Warren County Mosquito Extermination Commission

2023 ANNUAL REPORT

January 1, 2023 - December 31, 2023

Dragging for ticks at the DWGNRA June 2023

Cat Swamp blockage removal October 2023

Enlarged mosquito proboscis drawn and painted by Seasonal Adrianna Kaplinski July 2023

Amblyomma Americanum tick Taken with Leica microscope June 2023

Mapping with UAS Fall 2023

Lopatcong Creek blockage removal with Phillipsburg DPW June 2023

2023 Annual Report Summary

Year 2023 was a busy year for the Warren County Mosquito Control Commission, both administratively and operationally. One of the biggest challenges administratively during the year was locating affordable healthcare for the Commission employees and leaving the State Health Benefits Program. This transition was challenging; however, large savings to both the Commission and the County were realized. Now that the Commission employees are part of the County's self-insured healthcare fund, that account line will no longer appear in the Commission's budget. The Commission's website was migrated to a new host and with that came a need to change email servers as well. Both transitions went relatively smoothly and resulted in a higher level of cybersecurity.

After a long wait, Rutgers finally offered the mosquito identification certification exam, which both Ryan Hagerty and Stacey Giordano passed on the first attempt showing competency in larval and adult mosquito identification. Ryan Hagerty passed his Part 107 FAA certification as a remote pilot, so that now the Commission has two employees licensed to operate unmanned aircraft. John Necina added two new categories to his pesticide licensing aerial and demonstration/research pesticide, which will enable the Commission to perform public health insecticide applications with unmanned aircraft in the future.

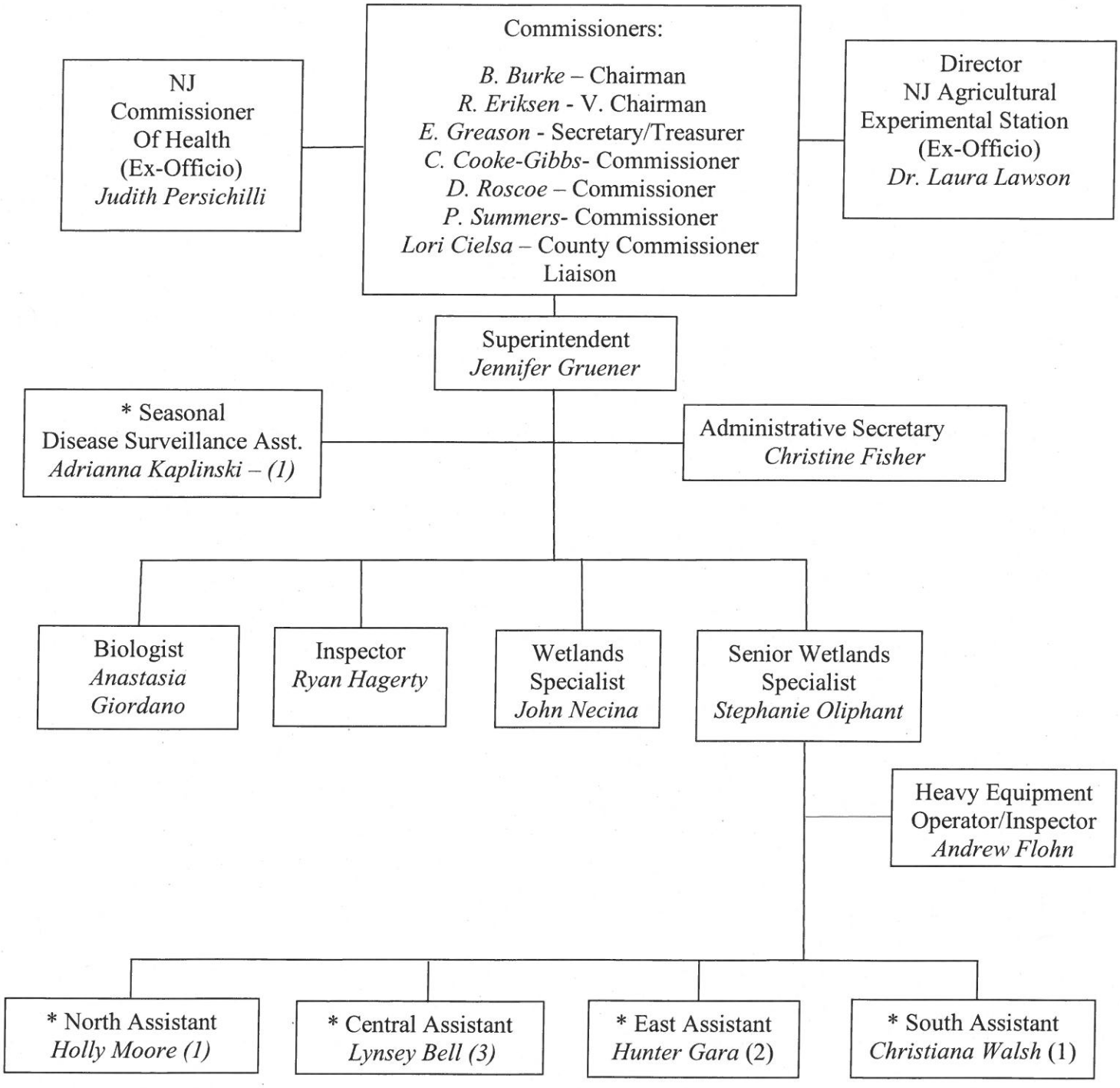
The spring of 2023 was relatively dry, which got the mosquito season off to a very slow start. Throughout April, May, and most of June rainfall was way below average. Larval mosquito sites throughout the County had dried down and adult mosquito populations were low. However, towards the end of June that really changed when rainfall picked up. Over 16 inches of rain was recorded in the Oxford rain gauge in July and sporadically large rainfall events continued to flood sites for the remainder of the season. As a result, it was one of the busiest aerial larviciding years in the Commission's history. Funds that had been allocated for equipment purchases were reallocated for purchasing additional insecticides and contracted aerial services. Additionally, mosquito-eating fish were desperately needed since most of the fish sites had dried down in the spring. Commission staff did an amazing job keeping up with ground larviciding and when fish and time were available, fish sites were restocked.

On average, the NJ light traps caught more mosquitoes per night in 2023 (31.01/trap night) than they have since 2009 (36.01/trap night). Some populations in particular parts of the County were extremely high. In response, staff performed truck mounted ultra-low volume (ULV) applications on a targeted and localized basis and were able to keep service requests relatively low for such a busy year. A third ULV sprayer was even put into rotation to keep the adult mosquito populations below nuisance and disease thresholds. There were more than double the average number of WNV positive mosquitoes collected in the County in 2023 and targeted ULV applications were done in those areas, which successfully lowered the risk of human disease. There were no human WNV cases in Warren County in 2023.

Commission staff initiated numerous research and field studies in 2023, bringing the Commission to the forefront of integrated mosquito control. The purchase of the Commission's first UAS allowed for real-time aerial mapping and inspection to be performed. This program will increase efficiency, accuracy, and safety. In-house insecticide resistance techniques were perfected, and valuable insights gained that will direct future control decisions. The Commission's colony mosquitoes were used in a field trial for a brand-new adult mosquito control insecticides with a novel active ingredient. And last but not least, the Commission received state grant funding for the third year in a row, which allowed the tick surveillance program to expand and cover more sites in other parts of the County.

TABLE OF CONTENTS

2023
WARREN COUNTY MOSQUITO COMMISSION
ORGANIZATIONAL CHART



* Seasonal Position
(*x*) Indicates number of seasons worked

I. ADMINISTRATION

A. Budget/Treasurer's Report

Following the body of this report are the final Budget and Treasurer's reports (Figures 1 & 2, respectively) for the year, which reflect the Commission's expenditures and financial status as of December 31, 2023.

Late in 2022, the State Health Benefits Plan announced that premium rates for healthcare plans administered under their program would increase by over 20% for active employees. This added nearly $30,000 to the Commission's 2023 budget request. Alternatives to the SHBP for employee healthcare coverage were researched and the most advantageous option was determined to be the County's self-insured healthcare fund. Under the County's administration, there would be fewer plan choices but no loss of benefits to the employees or retirees. Applications were submitted, and early in 2023 the county healthcare consultant informed the Superintendent that the Commission employees would be accepted into the county self-insured healthcare fund if the Commission desired. The procedure to leave the State Health Benefits Program (SHBP) and join the County's self-insured fund took several months to complete but equated to a significant savings in employee healthcare costs to the Commission (and in turn to the County). Employees and retirees began coverage under the new system on May 1, 2023. For the remainder of 2023, the budget balance for the healthcare account line was calculated and subtracted from the 3rd and 4th quarter appropriation requests to the county. In future years, this account line will no longer be shown in the Commission's budget, rather it will be paid for directly by the County. Employee contributions are calculated and reimbursed to the County monthly.

Sixty-eight, two hundred dollars ($68,200) from reserve funding was applied to the 2023 budget to contribute towards the following year's budget, this amount was intended for the major equipment purchases of a side-by-side all-terrain vehicle (ATV), a replacement compact pickup truck (truck #352), and a mapping UAS with associated hardware. Neither vehicle was purchased in 2023 early in the year as the desired vehicles were still not available; as the season progressed it became apparent that those funds would be better allocated towards aerial larviciding and pesticide purchases since the County was experiencing repeat high rainfall events. The mapping UAS and associated hardware was purchased in June of 2023.

As of December 31, 2023, there was $37,008.26 unencumbered from the 2023 budget. This combined with $20.48 in miscellaneous receipts, less the balance of the 2022-23 Tick Grant expended in 2023 $9,806.34, plus the balance of the 2023-24 Tick Grant received $10,073.0, and plus the $79,179.39 left in reserves brought the total balance in reserve funding to $116,474.80. An effort to keep these funds in reserve for capital purchases and unforeseen emergencies will be made.

In 2023, an audit was performed on the 2022 financial records by Nisivoccia & Company LLP, Newton, New Jersey with no recommendations made regarding the accounting procedures.

B. Personnel

1. Staff

At the start of the New Year, two of the previous year's five seasonal staff had indicated they were interested in returning, leaving at least three positions open. Advertisements for the seasonal positions were posted on the County's Facebook page, shared on Community Facebook sites, shared with municipal clerk's for posting on their websites and/or social media, shared at all the local area colleges through their career centers and with department professors at some of the colleges.

In total, seven applications were received, and four interviews took place January through March. Two new seasonal employees were hired to assist with larval routes, and one was hired to assist with disease

surveillance, laboratory functions, and public education. Start dates ranged from May 11, 2023, to May 18, 2023. The new employees received their initial in-house training during the first two days of employment followed by two weeks of field training. The returning seasonal employees received refresher training on safe pesticide use, as well as on FieldSeeker software, and were then able to start working independently on their respective larval routes. All five of the seasonal employees worked through the majority of the season with one ending employment to return to an out-of-state college on August 18th, three ended their employment to return to in-state colleges on August 25th, and one was able to stay on part-time into the fall.

The Commission operated with seven (7) full-time employees for 2024; Superintendent, Administrative Secretary, Senior Wetlands Specialist, Biologist, Inspector, Heavy Equipment Operator/Inspector, and Wetlands Specialist.

2. Education/Training

The Commission makes a significant investment in their employees in terms of training, education, and attendance at professional meetings.

- **Mosquito Biology & Control/DEP Licensing Training/Tick Biology & Control/ IPM**
  In order to expedite pesticide applicator/operator licensing, an in-house training program was developed in 2002 and was approved by NJDEP- Pesticide Control Program. This program has been updated, revised, and modified over the years to keep current with changing pesticide regulations and requirements. The Basic Pesticide Training Program along with 40 hours of on-the-job training fulfills the NJDEP requirements for pesticide operator licensing. Currently, Jennifer Gruener and Stephanie Oliphant provide this training to new staff along with general mosquito biology, Right-to-Know/HazCom, general safety, and respirator training. Defensive driving, anti-discrimination and harassment training are provided online from PMA Companies Websource for all new staff. After their initial in-house training is completed, staff are accompanied by a full-time staff to learn specific surveillance routes.

  All full-time staff, except the Administrative Secretary, are certified by the NJDEP to be commercial pesticide applicators with their core pesticide license as well as category 8B, specifically for mosquito control. Ms. Gruener holds additional certifications in categories 8A (Public Health), 10 (Demonstration & Research), and 11(Aerial Applications). Since Ms. Oliphant directs the aerial larviciding program she is also certified in category 11. Mr. Necina obtained both category 11 & category 10 certification in 2023 in order to prepare for the unmanned aerial systems program. New seasonal staff are trained and tested to obtain certification as pesticide operators. If a seasonal staff returns for multiple seasons, they are encouraged to obtain certification as a full applicator.

  Additional virtual and in-person training sessions were attended to provide instruction on vector biology, vector borne diseases, basic pesticide safety, pesticide applications, and to obtain recertification credits, which apply for the requirements for maintaining pesticide applicator licenses. Those courses follow:

- Warren County MEC, "Basic Pesticide Safety Training": H. Moore, A. Kaplinski, & C. Walsh
- Rutgers Office of Continuing Professional Education (OCPE), "Basic Pesticide Training": S. Oliphant & R. Hagerty
- New Jersey Mosquito Control Association (NJMCA), "Northern Recertification Training Session", St Elizabeth University: J. Gruener, S. Oliphant, S. Giordano, R. Hagerty, & J. Necina

- Environmental Protection Agency (EPA), "Fungal Biopesticides – A Growing Option in Pest Control": S. Oliphant & J. Necina
- EPA, "Understanding Bulletins Live! Two: An Overview of this System": J. Gruener & S. Oliphant
- AMCA, "EPA Labels Live! Label Considerations for Mosquito Control Applications", recorded webinar: J. Gruener
- NJDEP, "Stakeholder Meeting, Pesticide Control Code", Teams: J. Gruener
- USDA, "EPA's Vulnerable Species Pilot Project", webinar: R. Hagerty & J. Gruener
- World Health Organization (WHO), "A Global Threat", episode 1 of EYE on Yellow Fever Podcast: J. Gruener
- Quirine Ten Bosch, Wageningen University, "Building Bridges, Crossing Scales, & Joining Forces: Using Models to Gain Epidemiological Insights from Small Scale Experiments", Virtual Seminar Series on Vector-borne & Zoonotic Diseases – Modeling Rift Valley Virus Transmission & Impacts of Mosquito Repellent: J. Gruener
- Seminar on Climate Change & Emerging Infectious Diseases, NYDOH & University at Albany – Morgan Gorris Los Alamos National Laboratory, "Projecting Mosquito Distributions in Response to Climate Change", Zoom: J. Gruener
- National Academies of Science, Engineering, & Medicine, "Mitigating Arboviral Threats & Strengthening Public Health Preparedness", Zoom: J. Gruener, S. Oliphant, & J. Necina
- Public Tick IPM Working Group, "Evaluating the Efficacy of Repellents & Acaricides for Medically Significant Tick Species", Zoom: J. Gruener
- Cornell Extension, "When Arthropods Attack", recorded webinar: J. Gruener
- Northeast Regional Center for Excellence in Vector-borne Diseases (NEVBD), "Pre-season Webinar for Insecticide Resistance Testing", Zoom: S. Giordano & J. Gruener
- NEVBD, "Annual Meeting", Zoom: J. Gruener
- University of Florida IFAS Extension, "Mosquito Training Program", Multiple Modules online: A. Kaplinski & H. Moore
- SMCC, "Aerial Adulticiding Calibration", Downstown Airport, Vineland, NJ: J. Gruener, S. Oliphant, R. Hagerty, J. Necina
- Valent BioSciences, "ReMOA Field Trial", Mercer County Airport: J. Necina
- Pesticide Control Technology, "Meet the Beetles", recorded webinar: S. Oliphant
- EPA, "Beech Leaf & Bark Diseases – Emerging Threats to Beech Trees": J. Gruener
- AMCA, Best Practices for IMM, virtual training (12-week course): S. Oliphant & S. Giordano
- Public Tick IPM Working Group, "Virtual Tick Academy" (two-day webinar): J. Gruener, S. Oliphant, & J. Necina
- NEVBD, "Vector Biology Boot Camp", in-person 2-day training in State College, PA: S. Giordano & R. Hagerty

- **Mosquito Identification Certification**
  Late in 2022, the Center for Vector Biology at Rutgers University announced they would finally offer the Mosquito Identification exam. Early in 2023, Ms. Giordano and Mr. Hagerty both took the Rutgers Center for Vector Biology Mosquito Identification Exam and passed.

- **- Right-To-Know/Hazard Communication Training**
  Due to training requirements implemented in 2004, a written Hazard Communication Program with an in-house training program (incorporating information from prior Right-to- Know training requirements) was developed in 2005. This program is updated annually. All new staff members receive a copy of this written program. A list of Hazardous Substances and all of their Safety Data Sheets are also updated annually. Hazard communication and Right-to-

know training is provided on the first day of work. Information is also supplied as necessary to contractors. Refresher training is given to staff once every two years along with Bloodborne Pathogens Awareness Training. PMA Companies provided this refresher training in 2022 to all staff that were due.

The annual Right-To-Know survey distributed by the New Jersey Department of Health and Senior Services was completed. This survey catalogs all hazardous materials used by the Warren County Mosquito Extermination Commission. Online reporting for the Right-To-Know Survey has been required since Survey Year 2013. The 2022 Right to Know Survey was completed by the 2023 deadline.

- **Respirator Training**

A written respiratory program and corresponding training program was developed in 2006 due to a label change requiring the use of N-95 respirators while handling *Bti* products. The program was put into policy format, reviewed and adopted as Commission policy in 2007. This policy was thoroughly reviewed and revised in 2019 and a new training program was developed. Fit testing and training take place annually for anyone having the potential to need a respirator during that particular year. Jennifer Gruener and Stephanie Oliphant are trained to perform fit testing.

- **Other Training**

- Rutgers Center for Government Services, "Municipal Finance Administration", 5-week online course: J. Gruener
- NJ Division of Pensions & Benefits (NJDPB), "Completing Certifications", GoToWebinar: J. Gruener
- NJDPB, "Purchasing Service Credit for PERS, TPAF, & PFRS Members", GoToWebinar: JG
- NJDPB, "Retirement Types, Eligibility Calculations for PERS & TPAF Members", GoToWebinar: J. Gruener
- NJDPB, "PERS & TPAF Members Pension Payment Options", GoToWebinar: J. Gruener
- NJDPB, "Reviewing a Sample Retirement Application for PERS or TPAF Member", GoToWebinar: J. Gruener
- NJDPB, "Social Security Benefits for Members of PERS, TPAF, PFRS, SPRS, ABP, & DCRP", GoToWebinar: J. Gruener
- NJDPB, "Retirement Planning for PERS Members, Local Government Employees", GoToWebinar: J. Gruener
- NJIIF, "CDL Supervisory Training", online: J. Gruener & S. Oliphant
- NPMS Support, "Classes for Grasses Episode 1 – Grass Structure and Anatomy", YouTube: J. Necina
- Lawn Solutions Australia, "How to Identify Different Grass Types", YouTube,: J. Necina
- Rutgers Growers Meeting (including UAS demonstration), Snyders Research Farm: J. Necina
- Entomology Society Association (ESA), "Entomology Advocacy Week: Getting Involved in State-level Advocacy": J. Gruener
- ESA, "Infographics 101: Techniques for Effective Visual Communication": J. Gruener & C. Fisher
- EPA, "2023 Amended Waters of the United States", webinar: S. Oliphant
- The Watershed Institute, "Stormwater Design: Myths & Misconceptions", webinar: S. Oliphant
- Fuel Dispensing Safety Training, County Administration Building: J. Gruener, C. Fisher, S. Oliphant, A. Flohn, S. Giordano, R. Hagerty, & J. Necina
- Basic Service & Winterization of ULV Foggers, Target Specialty, GoToWebinar: J. Gruener
- PMA, "Workplace Harassment": H. Moore, A. Kaplinski, C. Walsh

- PMA, "Sexual Harassment: What Employees Need to Know": H. Moore, A. Kaplinski, C. Walsh
- PMA, "Defensive Driving": H. Moore, A. Kaplinski, C. Walsh

• **Computer Software/New Technologies**

- ESRI, "Migrating to ArcGIS Pro from ArcMap": S. Oliphant
- ESRI, "Migrating to ArcGIS Pro 3.0": S. Oliphant
- ESRI, "Getting Started with ArcGIS Pro", short course: S. Oliphant
- ESRI, MOOC, GIS for Climate Change (6-week course): S. Oliphant
- HowTech, "How to Create Drop Down List in Access", YouTube: S. Giordano
- Simon Sez IT, "Microsoft Access Tutorial: 7 Hours of Advanced Training", YouTube (partial):. S. Giordano
- VectorSurv Training, live webinar and recorded viewing: S. Giordano, J. Gruener, S. Oliphant, & R. Hagerty
- Painless360, "Ardupilot flight modes explained simply (Patreon Request), YouTube,": J.Necina
- MadsTech, "HDZero FPV Goggles Review – Best FPV Goggle Available Today?", YouTube, J. Necina
- MadsTech, "HDZero Goggles Express LRS Backpack – I love This", YouTube: J. Necina
- UAV Coach, "Autel Lite+(Plus) vs DJI Air 2S/Which One Should You Get?", YouTube: J. Necina
- Joshua Bardwell, "Express LRS definitive getting started guide", YouTube : J. Necina
- Joshua Bardwell, "The most powerful 2.4 GHz Express LRS module you can buy//Radiomaster Ranger", YouTube: J. Necina
- Xjet, "The FAA can't answer my drone questions (the rules are that bad)", YouTube,: J. Necina
- Xjent, "The FAA response to my Remote ID question", YouTube: J. Necina
- WordPress, YouTube: J. Gruener
- Matthew Brennan, "DJI Mini 3 Pro – 12 Biggest Drone Mistakes New Pilots Make", YouTube: J. Necina
- MadsTech "DJI O3 CE vs FCC Ham Hack – Is there a Difference?", YouTube: J. Necina
- EPA Center for IPM, "Innovative Tools in Mosquito Control – Unmanned Aerial Vehicles" webinar: R. Hagerty
- Agri Spray Drones, "DI Agras T40 Full Spraying Demo", recorded video: J. Necina
- DJI Agriculture, "DJI Agras T40 Introduction and Tutorial (Part 2)", recorded video: J. Necina
- Agri Spray Drones, "First Flight and Practicing with the Agras T40", recorded video: J. Necina
- SAG Drone Technologies, "New EFT G610 Drone specification & Test fly#EFT#SAG#SAGdrones", recorded video: J. Necina
- EFT Drone, "EFT G20", recorded video: J. Necina
- EFT Products, "Plug-in Agricultural Spraying and Spreading Drone Installation Tutorial", recorded video: J. Necina
- Ken Heron "How to Precision-Fly a Drone - KEN HERON (Phantom 4 Pro)" YouTube recorded: J. Necina
- UAV Coach "How to Use NIST Bucket Stands - Improve Your Drone Pilot Skills" YouTube recorded: J. Necina
- Influential drones "FAASTeam / NIST: Measuring & Comparing sUAS Capabilities and Remote Pilot Proficiency" Youtube recorded: J. Necina
- UAV Coach "How to Master NIST Bucket Stands - Improve Your Drone Pilot Skills" YouTube recorded: J. Necina

- UAV Coach "Drone Videography 101: BEGINNERS START HERE!" YouTube recorded: J. Necina
- Agri Spray Drones "Agri Spray Drones — Trailer Setup" YouTube recorded: J. Necina
- Rami Tamimi "Drone Inspection with DJI Mavic 3 Enterprise" YouTube recorded: J. Necina
- Florida Drone Supply "DJI Mavic 3 Enterprise - RC Pro Walkthrough & DJI Care Activation Important Tips" Youtube recorded: J. Necina
- How Farms Work "The World's Largest Crop Spraying Drone - DJI Agras T30" YouTube recorded: J. Necina
- Hylio "Texas Sized Hylio Crop Spraying Drone - The AG-230" YouTube, recorded: J. Necina
- Painless360 "Baby AR Wing PRO: Full Build and Flying Review" YouTube, recorded: J. Necina
- Agri Spray Drones "Agri Spray Drones Trailer Setup 2023" YouTube, recorded: J. Necina
- DJI Mavic 3 Enterprise Series: First Flight, Using the RTK Module, Firmware Update, Linking, RTH Mode, Obstacle Sensing and Avoidance, Waypoint Mission, Mapping Mission, Oblique Mission, Linear Mission, Smart Oblique, Real-Time Terrain Follow, Cloud Mapping: J. Necina
- Homeland Surveillance & Electronics (www.HSE-UAV.com), DJI T40 vs. XAG P100 – "SPRAYING DRONE STANDOFF! "Recorded: J. Necina
- Agri Spray Drones, DJI Agras T40 vs Hylio AG-272 Comparison, Agri Spray Drones, recorded: J.Necina
- Agri Spray Drones, DJI Agras T40 Full Spraying Demo, DJI Agras T40, Agri Spray Drones, recorded: J.Necina
- Hylio, Compact Hylio Crop Spraying Drone - The AG-210, recorded: J. Necina
- Hylio, How to use the SkyRC Charger, recorded: J. Necina
- Hylio, How to use the OKCell Charger, recorded: J.Necina
- Aerial Influence, New Drones In 2023 - Bigger Is Better, recorded: J. Necina
- Hylio, Operations Manual Part 1: Introduction & Hardware, recorded: J. Necina
- Hylio, Operations Manual Part 2: Spray Drone Basics & RC, recorded: J. Necina

3. Commercial Driver's License Testing Program

Our heavy equipment operator is the Commission's CDL holder. The employee working in this title is included in with the County pool of employees to be randomly tested for drugs and alcohol, which is required by Federal DOT regulations. In 2023, the NJIIF provided a 2-day online "CDL Supervisory Training" training course that both Ms. Gruener and Ms. Oliphant attended.

4. Employee Assistance Program

The Commission staff members were able to utilize the Employee Assistance Program (EAP) in 2023, which is made available through the NJ Intergovernmental Insurance Fund, NJIIF. This program offers assessment, counseling, and referrals for a variety of personal and work-related problems, including those related to drug and alcohol abuse. EAP services are available by calling 1-888-243-5744 or visiting www.sandcreekeap.com; anonymity and confidentiality are assured.

C. New Jersey Mosquito Control Association (NJMCA)

The New Jersey Mosquito Control Association is the oldest mosquito control association in the country and celebrated its 110th Year Anniversary in 2023. The NJMCA is a state-wide professional organization comprised of members from the 21 county mosquito control agencies, the NJDEP Office of Mosquito Control Coordination, the State Mosquito Control Commission, Rutgers University's Center for Vector Biology, and other interested parties. The purpose of the NJMCA is to promote and encourage close cooperation among those directly and indirectly concerned with mosquito control work, stimulate educational activities to increase the knowledge of mosquito control, and advance the cause of mosquito control and related environmental concerns in the State of New Jersey and

elsewhere. The NJMCA's primary goal is to promote, encourage, develop, and record safe, effective, and environmentally sound mosquito control activities in order to protect the health and welfare of the citizens of New Jersey, and to make this information available to all who may be interested or concerned with mosquito control activities. The strength of the mosquito control community in New Jersey is reflected in the strength and activity of this association.

At the 2023 Annual Business Meeting of the NJMCA, Jennifer Gruener was re-elected Treasurer of the Association and Christine Fisher was reappointed as Bookkeeper for the Association. The pair maintained the Association's accounting, produced quarterly reports, filed the annual taxes, and developed a budget for the following year's activities.

Ms. Gruener serves as Trustee on the NJMCA Board with Ms. Oliphant as alternate. In addition, the following staff members were named to various committees including:
Jennifer Gruener: Convention Arrangements Committee, Editorial Committee, Legislative Committee
Christine Fisher: Membership Committee
Stephanie Oliphant: Editorial Committee
John Necina: Archives Committee, Research and Development Committee
Ryan Hagerty: Legislative Committee

D. Associated Executives of Mosquito Control Work in New Jersey (AEMCNJ)

The regular membership of the Associated Executives of Mosquito Control Work in NJ consists of Superintendents and Directors of the county and state mosquito agencies, as well as representatives from the NJ Agricultural Experiment Station. Associate members may also be voted in but must be technical full-time mosquito control professionals. The main purpose of this Association is to promote, preserve, and protect, professional standards of full-time mosquito control employees throughout the state. As members of this operationally oriented organization in New Jersey, Jennifer Gruener and/or Stephanie Oliphant attended most of these monthly meetings throughout the year. Association meetings in 2023 was a combination of in person and virtual meetings. Ms. Gruener was elected to serve a 2-year term as Vice-President of the Association in 2023.

Commission members who were named to the following committees:
Jennifer Gruener: Vector-borne Disease Working Group, Legislative Committee

E. American Mosquito Control Association (AMCA)

The AMCA is a professional association of individuals and organizations interested in mosquito and other vector control comprised of members from over 50 countries. The Commission maintains a sustaining membership in the National Association, which directly supports legislative and regulatory advocacy. Membership also includes but is not limited to lowered rates for attendance at national meetings, web access to member only information, technical advisor services, the *Journal of the American Mosquito Control Association*, *Wingbeats* - magazine for mosquito control, the *AMCA Newsletter*, monthly e-newsletters, and free webinars throughout the year on numerous relevant subjects. Starting in 2023, the AMCA technical advisor began sharing a monthly curate report with the membership, which includes links to local legislation pertaining to mosquito control, pesticides, pollinators, and unmanned aerial systems.

F. Northeast Mosquito Control Association (NMCA)

NMCA is a non-profit, educational organization of nearly 250 mosquito research and control professionals from New England, New York, New Jersey, and Pennsylvania. Their objectives are to promote the efficiency of mosquito abatement and related activities, through the encouragement of research, development of procedure, and the interchange of information; to circulate among its members and other interested parties' pertinent knowledge relative to mosquito abatement and related subjects, and to encourage field trips and meetings of its members.

G. Entomological Society of America (ESA)

Membership in this association began in 2007 and continues annually. This membership allows our Commission access to valuable literature in multiple professional journals.

H. Public Tick IPM Working Group

Superintendent Gruener continued to participate in the Public Tick IPM Working Group, which is composed of tick experts, tickborne disease advocates, medical professionals, vector control professionals, and other interested parties. The group collaborates (via a monthly conference call) on Integrated Pest Management related activities, exchanges knowledge, and shares resources to expand the network and reduce the public's risk of exposure to infected ticks. This work is supported by the USDA National Institute of Food and Agriculture, Crop Protection and Pest Management Program through the North Central IPM Center.

I. U.S. EPA - Pesticide Environmental Stewardship Program

At the end of 1997, the New Jersey Mosquito Control Association (NJMCA) approved an extensive mosquito control strategy document for the Pesticide Environmental Stewardship Program (PESP) to be submitted under the American Mosquito Control Association's PESP partnership. The New Jersey document was based on the approved strategy document from the AMCA (the national organization) but goes beyond in specific areas of surveillance, biological control and water management, some of which were pioneered in New Jersey and all of which are employed today. The New Jersey strategy document was accepted by the AMCA in March of 1998 establishing New Jersey as an official sub-partner. This document is frequently referred to around the country to outline details of a comprehensive mosquito control program. Warren County's current programs are consistent with the strategies outlined in this document and the Commission participates in the annual PESP survey from the EPA.

J. Safety Coalition

The Mosquito Commission is represented on the Warren County Safety Coalition where current safety related topics are discussed and information is disseminated. The Commission was not aware of any safety coalition meetings in 2023.

Mosquito Commission staff safety meetings are also held on occasions when appropriate. Superintendent Gruener meets with PMA Companies safety representative, Tim Weir, annually to ensure compliance with safety standards and to plan for safety training for employees. Safety training is listed in part B.2. under "other training" and a hard copy of safety training logs are kept in the office.

K. Records Retention

A request and authorization for records disposal was completed on the New Jersey Division of Archives and Records Management website, *Artemis* in 2023 for disposal of appropriate records. This request was forwarded first to Nisivoccia & Company LLP for necessary signatures, then uploaded to *Artemis* for final approval prior to our disposing of old records. Certain documents are considered permanent and will remain in our central files. Pesticide application records are retained in accordance with the NJ Pesticide Regulations and the NJPDES Pesticide General Permit, which combined, result in a 5-year retention of all pesticide records.

L. Insurance

In 2017, the Commission became an independent member of the NJ Intergovernmental Insurance Fund, NJIIF. The Commission had been insured through the County of Warren's policies with the NJIIF for its Public Officials/Employer Liability, Workers Compensation, General Liability, Excess Liability, and Automobile Liability coverages from 2004 through 2016 but had held its own separate policy for Pollution Liability with a different carrier. Confusion with a minor workers compensation claim spurred discussions with the County and the Insurance brokers, and it was decided that the

Commission would be better served if it had its own policies under the NJIIF, separate from the County's. Now all the Commission's insurance policies, including Pollution Liability and Cyber Liability, are under the Commission's account with the NJIIF. All claims are managed through PMA Companies, which also offer a variety of training resources.

II. FACILITIES/EQUIPMENT

A. Facilities

The Commission continues to utilize the county owned building and grounds at 2 Furnace Street in Oxford, New Jersey. The building is shared with the Department of Weights & Measures and the grounds are shared with the Oxford division of the County Road Department. A 44' aluminum shipping container is located in the yard behind the building and is used for storing all of the dry, non-flammable pesticides. Liquid pesticides are stored in a temperature controlled chemical storage building located between the building and the shipping container.

Both office and yard space are extremely limited, so efforts are made to make the best use of the space we have. The breakroom serves as an office to both the Senior Wetlands Specialist and the Heavy Equipment Operator/Inspector and the laboratory serves as an office to the Inspector, Biologist, and Wetlands Specialist as well as an overflow area for seasonal staff. Storage sheds have been purchased for materials and supplies that need to be out of the elements but that can withstand the extreme temperatures of winter and summer. There are storage sheds designated for public relations, fish supplies, trapping supplies, water management supplies, and utility supplies. There is also a carport for storing the Polaris Ranger, the Forklift, and items tagged for the annual county auction. In 2023, an additional carport was purchased and assembled to provide cover for the fish holding tanks. The placement of the carport lessens the maintenance requirements on the tanks by reducing the amount of debris that fall into the holding tanks and it provides shade, reducing algal growth in the tanks. Efforts are also made to keep vehicles and equipment under cover to extend their usable life; however, the larger excavator, bulldozer, Eager Beaver Trailer, the utility trailers, and all the service vehicles are currently stored out of doors due to limited garage space. The Commission-owned dump truck is kept in the garage as much as possible.

In March of 2023, the director of Public Works held a meeting with the superintendents of Weights & Measures and the Mosquito Commission to discuss the building and space needs of both entities. Several possibilities were discussed but the superintendent is not aware of any existing plans to address the issues.

B. Equipment

1 a. State Equipment

The following equipment is provided by the State Mosquito Control Commission (SMCC) for the Commission's use under an annual equipment use agreement:

1980 John Deere 350C Bulldozer
2003 Kobelco Low Ground Pressure Excavator with Powertilt
1988 Bausch & Lomb Stereo Zoom 7 Microscope with Fiber-Lite Illuminator
1990 Eager Beaver 20-Ton Tagalong Trailer
2001 Revco Freezer

The heavy equipment is the mainstay of our water management program. The excavator, along with the eager beaver trailer are regularly utilized. (See the *Water Management section* for program description and current activities). The John Deere bulldozer is underpowered to be useful on most projects. Therefore, the Commission surrendered the bulldozer to the SMCC in 2023 and as of the end of the year was waiting for further instruction.

The ultra-low temperature freezer is used for storing mosquitoes that are submitted for disease monitoring. This freezer also allows for the extended storage of the dry ice that is used for our surveillance program. The SMCC officially stopped supporting the Revco freezers in 2017; however, they have allowed the freezer to remain on the state lease agreement for the Commission's use. The Commission contracts to have preventative maintenance performed on the freezer twice each year but it is over 20 years old. In the height of the very busy 2023 mosquito season, the freezer lost the ability to hold temperature and it was necessary to send this large piece of equipment out for repairs. The purchase of a replacement freezer was researched but this large expense was not budgeted and would have left the commission with no freezer for about a month in the middle of the season. The superintendent decided to proceed with the emergency repairs and an upright ultra-low temperature freezer was temporarily rented to minimize interruption to the disease surveillance program.

1 b. Commission Owned Equipment

The following surveillance/treatment equipment is owned by the Warren County Mosquito Commission. The Commission also owns numerous small pieces of surveillance, collection, and treatment equipment that are too cumbersome to list in this report.

2006 Polaris Ranger – Utility Vehicle
2006 16 ft Ringo Trailer
2013 AcrEase 44" Trail Mower
Cougar ULV Sprayer with GPS/SmartFlow Assembly
2012 London Fog ULV Sprayer
Bausch & Lomb – Stereo Zoom 5 Microscope
Southern Precision Microscope
AmScope Fiber Optic Illuminator
Tuttnauer 7-inch tabletop Autoclave
RAMP Virus Testing System
Maruyama Gas-powered Backpack Sprayer
Maruyama Battery-powered Backpack Sprayer
2007 Clark Forklift
Red Lion Aluminum 6.0 hp Trash Pump & hose (2015)
Northstar Tank Sprayer
2020 Clarke Electric Promist ULV Sprayer with GPS/SmartFlow Assembly
2021 Leica S8 APO Stereozoom Microscope with View 4K digital camera & software
2022 EBY DO14K Aluminum Equipment Trailer
DJI Mavic 3E with support hardware & software

2. Vehicles

The Commission has a fleet of 4WD pickup trucks and a dump truck to utilize in its operations. Annual inspections of all our vehicles are performed prior to the end of January, before our season begins, in the event repairs are necessary as a safety measure and to avoid untimely delays during our busy season. In 2023 plans to replace one of the Commission's fleet trucks were delayed once again in hopes that a suitable replacement will be made available on the NJ state contract in 2024.

Almost all vehicles are kept equipped with 2-way radios utilizing the county frequency, lockable storage boxes, and a full complement of inspection, safety/emergency equipment and informational materials for distribution. The notebooks containing pesticide labels in each vehicle are updated annually with current labels for each of the products we use.

3. Computers

The Commission staff currently utilizes 7 desktop workstations, 2 laptops, and a Chromebook linked together by a local area network (LAN), which is held on an in-house server. The Superintendent, Administrative Secretary, Biologist, Inspector, Senior Wetlands Specialist, and Wetlands Specialist each have their own workstations. All computer workstations are set up with upgraded battery backup units (Uninterrupted Power Supply- UPS) to protect against data loss in the event of power problems. This computer system has become integral to the daily operations of the Commission and is maintained by an outside IT company. As particular workstations age and become outdated they are replaced. A new network server was installed in 2023 with the internal backup operating properly; however, the external backup was found to be incompatible with the new system. Alternate external backups were explored but were not installed in 2023.

The primary laptop is used for the Superintendent to work away from the office and with our LCD projector for educational purposes. The other laptop is shared by the Heavy Equipment Operator/Inspector, Seasonal Inspectors, Research Interns, and the Disease Surveillance/Laboratory Assistant as needed. Since the Coronavirus pandemic, the Commission has maintained software subscriptions that enable staff to remotely log into their computers from home, when necessary. Originally this service was provided by AnyDesk but was changed to LogMeIn late in 2022 at significant cost savings. The Commission has also maintained a subscription for GoToMeeting to allow for virtual Commission meetings and gives staff the ability to host other virtual meetings as needed.

In the beginning of 2023, the Commission website and email were transferred to a new hosting service with additional security options following several months of research. A subscription to Office 365 was purchased for each desktop, which provided more secure email for each member of staff and the original email addresses were preserved. The Commission website was transferred to My Corporate Hosting service, which gets updated quarterly and provides added security and support.

The Commission continued to use the FieldSeeker GIS data collection system from Frontier Precision for the 2023 season with relatively few problems. Frontier Precision had exchanged the six Mesa tablets used for collecting field data with six iPads late in 2022 at no cost. The software seemed to perform much better on the iOS platform, which resulted in less downtime in the field. ArcGIS Pro was installed on 2 desktops as an upgrade from ArcMap.

4. Inventory

A comprehensive item inventory with corresponding replacement values was developed in 1996 and is maintained. The inventory list is modified as items are purchased or sold at the Warren County auction. A separate inventory is maintained for pesticides, which incorporates delivery and billing records to insure loss prevention. Pesticide inventory is documented in excel and verified with product usage in FieldSeeker.

III. COMPLAINT RESPONSE

Service requests are directed to our office to complain of standing water, abandoned swimming pools, mosquitoes, and other related concerns. Specific information is obtained directly from the caller to deal with the problem most efficiently. Service requests are entered into the FieldSeeker database when received. The database automatically maps the request, and it becomes available on all the handhelds once they are synced with the FieldSeeker database. Each request is assigned to an inspector depending on the nature of the request and its location within the county. The inspector can complete the entire request digitally via the handheld, and then each request is closed by either the Senior Wetland Specialist or the Superintendent. A paper copy of each request is still generated and kept on file to ensure completion.

Our staff investigates all spray requests to verify the presence of adult mosquitoes before the Commission will apply insecticides with truck-mounted sprayers. In addition, staff works to locate the source of the problem (the water where the larval mosquitoes are developing) and then applies appropriate control measures (larvicides with ground equipment or by aircraft; fish stocking and/or water management) to control the immature stages of the mosquitoes when necessary.

A wet summer in 2023 resulted in a higher number of service requests than the previous year (215 in 2023 versus 145 in 2022). A breakdown of 2023 complaints is as follows: 80% adult mosquitoes, 8.3% standing water, 2.8% swimming pools, 1.4% containers, 1% stream blockages, and 6.5% other (fish requests, stormwater facility concerns, and inquiries about our operational procedures).

IV. VECTOR BORNE DISEASE

In 2023, the NJ Public Health & Environmental Laboratory (PHEL) continued panel testing for several viruses. All samples that are tested for West Nile virus (WNV) are automatically and simultaneously tested for eastern equine encephalitis (EEE), Jamestown Canyon virus (JCV), and St. Louis encephalitis (SLE). The Commission's written trap placement plan was slightly revised in 2023 to reflect changes in disease activity. This plan has been modified as needed for other mosquito-borne disease surveillance in the past and is updated periodically when the need arises. The plan merges the trapping schedules and trap placements for all disease surveillance, which is done primarily by the Disease Surveillance/Laboratory Assistant. The plan provides for standard trap sites that have had a history of, or have a high potential for, disease activity. The 2023 Disease Surveillance Trapping Schedule is provided in Figure 3. In addition to these standard sites, random sites throughout the county are also trapped for disease testing. This procedure enhances our ability to detect mosquito-borne disease activity in the county. In 2023, routine trapping for Asian tiger mosquito (ATM) continued on an as-needed basis with the disease trapping schedule and those sites are also indicated on Figure 3. This is discussed further under Section V. A. 5 – BG Traps. The collections from these traps are often sent in for WNV, EEE, JCV, and SLE panel testing but other panel testing, specific to ATM such as the Zika, chikungunya, and dengue panel or the La Crosse panel are available if the need arises.

A. Disease Response Guidelines

The Commission's Mosquito Borne Disease Response Guidelines were reviewed and revised in 2018 to provide consistency and to respect state restrictions on the use of identifiable personal information with respect to human disease involvement. These guidelines are based on the current knowledge regarding West Nile virus and take into consideration other potential disease detection. The current version can be found in Figure 4. This serves as a guide for communication, surveillance, and control when evidence of mosquito borne disease is noted in Warren County.

B. Vector Borne Disease Working Group (VBDWG)

This interagency group is comprised of representatives from the State Health Department, the State Public Health Laboratory, the NJ Office of Mosquito Control Coordination, the military, State Epidemiologists, the NJ Department of Agriculture-Division of Animal Health, US Department of Agriculture, Rutgers Center for Vector Biology, Local Epidemiologists, NJ Health Officers Association, and the Associated Executives of Mosquito Control in NJ (AEMCNJ). The Superintendent is one of the AEMCNJ representatives for the group. The group typically meets every month during the active season (with sub-committees meeting during the off months) to discuss current activities and guide each agency in enhanced activities that would help address important public health issues caused by vector-borne disease in the state. Meetings in 2023 were held monthly from April through October with an additional meeting in December. They were a mix of in-person and virtual meetings.

Since 2021, the VBDWB has updated the Disease Surveillance Guidelines for the state and distributed these guidelines to the 21 county mosquito agencies annually. These guidelines outline the species and ideal number of mosquito samples (pools) per week for each disease that the county agencies should aim to submit to the state testing laboratory to provide an accurate account of the presence of mosquito borne disease throughout the state.

C. VectorSurv

In 2023, New Jersey continued to utilize CalSurv for statewide arbovirus data management. This database system was developed by the University of California, Davis as a collaborative between the state, university, and county public health entities. The NJ Vector-borne Disease Working Group worked with the developers to customize the system for use by the NJ counties, creating JerseySurv. The Centers for Disease Control funded the entire effort and more states/territories have joined, so the system has been renamed "VectorSurv". Now the PHEL and the 21 counties, as well as Rutgers University and the NJ Office of Mosquito Control, have free access to this system.

Mosquito control and public health agencies who use the VectorSurv system do so through the Gateway, which is an online interface for managing and analyzing surveillance and control data related to mosquitoes and arboviruses. The Gateway requires login credentials for each user, who must belong to an identified agency. Each agency maintains all privileges to manage its own data and user accounts, and higher-level aggregate reporting functions are managed by the state. The counties enter the sample information for the specimens being sent to PHEL (or the Cape May laboratory) for disease testing and when the laboratory receives the samples and tests them, they enter the results. VectorSurv has the capacity to handle all trap data (including NJ light trap data) not just disease surveillance data. This system increases efficiency and communication between the various agencies and allows for data sharing and data analysis. In 2023, tick surveillance data and pools were also entered into this system.

Mosquito and tick testing results submitted from Warren County to the state are reported in the Vector-borne Surveillance Report produced by the NJ Department of Health, Communicable Disease Survey. This report is shared publicly along with an interactive dashboard that provides information on vector-borne disease incidence and trends as well as mosquito and tick activity. A year-end summary of mosquito borne disease taken from this report can be found in Figure 5.

D. West Nile Virus, Eastern Equine Encephalitis, St. Louis Encephalitis, and Jamestown Canyon Virus

A chart showing real time disease activity by municipality is included on the Commission's website to keep residents informed. Mosquito-borne disease surveillance activities are described below. The Commission has been monitoring for West Nile virus since its introduction into New Jersey in 1999; therefore, most historical disease data pertains to WNV. A map showing the locations of all cumulative WNV activity in Warren County to date (including mosquitoes, birds, and horses) can be found on the WNV Cumulative Positive Map, Figure 6. Locations of confirmed human cases are not publicly disclosed; therefore, these points are not shown on Figure 6. As mentioned earlier, in 2023 all samples submitted for WNV were simultaneously tested for EEE, SLE, and JCV. Although the Commission has periodically been able to test for these and other viruses before, the panel testing allows for a much more comprehensive surveillance program.

1. Bird Testing

The bird testing regime followed since 2001 was discontinued in 2016. This service is no longer available through the NJ Department of Health and Human Services; however, the NJ Department of Agriculture does occasionally test birds for WNV. In Warren County, dead bird reports are entered as service requests, and the area is trapped as soon as possible for mosquitoes that are likely to be

carrying the virus. The mosquitoes caught from those areas are submitted for testing and often result in detections of the West Nile virus.

While performing inspections on October 16, 2023, the Inspector and Biologist came across a recently deceased raptor in Allamuchy Township. Since it was an active season for West Nile virus, the specimen was collected and kept on ice until it was delivered to the NJDEP Fish & Wildlife Pathology Laboratory for testing. The raptor was confirmed to be a Cooper's Hawk and autopsy found there was hemorrhage in the oropharyngeal cavity, lungs and coelomic cavity with damage to the liver consistent with trauma, although there was no evidence of broken bones. No testing results were ever received, and it is unclear whether any further testing was even done.

2. Mosquito Sampling/Testing

In 2023, a total of 461 pools (samples) of mosquitoes comprised of 15,138 mosquitoes from Warren County were submitted to the NJ PHEL for virus testing. The State Mosquito Control Commission covered the total costs of testing for each county (up to 20 pools per week). Please refer to Figure 6a, Mosquito Samples by Species Submitted to PHEL for Mosquito-borne Disease Testing to see the species and counts of mosquitoes submitted. A map of all the sites where mosquitoes were collected and submitted to PHEL in 2023 for disease testing can be found on Figure 6b, Mosquito-borne Disease Trapping Locations.

a. West Nile Virus

Currently, West Nile virus (WNV) is the primary mosquito-borne virus of concern in Warren County; therefore, the methodology of our disease surveillance program is centered on this disease. For West Nile virus surveillance, gravid traps were placed at locations throughout the county to target *Culex* mosquitoes, the primary vector of WNV. These traps were set beginning May 8 through October 12 in 2023. All municipalities were sampled multiple times starting with sites on the trapping schedule, then supplemented with sites that had a high disease potential to fill geographic voids. Neighborhoods with positive WNV indicators were also focused on to assess the general mosquito activity as well as the WNV activity in those areas. *Culex* species (mostly *Cx. pipiens* and *Cx. restuans*) were tested since they are the known amplification vectors of WNV. If any of those pools tested positive, then additional trapping and/or testing was done to include other species that may bridge the disease to humans.

In 2023, Warren County had 29 WNV positive mosquito samples out of the 458 samples tested for WNV. This is more than double the 1999-2022 county average of 12 WNV positive samples/year. The first WNV positive pools of the year were collected from Franklin Township and Lopatcong Township on July 25, 2023. The final WNV positive pool of the year was collected from Blairstown Township on September 12, 2023. The twenty-nine (29) mosquito samples that tested positive for WNV from Warren County in 2023 were from the following townships: Allamuchy (2), Alpha (1), Belvidere (2), Blairstown (2), Franklin (3), Greenwich (1), Harmony (4), Hope (4), Liberty (1), Lopatcong (3), Washington Boro (2), and Washington Township (4). The species that tested positive for mosquito-borne disease in 2023 were *Culex pipiens/restuans/salinarius mix* (28) and *Aedes triseriatus (1).* This information can be found in Figure 6a and both positive and negative trap locations are mapped in Figure 6b.

Statewide, 2023 was also an above average year for WNV activity in the mosquito population. There were 847 positive pools (as opposed to 609 positive pools in 2022). Every county in the state reported at least one WNV positive mosquito sample with the highest positive mosquito activity being reported from the suburban corridor (Bergen, Hudson, Middlesex, Somerset, Hunterdon, Union, and Mercer Counties). Ninety-seven (97%) of the WNV positive mosquito samples were *Culex* species and the remaining 3 percent (3%) comprised 7 different species (*Aedes albopictus*, *Ae. japonicus, Cs. melanura, Ae. triseriatus, An. punctipennis, Ae. taeniorynchus,* and *Ps. ferox*).

b. Eastern Equine Encephalitis

To better conform to the Mosquito and Vector Surveillance Submission guidelines, the goal was to have some pools submitted for testing each week that would target eastern equine encephalitis and Jamestown Canyon virus vectors in addition to West Nile virus vectors. For eastern equine encephalitis, the target species are *Culiseta melanura* and *Coquillettidia perturbans*, the primary vectors of EEE. In 2023, although additional traps were set in areas to target EEE vectors, populations were low. There was only one pool of 14 *Coquillettidia perturbans* collected and submitted for testing. Since the inception of panel testing at PHEL, all samples submitted for the WNV testing panel are also tested for EEE; therefore, 429 mosquito pools (15,042 mosquitoes) were tested for EEE. None of the mosquito samples from Warren County tested positive for EEE in 2023. If positive mosquitoes were to be found in any sampling, more extensive trapping would have followed to determine the best course of action.

Statewide, 2023 was a relatively active year for EEE; although activity was slow to start. There were eighteen (18) positive mosquito pools, whereas there were only four (4) EEE positive mosquito pools in 2022. The breakdown is as follows: Atlantic (3), Burlington (3), Camden (2), Cape May (2), Cumberland (3), Hunterdon (1), Morris (1), Somerset (1), and Sussex (2). Three of these pools were *Culiseta melanura* and one was a pool of *Culex* Mix.

c. Jamestown Canyon virus (JCV) and St. Louis encephalitis (SLE)

In Warren County, specific trapping for JCV was done early in the season, beginning April 12, 2023. Between April 12 and May 11, CDC traps baited with dry ice were set at snowpool habitats throughout the county to target early season *Aedes* species. Collections predominantly included *Culex mix,* but there were some *Anopheles punctipennis, An. quadrimaculatus,* and *Aedes cantator* individuals collected as well. Collections in general were minimal. As a result, special effort was made later in the season to submit these species if they were found in higher abundance from other trapping ventures. Jamestown Canyon virus is included in the West Nile virus multi-plex panel, so in the end, 429 pools (15,042 mosquitoes) submitted for WNV panel testing were also tested for JCV and SLE yielding no positive pools in Warren County for either of the two viruses. However, statewide Jamestown Canyon virus was detected in five mosquito samples in the following counties: Cumberland (1), Gloucester (1), Salem (1), and Sussex (2). There was no Saint Louis encephalitis activity in NJ in 2023.

3. Equine Cases

No horses were confirmed to have WNV in Warren County in 2023. There were three confirmed EEE positive horses reported in 2023; one each from Gloucester, Salem, and Ocean County.

4. Human Cases

The Commission is kept abreast of human cases being tested for mosquito-borne diseases via regional meetings (Associated Executives of Mosquito Control in NJ, Vector-borne disease working group, and NJMCA Board meetings). If the Superintendent was notified of suspect human cases in Warren County via phone calls from the State Mosquito Control Commission, this would then prompt contact with the county health department for additional information. Information about each individual case is shared between the county health department and the mosquito commission superintendent. If a case is confirmed positive for mosquito-borne virus, the superintendent notifies the Commissioners as well as the County Board of Commissioners.

There were no human cases of WNV, EEE, JCV, or SLE detected in Warren County in 2023.

Statewide, there were 14 human cases of WNV reported in 2023: Bergen (4), Middlesex (3), Camden (2), Atlantic (1), Burlington (1), Monmouth (1), Morris (1), and Passaic (1) with 1 fatality from Bergen County. Twelve of the 14 cases were considered neuroinvasive. In 2023, the date of illness onset for

human WNV cases ranged from week ending 7/15/23 to the week ending 10/21/23, which followed the typical pattern.

One human case of JCV was reported from Sussex County in 2023. This case was reported as neuroinvasive illness. The date of onset was reported as the week ending October 21, 2023.

There were no reported confirmed human EEE or SLE cases in the state of NJ in 2023.

5. National Recreation Area Cooperation

The lines of communication are open regarding detection of mosquito-borne disease in the Delaware Water Gap National Recreation Area (DWGNRA) and surrounding areas. Provisions have been made to allow for limited control measures to be taken in the park if mosquito-borne disease occurs there. National Park Service Collection Permits were received for the 2023 season, but limited mosquito sampling was done in the DWGNRA in 2023. However, two of the exploratory sites for the grant-funded tick surveillance program were in the DWGNRA. That information is included in the Grant Funded Tick Surveillance Project found in the Research & Field Studies section VIII.D.

D. <u>Chikungunya Virus (CHIKV) and Dengue Virus (DENV) and Zika Virus (ZIKV)</u>

Humans can serve as a reservoir for chikungunya (CHIKV), dengue (DENV), and Zika (ZIKV) viruses. Therefore, a mosquito can actually acquire enough virus from an infected person (while obtaining a blood meal) to pass that virus onto another person. Unlike WNV, these viruses do not require a bird reservoir. *Aedes aegypti* and *Aedes albopictus* are both able to transmit the virus. *Ae. aegypti* is not present in Warren County but *Ae. albopictus* is becoming more abundant.

To date, there have not been any locally transmitted cases of CHIKV, DENV, or ZIKV in New Jersey; however, there have been travel related cases of all three viruses in the state. Year 2023 was a particularly high year for travel-related Dengue cases in NJ following extremely large outbreaks of the disease worldwide. It is theoretically possible for local transmission to occur in Warren County in areas where *Ae. albopictus* are abundant (when travel related cases are present). Therefore, when reports of travel-related cases are reported to the Commission, follow up mosquito surveillance occurs as soon as possible and a request for testing is submitted to the State Mosquito Control Commission.

In 2023, following a report of a possible human dengue case in Warren County, three samples consisting of eight (8) *Aedes albopictus* were submitted for CHIKV/DENV/ZIKV panel testing; the results were negative. The human case was later confirmed but was found to be travel related. Larval and adult mosquito surveillance in the immediate area prompted control efforts to lower the *Aedes albopictus* population and prevent any local transmission of the disease from occurring.

A detailed Zika Action Plan was developed and approved by the Commission in 2017. The Plan follows the recommendations set forth by the CDC for Zika Vector Control in the Continental United States and incorporates properties of the NJ DOH Interim Zika Virus Concept of Operations Plan and the AMCA Best Management Practices for Integrated Mosquito Management. The Commission's Zika Action Plan outlines the preparations and responses to various scenarios of a Zika virus epidemic. The actions laid out in this plan would also be applicable to many other vector-borne disease outbreaks.

E. <u>La Crosse Encephalitis (LAC)</u>

Mosquito testing for La Crosse encephalitis was made available through the NJ PHEL for 2019 by choosing a separate LAC/WNV panel test instead of the WNV/EEE/SLE/JCV panel testing. There was no suspected LAC activity in Warren County in 2023; therefore, no specific trapping was done for LAC. However, to adhere to the Mosquito and Vector Submission Guidelines that suggest 1-2 pools per week for LAC surveillance, pools were submitted for LAC testing as often as possible. *Aedes triseriatus*, the Tree hole Mosquito, is the primary vector species for LAC and it is seldom caught in high numbers in Warren County traps; the greatest single collection in 2023 was 19 specimens from a

CDC trap set on August 28 in Hope followed by 10 specimens collected from a gravid trap that same day in the same location. Most pools were derived from gravid traps, but there were also a handful of submissions from BG traps as well. In 2023, a total of 30 pools (totaling 90 mosquitoes) were submitted for LAC testing; all samples tested negative for LAC.

Statewide, there was one (1) positive pool of La Crosse detected in Sussex County, The positive pool consisted of *Ae.triseriatus* mosquitoes. This was the first La Crosse positive mosquito found in New Jersey since 2019. There were no confirmed human cases of La Crosse in NJ in 2023.

F. Tickborne Disease

Since 2000, the number of tickborne diseases in Warren County has markedly increased. The tickborne diseases reported to the NJ State Health Department from Warren County include Lyme disease, alpha-gal syndrome, babesiosis, *Borrelia miyamotoi*, ehrlichiosis/anaplasmosis, Rocky Mountain spotted fever, and Powassan virus. The State Health Department has not released the final number of cases per county of the aforementioned tickborne diseases for 2023 as of the date of this report; however, once finalized it can be found at: http://www.nj.gov/health/cd/statistics/reportable-disease-stats/index.shtml.

From 2010-2019, Warren County was consistently one of the top three counties for the highest incidence of Lyme disease in the state and experienced the highest incidence in both 2016 and 2017. Increasing numbers of other tickborne illnesses are also occurring and unfortunately, in 2013, there was a fatal case of Powassan virus that occurred in Warren County. The Board of County Commissioners passed a resolution in 2019 designating the county mosquito commission as the appropriate agency for tick surveillance in Warren County should funding become available. The Commission sought and was awarded grant funding for tick surveillance in 2021, 2022, and 2023.

One goal of the grant-funded tick surveillance project is to calculate the density of infected ticks in Warren County for a variety of tickborne pathogens. There were significant delays in developing and validating the tick testing methods at the NJ Public Health and Environmental Laboratory (NJ PHEL) which left the data from 2021 incomplete (the fall submissions were only tested for Powassan virus). The tick testing panels were finalized in 2023 and all the backlogged collection data from 2022 as well as the new collection data from 2023 were tested and the results have been entered into VectorSurv. Detailed information about the tick surveillance project can be found in Section VIII. D. Grant Funded Tick Surveillance.

V. SURVEILLANCE

Surveillance is the foundation of all the Commission's efforts and is a necessity to make sound, scientifically based decisions. Rainfall surveillance guides our efforts and allows for the most efficient use of Commission time. Rainfall events are tracked throughout the county so that inspection efforts are concentrated where the most flooding potential exists. Adult and larval mosquito surveillance is time-consuming, but it is an integral part of any integrated pest management (IPM) approach. County-wide mosquito surveillance not only provides the data needed to make control decisions but also provides an overall picture of mosquito productivity in the county. This information is useful in identifying where future problems may occur, such as invasive mosquito species and the potential introduction of emerging infectious diseases.

A. Adult Mosquito Surveillance

Routine surveillance for adult mosquitoes occurs at predetermined surveillance stations utilizing stationary New Jersey light traps. The locations of the 2023 Warren County surveillance stations can be seen in Figure 7. These stations are vital to our mosquito abatement efforts. They provide adult mosquito population data to direct and justify control measures and provide follow-up data to evaluate the control measures employed. The detailed 2023 seasonal synopsis of mosquito species collected

from the routine surveillance stations can be found in Figure 7a. A summary of the overall number of mosquitoes collected from these stations is graphed on the New Jersey light trap Figure 7b.

In addition to the routine surveillance, randomized adult mosquito surveillance is done throughout the county utilizing gravid traps, CDC traps, and BG sentinel traps. These traps are often set in response to resident complaints of biting mosquitoes or for disease testing. Figure 8. The Five-Year Summary of the 2023 Disease, Complaint, and Field Study Surveillance Synopsis shows a summary of the mosquitoes collected from these traps. Please note that only complete data was used to calculate the mosquitoes per trap night and species abundances beginning in 2022 and continuing in 2023; that is, all malfunctioning traps and their collections (or lack thereof) were removed from the equation. If a trap was set and yielded no collection but was functioning upon retrieval, then it was included in the calculation. In 2023, there were twenty-three malfunctioning traps disregarded from the collection data.

Calls from residents are not necessarily used as a surveillance method themselves; however, they can help bring attention to areas with adult mosquito problems. Inspections made at the site of these service requests often include setting adult collection traps (usually CDC traps baited with CO_2) to ascertain the mosquito species present and the extent of the problem. Occasionally it occurs where the CDC trap doesn't collect any mosquitoes, but the complaint persists. In those cases, residents are urged to gently swat and collect adult mosquitoes that are present and call our office so that a staff member can pick up what they have collected. If the collection includes biting mosquitoes, surveillance efforts can be repeated.

1. NJ Light Traps

Seven New Jersey light trap (NJLT) surveillance stations were maintained in Warren County in 2023. All NJLTs were in operation from May 8, 2023, through October 16, 2023. Some of these traps have been monitoring the same areas for over 25 years. The consistency of placing light traps in an area for a number of years is beneficial to obtain a long-term picture of the mosquito production in that area. Mosquitoes from these traps are collected regularly by the cooperators and then picked up weekly by Commission staff. The collections are then sorted in the lab to isolate the mosquitoes from the other insects trapped. After prompt identification, the count and species information are entered directly into the New Jersey VectorSurv platform. Totals of all the NJLT collections for 2023 are found in Figure 9.

The top five mosquito species sampled through our NJLT surveillance in 2023 were: *Culex spp.* (39.69%), *Ae. vexans* (32.40%), *An. punctipennis* (9.30%), *An. quadrimaculatus* (5.32%), and *Ps. ciliata* (2.40%). There was an average of 31.01 mosquitoes per trap night (T/N), which is a 175.89% increase from the average number of mosquitoes per trap night collected in 2022 (11.24 mosquitoes/TN). In 2023, 34,952 mosquitoes were trapped in NJLT's compared to 12,666 mosquitoes in 2022 showing that overall populations were remarkably higher than the previous year. The greatest species diversity was observed at both Ivaseczko's on Post Lane in Independence Township and Kelsey's on Shades of Death Road in Independence; both traps collected 21 different species throughout the course of the season (although there were two different species collected in singular abundance at both locations). The least diverse trap in 2023 was Sehulster's on Bear Creek Road in Allamuchy (18 species collected), although this is an overall increase in diversity from the 13 species observed in 2022. Other traps ranged from 19 to 20 species collected over the course of the season. Compared to 2022, whose traps ranged in diversity from 13 to 23 different species, the 2023 season saw less variation in the species diversity between light traps but an overall increase in regional diversity.

With funding from the State Mosquito Control Commission, Rutgers Center for Vector Biology began a statewide NJLT Surveillance program in 2003. This program ran for almost 20 years but ended at the conclusion of 2022. Included in this statewide program were three traps from Warren County:

Pequest Road in Oxford Township (Woronowicz - Trap 2A); Young's Island Road in Independence Township (Ivaseczko - Trap 5), and Bear Creek Road in Allamuchy Township (Sehulster - Trap 4A). The three chosen traps from Warren County, along with three chosen traps from Sussex County, represented the Northwest Rural region figures on the state report. No reports were produced in 2023 from the Center for Vector Biology; however, 2003-2022 weekly summaries are made available to all mosquito control agencies in the state as part of the NJ State Surveillance program reports and can be found at: http://vectorbio.rutgers.edu/surveillance.php

2. Portable Carbon Dioxide Baited Light Traps

Historically, landing rates were used at our regular surveillance stations to augment the New Jersey light traps by collecting mosquito species that are not readily attracted to light. *Aedes trivittatus* is one of our primary summer nuisance species and falls into this category. With the onset of West Nile virus, it was deemed too dangerous to conduct regular landing rates. So, CDC traps baited with dry ice became a substitute for the human landing rates and were conducted regularly at NJLT locations for many years. However, the increased presence of *Aedes albopictus* in Warren County along with the increased demands of setting, identifying, and processing the disease surveillance traps made it burdensome to continue with the CDC trapping at our regular New Jersey light trap surveillance sites. There was very little to no new information being gleaned from double trapping each NJLT location with a CO_2-baited trap; therefore, in 2019, we ceased setting these additional traps. Nonetheless, CO_2-baited traps continue to be used for the majority of our service request/complaint trapping when host-seeking mosquitoes are being targeted. These traps are also used alongside our gravid traps for disease surveillance when species other than *Culex* are being sought as well as for conducting field studies near highly productive sites.

In 2023, CDC traps were the primary trap set in response to residential complaints and service requests to validate an adult mosquito problem. However, CDC traps were also set on occasion for other purposes, such as: to monitor adult populations before and after adulticide applications, in response to positive West Nile virus samples, to gauge larviciding efficacy and adult hatch-off, and to target early season species that may be involved in Jamestown Canyon virus transmission. When looking at Figure 8 (Surveillance Synopsis), it is important to take these trap uses into consideration, namely being that CDC traps are not 100% synonymous with service requests.

3. Landing Rates

As previously stated, the presence of mosquito-borne diseases eliminated the use of landing rates as a routine means of surveillance. However, over the last couple of years, the commission has transitioned back to using landing rates when adult activity is high to expedite the flow from service request to adult mosquito control. This not only increases response turnaround but also alleviates pressure in the lab when trap counts can be overwhelming. In 2023, a total of 30 landing rates were taken in response to service requests as opposed to setting a CDC trap.

4. Resting Boxes

Resting boxes are primarily used to assess population levels of *Culiseta* species mosquitoes. *Culiseta melanura* is the primary species implicated in the amplification of eastern equine encephalitis. After years of trapping for *Cs. melanura* utilizing resting boxes in various sites throughout Warren County, this species was only found occasionally, which led to resting box surveillance being terminated in 2009. Resting boxes can be set periodically if requested by the State, but we have had better success collecting *Cs. melanura* from the NJLTs and CO_2-baited traps.

5. BG Sentinel Traps

BG sentinel traps are the standard trap type used to monitor *Aedes albopictus.* This type of trap is known to collect higher numbers of *Ae. albopictus* than the other traps mentioned because they are set

low to the ground and are more in line with the flying height of a host seeking *Ae. albopictus,* they are baited with an additional human scented lure, and they use high contrast coloring. BG sentinel traps can be cumbersome to set and do not produce quality results if left out in the rain, so collections are often supplemented with other trap types. There have been several years when CDC traps collected significantly more *Ae. albopictus* than BG traps did; however, that was not the case in 2023. In 2023, fully operational BG traps collected 194 adult *Aedes albopictus* females, whereas fully operational CDC and gravid traps combined only yielded 114 *Aedes albopictus* adult females. This is partly due to the preferential selection of BG traps in areas with known populations of *Aedes albopictus*. For example, when conducting surveillance in Phillipsburg, where *Aedes albopictus* is the greatest nuisance, BG traps are primarily used, but CDC traps are generally given preference for surveillance efforts in other regions of the county because they attract a broader range of species that are more likely to be causing a nuisance.

In 2023, BG Sentinel traps were deployed at set locations throughout the county to monitor the spread of *Ae. albopictus* (refer to Figure 3). Locations were chosen in areas with established populations as well as locations that had small or no prior collections of *Ae.albopictus*. BG traps were set bi-weekly in Alpha, Belvidere, Blairstown, Hackettstown, Independence, Phillipsburg, Washington Borough, and White Township. In 2023, *Aedes albopictus* adults were collected from every routine BG trap except for the BG trap located in Blairstown. The abundance of *Ae. albopictus* was dramatically different from abundances observed in 2022. There was 113 adult *Ae. albopictus* females collected at these routine locations in 2023 as opposed to 473 adult females collected at the same locations in 2022. This is based on seasonal conditions but also trapping effort. Routine BG Sentinel trapping at the bi-weekly surveillance sites disbanded towards the end of August when the seasonal trapper ended her working term. Since BG trap collections are merely for abundance and not used for disease testing, trapping efforts were focused elsewhere September through October, which resulted in a data gap for *Ae. albopictus* populations during that time. This makes a year-to-year comparison difficult. In general, populations at Kucharski's junkyard on Ryan Road in Independence were significantly lower in 2023 at the end of August (8 adult females) than at the same time in 2022 (63 total adult females), whereas Paul Street in Belvidere yielded 26 adult females through the end of August as opposed to a season wide total of 25 adult females in 2022.

Because Phillipsburg has an established *Aedes albopictus* population, BG traps have been the primary device used to monitor the adult mosquito population in that portion of the county. Over the past two seasons, a transition has been made to primarily use BG traps in Phillipsburg so that the trap data between locations is consistent and can be compared from site to site and from season to season. There are six trap locations with historical data that are used to compare the populations from year to year and are generally trapped in preparation for an area wide adulticide following large influxes of residential service requests. Unfortunately, these locations were not visited in 2023. Resident complaints in the greater Phillipsburg area were minimal, so trapping priorities were reallocated. BG traps set at the end of August in response to two different service requests (in addition to a couple landing rates) served as the necessary data for an adulticide event.

Over the past couple of seasons, *Aedes albopictus* has been found sporadically in Allamuchy, Hackettstown, and Blairstown; if samples continue to be collected in these areas, it is likely that *Ae. albopictus* will be established county-wide. BG traps were chosen for this routine trapping so that populations could be easily compared to trapping done in other counties.

6. Ovitraps

Ovitraps are a unique surveillance method that targets the egg stage of container-type mosquitoes. The traps are simply small containers baited with organically rich water and are lined with egg laying paper or seed germination paper. It is a very labor intensive trapping method, and since *Ae.albopictus* can be

easily collected with other trap methods, it was decided to abandon the use of ovitraps as a regular surveillance method. However, ovitraps have been used to varying degrees since 2017 when there was a need to collect *Ae.albopictus* eggs for insecticide resistance workshops (see Research & Field Studies section VIII. A. Insecticide Resistance for more information). Commission staff have also been interested in utilizing lethal ovitraps as a control method for *Ae.albopictus* (see the Research and Field Studies section VIII. E. Lethal Ovitraps for more information).

7. *Aedes albopictus*

The most recent invasive species, *Aedes albopictus*, also called the Asian Tiger Mosquito (ATM), was first detected in Phillipsburg (at the Filmore Street Cemetery) on August 28, 2012, in both a gravid trap and a portable light trap which had been set following the report of a dead crow. Warren County was the last county in the state to fall prey to this invasive species. *Ae. albopictus* is a potential vector of several mosquito-borne diseases and unfortunately, requires non-conventional means to control. Up until 2017, Commission staff was able to contain this species to the townships in close proximity to Phillipsburg; however, in 2017 samples were collected in Washington Borough several times throughout the season and one sample was collected from the Pollution Control Financing Authority (PCFA) White Township. The extreme weather conditions of 2018 led to a population explosion and northward advancement throughout the county. In 2023, *Aedes albopictus* was collected in all but four municipalities (Frelinghuysen Township, Hardwick Township, Hope Township, and Liberty Township), a three township increase from 2022. Frelinghuysen, Hardwick, and Hope remain as the only municipalities in the county to not have any historical collections of *Ae. albopictus*. This year was the first year that there was a collection of a singular *Ae. albopictus* adult female in Knowlton Township collected in Columbia from a service request trap. Mansfield, Blairstown, and Harmony collections of *Ae. albopictus* were each from a singular collection event. Additionally, there has not been any additional *Ae. albopictus* specimens collected in Liberty Township since 2019. See Figure 10 for a map of *Ae. albopictus* collections in 2023.

Although the commission has seen a slight decrease in *Aedes albopictus* activity throughout the county over the past several seasons, the decrease in *Ae. albopictus* collections in 2023 has been heavily affected by lack of time and effort towards *Ae. albopictus* trapping. In 2023, a total of 308 adult female *Ae. albopictus* mosquitoes were collected across all functioning trap types (CDC, BG, and gravid), a 63.4% decrease from the 841 adult females collected in 2022. Out of 436 total traps set in 2023 (inclusive of GT, BG, and CDC traps and exclusive of malfunctions), a total of 85 traps (19.50%) collected *Ae. albopictus* (either males, females, or both). A total of 118 functioning traps, BG, CDC, and gravid, were set in response to service requests; twenty-three (19.49%) of those traps were positive for *Aedes albopictus*. Although the goal is to put forth a regular and consistent effort towards monitoring ATM populations throughout the Phillipsburg and surrounding areas, the early dry conditions surrounding the 2023 season did not require the same wide-scale efforts to control *Aedes albopictus* since habitat was readily reduced during that time. Surveillance after heavy rainfall events in July fell to the wayside, but service requests were extraordinarily low as well. There was one area wide adulticide that occurred in the Phillipsburg area resulting from two residential complaints, but it was completed at a smaller scale than it had been in previous seasons.

B. Rainfall Monitoring

The State Climatologist's Office reported the annual average precipitation for the state was 2.68" above the 1991-2020 normal at 50.24"; however, seven months during the year saw below average precipitation totals. The precipitation was extremely inconsistent with long dry spells ending with torrential downpours. The annual statewide average temperature was 55.3° F and ranked as the 3rd warmest year in the past 129 years.

The rain gauge located in Oxford at the Commission office collected a total of 64.94 inches of precipitation for the 2023 year. Rainfall amounts from this gauge are shown in Figure 11 for the

months of April through September and reflect the rainfall that fell in the county in 2023. Please refer to Figure 11 for the ten (10) years of rainfall monitoring data from the Oxford rain gauge for the above-mentioned months.

The 2023 mosquito season was shaping up to be a dry season as the county received less rain than the 10-year average in the early spring months. Towards the end of June there was a dramatic shift in conditions. A large rainfall event dumped over 5 inches of rain in parts of the county. When another round of excessively heavy rainfall hit the county in mid-July, it dropped over 8 inches of rain at the office rain gauge in less than three days! The rain gauge recorded 16.42 inches of rain for the month of July, which created an incredibly busy environment with extensive flooding and high demand to treat larval habitat which continued well into September despite the August and September rainfall approaching closer to the 10-year average.

While the records kept at our office are helpful in comparing one year to the next, it does not provide accurate knowledge of what goes on in other parts of the county. The Community Cooperative Rain, Hail and Snow (CoCoRaHs) network was identified in 2009 as a source of real time precipitation data. This nationwide network had an increase of sites in 2009, in part due to newspaper coverage regarding this network. Cooperators in the county include Secretary Christine Fisher and Superintendent Jennifer Gruener in addition to our Oxford office. The CoCoRaHs precipitation maps were referred to almost daily and served well in 2023 to identify rainfall patterns that needed attention in various parts of the county.

C. Larval Mosquito Surveillance

1. Breeding Site Inspections

A detailed route system for our four districts is followed to monitor larval mosquito populations. Twelve thousand, eight hundred and seventy-four (12,874) inspections were performed on mosquito breeding habitat throughout Warren County in 2023. Each year new sites must be added and sites that no longer pose a problem must be deleted from the site logbook and the detailed inspection route system. Inspection data is recorded in the field with handheld tablets. Site specific data is collected for every inspection and treatment, as per NJ Pesticide Control Regulations, and this data is then downloaded into the database at the end of every day. The FieldSeeker system allows for additional data to be recorded in the field or in the office, such as ownership information, site access, and inspector comments. Inspection and treatment history are stored on the tablets and are available to the inspector in the field at the touch of a button. The Activity Summary chart on Figure 12 contains a breakdown of inspections and control measures in the field by township for the 2023 season.

2. Larval Dip Counts

Larval samples are taken at every location when possible. Larvae are transported back to the laboratory and reared to 4th instar or adult so accurate identifications can be made. This information serves as justification for the pesticide application as well as documentation for permit applications for water management projects. Larval identifications are later entered into the FieldSeeker database for each site collection. Larval identification paper slips are also kept on hand for five years.

The first larvae of the season were collected March 21, 2023, in a site located within Allamuchy Township and included samples of *Ae. vexans* and *Ae. trivittatus*. Spring collections were dominated by *Aedes canadensis* although there were occasional collections of other characteristic early spring and snow pool species, including *Aedes stimulans, Aedes cinereus,* and *Aedes excrucians*. There is a continuing trend of early collections of *Aedes vexans*, a common summer species that is now being regularly collected as larvae throughout April; there were even several early collections of *Aedes trivittatus* and even *Psorophora ferox* during this time! It was a productive season for *Psorophora*

ciliata and *Psorophora howardii* during the summer months. Larval *Culex* collections were predominantly *Culex restuans*. Due to the influx of rain in July, larval collections were not taken frequently later the season.

D. Species List

The full New Jersey Species List (64 species), with Warren County species (46 species) bolded, can be found on Figure 13. There have been no new additions during the 2023 season. The most recent addition, *Aedes tormentor*, occurred on July 7, 2021. *Aedes tormentor*, a floodwater mosquito, was first collected as larvae on July 7, 2021, from a swamp in Independence Township. Adults were later collected from a CO_2-baited trap set at the same site as well as from three surveillance stations throughout the year. In total, *Aedes tormentor* was documented in five townships in 2021. However, there were only two adult collections in 2022 in Allamuchy and Independence Townships totaling four specimens. There were no confirmed larval collections in 2022. In 2023, there were no adult collections; however, there were two separate larval collections. One collection was from June 28 on Youngs Island Road in Independence Township, totaling four larvae. The second collection occurred on July 1 from Free Union Road in Liberty Township, totaling one individual.

Even though there was one adult female *Aedes infirmatus* collected in September of 2021 from a New Jersey Light Trap in Independence Township, there have been no collections of *Aedes infirmatus* since. As a result, it remains unclear currently if there is an established population. Continued surveillance efforts must be made to collect additional adults and larvae before adding this species to Warren County's list.

The *Ae. tormentor* adults and singular *Ae. infirmatus* adult collected in 2021 were sent to Rutgers in April and were tested in 2022 with a restriction enzyme assay to confirm their identifications. As a result, *Ae. infirmatus* has still not been added to the Warren County species list until more substantial collections confirm its establishment. Due to collection data from 2021, *Ae. tormentor* remains an established species in Warren County but has proven to be inconsistent in collection method, location, and abundance.

VI. CHEMICAL CONTROL

All pesticide applications comply with pesticide regulations established by the NJ Department of Environmental Protection as well as the Pesticide General Permit of the NJ Pollutant Discharge Elimination System. The Recommendations for Insecticide Use in New Jersey, provided by the New Jersey Agricultural Experiment Station, are no longer followed for guidance in product selection and use since they are dangerously outdated (last publication 2012).

Particular insecticides have the ability to alter cholinesterase levels of exposed individuals. So, baseline cholinesterase levels are documented pre-season for each new employee that would be in contact with these insecticides. Currently, the only product in use in Warren County that would fit these criteria is Fyfanon ULV used for adult mosquito control (active ingredient malathion). Mid-season blood work is done when appropriate to check cholinesterase levels for employees who handled Fyfanon ULV regularly during the season. Appropriate action, if any, is taken based on test results. In 2023 Fyfanon ULV was used in rotation with synthetic insecticides, Zenivex and Deltagard in the adult mosquito control program. Employees deemed susceptible to the cholinesterase-inhibiting product avoided contact with it.

In 2010, a comprehensive plan was developed and put into place to address the New Jersey pesticide regulations that deal with the requirements of the School Integrated Pest Management (IPM) Act. A complete list of public and private schools was compiled. Any known breeding sites on any of these properties were designated for long term briquets and preparations are in place for notification to be

made before these are applied in the spring. After year-end, annual reports are sent to affected schools listing insecticide applications. In 2023, nine sites located on school properties required pesticide treatments.

Under the US Clean Water Act administered by the US Environmental Protection Agency, the New Jersey Department of Environmental Protection developed a Pesticide General Permit (PGP), which included a use pattern for mosquito control to operate under. The draft general permit went into effect in November of 2011 with renewals being issued every five (5) years. On February 13, 2020, a final reissued General Permit under the PGP category was issued by the Department of Environmental Protection, which went into effect on March 1, 2020. The Commission received their permit on April 3, 2020. This permit expires on February 28, 2025. A renewal application will be submitted by August 28, 2024, as required. The general permit authorization is issued in accordance with the NJPDES Regulations (N.J.A.C. 7:14A-1 et seq.). This permit authorizes the applications of biological and chemical pesticides in water when such applications are made in, over, or near surface waters of the State for certain pesticide use patterns (including mosquito control). The PGP required the Commission to develop and operate under a Pesticide Discharge Management Plan (PDMP). The PDMP was updated and revised in 2021 to reflect changes in the permit requirements and staffing changes at the Commission. Other forms were developed (ex: adverse incident report) or existing forms modified (ex: adult mosquito control application cover sheet to allow conversion of application to acreage) to satisfy requirements of the General Permit.

A. Larviciding/Pupiciding

Controlling mosquito larvae before they can emerge as adult mosquitoes and cause problems remains the primary focus of our operations. Larviciding is performed when source reduction, water management, and/or biocontrols cannot be employed.

1. Ground Applications

Ground larviciding is a major component of our abatement program. The Biologist, Senior Wetlands Specialist, Wetland Specialist, Inspector, and Heavy Equipment Operator along with the four seasonal inspectors manage the inspection routes during the season. The full-time staff members manage the ground larviciding before and after the seasonal staff are onboard and assist them during the seasonal peak. The seasonal inspectors carry out the bulk of the ground larviciding from June-August. This staffing allows us to keep up with inspecting and treating over 1000 sites currently. These districts and the number of sites in each township are shown in Figure 14, Inspection Districts & Site Breakdown. Inspection and treatment data for each site is recorded in the field with the use of the handheld tablets and that data is transferred into the FieldSeeker database at the end of every day. Treatment records can be quickly retrieved by site, date, inspector, insecticide, or municipality.

The majority of larval sites are treated with a liquid *B.t.i.* formulation using hand-pump compression sprayers. Extended release briquets are also utilized although primarily in situations where there is a hazard or access concerns and in sites that are on school property. These briquets are utilized in the spring and provide season long control at these sites. In 2023, ground applications for larval mosquito control took place from late March through the middle of October. A portion of treated sites were backchecked to determine insecticide effectiveness and to make sure seasonal inspectors were visiting the correct sites and correctly applying the insecticides.

Starting in 2012, a relatively new and innovative way to apply larvicides for *Aedes albopictus* control was used. Area-wide applications of Altosid Liquid Larvicide were performed utilizing a truck-mounted ultra - low volume (ULV) sprayer. This method allows the product to settle in small pockets of water that are not practical to treat using traditional methods; however, the application is extremely expensive in both dollars and time. A standard procedure for this unusual type of application was tested and published by the Rutgers Center for Vector Biology. Area-wide notification utilizing the

County's alert system (RAVE mobile safety) was done prior to the applications as well as notification postings on the Commission's and pertinent town's websites and social media accounts. Only one ULV larvicide application was performed in 2023. This application took place on September 11th in response to high trap counts following service requests in parts of Alpha Boro and Phillipsburg.

2. Catch Basins

Catch basins, also referred to as roadside storm drains, are numerous and provide perfect larval habitat for *Culex* and other container breeding mosquito species. Throughout the years, the county's catch basins have been inspected and the hundreds of basins that consistently hold water have been indicated on paper maps. Those paper maps are still referred to, but now the catch basins that the Commission treats are also mapped with the FieldSeeker GIS database system and treatments are logged in real-time. The approximate number of basins that need to be treated on each route are as follows: Central – 63 basins, East – 552 basins, North – 47 basins, South – 819 basins. Insecticides that provide 30-60 days of larval control are typically used for catch basin treatments. Ideally, commission staff aim to treat catch basins at least three times during the active season.

High rainfall in 2023 kept staff busy with the regular routes, the airspray route, and service requests. Therefore, staff was not able to address the catch basins on a regular schedule. In 2023, all catch basins on the central route were treated in May and a second round took place in late August to early September. East route catch basins were treated in May and a portion of them were treated in September and October. North route catch basins were treated in early June and again in early September. South route catch basins were treated in late May into early June and again in late July to early August. Overall, 1,538 catch basin treatments took place in 2023 compared with 2,448 treatments in 2022.

Seven catch basins in Belvidere, Frelinghuysen, Greenwich, Lopatcong, and Washington Townships were sampled in late May to early June of 2023 to identify the mosquito species utilizing those basins for larval habitat. Out of 50 mosquitoes identified, 36 were *Culex restuans* and 14 were *Culex pipiens.* In the future, the commission would like to use this data to compare larval activity in catch basins with adjacent adult trap activity and also to compare larval collection abundance in relation to the timing of catch basin treatments.

3. Aerial Larviciding

Large tracts of larval habitat that cannot practically be treated by ground applications are indicated for treatment with fixed wing aircraft. Aerial larviciding is contracted annually. Bid specifications are revised and undergo attorney review during the off-season each year. In 2023, the bid packet was approved by the Commission at their December 2022 meeting and bid advertising occurred January 4, 2023. Bid opening occurred on February 2, 2024; Wings Aerial was awarded the Aerial Larviciding Contract by the Commission at their regular meeting on February 16, 2023.

All our aerial larviciding sites are digitally mapped and uploaded to an onboard navigation program, AgNav, which the pilot uses to accurately record his applications. The pilot uses these digital maps to pinpoint individual sites. In 2023, aerial larviciding sites were primarily inspected by the Senior Wetlands Specialist with help from other staff as needed. Following significant rainfall events, sites were inspected and when sites met the criteria, they were added to the list for the pilot to perform aerial treatment. A granular formulation of *B.t.i.* was used in all aerial applications during the year.

There was a total of five airsprays between May and August in 2023. Late April into early May brought two to three inches of rain throughout the county which triggered a small airspray of 658 acres on May 4th. An unusually heavy rain event in late June dumped three to five inches of rain throughout the county; this triggered a large hatch and an airspray took place on June 30th covering 1,920 acres.

More unusually heavy rain events in mid-July triggered two more airsprays: on July 12th,770 acres were treated, and then 420 acres were treated on the 19th. The last airspray of 2023 took place on August 18th after more than two inches of rain fell between the 15th and 16th of the month; this resulted in the largest aerial larviciding treatment of the year at 1,965 acres.

In 2023, aerial larviciding took place in Allamuchy, Frelinghuysen, Independence, Liberty, Oxford, and White Townships. Figure 15 maps the locations of the aerial sites and shows the number of times each airspray site was treated in 2023. It should be noted that in 2023, a new airspray site on Youngs Island Road in Independence was added and the Kasper Road airspray site in Allamuchy was reshaped to include wet areas more accurately. Figure 15a contains a summary of the aerial larviciding applications that took place throughout the year as well as the acres aerially larvicided each year since the beginning of the Commission's aerial larviciding program in 1987. The graph shows the trend line of increasing aerial acreage over time.

B. Adult Mosquito Control

Our adult mosquito control program continues to be based on our surveillance program. Ideally, large hatches of emerging adult mosquitoes are detected by staff and treated quickly to keep the adult mosquitoes from entering the populated areas and generating complaints. However, this does not always occur and does not account for species utilizing container source habitat. Service requests from the public are responded to and investigated as soon as possible. Prior to any adult mosquito control applications taking place, adult mosquito surveillance is conducted to justify the applications. Surveillance includes the setting of CO_2-baited portable light traps, landing rate collections, or disease monitoring. Spraying for adult mosquitoes is dependent upon the number and species of mosquitoes collected and/or if any mosquito-borne virus is present in the area.

1. Notification

The legal notice for area wide adult mosquito control was reviewed and updated for 2023. The schedule was developed for publication of this advertisement throughout the season in two newspapers (a legal ad in one paper, a display ad in the other) to best cover the entire county in accordance with pesticide regulations. Our advertising in 2023 continued to utilize two daily papers for better exposure.

Due to increased notification requirements as of November 2001, a Question-and-Answer Sheet on our Commission's program was developed and approved by NJDEP- Pesticide Control Program (PCP) in April 2002. This fact sheet was updated in 2015 and reapproved by the PCP. It is assembled with other required packet components (information on any product we may use in a given year for adult mosquito control, a copy of our legal advertisement, etc.) and sent to each municipality in the county prior to March 31st each year. In 2023, a copy of the entire municipality packet was posted to the Commission website, mailed to each municipality, and emailed to each municipal clerk to facilitate easy access by the residents. At the request of the Hunterdon County Mosquito Control, notification of Hunterdon County's Black Fly Treatment Program on the Musconetcong River was included with the Pohatcong Township municipal packet in 2023.

Since 2006, our website has been utilized to supply countywide adult mosquito control treatment information. Adult mosquito treatments are posted (by township) at least 12 hours prior to the scheduled treatment. All beekeepers within the county and three miles of the county border were notified by email 24 hours prior to any ground adult mosquito control treatments. Pesticide regulations require beekeeper notification of applications of products that are toxic to bees and occurring within a three-mile range of the hives; however, Commission staff sends a blast email to all registered beekeepers for every adult mosquito control application. The blast email is much more efficient than identifying which hives are within three miles of each treatment for every application and is more useful to beekeepers that transport their hives around the County. Twelve-hour notification calls were made to those residents who requested pre-notification. In highly urbanized areas, the county's alert

(RAVE) system was used to alert residents of the upcoming adult mosquito control treatments. In compliance with the School IPM Act, schools are notified of planned adult mosquito control applications on their property in advance to allow them to conduct the required 72-hour notification to parents.

Aerial approval forms were sent to municipalities where aerial larviciding takes place. This was done in preparation for the possible need to aerially treat for adult mosquitoes in case of mosquito-borne disease control in 2023 with the expectation that aerial applications would only be required in the municipalities with huge mosquito production areas. This approval is necessary to comply with FAA regulations if the area could be determined to be congested. Copies of the signed approvals that were obtained were forwarded to the contracted pilot prior to any aerial taking place in the respective municipalities.

2. Ground Treatments for Adult Mosquito Control

Our ground treatments for adult mosquito control operations ran from June 29, 2023, through October 3, 2023. A summary of our adult mosquito control applications by township can be found within the Activity Summary on Figure 12. Typically, adult mosquito control efforts begin in May in response to flood water species; however, in 2023 a dry spring led to the first application not occurring until June 29th. From the initial applications through mid-July control efforts were in response to summer flood water species as well as some permanent water species. Heavy rain events starting in mid-July followed by substantial rains in August led to large population increases in flood water species, followed by permanent water and container breeding species. Throughout the season, all WNV positive samples were responded to with targeted adult mosquito control applications to break the disease cycle and prevent human transmission.

After the two primary ULV sprayers were mounted on the trucks (but before they were used) flow rate and droplet size were calibrated to ensure that each sprayer was performing according to label specifications. Flow rates on the Cougar and Promist ULV sprayers were calibrated on April 20, 2023. Droplets were calibrated using the DCIII AIMS machine on April 24, 2023. As the season progressed, it became evident that it would be necessary to add the third ULV sprayer into rotation. The flow rate and droplet size on the London Fogger was calibrated on August 14, 2024, prior to its use.

3. Aerial Adult Mosquito Control

Aerial adult mosquito control applications were not necessary again in 2023.

VII. BIOLOGICAL CONTROL

A. Predatory Fish

The NJ State Mosquito Control Commission bio-control program was utilized again in 2023. Stocking fish in permanent/semi-permanent wet areas to control larval mosquito populations remains a vital part of our integrated pest management approach. Larvivorous fish are an excellent alternative to pesticide applications in certain situations. A total of 64,682 fish were stocked throughout Warren County in 2023 to control mosquito larvae. Stocking primarily occurred on the following dates: April 5, May 12, June 18, June 21, June 28, and August 16, 2023 (see Figure 12).

There were 40,300 *Pimephales promelas* (fathead minnows) stocked in Warren County in 2023. Fathead minnows have been utilized in our biological control efforts at sites that connect to streams and other bodies of water where native fish populations exist as per DEP regulations. Of the 40,300 fathead minnows, 30,300 were supplied by the state fish hatchery in Hackettstown. Due to sourcing issues encountered by the state hatchery, an additional 10,000 fathead minnows were purchased from the Musky Trout Hatchery to fulfill the commission's need.

Gambusia affinis (mosquito fish) continue to work well in habitat types that retain water long enough to support the fish population, but stocking is limited to sites that are not connected to streams and don't have potential for overflow since this species is not native. Under correct conditions mosquito fish reproduce rapidly to establish a substantial population. A total of 24,382 *Gambusia affinis* were stocked at 16 sites April 5th and at an additional 10 sites on June 28th.

The Commission utilizes two 300-gallon livestock water tanks as temporary holding ponds for *Gambusia affinis* and fathead minnows after initial stocking is complete. The fish are held in these tanks until they are needed to stock areas as needed during the breeding season. This is extremely useful when stocking small amounts of fish in abandoned swimming pools. Rescue operations are performed when we know of an area that is in danger of drying down and those fish are relocated temporarily into our holding tanks. We use one purchased 30-gallon transportation tank, along with two fabricated 100-gallon transportation tanks, for our in-house stocking and fish rescue.

VIII. RESEARCH & FIELD STUDIES/COLLECTIONS

A. Insecticide Resistance Studies

Insecticide resistance is a heritable decrease in the sensitivity of an insect population to a particular insecticide or class of insecticides. It is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label directions for that species. Resistance usually occurs when the insect population is repeatedly exposed to the same or very similar insecticides over many years. With a limited number of insecticide choices available to mosquito control professionals, great care must be taken to manage insecticide resistance and monitor local mosquito populations for any sign of resistance. Building an effective monitoring program takes an investment of time, staff, and funding. It should be noted that insecticide resistance in mosquitoes is species specific and can be very localized. Additionally, baseline data for most species is not available.

Resistance to adult mosquito control products is the primary concern at this time since adulticide products in the United States has been limited to two modes of action for an extended period of time (organophosphates and pyrethroids). Resistance to both groups has been detected in mosquito populations in the United States. It has been hypothesized that at least some of this resistance stems from exposure due to non-public health uses, which are heavily biased towards pyrethroids.

There are several different ways to test for insecticide resistance in populations of adult mosquitoes. One of the most common ways currently in the United States is the CDC Bottle Bioassay. In this laboratory experiment, bottles are coated with a pre-determined dose of an active ingredient and mosquitoes are introduced to the bottle for 2 hours while the number of dead and alive mosquitoes is recorded at regular time intervals. Resistance is determined by the percentage of mosquitoes that die (mortality rate) at the pre-determined threshold time (diagnostic time). The test is run for the entire 2 hours unless all mosquitoes have died earlier than the 2 hours.

The SMCC funded workshops for counties to learn and practice the CDC Bottle Bioassay technique and establish baselines for their local populations in 2017, 2018, and 2019. Commission staff participated in those workshops and results indicated that local populations of Culex mosquitoes in Warren County showed varying degrees of susceptibility to the products being used. Those initial workshops showed Commission staff the importance and the possibility of performing their own in-house bottle bioassay testing.

Additionally, the Northeast Regional Center for Excellence in Vector-borne Diseases (NEVBD) at Cornell University has offered insecticide resistance testing on adult *Culex pipiens* and/or *Aedes albopictus* samples collected by public health agencies for several years. The samples are collected as eggs and/or larvae, shipped to the NEVBD, and raised there to the adult stage. The adult mosquitoes are tested using the CDC Bottle Bioassay technique. The commission first participated in NEVBD's program in 2019 with *Aedes albopictus*; the results showed moderate resistance of *Aedes albopictus* to etofenprox, an active ingredient in one of the adulticide products (Zenivex E4). Collection and submission attempts for this species have been made each year since; however, due to the huge time investment it requires and the competing demands of daily operations in mosquito control, not enough *Aedes albopictus* eggs have been successfully submitted to repeat the testing.

The Commission has also made attempts to collect *Culex pipiens* eggs and submit the larvae to NEVBD to raise and test for resistance. Results from participation in this program in 2021 indicated populations of *Culex pipiens* collected from Washington Township, Belvidere, and Hackettstown were exhibiting resistance to etofenprox. Fortunately, *Culex pipiens* populations from Washington Township submitted in 2022 showed no resistance to malathion (the alternative active ingredient used in Fyfanon ULV) indicating that product would remain effective.

In 2023, a continued effort was made to collect *Culex pipiens* for submission to NEVBD; this time, the commission wanted to determine the mechanism for resistance to etofenprox, which would include exposing the mosquitoes to a synergist. However, this testing procedure requires a significantly higher number of mosquitoes. There were eight egg collection attempts from June 1 through August 25, on a nearly weekly basis. Meadow Breeze Park in Washington Township was the primary focal site because of its proximity to the office (reduced time investment), but mostly because of its history of West Nile virus and previous detection of insecticide resistance to etophenprox. It is also the location of the only eastern equine encephalitis positive mosquito pool ever collected in Warren County and is a popular recreation destination. A combination of either hay and grass infusion water or oak leaf infusion water was placed in gravid trap pans (without the collection attachment) and set at Meadow Breeze Park in proximity to the Morris Canal, a productive larval site. Egg rafts were collected in individual containers and brought back to the lab to be reared to larvae. Once the eggs hatched, larvae were identified to genus and species, the goal being to have collected *Culex pipiens* that could be submitted to Cornell's program.

The collection events at Meadow Breeze Park occurred on June 2, 9, 23, and 30, July 7 and 14, and August 11 and 25. There were 345 egg rafts collected in total; there were 340 egg rafts identified as *Culex restuans*, 2 egg rafts identified as *Culex pipiens*, and 3 egg rafts that were damaged beyond identification. The same collection strategy was used in the vicinity of East Baldwin Street in Hackettstown on June 8; although copious numbers of egg rafts were collected, most were damaged in transport. Fifteen egg rafts were salvaged and hatched, and all were positively identified as *Culex restuans*. There was also an attempt to collect egg rafts from within Worthington State Forest in Hardwick on June 23. The ideology was that mosquitoes from within the park would be less likely to be exposed to pesticides from both mosquito control and agricultural use, especially since the commission's adulticide applications are typically far removed from that area. There was one *Culex restuans* egg raft collected. The commission would like to make future attempts to collect eggs from this area to use as a basis of comparison when conducting in-house pesticide testing.

Although the commission had collected *Culex* egg rafts in high abundance, we were not able to submit those larvae to Cornell to raise and test. The only *Culex* species NEVBD was accepting was *Culex*

pipiens. Once the eggs were hatched and identified it turned out only a few were *Culex pipiens* and this likely would not have provided enough mosquitoes for a proper test. Since the season was off to a slow start, it was decided to perform in-house insecticide testing using the CDC Bottle Bioassay. When conducting CDC Bottle Bioassay testing, the percent mortality in each bottle is calculated at the published diagnostic time for that species and active ingredient. However, there is not a published diagnostic time for *Cx. restuans*, so the goal of conducting the bottle bioassay was to note when 100 % mortality occurred and compare that time among the tested locations. Additionally, the mortality rate could also be calculated at a diagnostic time of a similar species (for example, the diagnostic time for *Culex pipiens*). Without a published diagnostic time for *Cx. restuans*, the commission saw value in comparing the results between different site selections.

The *Culex restuans* egg rafts collected on June 9 at East Baldwin Street area in Hackettstown were hatched and raised to adults and then used in three in-house bottle bioassays: one against malathion and two against etofenprox. Since resistance was detected to etofenprox in the past, we wanted to confirm that our alternative active ingredient, malathion, an organophosphate, was an effective means of control. There was 100% mortality in 45 minutes, which is the diagnostic time for malathion against *Cx. pipiens*. There were two bottle bioassays from the same egg collection performed against etofenprox, a synthetic pyrethroid. One stock solution was *prepared* with ethanol while the other was prepared with acetone. There was no documentation that indicated results would vary with one stock solution versus the other, but the commission was curious if there were any major differences in mortality based on how the stock solution was prepared. In both instances (6 replicates total), the *Cx. restuans* mosquitoes from East Baldwin exhibited 100% mortality in 30 minutes. However, there was a marked difference in mortality between the two experiments when compared at the diagnostic time for *Culex pipiens*. These results indicate that the solvent used to dilute the etofenprox may affect the results, but it should be noted the acetone-based solution was stock solution mixed in 2022. Experiments with the ethanol stock solution indicated no resistance, whereas, the acetone stock solution indicated a low level of resistance in the East Baldwin *Cx. restuans* population. The comparisons between solvents will be repeated in the future.

The *Culex restuans* egg raft collected from Worthington State Forest in Hardwick Township on June 23 was hatched and the larvae were raised to adults. Those adults were tested against etofenprox (using the ethanol-based stock solution). There were two replicates performed but the number of mosquitoes in each bottle was limited to less than 14 mosquitoes (ideally, we would want 20-25) due to a limited number of available adults). Results indicated this population is showing high-level resistance to etofenprox; however, conditions in one of the replicates may have affected the results. Although these results are interesting, more data is needed to confirm these results.

The *Culex restuans* egg rafts collected from Meadow Breeze Park in Washington Township on June 2 and June 23 were hatched and reared to adults for bottle bioassay testing; any other collected eggs were discarded. In the bottle bioassay against malathion, there was 100% mortality in 30 minutes, showing them to be susceptible to this active ingredient. There were five replicates conducted against etofenprox (using mosquitoes collected at two different collection periods). The results from this experiment varied but all samples showed a high level of resistance. These results are consistent with the *Culex pipiens* tested by the NEVBD previously. The commission would like to continue testing these populations now that selection pressure from mosquito control adulticides favoring resistance to etofenprox has been removed in that area to determine if the degree of resistance is maintained or diminished.

There was an additional attempt to test the mosquitoes collected from Meadow Breeze Park after exposure to a synergist to help determine the mechanism of resistance. In this procedure, mosquitoes are exposed to a synergist (in this case it was piperonyl butoxide, also called PBO) before being exposed to the pesticide. PBO inhibits oxidase activity. Essentially, this product inhibits the enzymes the mosquito might be using to detoxify the pesticide through metabolic processes. If that is the mechanism that is causing the resistance, then mosquitoes exposed to this synergist prior to pesticide exposure will likely experience mortality earlier because their metabolic system is not working the same way.

This testing procedure was conducted against the *Culex restuans* collected on June 2. The mosquitoes exposed to PBO did exhibit higher mortality rates, indicating that enzymatic action may be involved in this population's resistance to etofenprox; however, even the PBO exposed mosquitoes exhibited a moderate level of resistance. There was a learning curve involved in this process because the mosquitoes are transferred multiple times, resulting in loss not attributed to pesticide exposure. Ideally, this testing would be conducted again in future years to give better cause and reason to these conclusions.

In summary, the in-house bottle bioassay testing indicated that *Culex restuans* populations collected from various locations around the County are showing varying degrees of resistance to etofenprox but remain susceptible to malathion. If the diagnostic time for *Culex pipiens* against etofenprox is used (15 minutes), then the results would indicate that all the *Culex restuans* populations tested showed at least some level of resistance to etofenprox; however, it is not known if this is an accurate assumption. Additionally, it is unknown how well bottle bioassay testing with active ingredients relates to actual field applications of formulated products.

Another accepted way to test for insecticide resistance in mosquito populations is with caged field trials. Experimental caged field trials were performed for the first time in 2022 but were not possible in 2023. The goal of a field trial is to place susceptible verses wild caught mosquitoes in disposable cages in a symmetrical arrangement at a designated field site, perform a truck-mounted adulticide with a particular formulation, collect the cages, and evaluate the average mortality differences of the mosquitoes based on distance from the spray vehicle and time elapsed since exposure to the pesticide. The information gathered from this experiment would supplement the information gathered from the bottle bioassays and may also highlight differences in mortality due to product formulation, application techniques, and field conditions. Although the field trials are not conceptually difficult, they require appropriate staffing, adequate preparation, an appropriate location, and specific weather conditions in order to draw any conclusions from the data collected. Planning a field trial is highly dependent on collecting and raising field-collected mosquitoes, which can be a labor-intensive process. Ultimately, it was the heavy mid-July rain that dampened the commission's ability to allocate the appropriate staff hours to this project.

B. <u>Mosquito Rearing Colony</u>

There are often occasions when live mosquito larvae and/or adults are needed for insecticide studies and public outreach events. Since most events often occur during the off season, it is sometimes difficult to find live samples that are uniform in age. In the past, live larvae and/or aged adults were obtained from Rutgers University; however, they no longer maintain mosquito colonies for outreach purposes. In 2015, a colony cabinet was built and assembled in the laboratory for rearing mosquitoes in house. Initially, *Aedes atropalpus* eggs were taken from Rutgers stock and raised. This species is ideal for colonization since females can lay their first batch of eggs without a blood meal and those eggs are resistant to drying out. However, the *Ae.atropalpus* colony was finicky and required daily maintenance

(including weekends), so in 2016, a colony of *Culex pipiens molestus* was started as a replacement. This species is also able to lay its first batch of eggs without a blood meal; however, the eggs must stay wet in order to remain viable. This colony has been very successful and is much easier to maintain. The colony continued to be maintained in 2023 with the goal to continue maintenance throughout 2024.

In 2023, adults raised in colony were used in the bottle bioassays conducted in house as a point of comparison and evaluation. It had come to the commission's attention that the colony had originally been collected from a population that was already showing resistance. To confirm this hearsay, they were tested against both malathion and etofenprox. Each iteration or replicate included both males and females from the colony, and both sexes were used when calculating percent mortality. In 2023, the first bottle bioassays took place on June 9 to etofenprox and malathion. In the assay against malathion, there was 100% mortality observed at 45 minutes, which is the recognized diagnostic time and indicates that there is no resistance to this organophosphate. In the bioassay against etofenprox, there was no mortality at 15 minutes, which is the accepted diagnostic time for *Culex pipiens*. At the end of the 2-hour experiment there was an average of 51.49% mortality across three replicates. These results indicate that the colony has high level resistance to this pyrethroid and will likely exhibit resistance to other related pyrethroids.

On June 15, etofenprox was tested again in part with PBO synergist. No difference was seen at the 15 minutes diagnostic time; however, there was a difference in mortality at the end of the 2-hour experiment. Again, indicating possible involvement of enzymatic activity in the resistance mechanism this time with the colony mosquitoes. The last bottle bioassay with the colony mosquitoes against etofenprox occurred on June 20. These results confirm that the Commission's colony of *Culex pipiens molestus* are indeed highly resistant to etofenprox. A colony with known resistance may have limited use but is still valuable.

Colony mosquitoes were reared and donated to Valent BioSciences for a field trial of ReMOA, a novel adult mosquito control product with a new active ingredient for mosquito control, which is supposed to be effective against pyrethroid resistant mosquitoes. Since the Commission colony of *Cx. pipiens molestus* is known to be resistant to pyrethroids, Valent was particularly interested in using our mosquitoes. Several hundred colony mosquitoes were reared and donated to the field trial and one staff member participated in the field trials, which took place at Mercer County Airport. Several counties as well as staff from the Office of Mosquito Control assisted with the trial. The results look promising.

The colony mosquitoes were also used in a preliminary experiment with chlorine bleach in 2023. In 2022, the Inspector and Biologist began designing an experiment to determine the lethal dose of bleach to mosquito larvae. The original concept was developed by the Inspector following inspections and treatments of unmaintained swimming pools. Many homeowners claim that their unmaintained pools are treated with bleach, but larvae are often still found in those pools. As a result, the experiment was designed to determine the concentration of bleach in water that will kill larvae and then apply that ratio to the average size of a swimming pool to determine if and how effective a homeowner using bleach as a control method might be. Materials were acquired in the fall of 2022 and the initial stages of the project were implemented in the winter of 2023. Larval observations occurred over a 24-hour period to different bleach concentrations. The results show promise but a different experimental design is needed to determine the threshold for control and how long that control remains effective.

C. Unmanned Aircraft Systems (UAS)/Unmanned Aerial Vehicles (UAV) – Drones

In 2023, Warren County Mosquito Control Commission initiated a transformative step by trialing unmanned aerial systems (UAS), or drones, into our operations. This marked a significant potential enhancement in our capabilities for mosquito control and environmental mapping to improve our inspection, treatment, and data management processes. An integral piece of this program was the acquisition of the FAA Part 107 certification by our Wetland Specialist in December 2022 and the Inspector in early 2023, enabling legal and safe commercial drone operations.

Discussions for purchasing a DJI Mavic 3E drone began in June 2023. After considering several vendors, the lowest responsible quote was received from Frontier Precision. The Mavic 3E, deemed both adequate and capable for our program's first foray into drone technology, was received in July 2023. The first operational flight took place on August 9th, 2023, following a deliberation over purchasing a 2-year protection plan, which had to be decided within 48 hours after the first flight.

Baseline work was done to determine the data storage and software needs. Preliminary UAS operations generated an average of 4.5Gb of high-resolution imagery per "operational flight". To manage this influx of data, we explored data storage options and decided that a 16Terabyte Network Attached Storage (NAS) configured in RAID 5 (Functionally 12Tb), would allow for the storage of approximately 888 flights per year over a three-year span. We also explored options for storing processed data, either locally on one of the desktop computers, the previously discussed 16 Tb NAS, or on the FieldSeeker server.

For 2023, there was a total flight time of 9 hours and 31 minutes, a total travel distance of approximately 119.2 miles (628,782 feet), 76 flights, 9,351 total pictures taken, and 16 maps produced. All operations were conducted incident-free, reflecting our commitment to safety and precision.

For mapping software, Drone Deploy and PIX4D were evaluated. Drone Deploy requires an internet connection for cloud processing and is more user-friendly. PIX4D offers more power, and because it processes data locally, allows for the possibility of processing data in real time data in the field. This could be advantageous for future drone treatments and/or provide additional last-minute data to make informed operational decisions. However, the choice between these software options is still under consideration.

To maintain visual line of sight with our DJI Mavic 3E drone, and to expand the area covered per mapping mission, acquiring an aerial lift or bucket truck was researched. This would also be relevant for future treatment UAS operations. It was decided that this purchase would be best suited for the State Mosquito Control Commission equipment use program, since there may be need for this equipment to be shared by other county programs as well. A future request to the SMCC is planned.

The integration of UAS technology into our operations is a significant step forward. We are optimistic about the potential expansion of this program, including the addition of a treatment drone. This technological advancement aligns with our goals of improved operational efficiency and accuracy in our mosquito control program.

D. Grant Funded Tick Surveillance Project

In 2021, the New Jersey Department of Health announced that a small amount of grant funding would be available to five counties for a tick surveillance project. The Commission submitted a Letter of Interest and an application and was awarded $12,000.00 in grant funding along with four other counties. Grant funding runs on an off-center fiscal cycle from August - July and can possibly be renewed for a 5-year cycle. The first grant cycle was August 1, 2021 – July 30, 2022, grant funding

was renewed for a second cycle from August 1, 2022 – July 30, 2023, and now for a third cycle from August 1, 2023 – July 30, 2024.

The NJDOH Grant Funded Tick Surveillance Project started in Warren County in the fall of 2021. The primary focus at that point in time was to select long-term surveillance sites with suitable habitat for *Ixodes scapularis* ticks, the perpetrator of the majority of tickborne disease in Warren County and the focal species for the surveillance project. By the end of 2021, four sites meeting site criteria and preferences were chosen as regular and routine surveillance sites, based on accessibility, habitat suitability, Lyme disease incidence in the municipality, and land ownership. During the winter of 2022, a fifth site was established in Blairstown. These five permanent sites include: Frelinghuysen Township Forest Preserve, Hardwick Township-White Lake Orange Trail, Harmony Township - Merrill Creek Reservoir off of Fox Farm Road, Knowlton Township -Paulinskill Valley Trail at Station Rd, and Blairstown Township- Paulinskill Valley Trail at Footbridge Park. The same sampling protocol remained in place for the spring 2023 collection season. All sampled sites had a predetermined 750-square meter area (set up as either a linear transect or a grid) that was sampled using a 1-meter square drag. The target species for the spring collection season was *Ixodes scapularis* nymphs. According to publications, the nymphal peak is anticipated between May and July, but since our program is still in its infancy, there was an effort made to sample sites in a manner similar to last year to confirm that these trends hold true for our region. The grant required that each site be visited a minimum of two times for each collection season (spring and fall), but Warren County's sites were visited more often. The aforementioned five permanent sites were visited between four and seven times during the spring collection season between April 3 and June 21, although collection of *Ixodes scapularis* nymphs (the primary target during this timeframe) did not occur until May 9. There were two additional exploratory sites within the Delaware Water Gap National Recreation Area (Hardwick), the Coventry Pond Trail and the Hamilton/Pioneer Trail, that were visited once on June 1, 2023. There was a total of 29 site visits completed which resulted in 1141 ticks collected across all species and life stages. Eighty-two percent of that total (928 specimens) were *Ixodes scapularis* nymphs. The single greatest collection of *Ixodes scapularis* nymphs (140) in 2023 occurred on May 24 at White Lake (HDW), followed closely by 126 nymphs collected on May 22 at Merrill Creek Reservoir (HRM). The single greatest collection in 2022 occurred on June 6 at Merrill Creek Reservoir (HRM), but there were merely 49 *Ixodes scapularis* nymphs collected. All sites saw an increase in the abundance of nymphs in 2023. There were 35 *Ixodes scapularis* adult females, 25 *Ixodes scapularis* adult males, and 72 *Ixodes* larvae collected as well. Although *Ixodes* larvae were collected, they were significantly less abundant than they had been during the 2022 spring collection season (352 specimens). A total of 44 *Dermacentor variabilis* adult females and 36 *Dermacentor variabilis* adult males were collected. Lastly, there was one notable collection from the Paulinskill Valley Trail at Station Road in Knowlton Township that occurred on May 9; a singular adult male *Amblyomma americanum*, a lone star tick. This is the second time this species has been documented in Warren County. The first collection of a singular adult female occurred on June 7, 2012, at a site in Independence Township during a larval mosquito inspection. Because of the rarity of finding this specimen in Warren County, it was saved for preservation and future identification references as opposed to being submitted for disease testing.

Overall, there were 859 pools (908 ticks total) from the spring collection period submitted to the Public Health and Environmental Lab (PHEL) for disease testing. Typically, *Ixodes scapularis* nymphs and adults are tested individually because of their generally high infection rates, but samples from sites with high productivity that meet predetermined criteria can be sent to the Center for Disease Control for testing. Six pools (150 ticks total) from three sites were sent to CDC for testing. Larval samples were not submitted to PHEL because larvae have not blood fed yet and are less likely to be carrying disease. Overall, thirty-four pools were positive for *A. phagocytophilum*, 108 pools positive for *B. burgdorferi*, 24 pools positive for *B. miyamotoi*, and 48 pools positive for *B. microti*. There were no

positive pools for *R. rickettsii* or Powassan virus. Thirty-four of these pools were positive for two or more pathogens.

Collection efforts for the fall season, where the primary species of interest is *Ixodes scapularis* adults, began on October 4 and concluded on November 1. In addition to the five permanent sites, there were 8 exploratory sites visited because the grant requirements had changed for the fall collection season. The new requirements identified a minimum of two standard surveillance sites (tick density sampling required) in addition to a minimum of 10 exploratory sites (flexibility in the degree of sampling deployed). There were 24 complete site visits during this time. There were 750 square meters sampled at all sites during all collections to make comparisons between sites more feasible. Most sites were visited twice. A total of 287 specimens were collected during the fall season, which were exclusive to *Ixodes scapularis* adults and nymphs (141 adult females, 143 adult males, and 3 nymphs). This was a significant increase from the 60 *Ixodes* ticks collected in the fall of 2022 during 20 site visits from five sites. A total of 282 tick pools from the fall collection period were submitted to PHEL. There were 171 positive samples, which included 24 co-infections and one tick that had a triple infection! The most prevalent pathogen was *B. burgdorferi* (128 samples positive), followed by 21 samples positive for *A. phagocytophilum*, 18 samples positive for *B. microti*, 3 samples positive for *B. miyamotoi*, and 1 sample positive for Powassan virus. The positive Powassan sample was an adult *Ixodes scapularis* female collected on October 23 from the Port Murray Preserve on Hoffman Road in Mansfield Township. Sites visited during the spring and fall collection seasons can be found in Figure 16 mapped alongside Lyme Disease incidence data from 2017-2021 from the Warren County Health Department. A summary of the tick species and life stages collected at all sites during both the spring and fall collection periods can be found in Figure 16a. A summary of the number of positive pools for each site during each collection season can be found in Figure 16b.

In the year 2023, a total of $12,118.14 was expended on the tick surveillance project. Payroll accounted for $6,692.02, training and supplies totaled $4,482.33, and mileage reimbursements totaled $943.79. For the spring surveillance season there were 194.75 staff hours at a cost of $4765.03 compared to the fall surveillance season when there was 80.5 staff hours spent, which totaled $1,926.99. As in the past, spring tick surveillance proved more laborious than fall tick surveillance due to the higher numbers and smaller size of the nymphal and larval ticks encountered.

As mentioned, the tick surveillance project was funded by a grant from the NJ DOH that was first awarded for the 2021/2022 grant year and was renewed for the 2022/2023 and 2023/2024 grant years. This grant is provided through the Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases (ELC) Cooperative Agreement between the NJDOH and the Centers for Disease Control (CDC). The current ELC Cooperative Agreement between the NJDOH and the CDC is from 2019 – 2023 with a possibility of renewal for another 5-year cycle.

E. Lethal Ovitraps

In 2023, a type of lethal ovitrap, the gravid Aedes traps (GAT), was used at Kucharski's junkyard in Independence Township to determine their effectiveness in reducing *Aedes albopictus* populations. Ten traps were placed at equidistant locations in an approximately 8000 square feet area. An oak water infusion was brewed with 160 grams of oak leaves per five gallons of water. Each trap held about 0.75 gallons of the oak water infusion to lure in the gravid mosquitoes. The clear dome of the trap was coated with vegetable oil on the inside to ensnare the flying mosquitoes. A net was in place between the water and the oil-coated dome to prevent mosquitoes from laying eggs and to prevent trapped mosquitoes from falling into the liquid. The traps were maintained once a week to collect the adult mosquitoes, sample the water for larvae, change the water, place a new net, and recoat the dome with oil.

The GATs caught 200 total female adult mosquitoes between June 2nd and August 10th. The species break down was as follows: 151 *Aedes japonicus* (75.5%), 37 damaged, unidentified mosquitoes (18.5%), 9 *Culex* species (4.5%), 1 *Anopheles punctipennis* (0.5%), 1 unidentified *Aedes* species (0.5%), and 1 *Aedes albopictus* (0.5%). The gravid status of each mosquito was not noted. Larvae were found on one occasion in one of the traps, but this was because the clear dome and net had been somehow removed from the trap.

A BG trap has been historically set in the same area and was in place during this experiment. The data from these two different types of traps isn't directly comparable because GATs attract mosquitoes looking to lay eggs and BGs attract mosquitoes looking for a blood meal. Also, ten GATs were used while only one BG was used. However, comparing the numbers could, perhaps, provide a little information about the performance of the GATs. While keeping that in mind, the single BG trap set in the same area during the same time caught 138 total female adult mosquitoes. Of those trapped, 10 were *Aedes japonicus* (7.2%), 10 were *Culex* species (7.2%), 26 were *Anopheles punctipennis* (18.8%), 7 were Aedes albopictus (5%), and 85 were other species.

IX. WATER MANAGEMENT

Water Management allows for the elimination or reduction of mosquito breeding habitat and is an integral part of an integrated mosquito management approach. Water management includes habitat modification and/or source reduction and can be an effective long-term means of mosquito control. Major water management projects must gain prior approval from various state and federal agencies. Guidelines are detailed in the Commission's blanket permit issued by the NJ Division of Environmental Protection -Division of Land Resource Protection. Each blanket permit is valid for five years. The Commission's previous permit expired on May 10, 2023. A new blanket permit was applied for and received in the spring of 2023. Just like the old permit, it includes a Flood Hazard Area General Permit 2 (Mosquito Control Water Management Activities), Freshwater Wetland General Permits 1 (Maintenance and Repair of Existing Features) and 15 (Mosquito Control Activities), and a Water Quality Certificate. The new permit is valid from May 15, 2023, until May 14, 2028.

Three water management complaints in two townships were responded to in 2023.

A Belvidere resident called to report a tree that had fallen into the Pequest River near S. Johnson & Sons factory. Upon inspection it was determined that the matter did not require immediate attention. The small tree did not span the width of the river and was not interfering with the flow of water yet. It was also determined that some sort of rubber-tired machine would need to be used because the access area was paved. However, the heavy summer rains swept the tree away and the project was crossed off the list.

At the end of August another resident from Belvidere at the end of Spring Street reported that a major rainstorm altered the channel of the Pophandusing Brook. Upon inspection, the brook appeared to have split from one channel to two in that area. There was a large deposit of rocks where the brook used to flow, and now two channels were flowing around both sides of the new rock island. One of the channels was flowing through an existing routine inspection site. There were a lot of mosquitoes biting at the time of the inspection, and various containers (holding water and producing larvae) were in the area. The containers had been deposited there after being swept away from their original location by the recent rainstorm. Containers that could be accessed were dumped. The brook's new channel eliminated the documented mosquito site in the immediate area so no further action was taken.

In early November, a resident from Ravine Road in Greenwich called to report a stream blockage. The area was inspected later that day, and two problem areas were identified in Pohatcong Creek. Tree

stumps were wedged under a vehicle bridge at #112 Ravine Road. A little further downstream in front of #114 a large tree was observed to have fallen across the creek. Neither blockage presented an immediate threat but could accumulate more debris in the future and cause flooding. NJDEP fishery restriction dates allow work to be performed in that section of Pohatcong Creek between March 15 and September 15, so the project is planned to take place during that time in 2024.

The statewide Water Management network established in 2001 met twice in 2023: the first meeting was held on January 27th and the second was on April 19th. The focus of both meetings was on revising the currently outdated Best Management Practices for Mosquito Control in Freshwater Wetlands manual, which is currently underway.

A. Activity Summary

1. Projects

a. FWW GP1&15/FHA GP2 Projects

This type of project was not performed in 2023.

b. Permit-By-Rule Ditch Clearing Projects

Regulated ditches, as well as waterways, can be cleared of blockages under a Permit-By-Rule 6 (removal of major obstructions from regulated waters with machinery). No ditch clearing projects were done in 2023; however, stream desnagging projects under this permit were completed (please refer to the Stream Desnagging section under 2. Maintenance).

2. Maintenance

a. Hand Cleaning

Hand cleaning for the maintenance of existing drainage structures was completed 29 times in 11 municipalities in 2023. Container dumps were completed 47 times in 8 municipalities. (Each recorded instance of a 'container dump' may, and often does, include the drainage of multiple sources of larval habitat in one area.)

b. Access Brushing

Hand clearing of brush for access to mosquito breeding sites was performed 63 times in 13 municipalities in 2023.

c. Trail Mowing

Trail mowing was completed at all six locations that are regularly maintained by the Commission for access. The locations mowed in June 2023 included the following: the Freeborn Lane ditch system in Allamuchy Township, Young's Island Road ditch system in Independence, Cat Swamp and Axford Avenue Wildlife Management Area in Oxford Township, the Bear Creek Road airspray access road in Allamuchy Township, and the Love Pallet Company in Pohatcong Township. In addition, a routine inspection site on Still Valley Road in Pohatcong Township was mowed in 2023 to allow easier access for seasonals to inspect and treat.

d. Stream Desnagging

This activity is regulated by Permit-By-Rule 6. All activities that meet the requirements of the Permits-By-Rule may be conducted without prior NJDEP approval. However, machinery must be situated outside the regulated water. They may be used to reach into the waterway to remove material but cannot be driven or otherwise placed in the regulated water.

Three stream desnagging projects were completed in 2023.

On June 5, 2023, a blockage was removed from Lopatcong Creek in Phillipsburg with the assistance of the Phillipsburg Department Public Works. A blockage consisting of a large fallen tree and debris was located in a portion of the creek immediately adjacent to Lock Street. The Kobelco was offloaded on Lock Street directly into the work area. The large tree was cut into sections and hauled away by a Phillipsburg DPW employee. The disturbed soil on the bank of the creek was seeded with a wetland mix and stabilized with straw.

A large blockage was removed from the Paulinskill River in Frelinghuysen Township on June 21, 2023. The blockage was located just upstream of the Paulinskill Trail footbridge between E. Crisman Road and Spring Valley Road. A large Sycamore tree fell into the river from the bank right next to the footbridge and snagged more fallen trees and debris over time. Logs were methodically removed from the waterway and stacked in the woods in such a way that would prevent them from reentering the river in future flood conditions. The access area was seeded with a wetland mix and stabilized with straw.

A brook and road clearing project took place at Cat Swamp in Oxford in late October. Two blockages were removed from Furnace Brook. The first blockage appeared to be made up of a couple homemade footbridges that fell apart. There was a large amount of garbage in this blockage that appeared to have come from the inside of the footbridges to keep them afloat. The second blockage was a small mess of logs, branches, and organic debris.

Permit-By-Rule 5 (removal of accumulated sediment and debris from a regulated water by hand) was not utilized by the Commission in 2023. This rule authorizes the removal of accumulated sediment and debris by hand provided no machinery besides handheld equipment is used in the regulated water, the bed and natural banks are not altered, fishery resource timing restrictions are followed, and disturbance is minimized.

B. Stormwater Facilities

NJ stormwater rules were enacted in 2004. The collective stormwater regulations are comprised of two rules; one governs how municipalities will regulate new development with respect to stormwater and a second requires municipalities to comply with new permits that control how municipal storm systems are managed. The NJDEP has developed a guidance manual with input by various constituents including the Warren County Mosquito Control Commission and several other NJ Mosquito Control agencies. Of particular interest and concern to mosquito control agencies is the recommendation of Best Management Practices (BMP's) such as constructed wetlands and infiltration basins. These systems are known to breed mosquitoes without proper design, construction, and maintenance. Underground stormwater facilities are becoming more common in Warren County. These present nearly impossible conditions for inspecting and treating. Without surveillance capabilities, it is unknown whether these underground structures will produce mosquitoes, which is problematic.

Detention basins have one or more inlets and one outlet structure. If designed and constructed correctly, water should drain from these within 72 hours. Infiltration basins have one or more inlets and no outlet structure. Water should infiltrate these within 72 hours. Retention basins have one or more inlets and no outlet structure. These should hold water year-round and usually have aeration or fish to prevent them from becoming larval habitat.

All basins were inspected for standing water and larval mosquitoes. There are different ways that basins can provide larval mosquito habitat. Clogged drainage holes in outlet structures cause water to back up and stagnate in low flow channels. If a basin is mowed under saturated soil conditions, ruts are

created that collect water and serve as larval mosquito habitat. Lack of maintenance can cause basins to convert into mosquito-producing wetlands. Infiltration basins without the proper substrate will hold water longer than they should.

Many of the stormwater basins that the Commission is aware of are inspected and treated, if necessary, on a weekly basis. A sumped outfall structure is one in which the bottom of the structure is lower than the bottom of the pipe that is meant to convey the water out of the structure. This causes water to stagnate in the concrete structure. The length of time that the water remains depends on the depth of the water which can measure anywhere from 1" to 12" or sometimes more. Many species of mosquitoes will utilize this larval habitat. Outfall structures without sumped bottoms drain properly and quickly and do not hold water.

In 2016, the Commission was notified of a resource called the New Jersey Hydrologic Modeling Database. This electronic database is available online and is the culmination of several decades of data collection efforts by NJ Soil Conservation Districts and the NJ Department of Agriculture. It shows mapped locations of stormwater facilities throughout New Jersey. The list of stormwater facilities on this database is periodically checked against the Commission's own database.

In 2023, a letter was written to the owner of a stormwater facility in Hackettstown that was severely overgrown with *Phragmites australis*. The basin is known to produce large broods of nuisance mosquitoes and nearby residents call regularly to request truck mounted ULV spraying. The letter requested that the basin be mowed to allow access for inspection and treatment. The owner mowed the basin in early August which has made work in the basin much more convenient.

C. Tires

Since 2008, a cooperative agreement between the Warren County Planning Department and the WCMEC has allowed for a shared 45' trailer to be placed at the County Road Department facility in Belvidere. The trailer is filled, by both road department staff and mosquito commission staff, as abandoned tires are found throughout the year. At year end, the trailer is picked up by a recycling facility and replaced with an empty trailer for the next year. In the past, payment has alternated between the Commission and the Warren County Planning Department. However, since 2017 the Planning Department has been receiving a grant that covers the cost of the tire recycling. The number of tires picked up by Commission staff is listed by municipality in Figure 12 Activity Summary.
In cooperation with the Musconetcong Watershed Association (MWA), every year since 2011 we have picked up tires from their river clean-up sites and added them to the trailer we utilize for recycling. In 2023, the MWA notified the Commission of the locations of stockpiled tires from their cleanup.

The PCFA tire recycling program, launched in 2015, was continued in 2023. The program was brought about by the Warren County District Landfill, in conjunction with the Warren County Board of Commissioners, the Warren County Mosquito Control Commission, and the Warren County Health Department. One of the stated purposes in mind was to help control West Nile virus and other diseases spread by mosquitoes. The landfill located at 500 Mt. Pisgah Avenue in Oxford began accepting tires with or without rims from residents, small businesses, and farming communities in Warren County only. The fees were: $2.50 for tires up to 22", $5.00 each for tires 22.5" to 24", and $10.00 each for tires 24.5" to 50".

If tires are seen on private property, attempts are made to contact the property owners. This is an opportunity to educate them about tires and their ability to produce mosquitoes and the diseases those mosquitoes can transmit. Residents are advised to keep tires under cover and dry, or to recycle them through PCFA. If time and space allow, employees offer to take the tires to our trailer. If a resident isn't home at the time the tires are seen, any present mosquito breeding is abated, and a door knocker is

left for the resident. The visit is documented, and a return visit is made when time allows to follow up on the situation.

D. Catch Basins

No specific measures were taken in 2023 to encourage clean out of catch basins to keep water flowing but this is to be done routinely by departments of public works under existing stormwater legislation.

E. Swimming Pools

Abandoned swimming pools can be prolific mosquito producers. A spreadsheet of unmaintained swimming pools has been kept since 2012. The spreadsheet is divided by district and contains the addresses and inspection notes for each pool. Ms. Fisher reviews all the unmaintained pool complaints for each year and updates the spreadsheet accordingly. The list is updated as pools are taken down or restored to use. By the end of 2023, 57 unmaintained pools, with at least one pool located in all 22 townships, remained on the list. This number includes the addition of 3 new pools in 2023. The pools that are found producing mosquitoes are stocked with mosquito-eating fish or treated with a long-lasting control product and reported to the Warren County Health Department.

F. Beaver Management

A beaver dam located in Knowlton Township in 2022 was noted to still be active in 2023. Higher than normal flood conditions were noted at the Johnsonburg Camp air spray site throughout 2023. The area was inspected when time allowed later in the year and a beaver dam was located along Trout Brook in the same area one was built years ago. The dam was dismantled and revisited a couple days later. The dam was not rebuilt, and the beaver appears to have moved on.

G. Site Plan Review

Copies of Land Use Regulation Permit applications are periodically received by our Commission and are to be reviewed and comments/suggestions made when appropriate.

Warren County has been the target of a growing number of Wetland Mitigation sites in recent years. When the Commission is made aware of these sites, the plans are sought and reviewed. Comments on these plans are given to the respective Township Land Use Boards and other interested parties, when requested. Mitigation sites are often previously ditched farm fields that are being restored to natural wetlands. The Commission has been monitoring these sites by attending township meetings and conducting site inspections.

The Commission is currently aware of six wetland mitigation sites in Warren County. Roes Island mitigation site is located off Island Road in Independence and Liberty Townships. Kenco wetland restoration site is located off Alphano Road in Independence Township. The Trout Brook wetland preservation/mitigation bank is located at 203 Bear Creek Road. The Pequest River mitigation bank is located at 55 Gibbs Road in Allamuchy Township. The Oxford Western mitigation bank is located off Lower Denmark Road in Oxford. The Watergate Wetlands Restoration project is located off Old Mine Road in the Delaware Water Gap National Recreation Area. The Commission has been monitoring these sites when time allows by conducting site inspections. Growing numbers of larval and adult mosquitoes are being found at these completed mitigation sites. The burden of inspection and treatment of these sites is proving to be quite time consuming. Discussions seeking reimbursement from the state for partial or total costs for mosquito control on state owned and/or state created mitigation sites began with the State Mosquito Control Commission in 2018.

In 2023, inspections were performed at four wetland mitigations sites.

The Trout Brook preservation/mitigation bank is on the regular air spray inspection route. It is inspected and treated, if necessary, after rainfall events of 1" or greater.

The Roes Island mitigation site was inspected in April and found to be partially flooded. Larvae sampled and brought back to the lab were identified as *Aedes vexans*, *Aedes trivittatus*, and *Aedes canadensis*.

Kenco was inspected in April and early July. Larvae sampled from a puddle in April were identified as *Aedes vexans*. The site was found to be quite flooded in July. Larvae were sampled from five separate areas of the 90 acres site. Species identified included *Aedes vexans*, *Psorophora ciliata*, *Psorophora ferox*, *Psorophora howardii*, and *Aedes trivitattus*.

The Oxford Western mitigation site was partially flooded in mid-May. Larvae sampled were identified as *Aedes cinereus*, *Culex salinarius*, and *Aedes canadensis*.

X. PUBLIC EDUCATION

Most of the restrictions in place due to the COVID-19 pandemic, lifted allowing staff to once again communicate our public health message. Most outdoor festivals and educational opportunities resumed; however, school visits for presentations did not resume until later in the 2022-2023 school year.

A. Literature/Poster Distribution

Files with handouts on pesticides, general mosquito control, ticks, etc. that are commonly requested are kept on hand in the office and in each of the vehicles for easy access and distribution to concerned residents.

B. Community/School Presentations/Displays

The Commission offers *Mosquito & Ticks: An Interactive Approach* to all fourth-grade classes in Warren County. Fliers outlining the program are periodically emailed to all fourth-grade teachers in the County. The program includes PowerPoint presentations covering ticks, mosquito biology and control and hands-on learning stations. In 2023, the tick bite prevention presentation was updated. The learning stations include live mosquitoes and fish, preserved ticks and mosquitoes, a preserved dog heart with heartworm disease, activity sheets and games. A microscope, insect eye viewers and molded mosquito life cycle models were added to the program.

The Commission has a table-top tri-fold display that is used for inside venues and generally left on display for extended periods of time. The information on the display is developed and changed periodically by Ms. Fisher. Our staffed displays are generally for one-to-two-day events, with exception of the Warren County Farmers' Fair, which is an eight-day event. These displays familiarize the public with the Commission's activities and teach the public to recognize mosquito larvae in their own backyards.

Several posts were prepared for the Warren County Facebook and Twitter pages, which were shared with townships for their Facebook pages and websites to promote several community awareness days, promote community action *Dump & Drain* campaigns after high rainfalls, and also as a reminder during the fall to take precautions to prevent tick bites.

In 2023, the presentations that were made regarding mosquitoes and mosquito control are as follows:

Presentation/Display List:
Hope Green Fair
National Mosquito Control Awareness Week

Warren County Farmer's Fair
National Night Out

The Warren County Farmer's Fair display theme for 2023 was *Don't give Mosquitoes & Ticks a Biting Chance!* The display featured the magnified labeled mouth parts of mosquitoes and ticks and ways to protect yourself. Tick habitats were also featured and there was a photo lift game featuring positive and negative mosquito control actions. The mouth parts of the mosquito and tick were drawn and painted by seasonal employee, Adriana Kaplinski. Educational fliers, pens, repellent wipes and mosquito swatter handouts, as well as the photo board, Albo Annie, and the all-time favorite mosquito eating fish, were available in the display booth.

The table top tri-fold board and handouts were displayed at the Southwest Branch of the Warren County library June 18-24, 2023 for National Mosquito control Awareness Week.

School Presentation List:
Knowlton Township Elementary School
Allamuchy Elementary School
Pohatcong Township School
Harmony Elementary School

In June of 2023, the Commission agreed to partner with Cornell University to learn more about community perceptions on mosquito-borne disease risk, bite prevention, and mosquito management. Cornell University implemented focus groups in the south, central, and north regions of the state as well as in other states in the northeast. The Commission staff helped Cornell staff recruit volunteers through social media, at the county and municipal levels, and word of mouth and also offered suggestions on a venue to hold the focus group meeting. Although turnout was low, Cornell reported that they were able to complete the study. As of the end of 2023, results from the focus group study have not been received.

C. Office/Truck Files

Files with commonly requested handouts on pesticides, general mosquito control, ticks, etc. were maintained in each of the vehicles for easy access and distribution to concerned residents. This collection of handouts includes a flier on mosquito control in Spanish. These files were revamped in 2020 and continued to be available in 2023.

D. Ticks/Lyme Disease

A presentation on ticks and prevention of Lyme disease is included in the Commission's program that is offered to county schools, *Mosquitoes & Ticks: An Interactive Approach.* One of the four hands on station includes preserved ticks of various species and life stages so that the children can appreciate their small size and varying appearances. Children are also provided with tick bookmarks, provided to the Commission by the NJ DOH and the CDC, and worksheets to assist in their education. The Commission includes tick information with other educational handouts for the public during routine inspections as well as at educational events. Tick Grant funds were used to purchase an additional child's microscope and preserved tick slides for use in the school presentation in 2023.

In 2022, Prevent Tick Bites trail signs were ordered from the CDC and were placed on walking trails in the Frelinghuysen Forest Preserve and provided to staff at several other locations to alert the public to protect themselves due to the high populations of ticks in the area. Also, Prevent Tickborne Disease bookmarks were also received from the CDC to hand out at public education events.

E. Presentations/Publications

"Estimating the Nymphal Peak of *Ix.scapularis* in Warren County, NJ", by Anastasia Giordano was presented during the poster competition at 2023 NJMCA's 110th Annual Meeting, March 15-17, 2023.

F. Internet Presence

In 2005, the Commission arranged for its own website utilizing the domain name www.warrencountymosquito.org. The domain name www.warrencountymosquito.com also continues to be registered. Information for the Warren County Mosquito Extermination Commission was updated on the Rutgers hosted website within NJ Mosquitoes: Biology and Control at www.njmosquito.org. A link to this site is provided on the general web page for Warren County http://www.co.warren.nj.us/.

The Commission's original website content was finalized in February 2006. Minor modifications were made to the website following subsequent review and comment from the public. The website was updated in 2015 to be more compatible with current handheld devices and with current browser technology and web standards, to allow Commission staff to update more areas of the website, and to give the website an updated appearance. In 2021, the website had to be moved to a new host server since the current server could no longer support the outdated code it was written in. Since the cost of migrating to a new platform was above the quote threshold, it was temporarily moved, along with the staff email, until a more permanent solution could be found. Quotes and proposals for redesigning the website were sought and the quote from Computer Images Web was approved in December 2021. The website redesign and transfer took place and went live in 2022.

Unfortunately, in October 2022, the website was blacklisted by Google due to security issues. Although a specific cause was not determined, it was thought that the website or email addresses were hacked. Amitech Computer Services, the company that provides IT services for the commission, recommended My Corporate Hosting Solutions be contacted to handle the website and email addresses. The current website and email were reviewed, security suggestions were made, a quote received and accepted. My Corporate Hosting Solutions placed the website and email addresses on separate servers for the most security, Wordfence security was added to prevent intrusion attacks and allow MCHS to block other countries from accessing the website, also Wordpress semi-annual updates are run to keep the website's WordPress core, themes, and plugins up-to-date, and the email system was changed to Office 365.

Adult mosquito control information has been provided on the Commission website for County residents to access since 2006. A link to this information is predominantly displayed on the main page of our website. In 2018, a link to the municipal information packet was added to the main page of the website. In 2020, a link to the aerial larviciding treatment information was added to the main page of the website.

G. Media Coverage

Several radio interviews with WRNJ were conducted throughout the season.

Notices were supplied to townships where aerial larviciding and adult mosquito control took place for posting on their websites and social media platforms. The municipalities of Allamuchy, Alpha, Belvidere, Blairstown, Franklin, Greenwich, Harmony, Hope, Liberty, Lopatcong, Washington Borough, Washington Township, were supplied with notices for posting on their website and Facebook pages regarding WNV activity. The County mass notification system, Rave, was used to send alerts to the entire county following a significant rainfall event to ask residents to dump any standing water on their property. Rave was also use on August 31, 2023, to alert certain areas of Alpha, Franklin, Greenwich, Lopatcong, Mansfield, Phillipsburg, and Washington Townships municipalities about adult mosquito control taking place due to West Nile virus and high populations of *Aedes albopictus* mosquitoes.

H. National Week Observance

Unfortunately, our usual displays for Heartworm Awareness Month/Malaria Day and National Mosquito Control Awareness Week were not exhibited at the Administration Building because the building was closed to the public.

In May, Tickborne Disease Awareness Month was promoted by sharing multiple blurbs and NJDOH and CDC graphics on the County Facebook and Twitter pages and also on municipal websites and social media forums. In June, for National Mosquito Control Awareness Week, several posts were shared on the County Facebook and Twitter pages.

ACKNOWLEDGEMENTS: The following staff members contributed to the text and/or figures included in this report: Jennifer Gruener, Christine Fisher, Stephanie Oliphant, Anastasia Giordano, Ryan Hagerty, and John Necina.

AEMCNJ	Associated Executives of Mosquito Control in New Jersey
AIMS	Army insecticide measurement system
AMCA	American Mosquito Control Association
ATM	Asian Tiger Mosquito (*Aedes albopictus*)
ATV	All terrain vehicle
BG	BioGents
BMP	Best Management Practices
BTI	*Bacillus thuringiensis israelensis*
CDC	Center for Disease Control and Prevention
CHIKV	Chikungunya virus
CO_2	Carbon dioxide
COA	Certificate of Authorization
CoCoRaHS	Community Collaborative Rain, Hail, & Snow Network
CWA	Clean Water Act
DENV	Dengue virus
DWGNRA	Delaware Water Gap National Recreation Area
EEE	Eastern equine encephalitis
ELC	Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases
ESA	Entomological Society of America
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHAGP	Flood Hazard Act General Permit
FWWGP	Fresh Water Wetlands General Permit
GIS	Geographic Information System
GPS	Global Positioning System
GT	Gravid Trap
IPM	Integrated Pest Management
IR	Insecticide Resistance

JCV	Jamestown Canyon virus
KDR	Knockdown Resistance
LAC	La Crosse virus
LCD	Liquid Crystal Display
MSI	Municipal Software Incorporated
MWA	Musconetcong Watershed Association
NEVBD	Northeast Regional Center for Excellence for Vector-borne Diseases
NJDEP	New Jersey Department of Environmental Protection
NJDOH	New Jersey Department of Health
NJIIF	New Jersey Intergovernmental Insurance Fund
NJLT	New Jersey Light Trap
NJPDES	New Jersey Pollutant Discharge Elimination System
NMCA	Northeast Mosquito Control Association
PCP	Pesticide Control Program
PDMP	Pesticide Discharge Management Plan
PGP	Pesticide General Permit
PESP	Pesticide Environmental Stewardship Program
PCFA	Pollution Control Finance Authority
PHEL	Public Health Environmental Laboratory
PMA	Pennsylvania Manufacturers Association Insurance Group
SLE	Saint Louis encephalitis
SMCC	State Mosquito Control Commission
UAS/UAV	Unmanned Aviation System/ Unmanned Aviation Vehicle
USFWS	United States Fish & Wildlife Service
ULV	Ultra-low volume
VBDWG	Vector-borne Disease Working Group
WNV	West Nile virus
ZIKV	Zika virus

FIGURE INDEX – 2023

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Expenditure Budget
GENERAL FUND
Activity to 12/31/2023

*ACTIVITY = Budget - (Balance + Encumbered) (You can include the break out by journal from the report options)

Account Number	Description	Budget	Activity	Encumbered	Balance	% of Budget
105010	M-01 Salaries/Wages	496,739.00	496,460.68	-	278.32	99.9%
105020	M-02 Benefits	169,582.00	164,562.34	-	5,019.66	97.0%
105030	M-03 Insurance	23,204.00	23,204.00	-	-	100.0%
105040	M-04 Telephone/Internet	3,360.00	3,170.84	-	189.16	94.4%
105050	M-05 Legal Ads/Advertising	2,888.00	1,148.99	-	1,739.01	39.8%
105060	M-06 Meetings/Memberships	10,698.00	7,518.56	-	3,179.44	70.3%
105070	M-07 Professional Services	2,805.00	2,039.15	-	765.85	72.7%
105080	M-08 Permits/Eng/Water Mgmt	3,645.00	3,592.04	-	52.96	98.5%
105090	M-09 Contract Services	54,278.00	54,094.25	-	183.75	99.7%
105100	M-10 Fish/Insecticides/Licenses	69,884.00	69,173.18	-	710.82	99.0%
105110	M-11 Vehicle/Equipment Maint	41,300.00	37,187.06	-	4,112.94	90.0%
105120	M-12 Office Supplies	3,425.00	2,585.89	-	839.11	75.5%
105130	M-13 Shop Supplies	1,000.00	945.29	-	54.71	94.5%
105140	M-14 Lab/Field Supplies	7,525.00	6,320.10	-	1,204.90	84.0%
105150	M-15 Equipment Purchase	54,200.00	46,322.37	-	7,877.63	85.5%
105230	Reimburseable Expenses	-	(10,800.00)	-	10,800.00	
TOTALS		**944,533.00**	**907,524.74**	**-**	**37,008.26**	**96.1%**

Figure 1
Budget Report

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Grant Expenses
GENERAL FUND
Activity to 12/31/2023

*ACTIVITY = Budget - (Balance + Encumbered) (You can include the break out by journal from the report options)

Account Number	Description	Budget	Activity	Encumbered	Balance	% of Budget
106108	GRANT - TICKS SURVEILLANCE PROJECT	-	(10,073.01)	-	10,073.01	
TOTALS		-	(10,073.01)	-	**10,073.01**	

Figure 1
Budget Report

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100001 Pnc Bank - Regular

From 12/01/2023 to 12/31/2023

Figure 2
Treasurer's Report

Date	Source	PO#	Contract#	Check #	Vendor#	Vendor/Description	Budget	Debit	Credit	PO Encumber	PO Payment	Balance (DR)
						ACTIVITY/BALANCE BEFORE 12/01/2023	-	899,896.31	886,111.30			161,164.40
12/13/2023	DJ 445	11569		488212	410	WARREN CO. MOSQUITO EXT. COMMI			16,042.62			145,121.78
12/21/2023	DJ 446	11574		6263	292	PETTY CASH			13.78			145,108.00
12/21/2023	DJ 447	11573		6262	455	Washington Diner			130.00			144,978.00
12/21/2023	DJ 448	11572		6261	456	My Corporate Hosting Solutions			1,872.00			143,106.00
12/21/2023	DJ 449	11570		6260	459	Amazon Business			57.53			143,048.47
12/21/2023	DJ 450	11568		6259	192	JENNIFER GRUENER Reimbursement			25.00			143,023.47
12/21/2023	DJ 451	11567		6258	475	Ritter Lumber & Coal			142.11			142,881.36
12/21/2023	DJ 452	11564		6257	333	RUTGERS, THE STATE UNIVERSITY			115.00			142,766.36
12/21/2023	DJ 453	11557		6256	215	LOWE'S			129.15			142,637.21
12/21/2023	DJ 454	11554		6255	389	TRACTOR SUPPLY			39.99			142,597.22
12/21/2023	DJ 455	11560		6255	389	TRACTOR SUPPLY			32.99			142,564.23
12/21/2023	DJ 456	11562		6255	389	TRACTOR SUPPLY			159.98			142,404.25
12/21/2023	DJ 457	11566		6255	389	TRACTOR SUPPLY			13.41			142,390.84
12/21/2023	DJ 458	11549		6254	23	ALL SEASONS AUTOMOTIVE LLC			1,252.98			141,137.86
12/21/2023	DJ 459	11571		6254	23	ALL SEASONS AUTOMOTIVE LLC			2,057.79			139,080.07
12/21/2023	DJ 460	11536		6253	189	JAMES KELSEY Reimbursement			60.00			139,020.07
12/21/2023	DJ 461	11532		6252	322	ROBERT SELHULSTER Reimbursement			60.00			138,960.07
12/21/2023	DJ 462	11410		6251	156	GEBHARDT & KIEFER BLANKET			297.00			138,663.07
12/21/2023	DJ 463	11405		6250	435	WILSON PRODUCTS			91.89			138,571.18
12/21/2023	DJ 464	11379		6249	434	WEX BANK			49.35			138,521.83
12/21/2023	DJ 465	11378		6248	411	WARREN COUNTY Blanket			302.12			138,219.71
12/21/2023	DJ 466	11353		6247	373	T MOBILE Blanket			47.12			138,172.59
12/21/2023	DJ 467	11347		6246	425	WB MASON CO. INC. Blanket			26.82			138,145.77
12/21/2023	DJ 468	11333		6245	94	COMCAST Blanket			214.87			137,930.90
12/21/2023	DJ 469	11328		6244	118	DIGIT PAYROLL CORPORATION Payroll Services -			112.48			137,818.42
12/26/2023	DJ 477	11578		4782	410	WARREN CO. MOSQUITO EXT. COMMI			2,167.52			135,650.90
12/28/2023	DJ 478	11579		986426	410	WARREN CO. MOSQUITO EXT. COMMI			18,227.34			117,423.56
12/31/2023	DJ 479	11577		6270	192	JENNIFER GRUENER			193.54			117,230.02
12/31/2023	DJ 480	11576		6269	408	WAL-MART COMMUNITY			79.22			117,150.80
12/31/2023	DJ 481	11575		6268	23	ALL SEASONS AUTOMOTIVE LLC			306.04			116,844.76
12/31/2023	DJ 482	11410		6267	156	GEBHARDT & KIEFER BLANKET			66.00			116,778.76
12/31/2023	DJ 483	11405		6266	435	WILSON PRODUCTS			12.00			116,766.76
12/31/2023	DJ 484	11378		6265	411	WARREN COUNTY Blanket			246.09			116,520.67
12/31/2023	DJ 485	11353		6264	373	T MOBILE Blanket			47.12			116,473.55
12/31/2023	RJ 85					Interest-Regular Acct		1.25				116,474.80
RANGE							-	1.25	44,690.85	-	-	116,474.80
							-	899,897.56	930,802.15	-	-	116,474.80

Report Printed *01/12/2024 10:34:58*

100002 PNC Bank - Payroll

From 12/01/2023 to 12/31/2023

Figure 2
Treasurer's Report

Date	Source	PO#	Contract#	Check #	Vendor#	Vendor/Description	Budget	Debit	Credit	PO Encumber	PO Payment	Balance (DR)
						ACTIVITY/BALANCE BEFORE 12/01/2023	-	699,199.38	689,277.59			10,134.26
12/01/2023	DJ 444			33401900	285	PERS PERS & CLI November			2,947.34			7,186.92
12/04/2023	DJ 443			12042023	446	Digit Pay- Net Payroll PR 2023-25 Taxes			4,321.41			2,865.51
12/13/2023	RJ 82					PR 2023-26		16,042.62				18,908.13
12/14/2023	DJ 471			12142023	446	Digit Pay- Net Payroll PR 2023-26 DD			9,533.40			9,374.73
12/18/2023	DJ 472			12182023	446	Digit Pay- Net Payroll PR 2023-26 Taxes			3,743.98			5,630.75
12/18/2023	DJ 473			1242023	285	PERS PERS & CLI Dec			2,947.10			2,683.65
12/21/2023	DJ 470			1191	101	COUNTY OF WARREN Employee medical & dental co			2,583.65			100.00
12/22/2023	RJ 83					PR 2023-26 continued (John)		2,167.52				2,267.52
12/22/2023	DJ 474			12222023	446	Digit Pay- Net Payroll PR2023-26 DD (John)			1,631.83			635.69
12/27/2023	DJ 475			12272023	446	Digit Pay- Net Payroll PR2023-26 (John) Taxes			535.69			100.00
12/28/2023	RJ 84					PR 2024-01 1/2/2024		18,227.34				18,327.34
12/29/2023	DJ 476			12292023	446	Digit Pay- Net Payroll Pr 2024-01 DD 1/2/2024			11,057.78			7,269.56
RANGE							-	36,437.48	39,302.18	-	-	7,269.56
							-	735,636.86	728,579.77	-	-	7,269.56

Figure 2
Treasurer's Repor

100003 Fulton Bank - SUI

From 12/01/2023 to 12/31/2023

Date	Source	PO#	Contract#	Check #	Vendor#	Vendor/Description	Budget	Debit	PO Encumber	PO Payment	Balance (DR)
						ACTIVITY/BALANCE BEFORE 12/01/2023	-	980.24			7,307.74
12/31/2023	RJ	86				Interest SUI		0.06			7,307.80
							-	980.30	-	-	7,307.80

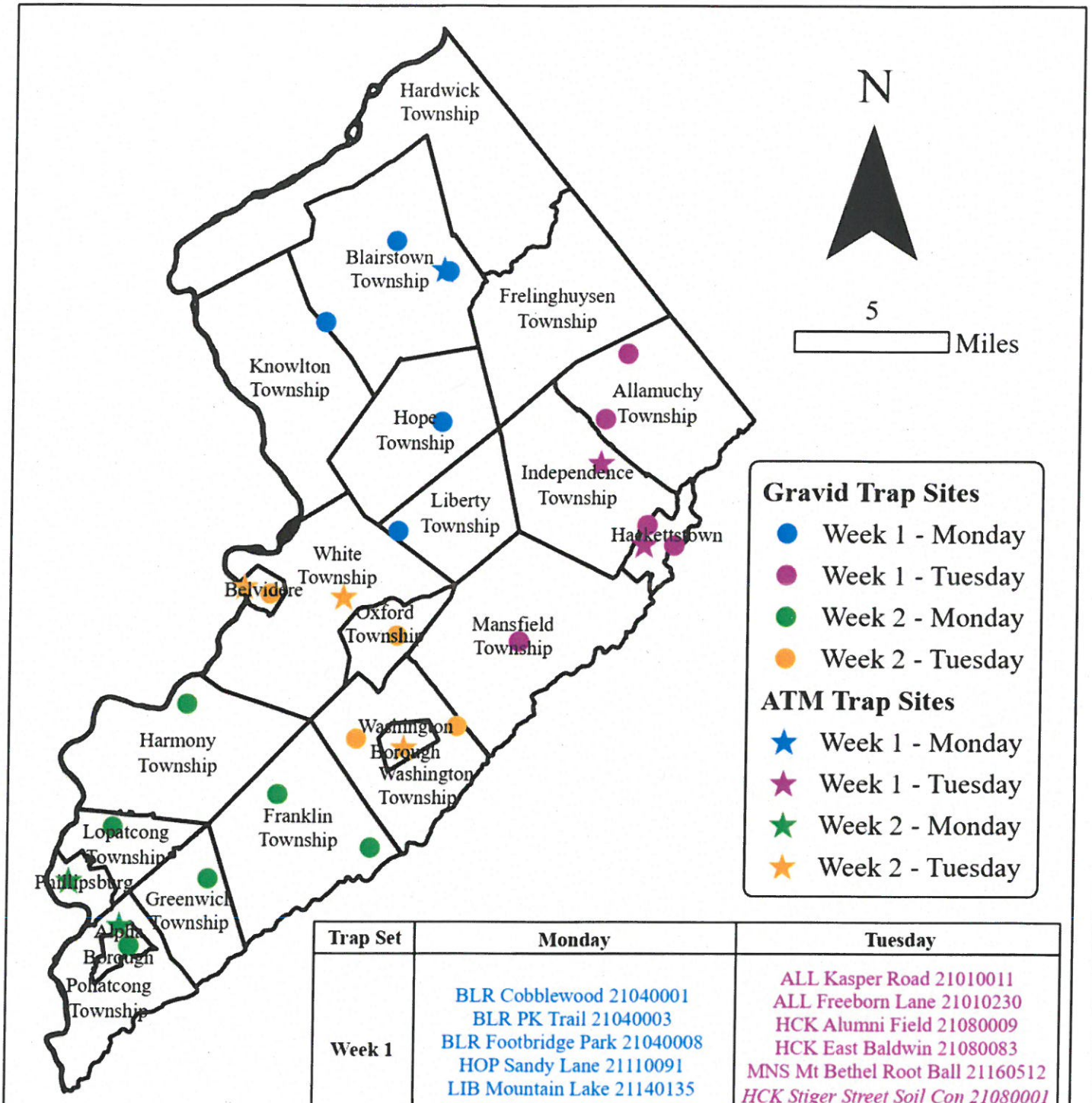
100004 Fulton Bank Retirement Pay

From 12/01/2023 to 12/31/2023

Date	Source	PO#	Contract#	Check #	Vendor#	Vendor/Description	Budget	Debit	PO Encumber	PO Payment	Balance (DR)
						ACTIVITY/BALANCE BEFORE 12/01/2023	-	5,001.40			15,859.91
12/31/2023	RJ	86				Interest Retirement		0.13			15,860.04
							-	5,001.53	-	-	15,860.04

Warren County Mosquito Control Commission
2023 Disease Surveillance/Trapping Schedule

WNV ,EEE, SLE, LAC, JCV, CHIKV, & DENV



Trap Set	Monday	Tuesday
Week 1	BLR Cobblewood 21040001 BLR PK Trail 21040003 BLR Footbridge Park 21040008 HOP Sandy Lane 21110091 LIB Mountain Lake 21140135 *BLR Alpine Meats 21040377*	ALL Kasper Road 21010011 ALL Freeborn Lane 21010230 HCK Alumni Field 21080009 HCK East Baldwin 21080083 MNS Mt Bethel Root Ball 21160512 *HCK Stiger Street Soil Con 21080001* *IND Kucharski Junkyard 21120082*
Week 2	ALP 7th Street Quarry 21020363 FRK W Asbury 21050001 FRK Whites Road 21050279 GRN Ironwolf Road 21070045 HRM Reeder Road 21100044 LOP Jade Lane 21150246 *PBG Filmore Cemetery 21190196* *ALP Williams Street 21020521*	BEL Cemetery 21030220 OXF Cat Swamp 21170042 WAT Meadow Breeze 21220029 WAT Morris Canal 21220153 *WHT Mt Pisgah Landfill 21230241* *BEL Paul Street 21030001* *WAB South Wandling 21210233*

WARREN COUNTY MOSQUITO EXTERMINATION COMMISSION
MOSQUITO-BORNE DISEASE RESPONSE GUIDELINES

PURPOSE

This is to serve as a guideline for a course of action to be taken in the event of the known presence of any mosquito-borne disease through either identification of the presence of the disease in mosquito populations or as evidenced by the illness or death of an animal/human from a mosquito borne disease within Warren County. While the focus is primarily on Eastern Equine Encephalitis (EEE) and West Nile Virus (WNV), other diseases that would be responded to include but are not limited to La Crosse Encephalitis, St. Louis Encephalitis, Malaria, Dengue Fever, and concentrated cases of Dog Heartworm.

PROCEDURE

A. In the event of positive disease test results from mosquitoes, sentinel chickens or the resident wild bird population (taking into consideration the migratory habits and nesting behavior of the particular bird species involved) the following procedures, as appropriate, will be implemented:

1. Notify Commissioners promptly.
2. Communicate with NJAES, Center for Vector Biology Director.
3. Communicate with the Office of Mosquito Control Coordination Administrator.
4. Disseminate information to employees regarding the disease situation and necessary precautions.
5. Increase adult mosquito surveillance efforts in the area utilizing available traps and baits/lures as appropriate for the target mosquito species (such as portable traps, NJ Light Traps, resting boxes etc.). The object is to collect additional species for virus testing within and adjacent to known mosquito breeding site in the areas.
6. Submit subsequent collections for virus testing either through the State Surveillance Program or another source, depending on what services are available (including testing at our facility).
7. Based on surveillance data, larvicide and/or adulticide by ground and/or by air, if warranted.
8. Discuss disease situation at next monthly Commission meeting.
9. Relay disease related information at next monthly meeting of Associated Executives of Mosquito Control Work in NJ.
10. Public notification is to be implemented as appropriate for the particular situation.

Continued...

B. In the event that the illness or death of a human, horse or other domesticated animal (including pets, livestock, zoo animal etc.) is confirmed to be due to a mosquito borne disease of public health importance and suspected to have been contracted in Warren County, the following procedures, as appropriate will be implemented.

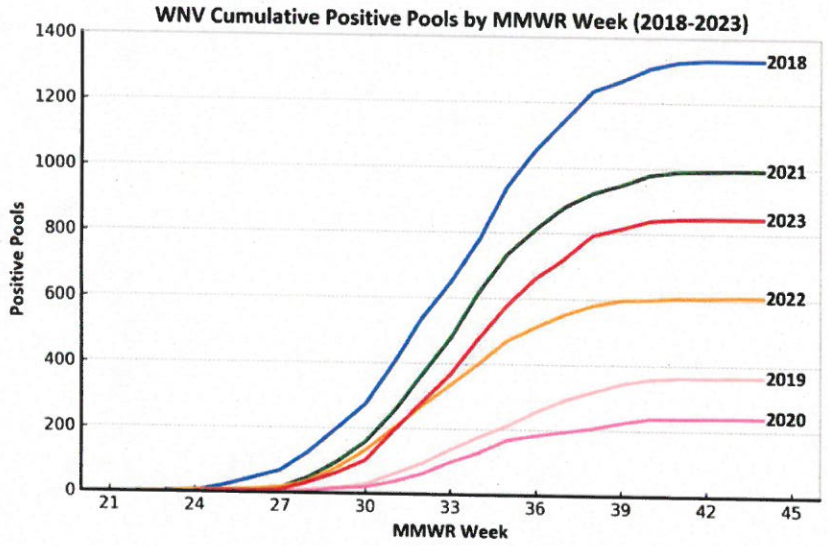
1. Notify Commissioners promptly.
2. Communicate with the NJAES, Center for Vector Biology Director.
3. Communicate with the Office of Mosquito Control Coordination Administrator.
4. Disseminate information to employees regarding the disease situation and necessary precautions.
5. Increase adult mosquito surveillance efforts in the area utilizing available traps and baits/lures as appropriate for the target mosquito species (such as portable traps, NJ Light Traps, resting boxes etc.). The object is to collect additional species for virus testing from:
   a. known and potential mosquito breeding sites in the immediate and adjacent areas and,
   b. in the vicinity of the original virus isolation and/or detection of animal illness/death.
6. Increase larval mosquito surveillance and control methods in the area.
7. Coordinate activities with other counties and state departments/agencies as appropriate.
8. Communicate with the Warren County Health Department and any other Warren County agencies involved.
9. Notify the Warren County Board of Chosen Freeholders.
10. Based on surveillance data, larvicide/adulticide by ground and if warranted, by air.
11. Continue surveillance and testing to further assess the disease situation. Submit post treatment collections for virus testing either through the State Surveillance Program or another source, depending on what services are available.
12. Prepare a news release with review by the Mosquito Commission Chair, the Warren County Health Officer and the Director of the Public Information Department if available. Coordinate information details to be released with the NJ Health Department and SMCC and direct any inquiries regarding human case information to the NJ Health Department. Do not include any identifiable information in the release (address or municipality, detailed health information, etc.). Refer to the EEE Protocol approved by the Associated Executives of Mosquito Control in NJ when preparing the press release. Refrain from using language that might be alarming (i.e. no scare tactics). Suggest the use of repellent and avoidance (staying indoors, maintaining screens on doors and windows etc.) and let the public know that the Commission is fully aware and is responding accordingly.
13. Seek guidance from Rutgers regarding assessment and response in area of the disease threat.
14. If the situation becomes more than we can handle with our own adulticiding equipment and personnel, ask for assistance from the State Mosquito Control Commission and the use of the State Airspray Program.
15. Request emergency funds from the Warren County Board of Chosen Freeholders if the Commission budget is not sufficient to continue needed response and reserve funding has already been expended.
16. Discuss disease situation at next monthly Commission meeting.
17. Relay disease related information at next monthly meeting of Associated Executives of Mosquito Control Work in New Jersey.

NJ VECTOR SURVEILLANCE SUMMARY 2023

"Vector-borne Surveillance Report"

Excerpts from 2023 Summary Report published by the NJ Department of Health, Communicable Disease Service

The full report can be found at:
https://www.nj.gov/health/cd/statistics/arboviral-stats/index.shtml



*The above graph shows cumulative **WNV** positive pools for the previous 11 years, including the most active (2018) and least active (2020) years.*

Mosquito-borne Disease Summary

Eastern equine encephalitis (EEE)

- In 2023, EEE activity increased from the previous year but got off to a slow start.
- Eighteen (18) EEE positive mosquito pools; thirteen of which were *Culiseta melanura* and the remainder were *Culex* species.
- Nine counties had EEE positive mosquitoes: Atlantic, Burlington, Cumberland, Camden, Cape May, Sussex, Hunterdon, Morris, and Somerset Counties.
- Three equine cases of EEE reported in NJ in 2023. One each from Gloucester, Salem, and Ocean Counties.
- No human cases of EEE in NJ in 2023

West Nile virus (WNV)

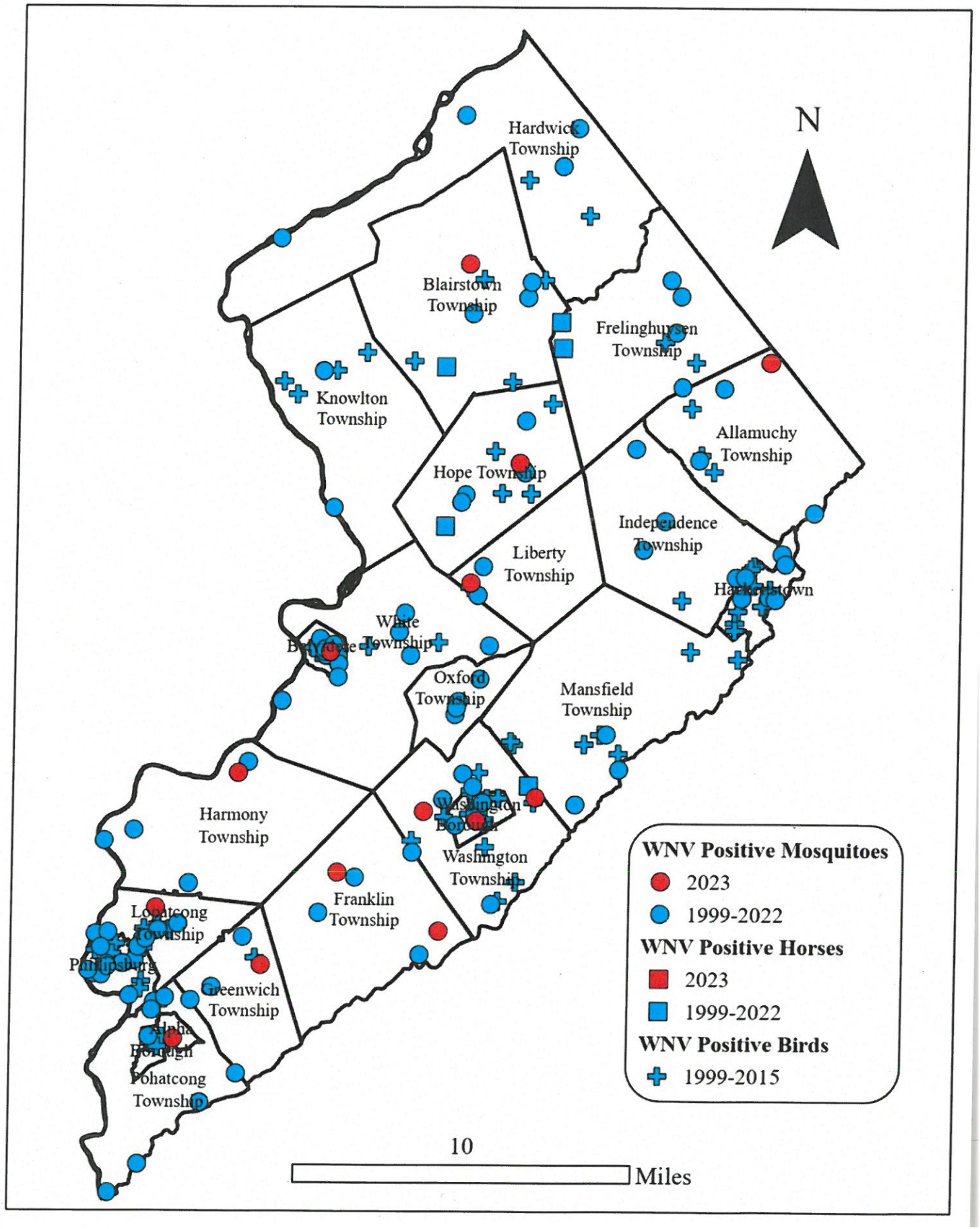
- WNV in mosquitoes was higher in 2023 than the previous year.
- 897 WNV positive pools; 784 *Culex* mix, 26 *Culex pipiens*, 12 *Aedes albopictus*, 6 *Cx. restuans*, 4 *Ae.japonicus*, , 4 *Cx. erraticus*, 4 *Cs. melanura*, 3 *Ae.triseriatus*, 2 *An.punctipennis*, 1 *Ae.taeniorhynchus*, 1 *Ps. ferox*.
    - All counties collected positive WNV mosquitoes.
- No horses reported confirmed positive for WNV in 2023
- There were fewer WNV human cases in 2023 than the previous year.
- 14 human cases with one (1) fatality (Bergen County). Cases were reported in Bergen (4), Middlesex (3), Camden (2), Burlington (1), and Mercer (1) Counties. Twelve of the fourteen WNV cases were classified as neuroinvasive disease.
- There were three viremic blood donors reported in 2023.

Other mosquito-borne viruses

- One (1) human case of Jamestown Virus (JCV) from Sussex County was reported in 2023.
- Five (5) mosquito pools were reported positive for JCV in 2023 from Sussex (2), Cumberland (1) ,Gloucester (1), and Salem (1) Counties.
- LaCrosse encephalitis (LAC) was detected in one mosquito sample from Sussex County in 2023.
- No mosquitoes tested positive for Saint Louis encephalitis (SLE), dengue virus (DENG), chikungunya virus (CHIK), or Zika virus (ZIKA) in 2023.
- Travel-related human cases of dengue virus were very high in 2023

Figure 5

Warren County Mosquito Control Commission
Cumulative WNV Positives Through 2023



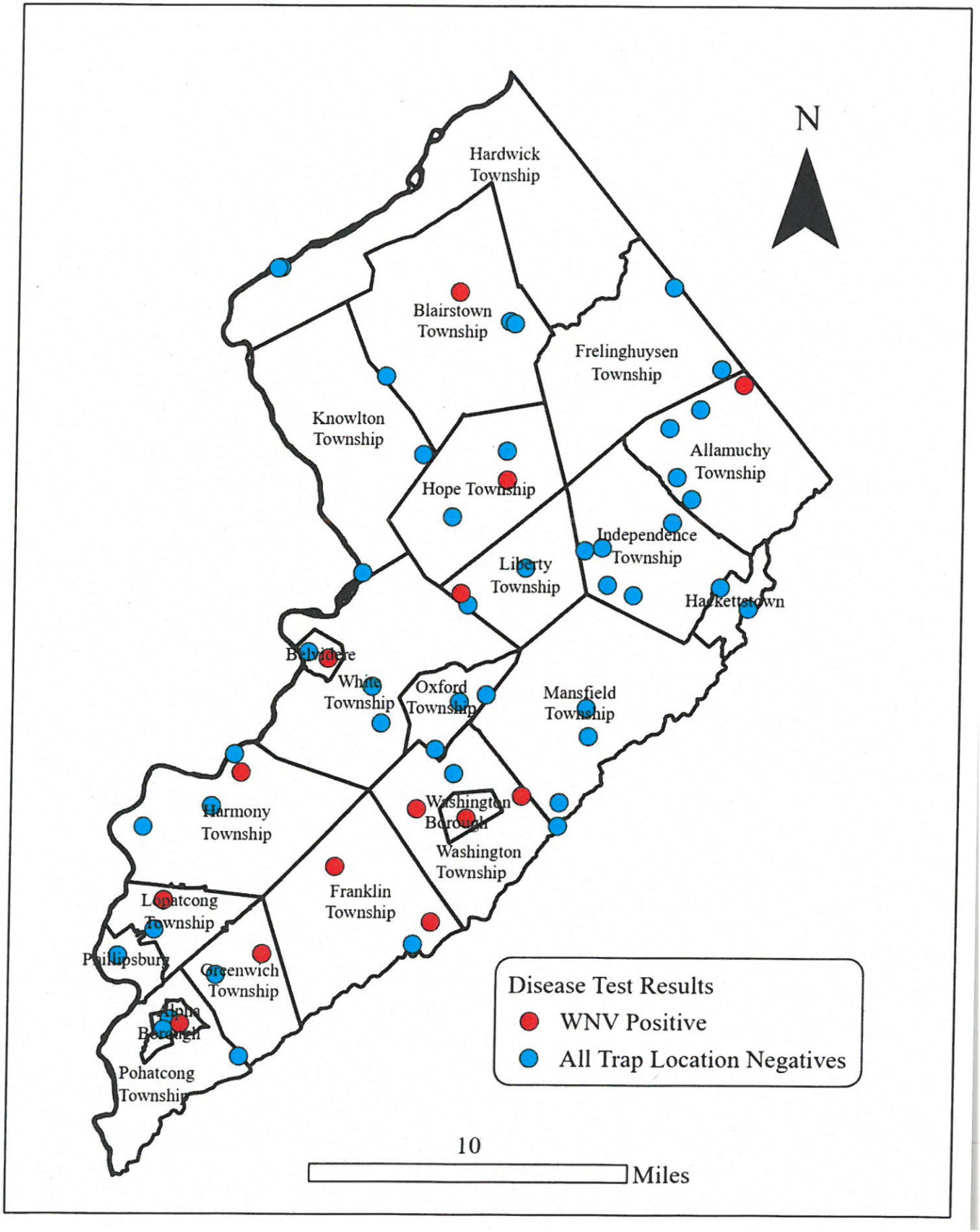
Mosquito Samples by Species
Submitted to PHEL for Mosquito-borne Disesase Testing

Species	# Pools	# Mosquitoes	WNV+	EEE+	SLE+	JCV+	LAC+
Culex pipiens/restuans/salinarius	314	14,359	28	0	0	0	0
Aedes japonicus	57	464	0	0	0	0	0
Anopheles punctipennis	29	126	0	0	0	0	0
Aedes triseriatus	30	90	1	0	0	0	0
Culex restuans	3	35	0	0	0	0	0
Anopheles quadrimaculatus	11	19	0	0	0	0	0
Coquillettidia perturbans	1	14	0	0	0	0	0
Aedes albopictus	5	10	0	0	0	0	0
Culex pipiens	2	8	0	0	0	0	0
Culex	6	7	0	0	0	0	0
Orthopodomyia signifera	1	4	0	0	0	0	0
Aedes cantator	1	1	0	0	0	0	0
Aedes vexans	1	1	0	0	0	0	0
Total	461	15,138	29	0	0	0	0

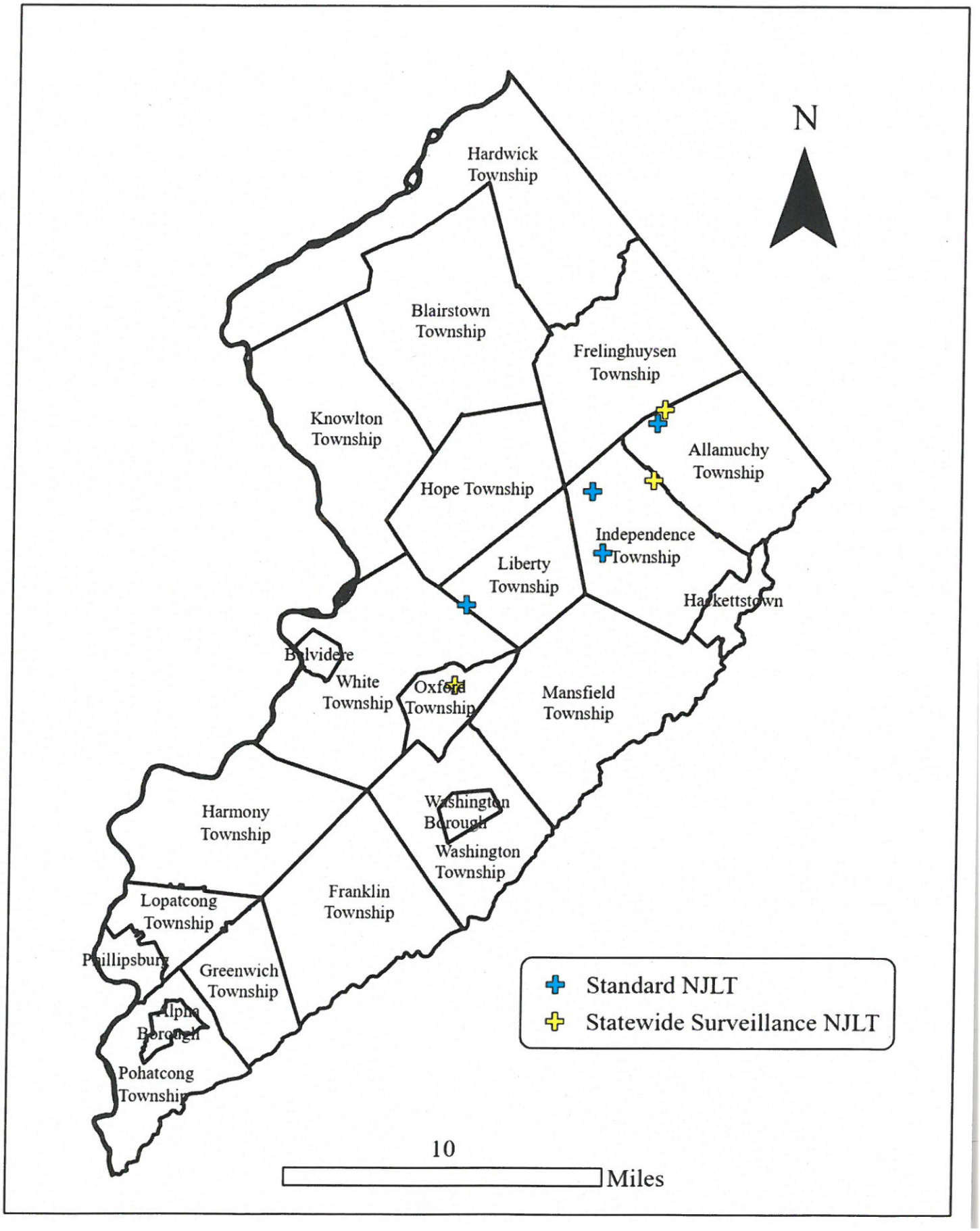
Figure 6a

Warren County Mosquito Control Commission
2023 Disease Trap Locations

WNV ,EEE, SLE, LAC, JCV, CHIKV, & DENV



Warren County Mosquito Control Commission
2023 Surveillance Stations



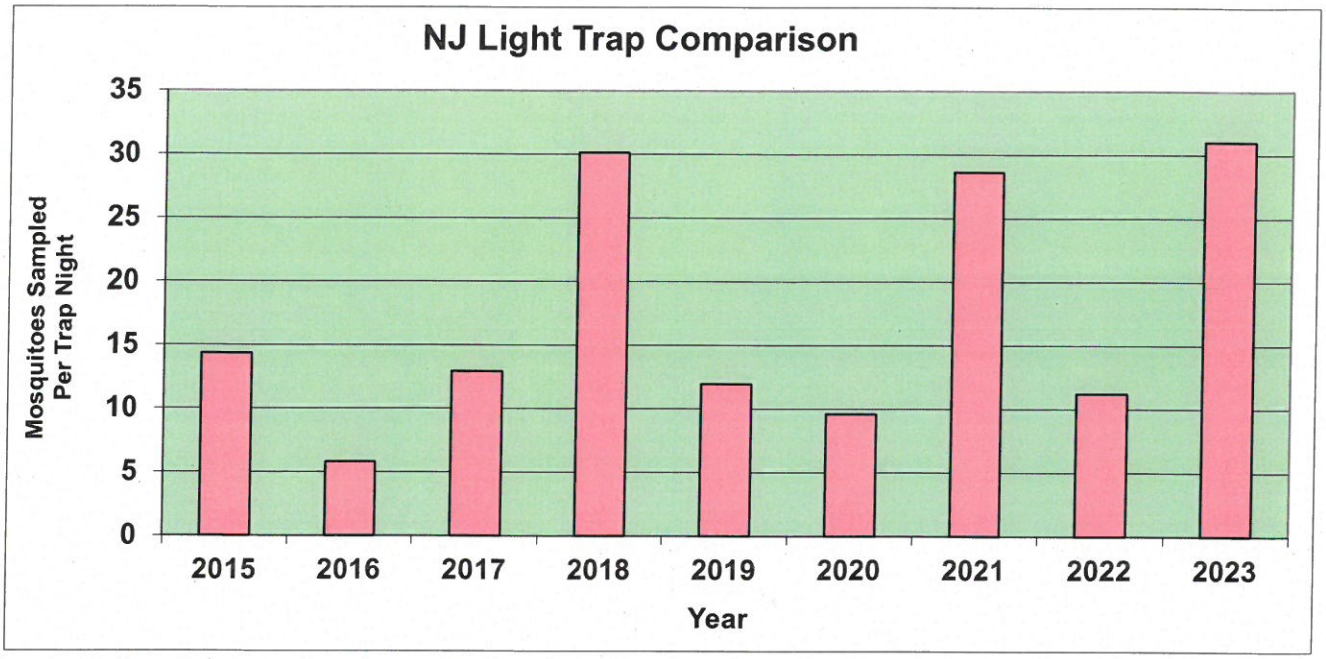
ROUTINE SURVEILLANCE
FIVE YEAR SUMMARY

NJ LIGHT TRAPS	2019		2020		2021		2022		2023	
Mosquitoes Caught	**11.94/Trap Night**	**16,607**	**9.60/Trap Night**	**10,817**	**28.60/Trap Night**	**32,465**	**11.24/Trap Night**	**12,666**	**31.01/Trap Night**	**34,952**
Species Caught	*Cx. spp.*	26.4%	*Cx. spp.*	26.07%	*Ae. vexans*	37.67%	*Ae. vexans*	31.97%	*Culex*	39.69%
	Ae. vexans	22.5%	*An. walkeri*	24.35%	*Culex spp.*	22.64%	*Culex spp.*	26.11%	*Ae. vexans*	32.40%
	An. walkeri	12.8%	*Ae. vexans*	12.88%	*An. walkeri*	10.12%	*An. punctipennis*	11.52%	*An. punctipennis*	9.30%
	An. punctipennis	6.9%	*An. quadrimaculatus*	7.65%	*An. punctipennis*	7.63%	*An. quadrimaculatus*	8.93%	*An. quadrimaculatus*	5.32%
	Cs. melanura	6.0%	*Cq. perturbans*	7.65%	*An. quadrimaculatus*	3.50%	*Ae. trivittatus*	5.11%	*Ps. ciliata*	2.40%
	Cq. perturbans	5.7%	*An. punctipennis*	5.84%	*Ae. trivittatus*	3.04%	*Cq. perturbans*	4.84%	*Ae. trivittatus*	1.91%
	Ur. sapphirina	4.2%	*Cs. melanura*	5.20%	*An. brad/cru*	3.02%	*Ur. sapphirinia*	3.58%	*Ur. sapphirina*	1.50%
	An. quadrimaculatus	3.6%	*Ur. sapphirina*	4.32%	*Ps. ciliata*	2.73%	*An. walkeri*	1.82%	*Ae. cinereus*	1.43%
	Ae. trivittatus	2.6%	*An. brad/cru*	1.98%	*Ps. howardii*	2.57%	*Cs. melanura*	1.37%	*Ps. howardii*	1.28%
	Ae. cinereus	2.0%	*Ps. ciliata*	0.80%	*Cq. perturbans*	1.97%	*Ae. japonicus*	1.35%	*Cq. perturbans*	1.24%
	An. brad/cru	1.5%	*Ae. japonicus*	0.78%	*Cs. melanura*	1.29%	*Ae. cinereus*	0.87%	*An. brad/cru*	1.00%
	Ae. japonicus	1.3%	*Ps. howardii*	0.42%	*Ur. sapphirina*	1.19%	*Ae. stimulans*	0.55%	*Cs. melanura*	0.93%
	Ae. stimulans	1.2%	*Ae. cinereus*	0.37%	*Ae. sticticus*	0.84%	*Ae. sticticus*	0.42%	*Ae. japonicus*	0.43%
	Ae. sticticus	1.0%	*Ps. columbiae*	0.36%	*Ps. ferox*	0.48%	*Ae. triseriatus*	0.39%	*Ps. ferox*	0.29%
	Ps. ciliata	1.0%	*Ae. canadensis*	0.36%	*Ae. japonicus*	0.46%	*Ps. ciliata*	0.35%	*Ae. sticticus*	0.17%
	Ps.howardi	0.3%	*Ae. stimulans*	0.34%	*Ae. stimulans*	0.31%	*Ps. howardii*	0.20%	*Ae. stimulans*	0.15%
	Damaged	0.3%	*Ae. trivittatus*	0.18%	*Ps. columbiae*	0.27%	*Or. signifera*	0.17%	*Ae. triseriatus*	0.15%
			Damaged	0.16%	*Ae. canadensis*	0.06%	*Ps. ferox*	0.12%	*Ps. columbiae*	0.11%
			Ae. triseriatus	0.10%	*Ae. cinereus*	0.05%	*Ae. canadensis*	0.11%	*Or. signifera*	0.10%
			Ps. ferox	0.04%	*Ae. triseriatus*	0.05%	*Ps. columbiae*	0.08%	*An. walkeri*	0.07%
			Ae. cantator	0.04%	*Ae. aurifer*	0.02%	*Ae. aurifer*	0.05%	*Ae. canadensis*	0.06%
			Ae. sticticus	0.04%	*Ae. cantator*	0.02%	*Ae. excrucians*	0.03%	*Ae. excrucians*	0.03%
			Ae. aurifer	0.03%	*Ae. tormentor*	0.02%	*An. brad/cru*	0.03%	*Ae. aurifer*	0.01%
			Or. signifera	0.03%	*Ae. excrucians*	0.01%	*Damaged*	0.02%	*Ae. albopictus*	0.01%
			Ae. albopictus	0.02%	*Damaged*	0.01%	*Ae. albopictus*	0.01%	*Damaged*	0.01%
			Ae. excrucians	0.01%	*Or. signifera*	0.01%	*Ae. tormentor*	0.01%		
					Ae. gross, Ae. infir	0.02%				

Figure 7a

Figure 7b

NJ LIGHT TRAP YEARLY COMPARISONS



DISEASE, COMPLAINT and FIELD STUDY SURVEILLANCE SYNOPSIS - FIVE YEAR SUMMARY

	2019		2020		2021		2022		2023	
GRAVID TRAPS										
Mosquitoes Caught	**85.65/Trap Night**	**18,672**	**42.181/Trap night**	**9,786**	**58.97/Trap night**	**12,148**	**38.01/Trap night**	**10,452**	**74.60/Trap night**	**17,381**
Mosquito Species	*Cx. spp*	94.00%	*Cx. spp*	92.19%	*Culex spp.*	91.88%	*Culex spp.*	88.40%	*Culex spp.*	91.39%
	Ae. japonicus	4.10%	*Ae. japonicus*	4.41%	*Ae. japonicus*	5.64%	*Ae. japonicus*	8.01%	*Ae. japonicus*	5.19%
	An. punctipennis	1.00%	*Ae. triseriatus*	1.15%	*Ae. triseriatus*	0.90%	*An. punctipennis*	1.23%	*Ae. triseriatus*	0.91%
	Ae. triseriatus	0.40%	*Ae. albopictus*	0.87%	*An. punctipennis*	0.46%	*Ae. triseriatus*	0.92%	*An. punctipennis*	0.79%
	Ae. albopicitus	0.10%	*An. punctipennis*	0.62%	*Ae. trivittatus*	0.36%	*Ae. albopictus*	0.46%	*Ae. albopictus*	0.24%
	Ae. vexans	0.08%	*An. quadrimaculatus*	0.35%	*Ae. albopictus*	0.32%	*Ae. vexans*	0.38%	*Ae. vexans*	0.10%
	An. quadrimaculatus	0.07%	*Ae. trivittatus*	0.18%	*An. quadrimaculatus*	0.14%	*An. quadrimaculat*	0.32%	*An. quadrimaculatus*	0.10%
			Ps. ferox	0.10%	*Ps. ferox*	0.12%	*Ae. trivittatus*	0.09%	*Ae. trivittatus*	0.08%
			Ae. vexans	0.05%	*Ae. sticticus*	0.08%	*Ae. canadensis*	0.06%	*Ps. ferox*	0.03%
			An. walkeri	0.02%	*Ae. vexans*	0.07%	*Ae. cinereus*	0.06%	*Or. signifera*	0.03%
			Or. signifera	0.02%	*Ur. sapphirina*	0.02%	*Ps. columbiae*	0.02%	*Ae. cinereus*	0.01%
			Ae. canadensis	0.01%	*Ae. tormentor*	0.01%	*Ur. sapphirinia*	0.02%	*Ur. saphhirinia*	0.01%
			Ps. columbiae	0.01%	*Or. signifera*	0.01%	*Or. signifera*	0.01%	*Ps. howardii*	0.01%
BG SENTINEL TRAPS										
Mosquitoes Caught	**9.89/Trap night**	**554**	**7.04/Trap night**	**704**	**10.43/Trap night**	**720**	**11.55/Trap night**	**1,247**	**9.09/Trap night**	**582**
Mosquito Species	*Cx. spp*	22.40%	*Ae. albopictus*	71.45%	*Ae. albopictus*	81.94%	*Ae. albopictus*	58.06%	*Ae. albopictus*	33.33%
	Ae. trivittatus	19.30%	*An. quadrimaculatus*	9.09%	*An. punctipennis*	4.17%	*Culex spp.*	11.07%	*Culex spp.*	20.45%
	Ps. ferox	11.20%	*Cx. spp*	8.52%	*Culex spp.*	3.75%	*An. punctipennis*	7.54%	*Ae. trivittatus*	11.51%
	Ae. albopictus	10.60%	*An. punctipennis*	2.56%	*Ae. trivittatus*	2.92%	*Ae. triseriatus*	4.81%	*An. punctipennis*	9.97%
	An. punctipennis	8.30%	*Ae. japonicus*	2.27%	*Ae. vexans*	1.39%	*Ae. japonicus*	4.57%	*An. quadrimaculatus*	9.62%
	Ae. sticticus	6.00%	*Ae. triseriatus*	2.13%	*Ae. triseriatus*	1.25%	*Ae. trivittatus*	4.25%	*Ae. triseriatus*	5.33%
	Ae. triseriatus	4.90%	*Cq. perturbans*	1.14%	*Ps. ferox*	1.11%	*Ae. vexans*	2.97%	*Ae. vexans*	3.61%
	An. quadrimaculatus	4.20%	*Ae. trivittatus*	0.99%	*Ae. japonicus*	0.97%	*An. quadrimaculat*	2.81%	*Ae. japonicus*	2.41%
	Ae. japonicus	3.60%	*Ae. vexans*	0.99%	*Ps. columbiae*	0.83%	*Ps. ferox*	1.44%	*Ps. ferox*	2.23%
	Cq. perturbans	2.90%	*Ae. stimulans*	0.28%	*An. quadrimaculatus*	0.56%	*Ae. canadensis*	0.72%	*Ae. sticticus*	1.03%
			Ps. ferox	0.28%	*Ae. sticticus*	0.42%	*Ur. sapphirinia*	0.64%	*Ur. sapphirina*	0.34%
			An. walkeri	0.14%	*Ae. canadensis*	0.28%	*Cq. perturbans*	0.40%	*Ae. stimulans*	0.17%
			Damaged	0.14%	*Damaged*	0.28%	*Damaged Aedes*	0.24%		
					Cq. perturbans	0.14%	*additional six spec*	<1.0% ea		
CDC Traps (Inc. complaints)			All CDC traps, inclusive of complaints		All CDC traps, inclusive of complaints		All CDC traps, inclusive of complaints		All CDC traps, inclusive of complaints	
Mosquitoes Caught	**46.85/Trap night**		**40.679/Trap night**	**5,573**	**113.72/Trap night**	**22,631**	**98.28/Trap night**	**11,007**	**87.06/Trap night**	**12,101**
Mosquito Species	*Ae. trivittatus*	36.10%	*An. walkeri*	26.45%	*Ae. vexans*	37.89%	*Ae. trivittatus*	29.37%	*Ae. vexans*	36.18%
	Ae. sticticus	19.50%	*Cq. perturbans*	17.71%	*Ae. trivittatus*	28.83%	*Ae. vexans*	25.65%	*Ae. trivittatus*	22.28%
	Ae. vexans	11.50%	*Ae. trivittatus*	13.28%	*Ps. ferox*	8.55%	*Ae. sticticus*	22.90%	*Culex spp.*	17.55%
	An. walkeri	5.50%	*Ae. vexans*	11.02%	*Ae. sticticus*	4.56%	*An. punctipennis*	7.42%	*Ae. sticticus*	10.41%
	Cq. perturbans	5.30%	*Ps. ferox*	10.66%	*Culex spp.*	4.41%	*Cq. perturbans*	6.56%	*An. punctipennis*	4.74%
	Cx. spp	5.20%	*Ae. albopictus*	5.69%	*An. walkeri*	4.35%	*Culex spp.*	1.62%	*An. quadrimaculatus*	2.38%
	Ps. ferox	4.00%	*Cx. spp*	5.42%	*Cq. perturbans*	4.33%	*An. quadrimaculat*	1.43%	*Ae. cinereus*	1.80%
	Cq. perturbans	3.70%	*An. punctipennis*	2.71%	*An. punctipennis*	1.90%	*An. walkeri*	1.03%	*Cq. perturbans*	0.77%
	An. punctipennis	2.90%	*An. quadrimaculatus*	2.23%	*Ps. ciliata*	1.04%	*Ps. ferox*	0.90%	*Ps. ciliata*	0.74%
	Ae. albopictus	2.40%	*Ps. columbiae*	0.79%	*Ae. albopictus*	0.98%	*Ae. canadensis*	0.74%	*Ps. ferox*	0.74%
			Ae. japonicus	0.75%	*An. quadrimaculatus*	0.58%	*Ae. cinereus*	0.64%	*Ae. albopictus*	0.59%
			Ae.canadensis	0.57%	*Ae. cinereus*	0.40%	*Ae. albopictus*	0.62%	*Ae. triseriatus*	0.45%
			Ae.cinereus	0.56%	*Ps. howardii*	0.38%	*Ae. stimulans*	0.36%	*Ae. japonicus*	0.35%
			Ae. triseriatus	0.48%	*Ps. columbiae*	0.38%	*Ae. japonicus*	0.24%	*Ps. howardii*	0.25%
			Ps. ciliata	0.48%	*Ae. japonicus*	0.27%	*Ae. triseriatus*	0.17%	*Ur. sapphirina*	0.24%
			Ae. stimulans	0.39%	*Ae. canadensis*	0.20%	*Ae. aurifer*	0.12%	*Ps. columbiae*	0.18%
			Ur. sapphirina	0.34%	*Ae. triseriatus*	0.17%	*Ur. sapphirina*	0.07%	*An. walkeri*	0.15%
			Ps. howardii	0.25%	*Cs. melanura*	0.16%	*Ps. ciliata*	0.05%	*Ae. stimulans*	0.06%
			Ae. aurifer	0.07%	*Ur. sapphirina*	0.15%	*Ps. howardii*	0.04%	*An. brad/cru*	0.05%
			An. bradleyi/crucians	0.05%	*Ae. aurifer*	0.11%	*Ae. tormentor*	0.03%	*Ae. canadensis*	0.04%
			Cs. melanura	0.05%	*Ae. cantator*	0.09%	*Ps. columbiae*	0.03%	*Or. Signifera*	0.30%
			Ae. cantator	0.04%	*Ae. stimulans*	0.06%	*Damaged Aedes*	0.01%	*additional 3 species*	<0.01% ea.

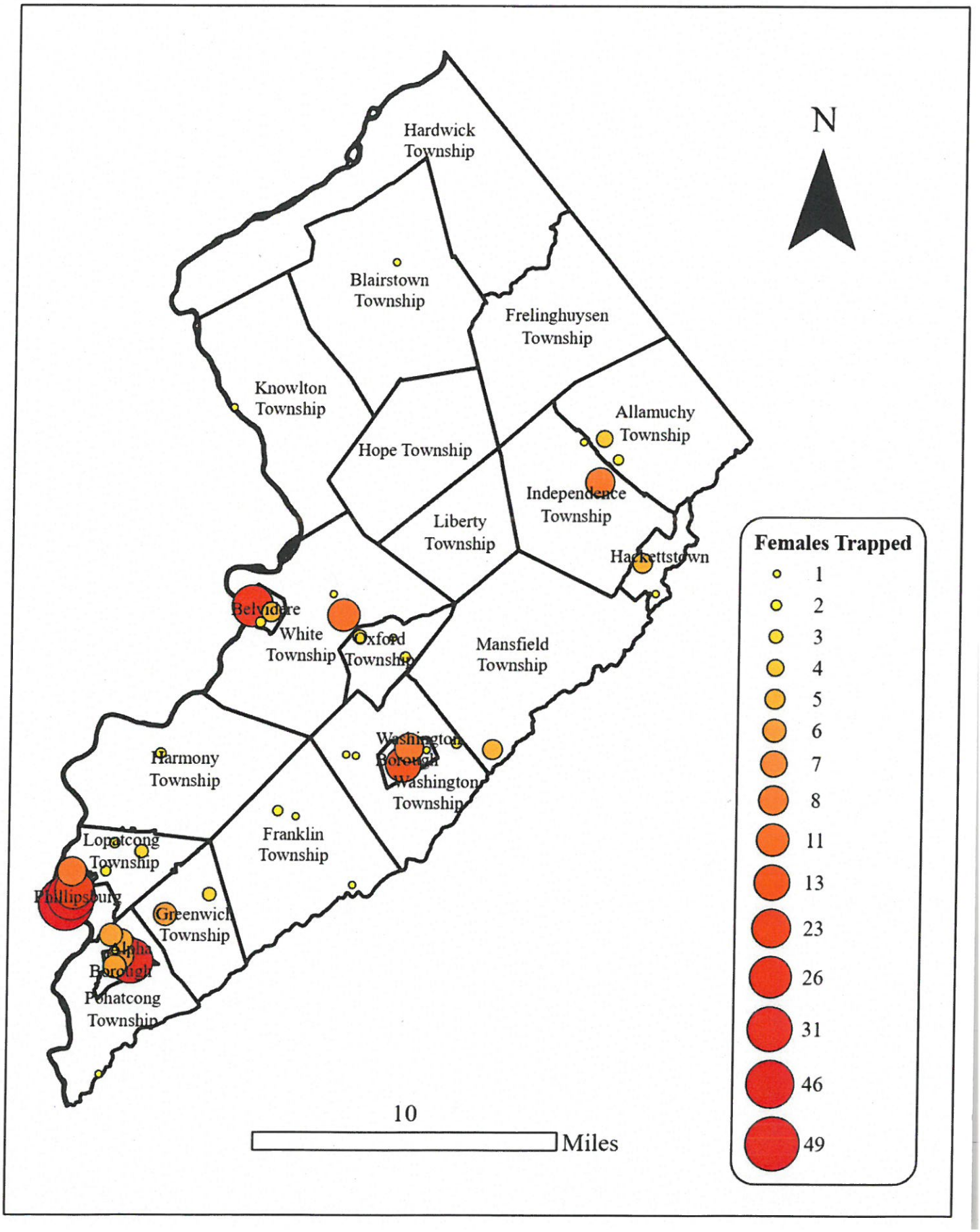
Figure 8

Warren County Light Trap Collections
2023
Warren County Mosquito Extermination Commission

	AEDES															ANOPHELES				CQ.	CX.	CULISETA			OR.	PSOROPHORA				UR.		
LOCATION (site no.)	*Ae. albopictus*	*Ae. aurifer*	*Ae. canadensis*	*Ae. cantator*	*Ae.cinereus*	*Ae. excrucians*	*Ae. grossbecki*	*Ae. infirmatus*	*Ae. japonicus*	*Ae. sticticus*	*Ae. stimulans*	*Ae. tormentor*	*Ae. triseriatus*	*Ae. trivittatus*	*Ae. vexans*	*An. punctipennis*	*An. quadrimaculatus*	*An. walkeri*	*An. bradleyi/cruicians*	*Cq. perturbans*	*Cx. spp*	*Cs. inornata*	*Cs. melanura*	*Cs. morsitans*	*Cr. signifera*	*Ps. ciliata*	*Ps. columbiae*	*Ps. ferox*	*Ps. howardii*	*Ur. sapphirina*	Damaged	TOTAL
Woronowicz; Pequest Road, Oxford (2A)	1				7	6			35	4			8	14	226	133	54		4	2	555		1		2	35		1	20	157		1265
Independence Road Department (3A)			1		14				26	3			8	65	1043	172	233		2	15	456		3		1	27	1	1	16	13		2100
Sehulster; Bear Creek Road, Allamuchy (4A)			1		12				6	2				71	571	152	26	1	5	3	567		2			72	3	3	22	24		1543
Zellars; Bear Creek Road, Allamuchy (4B)			1		64				27	3			19	211	1542	624	157	8	9	9	4818		5		1	61	1	29	150	153	4	7896
Ivaseczko; Post Lane, Independence (5)	1				89	1			40	34	5		7	210	6391	733	1009		10	17	2911		2		3	533	15	56	181	17		12265
Mountain Lake Fire Company, Liberty (7)		5	16		209				12	5			5	2	54	1040	139	16	316	126	2504		309		27	1		3	7	23		4819
Kelsey; Shades of Death Road, Indpendence (20)			1		104	2			6	9	49		7	96	1497	397	243	1	5	260	2061		3			111	18	7	50	137		5064
TOTAL	2	5	20	0	499	9	0	0	152	60	54	0	54	669	11324	3251	1861	26	351	432	13872	0	325	0	34	840	38	100	446	524	4	34952
% OF TOTAL CATCH	0.01%	0.01%	0.06%	0.00%	1.43%	0.03%	0.00%	0.00%	0.43%	0.17%	0.15%	0.00%	0.15%	1.91%	32.40%	9.30%	5.32%	0.07%	1.00%	1.24%	39.69%	0.00%	0.93%	0.00%	0.10%	2.40%	0.11%	0.29%	1.28%	1.50%	0.01%	100%

Figure 9

Warren County Mosquito Control Commission
2023 *Aedes albopictus* Distribution

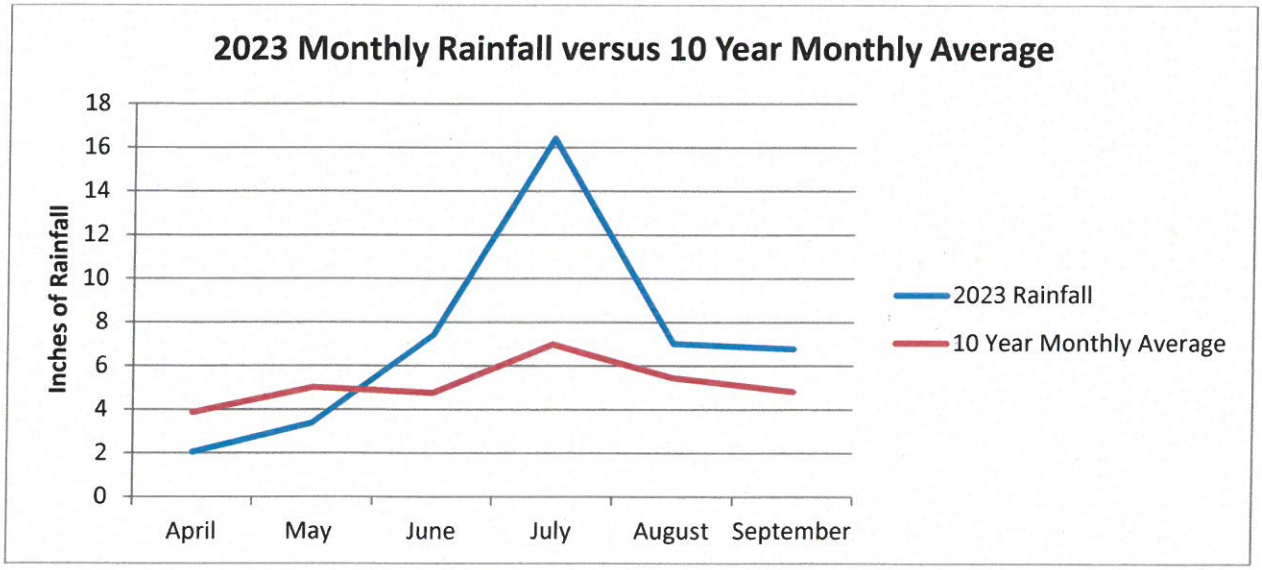


Oxford Rainfall Comparison over Ten Year (April – September)

Figure 11

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
April	4.73	2.58	2.61	3.87	4.49	4.28	3.74	1.91	8.42	2.06
May	6.50	1.60	3.29	4.98	4.81	10.46	4.57	4.70	5.98	3.39
June	5.56	8.66	3.21	4.13	3.57	4.92	3.07	3.11	3.94	7.41
July	7.60	3.96	2.87	8.34	6.54	9.55	6.00	6.83	1.97	16.42
August	2.55	4.76	4.20	4.89	8.23	5.33	8.34	7.45	1.66	7.01
September	2.40	5.14	2.50	3.40	6.77	1.56	3.91	11.35	4.4	6.78
TOTAL	29.34	26.70	18.68	29.61	34.41	36.10	29.63	35.35	26.37	43.07

2023 Seasonal Rainfall vs. Ten Year Average



2023 Activity Summary

Figure 12

MUNICIPALITY	Catch Basin Treatments	Routine Larval Inspections	Larval Samples	Service Requests Received	Service Request Adult Samples	Service Requests Landing Rates	Larvicide/Pupicide Applications	Number of Fish Site Stockings	Water Management	Tires Collected	Brush Cutting	Adulticide Applications	Total
ALL	31	730	50	14	11	3	280	5	2	0	8	15	1,149
ALP	4	44	0	7	7	0	6	0	0	0	0	5	73
BEL	50	127	3	5	1	0	19	0	0	0	0	2	207
BLR	31	993	16	15	9	4	186	7	0	0	4	11	1,276
FRK	20	337	2	11	11	3	45	2	0	17	0	8	456
FRL	6	735	14	24	9	3	92	5	2	0	1	12	903
GRN	71	195	3	4	4	2	11	0	2	0	0	3	295
HCK	373	371	1	4	4	0	116	1	7	22	5	1	905
HDW	8	598	7	13	11	3	117	13	1	0	1	13	785
HRM	0	534	1	3	2	0	129	1	0	0	0	3	673
HOP	4	796	1	24	15	3	70	2	0	0	3	13	931
IND	133	1,204	75	11	7	0	362	15	8	0	5	12	1,832
KNL	15	1,185	11	15	11	0	220	12	4	0	7	10	1,490
LIB	34	714	8	10	5	1	87	3	0	0	6	6	874
LOP	135	413	5	3	2	0	80	0	3	0	0	4	645
MNS	208	649	7	5	4	1	218	1	1	0	12	3	1,109
OXF	16	731	56	5	4	1	128	1	34	0	1	4	981
PBG	51	1	1	3	2	0	2	0	1	2	0	2	65
PHT	110	544	3	7	6	0	75	0	8	0	0	2	755
WAB	66	169	3	8	6	1	31	0	1	0	1	6	292
WAT	139	861	5	7	6	0	112	3	6	21	0	8	1,168
WHT	33	943	16	17	12	5	105	7	1	4	9	12	1,164
TOTAL	1,538	12,874	288	215	149	30	2,491	78	81	66	63	155	18,028

* indicates at least one area-wide application for *Aedes albopictus* control

Figure 13

NEW JERSEY'S MOSQUITOES – 2023

Bolded Species - Sampled in Warren County

Genus *Aedes* (Meigen)

1. ***Aedes abserratus* (Felt and Young)**
2. *Aedes atlanticus* (Dyar and Knab)
3. ***Aedes albopictus* (Skuse)**
4. ***Aedes atropalpus* (Coquillett)**
5. ***Aedes aurifer* (Coquillett)**
6. ***Aedes canadensis canadensis* (Theobald)**
7. ***Aedes cantator* (Coquillet)**
8. ***Aedes cinereus (Meigen)***
9. ***Aedes communis* (De Geer)**
10. *Aedes dorsalis* (Meigen)
11. *Aedes dupreei* (Coquillet)
12. ***Aedes excrucians* (Walker)**
13. ***Aedes fitchii* (Felt and Young)**
14. *Aedes flavescens* (Miller)
15. ***Aedes** grossbecki* **(Dyar and Knab)**
16. *Aedes hendersoni* (Cockerell)
17. *Aedes implicates* (Vockeroth)
18. *Aedes infirmatus* (Dyar and Knab)
19. ***Aedes intruden* (Dyar)**
20. ***Aedes japonicus (Theobald)***
21. *Aedes mitchellae* (Dyar)
22. *Aedes provocans* (Walker)
23. *Aedes punctor* (Kirby)
24. ***Aedes sollicitans* (Walker)**
25. *Aedes spencerii spencerii* (Theobald)
26. ***Aedes sticticus* (Meigen)**
27. ***Aedes stimulans* (Walker)**
28. *Aedes taeniorhynchus* (Say)
29. *Aedes thibaulti* (Dyar and Knab)
30. ***Aedes tormentor* (Dyar and Knab)***
31. ***Aedes triseriatus* (Say)**
32. ***Aedes trivittatus* (Coquillet)**
33. ***Aedes vexans (Meigen)***

Genus *Anopheles* (Meigen)

34. *Anopheles atropos* (Dyar and Knab)
35. ***Anopheles barberi* (Coquillett)**
36. ***Anopheles bradleyi* (King)**
37. ***Anopheles crucians (Weidemann)***
38. ***Anopheles earlei (Vargas)***
39. ***Anopheles punctipennis* (Say)**
40. ***Anopheles quadrimaculatus* (Say)**
41. ***Anopheles walkeri* (Theobald)**

Genus *Coquillettidia* (Dyar)

42. ***Coquillettidia perturbans (Walker)***

Genus *Culex* (Linnaeus)

43. ***Culex erraticus* (Dyar and Knab)**
44. ***Culex pipiens* (Linnaeus)**
45. ***Culex restuans* (Theobald)**
46. ***Culex salinarius* (Coquillett)**
47. ***Culex tarsalis* (Coquillett)**
48. ***Culex territans (Walker)***

Genus *Culiseta* (Felt)

49. ***Culiseta inornata* (Williston)**
50. ***Culiseta melanura* (Coquillett)**
51. ***Culiseta minnesotae* (Barr)**
52. ***Culiseta morsitans* (Theobald)**

Genus *Orthopodomyia* (Theobald)

53. *Orthopodomyia alba* (Baker)
54. ***Orthopodomyia signifera* (Coquillett)**

Genus *Psorophora* (Robineau-Desvoidy)

55. ***Psorophora ciliata* (Fabricius)**
56. ***Psorophora columbiae* (Dyar and Knab)**
57. *Psorophora cyanescens* (Coquillett)
58. *Psorophora discolor* (Coquillett)
59. ***Psorophora ferox* (von Humboldt)**
60. ***Psorophora howardii* (Coquillet)**
61. *Psorophora mathesoni*(Belkin & Heinemann)

Genus *Toxorhynchites* (Theobald)

62. ***Toxorhynchites rutilus septentrionalis* (Dyar and Knab)**

Genus *Uranotaenia* (Lynch- Arribalzaga)

63. ***Uranotaenia sapphirina* (Osten Sacken)**

Genus *Wyeomyia* (Theobald)

64. ***Wyeomyia smithii* (Coquillett)**

46 species in Warren County

***Most recent addition 7/7/21**

Figure 14

2023 GROUND INSPECTION/LARVICIDING DISTRICTS
Known Mosquito Production Sites by Control Approach

DISTRICT 1 (North)

Township	*Regular Sites*	*Ext Release Briquets*	*Fish Sites*	*2 Person Sites*	*Aerial Sites*	*Untreated Sites*	TOTAL
Blairstown	54	7	17	0	0	0	78
Hardwick	38	7	17	0	2	5	69
Knowlton	62	3	18	0	0	0	83
Total	154	17	52	0	2	5	230

DISTRICT 2 (East)

Township	*Regular Sites*	*Ext Release Briquets*	*Fish Sites*	*2 Person Sites*	*Aerial Sites*	*Untreated Sites*	TOTAL
Allamuchy	55	1	6	6	18	2	88
Hackettstown	22	4	4	0	0	16	46
Independence	61	14	22	5	11	0	113
Mansfield	31	1	9	1	0	0	42
Total	169	20	41	12	29	18	289

DISTRICT 3 (Central)

Township	*Regular Sites*	*Ext Release Briquets*	*Fish Sites*	*2 Person Sites*	*Aerial Sites*	*Untreated Sites*	TOTAL
White	46	4	15	0	4	0	69
Hope	43	7	14	2	1	0	67
Liberty	36	1	8	0	1	0	46
Frelinghuysen	58	7	6	3	6	0	80
Total	183	19	43	5	12	0	262

DISTRICT 4 (South)

Township	*Regular Sites*	*Ext Release Briquets*	*Fish Sites*	*2 Person Sites*	*Aerial Sites*	*Untreated Sites*	TOTAL
Alpha	5	0	0	0	0	0	5
Belvidere	8	0	1	2	0	0	11
Franklin	17	2	2	0	0	0	21
Greenwich	10	0	1	0	0	0	11
Harmony	35	0	6	1	0	0	42
Lopatcong	22	1	1	0	0	0	24
Oxford	31	4	9	3	15	0	62
Phillipsburg	0	0	1	0	0	0	1
Pohatcong	26	17	3	0	0	0	46
Washington Boro.	8	1	2	0	0	0	11
Washington Twsp.	38	7	6	0	0	0	51
Total	200	32	32	6	15	0	285
GRAND TOTAL	706	88	168	23	58	23	1,066

DISTRICTS 1, 2, 3 & 4 Catch Basins

Catch basins throughout the county, inspected and treated bimonthly	1800+
Swimming pools (abandoned/unused) constantly changing status	70+

KEY:

Regular Sites	Inspected regularly by one or more inspectors
Ext Release	Use of an extended release product for season long control- -primarily for safety concerns & visited only periodically
Fish	Sites where fish are regularly used for larval/pupal control -sites visited periodically to check on status of fish
2 Person	Sites where inspection in pairs (2 people) is advisable -primarily due to either size of the flooded area or a safety issue
Aerial	Parcels of land inspected seperated and larvicided using aircraft
Untreated	While periodically monitored for breeding theses sites are left untreated -primarily due to lack of human population or large size.

Warren County Mosquito Control Commission
2023 Airspray Site Treatments

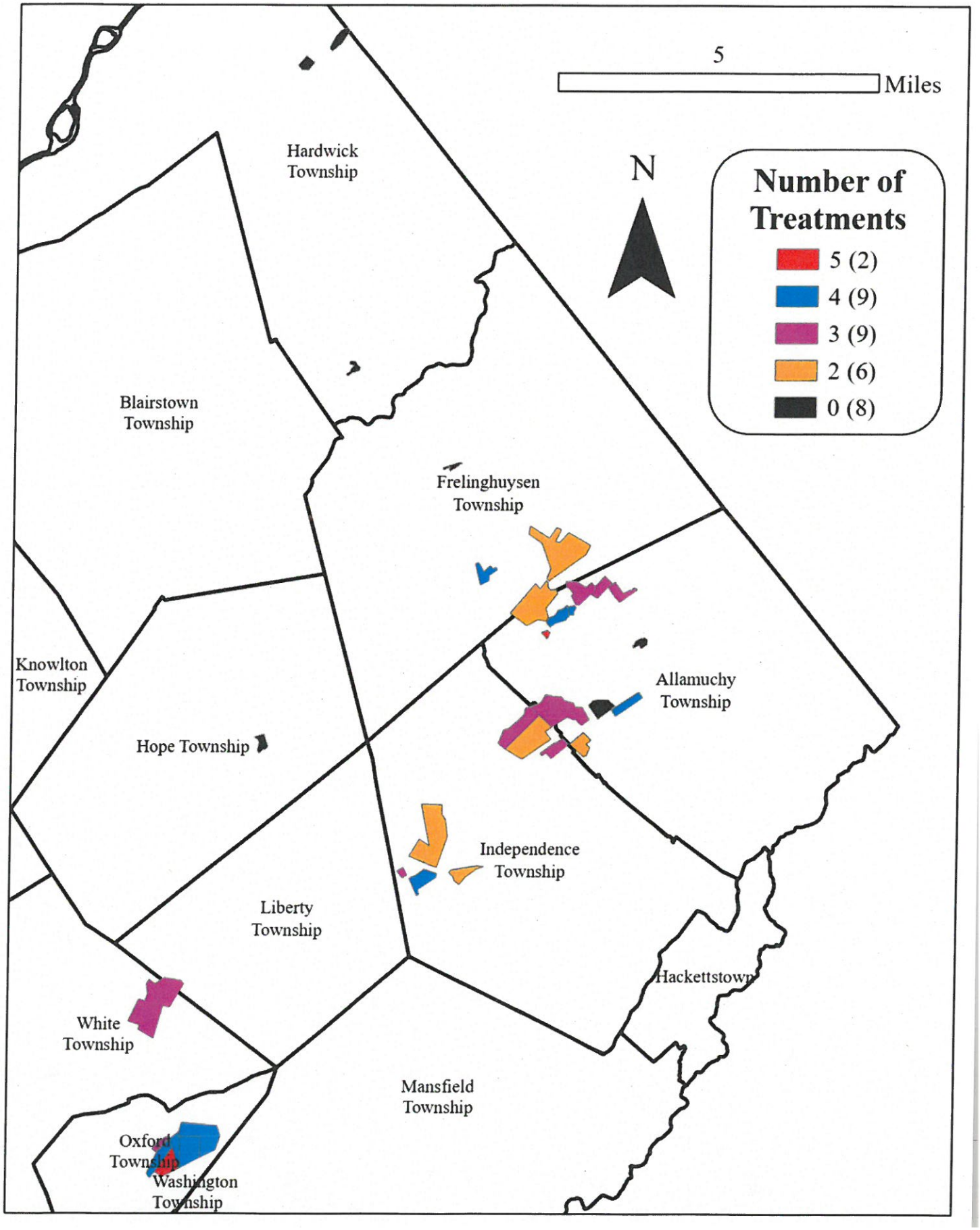


Figure 15a

Summary of 2023 Aerial Applications

Date	Area	Township	Acres Treated	
5/4/2023	Cat Swamp	Oxford	215	658
	Youngs Island	Independence/Allamuchy	317	
	Dragstrip & Herbies	Independence	51	
	Kasper Road	Allamuchy	37	
	Rydell Road	Allamuchy	38	
6/30/2023	Mountain Lake Bog	Liberty/White	242	1920
	Bear Creek	Allamuchy/Frelinghuysen	478	
	Rydell Road	Allamuchy	46	
	Youngs Island	Independence/Allamuchy	467	
	Johnsonburg Camp	Frelinghuysen	33	
	Dragstrip & Herbies	Independence	308	
	Cat Swamp	Oxford	346	
7/12/2023	Dragstrip & Herbies	Independence	59	770
	Youngs Island	Independence	36	
	Kasper Road	Allamuchy	37	
	Cat Swamp	Oxford	350	
	Mountain Lake Bog	Liberty/White	242	
	Johnsonburg Camp	Frelinghuysen	33	
	Rydell Road	Allamuchy	13	
7/19/2023	Bear Creek	Allamuchy	88	420
	Rydell Road	Allamuchy	46	
	Johnsonburg Camp	Frelinghuysen	33	
	Youngs Island	Independence	77	
	Cat Swamp	Oxford	176	
8/18/2023	Youngs Island	Independence/Allamuchy	476	1965
	Dragstrip & Herbies	Independence	308	
	Bear Creek	Allamuchy/Frelinghuysen	478	
	Johnsonburg Camp	Frelinghuysen	33	
	Rydell Road	Allamuchy	46	
	Cat Swamp	Oxford	350	
	Mountain Lake Bog	Liberty/White	242	
	Kasper Road	Allamuchy	32	

Summary of 2023 Aerial Applications

Figure 15a

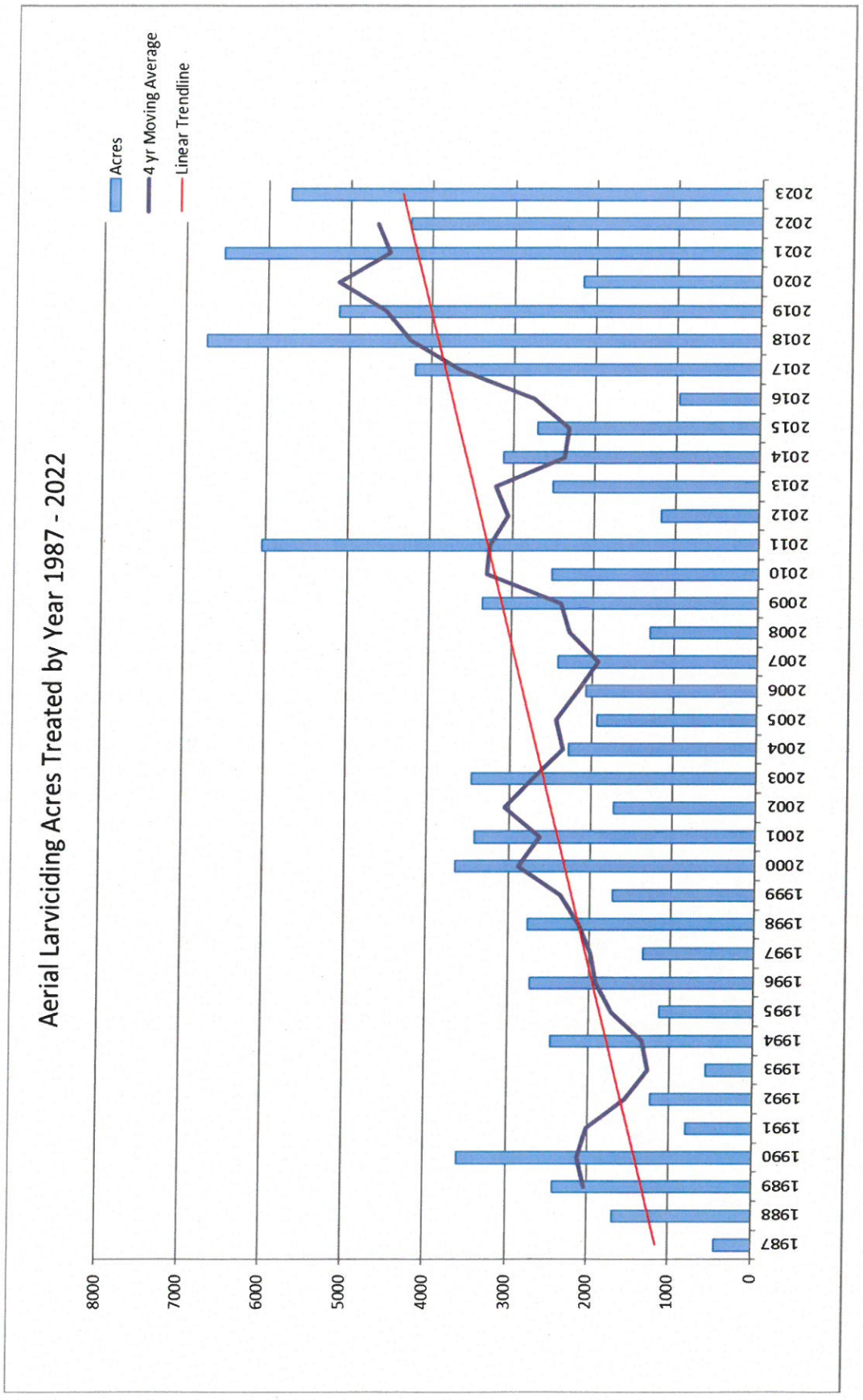
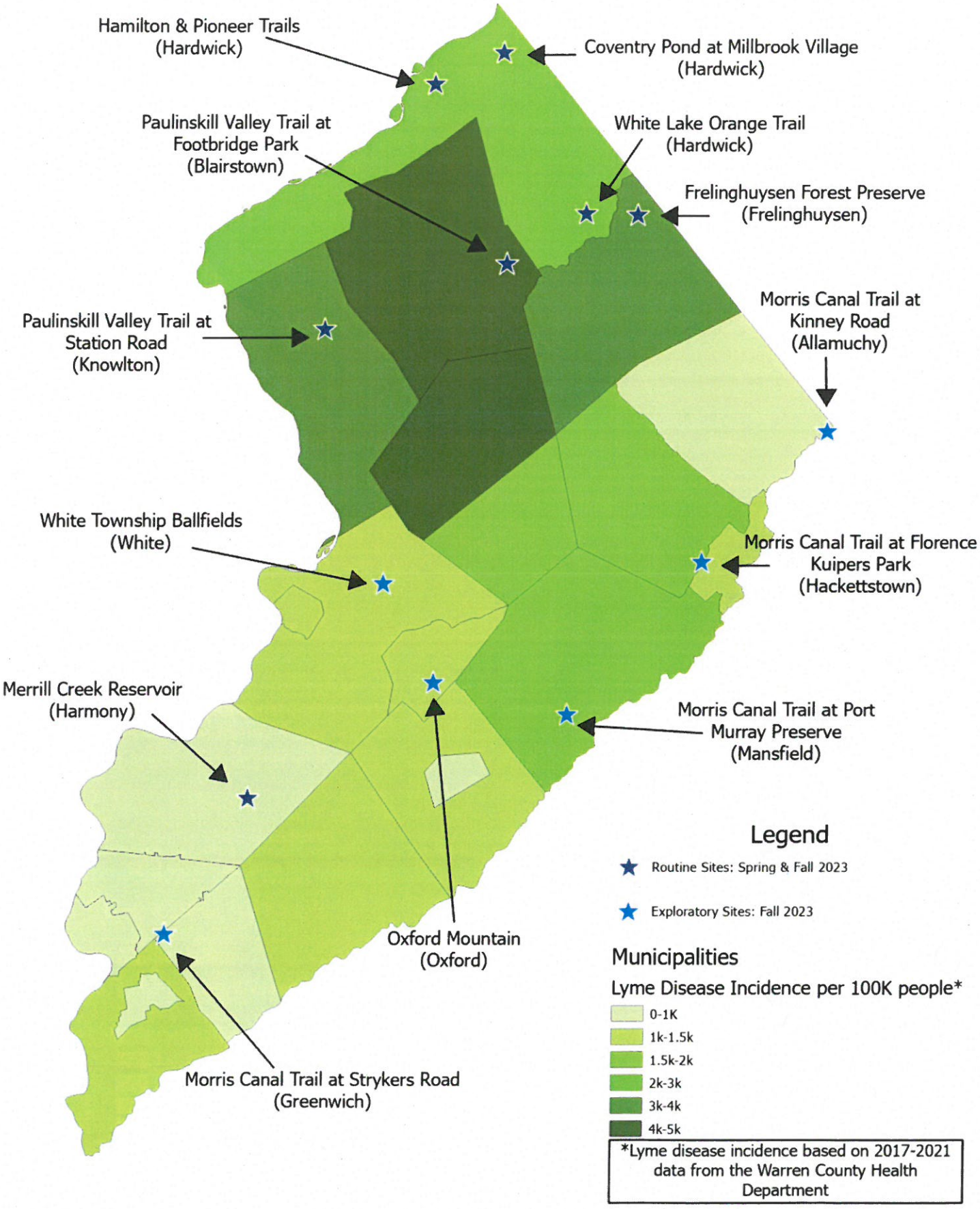


Figure 16

2023 Warren County Tick Surveillance Sites



2023 Warren County Tick Surveillance Summary

2023 Spring Collection Season																
			Ixodes scapularis			*Ixodes*	*Dermacentor variabilis*			*Amblyomma americanum*			*Haemaphysalis longicornis*			TOTAL
Site Name	Township	# Visits	Adult Female	Adult Male	Nymphs	Larvae	Adult Female	Adult Male	Nymph	Adult Female	Adult Male	Nymph	Adult Female	Adult Male	Nymph	
Paulinskill Valley Trail at Footbridge Park	Blairstown	6	6	7	21	–	2	4	–	–	–	–	–	–	–	40
Frelinghuysen Forest Preserve	Frelinhuysen	5	–	–	217	21	–	–	–	–	–	–	–	–	–	238
White Lake Orange Trail	Hardwick	5	2	–	290	6	4	2	–	–	–	–	–	–	–	304
National Water Gap: Coventry Pond Trail	Hardwick	1	3	1	38	–	7	5	–	–	–	–	–	–	–	54
National Water Gap: Hamilton/Pioneer Trail	Hardwick	1	–	–	2	–	10	4	–	–	–	–	–	–	–	16
Merrill Creek Reservoir	Harmony	4	–	–	277	45	–	–	–	–	–	–	–	–	–	322
Paulinskill Valley Trail at Station Road	Knowlton	7	24	17	83	–	21	21	–	–	1	–	–	–	–	167
	TOTALS	**29**	**35**	**25**	**928**	**72**	**44**	**36**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1141**

Figure 16a

2023 Warren County Tick Surveillance Summary

2023 Fall Collection Season																
			Ixodes scapularis			*Ixodes*	*Dermacentor variabilis*			*Amblyomma americanum*			*Haemaphysalis longicornis*			TOTAL
Site Name	Township	# Visits	Adult Female	Adult Male	Nymphs	Larvae	Adult Female	Adult Male	Nymph	Adult Female	Adult Male	Nymph	Adult Female	Adult Male	Nymph	
Kinney Road Morris Canal Trail	Allamuchy	2	53	33	–	–	–	–	–	–	–	–	–	–	–	86
Paulinskill Valley Trail at Footbridge Park	Blairstown	3	3	4	2	–	–	–	–	–	–	–	–	–	–	9
Frelinghuysen Forest Preserve	Frelinhuysen	2	5	7	–	–	–	–	–	–	–	–	–	–	–	12
Strykers Road Morris Canal Trail	Greenwich	2	12	6	–	–	–	–	–	–	–	–	–	–	–	18
Florence Kuipers Park Morris Canal Trail	Hackettstown	2	5	6	–	–	–	–	–	–	–	–	–	–	–	11
White Lake Orange Trail	Hardwick	2	4	4	–	–	–	–	–	–	–	–	–	–	–	8
National Water Gap: Coventry Pond Trail	Hardwick	1	28	30	–	–	–	–	–	–	–	–	–	–	–	58
National Water Gap: Hamilton/Pioneer Trail	Hardwick	1	–	14	–	–	–	–	–	–	–	–	–	–	–	14
Merrill Creek Reservoir	Harmony	1	–	6	–	–	–	–	–	–	–	–	–	–	–	6
Paulinskill Valley Trail at Station Road	Knowlton	2	1	7	–	–	–	–	–	–	–	–	–	–	–	8
Port Murray Preserve Morris Canal Trail	Mansfield	2	27	25	1	–	–	–	–	–	–	–	–	–	–	53
Oxford Mountain Natural Resource Area	Oxford	2	2	–	–	–	–	–	–	–	–	–	–	–	–	2
White Township Ballfields	White	2	1	1	–	–	–	–	–	–	–	–	–	–	–	2
	TOTALS	**24**	**141**	**143**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**287**

Figure 16a

Figure 16b Tick Pool summary

Site Name	Township	2023 SPRING # pools	# ticks tested	# pools positive						Number of total positives
				A. phagocytophilum	B. burgdorferi	B. miyamotoi	B. microti	R. rickettsii	POW	
Paulinskill Valley Trail at Footbridge Park	Blairstown	38	39	4	12	0	5	0	0	21
Frelinghuysen Forest Preserve	Frelinhuysen	169	217	9	13	4	6	0	0	32
White Lake Orange Trail	Hardwick	240	289	1	17	5	6	0	0	29
National Water Gap: Coventry Pond Trail	Hardwick	45	54	2	7	1	2	0	0	12
National Water Gap: Hamilton/Pioneer Trail	Hardwick	5	16	0	1	0	0	0	0	1
Merrill Creek Reservoir	Harmony	229	277	16	17	13	7	0	0	53
Paulinskill Valley Trail at Station Road	Knowlton	139	166	2	41	1	22	0	0	66
	TOTAL	865	1058	34	108	24	48	0	0	214

*34 co-infections

Site Name	Township	2023 FALL # pools	# ticks tested	# pools positive						Number of total positives
				A. phagocytophilum	B. burgdorferi	B. miyamotoi	B. microti	R. rickettsii	POW	
Kinney Road Morris Canal Trail	Allamuchy	86	86	4	42	1	2	–	0	49
Paulinskill Valley Trail at Footbridge Park	Blairstown	9	9	0	5	0	2	–	0	7
Frelinghuysen Forest Preserve	Frelinhuysen	12	12	1	1	0	1	–	0	3
Strykers Road Morris Canal Trail	Greenwich	18	18	0	10	0	5	–	0	15
Florence Kuipers Park Morris Canal Trail	Hackettstown	11	11	1	0	1	0	–	0	2
White Lake Orange Trail	Hardwick	8	8	0	3	0	1	–	0	4
National Water Gap: Coventry Pond Trail	Hardwick	58	58	9	28	0	4	–	0	41
National Water Gap: Hamilton/Pioneer Trail	Hardwick	14	14	2	7	0	1	–	0	10
Merrill Creek Reservoir	Harmony	6	6	0	4	0	0	–	0	4
Paulinskill Valley Trail at Station Road	Knowlton	8	8	0	4	1	0	–	0	5
Port Murray Preserve Morris Canal Trail	Mansfield	51	51	4	24	0	2	–	1	31
Oxford Mountain Natural Resource Area	Oxford	–	–	–	–	–	–	–	–	0
White Township Ballfields	White	1	1	0	0	0	0	–	0	0
	TOTAL	282	282	21	128	3	18	–	1	171

*24 coinfections
*1 tri-infection

Figure 16b