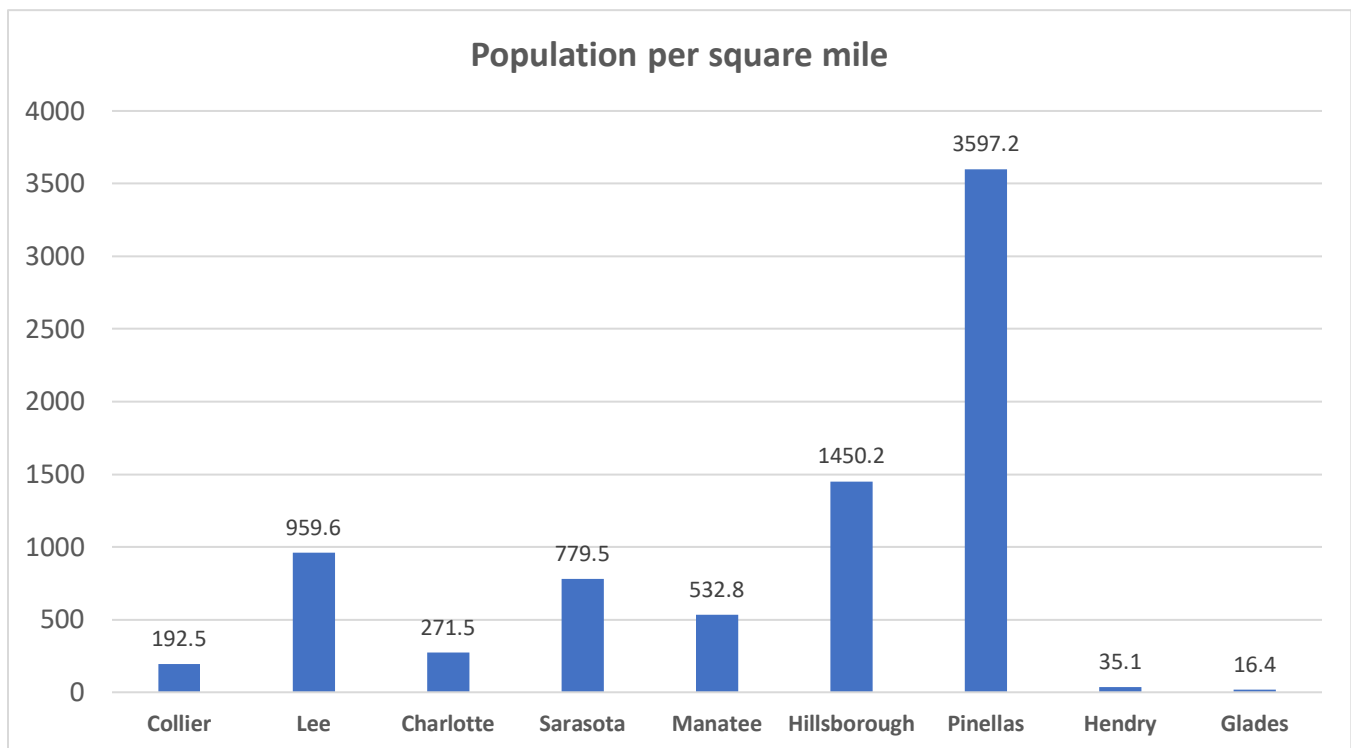


Figure 3. 2020 county population estimates per square mile (BEBR).

⁹ https://www3.epa.gov/npdes/pubs/nps_urban-facts_final.pdf

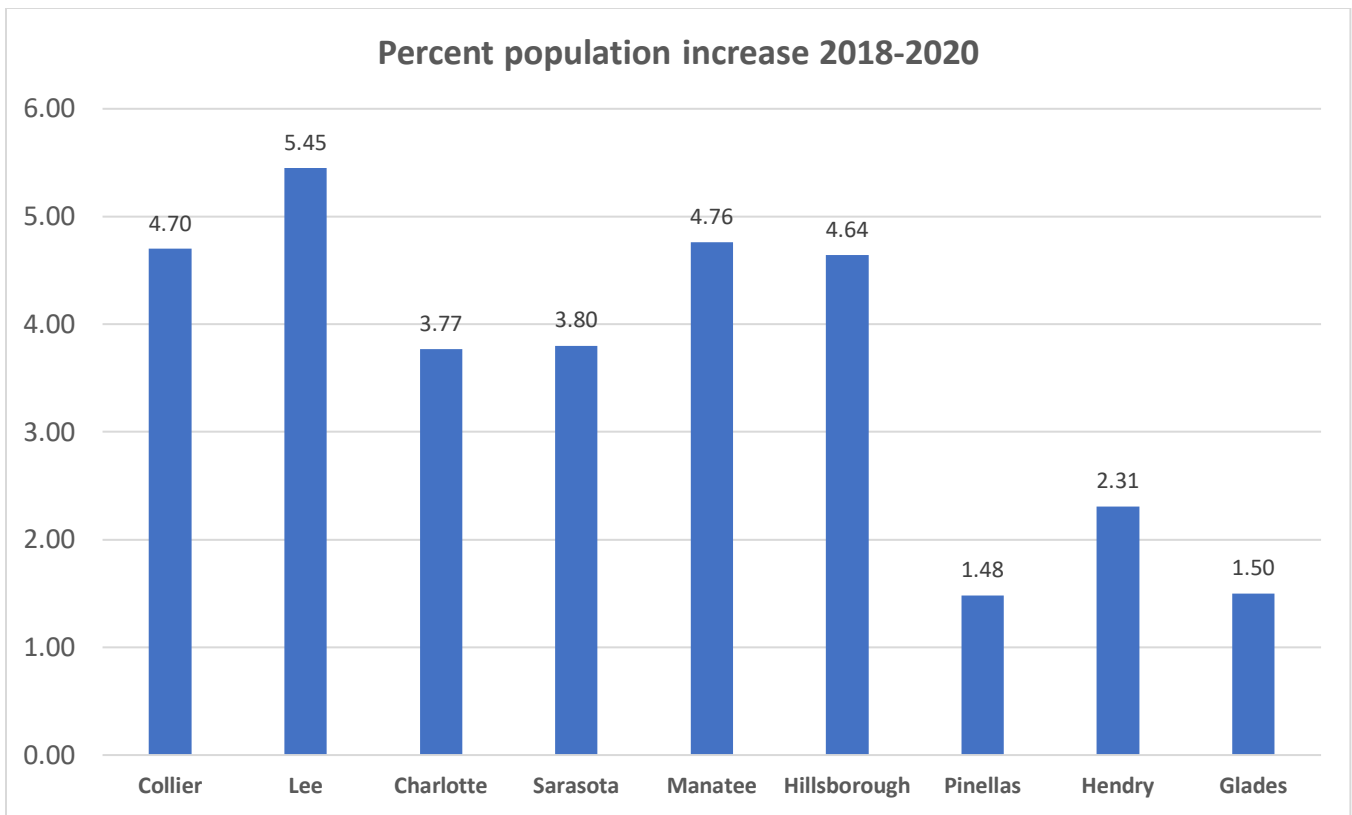


Figure 4. Percent population increase from 2018 to 2020 (BEBR).

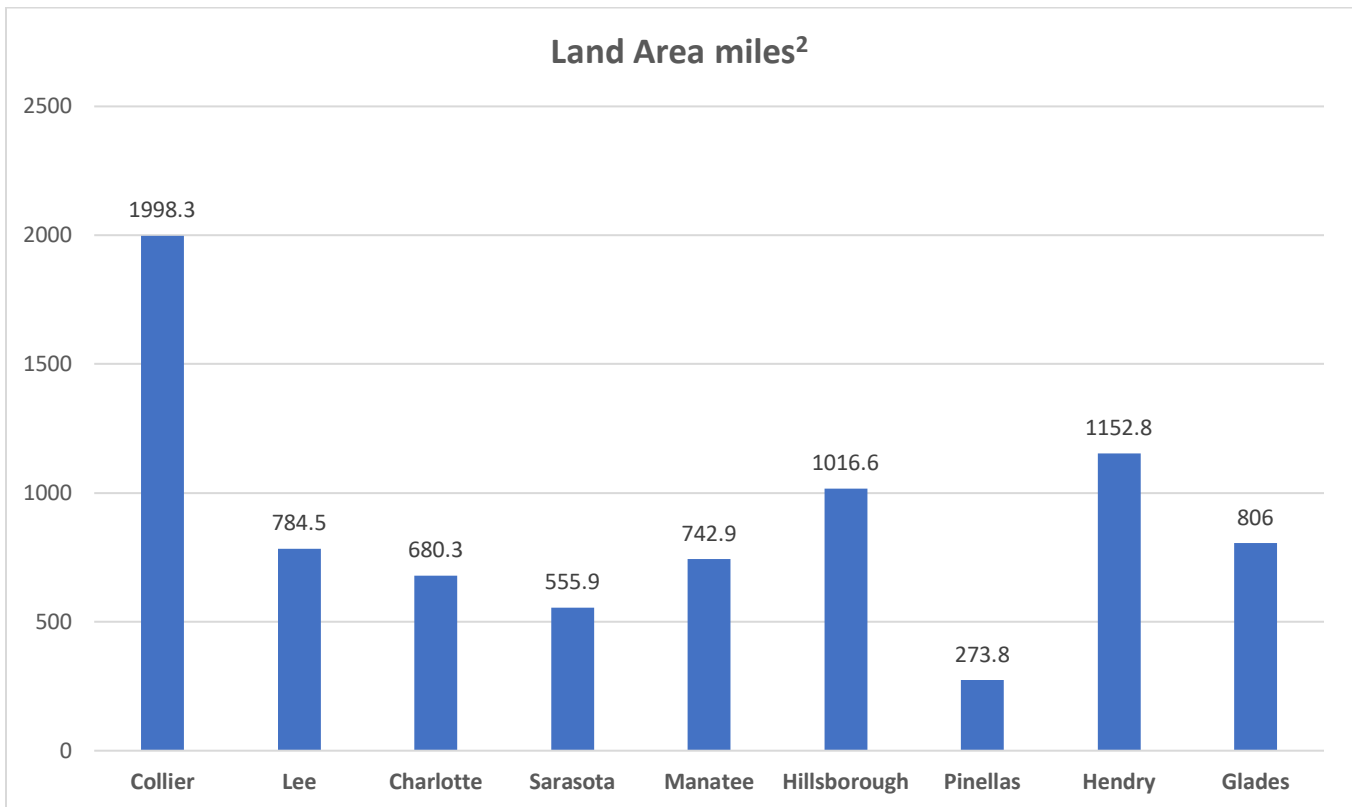


Figure 5. County land area.

ELEMENTS DEFINING OR CONTRIBUTING TO WATER QUALITY IMPAIRMENT

Average total unique impairments 2018-2020

Unique impairments averaged from each of the three FDEP verified impairment assessments (2018, 2019, 2020) establish a baseline for tracking cumulative change as a running average within and between counties as subsequent statewide verified impairment assessments become available (Figure 6). Unique impairments represent the number of rows on the FDEP comprehensive verified list that can be sorted by county outlining specific water quality impairments per parameter and associated WBID (waterbody or segment). A WBID can have multiple parameters verified as impaired. This metric has less utility for comparison between counties as it does not use comparisons on a proportional basis that considers variability between counties such as land use type or number of WBIDs (waterbodies or waterbody segments) as examples.

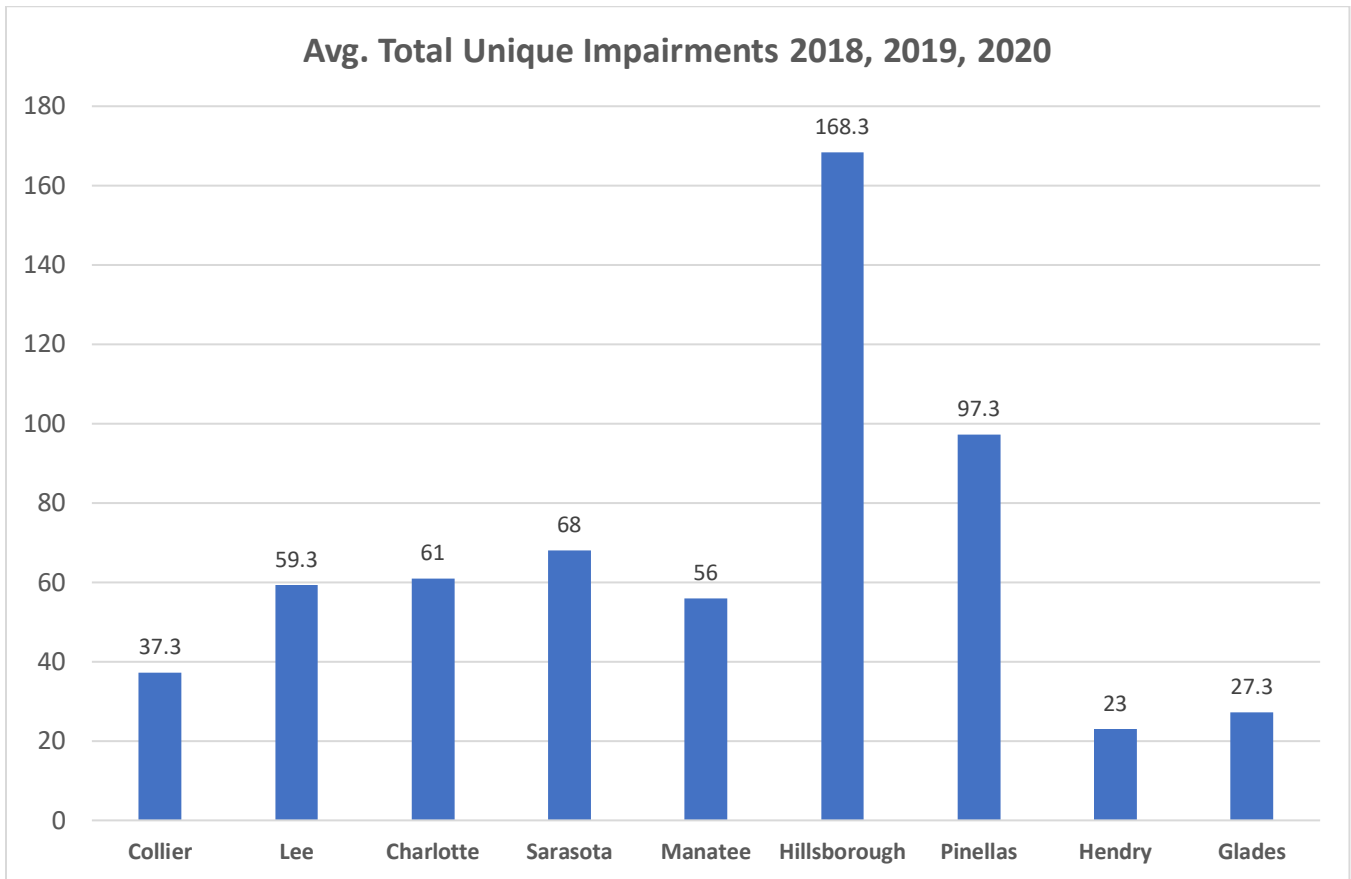


Figure 6. Average of total unique impairments.

Percent of total WBIDs impaired

Percent of total WBIDs within a county having an impairment is derived from the 6-3-20 FDEP comprehensive verified list of impairments (Figure 7). Using a percent of all WBIDs impaired is a reasonably equitable and conservative way to compare impairment between counties as some WBIDs can have multiple impairments and for tracking future change. Glades County has the highest percentage of all WBIDs impaired and is dominated by agricultural land use, ranking second in the percent area in agriculture among the nine-county group (Figure 10). Hendry County had the highest percent area in agricultural land and ranked second in the percent of total WBIDs impaired. Hendry and Glades counties each have 31 WBIDs.

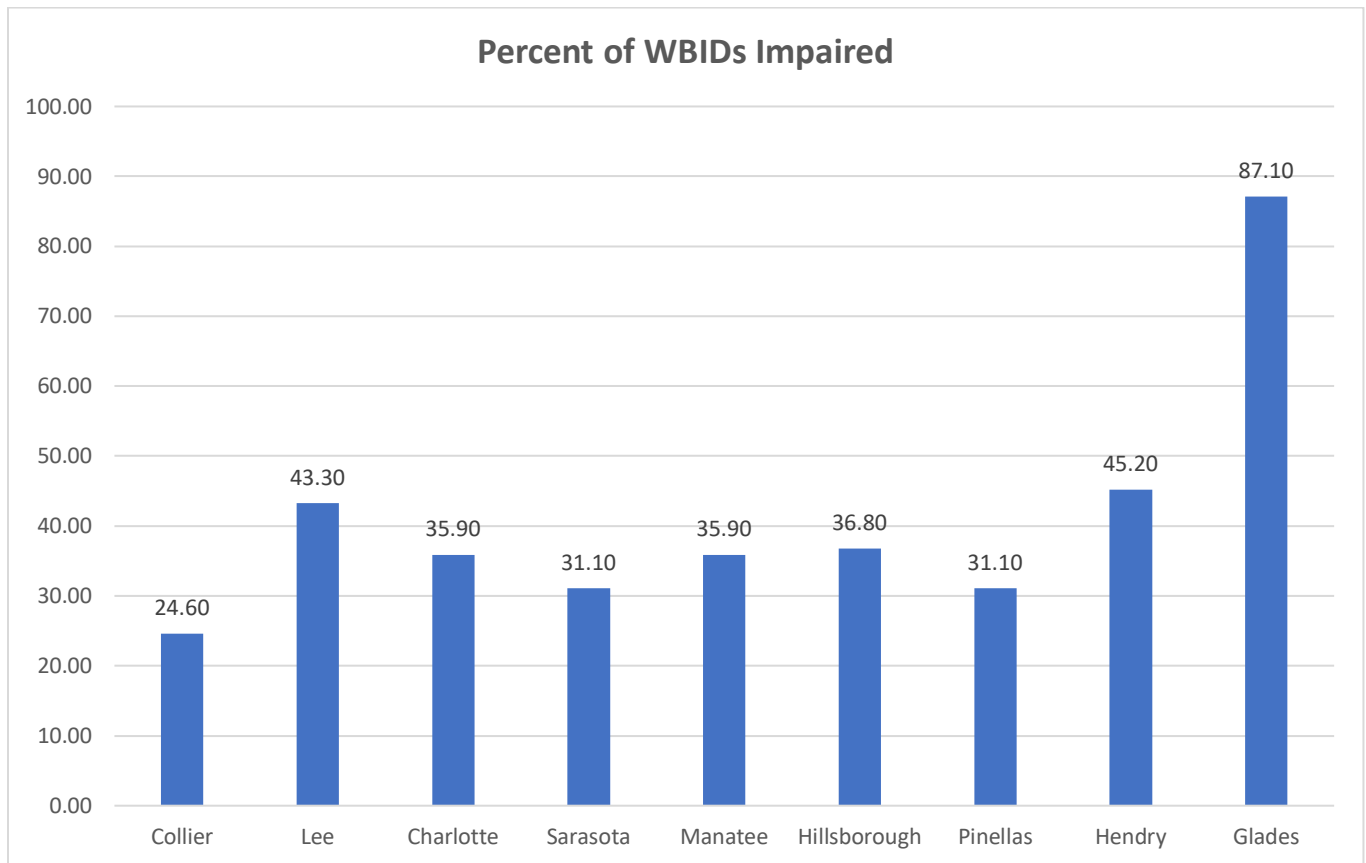


Figure 7. Percent of total WBIDs having a verified impairment as of 2020.

Percent change in total impairments 2018-2020

Comparing annual net change in total impairments is another important metric when evaluating annual change in the impairment rate between counties. Lee County ranked first in impairment rate increase between 2018 and 2020 followed by Collier and Manatee counties in second and third respectively (Figure 8). The same three counties, Lee, Collier and Manatee, also ranked as the top three counties with respect to the net change in population increase, 2018-2020 (Figure 4).

WBIDs in Hillsborough, Hendry and Glades counties had decreases in total impairments between the three annual assessments 2018-2020 (Figure 8).

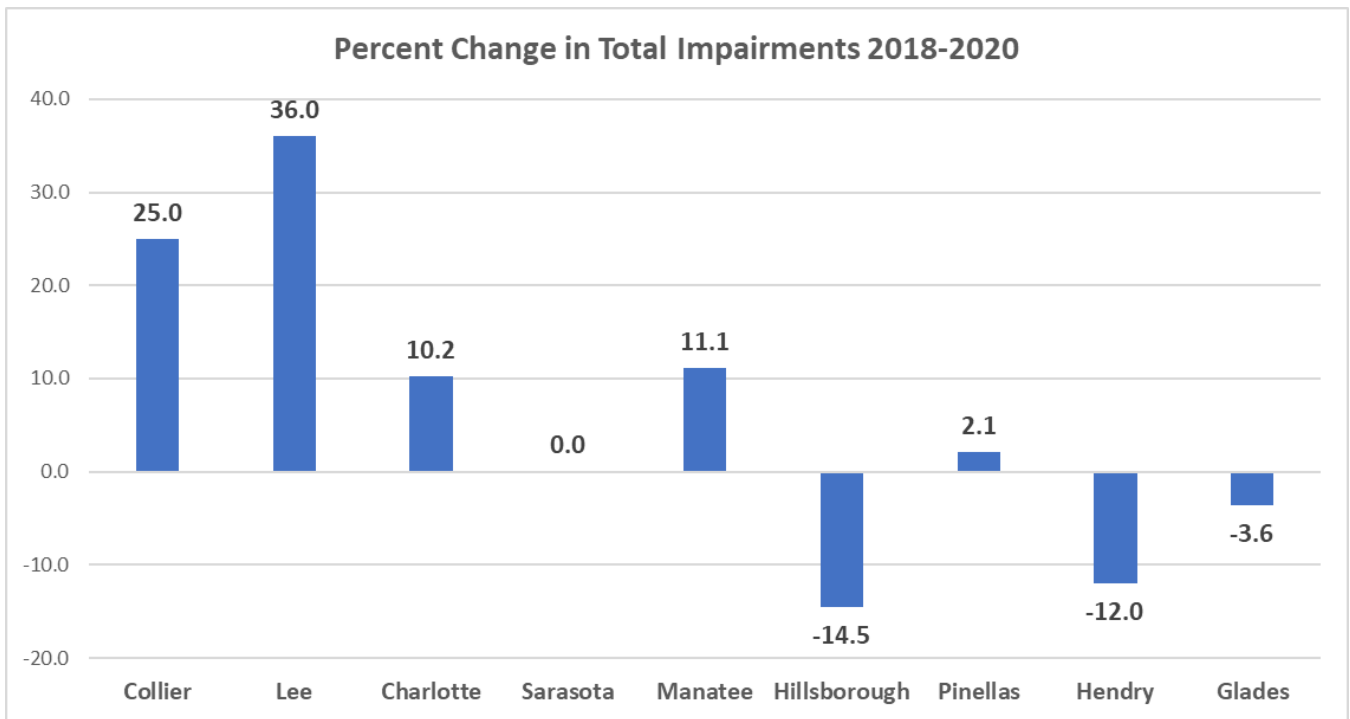


Figure 8. Percent change in total impairments 2018, 2019, 2020.

Percent increase in developed and impervious area 2001-2016

Two important parameters that contribute pollutants to receiving waters are urban development and impervious area associated with development.¹⁰ Impervious areas increase the rate and volume of stormwater runoff that deliver pollutants to receiving waters. The top three counties in percent increase in development were Manatee, Collier and Hillsborough with Lee as a close fourth (Figure 9). The top three counties in percent increase in impervious area were Manatee, Collier and Lee also among the top three counties with increasing number of verified impairments 2018-2020 (Figure 8) and percent population increase 2018-2020 (Figure 4).

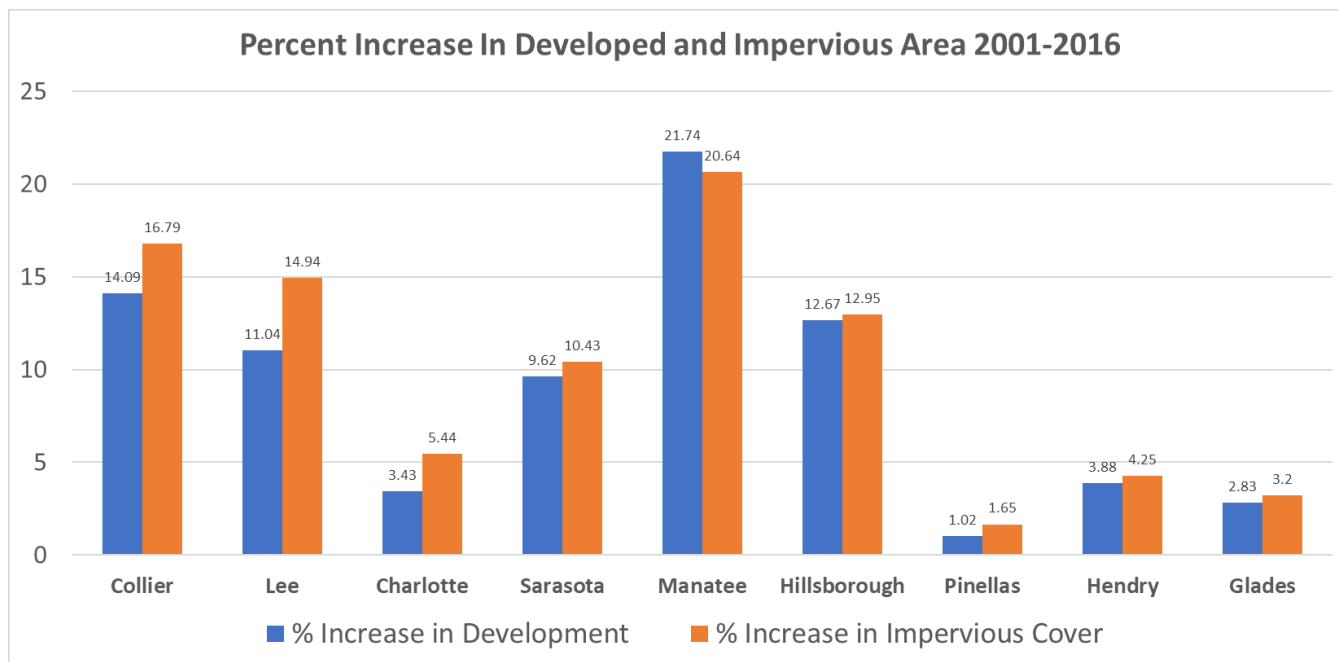


Figure 9. Percent increase in developed and impervious area 2001-2016.¹¹

¹⁰ [http://www.ijesi.org/papers/Vol\(4\)5/E045027031.pdf](http://www.ijesi.org/papers/Vol(4)5/E045027031.pdf)

¹¹ <https://coast.noaa.gov/digitalcoast/tools/lca.html>

Percent area in agriculture 2016

Agriculture is often the dominant source of nutrient pollution in many areas and to downstream counties as documented by estimates in Basin Management Action Plans (BMAPs) including the Everglades West Coast (Imperial River and Hendry Creek) and Caloosahatchee River BMAP. Nutrients are often targeted as the cause of low dissolved oxygen and become the BMAP proxy parameter for dissolved oxygen. The top three counties with the highest percent of area in agriculture were Hendry, Glades and Manatee counties (Figure 10). Glades County had the highest percentage of WBIDs impaired (Figure 7). Manatee ranked third with respect to percent increase in WBIDs impaired 2018-2020 (Figure 8), driven largely by fecal bacteria impairment (Figure 15) and first in development and impervious area 2001-2016 (Figure 9). Thus, Manatee County had a combination of impairment sources, with significant influence by both agriculture and urban development which contributed to its first-place rank in overall impairment status (Table 1). We used the most recent data available from the NOAA C-CAP (see Data Sources).

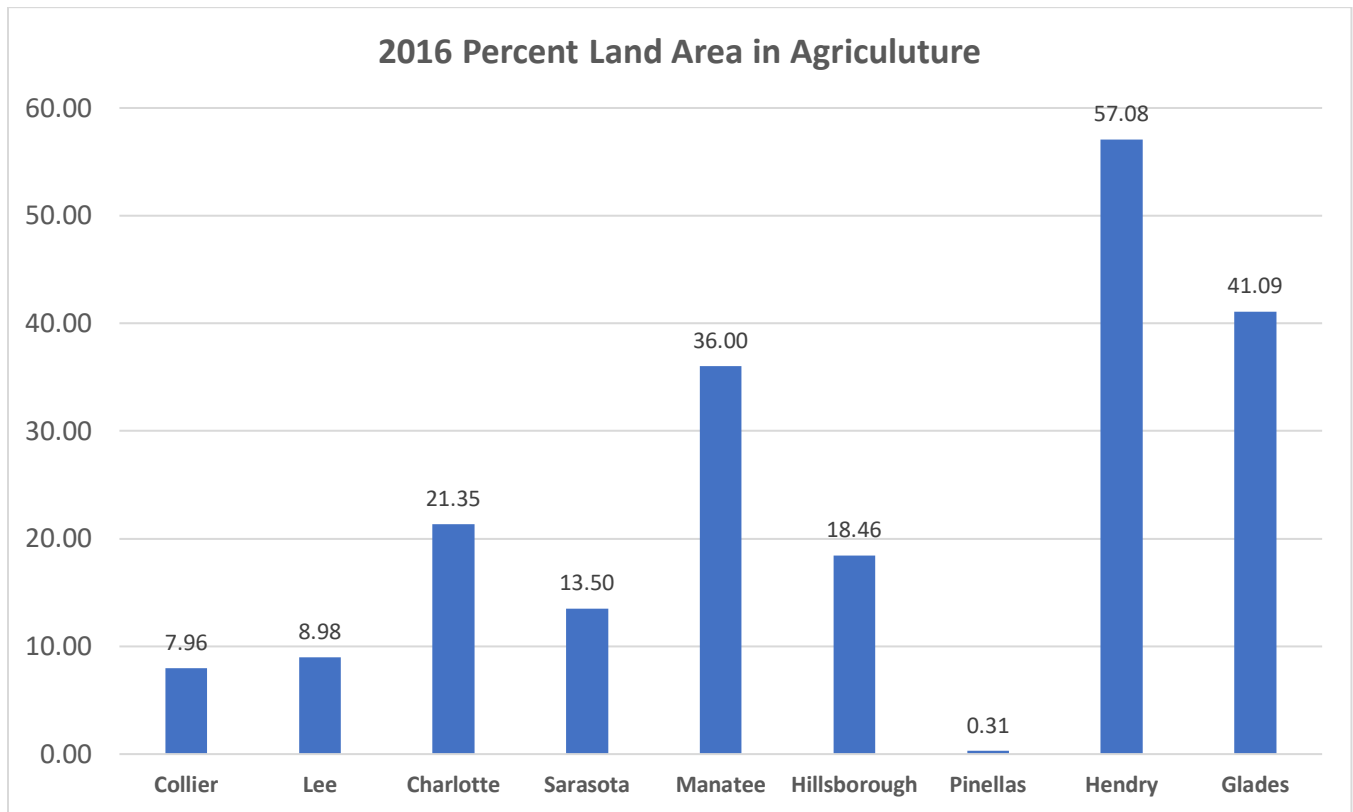


Figure 10. Percent area in agriculture per county.

ANNUAL CHANGE IN WATER QUALITY PARAMETERS IMPAIRED 2018-2020

The majority of parameters representing impaired waters within the nine-county region can be grouped into four categories including fecal bacteria, nutrients, metals and dissolved oxygen (DO). Nitrogen and phosphorus are the primary or macronutrients that define impairment. Fecal bacteria parameters include fecal coliform, E. coli and enterococci. FDEP stopped assessing for fecal coliform in 2017 and shifted to E. coli for predominantly freshwater and enterococci for predominantly marine waters. Representative metals that define impairment within the nine-county group include iron, copper and lead. A small minority of other impairments were grouped into the “other” category and, for example include chloride or biology (FDEP narrative criteria). Information sources that form the basis for water quality assessment related to water body type and criteria defining impairment are discussed in the introduction.

The following Figures 11-19 illustrate annual changes in the number of impairments within the parameter groups during the period 2018-2020 for each of the nine counties assessed.

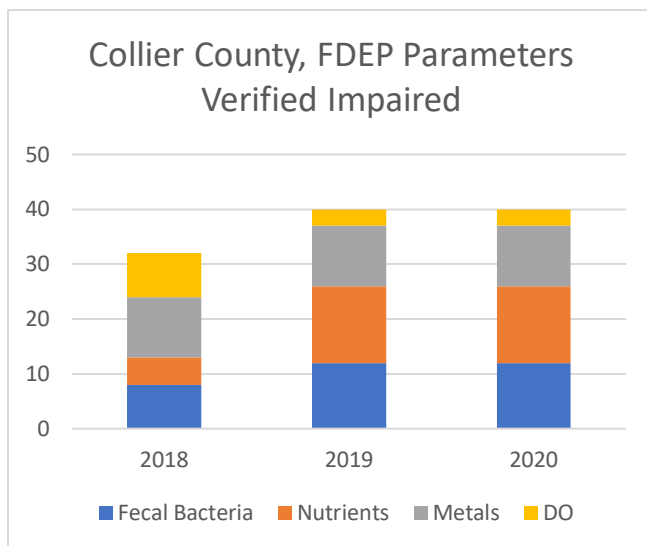


Figure 11. Collier County parameters verified impaired.

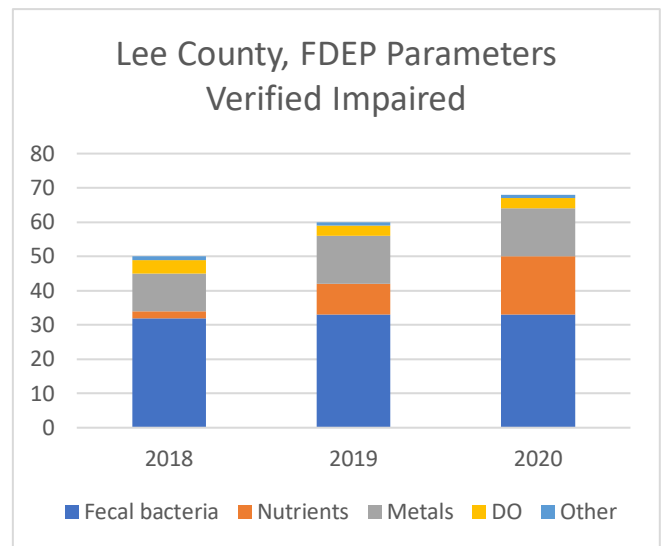


Figure 12. Lee County parameters verified impaired.

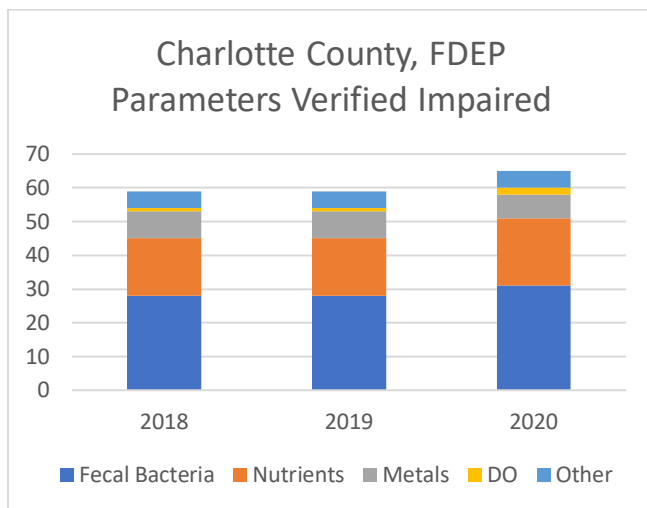


Figure 13. Charlotte County parameters verified impaired.

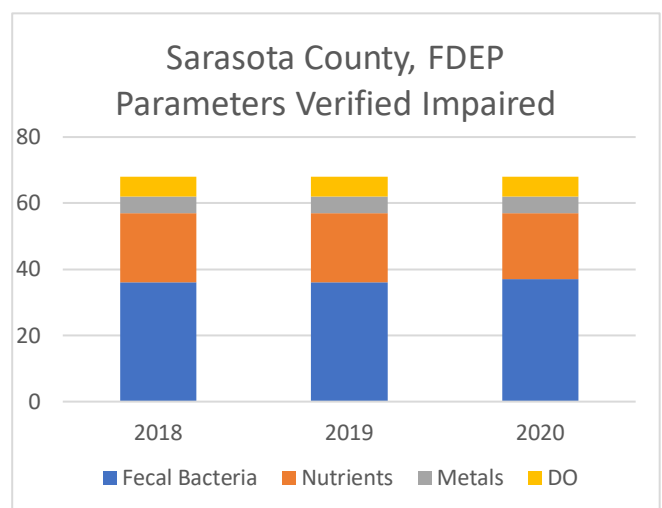


Figure 14. Sarasota County parameters verified impaired.

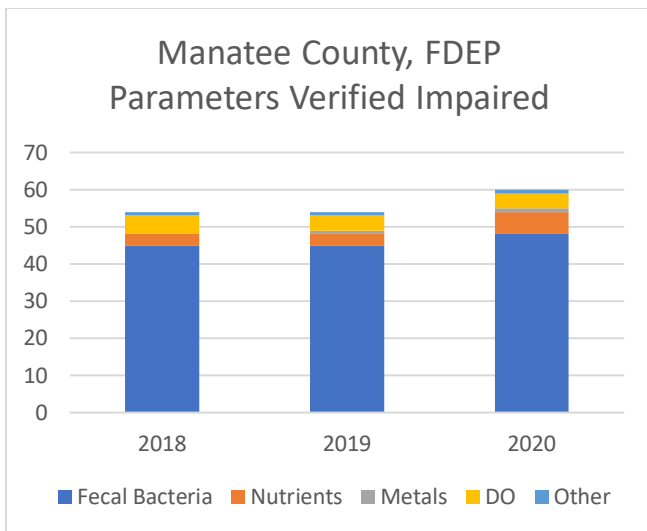


Figure 15. Manatee County FDEP parameters verified impaired.

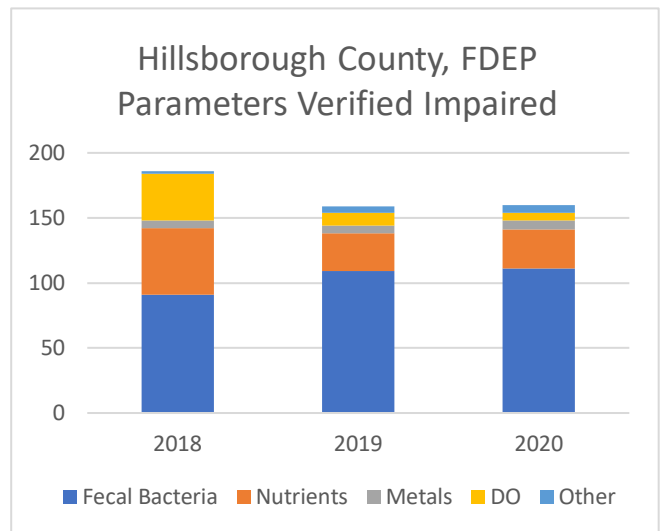


Figure 16. Hillsborough County FDEP parameters verified impaired.

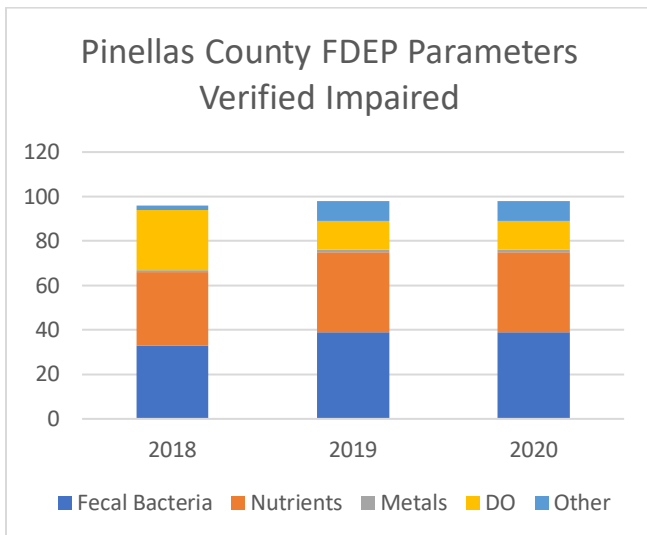


Figure 17. Pinellas County FDEP parameters verified impaired.

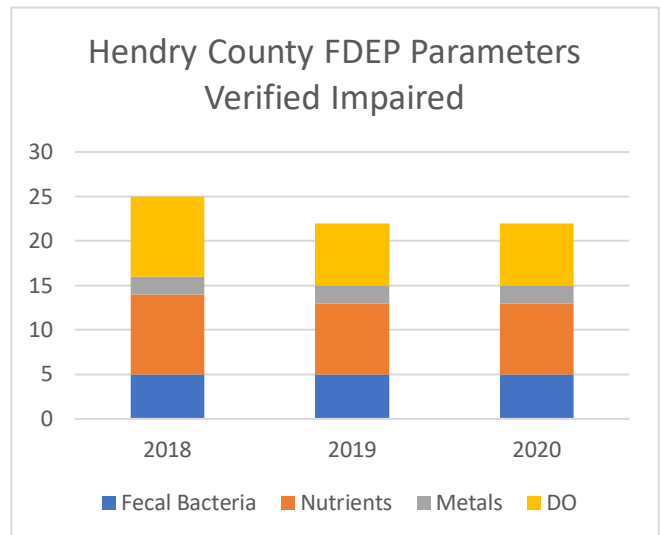


Figure 18. Hendry County FDEP parameters verified impaired.

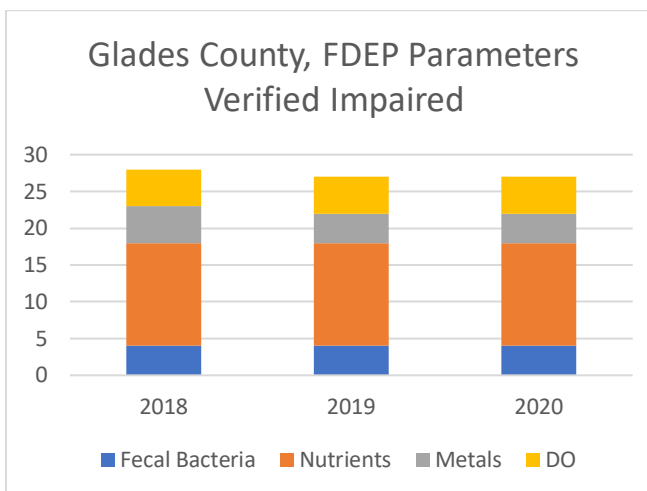


Figure 19. Glades County FDEP parameters verified impaired.

COUNTY RANK FOR IMPAIRMENT STATUS

Six metrics that define or contribute to water quality impairment were used to assess all nine counties to determine their overall rank on recent trends toward impairments and worsening water quality (Table 1). Each county was ranked for each of the six metrics and an average rank was calculated. Cumulative or final rank was determined from average rank. No attempt was made to weigh individual impairment metrics contributing to cumulative rank.

Table 1. Comparative rank of nine southwest Florida counties with respect to six water quality impairment metrics. Numbers in each column represent a rank derived from the respective metric summary (Figures 6-10). A ranking of 1 indicates the greatest recent trend towards impairments and worsening water quality. The higher the ranking number, the slower and less concerning the impairment trend is in relation to the comparable counties.

County	Avg. Total Impairments ¹ 2018, 2019, 2020	% of Total ² WBIDs Impaired	% Net Change ³ Impairment	% Change ⁴ Developed	% Change ⁵ Impervious	% Area ⁶ Agriculture	Avg. Rank	Rank
Collier	7	7	2	2	2	8	4.67	4
Lee	5	3	1	4	3	7	3.83	2
Charlotte	4	5	4	7	6	4	5.00	5
Sarasota	3	6	6	5	5	6	5.17	6
Manatee	6	5	3	1	1	3	3.17	1
Hillsborough	1	4	9	3	4	5	4.33	3
Pinellas	2	6	5	9	9	9	6.67	9
Hendry	9	2	8	6	7	1	5.50	7
Glades	8	1	7	8	8	2	5.67	8

¹ Average total impairments per FDEP Comprehensive List of Verified Impairments, 8-12-2018, 11-15-2019, 6-3-2020. Figure 6.

² Percent of total WBIDs impaired as of 6-3-2020 FDEP Comprehensive List of Verified Impairments. Figure 7.

³ Net percent change in impairment between 8-12-2018 and 6-3-2020 FDEP Comprehensive Lists of Verified Impairments. Figure 8.

⁴ Net percent change in developed area 2001-2016, <https://coast.noaa.gov/ccapatlas/>. Figure 9.

⁵ Net percent change in impervious area, 2001-2016, <https://coast.noaa.gov/ccapatlas/>. Figure 9.

⁶ Percent area in agriculture, 2016, <https://coast.noaa.gov/ccapatlas/>. Figure 10.

SUMMARY

Tracking water quality based on annual changes in verified impairment status should be considered a conservative yet robust estimate of changes in water quality. Before a waterbody or WBID is verified impaired for a pollutant parameter it must meet the minimum criteria set forth in FAC 62-302 and other relevant criteria related to frequency of impairment as one example as set forth in FAC 62-303. Some waterbodies that meet most of the criteria for a specific parameter impairment may not be considered verified impaired if impairment causality cannot be attributed to anthropogenic sources or a corroborating survey failed or was not conducted. Furthermore, each WBID and associated water quality parameter that leads to a verification of impairment, defined as the waterbody no longer attaining its designated uses, is based on dozens or even hundreds of water quality measurements over many years. Thus, tracking verified impairment should be considered a valid tool for measuring overall water quality but may only be the “tip of the iceberg” in a more comprehensive impairment context as other WBIDs are typically in the “pipeline” for impairment verification.

A number of consistent findings or commonalities with respect to water quality changes and related metrics defining or contributing to impairment were evident among the nine counties assessed. More current land use estimates for developed area, impervious area and area in agriculture for each county would help further resolve relationships or causality to water quality impairment especially as additional annual lists of verified impairments become available from FDEP.

The following are highlighted summary points of concern:

- Counties ranking highest with regard to **increased rate** of water quality impairment from highest to least were Lee, Collier, Manatee and Charlotte (Figure 8).
- Counties ranking in the top three, in the order listed, (highest first) with respect to **population increase**: Lee, Manatee and Collier (Figure 4); **percent of total WBIDs impaired**: Glades, Hendry and Lee (Figure 7); **percent increase in development 2001-2016**: Manatee, Collier and Hillsborough (Figure 9); **percent increase in impervious area 2001-2016**, Manatee, Collier and Lee (Figure 9).
- For the seven coastal counties, **urban population growth and associated development** underlie impairment causality. However, Manatee County as an exception, had a relatively high area in agriculture (Figure 10) as potentially contributing to its overall highest impairment status among all nine counties (Table 1).
- **Fecal bacteria** was the most frequently occurring impairment parameter in six of the nine counties including Lee, Charlotte, Sarasota, Manatee, Hillsborough and Pinellas (Figures 12-17). Fecal bacteria present a **public health risk** in addition to parameters emphasizing ecosystem or aquatic life support criteria. In 2020 impairment for fecal bacteria represented 80 percent of all verified impairments in Manatee, 69 percent in Hillsborough, 62 percent in Sarasota and 49 percent in Lee. Many of these fecal bacteria impairments occur in **Outstanding Florida Waters** that are supposed to be protected from water quality decline by statute.¹²
- **Nutrients** represented the highest proportion of impairments in Collier, Glades and Hendry counties (Figures 11,18,19). A relatively high percentage of Hendry, and Glades county land use is agriculture (Figure 10). Glades County had the highest percentage of WBIDs impaired across all parameters among the nine counties (Figure 10). In Lee County, nutrient impairment increases were responsible for the county's highest rate of increase in total impairments among all nine counties (Figures 8 and 12), despite having two BMAPs starting in 2012 (Everglades West Coast and Caloosahatchee Estuary) involving nutrient pollution.
- **Overall impairment trend.** The order (highest impairment status to lowest) of counties ranked across all metrics defining or contributing to impairment was **Manatee, Lee, Hillsborough, Collier, Charlotte, Sarasota, Hendry, Glades, Pinellas** (Table 1).

¹² <https://floridadep.gov/dear/water-quality-standards/content/outstanding-florida-waters>

GLOSSARY OF TERMS

Basin group: In reference to one of five basin groups FDEP has assigned to waters of the state.

BMAP: Basin Management Action Plan. An enforceable FDEP plan outlining restoration goals consistent with state and federal water quality standards.

NOAA C-CAP: Nationally standardized, raster-based inventories of land cover for the coastal areas of the U.S. Data are derived, through the Coastal Change Analysis Program

Class III: FDEP has classified waters of the state into five categories based on the respective definitions of intended use.

Designated use: Designated use refers to the basis for classifying waters of the state.

FDEP: Florida Department of Environmental Protection

Impairment: The term used for waters not attaining state water quality standards.

Impervious: Referred to in the context of land cover that inhibits infiltration of rainfall generating runoff.

Meteorological zone: Referred to here as a geographic zone that has similar rainfall.

Parameter: A substance or microbe occurring in water for determining compliance with state water quality standards.

TMDL: Total Maximum Daily Load. A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant.

WBID: Waterbody ID. A unique number used by FDEP for identifying a waterbody or waterbody segment.

About Calusa Waterkeeper

Calusa Waterkeeper (CWK) is a Fort Myers-based 501(c)3 nonprofit organization whose mission is to Protect and Restore the Caloosahatchee River from Lake Okeechobee to the Coastal Waters. CWK's project area covers more than 1,000 square miles of water, and its work includes testing and reporting, regulatory advisories, educational and community outreach and public advocacy. CWK's work relies on funding from individual donations, grants and a unique membership program which includes volunteer Ranger training. CWK is a member of the international Waterkeeper Alliance, the largest and fastest-growing nonprofit solely focused on clean water, with more than 300 Waterkeeper Organizations and Affiliates on the frontlines of the global water crisis, patrolling and protecting more than 2.5 million square miles of rivers, lakes and coastal waterways on six continents. Originally founded as the Caloosahatchee River Citizens Association in 1995, Calusa Waterkeeper is now in their 26th year advocating for Southwest Florida water quality, and the 6th year working as a Waterkeeper Alliance Member. For more information, visit calusawaterkeeper.org