



PASCO COUNTY MOSQUITO CONTROL DISTRICT REVIEW FINAL REPORT

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

Winter Park, FL 32789

Executive Summary

The Pasco County Mosquito Control District (Pasco County MCD) is an independent special district that serves the entirety of Pasco County, Florida, totaling 868 square miles. Pasco County MCD is among the larger mosquito control districts (MCDs) in the state, serving a population of nearly 608,794 residents in fiscal year (FY) 2021-22 (October 1, 2021 through September 30, 2022). The county population is expected to grow by more than 40% by 2050.

Pasco County boasts thousands of acres of federally and state-owned environmentally protected areas that can produce mosquitoes prolifically and have associated restrictions on Pasco County MCD operations. About 313,000 households paid ad valorem taxes to support Pasco County MCD operations in FY 2022-23. The most recent budget year included about \$38.6 billion in taxable value, plus an additional \$2.3 billion from about 22,000 tangible personal property accounts that are subject to district millage, resulting in a total budget of about \$9.4 million.

Pasco County MCD was established by referendum in 1951 to control mosquitoes. The district is governed by an elected board of three commissioners. To accommodate the growing populations in the county, Pasco County MCD's boundaries were continually expanded until 2003, at which time the district encompassed the entirety of Pasco County. The Board is actively engaged in review of operational success, financial stewardship, and efficiency. Due to geographic scale, the need to coordinate efforts with protected areas and high tourist activity, Pasco County MCD has committed to Integrated Pest Management methods. Operations largely focus on the prevention of mosquito infestation via surveillance, monitoring, larviciding, and targeted adulticiding, along with operationally applied research and development to improve the effectiveness and efficiency of Pasco County MCD activities.

The Balmoral Group worked in consultation with a mosquito control expert in the course of this review and found that Pasco County MCD follows industry standards for Integrated Pest Management and provides mosquito control services to residents as provided in the district's chapter law. The district has demonstrated effective and efficient resource management; however, future financial stability should be carefully monitored given the increasing demands that will be placed on the district's resources due to the continuing rapid development in Pasco County. Pasco County MCD does not have clearly defined goals or objectives but is in the process of developing a strategic plan; similar to other mosquito control districts, it monitors performance using service call responses and disease prevalence metrics.

Based on its review, The Balmoral Group presents the following recommendations for the improvement of mosquito control services in Pasco County:

SCOPE

Section 189.0695, *Florida Statutes*, requires the conduct of performance reviews of Independent Mosquito Control Districts. The Balmoral Group was selected by the Office of Program Policy Analysis and Government Accountability to perform the review, which evaluates the district's programs, activities, and functions, including

- evaluating the district board's primary function and governance;
- assessing service delivery and comparing similar services provided by municipal or county governments located within the district's boundaries;
- describing district purpose, goals, objectives, performance measures, and performance standards and evaluating the extent to which they are achieved;
- analyzing resources, revenues, and costs of programs and activities; and
- providing recommendations for statutory or budgetary changes to improve the special district's program operations, reduce costs, or reduce duplication.

- The Legislature could consider amending section 403.709(1), *Florida Statutes*, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.
- The district could continue to proceed with its process to formalize its goals, objectives, and performance measures and standards through a strategic planning process to consistently monitor and maintain performance information over time; the district could seek guidance from other districts that have conducted strategic planning processes.
- The Legislature could consider amending s. 388.46, *Florida Statutes*, to direct the Florida Coordinating Council on Mosquito Control to form a subcommittee consisting of mosquito professionals and researchers from around the state to develop model goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.

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1. Background

District Description

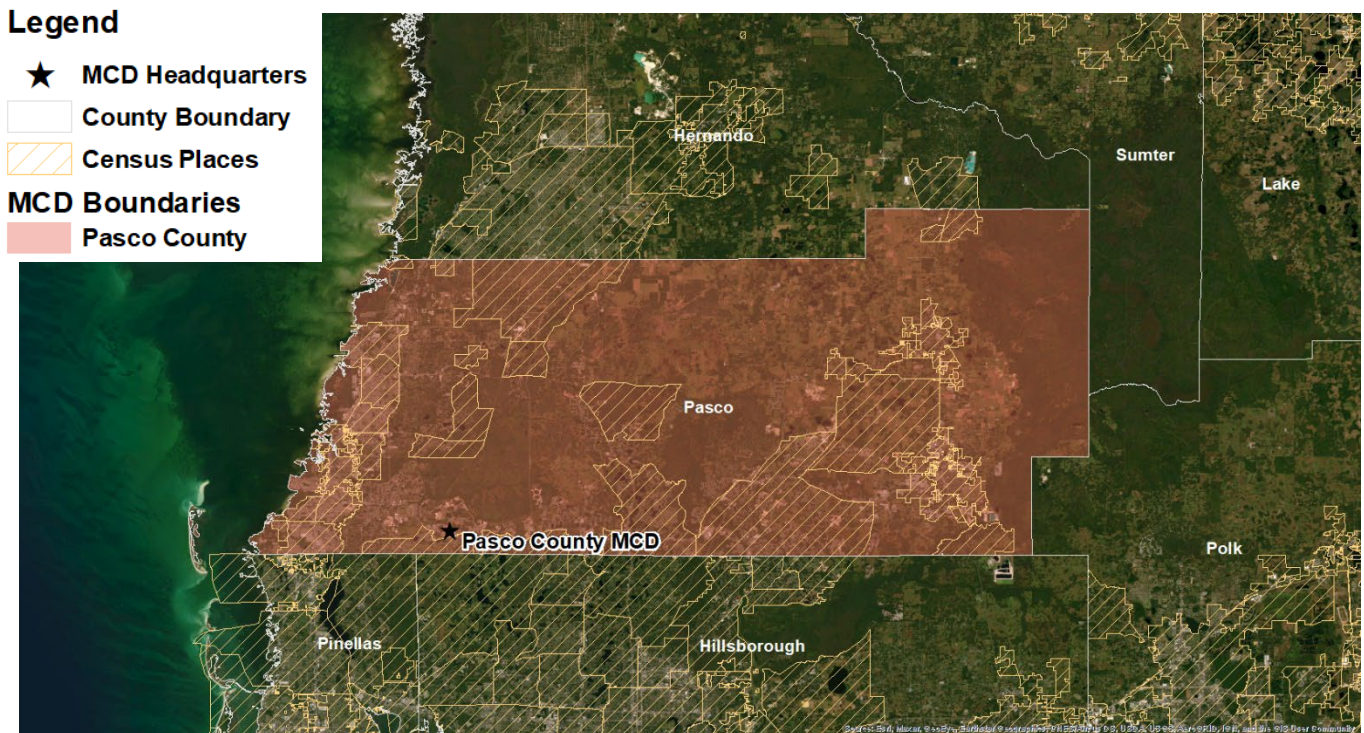
District Purpose

The purpose of Pasco County Mosquito Control District (Pasco County MCD), as established by referendum in 1951, is to provide a comfortable outdoor environment for Pasco County citizens and reduce the threat of diseases that can be transmitted by mosquitoes. According to district representatives, Pasco County MCD has worked, since inception, to provide a safe, effective, efficient, and fiscally responsible public health service to all residents of Pasco County by developing in-house technologies for mosquito control as an alternative to purchasing existing technologies.

Service Area

Pasco County MCD serves the entirety of Pasco County, Florida, totaling 868 square miles. The district's headquarters are located at 2308 Marathon Road, Odessa, Florida 33556. **Figure 1** is a map of the district boundary, with the county boundary and location of the current headquarters marked.

Figure 1. Pasco County MCD Map

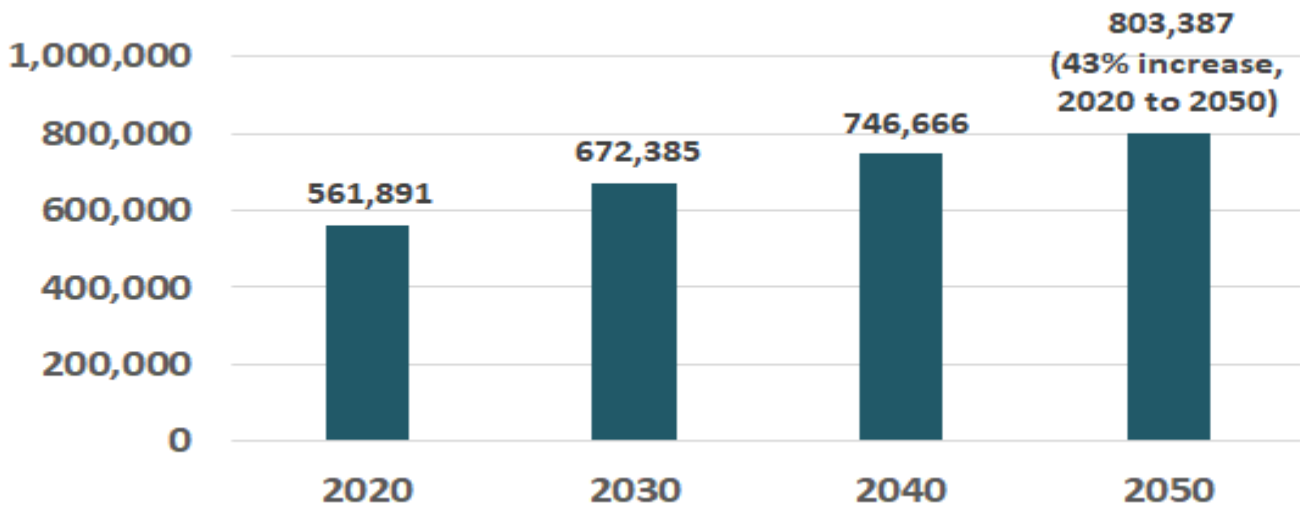


Source: TBG Work Product, ESRI, US Census, MCDs.

Population

Pasco County's population was estimated at 608,794 persons in 2022 according to the U.S. Census.¹ The county has experienced considerable population growth in the last two decades. According to data from the Florida Legislature's Office of Economic and Demographic Research (EDR), the county's population grew 72% between 2000 and 2022, exceeding the state's population growth rate of 39% for that same period by 33%.² Between 2017 and 2022, the county's population grew almost 14% as compared to the state's population growth rate of 8.5%.³ EDR projects the county's population to increase by 43% through 2050 to 803,387 residents compared to a 2020 baseline of 561,891.⁴ **Figure 2** shows Pasco County's projected population as estimated by EDR.

Figure 2. Pasco County Population Projection



Source: TBG Work Product, EDR.

District Characteristics

Pasco County is on the west coast of Florida, with about 27 miles of coastline on the Gulf of Mexico. Adjacent counties include Hernando, Sumter, Polk, Hillsborough, and Pinellas. The average annual temperature was 72.8 degrees Fahrenheit and total rainfall was just under 63.2 inches in 2022.

A majority of the county is residential, with many of the residents of Pasco County commuting daily into Tampa and St. Petersburg. Extremely rapid and intense urban and residential development has occurred in the coastal parts of the county with many people migrating to Pasco County to accommodate the growth of Tampa's industries. The majority of the county's residents are in eastern portions of the county or in the southern central area feeding into Tampa. Natural areas include several riverside state parks and preserve lands including the Green Swamp Wilderness Preserve, an over 110,000-acre swamp with 34,000 acres falling within Pasco County. To control mosquito populations and prevent the spread of nuisance and diseases in other regions of Pasco County from mosquito populations originating within the Green Swamp, the Pasco County MCD works closely with the Southwest Florida Water Management District (SWFWMD) and the Florida Department of Environmental

¹ Population Estimates, July 1, 2022, retrieved from [U.S. Census Bureau QuickFacts: United States](https://www.census.gov/quickfacts/US).

² Based on Total County Population: April 1, 1970 - 2050 retrieved from Population and Demographic Data - Florida Products (state.fl.us).

³ Based on Total County Population: April 1, 1970 - 2050 retrieved from Population and Demographic Data - Florida Products (state.fl.us).

⁴ Based on 2021 Estimates, Population: 1970-2050, County projections retrieved from [Population and Demographic Data - Florida Products \(state.fl.us\)](https://www.state.fl.us/economic/population-demographic-data/).

Protection (DEP). Several cases of eastern equine encephalitis have been linked to the Green Swamp area as recently as April, showing the necessity for effective mosquito control around the region.⁵ There are about 45 mosquito species in Pasco County and these occur in different habitats, from inland swamps to coastal tidal pools, to backyard residential pools.

Meteorology is the primary driving force for producing mosquitoes with heavy rainfall events creating standing pools of water that serve as breeding grounds for mosquito species capable of transmitting several arboviruses. Changing water levels through tidal events can also produce mosquitoes in large numbers, as well as coastal winds blowing mosquito populations across the county. Humans contribute to the problem by allowing water to stand in waste containers, garden pots, tires, and other vessels. The characteristics of the natural areas of the district, combined with the extremely rapid and intense urban development occurring in coastal and Tampa neighboring areas of the district and the meteorological conditions described above, create an environment conducive to extensive mosquito habitats that require constant mosquito control. The services needed to control mosquitoes include routine surveillance of mosquito-producing habitats, source reduction, aerial and/or ground treatments using pesticides to treat large areas of adult mosquito populations, regular testing for disease transmission in animals, and others described in greater detail later in the report.

Real Property Data

Pasco County MCD receives ad valorem taxes to fund district operations. The total taxable value of properties within Pasco County MCD was \$40.9 billion in the most recent fiscal year under a millage rate of 0.2545 (**Table 1**). Real property parcels subject to district millage grew from 290,168 parcels to 313,222 parcels over the last four years (**Table 2**). However, the taxable value of real property parcels increased 41% in FY 2022-23 compared to FY 2019-20, following changes in property values.

Table 1. Millage Rates and Total Taxable Value of Properties Subject to Pasco County MCD Millage

Pasco County MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Millage Rate	0.2646	0.2545	0.2545	0.2545
Taxable Value of Parcels (\$Bil.)	\$27.4	\$29.6	\$32.8	\$38.6
Taxable Value of Accounts (\$Bil.)	\$2.0	\$2.1	\$2.2	\$2.3
Taxable Value of Centrally Assessed Property (\$Mil.)¹	\$16.6	\$20.0	\$20.0	\$21.5
Total Taxable Value (\$Bil.)	\$29.4	\$31.7	\$35.0	\$40.9

Source: Florida Department of Revenue (FDOR).

¹ Centrally assessed property includes railroad and private carline company assessments as defined in Rule 12D-2.011, F.A.C.

Table 2. Real Property Parcels Subject to Pasco County MCD Millage

Pasco County MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Just Value of Parcels (\$Bil.)	\$43.6	\$46.3	\$52.2	\$66.6
Real Property Parcels Subject to Millage	290,168	296,459	303,948	313,222
Taxable Value of Parcels (\$Bil.)	\$27.4	\$29.6	\$32.8	\$38.6

Source: FDOR.

⁵ [Polk issues mosquito-borne illness alert after 2 horses die \(theledger.com\)](https://www.theledger.com/news/polk-issues-mosquito-borne-illness-alert-after-2-horses-die)

Tangible Personal Property Data

In addition to real property, tangible personal property accounts subject to district millage totaled 21,998 accounts in FY 2022-23, down over 50% since FY 2019-20 (**Table 3**). However, the taxable value of tangible personal property accounts also increased in FY 2022-23 by 16% compared to FY 2019-20 due to higher property values.

Table 3. Tangible Personal Property Accounts Subject to Pasco County MCD Millage

Pasco County MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Just Value of Accounts (\$Bil.)	\$3.4	\$3.2	\$3.2	\$3.4
Tangible Personal Property Accounts Subject to Millage	44,569	24,237	22,552	21,998
Taxable Value of Accounts (\$Bil.)	\$2.0	\$2.1	\$2.2	\$2.3

Source: FDOR.

History and Composition

The Pasco County MCD was created by the Pasco County Board of Commissioners as the result of a referendum in 1951 and established as the West Pasco County Mosquito Control District. The district was continued by Chapter 2005-322, *Laws of Florida*, which is the most recent legislative enactment governing the district. The district has expanded five times since its establishment. On each occasion (1979, 1981, 1986, 2002, and 2003), the expansion process was initiated by petition by the residents within a voting precinct that was adjacent to the existing boundary of Pasco County MCD. Petitions were first presented to the three-member Pasco County MCD for approval and then to the Pasco County Board of County Commissioners for authorization via public meetings.

Pasco County MCD also operates under Chapter 189, *Florida Statutes*, given its status as an independent special district; Chapter 388, *Florida Statutes*, setting forth the requirements for creating and operating MCDs in this state; and Chapter 5E-13, *Florida Administrative Code*, setting forth rules adopted by the Department of Agriculture and Consumer Services (DACS) for mosquito control program administration. The Pasco County MCD is governed by an elected board of three commissioners whose qualifications and election process are established in its governing chapter law. Each board member serves a four-year term, and the positions currently include a chairperson, vice chairperson, and secretary/treasurer. There are no vacant positions at this time. Board members are required to be resident registered electors.

Pursuant to Chapter 388, *Florida Statutes*, and the district’s chapter law, the powers and duties of the board of commissioners include:

- Performing all duties necessary for the control and elimination of mosquitoes and other arthropods of public health importance.
- Being authorized to provide for the construction of canals, ditches, drains, dikes, fills, and other necessary works, and to install and maintain pumps, excavators, and other machinery and equipment.
- Preparing and adopting a district budget.
- Being authorized to hold, control, and acquire by gift or purchase for district use any real or personal property.

- Having all the powers of a body corporate, including the power to contract; to employ a director, employees, and others; and to participate with employees in group insurance plans.

As required by s. 388.151, *Florida Statutes*, the board of commissioners holds monthly meetings, with an agenda published online prior to the proceedings of each assembly (**Table 4**).⁶ In addition to regular monthly meetings, special meetings may be called to discuss the draft and final budget for the upcoming fiscal year, as well as one-off topics like district banking practices and aerial activities. The board’s meetings are open to the public and noticed and conducted in accordance with s. 189.015, *Florida Statutes*. Meeting minutes are posted online alongside a schedule of board meetings.

Table 4. Pasco County MCD Commissioner Meeting Counts

Commissioner Meetings	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23¹
Monthly Meetings	12	12	12	7
Special Meetings	2	6	2	1

Source: TBG Work Product, MCD.

¹ 2023 YTD through April.

Intergovernmental Interactions

Pasco County MCD collaborates with the Florida Department of Health (DOH) to monitor for any cases of mosquito-borne disease as well as track their origin. The district also aids other MCDs in emergency situations, recently having provided Fort Myers Beach MCD with some traps after the complete destruction of the Fort Myers Beach MCD’s facilities in Hurricane Ian in 2022. However, no services are provided external to Pasco County.

Pasco County MCD coordinates its mosquito control application with state agencies, including DEP and SWFWMD, to address environmental considerations related to the Green Swamp, state parks, and other state-owned property within the district. Pasco MCD also coordinates with SWFWMD and Pasco County Board of County Commissioners (PBOCC) to control invasive aquatic weeds in various water bodies in Pasco County to avoid duplicate efforts. The Pasco County MCD performs aquatic weed management for the sole purpose of reducing mosquito populations and not for the beautification of waterbodies.

The district also, as discussed more fully below, conducts research and works with state universities, private industry, and government agencies to research cutting-edge mosquito control technologies.

Resources for Fiscal Year 2021-22

The published FY 2021-22 millage rate established by Pasco County MCD was 0.2545. The district received \$8.9 million in revenues and spent \$7.2 million in FY 2021-22. Pasco County MCD had 59 paid staff (three commissioners, 40 full-time, and 16 part-time) and owned or leased 52 vehicles and 10 buildings (**Table 5**).

⁶ <https://www.pascomosquito.org/board-meetings>

Table 5. Pasco County MCD Resources for FY 2021-22

Resource Item	FY 2021-22 Amount
Millage Rate	0.2545
Revenues	\$8.86 million
Expenditures	\$7.19 million
Number of Paid Staff	59
Vehicles	2 helicopters, 2 boats, 39 trucks and vans, 9 ATVs and Utility vehicles
Equipment	Field equipment: 149 Lab equipment: 9 Office equipment: 50 Surveillance equipment: 74 traps, 54 sentinel chickens, 9 coops
Facilities	6 fully enclosed buildings, 1 fire suppression pump house, 3 parking bays, 1 undeveloped property

Source: TBG Work Product, Pasco County MCD.

2. Findings

Service Delivery

Pasco County MCD follows industry standards for Integrated Pest Management and provides mosquito control services to residents as provided in the district’s chapter law and the Florida Statutes.

To assess the delivery of services in the district, The Balmoral Group (TBG) interviewed staff and management to assess delivery of services and requested information on the geographic characteristics of the district; other local governments to which the district provides services or with which it coordinates efforts; the services provided by the district; similar services provided by other entities; district studies or evaluations of alternative service delivery methods including consolidation of services with other government entities; unique contributions from the district relative to the county or municipalities; local stakeholder perceptions of the relative value of the district’s services. In addition, TBG requested information from representatives of the Board of County Commissioners, local health department, and local parks and recreation department on their perceptions of the district’s service delivery and efficiency.

Overview of Services

Most mosquito control programs use an Integrated Pest Management (IPM) approach to control mosquito populations, which targets the different stages of a mosquito’s life cycle with various prevention and control measures. IPM addresses eight areas. Surveillance of mosquito populations is an essential component of all IPM programs with chemical treatments based on the surveillance findings. IPM can also include source reduction (e.g., container disposal, water/impoundment management), larviciding and adulticiding (using ground and/or aerial treatments), biological and alternative control, and disease surveillance. Research and education are also important components of IPM programs. See attachment titled, “Integrated Pest Management” for more information. Pasco County MCD conducts activities in all eight areas of IPM.

Pasco County MCD monitors mosquito populations by inspecting and trapping mosquitoes daily. The district reports that its focus is to control mosquitoes in the aquatic immature stages before they become flying and biting adult mosquitoes. The district also monitors for diseases including West Nile Virus, eastern equine encephalitis, and St. Louis encephalitis viruses using sentinel chickens and sending weekly blood samples to the DOH laboratory.

Source reduction is conducted in a number of ways. The district empties containers with standing water on residential properties when responding to service requests and educates homeowners to perform similar activities. The district also has an aquatic weed control program through which the district uses equipment such as herbicide trucks, airboats, amphibious vessels, and helicopters to control aquatic weeds found along edges of lakes, ponds, canals, and ditches. A few mosquito species utilize roots of select invasive weeds to obtain oxygen and nutrients, and the district controls these mosquito species by using the equipment in community water bodies to remove these invasive, non-native weeds. When mosquitoes are identified in traps, field personnel will then search for species of weeds known to harbor these mosquitoes and apply herbicides to kill the weeds.

Waste tire disposal is another primary source reduction practice at Pasco County MCD. The district reported that it collects, on average, 10 tons of waste tires and expends approximately \$1,300 each year in waste tire disposal fees. The district does not have a fee exemption or other funding support to help defray these costs. District staff reported that the act of physically removing waste tires from its service area causes a significant burden in terms of the manual labor, time, and other resources spent on this regular activity and that financial assistance would help offset some of that burden. The district is currently incurring costs and inefficiencies in managing waste tire collection and disposal, which is an important source reduction activity. Districts like Pasco County MCD would benefit from additional sources of funding to help incentivize continued collection of waste tires in the district.

Larval control is one of the main aspects of the district's efforts to effectively control mosquito populations. Larviciding is conducted with the use of trucks, ATVs, lightweight equipment, and sometimes by hand unless access is limited or the timing of treatment is critical. In those cases, it is often necessary to use helicopters and drones to inspect and treat for larvae. The district uses helicopters to monitor and control the larval stages of mosquitoes that occur in both salt and freshwater environments. The district also uses an A1 Mister that combines high volumes of air with low volumes of liquid materials to more efficiently treat a wide variety of larval habitats.

Adulticiding is conducted using Ultra-Low Volume (ULV) trucks generally in areas with good road access for targeting adult mosquitoes during the evening when mosquitoes are most active, particularly during the summer rainy season. The district operates its ULV truck fleet for four to five hours at a time, typically beginning 30 minutes after sunset. Small, handheld ULV machines can be run by inspectors on the ground when responding to service requests.

In addition, the district conducts research and works with state universities, private industry, and government agencies to research cutting-edge mosquito control technologies. The entities include the University of Florida, the Florida A&M University, the University of South Florida, the United States Department of Agriculture, the Navy Entomology Center of Excellence, the World Health Organization, and others. District research and development programs are designed to evaluate the efficacy of new commercial products, evaluate the efficacy of application techniques and equipment, and develop novel insecticide and herbicide delivery systems. A number of insecticides, application equipment, and techniques now in worldwide use were originally tested or developed in Pasco County by district personnel. Additionally, the district has assisted several pesticide manufacturers in evaluating products in the field to gather the data necessary for bringing the products to market. The district also

conducts research on mosquito resistance to insecticides by collecting mosquito eggs and larvae from the wild, rearing them to the larval or adult stage, and then treating them with known concentrations of insecticides. These bioassays determine and monitor the susceptibility of Pasco County mosquitoes to each insecticide used by the district to determine the minimum dosage necessary for adequate control and this also reveals when resistance to a particular insecticide is developing.

The district conducts public education events and outreach to educate the public on mosquito control efforts in the district. It conducts school and summer programs for youth on mosquito education. The district also participates in fairs and festivals on the weekends throughout Pasco County and speaks to civic and municipal groups. In addition, the district’s educational trailer serves as a mobile outreach center for the public.

A summary of the seven areas of IPM in which the district conducts activities is set forth in (Table 6).

Table 6. Pasco County MCD Services Overview

Integrated Pest Management Service	Pasco County MCD Services Provided
Mosquito Surveillance	Adult mosquito trapping, landing rate counts, larval inspections, aquatic weed management, and other analysis
Disease Surveillance	Regular blood sample collection from sentinel chickens and submittal of samples to the state laboratory in Tampa and coordination with DOH on cases of suspected exotic arboviruses
Source Reduction	Emptying containers when responding to resident service requests, community education on source reduction, and waste tire collection
Larviciding	Application of larvicides in mosquito habitats
Adulticiding	Delivery of ULV insecticide using trucks, ATVs, hand sprayers, boats, or occasionally by helicopter
Biological Control	Use of predatory mosquito fish (Gambusia) to reduce larval mosquito populations
Mosquito Control Research	Ongoing research efforts to identify new methods and technologies to improve costs and treatment efficiency; continued resistance monitoring of local mosquito populations to regularly applied larvicides and adulticides
Outreach and Education	Doing community outreach events to educate community members as well as having school and summer programs available for free to all Pasco County schools.

Source: TBG Work Product, Pasco County MCD.

Analysis of Delivery Services

Pasco County MCD delivers services across all areas of IPM that are within the scope of its charter and purposes outlined in applicable laws and regulations. All district services are directed toward the abatement and control of mosquitoes. No services were noted that fall outside the district’s charter or applicable laws and regulations. Pasco County MCD provides services in all eight areas of IPM as described above, and all district services are directed toward the abatement and control of mosquitoes. Pasco MCD faces challenges of serving an area with an extremely high rate of population growth and urban and residential development, combined

with expansive natural areas that contain swamps and marshlands, necessitating multiple forms of mosquito control.

Comparison to Other Services

Pasco County MCD is the sole local government provider of mosquito control services in the district. TBG interviewed staff and reviewed documents available online to establish if services could be or are redundant to or overlapping with county and municipal government services. Services similar to those provided by Pasco County MCD are not provided by local governments within the county. Further, Pasco County MCD operations are fairly sophisticated and the district is extensively developing new specific technologies for mosquito control, which is an activity not commonly undertaken by other MCDs. Local governments within the county are likely not equipped to deliver those services or to engage in technology development.

TBG requested information from representatives of the PBOCC, local health department, and local parks and recreation department on their perceptions of the district’s service delivery and efficiency. The county health department reported that it is not aware of alternate methods for delivery of the same services provided by Pasco County MCD, believes that the district is the most efficient entity to deliver the services, and has no recommended consolidations. Local health department staff further reported that they have had a very good working relationship with the district and look forward to continuing to work with them as their community partner. Other stakeholders did not provide a response after multiple contacts.

While the PBOCC did not provide a direct response to TBG’s questions, in the agenda for PBOCC’s June 20th meeting, there was a resolution presented by the Board “expressing their support for the Pasco County MCD and calling on the Florida Legislature to leave the district intact as an independent special district.” The recommendation was to approve the resolution, which can be interpreted as the county’s support of the functions of the district.

The mosquito control expert retained by TBG for this review did not identify any alternative methods for providing the district’s services that would reduce the district’s costs or improve the district’s performance.

Considerations for Consolidations

Consolidation of operations is not recommended for Pasco County MCD based on the findings of this review. Pasco County MCD operates throughout the entirety of Pasco County and no other comparable service has been identified for consolidation.

Resource Management

Pasco County MCD has demonstrated effective and efficient resource management; future financial stability should be carefully monitored given the increasing demands that will be placed on the district’s resources due to continuing rapid development in Pasco County.

To assess the district’s resource management, TBG analyzed information on revenue sources, revenue and expenditure trends and their possible causes; analyzed staffing trends and their possible causes; requested data on services delivered by district staff versus third-party contractors for the last three fiscal years; analyzed

equipment inventory and capital investment trends; reviewed the activities the district conducts to manage costs and plan personnel; requested information on resident feedback survey data related to finances and spending by the district; reviewed performance reviews and audits; and interviewed district staff and board members.

Current and Historic Revenues and Expenditures

Revenues have increased steadily since FY 2019-20 without an increase in millage, while expenditures had a significant increase in FY 2020-21 and FY 2021-22 due to the lease of two new helicopters. The district’s funding is primarily comprised of ad valorem taxes. The Pasco County Property Appraiser, with approval from the Florida Department of Revenue, certifies the county’s tax roll each year and provides the information to the Pasco County Tax Collector, which in turn collects monies authorized under Pasco County MCD’s taxing authority. Millage rates are set each year by the district’s board of commissioners. Pasco County MCD has not received any state grants or federal funding in FY 2022-23 nor in the previous three fiscal years.

To analyze revenues and expenditures, TBG requested and received annual financial reports from Pasco County MCD for FY 2019-20 through FY 2022-23. In addition, TBG interviewed Pasco County MCD staff and reviewed documentation both online and as provided from Pasco County MCD’s accounting and operation systems. Revenues increased from \$7.63 million in FY 2019-20 to \$9.41 million in FY 2022-23, with the majority of revenues in each year coming from ad valorem taxes and a relatively small percentage from other sources (which include sales of equipment, interest earnings, and refunds from prior year’s expenditures). **Table 7** summarizes the revenues and expenditures by fiscal year.

Expenditures fluctuated during the review period, increasing from \$5.19 million in FY 2019-20 to \$8.64 million in FY 2020-21 and then decreasing to \$7.19 million in FY 2021-22. FY 2022-23 is ongoing and expenditures as of April 2023 were \$4.03 million. Revenues exceeded expenditures by at least \$1 million in FY 2019-20 and FY 2021-22, but expenditures exceeded revenues by \$0.28 million in FY 2020-21.

Table 7. Revenue and Expenditures

Revenues and Expenditures (in \$Mil.)	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ¹
Revenues	\$7.63	\$8.36	\$8.86	\$9.41
Ad Valorem	\$7.51	\$7.80	\$8.67	\$9.38
Other Sources	\$0.12	\$0.57	\$0.19	\$0.03
Expenditures	\$5.19	\$8.64	\$7.19	\$4.03
Administrative Costs	\$1.28	\$3.60	\$1.87	\$0.96
Direct Program and Activity Costs	\$3.91	\$5.04	\$5.32	\$3.07
Other Expenditures	\$0.00	\$0.00	\$0.00	\$0.00

Source: TBG Work Product, Pasco County MCD

¹ 2023 YTD through March.

Current and historic revenues and expenditures for Pasco County MCD had a significant increase since FY 2020-21 as tax collections have increased and the district leased two new helicopters in FY 2020-21. Revenues collected by Pasco County MCD increased during the current and past three fiscal years given rising property values. Revenue and expenditure trends are attributable to the continued growth in development in the county, and expenses associated with the expansion of services for new developments will continue to increase. It is unclear if the district will have sufficient resources to meet the needs of the extremely fast-growing population of the county in the future. The revenues of the current fiscal year, however, to date have exceeded expenditures by

approximately \$5 million, which is a positive indication of potential future financial stability. However, the current fiscal year is still in progress at the time of this writing and final fiscal year numbers could reflect a different trend.

Administrative Costs

Expenditures on administrative staff and benefits were relatively consistent, declining from FY 2019-20 through FY 2021-22 and accounting for about 29% of total expenditures on average. As requested by TBG, Pasco County MCD provided a breakdown of total expenditures by administrative and other program costs for FY 2019-20 through March FY 2022-23.

Costs fell into several categories, with the highest amounts of administrative costs during the review period including the Personal Services and Personal Service Benefits, Land and Buildings, and Operating Expenses categories **Table 8**. Land and Buildings increased significantly in FY 2020-21 and FY 2021-22 due to the land purchase for the new campus site and the construction of the new hangar. Operating expenses increased 53% between FY 2019-20 and FY 2021-22, where office supplies had the largest increase (225%). On the other hand, Personal Services (salaries) have decreased since FY 2020-21 as the retirement of the former executive director lowered costs.

Table 8. Administrative Cost Data

Expenditure Category ¹	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ²
Personal Services	\$447,839	\$318,997	\$358,952	\$222,047
Personal Service Benefits	\$231,658	\$179,738	\$202,006	\$140,085
Operating Expenses	\$255,218	\$306,360	\$389,301	\$249,290
Travel, Utilities, Repair, & Maintenance	\$41,507	\$41,010	\$46,196	\$23,300
Supplies and Materials	\$11,293	\$9,508	\$38,837	\$9,848
Land and Buildings	\$293,724	\$2,746,879	\$838,914	\$311,684
Total	\$1,281,239	\$3,602,491	\$1,874,205	\$956,254

Source: TBG Work Product, Pasco County MCD.

¹ Categorization of administrative costs was completed by Pasco County MCD based on an outline provided by TBG to ensure consistency across reports.

² 2023 YTD through March.

Direct Program Costs

Expenditures on direct program costs increased 23% from FY 2019-20 through FY 2021-22, accounting for about 71% of total expenditures on average. As requested by TBG, Pasco County MCD provided a breakdown of total expenditures by direct program costs for FY 2019-20 through March FY 2022-23.

Expenditures on direct Personal Services increased steadily between FY 2019-20 and FY 2021-22; overall, they increased by 23% during the timeframe. Direct operating expenses in FY 2019-20 and FY 2020-21 were almost entirely for entomology and software consulting services. As Pasco County MCD did not contract for any of these services in the following fiscal years, direct operating expenses were almost non-existent. On the other hand, the Travel, Utilities, Repair, & Maintenance category increased significantly due to the helicopter lease-purchase agreement executed in FY 2020-21. This added \$864,833 in expenses annually. Supplies and Materials declined 5% between FY 2019-20 and FY 2021-22. The decline was due to an 18% reduction in chemicals costs as other items in the category had significant increases. For instance, gasoline, oil and lube increased by 96%, labs, traps and safety supplies by 84%, and publications and dues increased by 74%. The district reported that it has

developed many cost-saving approaches to in-house equipment design and other techniques that help it utilize chemicals more efficiently and reduce costs of chemical purchases. **Table 9** summarizes the direct program costs by fiscal year.

Table 9. Direct Program Cost Data

Expenditure Category ¹	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ²
Personal Services	\$1,463,609	\$1,695,271	\$1,797,689	\$949,895
Personal Service Benefits	\$691,001	\$840,370	\$860,772	\$509,645
Operating Expenses	\$70,089	\$26,960	\$110	-
Travel, Utilities, Repair, & Maintenance	\$439,667	\$1,406,975	\$1,480,803	\$1,122,115
Supplies and Materials	\$1,246,195	\$1,066,116	\$1,179,532	\$490,441
Machinery & Equipment	-	-	-	-
Total	\$3,910,562	\$5,035,693	\$5,318,905	\$3,072,096

Source: TBG Work Product, Pasco County MCD.

¹ Categorization of direct program costs was completed by Pasco County MCD based on an outline provided by TBG to ensure consistency across reports.

² 2023 YTD through March.

Contracts for Services

Contracted service costs have decreased since FY 2021-22 due to not contracting for professional consulting services. TBG reviewed documentation provided by Pasco County MCD to determine what services were contracted rather than being conducted in-house. Pasco County MCD professional services included entomology and software consulting. Legal and Engineering Services saw a 65% increase from FY 2019-20 to 2021-22, but all other categories have been stable for the current and previous three fiscal years. Other contractual services include cleaning services. **Table 10** summarizes the cost of contracted services during the period of review.

Table 10. Summary of Contracted Services

Expenditure Category ¹	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ²
Professional Services	\$63,494	\$58,692	-	-
Legal & Engineering Services	\$36,520	\$48,892	\$59,478	\$50,999
Accounting & Auditing	\$12,300	\$12,600	\$13,280	-
Other Contractual Services	\$4,285	\$4,260	\$4,314	\$2,238
Total	\$116,599	\$124,444	\$77,072	\$53,237

Source: TBG Work Product, Pasco County MCD.

¹ Categorization of contracted costs was completed by Pasco County MCD based on an outline provided by TBG to ensure consistency across reports.

² 2023 YTD through March.

Staff

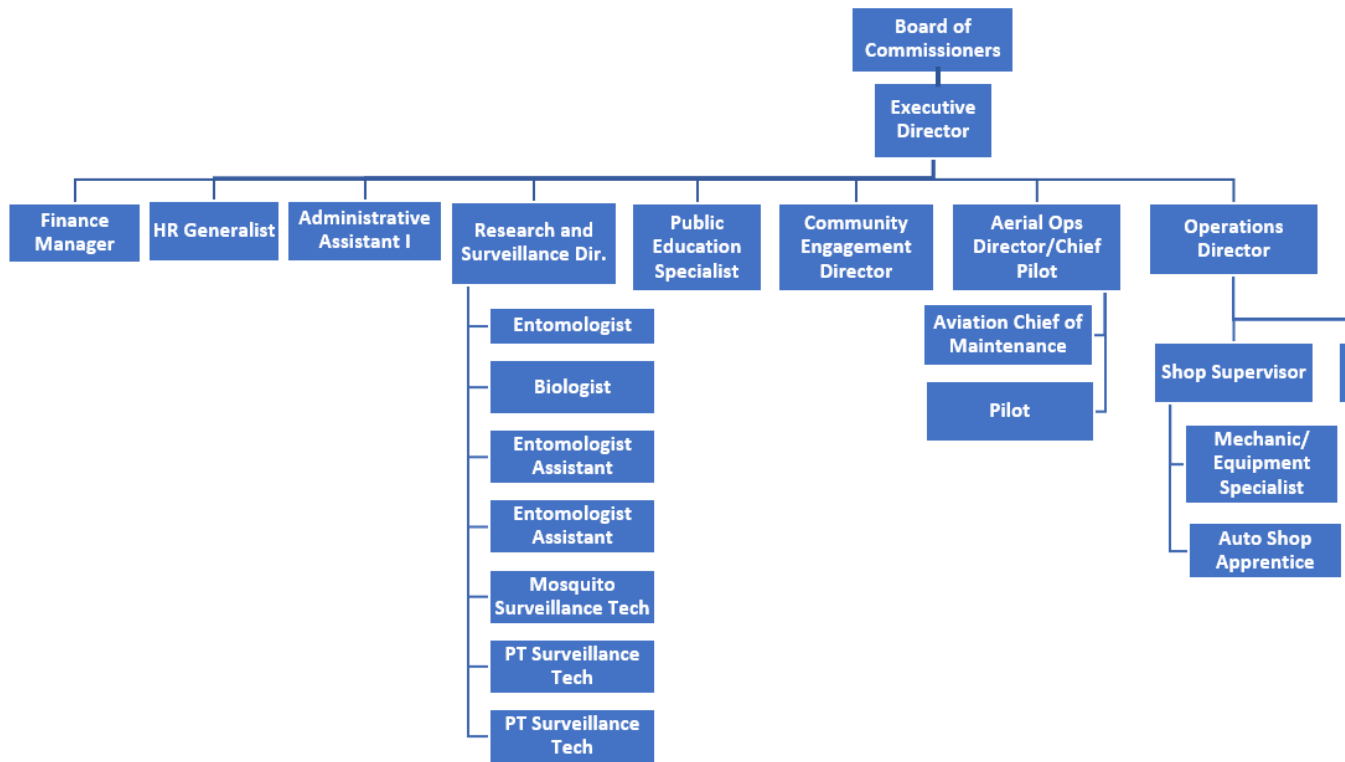
Pasco County MCD employed 60 in-house staff members in FY 2022-23 with a range of responsibilities and expertise. Pasco County MCD had 60 paid positions in FY 2022-23, with a wide range of responsibilities and requirements. Pasco County MCD staff retention has been good, with the annual turnover rate averaging 13% over the past four fiscal years. Turnover is higher for full-time positions than for part-time positions. The district had no volunteers in FY 2022-23. Pasco County MCD staff reported that vacancies are filled quickly. Additional lab and dedicated desk space would allow for additional hires and more efficient analysis conducted by their staff. **Table 11** illustrates staff positions, and an organizational chart is presented in **Figure 3** and **Figure 4**.

Table 11. Pasco County MCD Staff Positions

<ul style="list-style-type: none"> • Commissioners • Aerial Operations Director • Operations Director • Public Education Specialist • Research & Surveillance Director • Entomologist • Aquatic Weed Technician 	<ul style="list-style-type: none"> • Facilities Manager • Equipment Specialist • Mosquito Control Tech • Larvicide Supervisor • Entomologist Assistant • Pilot • Operations Director 	<ul style="list-style-type: none"> • Executive Director • Aircraft AP • Auto Shop Apprentice • Ground ULV Supervisor • Shop Supervisor • Welder
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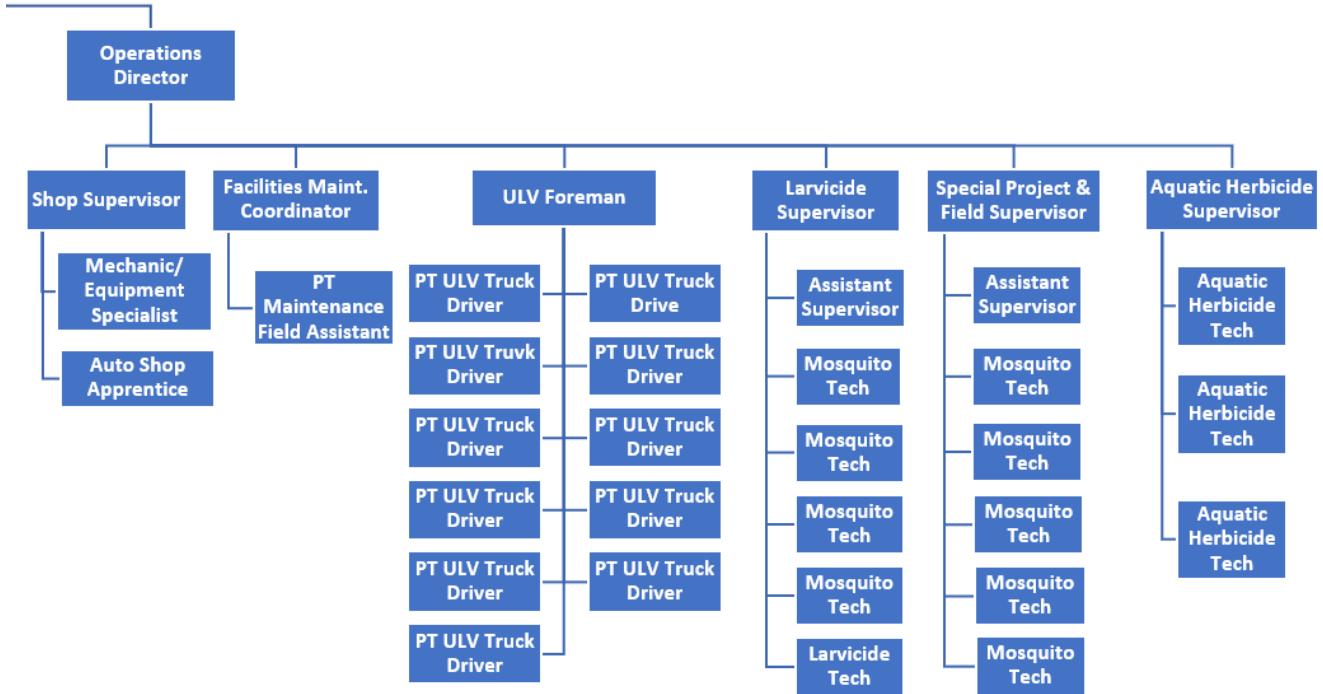
Source: Pasco County MCD.

Figure 3. Pasco County MCD Organizational Chart



Source: Pasco County MCD.

Figure 4. Pasco County MCD Organizational Chart, Continued



Source: Pasco County MCD.

Analysis of Program Staffing Levels

Pasco County MCD staffing levels have increased slightly from FY 2019-20 to FY 2022-23; district staff report that additional staff are needed to meet the growing needs of the rapidly growing county. With the need to expand mosquito control services due to recent and anticipated population growth, Pasco County MCD is increasing its number of staff positions along with increasing its facilities and fleet. Additionally, staff indicated that vacancies are actively promoted and filled quickly with no carryover to the next fiscal year and that additional staff would help to improve current operations. The average turnover rate was 13%, with about seven staff leaving every year, the majority of which left voluntarily. **Table 12** illustrates staff count by fiscal year. TBG requested an organizational chart of staff positions but did not receive one.

Table 12. Pasco County MCD Staff Counts

Employee Counts	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ¹
Commissioners	3	3	3	3
Full Time	38	40	40	44
Part Time	16	18	16	16
Contracted	0	0	0	0
Volunteers	0	0	0	0
Vacancies	0	0	0	0
Total	57	61	59	63
Turnover Rate	13%	16%	13%	10%

Source: TBG Work Product, MCD.

¹ 2023 YTD through March.

Equipment and Facilities

Equipment and vehicles owned by Pasco County MCD are currently sufficient for operations and are being serviced regularly to maintain and maximize efficiency in operational capabilities; however, operations are expected to outgrow current facilities and the district has facility expansion plans. To review the equipment and facility trends of Pasco County MCD, TBG analyzed documentation provided by Pasco County MCD, and interviewed district staff.

The reduction of the outdated fleet of four aircraft before the period of review to two modern helicopters that can provide the same service with improved efficiency demonstrates the efficacy of the program's management. Pasco County MCD purchased two new helicopters in FY 2020-21 in an effort to improve its fleet by replacing two previous helicopters and two fixed-wing airplanes that were over 50 and 45 years old, respectively.

Pasco County MCD owns one facility site that was built in 1987 in Odessa, FL. However, with the past and anticipated future growth in the district's population and resulting need to increase the district's operational capacity, expansion and relocation efforts are underway to build a new operational campus that is located more centrally in the county. As of this writing, a design for the campus is being completed for submission for permitting. Per district staff, the campus is expected to be move-in ready no earlier than calendar year 2025. The staff estimate the project will cost more than \$20 million and that the district currently has \$4.6 million in reserves, which will be used for the construction. The bulk of operations are planned to be housed in the new facility, but the helipad and hangar will remain located at the current facility due to a loss of several remote landing zones in the southwest portion of Pasco County.

In total, Pasco County MCD facilities currently include: the existing facility, six fully enclosed buildings, one fire suppression pump house, three parking bays, and one undeveloped property for the construction of the new campus. In FY 2022-23, Pasco County MCD owns more than 50 vehicles and 200 pieces of equipment. Field equipment includes aircraft-related equipment, operating equipment, and vehicle-related equipment, such as trailers and utility bodies. The facility has a main building, a chemical storage warehouse, a mechanic and fabricator shop, two fuel bays, two helicopter hangars, and three bays in a one-story open steel building. The district's resources appear to have been sufficient to meet needs in the past, however, the rapid growth of the county will require investment in additional facilities. Pasco County MCD reports that it is planning to expand their facility to a total of 41.2 acres to keep up with the growth and needs of Pasco County. A new campus is currently in the design phase to address increased service operations and support staff needs.

A summary of the number of vehicles, equipment, and facilities owned by Pasco County MCD is provided in **Table 13** by fiscal year.

Table 13. District Vehicles, Equipment, and Facilities

Category	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ¹
Vehicles	47	50	52	59
Helicopters	2	2	2	2
Boats	3	2	2	4
Trucks and Vans	35	38	39	45
ATVs and Utility Vehicles	7	8	9	8
Equipment	193	208	208	211
Field Equipment	142	149	149	149
Lab Equipment	6	9	9	9
Office Equipment	45	50	50	53
Facilities	1	1	1	1
Buildings	9	10	10	10

Source: TBG Work Product, Pasco County MCD.

¹ 2023 YTD through April.

In FY 2022-23, Pasco County MCD has 95 traps (including CDC light traps, bottle rotator traps, sentinel traps, and gravid traps) and 10 chicken coops. According to the district, the increase in the number of traps has been proportional to population growth and development in the county. A summary of the surveillance equipment owned by Pasco County MCD by fiscal year is provided in **Table 14**.

Table 14. Surveillance Equipment

Equipment	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ¹
Mosquito Traps	76	71	74	95
Suction Traps	42	32	25	20
BG Counter Traps	0	0	0	4
BG Pro Traps;	0	0	0	8
BG Sentinel Traps	8	13	13	13
Bottle Rotator Traps	2	2	2	2
CDC Light Traps	15	15	25	39
Gravid Traps	9	9	9	9
Sentinel Chicken Coops	9	9	9	10
Chicken Counts	54	54	54	60

Source: TBG Work Product, MCD.

¹ 2023 YTD through April.

Strategic or Other Formal Plans for the District's Future

Pasco County MCD does not have a strategic plan but reports that it has budgeted funds to develop one in FY 2022-23. Pasco County MCD has historically operated with the general intent of controlling adult mosquito populations but has not had a formally defined set of goals and objectives. With the continuing growth and expansion of Pasco County, the district is creating a strategic plan to formalize its goals and objectives and to plan appropriately for the future. This strategic plan will be broken down by department and will contain goals and objectives for each department with metrics for each goal's achievement. District staff reported that the district has budgeted funds for the development of a strategic plan in FY 2022-23 and is actively seeking a consultant to assist in the development of the plan. The strategic plan is slated to take effect in the last quarter of FY 2022-23.

As mentioned elsewhere in the report, one significant future plan is the construction of a new campus site. When completed, Pasco MCD expects to improve services provided by the district as commuting times will be reduced due to the more central location. Additionally, the new site will accommodate the additional staff and equipment needed to keep up with growth in the County, which cannot be accommodated by the existing facility.

Previous Performance Reviews, Financial Audits, and Resident Feedback Surveys

Pasco County MCD had no identified issues with financial audits. Pasco County MCD audits report no material findings nor weakness in internal controls. Pasco County MCD collects resident feedback following open houses and other events and is developing additional survey tools to implement in the future. Analysis of Pasco County MCD's financial audits was conducted by reviewing financial audits provided by Pasco County MCD. Review of the Independent Auditors' Reports from the last three fiscal years (FY 2019-20 through FY 2021-22) showed no findings or issues with Pasco County MCD's financial position, which is sound. Pasco County MCD's revenues routinely cover costs with reserves to cover any shortfalls. In addition, a 2020 financial feasibility study reported that the district is in sound financial position to accommodate the demands of building out a new operational campus.

The district requests citizen feedback following its annual Open House and Citizen Appreciation Event and regularly scheduled facility tours that occur twice per month. District staff provided some examples of positive feedback received from several residents that completed feedback forms. Pasco County MCD has not completed additional performance reviews at this time.

Analysis of Management Reports/Data and Performance Information

Pasco County MCD does not maintain formal reports that track and assess performance information. To assess management reporting and performance information, TBG reviewed documentation provided by Pasco County MCD and conducted interviews with staff. Pasco County MCD staff reported that their IPM activities have generally been guided by the requirements for MCDs set out in the Florida Statutes and the Florida Administrative Code. In interviews, it was gathered that the primary factor for measuring the success was the rate of mosquito-borne disease or human illness in Pasco County. In collaboration with the Florida DOH, Pasco County MCD monitors for any cases of arbovirus within Pasco County. Weekly reports are published by the Florida DOH that serve as a basis for Pasco County MCD's operations, providing a metric for service delivery effectiveness and a method of comparison to the services of other districts. The Florida DOH also directly communicates with Pasco County MCD when cases arise.

Evaluation of Cost, Timing, and Quality of Current Program Efforts

Pasco County MCD manages program costs and quality effectively and efficiently. To assess cost, timing and quality of program efforts, TBG reviewed documentation provided by Pasco County MCD, publicly available data and reports, and interviewed Pasco County MCD staff. District staff reported that they seek to reduce costs through material and equipment procurement processes. The district has a long history of purchasing equipment and supplies at significant savings through Florida State Contract pricing, military surplus facilities, and government rates for computer and office supplies. Vehicle purchases are made through state contract pricing at considerable savings as well. Additionally, the district typically retires a vehicle when it reaches 100,000 miles,

which is typically achieved within five to seven years. District staff report that they take very good care of their vehicles, which provide a better than expected return in dollars.

The district provided numerous examples to TBG of recent improvements to district operations to reduce costs and improve effectiveness and quality of current program efforts. District staff also reported that they seek to cut costs through equipment design and modification processes and that the district is known for being an innovator of equipment used in larviciding and adulticiding applications. Rather than purchasing new equipment, the district designs and builds equipment in-house that is used on larviciding trucks, ATVs, ULV trucks and other vehicles, and by hand. This equipment has proven to be more reliable and staff can make repairs more efficiently, while also being considerably less expensive than the purchase of new items. The district reports that several mosquito control programs throughout the U.S. have visited the Pasco County MCD to view the district's equipment to replicate it for use in their own programs to cut costs. Additionally, when activities are at their peak and parts and supplies are vulnerable to breaking down, the district keeps critical parts available in its shop for immediate replacement and minimal work stoppage.

An example of a treatment tool designed by the district staff is a handheld ULV sprayer that was converted from a weed-eater and transformed into an efficient tool for treating adult mosquitoes in difficult-to-reach areas. The cost of these sprayers is significantly less than those purchased from manufacturers. The cost of transforming the handheld sprayer is \$450 per unit, compared to a cost of \$3,000 to \$4,000 for a unit purchased from a supplier. With 10 of these handheld sprayers in the field, the district has saved \$35,500.

Goals, Objectives and Performance Measures and Standards

Pasco County MCD does not have clearly defined goals or objectives but is in the process of developing a strategic plan; similar to other mosquito control districts, it monitors performance using service call responses and arbovirus disease prevalence metrics.

To assess the district's goals, objectives, and performance measures and standards, TBG requested and reviewed the district's charter; requested the district's strategic plan and the last three years of annual reports; requested information on performance measures and standards and records of current and previous three fiscal years' measures, standards, and records of success or failure to meet the standards; and (if applicable) evaluated the district's actual performance in meeting its goals and objectives. TBG assessed (if applicable) whether performance measures and standards are relevant, useful, and sufficient to evaluate the performance and costs of the programs and activities, whether they are being met, and whether they need to be revised. TBG requested and reviewed (if applicable) previous performance reviews and audits; requested district assessments of why the district failed to meet performance measures and standards and/or goals and objectives; and requested information from the district on actions taken to address and prevent such failures in the future. In addition, TBG interviewed district staff and relevant local government entities about district performance and requested any available results of district-generated resident feedback surveys conducted during the current and previous three fiscal years.

Goals and Objectives

Pasco County MCD does not currently have formally defined goals and objectives; however, the board is currently creating a strategic plan that will establish goals and objectives for each of the district's departments. District staff provided information on recent improvements that have been made to district operations, which are summarized in the preceding section.

Performance Measures and Standards

Pasco County MCD monitors performance using information on responses to service calls and arbovirus prevalence in the district and does not have additional formally defined performance measures or standards. Pasco County MCD has historically operated without formal performance measures or standards, treating for the prevention of diseases through active control and preventative measures. The primary methods Pasco County MCD has used to measure the success of its operations have been the prevalence of disease in Pasco County and regular monitoring of larval and adult trap counts to determine application location and spraying frequencies. In collaboration with DOH, Pasco County MCD monitors for cases of arbovirus within Pasco County. Weekly reports published by the Florida DOH serve as a record of the effectiveness of Pasco County MCD's operations. Over the review period, there have been no deaths nor significant outbreaks of mosquito-borne diseases in the county, and all cases discovered in Pasco County have been travel-related. Regardless of where the case originated, Pasco County MCD conducts increased surveillance and control efforts in the area where the case was discovered to prevent any potential spread of mosquito-borne disease. This is done upon first suspicion of disease without waiting for confirmatory testing. Residents of Pasco County may call in any reports of mosquito activity, and Pasco County MCD will send a technician to the area to perform surveillance and control efforts as needed. The district aims to provide rapid, high quality responses to services requests from citizens within 24 hours. District staff reported that they often close out service requests within the same working day.

Analysis of Goals, Objectives, and Performance Measures

Pasco County MCD does not have clearly defined goals or objectives; performance metrics on arbovirus cases and service calls indicate success in prevention of disease outbreaks and responsiveness to citizen requests. TBG reviewed documents prepared by Pasco County MCD, interviewed staff, and reviewed records provided by Pasco County MCD and available online or through DACS. Pasco County MCD has not established formal goals, objectives, or performance measures and standards, therefore it is not possible to analyze how well the district is performing. However, information was available on responsiveness to service calls and prevalence of arbovirus in the district, which showed that all service calls received were addressed and that Pasco County has seen no significant outbreaks of mosquito-borne disease in the current and previous three years fiscal years. All cases discovered in the district boundaries were found to be travel-related. Upon notice of a case of mosquito-borne disease in the district, the Pasco County MCD performs surveillance and necessary control efforts within the area immediately to prevent any further potential spread of diseases without waiting for confirmation that the case is positive.

Pasco County MCD has demonstrated efficient and effective resource management and conducts a wide range of IPM services for the county. It faces significant challenges moving forward due to the high level of recent and anticipated future population growth and urban development. The district has implemented numerous

techniques and technologies to reduce costs and maximize operational efficiencies and is in the process of developing a strategic plan to formalize the district’s goals and objectives, which will all stem from the general goal of prevention of mosquito-borne diseases.

Table 15 illustrates service responses as well as arbovirus cases over the review period. Pasco County MCD has responded to all service requests and, per staff, all requests are addressed within 24 hours. In relation to mosquito-borne disease cases, all cases have been travel-related for either dengue or malaria, with no deaths. The informal performance measures and standards for Pasco County MCD are summarized in **Table 16**.

Table 15. Performance Measures for Pasco County MCD

Performance Measure	CY 2020 ¹	CY 2021 ¹	CY 2022 ¹	CY 2023 ¹
Arbovirus Cases (Florida)	0	0	0	0
Arbovirus Cases (Travel)	1	0	5	1
Arbovirus Deaths	0	0	0	0
	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23 ²
Service Calls	1,047	1,507	1,155	638
Service Responses	1,047	1,507	1,155	638

Source: TBG Work Product, MCD, DOH. 2023 YTD through April.

¹ Florida DOH data is provided by calendar year (CY).

² 2023 YTD through April.

Table 16. Assessment of Performance Measures and Standards for Pasco County MCD

Performance Measure	Performance Standard	Assessment
Prevalence of arbovirus diseases humans	No human arbovirus cases acquired in Florida and detected in the district	Standard met as no such cases have occurred based on TBG review of DOH data.
Service Calls	Respond to all service requests	Standard met.

Source: TBG Work Product, based on review of information provided by Pasco County MCD.

Perceptions of the District's Performance by Local Government Stakeholders, Residents, and Other Relevant Local Stakeholders

Perceptions of Pasco County MCD’s performance by other stakeholders appear to be positive. Pasco County MCD has collected feedback from residents who participated in the district’s annual Open House and Citizen Appreciation event and participants in guided tours of the district’s facilities. In addition, the Pasco County MCD is in the process of developing resident surveys that will be implemented when responding to service requests. The district also conducts community outreach programs to improve communications and educate the Pasco County community. While the district does not have performance information documentation to allow assessment of the district’s performance, the district’s performance is viewed positively by stakeholders. For example, with the creation of in-house, cost-saving alternatives for equipment, Pasco County MCD is viewed by stakeholders as a statewide leader in innovation for mosquito control. Pasco County MCD was extensively cited in an operational review by the Florida Keys MCD that highlighted Pasco County MCD’s activities as a statewide example of innovation and efficiency for MCDs. Additionally, Pasco County MCD has a reputation for efficiency and innovation, building from scratch or modifying existing equipment for service delivery rather than purchasing equipment, as they have been noted by other MCDs in interviews for their resourcefulness. District staff reported

that several mosquito programs throughout the U.S. have visited the Pasco County MCD to view the district's equipment innovations to learn how they can replicate the same equipment for use in their own programs.

TBG requested information from representatives of the PBOCC, local health department, and local parks and recreation department on their perceptions of the district's service delivery and efficiency. The county health department reported that it is not aware of alternate methods for delivery of the same services provided by Pasco County MCD, believes that the district is the most efficient entity to deliver the services, and has no recommended consolidations. Local health department staff further reported that they have had a very good working relationship with the district and look forward to continuing to work with the district as a community partner. Other stakeholders did not provide a response after multiple contacts.

While the PBOCC did not provide a direct response to TBG's questions, in the agenda for the June 20, 2023, meeting of the PBOCC, a resolution was presented by the board "expressing their support for the Pasco County MCD and calling on the Florida Legislature to leave the district intact as an independent special district." The recommendation was to approve the resolution, which can be interpreted as the county's support of the functions of the district.

3. Recommendations

Discussion and Analysis

TBG analyzed findings by fiscal year to determine if revisions to district organization or administration can improve the efficiency, effectiveness, and/or economical operation of the district and presents two recommendations for Pasco MCD's consideration. TBG presents recommendations to allow the district access to solid waste management funds from DEP that could help improve efficiency of the district's operations by reducing costs for an important and never-ceasing source reduction activity of waste tire collection and disposal; for the district to complete its strategic planning process; and for the Legislature to consider directing the Florida Coordinating Council on Mosquito Control to develop model goals, objectives, and performance measures and standards to assist MCDs in this state.

Waste Tire Collection and Disposal Fees: Waste tires are commonly found scattered throughout residential and commercial areas across the state, and the design of tires makes them ideal habitat for mosquito larva, particularly for species of mosquito that are known to be important disease vectors. The removal of waste tires can help reduce populations of these disease-carrying mosquitoes and reduce the threat of diseases like dengue and Zika. However, the problematic mosquito-producing habitats created by waste tires are difficult to manage through routine chemical applications but can be managed through proper disposal.

Pasco County MCD is currently incurring costs and inefficiencies in managing waste tire collection and disposal, which is an important source reduction activity. District staff reported that the district collects, on average, 10 tons of waste tires and expends approximately \$1,300 each year in waste tire disposal fees. The district does not have a fee exemption or other funding support to help defray the costs. District staff reported that the act of physically removing waste tires from its service area causes a significant burden in terms of the manual labor, time, and other resources spent on this regular activity and that financial assistance would help offset some of that burden. Although Pasco County MCD has had excess revenues in two of the past three full fiscal years, it is

important for any public entity like an MCD to keep funding reserves to be prepared for unexpected expenditures that could result from disease outbreaks.

In Florida, DEP regulates the disposal of waste tires by creating requirements for the collection and disposal of waste tires at solid waste management facilities and waste tire processing facilities across the state.⁷ These facilities typically charge fees for the disposal of waste tires, which frequently cannot be waived due to bond requirements for the facilities. MCDs must pay these fees if the districts choose to collect and dispose of waste tires.

The state currently collects a waste tire fee of \$1 per each new tire sold at retail.⁸ These funds are allocated in different amounts defined in statute to various activities related to solid waste management in the state, including funds that DEP is directed to use for general solid waste activities.⁹ DEP currently uses a portion of this funding to reimburse counties for hosting waste tire amnesty events during which residents may bring in waste tires for disposal free of charge (businesses are not eligible for participation). DEP opens this opportunity annually from July through May to all counties in the state, and any county may apply for the assistance through the department by providing a scope of work including a description of how the amnesty event will be held, how many tires the district anticipates receiving, and other information. According to DEP representatives, the department advertises this funding opportunity specifically to counties; however, DEP has also allowed MCDs to apply for and receive the funding for waste tire amnesty events. For example, the Florida Keys MCD and East Flagler MCD, as discussed in their reports, received such funding in FY 2022-23.

For districts in which waste tires present a significant mosquito control challenge, the availability of funding to support waste tire abatement would be beneficial. Although DEP in its discretion has allowed MCDs to apply for the waste tire amnesty event funding in the past, advertising for the funding is not directed toward MCDs, and the department is not required by statute to continue to offer such funding in the future. Moreover, some MCDs would benefit from the reimbursement of waste tire disposal fees and other costs incurred by the district for tires collected and disposed of by district staff, in addition to funding for hosting waste tire amnesty events. Facilitating increased and consistent access to waste tire disposal funds by MCDs could help increase tire collections around the state, which has benefits beyond mosquito control, including general pollution reduction and beautification.

To allow regular access to waste tire abatement funding by MCDs, facilitate increased waste tire collection by MCDs around the state as a means of mosquito control, and increase the hosting of events like waste tire amnesty days by MCDs, the Legislature could consider amending section 403.709(1), Florida Statutes, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.

Strategic Plan and Performance Measures and Standards: Pasco County MCD has demonstrated effective and efficient resource management, but future financial stability should be carefully monitored given the increasing demands that will be placed on the district's resources due to the continuing rapid development in Pasco County. To ensure its ability to continue to deliver mosquito control services to the rapidly growing population of the county, the district should carefully develop and formalize its strategic plan as soon as feasible and include a plan for ensuring the financial stability of the district. The strategic plan should have clearly stated, measurable goals,

⁷ Sections [403.717](#) and [403.718](#), F.S. and Rule Chapter [62-711](#), F.A.C.

⁸ Section [403.718](#), F.S.

⁹ Section [403.709\(1\)](#), F.S.

objectives, and performance measures and standards that will allow the district to plan its operations efficiently and effectively and to monitor the district’s progress in achieving goals and objectives.

The district could seek guidance on strategic planning processes and development of goals and objectives from other districts that have recently conducted such processes, such as Anastasia MCD or Indian River MCD. Florida’s MCDs vary with regard to geography, incidences of species, and the scale and complexity of operations, however, there are similarities and opportunities for shared resources. Strategic planning processes such as those undertaken by Indian River MCD or Anastasia MCD could serve as a model for other MCDs.

Florida Coordinating Council on Mosquito Control: During TBG’s review of the 15 independent MCDs, TBG found that most districts have not developed sufficient goals, objectives, or performance measures and standards. The Florida Coordinating Council on Mosquito Control was established by the Legislature to foster maximum efficient use of existing resources and to assist entities involved in mosquito control with best management practices. Membership on the council includes the agency heads for DACs, DEP, and the Fish and Wildlife Conservation Commission, the State Surgeon General, as well as representatives of federal agencies, the University of Florida’s Florida Medical Entomology Laboratory, Florida MCDs, and others. The Legislature could direct the council to form a subcommittee consisting of mosquito professionals and researchers from around the state to develop model MCD goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.¹⁰

Recommendations

Based on the findings discussed above, TBG recommends the following changes to improve operations, and reduce costs (**Table 17**).

¹⁰ Section [388.46](#), F.S.

Table 17. Recommendations with Associated Considerations

Recommendation	Considerations
<p>The Legislature could consider amending section 403.709(1), Florida Statutes, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.</p>	<ul style="list-style-type: none"> • This recommendation would require a statutory change. • This recommendation would require DEP staff to communicate information about resources available through the department for waste tire collection and disposal assistance to MCDs and might add nominal additional administrative costs for the department. • This recommendation could lead to additional expenditures by the department from the Solid Waste Management Trust Fund; department staff reported that there tend to be unexpended funds from this funding source each year.
<p>The district could continue to proceed with its process to formalize its goals, objectives, and performance measures and standards through a strategic planning process to consistently monitor and maintain performance information over time; the district could seek guidance from other districts that have conducted strategic planning processes.</p>	<ul style="list-style-type: none"> • This recommendation would require additional staff time and would incur additional administrative costs to the district. • If the district chooses to seek guidance from other districts and/or the Florida Coordinating Council on Mosquito Control, those entities could incur additional administrative costs.
<p>The Legislature could consider amending s. 388.46, Florida Statutes, to direct the Florida Coordinating Council on Mosquito Control to form a subcommittee consisting of mosquito professionals and researchers from around the state to develop model goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.</p>	<ul style="list-style-type: none"> • This recommendation would require a statutory change. • This recommendation would impose additional workload on council members and staff. • The council’s membership could assemble a subcommittee with a broad range of expertise that could be ideal for the development of such model performance information. • While this guidance will assist all MCDs, it will be of particular benefit to MCDs that lack staff resources for the development of such performance information.

Source: TBG Work Product.

4. District Response

Each independent MCD under concurrent review by TBG was provided the option of submitting a formal response letter for inclusion in the final published report. Pasco County MCD did not provide TBG with a response letter for inclusion in the final report.



GLOSSARY OF TERMS MOSQUITO CONTROL DISTRICT REVIEWS

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

Winter Park, FL 32789

Attachment 1

Term	Definition
Adulticide	A chemical that kills adult insects, which is usually applied as a spray; depending on the circumstances, adulticide applications can be made from the ground (most commonly with ultra-low volume spray trucks) or from the air (with either fixed- or rotary-wing aircraft or helicopters)
<i>Aedes aegypti</i> mosquitoes	The primary type of mosquitoes (commonly referred to as yellow fever mosquitoes) that spread Zika, dengue, chikungunya, and other viruses; because these mosquitoes live near and prefer to feed on humans, they are more likely to spread these viruses to humans than other types of mosquitoes
<i>Aedes albopictus</i> mosquitoes	Although competent vectors of dengue, eastern equine encephalitis, and other viruses that affect humans, these mosquitoes (commonly referred to as Asian tiger mosquitoes) feed on animals as well as humans and are, thus, less likely to spread viruses to humans than <i>Aedes aegypti</i> mosquitoes
Altosid	The trade name for a mosquito larvicide that contains a synthetic version of the juvenile hormone insect growth regulator methoprene as the active ingredient
American Mosquito Control Association (AMCA)	A professional association that includes individuals working for mosquito control programs, academics conducting research on mosquitoes and other disease vectors, and industry representatives who support mosquito control efforts around the world; the AMCA is active in member training and educating the public on the health importance of mosquito control in the U.S. and beyond; the association is international in scope and has approximately 1,500 members
<i>Anopheles</i> mosquitoes	A genus of mosquitoes with more than 400 species; female mosquitoes in approximately 40 of these species transmit malaria; this is the only genus of mosquitoes that can transmit malaria
Arbovirus	Arthropod-borne viruses that are transmitted to humans primarily through the bites of infected mosquitoes, ticks, sand flies, or midges; includes West Nile virus, eastern equine encephalitis virus, St. Louis encephalitis virus, dengue, chikungunya, Zika, California encephalitis group viruses, and malaria
Arthropod	As defined in Ch. 388, <i>Florida Statutes</i> , titled “Mosquito Control,” “arthropods” are insects of public health or nuisance importance, including all mosquitoes, midges, sand flies, dog flies, yellow flies, and house flies



Attachment 1

Term	Definition
Barrier island	Land that separates the ocean from the mainland; frequently an estuary or a lagoon will be located between the barrier island and mainland
Biogents	A company that produces mosquito traps with the goal of reducing mosquito populations that are produced in container-type habitats
<i>Bacillus thuringiensis israelensis (Bti)</i>	A naturally occurring bacteria commonly used as a mosquito larvicide since the 1980s
Chikungunya	A mosquito-transmitted disease caused by a virus that originated in Africa and is transmitted by <i>Aedes</i> mosquitoes; symptoms include fever, joint pain, and rash; the name chikungunya comes from the African Makonde language and means “to bend over in pain,” which is the stance that many who contract this disease exhibit
<i>Culex</i> mosquitoes	A genus of mosquitoes, several species of which serve as vectors of one or more important diseases of birds, humans, and other animals; the diseases they vector include West Nile virus, Japanese encephalitis, and St. Louis encephalitis.
<i>Culiseta melanura</i> mosquitoes	A species of mosquitoes (commonly referred to as the black-tailed mosquito) that is significant due to its role in the transmission cycle of eastern equine encephalitis virus and potentially West Nile virus; these mosquitoes primarily feed on birds but can spread arboviruses to mammals as well
Dengue	A mosquito-transmitted virus that causes sudden fever and acute joint pain; occasionally occurs in Florida where the mosquito vector is <i>Aedes aegypti</i> or <i>Aedes albopictus</i>
Dibrom	The trade name for an organophosphate insecticide with the active ingredient naled; used in mosquito control as an adulticide and is typically applied with aircraft
Dipper	An approximately 300 ml container attached to an extension pole that is used to sample for the presence of mosquito larvae in aquatic habitats
Eastern equine encephalitis virus (EEEV)	A mosquito-transmitted virus that is rare but very dangerous when contracted by a horse, human, or other mammal; an average of 13 cases per year were reported in the United States from 2018-2022; approximately 30% of people with EEEV die and many survivors have ongoing neurologic

Attachment 1

Term	Definition
	problems; in Florida, the freshwater swamp inhabiting mosquito <i>Culiseta melanura</i> is the primary vector of this disease
Fixed-wing aircraft	Commonly referred to as an airplane, these aircraft include stationary wings that provide lift for the aircraft; in mosquito control, these aircraft are commonly used for larvicide and adulticide applications
Florida Coordinating Council on Mosquito Control	An interagency council created in Ch. 388, <i>Florida Statutes</i> , in 1986, primarily to address issues concerning mosquito control applications, possible environmental impacts of control actions, and mosquito control management on State of Florida-owned lands
Florida Department of Agriculture and Consumer Services	The state agency that oversees and regulates mosquito control programs in Florida
Florida Department of Environmental Protection	The state agency responsible for coordinating efforts for intensified mosquito control on protected public lands when needed
Florida Department of Health (DOH)	The state agency responsible for implementing the Florida Sentinel Chicken Surveillance Program, reporting weekly data on the prevalence of arboviruses in this state, issuing public health arbovirus advisories and alerts, conducting or participating in arbovirus epidemiologic investigations, distributing weekly arbovirus epidemiology summary reports for mosquito control agencies, healthcare agencies, researchers, and others, and reporting human and animal arbovirus cases to the national arbovirus surveillance database
Florida Fish and Wildlife Conservation Commission	The state agency responsible for maintaining a database that enables the surveillance of bird mortality from arboviruses and for providing assistance and information on arboviruses in wildlife
Florida Medical Entomology Laboratory	A University of Florida laboratory (within the Institute of Food & Agricultural Sciences) that conducts research primarily on the control of mosquitoes; for the past 70 years, research at this lab has been instrumental in assisting mosquito control programs in Florida and elsewhere
Florida Mosquito Control Association (FMCA)	Created in the 1920s, the FMCA is Florida’s professional association that includes individuals working for mosquito control programs, academic personnel conducting research on mosquitoes and other disease vectors,



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Term	Definition
	and industry, which supports mosquito control efforts in Florida; the FMCA is active in the training of members and educating the public on the public health importance of mosquito control
Florida Sentinel Chicken Arboviral Surveillance Program	A program of the DOH that provides laboratory assistance to local agencies to monitor for the transmission of mosquito-transmitted viruses; sentinel chickens are stationed at locations throughout the state; when the chicken is bit by an arbovirus-transmitting mosquito, the chicken develops antibodies to the virus (the chicken does not become sick and cannot spread the virus to other mosquitoes); blood samples obtained from the sentinel chickens are submitted to DOH’s lab in Tampa to be examined for the presence of antibodies; when present, the results indicate that arbovirus-transmitting mosquitoes are circulating in the location, enabling the increase of mosquito control efforts to reduce the risk of humans and animals from becoming ill
Genetically modified mosquitoes	<i>Ae. aegypti</i> mosquitoes that have been genetically modified to carry two genes: 1) a self-limiting gene that prevents female mosquito offspring from surviving to adulthood; and 2) a fluorescent marker gene that glows under a special red light, thereby allowing researchers to identify the genetically modified mosquitoes in the wild; because the female offspring die before becoming adults, the population of <i>Ae. aegypti</i> mosquitoes decreases
Geographic Information System (GIS)	Integrated computer hardware and software that stores, manages, analyzes, and visualizes geographic information
Good Laboratory Practices Program (GLP)	The goal of GLP is to ensure the quality and integrity of test data related to non-clinical safety studies
Granular application	Granular applications of chemicals differ from liquid applications by having a solid particle carrying the insecticide, which can better penetrate vegetation; this application is primarily used for larvicides to deliver mosquito toxin to the water where mosquito larvae are developing
Impoundment	Impoundments along Florida’s central-east coast were created in the 1950s and 1960s by building earthen dikes around salt marshes known to produce mosquitoes; this allows the mosquito control program to manage the water level within the impoundment to prevent saltmarsh mosquitoes from laying



Attachment 1

Term	Definition
	their eggs in these areas, thus effectively reducing their populations with a minimum need for pesticides; approximately 40,000 acres of impoundments were constructed from Volusia County south to Martin County; the impoundments remain a source reduction control method in the region
Landing rates	A surveillance method to determine the extent of a mosquito problem, where a person stands in a specific location and counts the number of mosquitoes that land on them within a designated period (such as 60 seconds)
Larvicide	A chemical that kills insects in their larval stages; for mosquitoes, larvicide must be introduced into the water where the larvae are developing; depending on the circumstances, larvicide applications can be made from the ground or from the air with either fixed- or rotary-wing aircraft or drones
Light Detection and Ranging (LiDAR)	A remote sensing technology used to precisely detect objects, such as mosquitoes, in real space
Malaria	A life-threatening illness transmitted primarily in tropical locations by female mosquitoes in the genus <i>Anopheles</i> primarily in tropical locations; symptoms include fever, headache, and chills and usually occur within 10-15 days after a bite
Methoprene	A synthetic juvenile hormone, which is an insect growth regulator, that has been used as a larvicide since the mid-1970s
Millage	A tax rate on property expressed as the number of dollars assessed for each \$1000 of property value; for example, the property owner of a house valued at \$250,000, which is assessed at a millage rate of 1.0, would be charged \$250
Mosquito Control District	A local government entity enabled through a voter-approved local or state legislative act to provide mosquito control services in a geographically defined area
Mosquito counts	Surveillance of mosquito populations using a variety of techniques (e.g., traps or landing rates); this term is usually used in reference to adult mosquitoes rather than immature ones
Natular	The trade name for a larvicide that includes the bacteria spinosid as its active ingredient



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Term	Definition
Nuisance mosquito	A term used to designate a mosquito that typically does not transmit a pathogen such as a virus; these mosquitoes are in contrast to disease-transmitting mosquitoes that are readily capable of transmitting a pathogen
Pest resistance	The situation in which mosquitoes are no longer killed by the standard dose of an insecticide or manage to avoid coming into contact with the insecticide
Pyrethrum	A biochemical derived from a chrysanthemum plant that contains insecticidal properties; typically used in mosquito control as an adulticide
Rotary-wing aircraft	Aircraft that use a rotary blade rather than wings; a helicopter is the most common example
Rotational impoundment management	A management technique common in saltmarsh impoundments along Florida’s Indian River Lagoon where the impoundment is artificially flooded during part of the spring and summer to prevent mosquitoes from laying their eggs in the marsh and is opened for the remainder of the year through culvert pipes to provide a hydrological connection between the impounded marsh and adjacent estuary or lagoon
Saint Louis encephalitis virus	A virus most commonly transmitted by <i>Culex</i> mosquitoes that can affect the central nervous system when a human is infected
Source reduction	Refers to the elimination of habitats that can produce mosquitoes; ranges from the proper disposal of waste containers to the complicated management of impoundments
Spinosid	A naturally occurring bacteria that contains insecticidal properties; is commonly applied as a larvicide; Natular is a commercial product that uses spinosid as its active ingredient
Sterile Insect Technique	A method whereby male insects are sterilized by radiation or other means; when the sterilized male mates with the female insect, viable offspring are not produced
Subcommittee on Managed Marshes	An interagency committee created in 1986 by the Florida Legislature in Ch. 388, <i>Florida Statutes</i> , to promote the wise management of Florida’s wetlands for the mutual benefit of mosquito control and environmental enhancement
Ultra-low volume	A technique to dispense extremely small droplets of insecticide; while historically used for adulticiding, in some instances the technique is now used for larviciding



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Term	Definition
United States Department of Agriculture (USDA)	Through its national Agricultural Research Service, the USDA participates in Florida mosquito control efforts largely with the Center for Medical, Agricultural and Veterinary Entomology, a laboratory in Gainesville, Florida, that conducts research on the biology and control of mosquitoes and other insects
United States Environmental Protection Agency	The federal agency that regulates mosquito control in Florida primarily through their approval and enforcement of chemical labels for insecticides
Unmanned Aerial System (UAS)	Aerial vehicles and associated equipment that do not carry a human operator and are remotely piloted or fly autonomously; drones are an example of a UAS
Vector	A living organism that transmits a pathogen (e.g., virus, plasmodium, nematode) from an infected animal to a human or another animal; mosquitoes are an example of a vector
Vector surveillance	Monitoring for vectors that can be accomplished in several ways (e.g., various types of traps or landing rates)
Waste tires	Vehicle tires that are no longer of value and that have been improperly disposed in a manner that allows water to collect in the tires; some species of mosquitoes (e.g., <i>Aedes aegypti</i> or <i>Aedes albopictus</i>) lay their eggs in the standing water where the immature mosquitoes will develop to adulthood
Water management	In mosquito control, this term refers to a source reduction technique to minimize the production of mosquitoes in a particular aquatic habitat; the management of saltmarsh impoundments and some ditches are examples of water management projects
West Nile virus (WNV)	Introduced into the United States in New York around 2000, the virus is carried by birds and primarily transmitted by <i>Culex</i> mosquitoes; humans who contract the virus can develop a fever and other symptoms including headache, body aches, joint pains, and rash; most recover completely but symptoms can linger for weeks to months
Yellow fly trap	A sticky-type trap used to entangle yellow flies, a type of biting fly that occurs regularly in the Florida Panhandle, to reduce their population without insecticides



Attachment 1

Term	Definition
Zika virus	A virus that originated in the Zika region of Africa and is transmitted by the mosquitoes <i>Aedes aegypti</i> and <i>Aedes albopictus</i> ; humans who contract the virus can have symptoms similar to dengue such as fever, rash, headache, and joint pain; Zika passed from a pregnant woman to her fetus can result in birth defects including microcephaly and other brain abnormalities

Source: TBG work product.



INTEGRATED PEST MANAGEMENT SUMMARY

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

Winter Park, FL 32789

Term	Summary
Integrated Pest Management	<p>Most mosquito control programs use an Integrated Pest Management (IPM) approach to control mosquito populations, which targets the different stages of a mosquito’s life cycle with various prevention and control measures. IPM addresses eight areas. Surveillance of mosquito populations is an essential component of all IPM programs with chemical treatments based on the surveillance findings. IPM can also include source reduction (e.g., container disposal and water/impoundment management), larviciding and adulticiding (using ground and/or aerial treatments), biological and alternative controls, and disease surveillance. Research and education are also important components of IPM programs.</p>
Mosquito Surveillance	<p>The general approach to surveillance is to define area-specific problems with mosquitoes through the establishment of a mosquito surveillance program. The program assists in determining the types of mosquito control efforts needed in each area so that pesticide applications are used only when necessary. Service requests made to mosquito control programs serve as one means of surveillance. Other means for adult mosquito surveillance include monitoring the landing rates and counts of mosquitoes in traps to determine when and where they are most prevalent and observing the effects of adulticide, larvicide, and source reduction efforts. Immature mosquito surveillance is conducted by collecting eggs, larvae, and pupae. Surveillance may also include inventorying and mapping data and using emerging technologies such as geo-referenced maps, geographic information systems (GIS), smart traps (e.g., a trap with an electronic device that differentiates mosquitoes from other insects, counts them, and wirelessly transmits the results), and unmanned aerial vehicles.</p>
Source Reduction	<p>Source reduction, also known as physical or permanent control, is considered the most effective mosquito control technique and is accomplished by eliminating larval habitats in salt marshes, freshwater habitats, temporarily flooded locations, and containers.</p> <p>Current saltmarsh source reduction techniques in Florida include</p> <ul style="list-style-type: none"> • construction of shallow ditches that enhance drainage and thus eliminate mosquito-producing sites and create connectivity among water bodies to allow larvivorous fish (fish that feed upon insect larvae) access to mosquito habitats; and • management of impoundments by maintaining a sheet of water across a saltmarsh to prevent mosquitoes from laying eggs on the soil; this achieves saltmarsh mosquito control with minimum insecticide use.

Term	Summary
	<p>Source reduction is also conducted in freshwater habitats and is based on the principle that manipulating water levels in low-lying areas will eliminate or reduce the need for insecticide use. The primary strategy used is reducing the amount of standing water or reducing the length of time that water can stand in low areas following significant rainfall.</p> <p>Another important area of source reduction is through aquatic plant management, which can be accomplished using chemical, biological, or mechanical control methods. Waste tire management is also a significant activity for many mosquito control districts because the proliferation and accumulation of discarded tires throughout the state continues to create habitats highly favored by mosquitoes, and these tires can be costly and labor-intensive to remove. Removing any receptacles that can contain water is beneficial in controlling mosquitoes.</p>
Larvicides and Larviciding	<p>Larvicides are insecticides used to kill insects in the larval stage. Most mosquitoes spend three to five days of their life cycle in the larval stage when they are highly susceptible to predation and control efforts; therefore, well-planned and timed larviciding is important for efficient operations to save labor costs and reduce chemical use. This also requires understanding the local mosquito ecology and patterns of arbovirus transmission to select the appropriate control techniques. Equipment used for ground application of larvicide can include trucks with sprayers mounted on the front bumper, all-terrain vehicles (ATVs), boats, and various hand-held and backpack sprayers. Aerial application uses various devices such as nozzles and metered systems that are attached to fixed-wing or rotary-wing aircraft (i.e., helicopters).</p>
Adulticides and Adulticiding	<p>Adulticides are insecticides used to kill adult mosquitoes. The majority of adulticiding in Florida is conducted using ultra-low volume (ULV) spraying during which an aerosol spray is released by specialized spray equipment mounted in aircraft, on the back of trucks or ATVs, or carried by hand or in a backpack. The spray drifts through the air and is effective only while it remains airborne; thus, having a short-term effect only. Where a longer-term effect is needed, residual sprays are applied to barriers or surfaces such as a stadium, park, or resident's yard and are often applied with a modified vehicle-mounted hydraulic sprayer. The mosquito must land on the surface where the residual insecticide has been deposited for it to be effective. Equipment operators must be properly trained in equipment maintenance and adulticide application because timing, targets, and thresholds for the application are based on numerous factors and can be challenging to establish.</p>

Term	Summary
Biological and Alternative Control	<p>Biological control agents include microbial control agents (e.g., bacteria, such as <i>Bacillus thuringiensis</i> or <i>Bt</i>, that can be sprayed over waterbodies to kill developing mosquito larvae), invertebrate arthropod mosquito predators (e.g., small aquatic crustaceans, such as copepods, that eat insect larvae), and vertebrate mosquito predators (e.g., larvivorous fish and birds). It is common for mosquito control districts in Florida to provide larvivorous fish as a service to the public. For example, Collier Mosquito Control District provides <i>Gambusia</i> mosquitofish to Collier County residents to release in standing water on their property to manage mosquito larvae.</p> <p>Alternative control methods include the sterile insect technique, trapping, repellents, and bug zappers.</p>
Disease surveillance	<p>Because of its geographic location and proximity to the Caribbean, Florida is vulnerable to the introduction of new vector-borne pathogens as occurred with the introduction of Zika virus in 2016 in South Florida. Disease surveillance includes monitoring for human cases of mosquito-borne arboviral diseases including dengue, chikungunya, West Nile virus, St. Louis encephalitis, and others. In addition, many mosquito control programs conduct regular blood testing of sentinel chickens. The state established the Florida Sentinel Chicken Arboviral Surveillance Program (FSCASP) in 1977 to provide laboratory services to local agencies to monitor the transmission of certain vector-borne diseases. The services are primarily used by mosquito control programs around the state. The programs submit sentinel chicken blood samples to the Florida Department of Health’s Bureau of Laboratories in Tampa, where an antibody test is performed to identify if the chicken has been exposed to one of several viruses. Results are provided to participating agencies on a weekly basis.</p>
Mosquito Control Research	<p>Mosquito control programs must base their activities on sound and up-to-date scientific research in order to provide safe, effective, and efficient mosquito control services. Research that is either conducted or reviewed by mosquito control programs is essential to developing and implementing new and innovative methods and technologies. Numerous federal, state, and other entities conduct mosquito control research, as do several mosquito control districts in this state.</p>
Outreach and Education	<p>Increasing the public’s understanding of the work of the mosquito control districts is an important component of overall mosquito control efforts. Public education helps people understand what is involved in mosquito control, the biology of mosquitoes, ecological issues, arboviral disease transmission, and actions that can be taken to prevent mosquito bites and reduce mosquitoes in yards and</p>

Attachment 2

Term	Summary
	neighborhoods. When adequately informed, the public is in a better position to protect themselves and support mosquito control efforts. This state’s mosquito control programs and other entities, such as the Florida Department of Agriculture and Consumer Services, Florida Mosquito Control Association, and the University of Florida’s, Institute of Food and Agricultural Sciences-Florida Medical Entomology Laboratory, dedicate significant efforts toward education.

Source: TBG work product.