STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

BOARD OF PESTICIDES CONTROL

October 25, 2024

MINUTES

1. Introductions of Board and Staff

- Board members: Adams, Bohlen, Carlton, Fanning, Gray
- Staff: Boyd, Couture, Peacock, Pietroski, Vacchiano

2. Welcome New & Reappointed Board Members

On September 9, 2024, the ACF Committee confirmed the appointments of two new Board members and reappointed two existing members to the BPC. The Senate accepted these appointments on October 10, 2024.

Presentation By: Alex Peacock, Director
Action Needed: Discussion

- Peacock welcomed newly appointed Board members Phillip Fanning and Justin Gray. He also noted the reappointment of Curtis Bohlen and Robert Carlton. Peacock thanked Dominic Lajoie for his service on the Board.

3. Minutes of the September 6, 2024 Board Meeting

Presentation By: Alex Peacock, Director
Action Needed: Amend and/or Approve

- **Carlton/Bohlen: Moved and seconded to approve the September 6, 2024, minutes**
- **In Favor: Unanimous**

4. Groundwater Monitoring Plan Revision

The BPC Generic State Management Plan for Pesticides and Groundwater has not been updated since 2006. Staff is suggesting updates and revisions to the plan to ensure it remains relevant and effective.

ALEXANDER PEACOCK, DIRECTOR
90 BLOSSOM LANE, DEERING BUILDING

PHONE: (207) 287-2731
WWW.THINKFIRSTSPRAYLAST.ORG

Presentation By: Julia Vacchiano, Pesticide Registrar/Water Quality Specialist
Action Needed: Discussion

- Vacchiano provided the Board with the 1994 Groundwater Monitoring Plan, which had not been revised in eighteen years. The plan called for groundwater monitoring every five to seven years to assess potential pesticide contamination problems and the extent of any identified problems. Pesticide management practices would then be implemented in response to identified pesticide contamination trends. Vacchiano asked the Board for feedback on updating the plan.
- Gray asked if Vacchiano had specific concerns.
- Vacchiano said she was currently working to complete the aerial forestry report and planning the 2025 water quality study, but updating the Groundwater Monitoring Plan was also on the list of projects for next year. She stated that she was hoping for the Board's initial thoughts and wanted them to begin thinking about water quality as a regular part of what the BPC does by introducing this plan most may have never seen.
- Bohlen stated that there were a lot of outdated procedures in the plan. He added that they needed to think about how the committees that oversaw the drafting and revision were structured.
- The Board said more time was needed to carefully review the plan. They asked that staff bring it back at the next meeting.

5. Service & Secondary Container Labeling Policy

Staff have drafted a policy based on EPA recommendations for labeling Secondary and Service Containers.

Presentation By: Alex Peacock, Director
Action Needed: Amend and/or Adopt

- Peacock explained that staff occasionally encountered companies buying products in higher concentrations and breaking them down into secondary containers. Staff had encountered several unlabeled secondary containers. He detailed suggested language of data that would be required to appear on these containers to achieve compliance, and especially to protect human and environmental health.
- Carlton asked what would constitute a label for a secondary container.
- Peacock said it could be a sticky label or information written with an indelible marker on the container.
- There was discussion about considering the requirement that anything left at the end of the day in a batch mix tank must be labeled.
- Adams thought it was a tall order to require the dilution rate on the secondary label.
- Bohlen asked if this had any implications for enforcement and, if not, what was the purpose that made it necessary.
- Peacock replied that as a policy, there would not be any enforcement, but depending on the level of compliance, the Board may consider adding it to the rule. He added that the policy's purpose was to reduce the number of times staff came across unlabeled pesticides.
- Adams asked if it would be major substantive to incorporate this language into Chapter 29.
- Gustanski replied in the affirmative but would need to review Title 7 Sec. 610 to confirm.
- Adams said that he had experienced this over the years and thought it would be a good idea to put it into rule.

- There was discussion about what information should be required on the secondary label, the policy's limit, and who it should apply to.
- Peacock suggested that staff could add language so that it only applied to licensed applicators.
- Gray stated that it seemed redundant to require that 'follow all label directions' be written on the secondary label.
- Deven Morrill, Regional Manager, Lucas Tree Expert Co, Inc., stated that they were in opposition to the proposed policy because the Occupational Safety and Health Administration (OSHA), as well as the US Department of Transportation (DOT) already regulated how pesticides were transported and labeled and had the authority to cite for an unmarked container. He added that Chapter 29 standards also discussed transportation standards. Morrill stated that he felt that the BPC already had the authority to enforce this, and a policy that went above and beyond federal standards would only further confuse and complicate interstate travel.
- Adams asked staff to bring back draft language for incorporation into the rule.

6. <u>Enforcement Protocol</u>

During previous presentations of enforcement actions through consent agreements, the Board has asked Staff to alert them prior to settlement of a consent agreement when certain factors of an enforcement case exist, such as harm to human health or the environment and repeat offenders. Draft language has been added to the existing enforcement protocol for the Board's consideration.

Presentation By: Alex Peacock, Director
Action Needed: Amend and/or Adopt

- Peacock stated that the Board expressed interest in hearing why certain violations occurred. There should be language for certain violations that trigger staff to bring the case before the Board before entering into a consent agreement.
    - **Carlton/Bohlen: Moved and seconded to adopt the draft language**
    - **In Favor: Unanimous**

7. <u>Report on repeat violations by Mosquito Squad of Southern Maine</u>

During several inspections in 2024, it was determined that the Mosquito Squad of Southern Maine had committed several violations. The BPC has previously accepted consent agreements with the Mosquito Squad of Southern Maine on 11/19/2021 and 2/9/2024. This report is being presented pursuant to the Board's request to be notified of repeat offenders prior to finalizing a consent agreement.

Presentation By: Alex Peacock, Director
Action Needed: Discussion/Guidance

- Peacock summarized the violations that Board staff had identified. These included application to an unauthorized property, non-compliance with label required PPE, and indication of off-target deposition. Additionally, the labels each had language to avoid blooming crops and weeds, but no effort was made to avoid them. The label of a specific lambda-cyhalothrin product being used said not to apply the product in residential areas, such as homes. Mosquito Squad of Southern Maine was alerted, and the company switched to another lambda-cyhalothrin product.

- Adams asked if part of the reason this was on the agenda was because of the history of violations.
- Peacock replied that a consent agreement was settled with Mosquito Squad of Southern Maine in 2021 for multiple infractions. There were no further infractions in a three-year period. In 2023 there were additional violations.
- Adams explained that over the past year, the Board had a lot of discussion on how to take action that would have a more lasting impact on preventing repeat offenses. Adams asked Gustanski what the process was for license suspension or revocation.
- Gustanski replied that pursuing revocation would require going to the district court and the Board had the authority to temporarily suspend for up to 45 days.
- There was discussion about penalties that could be levied for repeat violations within a four-year period. For the 2024 infractions the penalty could be up to $4,000 per violation, plus the $2,000 which had been suspended from the 2021 consent agreement.
- Carlton stated that this number of violations over the last few years was very concerning. He said that, as a Board, they needed to act because it seemed like monetary penalties were not working. Carlton added that for some companies, it seemed like the penalties were the cost of doing business.
- Gray stated that the company's track record leading up to these latest violations was worrisome.
- There was further discussion about how to proceed. The Board recommended that staff go forward with negotiating a consent agreement.

8. Other Old and New Business

   a. Variance Permit for CMR01-026 Chapter 29, Abenakee Golf Club, Parterre Ecological/Parterre Garden Services, Invasive Species Management, Biddeford
   b. New active ingredient: Pethoxamid, preemergent for turf care submitted for registration.
   c. EPA Finalizes Rule to protect farmworkers, Families and Communities from Pesticide Exposures
   d. EPA Updates Mitigation Menu Website with Options to Protect Nontarget Species from Pesticide Runoff
   e. EPA Releases Pesticide and Endangered Species Educational Resources Toolbox
      - Peacock talked about some of the outreach and education that staff had planned to inform the regulated community.

   f. Through an EPA grant BPC will be hosting 50 attendees from EPA Region 1 and Maine for National Certified Investigator/Inspector Training (NCIT) provided by The Council on Licensure, Enforcement & Regulation (CLEAR) in Augusta on November 13, 14, 15, 2024.
   g. E-Commerce Update & Brief Discussion
      - Peacock stated that many pesticides used in Maine were purchased online and delivered. He said that all companies that sell or distribute pesticides in the state of Maine are required to be licensed, both general use and restricted use pesticide dealers. Peacock said that many companies may not be aware of the number of Maine state restricted use pesticides, such as aquatic herbicides, Dylox, and others. He told the Board that staff would be looking into this and outlined how some other states were managing licensure compliance with online vendors.
      - Adams cautioned about spending a lot of staff time on this since it was a very large issue.

9. Schedule of Future Meetings

The next scheduled Board meeting date is December 6, 2024. The Board will decide whether to change and/or add dates. January 15, 2025 (ATS), Projected future dates: February 28, 2025, April 11, 2025.

Maine Agricultural Trade Show, January 14, 15 & 16, 2025. Board meetings typically occur on Wednesday of the ATS with a public forum. Augusta Civic Center v. Deering 101?

- Pietroski stated that staff could facilitate the Board meeting at the Augusta Civic Center.
- Bohlen replied that he would like to have the meeting at the civic center, and other Board members agreed.

10. Adjourn

  - **Carlton/Gray: Moved and seconded to adjourn at 10:42 AM**
  - **In Favor: Unanimous**

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
PLANT HEALTH PROGRAM
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

To: Board of Pesticides Control
From: Hillary Peterson, Integrated Pest Management Specialist
Re: Request for Funding
Date: November 1, 2024

The Integrated Pest Management Program is requesting funds to assist with ongoing efforts for the advancement of IPM in Maine. The Maine IPM Program works closely with the BPC to educate and promote IPM across the entire State of Maine, including giving talks annually for applicator credits across several categories, updating the GotPests Website with new factsheets and research, and referring to the BPC website in all presentations and educational materials.

Over the past three years, the program has been funded through various means including some BPC funding, general plant health funding, and grants received by the program. To run a consistent IPM program, funding needs to be secured for the 2025 calendar year. Programs that require funding include: Outreach and education, including travel for presentations, materials such as printing costs and handouts, and IPM Council tabling outreach events ($7,000 estimated); School IPM Program specific events and printing costs ($300 estimated); purchases related to the mosquito monitoring program ($600 estimated); and funds for a temporary hire to perform mosquito monitoring and IPM outreach efforts for 42 weeks out of 2025 ($38,640 estimated). Maintaining the same temporary hire who was brought on in 2024, supported by both BPC funding and an estimated $9,200 of Swallowwort Biocontrol grant funding in 2025 will result in more consistency across the program next year, as the current technician is excellent at mosquito taxonomy and has great interest in improving the program this winter and spring.

The IPM program is requesting a total budget of $46,540.00 for the 2025 program. Please see the following pages for a breakdown of the costs and expenditures from the 2024 BPC Funds.

Sincerely,

Hillary Peterson,
IPM Entomologist
Maine Department of Agriculture, Conservation and Forestry

2024 IPM Program BPC Funds Report

The Integrated Pest Management Program requested a total budget of $35,621 for the 2024 program, allotted to the following projects: Greenhouse IPM (estimated at $1,110 annually), outreach specific to the IPM council and its mission (estimated at $2,550 annually), funds for travel to provide education and outreach on various IPM topics, often for CEU Credits (estimated at $9,471 annually), the School IPM Program (estimated at $1,500 annually), structural IPM programs (namely, the Rodent Academy, which maintains a relationship with the world-renowned Rodentologist Bobby Corrigan, estimated at $10,000 annually), and the mosquito monitoring program (estimated at $11,0000 annually). Of these funds, $12,110 allotted to the Greenhouse IPM workshop and the Rodent Academy were to be spent and reimbursed, while the other funds were to be spent and not reimbursed.

Due to inefficiencies at the State level, and changes in the University of Maine event registration process, the allotted funds to be reimbursed were not used in 2024. The greenhouse IPM program was held, and instead of BPC funds being used and then reimbursed, a different system was used with the University of Maine. Attendance at the program paid for all needed costs, and educational materials were provided to growers at the event and spent out of outreach and education allotment. Due to a lack of a reimbursement system at the state level, it was decided to cancel plans for hosting a 2024 Rodent Academy, and time will be spent in the coming months determining what this may look like in the coming year.

An overview of the funds demonstrates that all funds will be spent by 12/31/2024. Some rebudgeting occurred from the original categories, primarily shifting more funds to the vector responsibilities section to keep the temporary hire on through the winter. Other grant funding allows the program to keep the temporary hire on through the spring, and the current hire is enthusiastic about improving both the mosquito program and IPM education and outreach. Categories also blurred at times – for example, many items under "outreach and education" were also related to the IPM council, and some work performed by the temp hire falls under outreach and the school IPM program. This is demonstrated in the table below:

Category	**Budget**	**Spent**	**Remaining**
IPM Council	$ 2,550.00	$ 350.00	$ 2,200.00
Outreach / Education	$ 9,471.00	$ 5,955.25	$ 3,515.75
School IPM	$ 1,500.00	$ 150.00	$ 1,350.00
Vector Responsibilities	$ 14,300.00	$ 21,365.75	$ (7,065.75)
Total	**$ 27,821.00**	**$ 27,821.00**	**$ -**

Continue to next page

The following list provides a more in-depth breakdown of spending within each category:

IPM Council	**$**	**350.00**
Maine Municipal Association Advertisement	$	350.00
Outreach / Education	**$**	**5,954.77**
2024 Common Ground Table	$	124.00
2024 Maine Sustainability and Water Conference	$	200.00
2024 MISN Registration	$	20.00
NYC Rat Summit - Attendee	$	1,177.12
The Physician's Guide to Delusional Infestation (Book)	$	109.00
WB Mason (Binders for Greenhouse BMP Workshop)	$	147.65
Outreach Materials - Brochures, Tabling Materials, Bulletin Board, etc. (Anticipated to be spent by 12/31/2024)	$	4,177.00
School IPM	**$**	**150.00**
School IPM Nurses Conference Registration	$	150.00
Vector Responsibilities	**$**	**21,365.75**
Temp hire - Mosquito work Completed	$	13,420.50
Temp hire - Mosquito & IPM work (Anticipated)	$	7,360.00
Mosquito Batteries	$	66.42
Mosquito Field Supplies (Backpack, fanny packs, sunscreen, bug spray)	$	130.44
Mosquito gravid trapping batteries	$	82.18
Mosquito Supplies (tape, head nets, petri dishes, specimen manipulators, microscope camera, ice packs)	$	232.75
Mosquito vacuum wire - amazon	$	25.00
Mosquito vacuum wire and connectors	$	48.46

Maine DACF IPM Program Update & Funding Request

Maine Board of Pesticides Control
December 6, 2024

Hillary Peterson, Ph.D.

Maine Department of Agriculture, Conservation and Forestry

hillary.peterson@maine.gov

www.maine.gov/ipm

maine MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

2024 BPC Funding Allocation

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Project	Sub-Category	Budget	
2024 BPC Fund	*Greenhouse IPM*	*NA*	
2024 BPC Fund	IPM Council	$	2,550.00
2024 BPC Fund	Outreach / Education	$	9,471.00
2024 BPC Fund	School IPM	$	1,500.00
2024 BPC Fund	*Structural IPM*	*NA*	
2024 BPC Fund	Vector Responsibilities	$	14,300.00
		Total $	**27,821.00**

2024 BPC Funding Allocation

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

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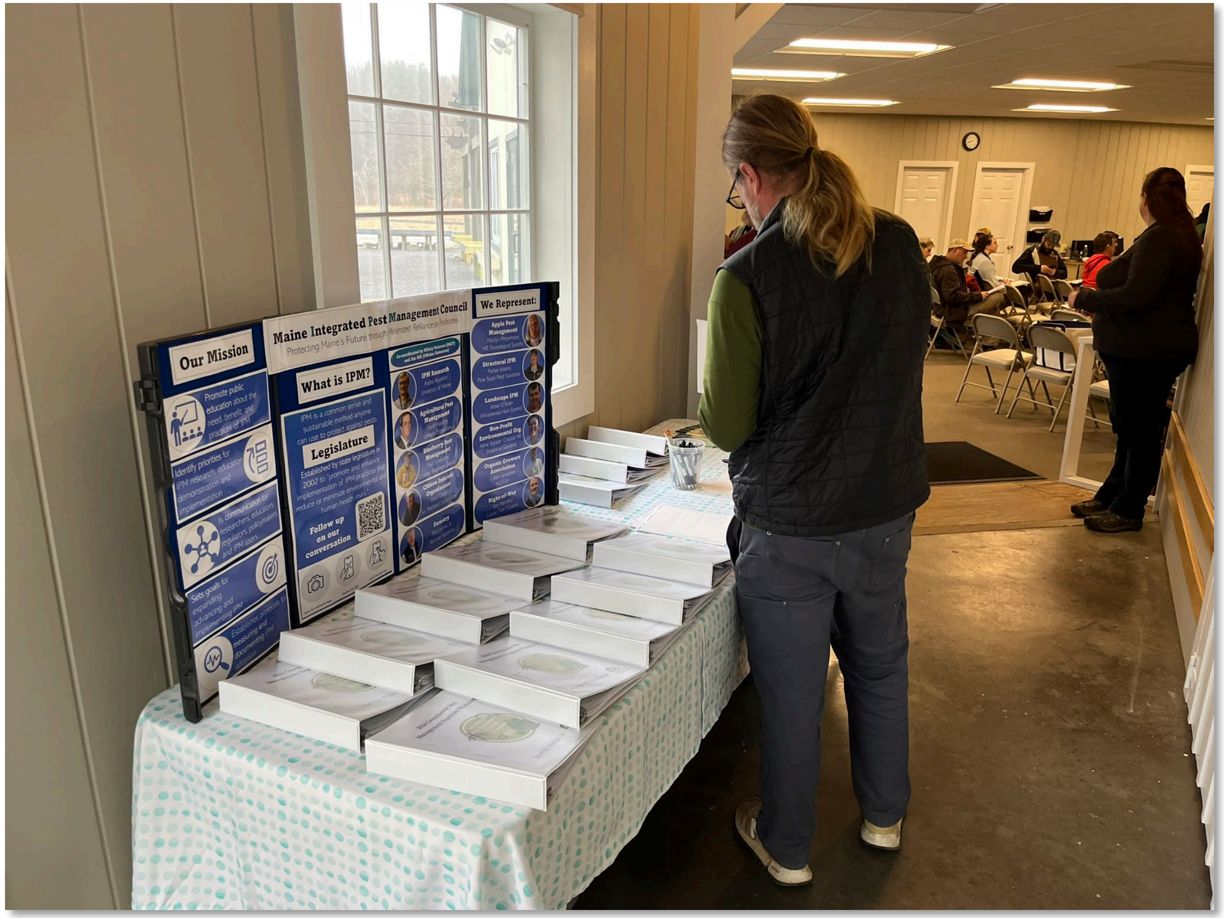
2024 BPC Fund	Outreach / Education	$ 9,471.00	$ 2,972.49	$ 6,498.51
2024 BPC Fund	School IPM	$ 1,500.00	$ 150.00	$ 1,350.00
2024 BPC Fund	*Structural IPM*	*NA*	*NA*	*NA*
2024 BPC Fund	Vector Responsibilities	$ 14,300.00	$ 20,445.75	$ (6,145.75)
	Total	**$ 27,821.00**	**$ 23,918.24**	**$ 3,902.76**

The Greenhouse IPM & Rodent Academy categories were essentially "loans" from BPC to be refunded. Neither were used as we could not determine the best system within the state to do so, we collaborated with UMaine for the Greenhouse BMP Meeting and did not run the Rodent Academy (also partially due to a medical event).

Some of the education and outreach funds were used to provide booklets to attendees of the Greenhouse IPM Meeting.

2024 Greenhouse BMP Workshop

Approximately 40 attendees gathered on March 5 at Longfellow Greenhouses in Manchester



2024 Greenhouse BMP Workshop

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

March 5, 2024 (March 8 Rain Date)
Longfellow's Greenhouses
81 Puddledock Rd, Manchester, ME

Approved for 3 pesticide applicator credits with full-day attendance.

8:30 – 9:00 AM	**Check-in and Coffee**
9:00 – 9:05 AM	**Welcome and Introductions**
9:05 – 9:30 AM	**Rodents & Other Mammals Around the Greenhouse** *Hillary Peterson, DACF IPM Specialist* *Kirk Michaud (Wildlife Specialist, USDA APHIS Wildlife Services)*
9:30 – 10:00 AM	**Recycling Plastics in the Greenhouse** *Lee Skillin, Skillin's Greenhouses*
10:00 – 11:00 AM	**Hiring and Retention of Employees** *Jason Entsminger, Ph.D., UMaine Cooperative Extension Specialist: Small Business*
11:00 – 11:15 AM	**Break**
11:15 – 12:15 PM	**Plant Disease Prevention, Detection, and Management** *Dr. Alicyn Smart, University of Maine*
12:15 – 1:00 PM	**Lunch – Brown Bag Lunch**

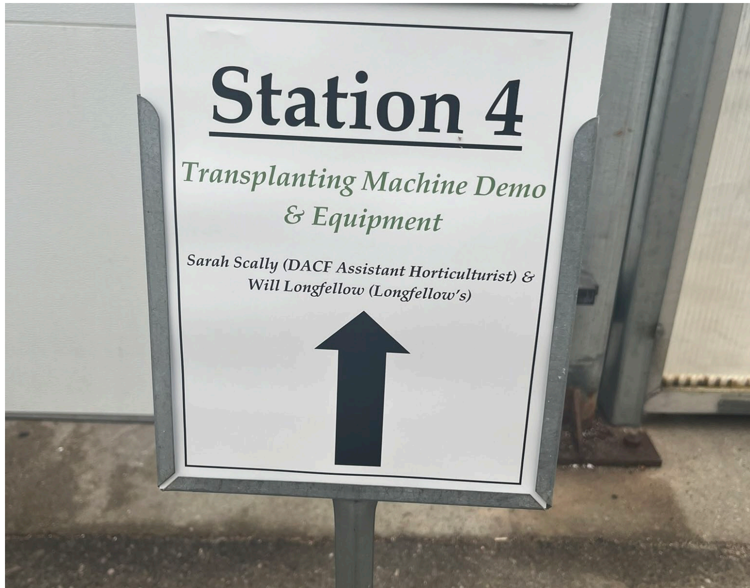
2024 Greenhouse BMP Workshop

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

1:00 – 3:30 PM	**Guided Tour of Longfellow's Greenhouses with Hands-On Activity Stations** *(25 Minutes per Station. See Map for your Group Number & Order of Stops)* **Station #1: Biological Control** *Diana LeBlanc (Longfellow's) & Hillary Peterson (DACF IPM Specialist)* **Station #2: Improving Disease Detection & Sanitation** *Dr. Alicyn Smart (University of Maine) & Matt Bilodeau (Longfellow's)* **Station #3: Perennials & Rodents and other Mammals** *Crystal Ferris (Longfellow's) & Kirk Michaud (Wildlife Specialist, USDA)* **Station #4: Transplanting Machine Demo & Equipment** *Will Longfellow (Longfellow's) & Sarah Scally (DACF Assistant Horticulturist)* **Station #5: Watering, pH & Calibrating Equipment** *Monica Bragg (Longfellow's) & Carole Neil (DACF Assistant Horticulturist) & Jeff Skillin (Head Grower, Skillins Greenhouses)*
3:30 – 4:00 PM	**Q&A Session, Grower Discussion & Wrap Up**


RESTROOMS


AMBLYforce
BeneficialInsectary


Station 4
Transplanting Machine Demo
& Equipment
Sarah Scally (DACF Assistant Horticulturist) &
Will Longfellow (Longfellow's)

2024 BPC Funding Allocation

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

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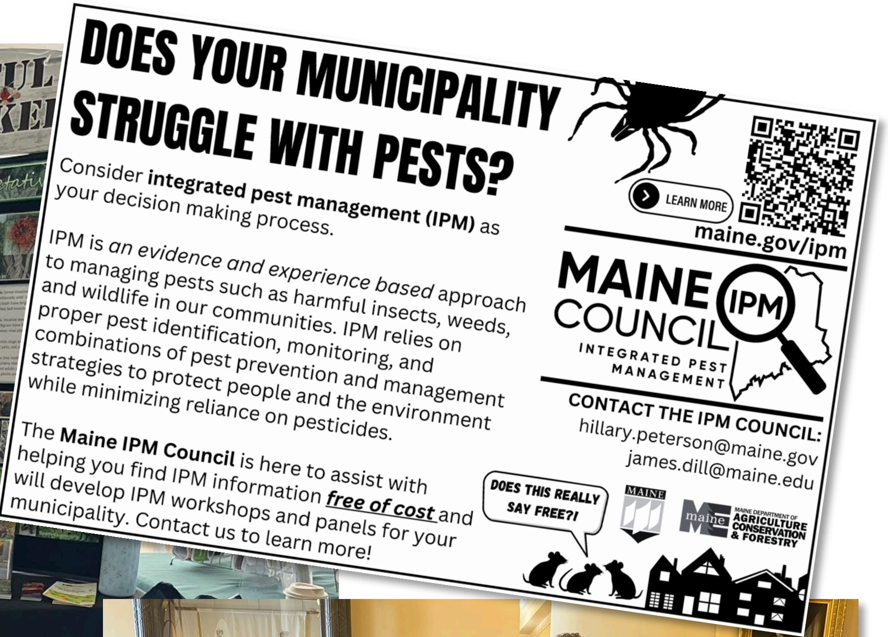
These two categories make the most sense to lump – we spent less than anticipated, and it was decided to use some funds towards keeping our temporary hire on through the fall and winter due to increased mosquito responsibilities and opportunities for education and outreach.

Funds will be spent from the remaining $3,902 on much needed outreach materials and attendance at the National Mosquito and Control Association meeting in December.

2024 IPM Council Outreach

- **Advertisement in Maine Municipal Association Catalog**
- **Greenhouse Best Management Practices Workshop** – approx. 40 reached
- **Maine Agricultural Day at the Legislature** – approx. 44 reached (including Janet Mills!)
- **Common Ground Country Fair** – approx. 600 reached



2024 IPM Outreach & Education

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Selected Presentations:

- Restaurant IPM Presentation for DHHS inspectors
- "The Maine IPM Toolbox" for the Ag Trades Show
- Maine State Update: Tri-State IPM Series
- Maine Calling: Beneficial Insects
- IPM for Arborists
    - Maine Arborist Association Annual Meeting
    - Maine Conservation Corps Stewards Training
- Swallowwort Biocontrol Presentations:
    - Friends of Merrymeeting Bay
    - Knox-Lincoln Soil & Water Conservation District
- Jumping Worm Talk: Old Bristol Garden Club
- Panelist: Northeastern Mosquito Control Association

Other Outreach & Networking:

- National Urban Rat Summit
- Tabling: Ag Trades Show
- MISN Meeting: Organizer
- Tri-State IPM Meeting: Organizer

2024 National Urban Rat Summit

2024 BPC Funding Allocation

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

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I had intended on using funds to build a new turfgrass workshop for the School IPM workshop this past summer, however I was unable to do so due to a medical event this past spring.

Funds were reallocated towards keeping the temp hire on this winter.

2024 School IPM Program

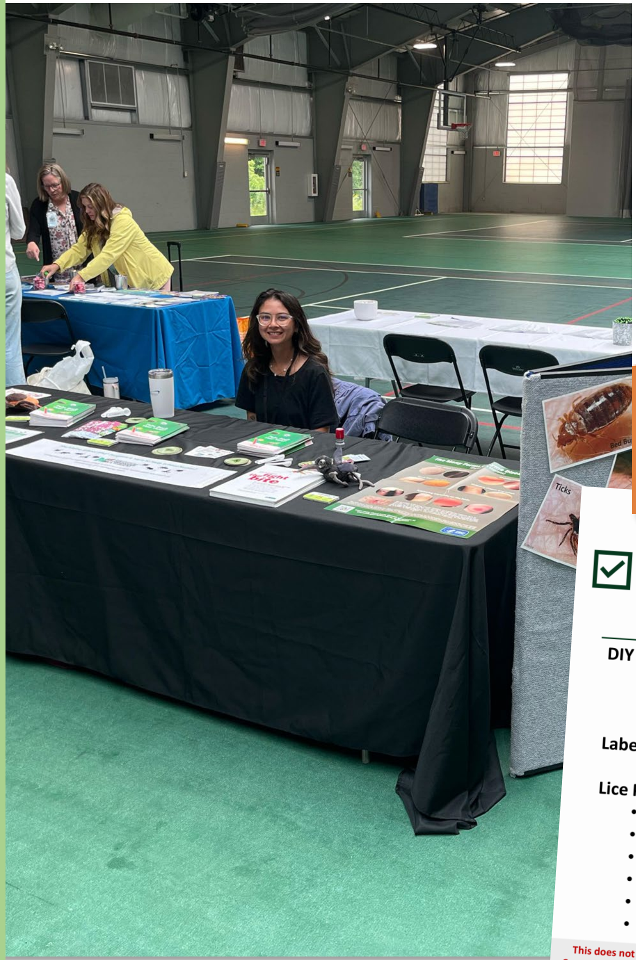
Comprehensive Trainings – 65 certificates total

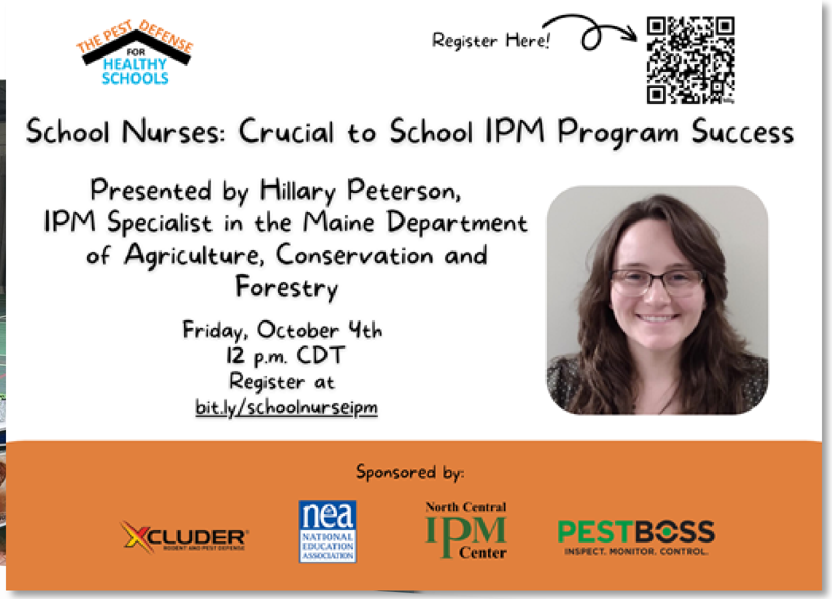
- Songo Locks School (Naples) – 9 attendees
- Education Plant Maintenance Association (EPMA) annual conference (Waterville) – 20 attendees

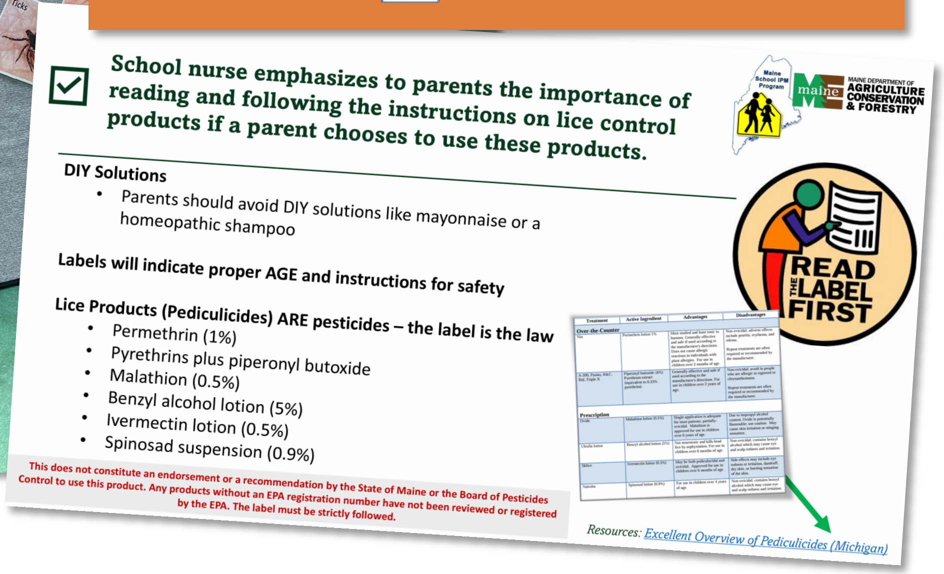
Initial Trainings – 43 certificates total

School Nurse Outreach

- School Nurse Conference (Waterville) – 75 conversations
- Pest Defense for Healthy Schools Webinar and Blog Post (Virtual) - ~20 attendees







2024 BPC Funding Allocation

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	Total	**$**	**27,821.00**	**$**	**23,918.24**	**$**	**3,902.76**

As mentioned previously, more funds were allocated to a temporary hire for vector work and vector supplies this year due to a mosquito season with increased needs of time, supplies, and labor.

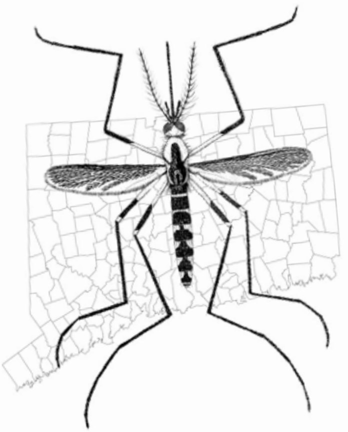
2024 Vector Responsibilities

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Maine CDC detects West Nile virus in Gorham crow

by WGME Staff | Tue, November 19th 2024 at 1:10 PM

IDENTIFICATION GUIDE
TO THE
MOSQUITOES OF CONNECTICUT



Theodore G. Andreadis, Michael C. Thomas, & John J. Shepard
Illustrations by Gale Ridge
The Connecticut Agricultural Experiment Station
123 Huntington Street
New Haven, CT 06511

Locally Acquired Eastern Equine Encephalitis Virus Infection Identified in a Maine Resident

Nov 07, 2024

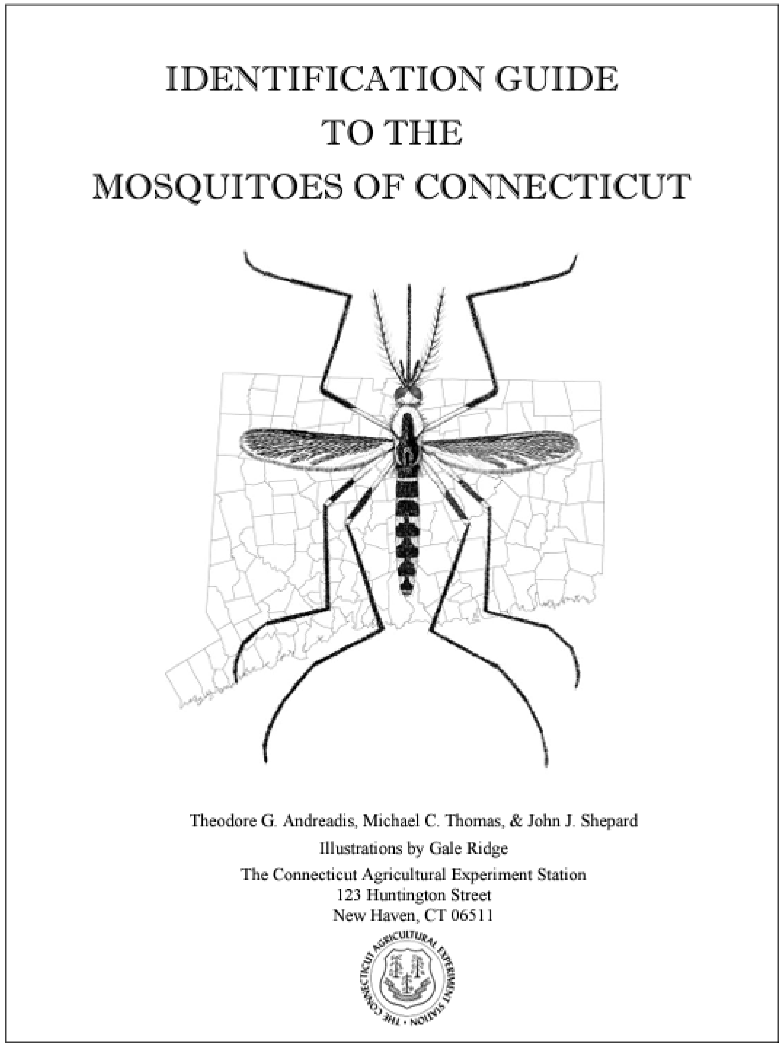
Public reminded to monitor for signs of mosquito-borne illness

ARBOVIRUSES ISOLATED FROM MOSQUITOES IN CONNECTICUT

Mosquito Species	**Arbovirus***							
	CV	EEE	FL	HJ	JC	TVT	WEE	WN
Aedes								
Aedes cinereus	X	X		X	X			X
Aedes vexans	X	X		X	X			X
Anopheles								
Anopheles punctipennis	X	X		X	X	X		X
Anopheles quadrimaculatus	X	X		X				X
Anopheles walkeri	X	X			X			X
Coquillettidia								
Coquillettidia perturbans	X	X	X	X	X	X		X
Culex								
Culex pipiens		X	X	X				X
Culex restuans		X	X	X	X			X
Culex salinarius		X	X	X				X
Culex territans		X						
Culiseta								
Culiseta melanura	X	X	X	X			X	X
Culiseta morsitans		X		X	X			
Ochlerotatus								
Ochlerotatus abserratus					X			
Ochlerotatus aurifer					X			
Ochlerotatus canadensis	X	X		X	X			X
Ochlerotatus cantator	X	X		X	X			X
Ochlerotatus communis					X			
Ochlerotatus excrucians					X			
Ochlerotatus provocans					X			
Ochlerotatus sollicitans	X	X			X			X
Ochlerotatus sticticus	X	X			X	X		X
Ochlerotatus stimulans				X	X			
Ochlerotatus taeniorhynchus	X	X			X			X
Ochlerotatus triseriatus	X	X		X	X			X
Ochlerotatus trivittatus	X	X			X	X		X
Psorophora								
Psorophora ferox	X	X		X	X	X		X
Uranotaenia								
Uranotaenia sapphirina		X		X				X

* CV-Cache Valley, EEE-Eastern equine encephalitis, FL-Flanders, HJ-Highlands J, JC-Jamestown Canyon, TVT-Trivittatus, WEE-Western equine encephalitis, WN-West Nile

2024 Vector Responsibilities



Mosquito Species	EEE	JCV	WNV
Aedes cinereus	X	X	X
Aedes vexans	X	X	X
Anopheles punctipennis	X	X	X
Anopheles quadrimaculatus	X		X
Anopheles walkeri	X	X	X
Coquillettidia perturbans	X	X	X
Culex pipiens	X		X
Culex restuans	X	X	X
Culex salinarius	X		X
Culex territans	X		
Culiseta melanura	X		X
Culiseta morsitans	X	X	
Ochlerotatus abserratus		X	
Ochlerotatus aurifer		X	
Ochlerotatus canadensis	X	X	X
Ochlerotatus cantator	X	X	X
Ochlerotatus communis		X	
Ochlerotatus excrucians		X	
Ochlerotatus provocans		X	
Ochlerotatus sollicitans	X	X	X
Ochlerotatus sticticus	X	X	X
Ochlerotatus stimulans		X	
Ochlerotatus taeniorhynchus	X	X	X
Ochlerotatus triseriatus	X	X	X
Ochlerotatus trivittatus	X	X	X
Psorophora ferox	X	X	X
Uranotaenia sapphirina	X		X

2024 Vector Responsibilities

Trap locations and type for the 2024 Mosquito Monitoring season.

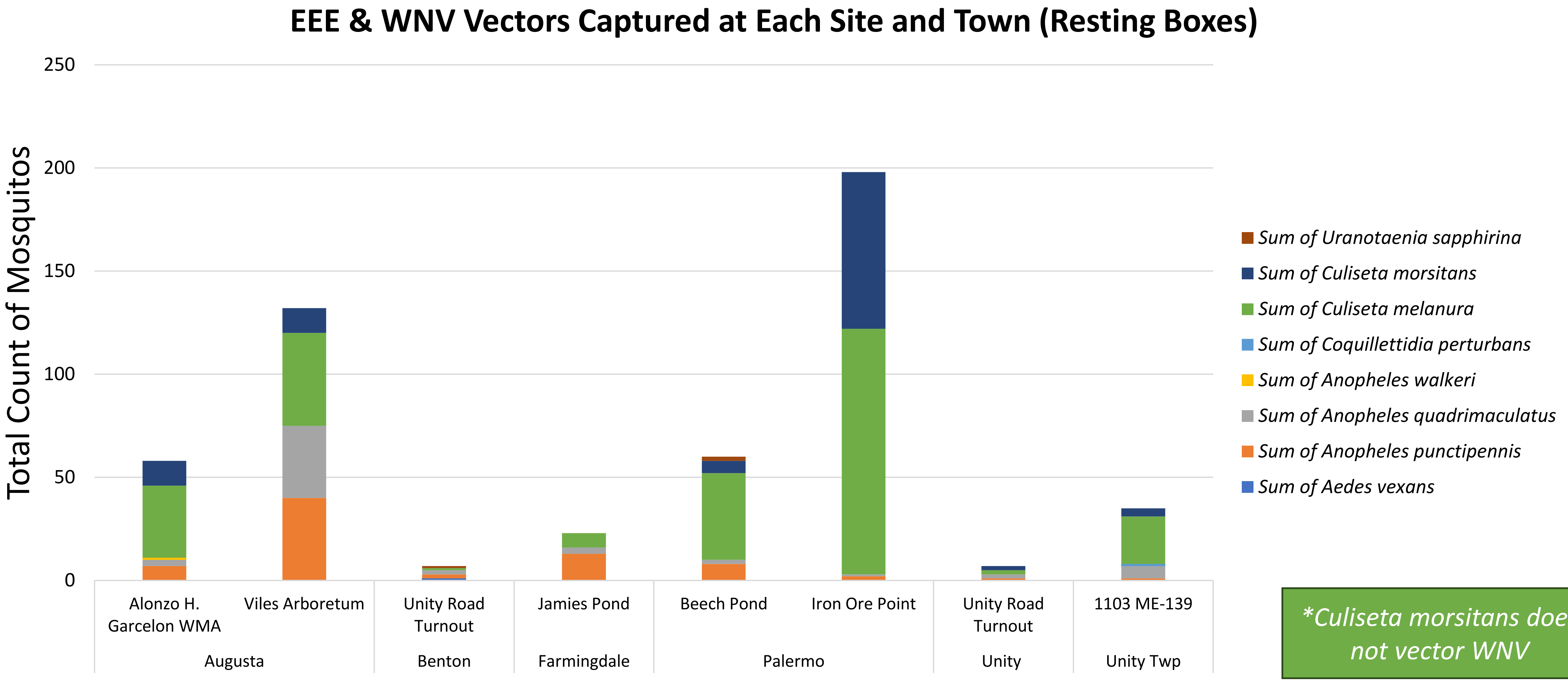
Trap types include resting boxes (RB) and gravid traps (GT).

Resting box sites were monitored from 7/1/24 through 10/09/24, and gravid trap sites were monitored from 08/08/24 to 9/10/24.

Site Name	Town	County	State	Trap Type
Jamie's Pond	Farmingdale	Kennebec	Maine	RB
Viles Arboretum	Augusta	Kennebec	Maine	RB
Garcelon WMA	Augusta	Kennebec	Maine	RB
Iron Ore Point	Palermo	Waldo	Maine	RB
Beech Pond	Palermo	Waldo	Maine	RB
Unity Plantation (1103 ME-139)	Unity Twp	Waldo	Maine	RB
Unity Road Turnout	Unity Twp	Waldo	Maine	RB
West River Rd	Sidney	Kennebec	Maine	GT
Sidney Boat Landing	Sidney	Kennebec	Maine	GT

2024: EEE & WNV* Vectors by Site

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

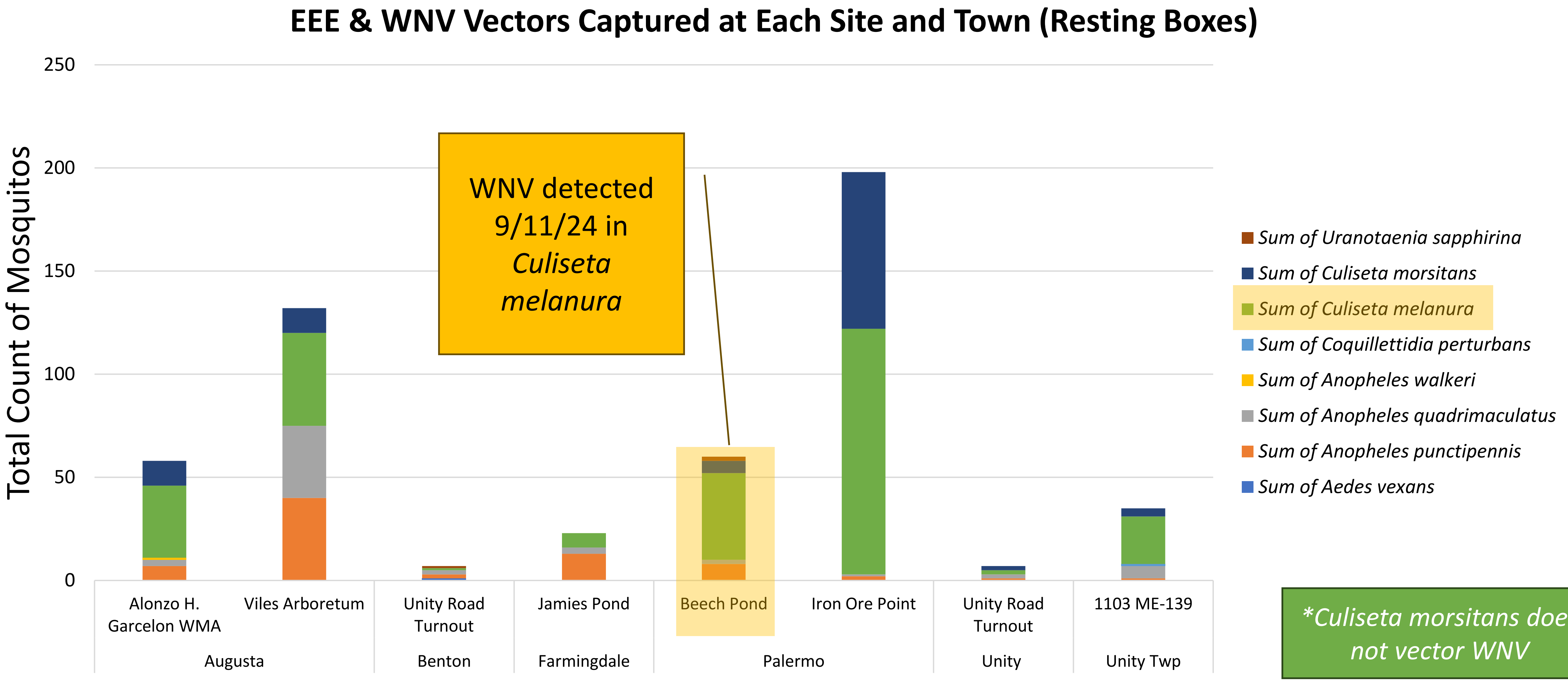


Culiseta morsitans does not vector WNV

Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

2024: EEE & WNV* Vectors by Site

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

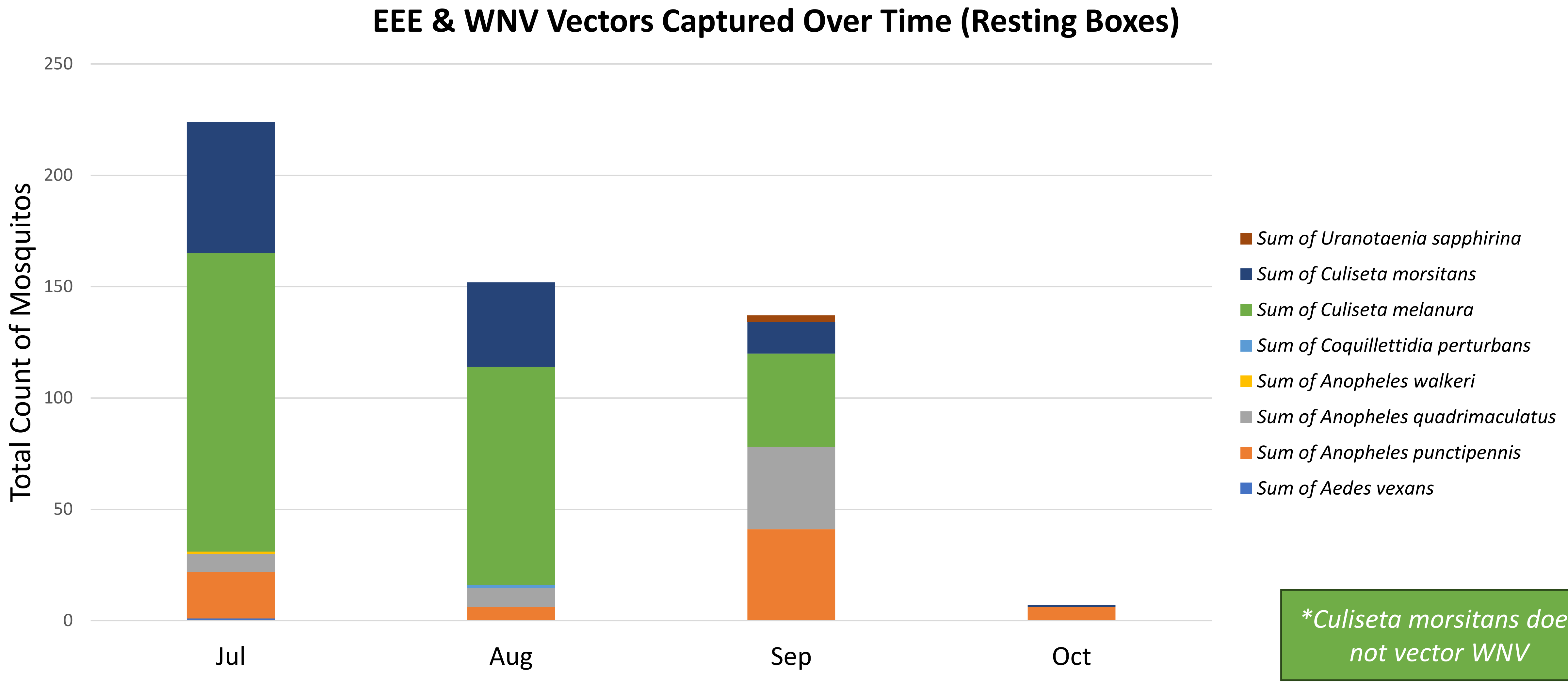


Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

**Culiseta morsitans does not vector WNV*

2024: EEE & WNV* Vectors by Date

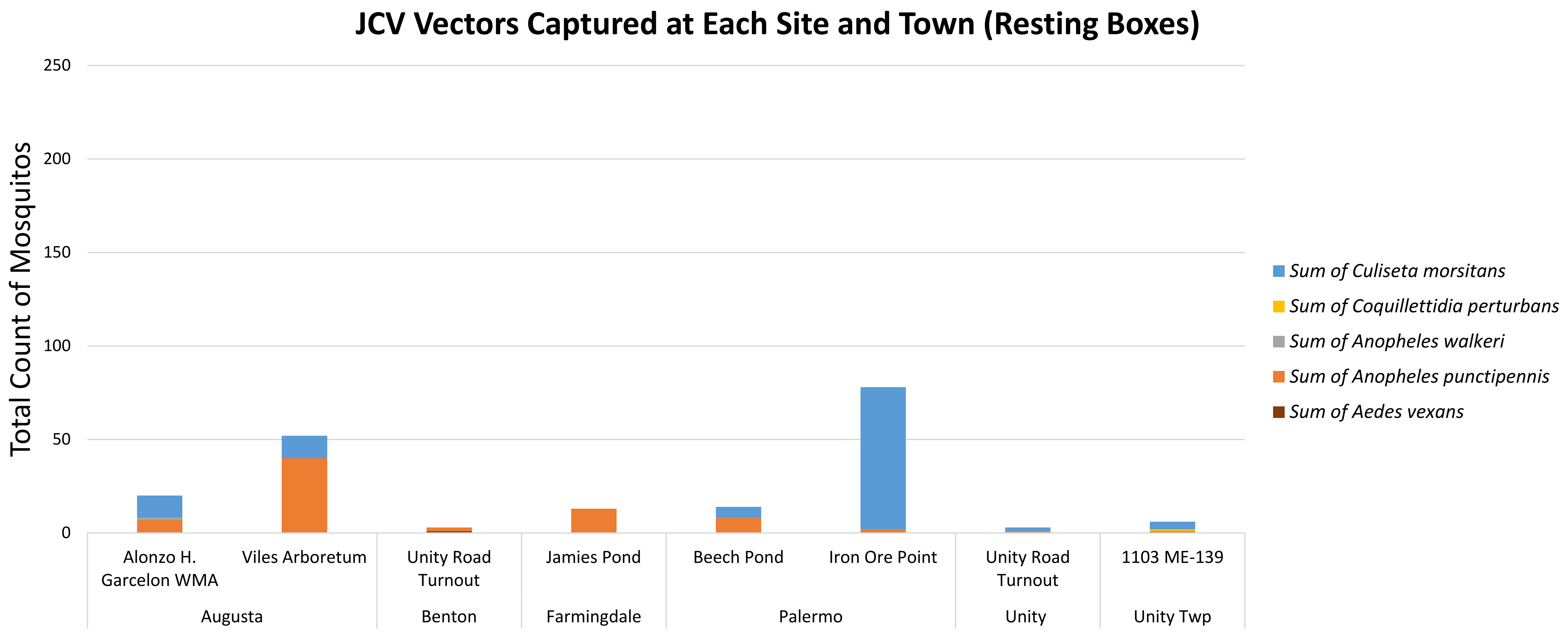
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



*Culiseta morsitans does not vector WNV

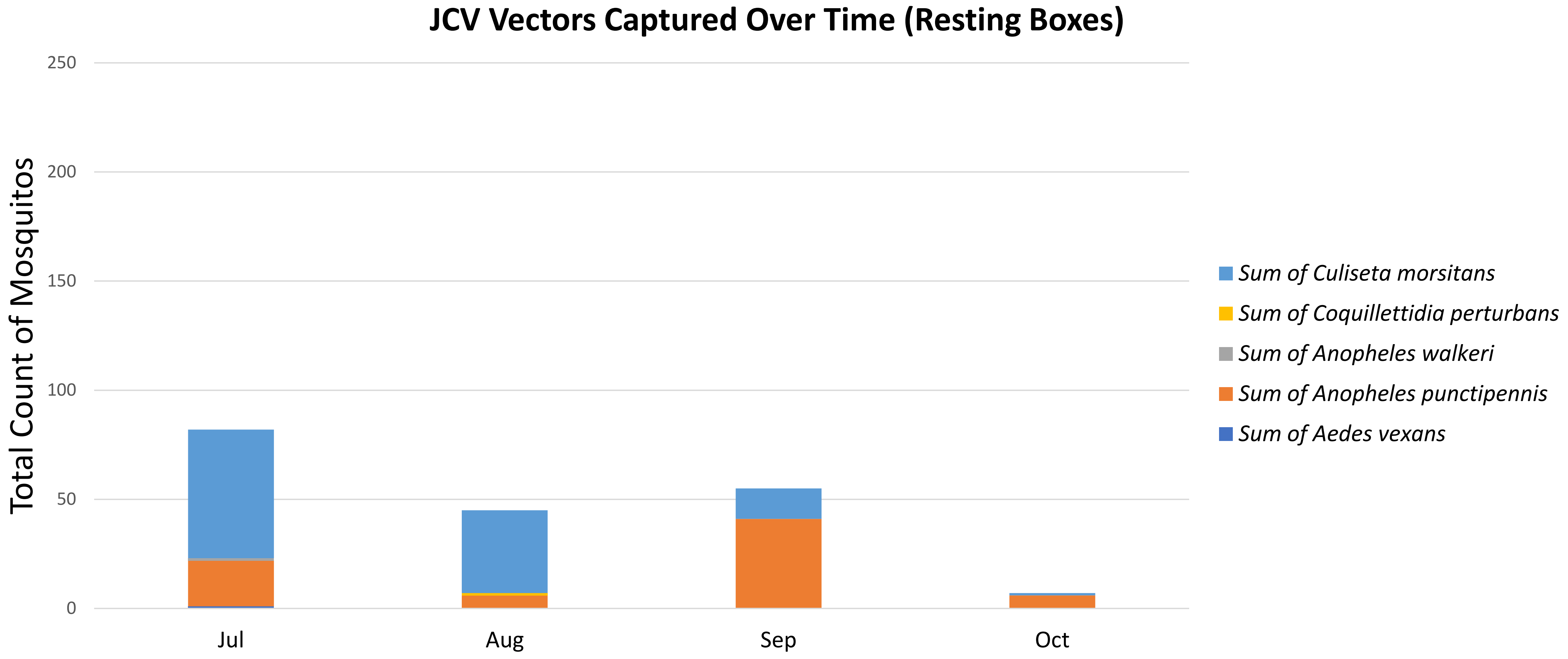
Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

2024: JCV Vectors by Site



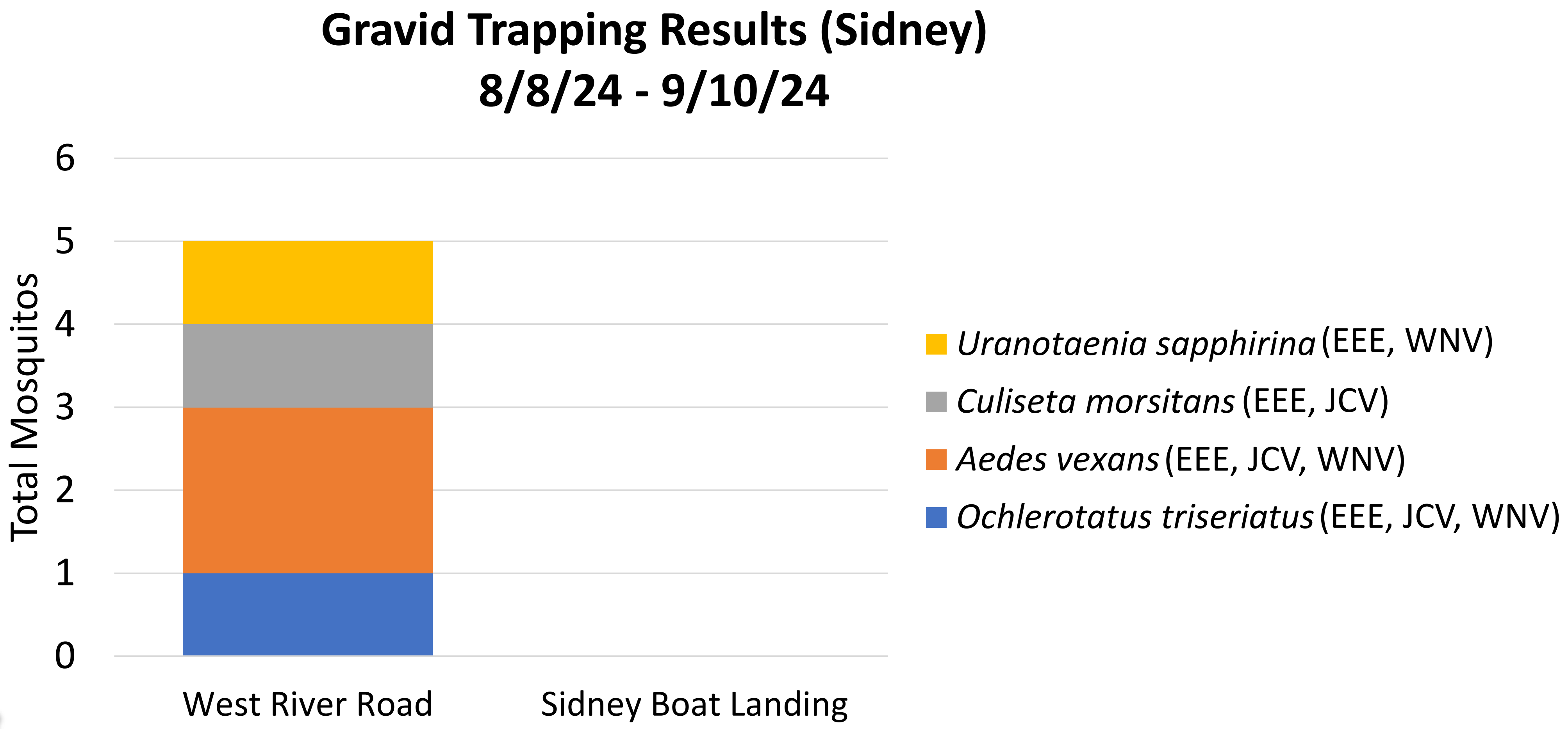
Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

2024: JCV Vectors by Date



Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

2024: Gravid Trapping Results



Note: Data represents only sites sampled by DACF, not sites sampled across all vector borne working group partners.

2025 Budget Request - BPC

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Category		Estimated Cost
Outreach / Education		
• travel for presentations		
• materials such as printing costs and handouts		
• IPM Council tabling and outreach events	$	7,000.00
School IPM		
• estimated printing costs	$	300.00
Vector Responsibilities		
• mosquito monitoring items & PPE	$	600.00
IPM Temp Hire (vector & outreach)*		
	$	38,640.00
Total	**$**	**46,540.00**

**for 42 weeks out of the year, supplementing with 10 weeks from grants.*

2025 Budget Request - BPC

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

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IPM Temp Hire (vector & outreach)*		
	$	38,640.00
Total	**$**	**46,540.00**

*for 42 weeks out of the year, **supplementing with 10 weeks from grants.**

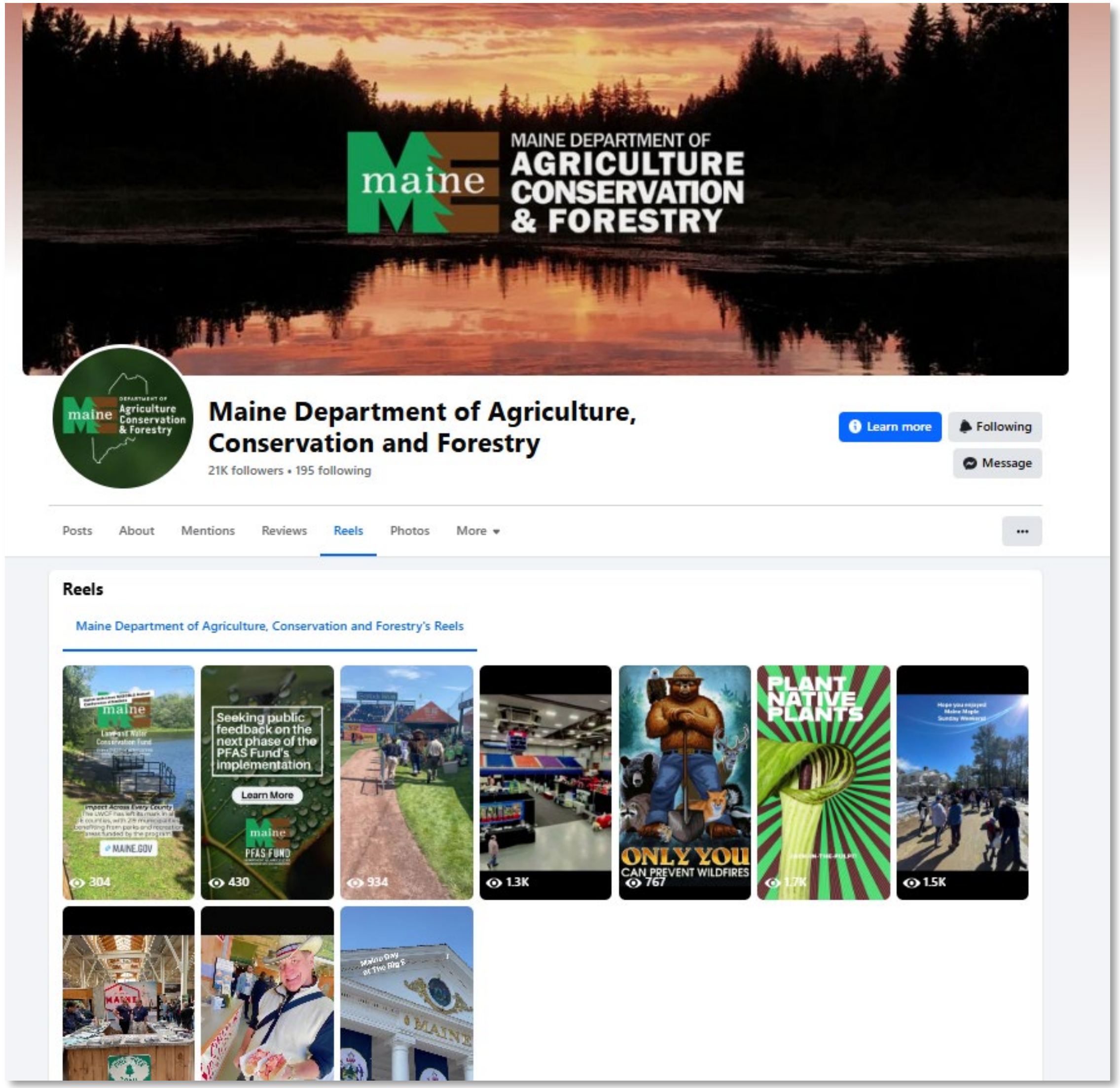
IPM Temp Hire Responsibilities

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

We have been given permission from Jim Britt to create educational reels on the DACF Facebook Page, which has over **21,000 followers**.

Plans:

- Mosquito education about trapping, monitoring, and biology; when and how to avoid mosquito bites.
- “IPM Myths vs. Reality” series:
    - Do chickens reduce ticks in my yard?
    - Do cats keep mice out of my home?
    - Should I rake my leaves?
    - Do bug zappers work?
    - How can I keep fruit flies out of my kitchen?
    - ….and more!



IPM Temp Hire Responsibilities

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Mosquito Monitoring Program & Improvements

Survey123 Key

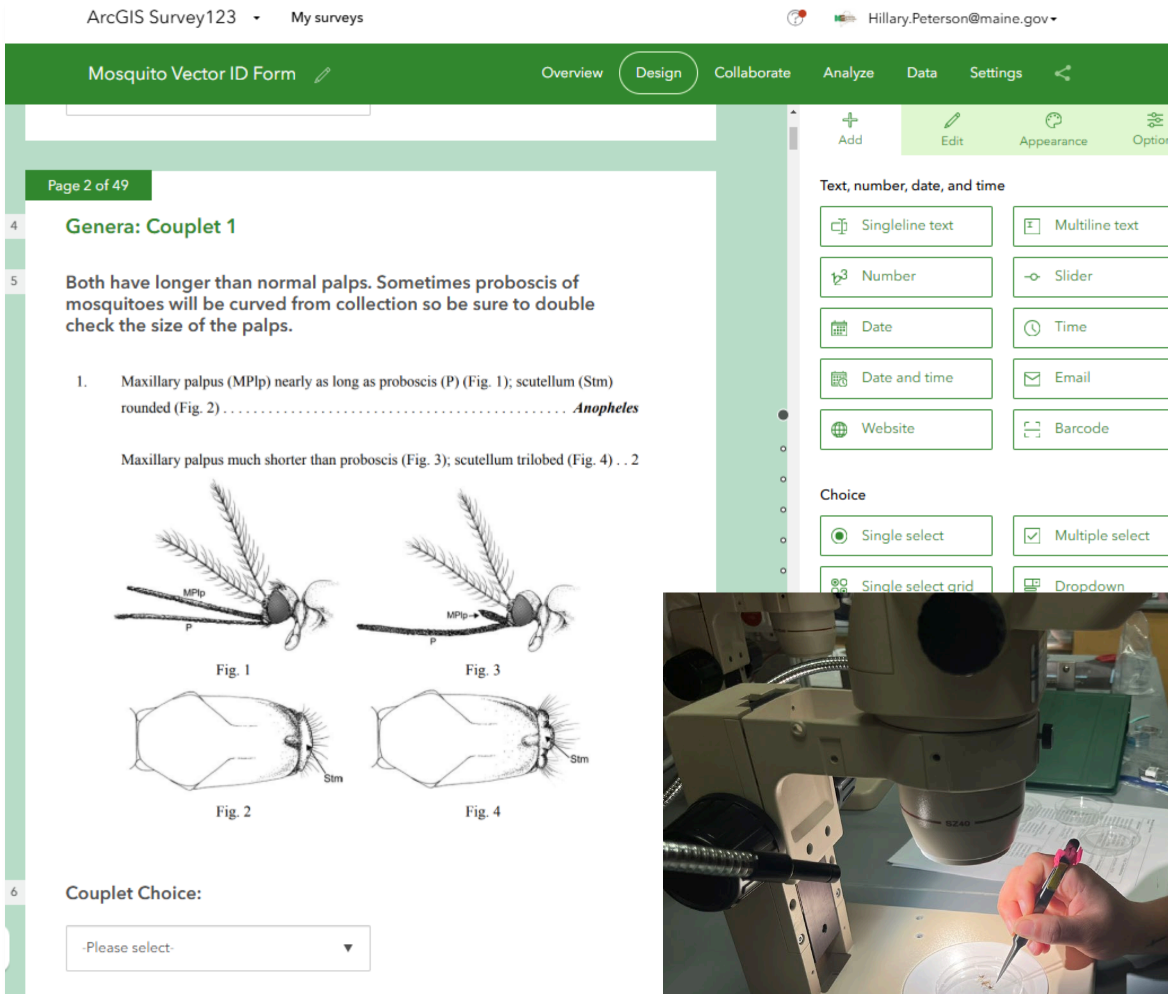
- Work with Lubelczyk lab to try and develop a working key for identification that collects data

Mosquito Outreach

- Create graphics about mosquito species and prevalence in regions for internal use and identification

Mosquito Monitoring Program

- Update SOPs, documents, repair vacuums (and create SOP on how to do so), be prepared to set up additional / earlier mosquito monitoring



Case Background Summary

Subjects: Peter Melendy
9 Tudor Drive
Kittery, Maine

Date of Incident(s): 2008 to Present

Background Narrative: In June of 2007, Steven Hathaway, who owns a shorefront residence located at 34 Newson Avenue in Kittery, received a letter from his neighbor—Peter Melendy—who owns a residence located uphill from Hathaway's. In the letter, Melendy requested permission to prune tree limbs and remove dead trees affecting his sight lines to the waterfront.

A second letter was received from Melendy in 2008 requesting a dialog and in which reference was made to the 2007 letter. Hathaway preferred to leave the existing vegetation in place and never responded to either letter.

During the years following receipt of the two letters, Hathaway began to notice tree decline followed by mortality near the waterfront. The tree decline aligned with potential sight lines to the Melendy property. In 2012, Hathaway took pictures depicting bore holes near the root collar two dead trees. In 2017, he took a picture of dead, mature pine near the waterfront.

The unexplained tree decline continued gradually. Hathaway stated he had multiple dead trees removed in approximately 2020. He suspected the trees were being deliberately poisoned and contacted the Kittery Police Department with his concerns. The Police Department was unable to make any determinations.

During 2023, Hathaway observed a larger swath of tree decline on the upslope portion of his property in a path that would improve the sight lines for the Melendy residence. This time, Hathaway contacted Maine Forest Service District Forester Oliver Markewicz, who, after assessing the site and the condition of the vegetation, referred Hathaway to the Board of Pesticides Control. Hathaway contacted the Board in mid-September of 2023 alleging chemical trespass to his property for the purpose of enhancing sight lines to waterfront.

Two Board staff members conducted a site visit on September 22, 2023. The staff interviewed Hathaway, made site observations, took photographs and collected two soil and two vegetation samples. As in similar investigations, there was a clear pattern of dead undergrowth around the base of the affected trees. Hathaway reported the same pattern of dead vegetation around the base of dead pine trees near the shorefront. He also provided photos depicting bore holes at the base of 2 dead trees.

Both sets of samples were analyzed for glyphosate and tebuthiuron. The soil samples were also analyzed for triclopyr. The laboratory results are summarized in the following table.

BPC Sample #	Sample Media	Location	Analyte	Result
230922JEP01A	Vegetation	Upslope from Driveway	Tebuthiuron	0.72 PPM
230922JEP01C	Vegetation	Downslope From Driveway	Tebuthiuron	0.52 PPM
230922JEP01B	Soil	Upslope from Driveway	Triclopyr	0.012 PPM
230922JEP01D	Soil	Downslope From Driveway	Triclopyr	ND
230922JEP01B	Soil	Upslope from Driveway	Tebuthiuron	15 PPM
230922JEP01D	Soil	Downslope From Driveway	Tebuthiuron	3 PPM
230922JEP01A	Vegetation	Upslope from Driveway	Glyphosate	ND
230922JEP01C	Vegetation	Downslope From Driveway	Glyphosate	ND
230922JEP01B	Soil	Upslope from Driveway	Glyphosate	ND
230922JEP01D	Soil	Downslope From Driveway	Glyphosate	ND
230922JEP01A	Vegetation	Upslope from Driveway	Triclopyr	ND
230922JEP01C	Vegetation	Downslope From Driveway	Triclopyr	ND

Summary of Applicable Pesticide Law: 01-026 CMR, Chapter 20, Section 6 (D) (2):

No person may apply a pesticide to a property of another unless prior authorization for the pesticide application has been obtained from the owner, manager or legal occupant of that property. The term “legal occupant” includes tenants of rented property.

Attachments: Narrative Reports, Laboratory Reports, Photographs, Tax Maps, Aerial Photos, Letters from Subject to Complainant, Emails from Subject

Staff Recommendation: Refer the Matter to the Office of the Attorney General for Enforcement

Provide supporting details and documents.

Physical Samples Taken

Sample Number	Sample Description	Sample Type	Date of Submission	Result	Lab Location	Analysis Completion Date	
230922JEP01A	Upslope from driveway Seal #2562662	Foliage	9/25/23	Tebuthiuron .72 ppm	Montana	10/12/23	Delete
230922JEP01B	Upslope from driveway Seal #2562616	Soil	9/25/23	Tebuthiuron 15 ppm and Triclopyr .012 ppm	Montana	10/20/23	Delete
230922JEP01C	Down slope from driveway Seal #2562615	Foliage	9/25/23	Tebuthiuron .52 ppm	Montana	10/12/23	Delete
230922JEP01D	Down Slope from driveway Seal #2562617	Soil	9/25/23	Tebuthiuron 3.0 ppm	Montana	10/20/23	Delete
230922JEP01E	Beech Leaves	Foliage	10/10/23	Confirmed for Beech Leaf Disease	Orono Maine	10/19/23	Delete

Add Physical Sample

Documentary Samples

Sample Number	Sample Description	
230922JEP01F	Photos of sample area	Delete
230922JEP01G	Letters from Paul Melendy regarding view easement	Delete
230922JEP01H	Emails from Steve Hathaway containing photos of damaged vegetation over multiple years	Delete

Add Documentary Sample

Reportable Data

Number of Documentary Samples Collected
0

Supporting Documents

(9)
Loading...

Brief Summary of Inspection
Visited Steve Hathaway at his home, 34 Newson Ave. in Kittery on 9/22/2023, with Manager of Compliance Alex Peacock, in response to a complaint Mr. Hathaway made alleging herbicidal trespassing on to his property. Mr. Hathaway contacted the BPC on 9/14/2023 with concerns that his neighbor may have applied pesticides to his property to improve water views.

Mr. Hathaway explained that he has been noticing on going vegetation death on the portion of his property behind his neighbor's house for multiple years. Peter Melendy, owner of the neighboring property, found at 9 Tudor Drive, had sent two letters in 2007 and 2008 requesting delimbing and trimming of trees on Mr. Hathaway's property. Mr. Hathaway did not respond to these letters and did not give any permissions to Mr. Melendy. Mr. Hathaway believes that the Melendy (or an agent of his) applied herbicideto this vegetation. Mr. Hathaway recalled having multiple pine trees cut down about 3 years ago after they died, after more trees began to decline, he suspected unnatural causes. He had previously been in contact with the Kittery police requesting that they investigate the possible use of herbicides on his property by Mr. Melendy, but they were unable to find evidence of herbicide use or trespassing.

This year when Mr. Hathaway saw a larger loss of vegetation, he contacted the District Forester, Oliver Markewicz, who after assessing the vegetation referred Mr. Hathaway to the Maine Board of Pesticides. There was visible death of vegetation behind Mr. Melendys property and across the driveway to the shoreline of the property.

Kittery code enforcement has been made aware of the allegations and damaged shoreline. They have also been sent the results of the sample testing.

Composite vegetation and soil samples were taken from the area adjacent to Mr. Melendys property, uphill from the driveway, and adjacent to the shoreline, downhill from the driveway. A vegetation sample was also taken from damaged beech trees outside of the area of concern and tested for Beech Leaf Disease at the University of Maine Plant Diagnostics Lab. The area of concern had visible damage to a multitude of vegetation species that would not be affected by Beach Leaf Disease.

The intent of this visit was to obtain physical samples for analysis to confirm that herbicides had been applied and impacted plant life at 34 Newson Ave. Kittery.
In total, five physical samples were taken, two vegetation samples, two soil samples and a vegetation sample of American Beech vegetation to be sent to the plant diagnostics lab. Sample location can be seen in the attachment, EC-38858_Sample map.

The following samples were collected:
230922JEP01A, Vegetation from upslope from driveway
230922JEP01B, Soil from upslope from driveway
230922JEP01C, Vegetation from down slope from driveway
230922JEP01D, Soil from down slope from driveway
230922JEP01E, American Beach vegetation to be tested for Beech Leaf Disease

All samples were shipped via FedEx Standard Overnight on 9/25/2023 to Montana State University Analytical Laboratory. Results for the vegetation samples and soil samples were received on 10/12/2023, 10/16/2023, 10/23/2023 and 11/1/2022.
All samples were positive for tebuthiuron and one soil sample detected triclopyr.

Recommendations

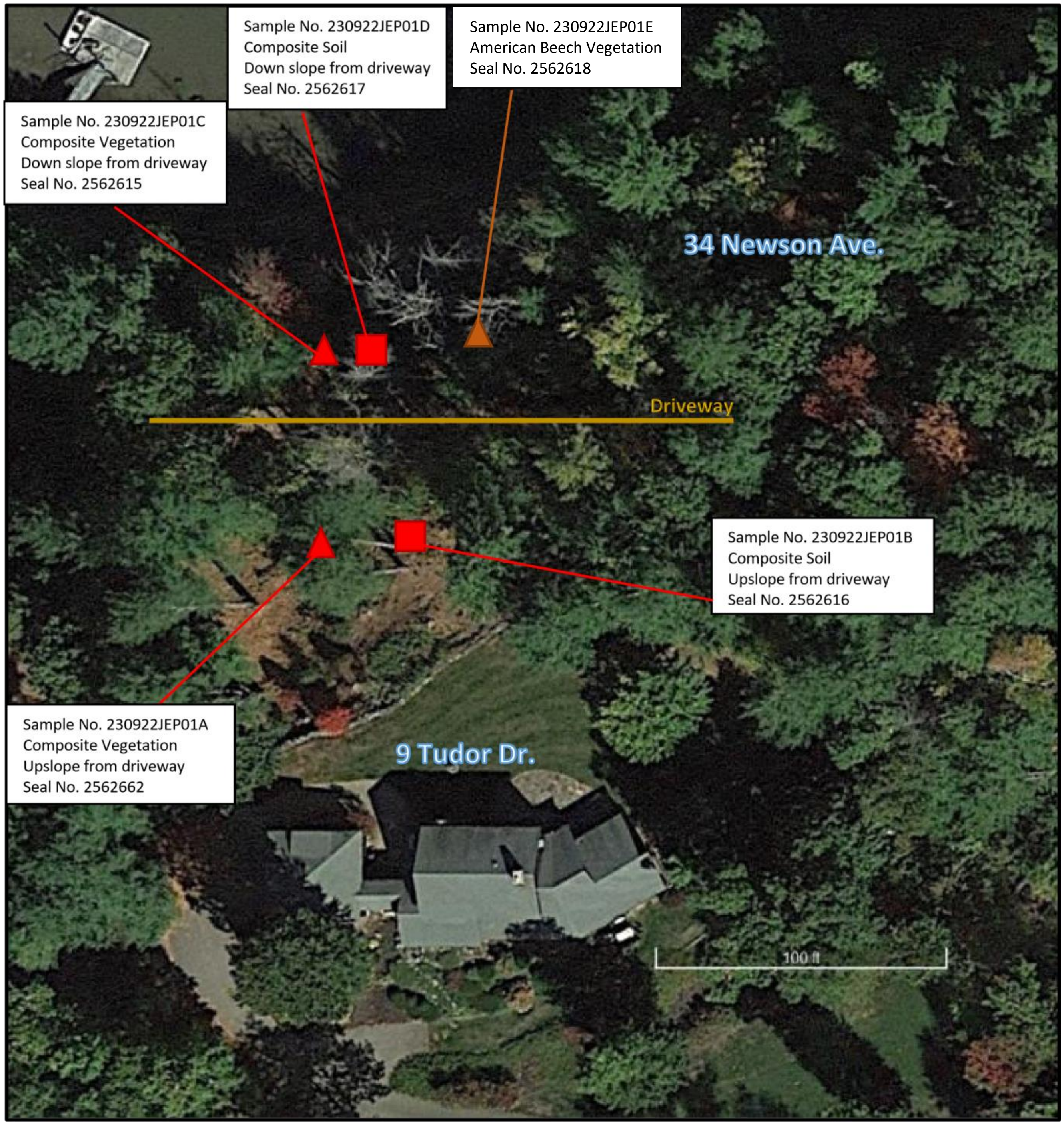
Acknowledgement

Acknowledgement:

The physical and/or documentary samples listed above were collected by a Maine Board of Pesticides Control Representative in connection with administration of FIFRA and/or State of Maine Pesticide Statutes and Regulations.

Accept Clear

EC-60858 – Sample Map
Hathaway, Steve: Complainant
34 Newson Avenue, Kittery, ME



June 1, 2007

Stephen Hathaway
7 Wintergreen Circle
Andover, MA 01810

First, let me introduce myself. I am Peter Melendy. I grew up in northern New Hampshire and have lived my whole life in New Hampshire until last summer. I bought lot 6 at the Briers development in May 2005 and I built my home there last year. The design and placement of my house was my attempt to respect the natural environment and to keep from disturbing you. I have always tried to be a good neighbor wherever I have lived.

Earlier this spring, Ms Coffey gave me a copy of an agreement between Paul Hollis and you, Ms Satterthwaite and Coffey in which he promised to provide a privacy barrier along the property line of lot 6. I was unaware of this agreement when I bought this lot and only became aware of it when Ms. Coffey gave me that copy.

As you may be aware, Mr. Hollis has had significant and serious financial problems and many of his property holdings have been foreclosed. The Briers has a number of unfinished needs and our association is grappling with how to handle them but it certain that we will suffer due to his financial problems. In short, I doubt that Mr. Hollis is able to fulfill his obligation to the Briers or other agreements that he has entered over recent years.

All of us seem to have a mutual problem and at the moment, I have no solution for anyone with respect to Mr. Hollis's promises and agreements. I do feel that some kind of buffer could benefit all of our residences but I am certainly unable to offer what Mr. Hollis proposed but I would like to discuss options with you and see if we could find a solution that would give each of us some kind of benefit.

I am in the process of doing landscaping around my house. There are only a few changes that will be made in the woodlands along my property line as I want to maintain that natural setting as a woodland walk. With the approval of Heather Ross, Kittery's CEO, I have created some sight lines by trimming some trees but these were done in ways to keep everyone's privacy. However, there are several trees beyond my property line and on your properties that I would like to limb and trim out the deadwood to create a more direct sight line. Again, the work would be done in ways that would not alter your privacy and would be consistent with the existing shoreline area cut restrictions. I am happy to show you what I would like to do and get your agreement and approval.

If you would allow me to take that action, at my expense I would try to provide an increased privacy buffer between our homes through the planting of different scrubs and trees – consistent with the existing woodland varieties for the area. Honestly, I cannot offer anything remotely approaching the 10 ft. specimens outlined in your agreement with Paul nor could I afford to extend it along with entire property line. But, in time these would grow and in 4-5 years they would achieve an improved buffer in and around each house area. I would also be prepared to talk with the current owner of lot 7 about being a partner in this effort although that house was built for resell and from my experience, the current owner has little interest to invest more in a house up for sale.

My suggestion provides you with some improved buffer and will provide me some improved sight lines of the wonderful Spruce Creek without impacting upon anyone's privacy.

I am reachable by phone - 603-770-9806 or email: pmelendy@hotmail.com or US post: 3 Merrill Drive, Hampton, NH 03842 and would greatly appreciate getting your inputs and learning about your interest. Because my business responsibilities require me to travel frequently, it is best to email me.

Thank you for your kind consideration on my suggestions and request. I have sent a letter to Ms. Satterthwaite and Coffey as I feel that this is a joint proposal which impacts all three lots uniformly and needs a common agreement.

Sincerely

Peter S. Melendy

ADHESIVE TECHNOLOGIES
Adhesive Technologies, Inc. / 3 Merrill Industrial Drive; Hampton, NH 03842-1995 / USA
Tel: 603 926 1616 x 127 / Fax: 603 926 1780 / email:pmelendy@adhesivetech.com

February 21, 2008

Stephen Hathaway
7 Wintergreen Circle
Andover, MA 01810

Re: Kittery Land

Dear Mr. Hathaway

My lot at The Briers abuts your property as well as Mary and Sue's. Last year I learned through Mary and Sue that Paul Hollis had offered to provide some buffer between the Briers and your homes but he never followed through on that action and his financial condition makes it unlikely that he has further interest or intent to fulfill his agreement. His situation with The Briers development is even more problematic as we have had to assume over $100,000 of direct expenses of his to allow the development to evolve.

I have talked with Mary and Sue about several options and how we can cooperate to improve the buffers between my home and theirs – although honestly their biggest problem rests with the adjacent home whose land does not actually abut theirs as its site line is across my land. We are discussing options that seem to be interesting and worth pursuing this spring

I had sent you a letter last year offering to do the same with you but I did not hear back from you. Certainly, I would like to extend a similar offer to discuss options to provide a better buffer for your house. This might be more significant since there is now a new home being constructed on lot 5 and could impact upon that privacy as well.

I hope that you will contact me and have some dialogue about options. My email address is pmelendy@adhesivetech.com and my office number is 603-929-5327.

Sincerely

Peter Melendy

From: Peter Melendy
To: Peacock, Alexander R
Subject: RE: Tree Investigation
Date: Wednesday, December 6, 2023 11:23:34 AM

Hi Alex

When I read your email I was quite surprised because you seem to be anxious about a comprehensive pesticide problem. I am not seeing that and will provide a series of photos of the entire property line and area around it in subsequent email to you.

To be clear, the property between Steve and me is a rising ledge which extends from Spruce Creek up and onto my property and was blasted away years ago to provide a trolley track passage way. Before I bought my property on 9 Tudor Drive Steve had built a fence along his property for unclear reasons since there is a dangerous 20 ft drop off to the rest of his land. After buying my land and building my house I suggested to Steve that we cooperate along the property line clearing dead trees and trimming other trees to keep the dead fall under control but he said he liked the rustic look and wanted a natural look – so I have left him alone and have only been to his property to retrieve balls from my grandchildren's play over the intervening decades. There has been no communication with him of any sort.

My house and the area around sits on top of that ledge with exposed rock and thin soil across much of it. When I built my house the ledge had to be blasted away for the foundation.– the lawn needs constant irrigation in the summer. I have worked to keep the pine trees upright and alive – even cabling them together but they have still died or been blown over. As recently as last February I had a neighbor's pine tree fall on my property and I have tried to encourage a low bush blueberry patch to expand across that ledge area on my property but it seems that the poison ivy is too happy to expand into that area and many other areas around my property and I am very allergic to it and have had it sprayed annually in the summer so I can be outside but it still returns.

In late October as I was mowing my lawn – I saw Steve for the first time in 15 years – Steve waved me over to the property and accused me of 'killing his bushes' – I had no explanation – the leaves were changing color and fall. He was insistent that I did but I did not! I assume that he approached you under that premise.

My assessment is different. There were dead trees and dead fall on his property since I bought my property and it is no different than what existed. Some of those trees were dead when I bought the property and I have pictures of bald eagle in them more than 10 years ago.

You can review the email that will follow. What should be clear is that this ledge area offers limited soil or vegetation.

I think these photo will speak for themselves

Regards

Peter

From: Peacock, Alexander R <Alexander.R.Peacock@maine.gov>
Sent: Tuesday, December 5, 2023 4:30 PM
To: Peter Melendy <peter@adhesivetech.com>
Subject: RE: Tree Investigation

Hi Peter,
Thank you for getting back to me.

Do you have any knowledge of the cause of the vegetation destruction that has occurred and continues to occur between your property and Spruce Creek?

Any information you may have will help us to mitigate the situation and prevent further harm to the vegetation and aquatic organisms that have been impacted.

Best,
Alex

Alexander R. Peacock
Manager of Compliance
Board of Pesticides Control
Maine Dept. of Agriculture, Conservation & Forestry
207-441-4193

From: Peter Melendy <peter@adhesivetech.com>
Sent: Friday, December 1, 2023 6:42 AM
To: Peacock, Alexander R <Alexander.R.Peacock@maine.gov>
Subject: Re: Tree Investigation

Hello Alexander

As usual I am traveling returning this weekend

This is my active email

What do you need?

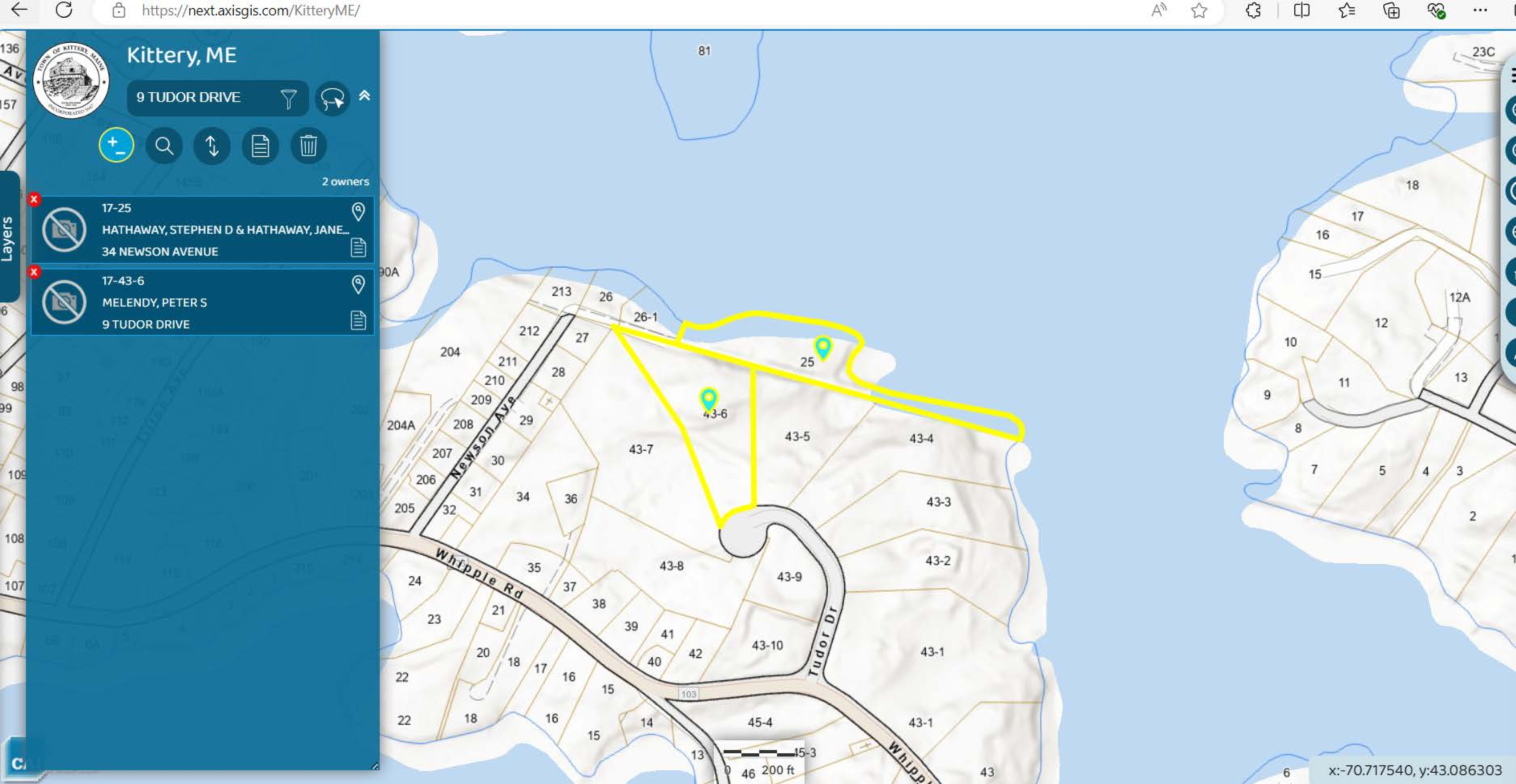
Regards
Peter

Sent from my iPhone
Peter Melendy

On Nov 30, 2023, at 3:16 PM, Peacock, Alexander R
<Alexander.R.Peacock@maine.gov> wrote:

Good afternoon Peter,
Our agency is investigating the decline of trees and vegetation along Newson Avenue in Kittery, between your home at 9 Tudor Drive and Spruce Creek.
If you could please contact me at your earliest convenience, it would be much appreciated.
Thank you,
Alex

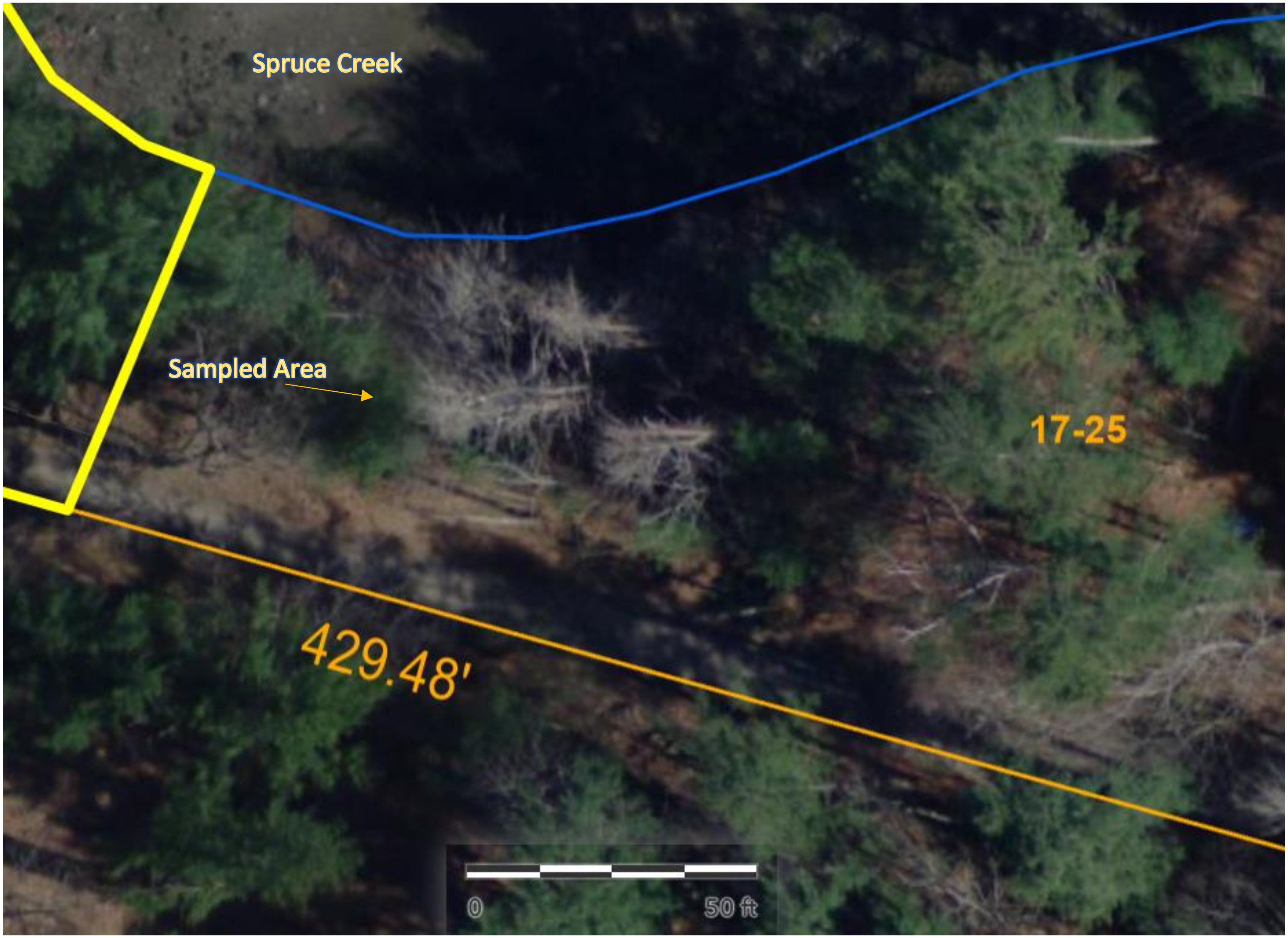
Alexander R. Peacock
Manager of Compliance
Board of Pesticides Control
Maine Dept. of Agriculture, Conservation & Forestry
207-441-4193


https://next.axisgis.com/KitteryME/
Kittery, ME
9 TUDOR DRIVE
2 owners
17-25
HATHAWAY, STEPHEN D & HATHAWAY, JANE...
34 NEWSON AVENUE
17-43-6
MELENDY, PETER S
9 TUDOR DRIVE
Layers
Newson Ave
Whipple Rd
Tudor Dr
200 ft
x:-70.717540, y:43.086303

EC-60858 – Satellite Images 2006-2018

34 Newson Avenue, Kittery, ME

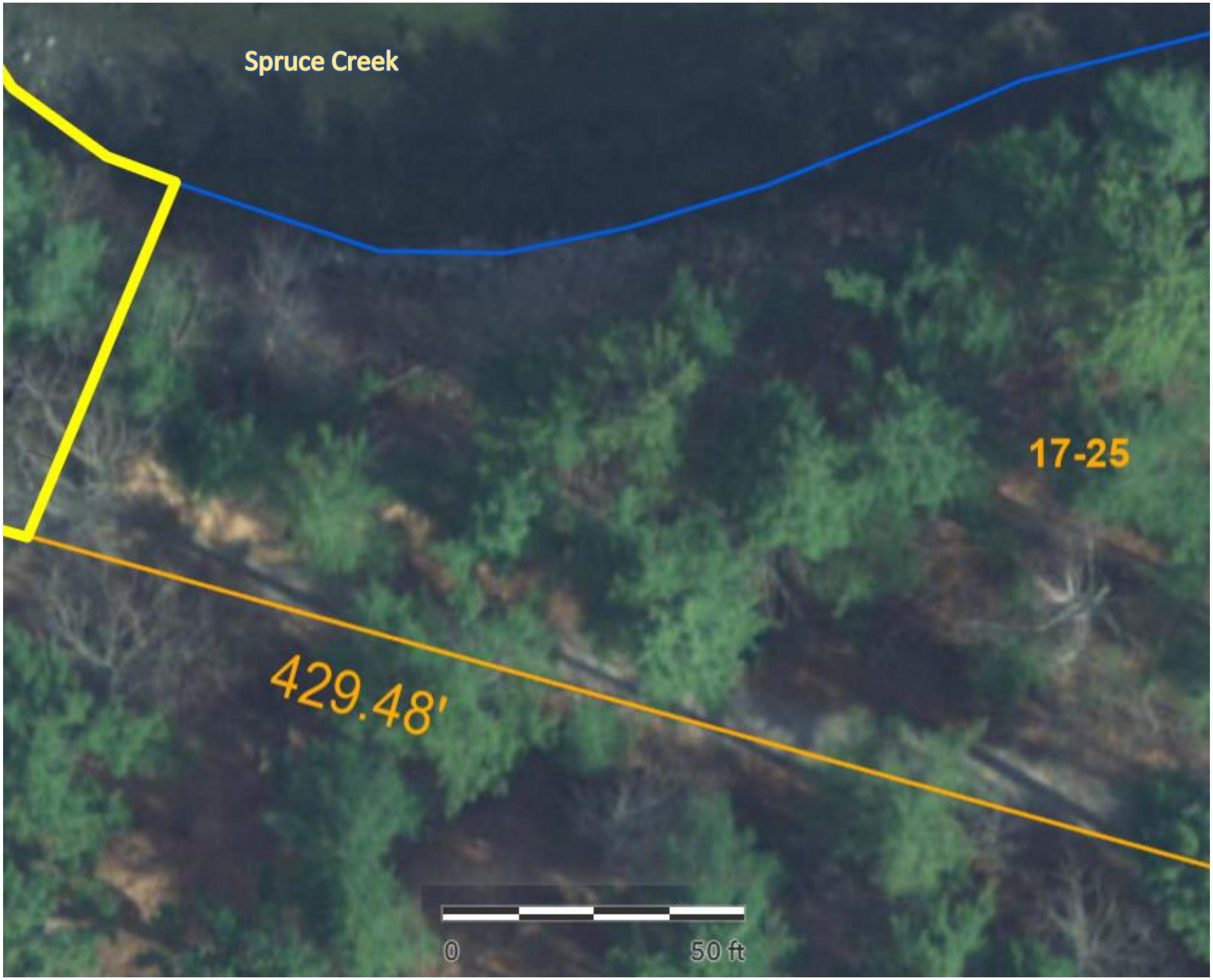
2018



EC-60858 – Satellite Images 2006-2018

34 Newson Avenue, Kittery, ME

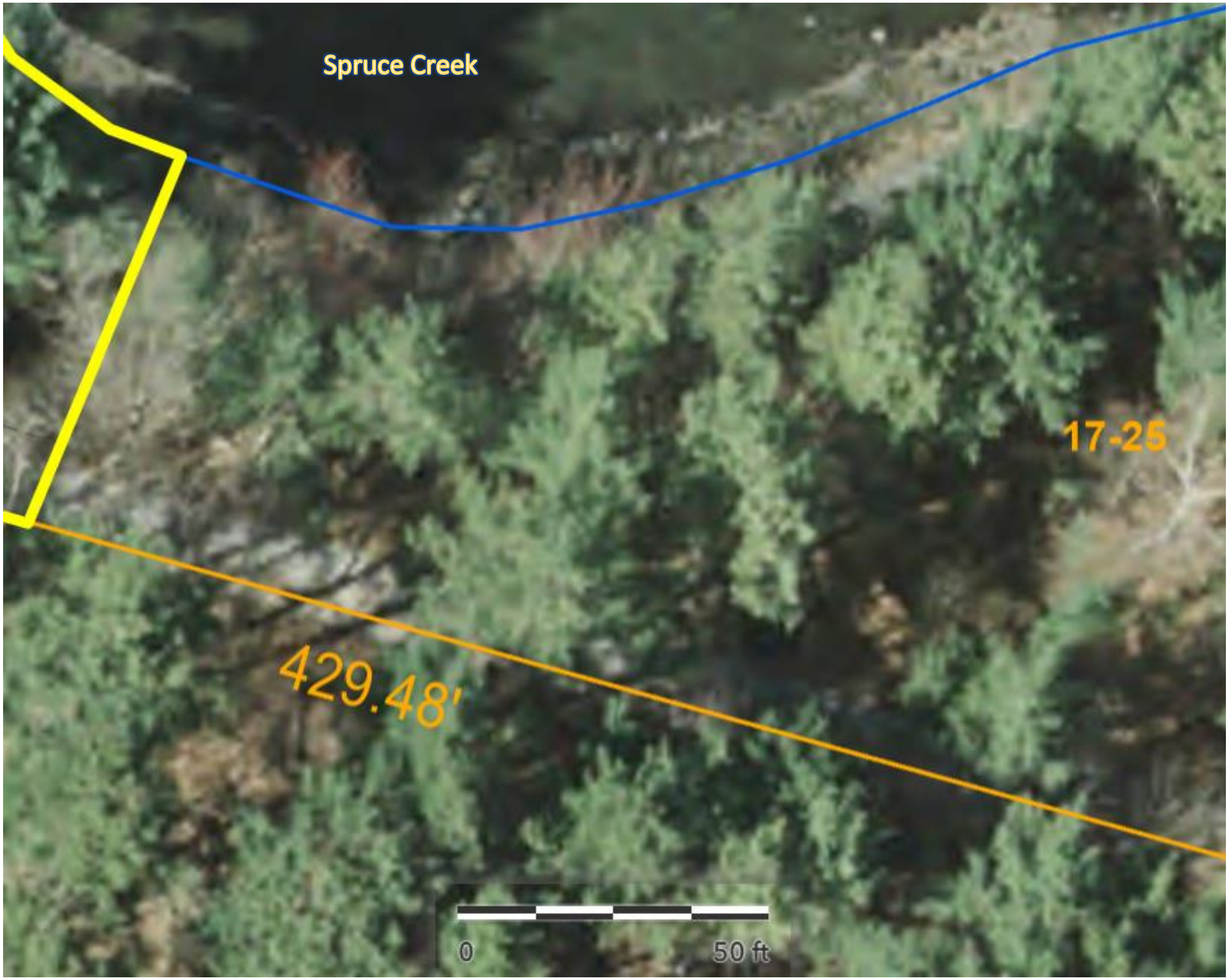
2012



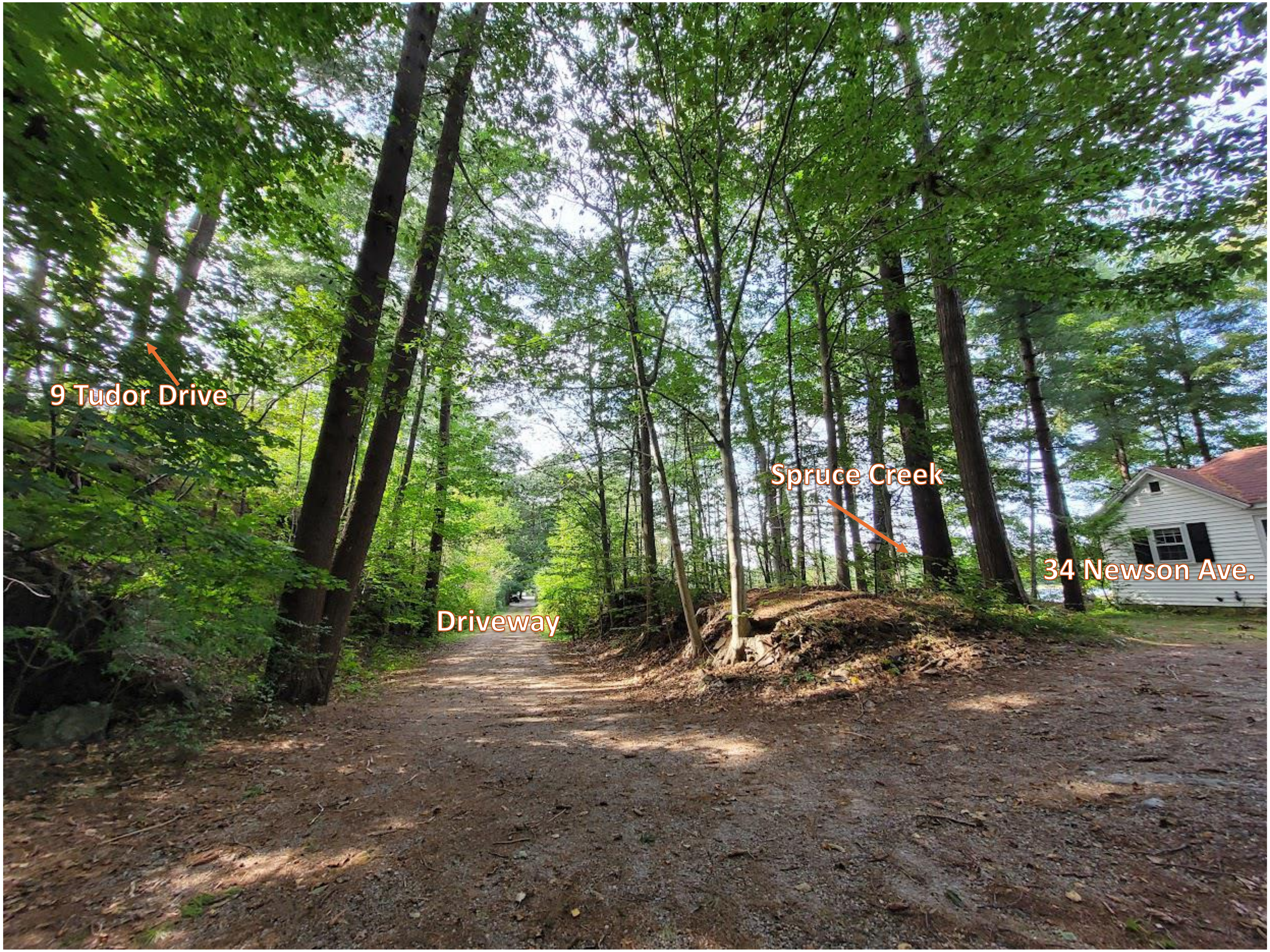
EC-60858 – Satellite Images 2006-2018

34 Newson Avenue, Kittery, ME

2006



Photos taken at 34 Newson Ave. in Kittery on 9/22/2023



Top of Slope, on border of Hathaway property

Top of slope, looking toward Melendy property

Dead vegetation looking down from top of slope toward Spruce Creek

Top of slope, on border of Hathaway Property

Dead trees from top of slope

Halfway up slope between Hathaway Driveway and Melendy property

Looking upslope toward Melendy property from Hathaway driveway

Dead trees, down slope from Hathaway driveway, upslope from Spruce Creek

Dead vegetation trees from top of slope, border of Hathaway property

View from Spruce Creek shoreline toward Hathway driveway and Melendy property

Dead vegetation to healthy vegetation from Spruce Creek shoreline toward Hathaway house

PHOTO TAKEN BY HOMEOWNER STEVEN HATHAWAY ON 9/3/2023


PHOTO TAKEN BY HOMEOWNER STEVE
HATHAWAY ON 11/10/2012


Photo Taken by homeowner Steve Hathaway on 11/10/2012

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

<u>Memorandum</u>

To: Board of Pesticides Control
From: Alexander Peacock, Director
Subject: Prohibited Acts Update

December 6, 2024

Background:

Upon the Board's acceptance of the Administrative Consent Agreement with Arthur and Amelia Bond in July of 2023, staff have often been asked what can be done to deter violations of unauthorized pesticide applications in the future. MRS Title 7 §606. Prohibited Acts, outlines criteria of pesticide use that are recognized as violations in statute. Staff has prepared sample language for MRS Title 7 §606: Prohibited Acts and MRS Title 22 §1471-D: Certification and Licenses that may enhance statutory provisions to create a greater deterrent for unauthorized applications of pesticides. This topic is brought to the board for input and discussion.

MRS Title 7 §606. Prohibited Acts (Current)

§606. Prohibited acts

1. Unlawful distribution. A person may not distribute in the State any of the following:

A. A pesticide that has not been registered pursuant to the provisions of this subchapter; [PL 2005, c. 620, §5 (AMD).]

B. A pesticide if any of the claims made for it or any of the directions for its use or other labeling differs from the representations made in connection with its registration, or if the composition of a pesticide differs from its composition as represented in connection with its registration; a change in the labeling or formulation of a pesticide may be made within a registration period without requiring reregistration of the product if the registration is amended to reflect that change and if that change will not violate any provision of FIFRA or this subchapter; [PL 2005, c. 620, §5 (AMD).]

C. A pesticide unless it is in the registrant's or the manufacturer's unbroken immediate container and there is affixed to the container, and to the outside container or wrapper of the retail package, if there is one, through which the required information on the immediate container cannot be clearly read, a label bearing the information required in this subchapter and rules adopted under this subchapter; [PL 2005, c. 620, §5 (AMD).]

D. A pesticide that has not been colored or discolored pursuant to section 610, subsection 1, paragraph D; [PL 2005, c. 620, §5 (AMD).]

E. A pesticide that is adulterated or misbranded or any device that is misbranded; [PL 2021, c. 105, §1 (AMD).]

F. A pesticide in containers that are unsafe due to damage; [PL 2021, c. 673, §4 (AMD).]

G. Beginning January 1, 2022, a pesticide containing chlorpyrifos as an active ingredient; [PL 2021, c. 673, §4 (AMD).]

H. A pesticide that has been contaminated by perfluoroalkyl and polyfluoroalkyl substances; or [PL 2021, c. 673, §4 (NEW).]

I. Beginning January 1, 2030, a pesticide that contains intentionally added PFAS that may not be sold or distributed pursuant to Title 38, section 1614, subsection 5, paragraph D. [PL 2021, c. 673, §4 (NEW).]

[PL 2021, c. 673, §4 (AMD).]

2. Unlawful alteration, misuse, divulging of formulas, transportation, disposal and noncompliance. A person may not:

A. Detach, alter, deface or destroy, wholly or in part, any label or labeling provided for in this subchapter or rules adopted under this subchapter; [PL 2005, c. 620, §5 (AMD).]

A-1. Add any substance to or take any substance from a pesticide in a manner that may defeat the purpose of this subchapter or rules adopted under this subchapter; [PL 2005, c. 620, §5 (NEW).]

B. Use or cause to be used any pesticide in a manner inconsistent with its labeling or with rules of the board, if those rules further restrict the uses provided on the labeling; [PL 2005, c. 620, §5 (AMD).]

C. Use for that person's own advantage or reveal, other than to the board or proper officials or employees of the state or federal executive agencies, to the courts of this State or of the United States in response to a subpoena, to physicians, or in emergencies to pharmacists and other qualified persons for use in the preparation of antidotes, any information relative to formulas of products acquired by authority of section 607 or any information judged by the board to contain or relate to trade secrets or commercial or financial information obtained by authority of this subchapter and marked as privileged or confidential by the registrant; [PL 2005, c. 620, §5 (AMD).]

D. Handle, transport, store, display or distribute pesticides in such a manner as to endanger human beings or their environment or to endanger food, feed or any other products that may be transported, stored, displayed or distributed with such pesticides; [PL 2005, c. 620, §5 (AMD).]

E. Dispose of, discard or store any pesticides or pesticide containers in such a manner as may cause injury to humans, vegetation, crops, livestock, wildlife or beneficial insects or pollute any water supply or waterway; [PL 2005, c. 620, §5 (AMD).]

F. Refuse or otherwise fail to comply with the provisions of this subchapter, the rules adopted under this subchapter or any lawful order of the board; [PL 2021, c. 673, §5 (AMD).]

G. Apply pesticides in a manner inconsistent with rules for pesticide application adopted by the board; or [PL 2021, c. 673, §5 (AMD).]

H. Use or cause to be used any pesticide container inconsistent with rules for pesticide containers adopted by the board. [PL 2021, c. 673, §5 (NEW).]

[PL 2021, c. 673, §5 (AMD).]

3. Unlawful use. A person may not apply glyphosate or dicamba within 75 feet of school grounds. This subsection does not apply to residential property or land used for commercial farming.

For purposes of this subsection, unless the context otherwise indicates, the following terms have the following meanings:

A. "Commercial farming" has the same meaning as in section 52, subsection 3; [PL 2021, c. 197, §1 (NEW).]

B. "Residential property" means real property located in this State that is used for residential dwelling purposes; [PL 2021, c. 197, §1 (NEW).]

C. "School" means any public, private or tribally funded elementary school as defined in Title 20-A, section 1, subsection 10, secondary school as defined in Title 20-A, section 1, subsection 32 or a nursery school that is part of an elementary or secondary school; and [PL 2021, c. 197, §1 (NEW).]

D. "School grounds" means:

(1) Land associated with a school building including playgrounds and athletic fields used by students or staff of a school. "School grounds" does not include land used for a school farm; and

(2) Any other outdoor area used by students or staff including property owned by a municipality or a private entity that is regularly used for school activities by students and staff but not including land used primarily for nonschool activities, such as golf courses, farms and museums. [PL 2021, c. 197, §1 (NEW).]

[PL 2021, c. 197, §1 (NEW).]

SECTION HISTORY

PL 1975, c. 382, §3 (NEW). PL 1983, c. 558, §§1,2 (AMD). PL 1983, c. 761, §§1,2 (AMD). PL 1985, c. 506, §A6 (AMD). PL 1989, c. 878, §§E3,4 (AMD). PL 2005, c. 620, §5 (AMD). PL 2021, c. 105, §§1-3 (AMD). PL 2021, c. 197, §1 (AMD). PL 2021, c. 673, §§4, 5 (AMD).

MRS Title 7 §606. Prohibited Acts (SAMPLE)

§606. Prohibited acts

1. Unlawful distribution. A person may not distribute in the State any of the following:

A. A pesticide that has not been registered pursuant to the provisions of this subchapter; [PL 2005, c. 620, §5 (AMD).]

B. A pesticide if any of the claims made for it or any of the directions for its use or other labeling differs from the representations made in connection with its registration, or if the composition of a pesticide differs from its composition as represented in connection with its registration; a change in the labeling or formulation of a pesticide may be made within a registration period without requiring reregistration of the product if the registration is amended to reflect that change and if that change will not violate any provision of FIFRA or this subchapter; [PL 2005, c. 620, §5 (AMD).]

C. A pesticide unless it is in the registrant's or the manufacturer's unbroken immediate container and there is affixed to the container, and to the outside container or wrapper of the retail package, if there is one, through which the required information on the immediate container cannot be clearly read, a label bearing the information required in this subchapter and rules adopted under this subchapter; [PL 2005, c. 620, §5 (AMD).]

D. A pesticide that has not been colored or discolored pursuant to section 610, subsection 1, paragraph D; [PL 2005, c. 620, §5 (AMD).]

E. A pesticide that is adulterated or misbranded or any device that is misbranded; [PL 2021, c. 105, §1 (AMD).]

F. A pesticide in containers that are unsafe due to damage; [PL 2021, c. 673, §4 (AMD).]

G. Beginning January 1, 2022, a pesticide containing chlorpyrifos as an active ingredient; [PL 2021, c. 673, §4 (AMD).]

H. A pesticide that has been contaminated by perfluoroalkyl and polyfluoroalkyl substances; or [PL 2021, c. 673, §4 (NEW).]

I. Beginning January 1, 2030, a pesticide that contains intentionally added PFAS that may not be sold or distributed pursuant to Title 38, section 1614, subsection 5, paragraph D. [PL 2021, c. 673, §4 (NEW).]

[PL 2021, c. 673, §4 (AMD).]

2. Unlawful alteration, misuse, divulging of formulas, transportation, disposal and noncompliance. A person may not:

A. Detach, alter, deface or destroy, wholly or in part, any label or labeling provided for in this subchapter or rules adopted under this subchapter; [PL 2005, c. 620, §5 (AMD).]

A-1. Add any substance to or take any substance from a pesticide in a manner that may defeat the purpose of this subchapter or rules adopted under this subchapter; [PL 2005, c. 620, §5 (NEW).]

B. Use or cause to be used any pesticide in a manner inconsistent with its labeling or with rules of the board, if those rules further restrict the uses provided on the labeling; [PL 2005, c. 620, §5 (AMD).]

C. Use for that person's own advantage or reveal, other than to the board or proper officials or employees of the state or federal executive agencies, to the courts of this State or of the United States in response to a subpoena, to physicians, or in emergencies to pharmacists and other qualified persons for use in the preparation of antidotes, any information relative to formulas of products acquired by authority of section 607 or any information judged by the board to contain or relate to trade secrets or commercial or financial information obtained by authority of this subchapter and marked as privileged or confidential by the registrant; [PL 2005, c. 620, §5 (AMD).]

D. Handle, transport, store, display or distribute pesticides in such a manner as to endanger human beings or their environment or to endanger food, feed or any other products that may be transported, stored, displayed or distributed with such pesticides; [PL 2005, c. 620, §5 (AMD).]

E. Dispose of, discard or store any pesticides or pesticide containers in such a manner as may cause injury to humans, vegetation, crops, livestock, wildlife or beneficial insects or pollute any water supply or waterway; [PL 2005, c. 620, §5 (AMD).]

F. Refuse or otherwise fail to comply with the provisions of this subchapter, the rules adopted under this subchapter or any lawful order of the board; [PL 2021, c. 673, §5 (AMD).]

G. Apply pesticides in a manner inconsistent with rules for pesticide application adopted by the board; or [PL 2021, c. 673, §5 (AMD).]

H. Use or cause to be used any pesticide container inconsistent with rules for pesticide containers adopted by the board. [PL 2021, c. 673, §5 (NEW).]

[PL 2021, c. 673, §5 (AMD).]

3. Unlawful use. A person may not apply glyphosate or dicamba within 75 feet of school grounds. This subsection does not apply to residential property or land used for commercial farming.

For purposes of this subsection, unless the context otherwise indicates, the following terms have the following meanings:

A. "Commercial farming" has the same meaning as in section 52, subsection 3; [PL 2021, c. 197, §1 (NEW).]

B. "Residential property" means real property located in this State that is used for residential dwelling purposes; [PL 2021, c. 197, §1 (NEW).]

C. "School" means any public, private or tribally funded elementary school as defined in Title 20-A, section 1, subsection 10, secondary school as defined in Title 20-A, section 1, subsection 32 or a nursery school that is part of an elementary or secondary school; and [PL 2021, c. 197, §1 (NEW).]

D. "School grounds" means:

(1) Land associated with a school building including playgrounds and athletic fields used by students or staff of a school. "School grounds" does not include land used for a school farm; and

(2) Any other outdoor area used by students or staff including property owned by a municipality or a private entity that is regularly used for school activities by students and staff but not including land used primarily for nonschool activities, such as golf courses, farms and museums.

4. Unauthorized Application of Pesticides. Except as provided pursuant to rules adopted under Section 610 and Title 22, Chapter 258-A, no person may apply, or cause to be applied, a pesticide to a property of another unless prior authorization for the pesticide application has been obtained from the owner, manager or legal occupant of that property. The term "legal occupant" includes tenants of rented property. Any person applying, or causing a pesticide to be applied on the property of another, shall bear the burden of proof demonstrating that prior authorization has been properly obtained pursuant to this section.

(a) Prima Facie Evidence. Clear and compelling evidence that only one person will benefit substantially from an unauthorized application of pesticides constitutes prima facie evidence that the person is responsible for the unauthorized application.

[PL 2021, c. 197, §1 (NEW).]

[PL 2021, c. 197, §1 (NEW).]

SECTION HISTORY

PL 1975, c. 382, §3 (NEW). PL 1983, c. 558, §§1,2 (AMD). PL 1983, c. 761, §§1,2 (AMD). PL 1985, c. 506, §A6 (AMD). PL 1989, c. 878, §§E3,4 (AMD). PL 2005, c. 620, §5 (AMD). PL 2021, c. 105, §§1-3 (AMD). PL 2021, c. 197, §1 (AMD). PL 2021, c. 673, §§4, 5 (AMD).

MRS Title 22 §1471-D. Certification and licenses (Current)

7. Suspension.

A. If the board determines that there may be grounds for revocation of a license or certificate, it may temporarily suspend said license or certificate pending inquiry and opportunity for hearing, provided that such suspension shall not extend for a period longer than 45 days. [PL 1975, c. 397, §2 (NEW).]

B. The board shall notify the licensee or certificate holder of the temporary suspension, indicating the basis therefor and informing the licensee or certificate holder of the right to request a public hearing. [PL 1983, c. 819, Pt. A, §47 (AMD).]

C. If the licensee or certificate holder fails to request a hearing within 20 days of the date of suspension, such right shall be deemed waived. If the licensee or certificate holder requests such a hearing, notice shall be given at least 20 days prior to the hearing to the licensee or certificate holder and to appropriate federal and state agencies. In addition, public notice shall be given by publication in a newspaper of general circulation in the State and such other publications as the board deems appropriate. [PL 1983, c. 819, Pt. A, §48 (AMD).]

D. This subsection is not governed by the provisions of Title 4, chapter 5 or Title 5, chapter 375. [PL 1999, c. 547, Pt. B, §39 (AMD); PL 1999, c. 547, Pt. B, §80 (AFF).]

[PL 1999, c. 547, Pt. B, §39 (AMD); PL 1999, c. 547, Pt. B, §80 (AFF).]

8. Revocation. The District Court may suspend or revoke the certification or license of a licensee or certificate holder upon a finding that the applicant:

A. Is no longer qualified; [PL 1975, c. 397, §2 (NEW).]

B. Has engaged in fraudulent business practices in the application or distribution of pesticides; [PL 1975, c. 397, §2 (NEW).]

C. Used or supervised the use of pesticides applied in a careless, negligent or faulty manner or in a manner which is potentially harmful to the public health, safety or welfare or the environment; [PL 1975, c. 397, §2 (NEW).]

D. Has stored, transported or otherwise distributed pesticides in a careless, faulty or negligent manner or in a manner which is potentially harmful to the environment or to the public health, safety or welfare; [PL 1975, c. 397, §2 (NEW).]

E. Has violated the provisions of this chapter or the rules and regulations issued hereunder; [PL 1975, c. 397, §2 (NEW).]

F. Has made a pesticide recommendation, use or application, or has supervised such use or application, inconsistent with the labelling or other restrictions imposed by the board; [PL 1975, c. 397, §2 (NEW).]

G. Has made false or fraudulent records or reports required by the board under this chapter or under regulations pursuant thereto; [PL 1981, c. 470, Pt. A, §67 (AMD).]

H. Has been subject to a criminal conviction under section 14 (b) of the amended FIFRA or a final order imposing a civil penalty under section 14 (a) of the amended FIFRA; or [PL 1981, c. 470, Pt. A, §67 (AMD).]

I. Has had the license or certificate, which supplied the basis for the Maine license or certification pursuant to subsection 10, revoked or suspended by the appropriate federal or other state government authority. [PL 1977, c. 694, §341 (NEW).]

[PL 1983, c. 819, Pt. A, §49 (AMD); PL 1999, c. 547, Pt. B, §78 (AMD); PL 1999, c. 547, Pt. B, §80 (AFF).]

MRS Title 22 §1471-D. Certification and licenses (SAMPLE)

Converting Grounds for Revocation in Title 22 to Prohibited Acts Making them Applicable to Unlicensed Applicators

7. Suspension.

A. If the board determines that there may be grounds for revocation of a license or certificate arising from prohibited acts pursuant to subsection 8-B, or Title 7, Section 606, it may temporarily suspend said license or certificate pending inquiry and opportunity for hearing, provided that such suspension shall not extend for a period longer than 45 days. [PL 1975, c. 397, §2 (NEW).]

B. The board shall notify the licensee or certificate holder of the temporary suspension, indicating the basis therefor and informing the licensee or certificate holder of the right to request a public hearing. [PL 1983, c. 819, Pt. A, §47 (AMD).]

C. If the licensee or certificate holder fails to request a hearing within 20 days of the date of suspension, such right shall be deemed waived. If the licensee or certificate holder requests such a hearing, notice shall be given at least 20 days prior to the hearing to the licensee or certificate holder and to appropriate federal and state agencies. In addition, public notice shall be given by publication in a newspaper of general circulation in the State and such other publications as the board deems appropriate. [PL 1983, c. 819, Pt. A, §48 (AMD).]

D. This subsection is not governed by the provisions of Title 4, chapter 5 or Title 5, chapter 375. [PL 1999, c. 547, Pt. B, §39 (AMD); PL 1999, c. 547, Pt. B, §80 (AFF).]

[PL 1999, c. 547, Pt. B, §39 (AMD); PL 1999, c. 547, Pt. B, §80 (AFF).]

8. Revocation. The District Court may suspend or revoke the certification or license of a licensee or certificate holder upon a finding that the applicant has committed a prohibited act pursuant subsection 8-B~~:~~or Title 7 Section 606.

8-B. Prohibited Acts. A person may not:

A. Hold a board license or certificate if the person ~~I~~is no longer qualified; [PL 1975, c. 397, §2 (NEW).]
B. ~~Has engaged~~ Engage in fraudulent business practices in the application or distribution of pesticides; [PL 1975, c. 397, §2 (NEW).]
C. Use~~d~~ or supervise~~d~~ the use of pesticides applied in a careless, negligent or faulty manner or in a manner which is potentially harmful to the public health, safety or welfare or the environment; [PL 1975, c. 397, §2 (NEW).]
D. ~~Has~~ ~~s~~Store~~d~~, transport~~ed~~ or otherwise distribute~~d~~ pesticides in a careless, faulty or negligent manner or in a manner which is potentially harmful to the environment or to the public health, safety or welfare; [PL 1975, c. 397, §2 (NEW).]
E. ~~Has v~~Violate~~d~~ the provisions of this chapter or the rules and regulations issued hereunder; [PL 1975, c. 397, §2 (NEW).]
F. ~~Has made~~ Make a pesticide recommendation, use or application, or ~~has~~ supervise~~d~~ such use or application, inconsistent with the labelling or other restrictions imposed by the board; [PL 1975, c. 397, §2 (NEW).]
G. ~~Has made~~ Make false or fraudulent records or reports required by the board under this chapter or under regulations pursuant thereto; [PL 1981, c. 470, Pt. A, §67 (AMD).]

Conclusion:

The addition of unauthorized application of pesticides to prohibited acts would allow for stricter enforceability both within and outside of the regulated community. These changes coupled with an enhanced penalty structure would provide a greater deterrent for a person to perform an unauthorized pesticide application.

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

Memorandum

To: Board of Pesticides Control
From: Alexander Peacock, Director
Subject: Penalties

December 6, 2024

Background:

During presentation and ratification of administrative consent agreements, the subject of insufficient penalties to deter future violations has often been raised. BPC penalties have also received attention in the media in connection with recent fines that have been assessed. MRS Title 7 §616-A. Penalties, outlines the BPC's penalty structure in statute. Staff has prepared sample language that may enhance the penalty provisions. This topic is brought to the board for input and discussion.

MRS Title 7 §616-A. Penalties (CURRENT)

§616-A. Penalties

1. Informal hearing. When the staff of the board proposes that the board take action on a possible violation, the board shall notify the alleged violator before discussing the alleged violation. The alleged violator may choose to address the board and may also choose to be represented by legal counsel. This requirement does not constitute and is not subject to the same procedures as an adjudicatory hearing under the Maine Administrative Procedure Act.
[PL 2005, c. 620, §16 (AMD).]

2. Civil violations. The following violations are civil violations.

A. A person may not violate this subchapter or a rule adopted pursuant to this subchapter or Title 22, chapter 258-A or a rule adopted pursuant to Title 22, chapter 258-A. Except as provided in paragraph B, the following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine of not more than $1,500 may be adjudged.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine

of not more than $4,000 may be adjudged. [PL 2003, c. 452, Pt. B, §6 (RPR); PL 2003, c. 452, Pt. X, §2 (AFF).]

B. A private applicator, as defined in Title 22, section 1471-C, may not violate a rule regarding records maintained pursuant to section 606, subsection 2, paragraph G. The following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine of not more than $500 may be adjudged.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine of not more than $1,000 may be adjudged. [PL 2011, c. 510, §1 (AMD).]

[PL 2011, c. 510, §1 (AMD).]

2-A. Criminal violation. A person may not intentionally or knowingly violate this subchapter or Title 22, chapter 258-A, a rule adopted under this subchapter or Title 22, chapter 258-A or a restriction of a registration issued pursuant to this subchapter. A person who violates this subsection commits a Class E crime. Notwithstanding Title 17-A, section 1604, subsection 1 and sections 1704 and 1705, the court may impose a sentencing alternative of a fine of not more than $7,500 or a term of imprisonment of not more than 30 days, or both, for each violation. Prosecution under this subsection is by summons and not by warrant. A prosecution under this subsection is separate from an action brought pursuant to subsection 2.
[PL 2019, c. 113, Pt. C, §1 (AMD).]

3. Continuation. Each day that the violation continues is considered a separate offense.
[PL 1989, c. 841, §3 (NEW).]

4. Exceptions.
[PL 2003, c. 452, Pt. B, §8 (RP); PL 2003, c. 452, Pt. X, §2 (AFF).]

5. Criminal violations.
[PL 2003, c. 452, Pt. B, §8 (RP); PL 2003, c. 452, Pt. X, §2 (AFF).]

6. Other relief. Notwithstanding Title 22, section 1471-D, subsections 6 to 8 and in addition to other sanctions provided under this section, the court may order that a violator obtain recertification credits through board-approved meetings or courses as a condition of retaining, maintaining or renewing a certification or license required under Title 22, chapter 258-A.
[PL 1989, c. 841, §3 (NEW).]

7. Considerations. In setting a penalty under this section, the court shall consider, without limitation:

A. Prior violations by the same party; [PL 1989, c. 841, §3 (NEW).]

B. The degree of harm to the public and the environment; [PL 1989, c. 841, §3 (NEW).]

C. The degree of environmental damage that has not been abated or corrected; [PL 1989, c. 841, §3 (NEW).]

D. The extent to which the violation continued following the board's notice to the violator; [PL 1989, c. 841, §3 (NEW).]

E. The importance of deterring the same person or others from future violations; and [PL 1989, c. 841, §3 (NEW).]

F. The cause and circumstances of the violation, including:

(1) The foreseeability of the violation;

(2) The standard of care exercised by the violator; and

(3) Whether or not the violator reported the incident to the board. [PL 1989, c. 841, §3 (NEW).]

[PL 1989, c. 841, §3 (NEW).]

8. Injunction. The board may bring an action to enjoin the violation or threatened violation of any provision of this subchapter or any rule made pursuant to this subchapter in a court of competent jurisdiction of the district in which the violation occurs or is about to occur. [PL 1989, c. 841, §3 (NEW).]

9. No damages from administrative action if probable cause exists. A court may not allow the recovery of damages from administrative action taken, or for a stop sale, use or removal order, if the court finds that there was probable cause for the administrative action. [PL 1989, c. 841, §3 (NEW).]

10. Sunset.

[PL 1991, c. 829, §1 (RP).]

SECTION HISTORY

PL 1989, c. 841, §3 (NEW). PL 1991, c. 829, §1 (AMD). PL 2003, c. 452, §§B6-8 (AMD). PL 2003, c. 452, §X2 (AFF). PL 2005, c. 620, §16 (AMD). PL 2011, c. 510, §1 (AMD). PL 2019, c. 113, Pt. C, §1 (AMD).

MRS Title 7 §616-A. Penalties (SAMPLE I)

§616-A. Penalties

1. Informal hearing. When the staff of the board proposes that the board take action on a possible violation, the board shall notify the alleged violator before discussing the alleged violation. The alleged violator may choose to address the board and may also choose to be represented by legal counsel. This requirement does not constitute and is not subject to the same procedures as an adjudicatory hearing under the Maine Administrative Procedure Act. [PL 2005, c. 620, §16 (AMD).]

2. Civil violations. The following violations are civil violations.

A. A person may not violate this subchapter or a rule adopted pursuant to this subchapter or Title 22, chapter 258-A or a rule adopted pursuant to Title 22, chapter 258-A. Except as provided in paragraph B, the following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine of not more than $2,500 may be adjudged.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine of not more than $5,000 may be adjudged. [PL 2003, c. 452, Pt. B, §6 (RPR); PL 2003, c. 452, Pt. X, §2 (AFF).]

B. A private applicator, as defined in Title 22, section 1471-C, may not violate a rule regarding records maintained pursuant to section 606, subsection 2, paragraph G. The following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine of not more than $1,000 may be adjudged.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine of not more than $2,000 may be adjudged. [PL 2011, c. 510, §1 (AMD).]

[PL 2011, c. 510, §1 (AMD).]

MRS Title 7 §616-A. Penalties (SAMPLE II)

§616-A. Penalties

1. Informal hearing. When the staff of the board proposes that the board take action on a possible violation, the board shall notify the alleged violator before discussing the alleged violation. The alleged violator may choose to address the board and may also choose to be represented by legal counsel. This requirement does not constitute and is not subject to the same procedures as an adjudicatory hearing under the Maine Administrative Procedure Act. [PL 2005, c. 620, §16 (AMD).]

2. Civil violations. The following violations are civil violations.

A. A person may not violate this subchapter or a rule adopted pursuant to this subchapter or Title 22, chapter 258-A or a rule adopted pursuant to Title 22, chapter 258-A. Except as provided in paragraph B, the following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine ~~of not more than $1,500~~ may be adjudged as follows.

a. $25,000 except as provided in subparagraph b. below; or

b. $50,000 for unauthorized pesticide applications for which the preponderance of demonstrates that the responsible party would benefit substantially.

(a) Prima Facie Evidence. Clear and compelling evidence that only one person will benefit substantially from an unauthorized application of pesticides constitutes prima facie evidence that the person is responsible for the unauthorized application.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine of not more than $4,000 may be adjudged. [PL 2003, c. 452, Pt. B, §6 (RPR); PL 2003, c. 452, Pt. X, §2 (AFF).]

B. A private applicator, as defined in Title 22, section 1471-C, may not violate a rule regarding records maintained pursuant to section 606, subsection 2, paragraph G. The following penalties apply to violations of this paragraph.

(1) A person who violates this paragraph commits a civil violation for which a fine of not more than $1,000 may be adjudged.

(2) A person who violates this paragraph after having previously violated this paragraph within the previous 4-year period commits a civil violation for which a fine of not more than $2,000 may be adjudged. [PL 2011, c. 510, §1 (AMD).]

[PL 2011, c. 510, §1 (AMD).]

Conclusion

An increase in the penalty would allow the BPC to assess fines that would deter future violations. An increase to an amount as shown in Sample II would likely require staff to develop a penalty matrix. This matrix could be written into policy and create transparency for future penalties assessed. Section 7. Considerations, may be another location for possible amendments to enhance the penalty structure.

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

Memorandum

To: Board of Pesticides Control
From: Alexander Peacock, Director
Subject: Service Containers for Pesticides

December 6, 2024

Background:

At the October 25, 2024 Board meeting a policy to label secondary and service containers that contain pesticides was presented by staff. Upon taking into consideration feedback from the Board, staff have revised the proposed policy as seen below. The October 25, 2024 memo and draft policy are attached for reference.

Draft Policy:

Board of Pesticides Control (BPC) Policy for Labeling Service Containers

Although the BPC does not require labels on service containers, the Department of Transportation (DOT) and Occupational Safety and Health Administration (OSHA) requirements may apply. The BPC recommends that applicators holding an active license issued by the BPC identify any pesticide concentrate that is stored in a service container by labeling said container the Product name and EPA registration number. In the event of a spill or other incident this will ensure that adequate information regarding the pesticide can be obtained in case of medical or environmental emergency. BPC recommends that such labels include the following information:

- Product name.
- EPA registration number.

The label with product name and EPA registration number may be affixed to the container as a sticker or written directly onto the container with an indelible writing implement.

It is a good management practice to ensure that the label for the pesticide product that has been put into a service container is available to any person transporting, handling and/or applying the pesticide.

Conclusions:

Often another employee/operator may use a vehicle or equipment that has a pesticide stored for use on it that the employee did not add themselves. If these containers are properly labeled, a new user will be aware of the materials on board and be able to reference the label for proper PPE and actions to take in the event of a spill or other incident. A policy to label service containers will help prevent undue harm to human health and environment. This policy will also aid in compliance with Chapter 20: Special Provisions and Title 7 § 606 as seen below.

Chapter 20: SPECIAL PROVISIONS

Section 3. Pesticide Storage and Disposal

A. Unused pesticides, whether in sealed or open containers, must be kept in a secure enclosure and otherwise maintained so as to prevent unauthorized use, mishandling or loss; and so as to prevent contamination of the environment and risk to public health.

Title 7: AGRICULTURE AND ANIMALS
Part 2: MARKETING, GRADING AND LABELING
Chapter 103: PRODUCTS CONTROLLED
Subchapter 2-A: MAINE PESTICIDE CONTROL ACT OF 1975

§606. Prohibited acts

2. Unlawful alteration, misuse, divulging of formulas, transportation, disposal and noncompliance. A person may not:

D. Handle, transport, store, display or distribute pesticides in such a manner as to endanger human beings or their environment or to endanger food, feed or any other products that may be transported, stored, displayed or distributed with such pesticides; [PL 2005, c. 620, §5 (AMD).]

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
BOARD OF PESTICIDES CONTROL
28 STATE HOUSE STATION
AUGUSTA, MAINE 04333

JANET T. MILLS
GOVERNOR

AMANDA E. BEAL
COMMISSIONER

Memorandum

To: Board of Pesticides Control
From: Alexander Peacock, Director
Subject: Secondary & Service Containers for Pesticides

October 25, 2024

Background:

It is not uncommon for pesticide applicators to purchase pesticide concentrates in bulk containers. These concentrates are then transferred to a smaller service (breakdown) container for use in the field during mixing and loading procedures as needed. Pesticide concentrates are also often pre-mixed at a company's headquarters into end use dilutions in accordance with the label. These end use dilutions are often stored in a secondary container for use in the field. BPC inspection Staff have observed unlabeled service & secondary containers in the field during the inspection and have raised concern over possible harm to human health and/or the environment if these containers are not handled appropriately.

Draft Policy:

Board of Pesticides Control (BPC) Policy for Labeling Secondary & Service Containers

Although the BPC does not require labels on secondary and service containers, the Department of Transportation (DOT) and Occupational Safety and Health Administration (OSHA) requirements may apply. BPC recommends that the applicator identify the material in the secondary or service container in the event of a spill to ensure that adequate information regarding the pesticide can be obtained in case of medical or environmental emergency. BPC recommends that such labels include the following information:

- Product name.
- EPA registration number.
- Name of active ingredient.
- Signal Word

- If the product in the container is diluted, it should be followed by the phrase:

  "*The product in this container is diluted as directed on the pesticide product label.*"

  "The dilution/mix ratio is ___________." (i.e. 2% or 1 fl.oz./gallon)

- The statement:
  "Follow the directions for use on the pesticide label when applying this product."
- The name and telephone number of the applicator/pest control firm [if applicable].

It is a good management practice to ensure that the label for the pesticide product that has been put into a secondary or service container is available to any person transporting, handling and/or applying the pesticide.

Conclusions:

Often another employee/operator may use a vehicle or equipment that has a pesticide stored or mixed for use on it that the employee did not add or mix themselves. If these containers or mix tanks are properly labeled, a new user will be aware of the materials on board and be able to reference the label for proper PPE and actions to take in the event of a spill or other incident. A policy to label secondary and service containers will help prevent undue harm to human health and environment. This policy will also aid in compliance with Chapter 29: Standards for Water Quality Protection and Title 7 § 606 as seen below.

Chapter 29: STANDARDS FOR WATER QUALITY PROTECTION
Section 2. Securing Pesticide Product Containers and Mix Tanks on Sprayers, Nurse Vehicles and Other Support Vehicles during Transportation

No person shall transport any pesticide unless it is secured so as to prevent release of pesticides onto the vehicle or from the vehicle. All tanks, liquid containers, cartons and bags must be securely held so they may not shift and become punctured or spilled.

Title 7: AGRICULTURE AND ANIMALS
Part 2: MARKETING, GRADING AND LABELING
Chapter 103: PRODUCTS CONTROLLED
Subchapter 2-A: MAINE PESTICIDE CONTROL ACT OF 1975

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D. Handle, transport, store, display or distribute pesticides in such a manner as to endanger human beings or their environment or to endanger food, feed or any other products that may be transported, stored, displayed or distributed with such pesticides; [PL 2005, c. 620, §5 (AMD).]

Preliminary Report to the Board on the 2023 Water Quality Study of Aerially Applied Herbicides in Forestry

November 2024

Prepared by:

Julia Vacchiano – Registrar and Water Quality Specialist

Maine Board of Pesticides Control

Department of Agriculture, Conservation & Forestry

Executive Summary

In 2021, the 131st Maine legislature voted to pass LD 125, An Act to Prohibit Aerial Spraying of Glyphosate and Other Synthetic Herbicides for the Purpose of Silviculture (Appendix I). Governor Janet Mills vetoed the bill and issued an executive order (EO 41 FY 2021) requiring state agencies to review the best management practices, rules and regulations, and potential consequences of aerial glyphosate application (Appendix II.) One of the key provisions of this executive order was the establishment of a surface water quality study specifically focused on the impact of aerial herbicide spraying in forestry. The Maine Board of Pesticides Control (BPC) was tasked with conducting this study, which was initially scheduled for completion in 2022.

Due to funding constraints, equipment and personnel availability, and significant changes in staffing, this project was conducted in the fall of 2023. BPC staff have undergone and overcome many changes and challenges while completing this study resulting in an extended timeline for completion.

Despite numerous hurdles, this report compiles the methodologies, data analyses, and results for the 2022 surface water quality study. The full dataset is also included in the appendix to provide transparency and facilitate further research. The findings of this study are crucial for understanding the potential environmental impacts of aerial herbicide spraying and informing future decisions regarding the practice.

Table of Contents

Introduction

Herbicide use is a key silvicultural tool in modern forestry practice. The aerial application of pesticides has been shown to increase timber yields, expedite reforestation, and reduce pressure from invasive species after logging has been conducted. While it offers several advantages, its environmental consequences also pose concerns. Parts of the scientific community, conservationists, and members of the public have challenged the validity of large-scale herbicide use in forestry due to its potential to impact biodiversity and contaminate surface and groundwater, posing risks to human health and aquatic life. (Wagner, 2004.)

This study intended to fulfill the requirements of Executive Order 41 (EO 41) and to find if, where, and in what quantity these aerially applied herbicides appear in Maine's surface waters.

Previous studies conducted by the BPC have detected and measured pesticides in the surface waters of Maine. Most recently, our 2021 study Surveillance for Current-Use Pesticides in Maine's Freshwater Resources Along a Population Gradient, otherwise known as the "10 Cities Project" found detectable and measurable levels of pesticides in the surface water of all 10 sites tested. Atrazine, imidacloprid, prometon, diuron, fipronil, and metolachlor had the most surface water detections in the 2021 study.

Samples included in this study were collected and analyzed from October 16, 2023, until November 9, 2023. Surface waters collected and tested were adjacent to and downstream from forest, agriculture, urban, and mixed-use land uses located in Aroostook, Franklin, Hancock, Kennebec, Oxford, Piscataquis, Penobscot, Somerset, and Washington Counties. The sampling sites encompassed various water bodies, including brooks, rivers, ponds, and lakes. Priority pesticides being monitored include glyphosate, aminomethylphosphonic acid (AMPA), aminopyralid, imazapyr, metsulfuron methyl, and sulfometuron methyl. These target pesticides were prioritized using records and data submitted to the BPC by foresters currently using herbicides in Maine. Additional pesticides detected and tested for are listed in Appendix III.

While the initial study design included a supplemental drift study to assess the potential for herbicide drift from aerial applications, this component was eliminated. Time constraints coupled with remote site location with difficult access played a role in this decision. The lack of suitable sites and dates available for testing hindered our ability to conduct a drift study.

Methods

Site Selection

Initially, site selection was built around exploring if the current distance cited in pesticide regulations restricting broadcast pesticide applications within 25' of waterbodies is sufficiently protective. However, timber harvesting by clearcutting is prohibited within 75 to 250' of a waterbody according to Department of Environmental Protection CMR 06-96 Chapter 310, and site exploration revealed that most harvesting happens 2000 – 2500' from water bodies. Site selection was re-evaluated and directed at watersheds downstream from herbicide application sites. Sampling of these watersheds could provide an integrated understanding of the extent of pesticide movement downstream. There were 149 sites selected based on available access points and the probability they could receive drainage from forestry site preparation or conifer-release herbicide applications. This information was gathered using the aerial application plans submitted to the BPC by Clayton Lake Woodland Holdings LLC, Irving Inc., Katahdin Forest Management, Northridge Services, Seven Islands Land Company, Solifor Timberlands, and Worcester Holdings LLC in 2022. In addition to these individual sampling locations there were 6 duplicate samples taken and 18 field blanks submitted.

Surface Water Sampling

Grab sampling was determined to be the best method for testing the water from the selected sites. Grab samples are single samples collected at a single location manually. An SOP for surface water sampling, “Standard Operating Procedure for Collecting Surface Water Samples for Pesticides Analysis” was developed in October of 2023 and instructed field staff on proper sample collection. Many of the details are outlined in this study and the full Standard Operating Procedure can be found in Appendix IV.

Collection Equipment included 500mL amber, glass, certified pre-cleaned bottles for the collection of pesticides. The bottles had Teflon-lined caps. The site was visited, the bottle was labeled and held below the water’s surface to collect the sample. The date and time were recorded at the time of the sampling along with a full recording of the inspector’s name, precise geographic location, accuracy, access point and water flow direction, and any applicable notes about the collection.

Duplicate Frequency and Field Blanks

When duplicate samples were collected the bottles were submerged either side by side or one immediately after the other. Field blanks were triple rinsed with distilled or deionized water to 1-2” depth, shaken, and emptied. Pre-rinsing was performed three times and refilled with distilled or deionized water to the shoulder of the bottle.

Sample Storage and Transfer

All samples were packed in ice or refrigerated from the time of collection to delivery to the laboratory. Samples were shipped in coolers with ice packs and were well-packaged to prevent breakage. All samples arrived at the laboratory within the holding period established by the lab for analysis.

Budget

This work was funded by a United States Environmental Protection Agency (EPA) Region 1 grant supporting the Board of Pesticides Control projects under the Federal Insecticide, Fungicide & Rodenticide Act (FIFRA) Cooperative Agreement.

Results

Surface Water Grab Samples

All counties sampled had at least one detection of a target herbicide (Table 1). None of the detections in this study reached any of EPA's lowest benchmarks (Table 2).

Field Blanks

Results from October 31st, 2023 were removed from the study due to consistencies found between the results and the positive field blanks. Identical compounds were found in similar concentrations suggesting that the field blanks could have become contaminated during transportation, packaging, or sample collection. To ensure the integrity of the data and to eliminate the possibility of cross-contamination affecting the conclusions of the study, the samples were discarded from the analysis.

Results with Exclusions

There were 98 detections of pesticide compounds across 53 sites, 50 of which were above the designated reporting limit. Imazapyr and metolachlor ES, a metabolite of metolachlor, had the highest number of detections. Three of the target compounds were detected. Imazapyr was detected in 25 samples, sulfometuron methyl was detected in 3 samples and metsulfuron methyl was detected in 1 sample. Of the 25 sites that had detections of the target pesticides, 7 were within a drainage divide where spraying occurred, 8 sites were in drainage divides adjacent to where aerial spraying occurred. 76 samples did not have any detections.

Table 1.

Field identification numbers not present on this table did not result in any detections. All units are represented in µg/L (ppb). 'Q' indicates a detection below the reporting limit that is adequate for identification but not sufficient for quantification.

SAMPLE DESCRIPTION	2,4-D	Alachlor OA	Aminocyclopyrachlor	Atrazine	Azoxystrobin	Carbaryl	DEA
Reporting Limit (ug/L (ppb)	0.009	0.0084	0.025	0.0022	0.0052	0.014	0.002
231016LRSLITTL06			Q				
231017BETHE07							
231017COLFLS02							
231017COLUM03							
231017ELSIE06		0.0085					
231017HANOVW05							
231017MACHI04							
231017WOODSS10				Q			Q
231018Allag04N							
231018LRSTHEFO09							Q
231018T13R1206							
231018T15R902E							

231018T15R1105						Q	
231019Allag01N							
231019Eagle07							Q
231019Walla05							
231019Winte08							
231020Ashla07W							
231020LRSFAIRF03							
231020LRSNEWPO01							
231020LRSPALMY02				Q			0.005
231020Masar01N							
231020Masar02W							
231020Masar03S							
231020Masar06E							
231020T8R504N							
231020T8R505W							
231023Carib03E				Q	Q		
231023Limes04							
231024Carib01W							
231024INDUS01				Q			Q
231024Sincl07					Q		
231024Squar06							
231024StAga10	Q						
231024Stock04S							
231024Washb11							
231024Westl02							
231027Conno07							
231027FortK05					Q		
231027NewCa04							
231027VanBu06							
231031ADAMS08				Q			Q
231101HERMO01							
231101KENDU02				Q			0.003
231101LINCO05	Q						
231101WINN06							
231101WINN06							
231102MEDWA03							
231102T11R701							
231102T6R1108				Q			Q
231102T9R1305							

Table 1. Continued

SAMPLE DESCRIPTION	Dimethenamid	HA	Hexazinone	Imazapyr	Imidacloprid	Isoxaben	Metalaxyl
Reporting Limit (ug/L (ppb)	0.006	0.004	0.0015	0.0035	0.0018	0.003	0.0035
231016LRSLITTL06				0.0044			
231017BETHE07							
231017COLFLS02			0.0066				
231017COLUM03			0.007				
231017ELSIE06							
231017HANOVW05							
231017MACHI04			0.0019				
231017WOODSS10							
231018Allag04N				0.012			
231018LRSTHEFO09							
231018T13R1206				Q			
231018T15R902E							
231018T15R1105	0.0092		Q	0.005			
231019Allag01N				Q			
231019Eagle07				Q			
231019Walla05				Q		0.0046	
231019Winte08				Q			
231020Ashla07W				0.016			
231020LRSFAIRF03							
231020LRSNEWPO01		Q					
231020LRSPALMY02		0.0041		Q			
231020Masar01N				0.045			
231020Masar02W				0.011			
231020Masar03S				0.01			
231020Masar06E				0.034			
231020T8R504N				0.048			
231020T8R505W				0.1			
231023Carib03E				0.0098			
231023Limes04					0.0043		Q
231024Carib01W				0.013			
231024INDUS01							
231024Sincl07					Q		Q
231024Squar06				0.038			
231024StAga10							
231024Stock04S				0.043			
231024Washb11				0.019			
231024Westl02				0.11			
231027Conno07				0.063			
231027FortK05							
231027NewCa04							

231027VanBu06							
231031ADAMS08							
231101HERMO01							
231101KENDU02		Q					
231101LINCO05							
231101WINN06							
231101WINN06							
231102MEDWA03							
231102T11R701				0.017			
231102T6R1108							
231102T9R1305				0.0043			

Table 1. Continued

SAMPLE DESCRIPTION	Metolachlor	Metolachlor ESA	Metolachlor OA	Metsulfuron methyl	Nicosulfuron	Pyroxsulam	Sulfometuron methyl	Tebuthiuron
Reporting Limit (ug/L (ppb)	0.024	0.005	0.042	0.01	0.011	0.013	0.0025	0.0011
231016LRSLITTL06								
231017BETHE07		Q						
231017COLFLS02								
231017COLUM03								
231017ELSIE06								
231017HANOVW05		0.006						
231017MACHI04								
231017WOODSS10								0.0015
231018Allag04N								
231018LRSTHEFO09								
231018T13R1206								
231018T15R902E		Q						
231018T15R1105					Q	Q		
231019Allag01N								
231019Eagle07		Q						
231019Walla05		Q						
231019Winte08								
231020Ashla07W		Q						
231020LRSFAIRF03		0.013						
231020LRSNEWPO01		0.015						
231020LRSPALMY02		0.34	0.085					
231020Masar01N		Q						
231020Masar02W								
231020Masar03S								
231020Masar06E							Q	
231020T8R504N							0.0042	
231020T8R505W				Q			0.0055	

231023Carib03E		0.02						
231023Limes04		Q						
231024Carib01W		0.013						
231024INDUS01								
231024Sincl07		0.37	0.12					
231024Squar06		0.026						
231024StAga10		0.024						
231024Stock04S								
231024Washb11		Q						
231024Westl02								
231027Conno07								
231027FortK05		Q						
231027NewCa04		0.1	Q					
231027VanBu06		0.0068						
231031ADAMS08								
231101HERMO01		0.016						
231101KENDU02	Q	0.34	0.13					
231101LINCO05								
231101WINN06		0.043						
231101WINN06		0.043						
231102MEDWA03		Q						
231102T11R701								
231102T6R1108								
231102T9R1305								

Table 2. Pesticide Summary by Lowest and Human Benchmark

Pesticide	Number of Detections	Highest Detection	Lowest Benchmark	Acute Human Health Benchmark
		(ppb)	(ppb)	(ppb)
2,4D	2	Q	299.2	400
Alachlor + analytes	1	0.0085	1.64	N/A
Aminocyclopyrachlor	1	Q	8900 Freshwater Invertebrate (Chronic)	16500
Atrazine + analytes	23	0.014	4.6 Vascular Plants	N/A
Azoxystrobin	3	Q	44	1070

			Freshwater Invertebrate (Chronic)	
Carbaryl	1	Q	0.5 Freshwater Invertebrate (Chronic)	N/A
Dimethenamid	1	0.0092	8.9 Vascular Plants	300
Hexazinone	4	0.007	7 Nonvascular Plants	N/A
Imazapyr	25	0.11	24 Vascular Plants	15000
Imidacloprid	2	0.0043	0.01 Freshwater Invertebrate (Chronic)	500
Isoxaben	1	0.0046	10 Vascular Plants	300
Metalaxyl	2	Q	1200 Freshwater Invertebrate (Chronic)	3000
Metolachlor + Analytes	26	0.4	N/A	N/A
Metsulfuron methyl	1	Q	0.36 Vascular Plants	1500
Nicosulfuron	1	Q	N/A	7400
Pyroxsulam	1	Q	2.57 Vascular Plants	6000
Sulfometuron methyl	3	0.0055	0.45 Vascular Plants	1630
Tebuthiuron	1	0.0015	50 Nonvascular Plants	N/A

Full data set available by request. Please email julia.vacchiano@maine.gov for complete testing results.

Glyphosate

There were no detections of glyphosate in any locations or in any samples. Similarly, there were no detections of AMPA, a primary breakdown product of glyphosate, or Glufosinate, a similar herbicide. Glyphosate and its breakdown byproducts bind tightly to the soil and are unlikely to enter the groundwater when bound to most soil types (National Pesticide Information Center, 2019.)

Discussion

This study confirms the presence of various pesticides in the waters of Maine, including but not limited to the pesticides commonly used in the forestry industry. The degree to which these substances exist in Maine's surface water varies from questionable detections below the reporting limit to clear and quantifiable results. These results align with water quality reports from states with significant forestry sectors like Wisconsin (Wisconsin Department of Agriculture, 2023), Minnesota (Minnesota Department of Agriculture, 2023), and Washington (Sandison, 2024.) The active ingredients found were primarily broad-spectrum herbicides. Imazapyr and a degradation product of Metolachlor were detected at a higher frequency than other pesticides in the study. Atrazine and one of its degradation products, deethylatrazine (DEA) are also detected more often than other pesticides despite field blanks with possible contamination being removed from the data. While pesticides were present, there were no detections that exceeded EPA established benchmarks for aquatic life, terrestrial life, or humans.

Trends

The study suggests that pesticide presence in the surface water is clustered. While most samples showed no pesticide detection, samples taken from certain areas had a wide range of pesticides present. The map below shows detections and pesticide compounds clustered in positive samples. Three samples had six detections each.

No single pesticide was detected in more than 20% of samples taken, indicating that detections are generally rare.

These findings suggest that reporting limits influence the detection of certain compounds. The analytes detected most frequently had the lowest reporting limits, implying a higher likelihood of detection. However, most of the analytes detected were broad-spectrum herbicides or their breakdown products. Despite the higher likelihood we would detect certain analytes, this specific kind of herbicide has variable reporting limits. This indicates that we are finding more broad-spectrum herbicides not due to their reporting limits, but because there is more of it leaching into the surface water.

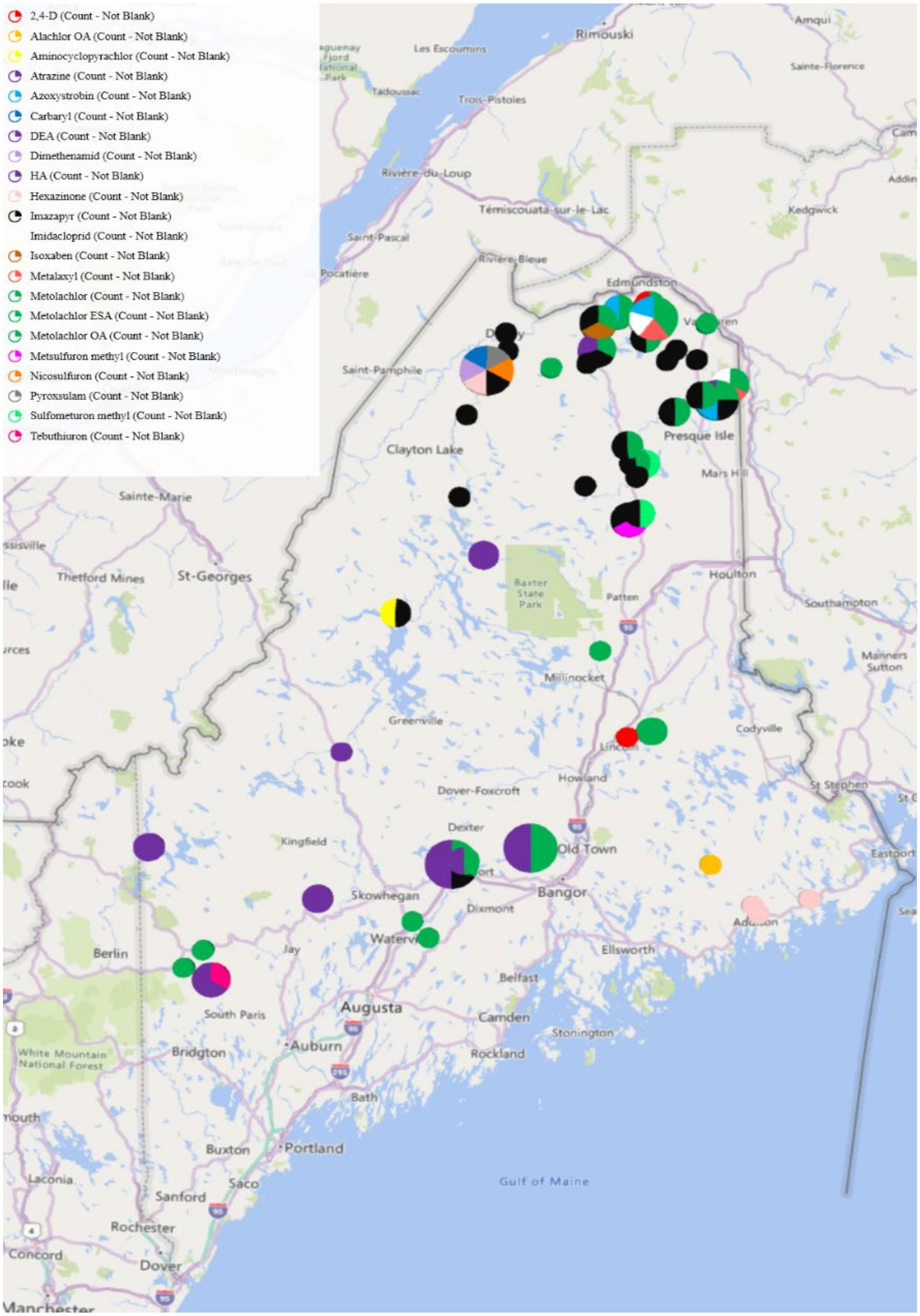

Figure 1. Detections and Analytes found. Map displays GPS coordinates with detections and points are divided by which compounds were detected.

Thresholds and Reporting Limits

Aquatic Life Benchmarks are presented with the data and determined by the United States Environmental Protection Agency. These benchmarks are intended to indicate the point at which a pesticide concentration begins to affect a population. There are no definitive levels at which all organisms of a singular category are injured but EPA evaluation has determined these benchmark figures are the levels where concern should be raised. As stated previously there are no samples in this study that are above any determined benchmark, but sample concentrations can be viewed and their absolute proximity to these determined figures can be evaluated to predict future issues that could arise. Levels in this study do not necessarily beg immediate action but encourage further monitoring.

It is also prudent to assess the benchmarks in relation to the reporting limits of the laboratory used. Reporting limits are the levels at which the methods of detection can identify an analyte in a sample. The only active ingredient in the study with a reporting limit above any EPA-determined benchmark was Chlorpyrifos. A non-chlorpyrifos non-detect in this study means that, regardless of whether the study can detect it, it is present at a concentration below the level of concern. Additionally, the use of chlorpyrifos began to be phased out in Maine with the signature of L.D. 316 on June 8, 2021.

Individual Compounds Most Commonly Found

Metolachlor

Metolachlor is a broad-spectrum herbicide used for weed control outdoors that has applications for agricultural fields, turf and lawns, ornamentals, trees, shrubs, vines, rights of way, and in forestry. Metolachlor was first registered with the EPA in 1976 and Maine has 46 registered products in 2024 containing the active ingredient or metabolites of metolachlor. According to the EPA, it has relatively low toxicity and is mostly non-irritating to the skin and eyes. It is classified as a likely carcinogen to humans. The highest risk of exposure is handlers and applicators who may be mixing, loading, and applying the pesticide in any of its liquid or granular formulations. Metolachlor is moderately persistent in the environment and is mobile in a variety of soil types. Half-life in water is about 200 days. It is toxic to birds exposed chronically and moderately toxic to freshwater fish when exposed acutely. Potential risk to nontarget plants is a likely consequence of runoff, leaching, and drift (United States Environmental Protection Agency, 1995.)

Imazapyr

Imazapyr is a systemic, non-selective herbicide used for the control of a wide variety of terrestrial and aquatic weeds in agricultural, industrial, residential, forestry, and ornamental settings. Imazapyr was first registered with the EPA in 1985, and Maine currently has 44 Imazapyr products registered. According to the EPA, this active ingredient has relatively low acute toxicity through oral and dermal exposure while it is determined to have a slightly higher toxicity when inhaled. It does not present dermal irritation but can cause irreversible eye damage. It is classified as non-carcinogenic in humans. The highest risk of exposure is, again, to applicators mixing, handling, or applying the product at higher concentrations. Risk evaluations of Imazapyr show that it is both mobile and persistent and degrades in surface water with a half-life of 3-5 days. There is very little risk to birds, mammals, bees, or aquatic organisms when levels in the surface water are below the established benchmarks. However, there are risks to aquatic vascular plants, particularly those on the federal and state endangered species lists (United States Environmental Protection Agency, 2006.)

Atrazine

Atrazine is a systemic herbicide used for broadleaf weeds and certain grasses. It is labeled for use on soil, roadsides, lawns, agricultural fields, and athletic fields. It was first registered by the EPA in 1958 and there are currently 39 products registered in Maine containing Atrazine or its metabolites. The EPA has determined that acute oral and dermal toxicity is low and inhalation toxicity is very low. There are minimal effects to the skin or eyes. Atrazine is not likely to be carcinogenic to humans. Human exposure is most likely for people handling and applying the product. Atrazine is broken down by water, sunlight, and microorganisms in the soil and has a half-life of around 578 days in water. Atrazine is moderately mobile, does not bind well to soil, and breaks down more slowly in colder climates. It is slightly to moderately toxic to fish, and highly toxic to other aquatic organisms while being essentially non-toxic to bees, worms, birds, and mammals. Due to runoff potential and mobility, off-target plants are likely to be injured by applications of atrazine and its breakdown products (NPIC, 2020.)

Conclusions

This study demonstrates that pesticides both used in and apart from the forestry industry can be found in the surface waters of Maine. Detections of pesticides appear to be clustered. None of the pesticides detected reached any level of concern established by EPA benchmarks. This data contributes to our understanding of pesticide presence and movement in the state and monitoring to show the progression of these figures is encouraged.

Contributors

This section acknowledges the valuable contributions of the individuals involved in this research. Their expertise and support were essential to the successful completion of this project.

Jennie Poisson - Region 1 Inspector, Southwest

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Appendix

Appendix I

130th MAINE LEGISLATURE

FIRST REGULAR SESSION-2021

Legislative Document	**No. 125**
S.P. 58	In Senate, January 21, 2021

An Act To Prohibit the Aerial Spraying of Glyphosate and Other Synthetic Herbicides for the Purpose of Silviculture

Received by the Secretary of the Senate on January 19, 2021. Referred to the Committee on Agriculture, Conservation and Forestry pursuant to Joint Rule 308.2 and ordered printed.

DAREK M. GRANT
Secretary of the Senate

Presented by President JACKSON of Aroostook.
Cosponsored by Speaker FECTEAU of Biddeford and
Senators: BENNETT of Oxford, MAXMIN of Lincoln, Representatives: O'NEIL of Saco, PLUECKER of Warren.

Be it enacted by the People of the State of Maine as follows:

Sec. 1. 7 MRSA §606, sub-§3 is enacted to read:

3. Aerial spraying of glyphosate and other synthetic herbicides. A person may not conduct an aerial application of glyphosate or other synthetic herbicides for the purpose of silviculture, including reforestation, regeneration or vegetation control after any timber harvest.

Sec. 2. 12 MRSA §8869, sub-§1, as enacted by PL 1989, c. 555, §10, is amended to read:

1. Standards for regeneration after harvests. The commissioner shall adopt rules to ensure adequate regeneration of commercial tree species on a site within 5 years of completion of any timber harvest. Rules to implement this requirement ~~shall~~ must include identification of commercial tree species, minimum stocking standards ~~and~~, methods to mitigate inadequate regeneration and a prohibition on the aerial application of glyphosate or other synthetic herbicides pursuant to Title 7, section 606, subsection 3. In developing regeneration standards, the commissioner shall take into consideration regional differences in forest types, tree species and physiographic conditions.

Sec. 3. 12 MRSA §8869, sub-§7-A, as amended by PL 2013, c. 542, §5, is further amended to read:

7-A. Exemption for outcome-based forestry areas. An outcome-based forestry area designated under section 8003, subsection 3, paragraph Q is exempt from the requirements of this section if specifically exempted in the agreement establishing the outcome-based forestry area. The agreement may not provide an exemption from the prohibition on the aerial application of glyphosate or other synthetic herbicides pursuant to Title 7, section 606, subsection 3.

SUMMARY

This bill prohibits the aerial application of glyphosate or other synthetic herbicides for the purpose of silviculture, including reforestation, regeneration or vegetation control after a timber harvest.

Appendix II

Executive Order

Office of
The Governor

No. 41 FY 20/21
DATE June 30, 2021

AN ORDER ESTABLISHING THE GOVERNOR'S REVIEW OF THE AERIAL APPLICATION OF HERBICIDES FOR FOREST MANAGEMENT

WHEREAS, Maine forests cover 89 percent of the state and support an important forest industry that is central to our natural resource-based economy, soil health, wildlife habitat, and quality of life, and its sustainable management is a top priority for the Administration;

WHEREAS, It is the policy of the State to promote the principles of integrated pest management and other science-based technology to minimize reliance on pesticides and herbicides while recognizing that outbreaks of disease, insects, and other pests will necessitate fluctuations in their use;

WHEREAS, State agencies, in cooperation with private interest groups, must work to educate pesticide users and the general public on the proper use of these chemicals and to determine other actions needed to accomplish the state policy and minimize the harm from the application of any harmful chemicals;

WHEREAS, The aerial application of herbicides in forest management is extremely limited, such that in 2019, the acreage treated amounted to less than five percent of the total acres harvested statewide and, in the last 30 years, Maine has seen an 82 percent reduction in acres treated;

WHEREAS, There are widespread concerns about the chemical glyphosate and whether the aerial application of herbicides is currently being performed safely and responsibly;

WHEREAS, It is State policy to allow the full growth of our forests to decarbonize our environment and achieve goals related to the disastrous effects of climate change, and eliminating undergrowth that limits the growth of these forests is done by limited application of synthetic pesticides and herbicides for which there is no known organic substitute;

WHEREAS, The Board of Pesticides Control authorized an independent assessment of Maine's pesticide use regulations concerning aerial application by industrial forest management companies in 2020, and the independent auditor, SCS Global Services, concluded, "The State of Maine regulatory framework, within which aerial application of herbicides in forest operations takes place, is functioning as designed."

NOW, THEREFORE, I, Janet T. Mills, Governor of the State of Maine, pursuant to *Me. Const. Art V, Pt 1, §1 and §12,* do hereby Order as follows:

I. ESTABLISHMENT AND PURPOSE

The Board of Pesticides Control shall, in consultation with the Maine Forest Service and other stakeholders and interested parties, review and amend rules related to the aerial application of glyphosate and other synthetic herbicides for the purpose of silviculture, including reforestation, forest regeneration, or vegetation control in forestry operations.

The process shall include:

A. A review of the existing BMPs for aerial application of herbicides including:

a. A review of the findings and recommendations of the independent assessment on aerial applications conducted in 2020.
b. A review of the current international scientific literature regarding the aerial application of herbicides for forestry purposes, taking into account the species addressed in other states and countries.
c. A review of Integrated Pest Management guidelines as they apply to aerial application of herbicides for forestry purposes to assess the relative effectiveness and costs of other treatment methods.

B. Development of a surface water quality monitoring effort to focus on aerial application of herbicides in forestry to be conducted in 2022.

C. A review undertaken by the Department of Inland Fisheries and Wildlife to assess wildlife habitat impacts related to sites treated by aerial application of herbicides.

D. A review of the existing regulatory framework for aerial application of herbicides in forest operations, to include:

a. A proposal to amend rules to expand the buffers and setbacks to further protect rivers, lakes, streams, ponds, brooks, wetlands, wildlife and human habitats and other natural resources.
b. A proposal to amend rules to expand the buffers for areas next to Sensitive Areas Likely to be Occupied (SALO) and other sensitive areas to include farming operations.

E. A series of public meetings to share and obtain public input on the results of the review before finalizing.

II. PROCEEDINGS

The Board of Pesticides Control and the Maine Forest Service shall solicit feedback from, and consult with, the University of Maine School of Forest Resources, Department of Inland Fisheries and Wildlife, forest landowners, foresters, licensed applicators, conservation groups, and others as necessary to complete their tasks.

The effort shall be led jointly by the Board of Pesticides Control and the Maine Forest Service and co-chaired by the respective directors. The meetings shall be held in locations determined by the chairs or will be held virtually but the proceedings of the group are not otherwise "public proceedings" within the meaning of 1 M.R.S. section 402.

III. RECOMMENDATIONS

The Board of Pesticides Control and the Maine Forest Service shall submit a summary of the review process and findings and any corresponding recommendations to the Governor on or before January 2, 2022, after which the authority of this Executive Order will dissolve.

IV. EFFECTIVE DATE

The effective date of this Order is June 30, 2021.

Janet T. Mills, Governor

Appendix III

List of 102 pesticides analyzed by Montana Department of Agriculture Analytical Laboratory. "Universal Method for the Determination of Polar Pesticides in Water Using Solid Phase Extraction and Liquid Chromatography/Mass Spectrometry/Mass Spectrometry."

Analyte	Reporting Limit ug/L (ppb)
2,4-D	0.009
Acetochlor	0.14
Acetochlor ESA	0.02
Acetochlor OA	0.0084
Alachlor	0.11
Alachlor ESA	0.044
Alachlor OA	0.0068
AMPA	1
Aminocyclopyrachlor	0.025
Aminopyralid	0.03
Atrazine	0.0022
Azoxystrobin	0.0052
Bentazon	0.0022
Bromacil	0.0041
Bromoxynil	0.012
Carbaryl	0.014
Chlorpyrifos	0.06
Chlorsulfuron	0.0056
Clodinafop acid	0.013
Clopyralid	0.088
Clothianidin	0.016
Deethyl atrazine (DEA)	0.0017
Deethyldeisopropylatrazine (DEDIA)	0.1
Deisopropyl atrazine (DIA)	0.04
Dicamba	0.88
Difenoconazole	0.011
Dimethenamid	0.006
Dimethenamid OA	0.0072
Dimethoate	0.0022

Disulfoton sulfone	0.0066
Diuron	0.0053
FDAT (indaziflam met)	0.0051
Fipronil	0.0024
Fipronil desulfinyl	0.14
Fipronil sulfide	0.08
Fipronil sulfone	0.04
Flucarbazone	0.0024
Flucarbazone sulfonamide	0.0039
Flumetsulam	0.029
Flupyradifurone	0.045
Fluroxypyr	0.035
Glufosinate	1
Glutaric acid	0.03
Glyphosate	1
Hydroxy atrazine	0.004
Halosulfuron methyl	0.01
Hexazinone	0.0015
Imazamethabenz acid	0.0025
Imazamethabenz ester	0.001
Imazamox	0.0057
Imazapic	0.003
Imazapyr	0.0035
Imazethapyr	0.004
Imidacloprid	0.0018
Indaziflam	0.002
Isoxaben	0.003
Isoxaflutole	0.13
Malathion	0.028
Malathion oxon	0.0024
MCPA	0.0046
MCPP	0.0044
Metalaxyl	0.0035
Methomyl	0.012
Methoxyfenozide	0.01
Metolachlor ESA	0.005
Metolachlor OA	0.042
Metolachlor OA	0.042
Metsulfuron methyl	0.01

Nicosulfuron	0.011
NOA 407854	0.0052
NOA 447204	0.02
Norflurazon	0.02
Norflurazon desmethyl	0.02
Oxamyl	0.01
Parathion methyl oxon	0.012
Phorate sulfone	0.024
Phorate sulfoxide	0.003
Picloram	0.28
Picoxystrobin	0.0075
Prometon	0.001
Propiconazole	0.01
Prosulfuron	0.005
Pyrasulfotole	0.02
Pyroxsulam	0.013
Saflufenacil	0.01
Simazine	0.0026
Sulfentrazone	0.035
Sulfometuron methyl	0.0025
Sulfosulfuron	0.0054
Tebuconazole	0.014
Tebuthiuron	0.0011
Tembotrione	0.073
Terbacil	0.0048
Terbufos sulfone	0.011
Tetraconazole	0.0039
Thiamethoxam	0.02
Thiencarbazone methyl	0.04
Thifensulfuron methyl	0.022
Tralkoxydim	0.0051
Tralkoxydim acid	0.005
Triallate	0.3
Triasulfuron	0.0055
Triclopyr	0.022
Trifloxystrobin	0.02

Appendix IV

Standard Operating Procedure
Maine Board of Pesticide Control
Date: October 13, 2023
SOP Number: *draft no number yet*
Page 1 of 11

Standard Operating Procedure for Collecting Surface Water Samples for Pesticides Analysis

APPROVALS

Approved by: ______________________ Date: ________

Megan Patterson, Director
Maine Board of Pesticides Control

Approved by: ______________________ Date: ________

John Pietroski, Program Manager
Maine Board of Pesticides Control

Prepared by: ______________________ Date: ________

Pam Bryer, Pesticides Toxicologist
Maine Board of Pesticides Control

Standard Operating Procedure for Collecting Surface Water Samples for Pesticides Analysis

1.0 PURPOSE AND SCOPE

1.1 This document delineates The Maine Board of Pesticides Control (BPC) Standard Operating Procedures (SOPs), for manual collection and handling of surface water grab samples, to be analyzed for a suite of pesticides at the Montana Agricultural Laboratory.

1.2 This SOP is a supplement to the BPC's general SOP for surface water grab samples.

1.3 This SOP establishes standard methods to assure the chemical and physical integrity of the samples. Consistent sampling techniques are essential for facilitating statistical analysis and comparability of results.

2.0 DEFINITIONS

2.1 **Grab Sample:** A discrete, single sample collected at a single location either manually or with an automatic sampler.

2.3 **Split Samples:** Samples formed by combining and mixing multiple samples collected at a single location, during a single sampling event, to be divided for analyses by two or more laboratories.

2.4 **Surface Water:** All inland waters of the state, excluding groundwater and estuarine and marine waters.

3.0 HEALTH AND SAFETY

3.1 Safety is a top priority. Two people should always be present for all field work conducted during inclement weather conditions or when there is risk to personal safety.

3.2 Hazards may include: fast moving and/or deep water, steep slopes to sampling locations, slippery rocks, incoming tides, and traffic.

3.3 Precautions should be taken when collecting and handling water samples, exiting vehicles, walking along roadsides, and accessing sampling sites. Protective gloves and other safety gear, as dictated by site conditions, should be worn.

4.0 MATERIALS

4.1 Field and Personal Safety Equipment

4.1.1 Reflective vests and/or highly visible clothing
4.1.2 Waders or water boots
4.1.3 U.S. Coast guard approved personal flotation device
4.1.4 Powder-free, Latex or nitrile gloves
4.1.5 Traffic cones or flagging
4.1.6 First aid kit

4.2 General materials

4.2.1 Record keeping: Chain-of-Custody forms; field data sheets; clip board; #2 pencil or waterproof, permanent pen
4.2.2 Map, satellite photos, directions
4.2.3 Sample container labels
4.2.4 Decontamination: de-ionized (or distilled) water, rinse bottles, paper towels
4.2.5 Re-closable one-gallon plastic Zip-Lock bags
4.2.6 Cooler and ice
4.2.7 Camera capability
4.2.8 GPS capability

4.3 Collection Equipment

4.3.1 Samples bottles: 500 mL, amber, glass, certified pre-cleaned for collection of pesticides; Teflon-lined caps (Bring extra bottles to each sampling event.)

4.3.3 (Optional) Swing sampler extension pole and adjustable clip

5.0 COLLECTION PROCEDURE

5.0.1 Select representative sample location according to BPC SOP for manual collection of surface water grab sampling. Ensure site is safely accessible from shore or a bridge.

5.0.2 Label the sample container prior to collection using #2 pencil or permanent, waterproof marker and waterproof labels.

5.0.2.1 Unique sample identification number (Write sample ID number on all sample containers and caps for each site.) Use format: **YYMMDDXXXXX##** where YY = last two digits of year; MM = two digit month; DD = two digit day; XXXXX = first five letters of the town (example: AUGUS for Augusta) -or- the entire township grid coordinate (example: T11R10); ## = the sample number for that day. If there is more than one sample location within the same town add a direction to the end of the town portion of the sample ID; N for northern, E for eastern, and so on.

(Example: Sample 1 = 140825AUGUSN01, Sample 2 = 140825AUGUSE02, etc.)

5.0.2.2 Type of sample (Grab)

5.0.2.3 Sample location - town

5.0.2.4 Date and time

5.0.2.5 Analysis to be conducted

5.0.3 Don a fresh pair of powder-free, Latex or nitrile gloves before sampling.

5.1 Stream Grab Sampling

5.1.1 Manual Collection

5.1.1.1 If stream is not wadeable, sample from the bank, reaching as close to center of stream as is safe and practical.

5.1.1.2 Remove the cap/lid. Do not touch the inside of the cap and keep hands away from the opening to avoid contaminating the cap, neck, or inside of the bottle. When not needed place cap on clean work surface with the opening up; do not place cap on the ground.

5.1.1.3 Downstream or away from the sample collection location triple rinse the collection container in the site water. Triple rinse as follows: remove cap, mostly fill with water (using at least an inch or two of water in the container), replace the lid and shake, dump the rinsate out on shore or in an area where it cannot reach the sampling location, repeat twice more prior to taking the sample.

5.1.1.4 If possible, hold the container near the base with the opening facing upstream. Plunge the sample bottle, mouth down to about elbow depth and sweep bottle up through the water column. Avoid disturbing the sediment.

5.1.1.5 Fill bottle and securely replace cap. Rinse exterior of bottle with deionized/distilled water. Place sample bottle in a re-closable bag and seal. Place in a cooler, completely cover with ice at 4°C for transport.

5.1.1 Collection Using a Sampling Pole (Optional)

5.1.2.1 Secure bottle onto swing sampling pole. Enter downstream from the sample location, limiting disturbance of sediment.

5.1.2.2 Remove the cap/lid. Do not touch the inside of the cap and keep hands away from the opening to avoid contaminating the cap, neck, or inside of the bottle. Place cap on clean work surface with opening up; do not place cap on the ground.

5.1.2.3 Extend the sampling pole upstream, as close to the center of the channel as possible, with the opening of the bottle facing upstream. Submerge the bottle, mouth down, and sweep bottle up through the water column.

5.1.2.4 Fill to neck of the bottle (avoid overfilling) and securely replace cap. Rinse exterior of bottle with deionized water. Place sample bottle in a re-closable bag and seal. Place in a cooler, partially filled with ice, at 4°C for transport.

5.2 **Field Blank Sampling:**

5.2.1. Overall, field blanks should be collected on a one-in-ten basis.

5.2.2. Each individual collecting samples should collect a field blank at the beginning and end of the project, at their first and last field sites respectively.

5.2.3. Water for field blanks should be recently purchased distilled water.

5.2.4. Wearing fresh gloves, remove the cap/lid of the sample collection container. Do not touch the inside of the cap and keep hands away from the opening to avoid contaminating the cap, neck, or inside of the bottle. When not needed place cap on clean work surface with the opening up; do not place cap on the ground.

5.2.5. Triple rinse as follows: remove cap, mostly fill with water (using at least an inch or two of water in the container), replace the lid and shake, dump the rinsate out on shore or in an area where it cannot reach the sampling location, repeat twice more prior to taking the sample.

5.2.6. Fill bottle and securely replace cap. Rinse exterior of bottle with deionized/distilled water. Place sample bottle in a re-closable bag and seal. Place in a cooler, completely cover with ice at 4°C for transport.

5.2 **Storm Drain Sampling:** <Not applicable to this sampling effort>

5.3 **Stormwater Grab Samples** <Not applicable to this sampling effort>

5.4 **Collection of a Composite Sample** <Not applicable to this sampling effort>

5.5 **Storage of Sample:** Refrigerate samples at 4°C overnight and until shipment.

6.0 DECONTAMINATION

6.0.1 As needed, triple rinse equipment with site water prior to sampling.

6.0.2 Prior to each discrete sample and prior to leaving site, triple rinse equipment with tap water, then triple rinse with deionized water to prevent cross-contamination from one sample and site to the next.

6.0.3 Store equipment in clean plastic bags.

7.0 CHAIN OF CUSTODY

7.0.1 All samples must be packed in ice or refrigerated from time of collection to delivery to the laboratory. Ship samples in coolers with ice packs and well packaged to prevent breakage.

7.0.2 Ensure samples are shipped to arrive at the laboratory within the holding period established by the laboratory for the specified analytical analyses.

7.0.3 Complete the chain of custody (COC) form for all samples. Note any special instructions or clarifications.

7.0.4 Send the white copy with the samples; keep other copies on file with field notes and data sheet.

7.0.5 Packages being shipped to Montana Agricultural Laboratory should be shipped Monday through to Thursday, not Friday, to ensure the package can be received and placed in cold storage upon arrival.

8.0 QA/QC

7.0.1 Quality Assurance/Quality Control (QA/QC) will be conducted in accordance with Standard Operating Procedures.

7.0.2 Ideally, ten percent of the total number of samples will be submitted as field blanks, field duplicates, and split samples.

7.0.2.1 **Field Split Sample:** <Not applicable to this sampling effort>

7.0.2.2 **Field Replicates/Duplicates:** Collect two samples, at the same sample event, by collecting side by side or by collecting one sample immediately after another. Label the routine sample and the duplicate sample separately. Example: The routine sample would have a sample ID of **140825AUGUS01**, and the duplicate would have a sample ID of

-

140825AUGUS02. Each inspector will be taking one duplicate sample during this project; ideally the duplicate will be taken in the middle of the sampling sequence.

7.0.2.3 **Field Blanks:** Triple rinse the field blank containers with distilled water. Pour a small volume of distilled or deionized water (to a depth of an inch or two) into the labeled sample bottle, replace the lid, shake, and empty. Repeat this pre-rinsing step twice more. Fill to the shoulder of the bottle. The blank will have its own sample ID number.

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APPENDIX B: Order of Sample Collection

In order to reach our quality assurance objectives, each inspector shall follow the this framework of organizing sample collection. Field Blanks are collected at the beginning and end of the project for each inspector and on a one in every ten basis. Each inspector should take one duplicate field sample when they have reached the middle of their data collection.

The following table shows the sample sequence needed for someone collecting samples from 19 unique sites.

Sample Location	Sample Order	>	Sample Type
1st	1st	>	Field Blank
1st	2nd	>	Sample
2nd	3rd	>	Sample
3rd	4th	>	Sample
4th	5th	>	Sample
5th	6th	>	Sample
6th	7th	>	Sample
7th	8th	>	Sample
8th	9th	>	Sample
9th	10th	>	Sample
10th	11th	>	Sample
10th	12th	>	Duplicate
11th*	13th	>	Field Blank
11th	14th	>	Sample
12th	15th	>	Sample
13th	16th	>	Sample
14th	17th	>	Sample
15th	18th	>	Sample
16th	19th	>	Sample
17th	20th	>	Sample
18th	21st	>	Sample
19th	22nd	>	Sample
19th	23rd	>	Field Blank

*This field blank could be collected at the 10th location; however, it makes more sense to move it to the following location to avoid clustering the QA samples at one site.

SAMPLE DESCRIPTION	Universal Sample ID	Glyphosate Sample ID
231016LRSBIGMO08	AC33183	AC33195
231016LRSELLIO09	AC33184	AC33196
231016LRSGUILF12	AC33187	AC33199
231016LRSLITTL06	AC33181	AC33193
231016LRSLOBST07	AC33182	AC33194
231016LRSLONGP01	AC33176	AC33188
231016LRSLONGP02	AC33177	AC33189
231016LRSMISER03	AC33178	AC33190
231016LRSMONSO10	AC33185	AC33197
231016LRSMONSO11	AC33186	AC33198
231016LRSPITTS05	AC33180	AC33192
231016LRSPLYMO04	AC33179	AC33191
231017BETHE07	AC33068	AC33080
231017BUMFO04	AC33065	AC33077
231017COLFLS01	AC33054	AC33357
231017COLFLS02	AC33055	AC33358
231017COLUM03	AC33056	AC33359
231017DEVER07	AC33060	AC33363
231017ELSIE06	AC33059	AC33362
231017GREEN08	AC33069	AC33081
231017HANOVE06	AC33067	AC33079
231017HANOVW05	AC33066	AC33078
231017MACHI04	AC33057	AC33360
231017MARSH05	AC33058	AC33361

231017ROXBU03	AC33064	AC33076
231017STONE11	AC33072	AC33084
231017STONE12	AC33073	AC33085
231017WELD01	AC33062	AC33074
231017WELD02	AC33063	AC33075
231017WOODSN09	AC33070	AC33082
231017WOODSS10	AC33071	AC33083
231018Allag04N	AC33125	AC33136
231018LRSATHEN13	AC33155	AC33167
231018LRSBRIGH12	AC33154	AC33166
231018LRSCONCO11	AC33153	AC33165
231018LRSJACKMN01	AC33144	AC33156
231018LRSJACKMS02	AC33145	AC33157
231018LRSJOHNS05	AC33147	AC33159
231018LRSLOWER07	AC33149	AC33161
231018LRSMOXIE10	AC33152	AC33164
231018LRSPARLI03	AC33269	AC33277
231018LRSPARLI04	AC33146	AC33158
231018LRSSOLONN14	AC33270	AC33278
231018LRSSOLONS15	AC33271	AC33279
231018LRSTHEFO08	AC33150	AC33162
231018LRSTHEFO09	AC33151	AC33163
231018LRSWESTF06	AC33148	AC33160
231018T11R1307	AC33128	AC33139
231018T13R1206	AC33127	AC33138
231018T15R1105	AC33126	AC33137
231018T15R901E	AC33122	AC33133
231018T15R902E	AC33123	AC33134
231018T15R903W	AC33124	AC33135
231019Allag01N	AC33129	AC33140
231019Allag02S	AC33130	AC33141
231019Eagle06	AC33105	AC33114
231019Eagle07	AC33106	AC33115

231019INDIA01	AC33259	AC33264
231019Porta09	AC33108	AC33117
231019StJoh03	AC33131	AC33142
231019T3R1103	AC33261	AC33266
231019T4R1002	AC33260	AC33265
231019T4R1104	AC33262	AC33267
231019T4R1105	AC33263	AC33268
231019Walla04	AC33132	AC33143
231019Walla05	AC33104	AC33113
231019Winte08	AC33107	AC33116
231020Ashla07W	AC33170	AC33170
231020Ashla08W	AC33171	AC33171
231020LRSFAIRF03	AC33274	AC33282
231020LRSNEWPO01	AC33272	AC33280
231020LRSPALMY02	AC33273	AC33281
231020Masar01N	AC33109	AC33118
231020Masar02W	AC33110	AC33119
231020Masar03S	AC33111	AC33120
231020Masar06E	AC33169	AC33169
231020T8R504N	AC33112	AC33121
231020T8R505W	AC33168	AC33168
231023Carib03E	AC33235	AC33246
231023Limes04	AC33236	AC33247
231023Presq01	AC33233	AC33244
231023Presq02	AC33234	AC33245
231024Carib01W	AC33237	AC33248
231024EUSTI05	AC33209	AC33218
231024EUSTIN06	AC33210	AC33219
231024EUSTIN07	AC33211	AC33220
231024INDUS01	AC33214	AC33223
231024KINGF04	AC33208	AC33217
231024NEWVI02	AC33206	AC33215
231024NORTH09	AC33213	AC33222
231024NORTHN08	AC33212	AC33221
231024SALEM03	AC33207	AC33216
231024Sincl07	AC33224	AC33229
231024Sincl08	AC33225	AC33230
231024Squar06	AC33242	AC33253

231024StAga09	AC33226	AC33231
231024StAga10	AC33227	AC33232
231024Stock03N	AC33239	AC33250
231024Stock04S	AC33240	AC33251
231024T15R405	AC33241	AC33252
231024Washb11	AC33243	AC33254
231024Westl02	AC33238	AC33249
231025LRSUPPER01	AC33275	AC33283
231025LRSUPPER02	AC33276	AC33284
231027Ashla01E	AC33285	AC33292
231027Conno07	AC33291	AC33298
231027Eagle03E	AC33287	AC33294
231027FortK05	AC33289	AC33296
231027NewCa04	AC33288	AC33295
231027T14R602	AC33286	AC33293
231027VanBu06	AC33290	AC33297
231031ADAMS08	AC33334	AC33342
231031CEDAR04	AC33346	AC33352
231031DOVER01	AC33343	AC33349
231031LINCOE09	AC33317	AC33322
231031LINCOW10	AC33318	AC33323
231031LOWER06	AC33332	AC33340
231031MAGAL11	AC33319	AC33324
231031MAGAL12	AC33320	AC33325
231031OQUOS04	AC33330	AC33338
231031RANGE05	AC33331	AC33339
231031RANGP03	AC33329	AC33337
231031RICHA01	AC33327	AC33335
231031RICHA02	AC33328	AC33336
231031RICHAN07	AC33333	AC33341
231031SEBEC02	AC33344	AC33350
231031SEBOE05	AC33347	AC33353
231031T4R9N03	AC33345	AC33351
231031UPTON13	AC33321	AC33326
231101BRADL03	AC33421	AC33428
231101GLENW07	AC33401	AC33408
231101HERMO01	AC33419	AC33426

231101KENDU02	AC33420	AC33427
231101LINCO04	AC33422	AC33429
231101LINCO05	AC33423	AC33430
231101MEDWA08	AC33425	AC33432
231101WINN06	AC33424	AC33431
231102MEDWA03	AC33397	AC33404
231102T11R701	AC33379	AC33387
231102T11R702	AC33380	AC33388
231102T1R1102	AC33396	AC33403
231102T2R1001	AC33395	AC33402
231102T3R7W04	AC33398	AC33405
231102T6R1108	AC33386	AC33394
231102T6R8W05	AC33399	AC33406
231102T6R8W06	AC33400	AC33407
231102T7R1707	AC33385	AC33393
231102T8R1506	AC33384	AC33392
231102T9R1305	AC33383	AC33391
231102T9R803	AC33381	AC33389
231102T9R804	AC33382	AC33390
231109T10R1202	AC33469	AC33472
231109T10R1203	AC33470	AC33473
231109T8R901	AC33468	AC33471

Sampler	Collection Start Time	GPS Instrument ID
Lou	14:16	GPSMAP64sx
Lou	15:16	GPSMAP64sx
Lou	16:21	GPSMAP64sx
Lou	11:27	GPSMAP64sx
Lou	11:56	GPSMAP64sx
Lou	7:14	GPSMAP64sx
Lou	7:14	GPSMAP64sx
Lou	7:46	GPSMAP64sx
Lou	15:49	GPSMAP64sx
Lou	15:49	GPSMAP64sx
Lou	10:11	GPSMAP64sx
Lou	9:42	GPSMAP64sx
Jennie	11:58	GPSMAP64sx
Jennie	10:00	GPSMAP64sx
Shannon	9:45	GPSMAP64sx
Shannon	10:16	GPSMAP64sx
Shannon	10:46	GPSMAP64sx
Shannon	14:51	GPSMAP64sx
Shannon	13:57	GPSMAP64sx
Jennie	12:23	GPSMAP64sx
Jennie	11:18	GPSMAP64sx
Jennie	10:55	GPSMAP64sx
Shannon	11:38	GPSMAP64sx
Shannon	12:46	GPSMAP64sx

Jennie	9:30	GPSMAP64sx
Jennie	14:45	GPSMAP64sx
Jennie	14:45	GPSMAP64sx
Jennie	7:40	GPSMAP64sx
Jennie	7:40	GPSMAP64sx
Jennie	13:00	GPSMAP64sx
Jennie	13:39	GPSMAP64sx
Keith	10:20	GPSMAP64sx
Lou	12:38	GPSMAP64sx
Lou	11:55	GPSMAP64sx
Lou	11:18	GPSMAP64sx
Lou	6:58	GPSMAP64sx
Lou	7:24	GPSMAP64sx
Lou	8:21	GPSMAP64sx
Lou	9:26	GPSMAP64sx
Lou	10:20	GPSMAP64sx
Lou	7:56	GPSMAP64sx
Lou	7:56	GPSMAP64sx
Lou	13:22	GPSMAP64sx
Lou	14:07	GPSMAP64sx
Lou	9:57	GPSMAP64sx
Lou	9:57	GPSMAP64sx
Lou	8:47	GPSMAP64sx
Keith	2:02	GPSMAP64sx
Keith	12:58	GPSMAP64sx
Keith	11:12	GPSMAP64sx
Keith	8:45	GPSMAP64sx
Keith	8:45	GPSMAP64sx
Keith	9:15	GPSMAP64sx
Keith	10:45	GPSMAP64sx
Keith	11:16	GPSMAP64sx
Keith	1:55	GPSMAP64sx
Keith	1:55	GPSMAP64sx

Shannon	10:03	GPSMAP64sx
Keith	3:40	GPSMAP64sx
Keith	11:45	GPSMAP64sx
Shannon	15:21	GPSMAP64sx
Shannon	12:45	GPSMAP64sx
Shannon	16:22	GPSMAP64sx
Shannon	16:38	GPSMAP64sx
Keith	1:10	GPSMAP64sx
Keith	1:10	GPSMAP64sx
Keith	2:30	GPSMAP64sx
Keith	12:30	GPSMAP64sx
Keith	12:30	GPSMAP64sx
Lou	10:16	GPSMAP64sx
Lou	8:44	GPSMAP64sx
Lou	9:22	GPSMAP64sx
Keith	8:30	GPSMAP64sx
Keith	9:00	GPSMAP64sx
Keith	9:20	GPSMAP64sx
Keith	11:30	GPSMAP64sx
Keith	10:00	GPSMAP64sx
Keith	10:45	GPSMAP64sx
Keith	3:15	GPSMAP64sx
Keith	4:00	GPSMAP64sx
Keith	2:00	GPSMAP64sx
Keith	2:00	GPSMAP64sx
Keith	9:15	GPSMAP64sx
Jennie	9:40	GPSMAP64sx
Jennie	10:20	GPSMAP64sx
Jennie	10:20	GPSMAP64sx
Jennie	7:18	GPSMAP64sx
Jennie	9:20	GPSMAP64sx
Jennie	7:49	GPSMAP64sx
Jennie	11:15	GPSMAP64sx
Jennie	11:00	GPSMAP64sx
Jennie	8:30	GPSMAP64sx
Keith	1:10	GPSMAP64sx
Keith	1:10	GPSMAP64sx
Keith	12:30	GPSMAP64sx

Keith	1:45	GPSMAP64sx
Keith	1:45	GPSMAP64sx
Keith	10:50	GPSMAP64sx
Keith	11:20	GPSMAP64sx
Keith	12:00	GPSMAP64sx
Keith	3:10	GPSMAP64sx
Keith	10:20	GPSMAP64sx
Lou	9:55	GPSMAP64sx
Lou	9:55	GPSMAP64sx
Keith	9:00	GPSMAP64sx
Keith	2:15	GPSMAP64sx
Keith	10:45	GPSMAP64sx
Keith	11:45	GPSMAP64sx
Keith	11:30	GPSMAP64sx
Keith	9:50	GPSMAP64sx
Keith	1:45	GPSMAP64sx
Jennie	8:35	GPSMAP64sx
Shannon	16:19	GPSMAP64sx
Shannon	12:37	GPSMAP64sx
Jennie	9:11	GPSMAP64sx
Jennie	9:30	GPSMAP64sx
Jennie	8:00	GPSMAP64sx
Jennie	9:45	GPSMAP64sx
Jennie	9:45	GPSMAP64sx
Jennie	7:15	GPSMAP64sx
Jennie	7:30	GPSMAP64sx
Jennie	6:30	GPSMAP64sx
Jennie	6:10	GPSMAP64sx
Jennie	6:10	GPSMAP64sx
Jennie	8:25	GPSMAP64sx
Shannon	13:42	GPSMAP64sx
Shannon	18:09	GPSMAP64sx
Shannon	15:23	GPSMAP64sx
Jennie	11:00	GPSMAP64sx
Shannon	15:25	GPSMAP64sx
Shannon	19:05	GPSMAP64sx
Shannon	12:40	GPSMAP64sx

Shannon	14:30	GPSMAP64sx
Shannon	16:30	GPSMAP64sx
Shannon	16:38	GPSMAP64sx
Shannon	20:00	GPSMAP64sx
Shannon	17:23	GPSMAP64sx
Shannon	16:28	GPSMAP64sx
Keith	7:50	GPSMAP64sx
Keith	7:50	GPSMAP64sx
Shannon	14:38	GPSMAP64sx
Shannon	12:15	GPSMAP64sx
Shannon	17:13	GPSMAP64sx
Keith	1:50	GPSMAP64sx
Shannon	18:44	GPSMAP64sx
Shannon	18:51	GPSMAP64sx
Keith	11:30	GPSMAP64sx
Keith	10:50	GPSMAP64sx
Keith	9:46	GPSMAP64sx
Keith	8:36	GPSMAP64sx
Keith	8:36	GPSMAP64sx
Keith	11:00	GPSMAP64sx
Keith	11:00	GPSMAP64sx
Keith	8:45	GPSMAP64sx

Latitdue	Longitude	Datum	Accuracy (ft/meter)
45.47963	-69.68007	WGS 84 Datum	9'
45.36924	-69.43701	WGS 84 Datum	9'
45.16832	-69.38666	WGS 84 Datum	9'
45.92422	-69.68436	WGS 84 Datum	9'
45.92715	-69.63875	WGS 84 Datum	9'
45.60451	-70.00307	WGS 84 Datum	9'
45.60451	-70.00307	WGS 84 Datum	9'
45.59765	-69.89007	WGS 84 Datum	9'
45.27583	-69.50804	WGS 84 Datum	9'
45.27583	-69.50804	WGS 84 Datum	9'
45.89161	-69.96378	WGS 84 Datum	9'
45.88823	-69.94971	WGS 84 Datum	9'
44.41459924	-70.7869261	WGS 84 Datum	9'
44.54168514	-70.54713286	WGS 84 Datum	9'
44.6561297	-67.73388272	WGS 84 Datum	9'
44.6561297	-67.73388272	WGS 84 Datum	9'
44.68940903	-67.76384803	WGS 84 Datum	9'
44.84090144	-68.16152644	WGS 84 Datum	9'
44.86397748	-67.98630582	WGS 84 Datum	9'
44.39844153	-70.70094644	WGS 84 Datum	9'
44.4867838	-70.78223113	WGS 84 Datum	9'
44.49147411	-70.68666422	WGS 84 Datum	9'
44.71387908	-67.45899738	WGS 84 Datum	9'
44.76221663	-67.52306359	WGS 84 Datum	9'

44.65886149	-70.65920728	WGS 84 Datum	9'
44.26069059	-70.82442141	WGS 84 Datum	9'
44.26069059	-70.82442141	WGS 84 Datum	9'
44.68428262	-70.45250026	WGS 84 Datum	9'
44.68428262	-70.45250026	WGS 84 Datum	9'
44.44460084	-70.5505768	WGS 84 Datum	9'
44.36636239	-70.63866562	WGS 84 Datum	9'
47.0350194	-69.0805111	WGS 84 Datum	10'
45.96506	-69.63635	WGS 84 Datum	9'
45.0813	-69.70411	WGS 84 Datum	9'
45.05732	-69.88845	WGS 84 Datum	9'
45.61975	-70.25762	WGS 84 Datum	9'
45.58829	-70.25671	WGS 84 Datum	9'
45.52639	-70.09866	WGS 84 Datum	9'
45.36327	-70.10041	WGS 84 Datum	9'
45.34977	-69.87396	WGS 84 Datum	9'
45.53788	-70.10049	WGS 84 Datum	9'
45.53788	-70.10049	WGS 84 Datum	9'
45.96085	-69.86719	WGS 84 Datum	9'
45.92955	-69.83347	WGS 84 Datum	9'
45.33694	-69.96762	WGS 84 Datum	9'
45.33694	-69.96762	WGS 84 Datum	9'
45.40061	-70.03929	WGS 84 Datum	9'
46.6143861	-69.39320278	WGS 84 Datum	12'
46.7635361	-69.3053194	WGS 84 Datum	12'
46.9518278	-69.1962806	WGS 84 Datum	10'
46.9644917	-68.8387111	WGS 84 Datum	12'
46.9644917	-68.8387111	WGS 84 Datum	12'
46.9374861	-68.8923694	WGS 84 Datum	12'
47.11245	-69.0895778	WGS 84 Datum	10'
47.0888361	-69.0236167	WGS 84 Datum	11'
47.0407972	-68.583475	WGS 84 Datum	10'
47.0407972	-68.583475	WGS 84 Datum	10'

45.63437905	-68.77941528	WGS 84 Datum	9'
46.7842222	-68.5364194	WGS 84 Datum	14'
47.1835333	-68.8716944	WGS 84 Datum	10'
45.87717605	-69.14063028	WGS 84 Datum	9'
45.97605957	-69.07044875	WGS 84 Datum	9'
45.96642448	-69.17323526	WGS 84 Datum	9'
45.96642448	-69.17323526	WGS 84 Datum	9'
47.1562361	-68.5738194	WGS 84 Datum	10'
47.1562361	-68.5738194	WGS 84 Datum	10'
46.9830167	-68.63725	WGS 84 Datum	10'
46.6341472	-68.4175028	WGS 84 Datum	17'
46.6341472	-68.4175028	WGS 84 Datum	17'
44.62623	-69.57677	WGS 84 Datum	9'
44.88288	-69.30383	WGS 84 Datum	9'
44.86844	-69.36922	WGS 84 Datum	9'
46.5613472	-68.3760972	WGS 84 Datum	11'
46.5039611	-68.3626389	WGS 84 Datum	11'
46.4999972	-68.3667194	WGS 84 Datum	10'
46.5562	-68.3244917	WGS 84 Datum	10'
46.3461278	-68.3536167	WGS 84 Datum	10'
46.3208694	-68.4081111	WGS 84 Datum	12'
46.8244667	-67.9212667	WGS 84 Datum	13'
46.8871528	-67.8437472	WGS 84 Datum	10'
46.6144028	-68.0060083	WGS 84 Datum	13'
46.6144028	-68.0060083	WGS 84 Datum	13'
46.8444556	-68.0005389	WGS 84 Datum	14'
45.15317764	-70.44710579	WGS 84 Datum	9'
45.23382376	-70.48893052	WGS 84 Datum	9'
45.23382376	-70.48893052	WGS 84 Datum	9'
44.71672144	-70.08139208	WGS 84 Datum	9'
45.11225577	-70.35916144	WGS 84 Datum	9'
44.82257773	-70.11013446	WGS 84 Datum	9'
45.31537714	-70.62087671	WGS 84 Datum	9'
45.35658193	-70.7003926	WGS 84 Datum	9'
44.89191881	-70.27381872	WGS 84 Datum	9'
47.1716972	-68.2671222	WGS 84 Datum	11'
47.1716972	-68.2671222	WGS 84 Datum	11'
47.0923056	-68.3098361	WGS 84 Datum	13'

47.2289694	-68.2891472	WGS 84 Datum	11'
47.2289694	-68.2891472	WGS 84 Datum	11'
47.0705889	-68.1304194	WGS 84 Datum	13'
47.0398361	-68.1412333	WGS 84 Datum	13'
47.0418833	-68.1939861	WGS 84 Datum	12'
46.7760667	-68.1552611	WGS 84 Datum	11'
46.9951472	-68.1937472	WGS 84 Datum	11'
45.50917	-70.10061	WGS 84 Datum	9'
45.50917	-70.10061	WGS 84 Datum	9'
46.6701806	-68.3513639	WGS 84 Datum	11'
46.9975472	-68.0264944	WGS 84 Datum	15'
47.0816722	-68.5862889	WGS 84 Datum	13'
47.2119639	-68.4595361	WGS 84 Datum	12'
47.189	-68.4636556	WGS 84 Datum	13'
46.8885639	-68.5152639	WGS 84 Datum	15'
47.151	-67.9688833	WGS 84 Datum	10'
44.92052618	-70.98900485	WGS 84 Datum	9'
45.43870543	-68.80602832	WGS 84 Datum	9'
45.14285377	-69.44591282	WGS 84 Datum	9'
44.93553428	-70.96417951	WGS 84 Datum	9'
44.93593852	-71.03345254	WGS 84 Datum	9'
45.01505641	-70.84876746	WGS 84 Datum	9'
44.86606428	-71.03992717	WGS 84 Datum	9'
44.86606428	-71.03992717	WGS 84 Datum	9'
44.96679972	-70.76585787	WGS 84 Datum	9'
44.97211484	-70.70749834	WGS 84 Datum	9'
44.85107217	-70.72254624	WGS 84 Datum	9'
44.8571731	-70.7770887	WGS 84 Datum	9'
44.8571731	-70.7770887	WGS 84 Datum	9'
44.91891154	-70.91478422	WGS 84 Datum	9'
45.27022171	-69.11881053	WGS 84 Datum	9'
45.41445508	-68.68832831	WGS 84 Datum	9'
45.50169937	-68.82429737	WGS 84 Datum	9'
44.74727834	-70.98184958	WGS 84 Datum	9'
44.91572721	-68.63854309	WGS 84 Datum	9'
45.7869019	-68.14752655	WGS 84 Datum	9'
44.55731782	-69.48921966	WGS 84 Datum	9'

44.93797179	-68.9485858	WGS 84 Datum	9'
45.40502532	-68.4297962	WGS 84 Datum	9'
45.40502532	-68.4297962	WGS 84 Datum	9'
45.61455246	-68.53611651	WGS 84 Datum	9'
45.42875875	-68.29548941	WGS 84 Datum	9'
45.76769136	-68.57281974	WGS 84 Datum	9'
46.4637583	-68.6520694	WGS 84 Datum	12'
46.4637583	-68.6520694	WGS 84 Datum	12'
45.73723338	-69.10354199	WGS 84 Datum	9'
45.80226155	-69.01378054	WGS 84 Datum	9'
45.86084511	-68.62518156	WGS 84 Datum	9'
46.1706139	-69.2078917	WGS 84 Datum	11'
46.15358168	-68.80474638	WGS 84 Datum	9'
46.15358168	-68.80474638	WGS 84 Datum	9'
46.2888417	-69.9293639	WGS 84 Datum	12'
46.3528694	-69.7090722	WGS 84 Datum	10'
46.4157278	-69.3418611	WGS 84 Datum	10'
46.4196028	-68.7916	WGS 84 Datum	12'
46.4196028	-68.7916	WGS 84 Datum	12'
46.4933722	-69.2887417	WGS 84 Datum	10'
46.4933722	-69.2887417	WGS 84 Datum	10'
46.3086639	-68.8434667	WGS 84 Datum	10'

Detailed description of site access	Access (Walk-in/Wading; Bridge; Bank)
Couldn't maneuver to the sample site, as plotted (boat launch site). The road turned horrible and it was too unpleasant to walk upon. The tributary to the north of the sample site (Trout Brook) was sampled.	Bridge
Immediately Obvious	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bridge
The sample site, as plotted, was on a road that traverses a boggy area. The road was unsafe for raggedy-vehicle passage. The body of water associated with the sample site (Lobster Stream), flows under Golden Road. This sample was taken from Golden Road.	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bank
The sample site, as plotted, is on a road that is gated / locked. This sample was taken from the river that flows into the (plotted) body of water (Canada Falls Lake).	Bank
Immediately Obvious	Bank
Down rock tumble infront of park parking lot	Bank
Stream adjacent to park	Walk-in/Wading
Pleasant River	Bank
Public boat access on RTE 1 in Columbia Falls on Pleasant River	Bank
Clifford Stevens Canoe Launch	Bank
22-0 Rd)	Bank
55-0 Rd)	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
across the street from Bad Little Falls	Bank
Six Mile Lake Boat Launch in Marshfeild Rte 192	Bank

Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Towards Mt Blue State Park on Fire lane 27, at bridge of Swwet Brook	Walk-in/Wading
Towards Mt Blue State Park on Fire lane 27, at bridge of Swwet Brook	Walk-in/Wading
Immediately Obvious	Bank
Immediately Obvious	Bank
good access	Walk-in/Wading
Immediately Obvious	Bank
Immediately Obvious	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bridge
Immediately Obvious	Bridge
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
good access	Walk-in/Wading
Private Road in North Maine Woods	Walk-in/Wading
Private Road in North Maine Woods	Walk-in/Wading
Good Access	Walk-in/Wading
good access	Walk-in/Wading
bushy growth between access and sample site	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading

Below the dam, east side bank	Bank
Good Access	Walk-in/Wading
Very steep bank, swift current	Walk-in/Wading
Bank access in Big Eddy Campground	Bank
NW side of walking bridge stream bank. Baxter State Park	Bank
SW of bridge, NW side of stream	Bank
SW of bridge, NW side of stream	Bank
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bridge
Location 1 mile south of desired due to access limitations; swift current	Walk-in/Wading
Good Access	Walk-in/Wading
Muddy, but accessible	Walk-in/Wading
Good Access	Walk-in/Wading
Deep water at bank	Bank
Difficult, steep, heavy brush, swift current	Bank
Deep water, but accessible	Walk-in/Wading
Good Access	Walk-in/Wading
easy access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access, rough road in	Walk-in/Wading
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Downstream, north bank, difficult rip rap	Walk-in/Wading
Downstream, north bank, difficult rip rap	Walk-in/Wading
Good Access	Walk-in/Wading

Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
heavy brush made access difficult	Bank
Relocated 1 mile downstream due to risky access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Good Access	Walk-in/Wading
Immediately Obvious	Bank
Immediately Obvious	Bank
Downstream, south bank	Walk-in/Wading
abutment	Walk-in/Wading
Upstream, north side of brook	Walk-in/Wading
Good Access	Walk-in/Wading
Upstream of dam, very deep water	Bank
Upstream, south bank, heavy brush	Walk-in/Wading
Upstream of bridge, east side of stream	Walk-in/Wading
Immediately Obvious	Bank
Endless Lake Boat Launch @ Deadman Cove	Bank
Boatlaunch on northside of Notch Rd.	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Immediately Obvious	Bank
Hap Smith Boat Launch. Memorial Boat Landing 9-11 Cove Rd.	Bank
Public Boat Launch @ the end of Lake Rd.	Bank
Seboeis Public Lands Boat Launch @ the end of W. Seboeis Rd.	Bank
Immediately Obvious	Bank
Stream bank adj. to Town ParK	Bank
Boat Launch on Dixie Rd	Bank
Beach + Boat Launch at Jackson Beach Park	Bank

Kenduskeag Veterans Memorial Bridge. So under bridge then Park.	Bank
	Bank
Boat Launch @ 45 Woodland Dr.	Bank
Boat launch @ Medway Recreational Complex on Recriational RD.	Bank
Boat Launch @ Dwinal Pond 4-Seasons Club	Bank
Boat launch at Penobscot River Trail	Bank
Followed path to stream	Walk-in/Wading
Followed path to stream	Walk-in/Wading
Lake banl @ Nahamakanta Soutth Enol State Campsite on Nahmakanta Stream Rd.	Bank
River bank @ river access off of Nevens Corner Rd. across rom state rest room	Bank
River bank adj. Cabin on Lunkasoo RD. (north side)	
Public boat launch site	Walk-in/Wading
Bank @ Maine High Adventure Camp and beach area	Bank
Bank @ Maine High Adventure Camp and beach area	Bank
Steep rip rap bridge embankment	Walk-in/Wading
Sampled from camp site. Significant variation between desired location and sample site, due to access availability	Walk-in/Wading
Relatively steep bridge embankment	Walk-in/Wading
Followed path to stream	Walk-in/Wading
Followed path to stream	Walk-in/Wading
Very rough access roads to the site	Walk-in/Wading
Very rough access roads to the site	Walk-in/Wading
Limited access to lake, accessed at private lodge	Walk-in/Wading

Picture number	Taken from	Looking direction (Upstream; Downstream)
DSCN-1218	South of North Road	Downstream
DSCN-1221	East of Roadway	Downstream
DSCN-1227	South of Memorial Field / Rte. 150	Downstream
DSCN-1213	South of Golden Road	Downstream
DSCN-1216	South of Golden Road	Downstream
DSCN-1202	South of Rte. 15	Upstream
DSCN-1202	South of Rte. 15	Upstream
DSCN-1204	South of Rte. 15	Upstream
DSCN-1223	South of Blanchard Road	Upstream
DSCN-1223	South of Blanchard Road	Upstream
DSCN-1209	South of Northern Road	Upstream
DSCN-1207	South of Seboomook Road	Upstream
IMG_0600	Bank	Upstream
IMG_0596, IMG_0597	Bank	Upstream and Downstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
IMG_0601	Boat Launch	Upstream
IMG_0599	Boat Launch	Upstream
IMG_0598	Boat Launch	Upstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)

IMG_0595	Boat Launch	At pond
IMG_0607	Boat Launch	Upstream
IMG_0607	Boat Launch	Upstream
IMG_0594	Bridge	Upstream
IMG_0594	Bridge	Upstream
IMG_0603	Boat Launch	At pond
IMG_0606	Bank	At pond
N/A	(Blank)	(Blank)
DSCN-1263	Northeast of Davis Road	Upstream
DSCN-1260	East of Rte. 151	Upstream
DSCN-1258	Boat Launch / East Bank of the Kennebec River	Upstream
DSCN-1240	West of Mill Road	Downstream
DSCN-1242	South of Attean Road	Upstream
DSCN-1246	East of Rte. 201	Upstream
DSCN-1251	East of Upper Enchanted Road	Upstream
DSCN-1256	Boat Landing @ Lake Moxie	Upstream
DSCN-1244	East of Parlin Mountain Road	Upstream
DSCN-1244	Same as Above	Upstream
DSCN-1265	East Bank of the Kennebec	Upstream
DSCN-1267	West of Rte. 201	Downstream
DSCN-1253	Rest Area	Upstream
DSCN-1253	Rest Area	Upstream
DSCN-1248	South of North Road	Upstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
DSCN-2596, DSCN-2597	Sample location	(Blank)
DSCN-2596, DSCN-2597	Sample location	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
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DSCN-1285	West of River Road	Upstream
DSCN-1280	West of Hope Road	Downstream
DSCN-1282	East of St. Albans Road	Downstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
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N/A	(Blank)	(Blank)
IMG_0629	Boat Launch	Downstream
IMG_0630	Bridge	Downstream
IMG_0630	Bridge	Downstream
IMG_0624	Bank	Upstream
IMG_0628	Bridge	Downstream
IMG_0626	Bank	Downstream
IMG_0632	Bank	Upstream
IMG_0631	Boat Launch	Lake
IMG_0627	Bridge	Downstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)

N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
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N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
DSCN-1290	North of Spencer Road	Downstream
DSCN-1290	North of Spencer Road	Downstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
IMG_0645	Boat Launch	Upstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
IMG_0646	Boat Launch	Upstream
IMG_0647	Bank by parking area	Downstream
IMG_0643	Boat Launch	Upstream
IMG_0648	Bank	Downstream
IMG_0648	Bank	Downstream
IMG_0641	Boat Launch	Upstream
IMG_0642	Boat Launch	Pond
N/A	(Blank)	(Blank)
IMG_0639	Boat Launch	Lake
IMG_0639	Boat Launch	Lake
IMG_0644	Bank	Upstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
IMG_0651	Bridge	Upstream
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)
N/A	(Blank)	(Blank)

N/A	(Blank)	(Blank)
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If QA/QC: Field Blank; Split; Duplicate Otherwise: Regular
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Longitude	Latitude	Glyphosat	Sample ID	SAMPLE_DESCRIPTION	Sample Type	2,4-D
				Reporting Limit	(ug/L (ppb)	0.009
45.96642	-69.1732	AC33195	AC33183	231016LRSBIGMO08	Regular	
45.96642	-69.1732	AC33196	AC33184	231016LRSELLIO09	Regular	
46.983	-68.637	AC33199	AC33187	231016LRSGUILF12	Regular	
45.87718	-69.1406	AC33193	AC33181	231016LRSLITTL06	Regular	
45.97606	-69.0704	AC33194	AC33182	231016LRSLOBST07	Regular	
47.0408	-68.583	AC33189	AC33177	231016LRSLONGP02	Regular	
45.63438	-68.7794	AC33190	AC33178	231016LRSMISER03	Regular	
47.1562	-68.574	AC33198	AC33186	231016LRSMONSO11	Regular	
47.1835	-68.872	AC33192	AC33180	231016LRSPITTS05	Regular	
46.7842	-68.536	AC33191	AC33179	231016LRSPLYMO04	Regular	
44.65613	-67.7339	AC33080	AC33068	231017BETHE07	Regular	
45.8916	-69.964	AC33077	AC33065	231017BUMFO04	Regular	
45.3692	-69.437	AC33358	AC33055	231017COLFLS02	Regular	
45.1683	-69.387	AC33359	AC33056	231017COLUM03	Regular	
45.6045	-70.003	AC33363	AC33060	231017DEVER07	Regular	
45.6045	-70.003	AC33362	AC33059	231017ELSIE06	Regular	
44.65613	-67.7339	AC33081	AC33069	231017GREEN08	Regular	
44.4146	-70.787	AC33079	AC33067	231017HANOVE06	Regular	
45.8882	-69.95	AC33078	AC33066	231017HANOVW05	Regular	
45.9242	-69.684	AC33360	AC33057	231017MACHI04	Regular	
45.9272	-69.639	AC33361	AC33058	231017MARSH05	Regular	
45.2758	-69.508	AC33076	AC33064	231017ROXBU03	Regular	
44.86398	-67.9863	AC33084	AC33072	231017STONE11	Regular	
45.2758	-69.508	AC33075	AC33063	231017WELD02	Regular	
44.68941	-67.7638	AC33082	AC33070	231017WOODSN09	Regular	
44.8409	-68.1615	AC33083	AC33071	231017WOODSS10	Regular	
47.035	-69.081	AC33136	AC33125	231018Allag04N	Regular	
46.9645	-68.839	AC33167	AC33155	231018LRSATHEN13	Regular	
46.9645	-68.839	AC33166	AC33154	231018LRSBRIGH12	Regular	
46.7635	-69.305	AC33165	AC33153	231018LRSCONCO11	Regular	
45.3498	-69.874	AC33156	AC33144	231018LRSJACKMN01	Regular	
45.5379	-70.1	AC33157	AC33145	231018LRSJACKMS02	Regular	
45.9609	-69.867	AC33159	AC33147	231018LRSJOHNS05	Regular	
45.3369	-69.968	AC33161	AC33149	231018LRSLOWER07	Regular	
46.6144	-69.393	AC33164	AC33152	231018LRSMOXIE10	Regular	
47.229	-68.289	AC33277	AC33269	231018LRSPARLI03	Duplicate	
45.5379	-70.1	AC33158	AC33146	231018LRSPARLI04	Regular	
47.0706	-68.13	AC33278	AC33270	231018LRSSOLONN14	Regular	

47.0398	-68.141	AC33279	AC33271	231018LRSSOLONS15	Regular	
45.4006	-70.039	AC33163	AC33151	231018LRSTHEFO09	Regular	
45.9296	-69.833	AC33160	AC33148	231018LRSWESTF06	Regular	
45.0573	-69.888	AC33139	AC33128	231018T11R1307	Regular	
45.0813	-69.704	AC33138	AC33127	231018T13R1206	Regular	
45.9651	-69.636	AC33137	AC33126	231018T15R1105	Regular	
44.4446	-70.551	AC33134	AC33123	231018T15R902E	Regular	
44.3664	-70.639	AC33135	AC33124	231018T15R903W	Regular	
45.6198	-70.258	AC33140	AC33129	231019Allag01N	Regular	
45.5883	-70.257	AC33141	AC33130	231019Allag02S	Regular	
44.71388	-67.459	AC33115	AC33106	231019Eagle07	Regular	
44.8919	-70.274	AC33264	AC33259	231019INDIA01	Regular	
44.6589	-70.659	AC33117	AC33108	231019Porta09	Regular	
45.5264	-70.099	AC33142	AC33131	231019StJoh03	Regular	
47.1717	-68.267	AC33266	AC33261	231019T3R1103	Regular	
47.1717	-68.267	AC33265	AC33260	231019T4R1002	Regular	
47.229	-68.289	AC33266	AC33263	231019T4R1105	Regular	
45.3633	-70.1	AC33265	AC33132	231019Walla04	Regular	
44.4868	-70.782	AC33113	AC33104	231019Walla05	Duplicate	
44.76222	-67.5231	AC33116	AC33107	231019Winte08	Regular	
47.1125	-69.09	AC33170	AC33170	231020Ashla07W	Regular	
47.0888	-69.024	AC33171	AC33171	231020Ashla08W	Duplicate	
46.9951	-68.194	AC33282	AC33274	231020LRSFAIRF03	Regular	
47.0419	-68.194	AC33280	AC33272	231020LRSNEWPO01	Regular	
46.7761	-68.155	AC33281	AC33273	231020LRSPALMY02	Regular	
44.5417	-70.547	AC33118	AC33109	231020Masar01N	Regular	
44.2607	-70.824	AC33119	AC33110	231020Masar02W	Regular	
44.2607	-70.824	AC33120	AC33111	231020Masar03S	Regular	
46.9518	-69.196	AC33169	AC33169	231020Masar06E	Regular	
44.6843	-70.453	AC33121	AC33112	231020T8R504N	Regular	
46.9375	-68.892	AC33168	AC33168	231020T8R505W	Regular	
46.8445	-68.001	AC33246	AC33235	231023Carib03E	Regular	
45.1532	-70.447	AC33247	AC33236	231023Limes04	Regular	
46.6144	-68.006	AC33234	AC33245	231023Presq02	Regular	
45.2338	-70.489	AC33248	AC33237	231024Carib01W	Regular	
44.8829	-69.304	AC33218	AC33209	231024EUSTI05	Regular	
44.8684	-69.369	AC33219	AC33210	231024EUSTIN06	Regular	
46.5613	-68.376	AC33220	AC33211	231024EUSTIN07	Duplicate	
46.5562	-68.324	AC33223	AC33214	231024INDUS01	Regular	
44.6262	-69.577	AC33217	AC33208	231024KINGF04	Regular	

46.6341	-68.418	AC33215	AC33206	231024NEWVI02	Regular	
46.5	-68.367	AC33222	AC33213	231024NORTH09	Regular	
46.504	-68.363	AC33221	AC33212	231024NORTHN08	Regular	
46.6341	-68.418	AC33216	AC33207	231024SALEM03	Regular	
46.3461	-68.354	AC33229	AC33224	231024Sincl07	Regular	
46.3209	-68.408	AC33230	AC33225	231024Sincl08	Duplicate	
45.3154	-70.621	AC33253	AC33242	231024Squar06	Regular	
46.8872	-67.844	AC33232	AC33227	231024StAga10	Regular	Q
44.7167	-70.081	AC33250	AC33239	231024Stock03N	Regular	
45.1123	-70.359	AC33251	AC33240	231024Stock04S	Regular	
44.8226	-70.11	AC33252	AC33241	231024T15R405	Regular	
45.3566	-70.7	AC33254	AC33243	231024Washb11	Regular	
45.2338	-70.489	AC33249	AC33238	231024Westl02	Regular	
45.5092	-70.101	AC33283	AC33275	231025LRSUPPER01	Regular	
46.6702	-68.351	AC33292	AC33285	231027Ashla01E	Regular	
47.151	-67.969	AC33298	AC33291	231027Conno07	Regular	
47.0817	-68.586	AC33294	AC33287	231027Eagle03E	Regular	
47.189	-68.464	AC33296	AC33289	231027FortK05	Regular	
47.212	-68.46	AC33295	AC33288	231027NewCa04	Regular	
46.9975	-68.026	AC33293	AC33286	231027T14R602	Regular	
46.8886	-68.515	AC33297	AC33290	231027VanBu06	Regular	
44.8572	-70.777	AC33342	AC33334	231031ADAMS08	Regular	
45.5017	-68.8243	AC33352	AC33346	231031CEDAR04	Regular	
44.9189	-70.915	AC33349	AC33343	231031DOVER01	Regular	
44.9205	-70.989	AC33322	AC33317	231031LINCOE09	Regular	
45.43871	-68.806	AC33323	AC33318	231031LINCOW10	Regular	
44.8511	-70.723	AC33340	AC33332	231031LOWER06	Regular	
45.14285	-69.4459	AC33324	AC33319	231031MAGAL11	Regular	
44.9668	-70.766	AC33338	AC33330	231031OQUOS04	Regular	
44.9721	-70.707	AC33339	AC33331	231031RANGE05	Regular	
44.8661	-71.04	AC33337	AC33329	231031RANGP03	Regular	
44.8661	-71.04	AC33336	AC33328	231031RICHA02	Regular	
44.8572	-70.777	AC33341	AC33333	231031RICHAN07	Regular	
45.27022	-69.1188	AC33350	AC33344	231031SEBEC02	Regular	
44.7473	-70.982	AC33353	AC33347	231031SEBOE05	Regular	
45.41446	-68.6883	AC33351	AC33345	231031T4R9N03	Regular	
44.9359	-71.033	AC33326	AC33321	231031UPTON13	Regular	
46.2888	-69.929	AC33428	AC33421	231101BRADL03	Regular	
46.1706	-69.208	AC33408	AC33401	231101GLENW07	Regular	
46.15358	-68.8047	AC33426	AC33419	231101HERMO01	Regular	

46.15358	-68.8047	AC33427	AC33420	231101KENDU02	Regular	
46.4157	-69.342	AC33430	AC33423	231101LINCO05	Regular	Q
46.4196	-68.792	AC33432	AC33425	231101MEDWA08	Regular	
46.4196	-68.792	AC33431	AC33424	231101WINN06	Regular	
46.4638	-68.652	AC33404	AC33397	231102MEDWA03	Regular	
44.91573	-68.6385	AC33387	AC33379	231102T11R701	Regular	
45.7869	-68.1475	AC33388	AC33380	231102T11R702	Duplicate	
46.4638	-68.652	AC33403	AC33396	231102T1R1102	Regular	
45.76769	-68.5728	AC33402	AC33395	231102T2R1001	Regular	
45.73723	-69.1035	AC33405	AC33398	231102T3R7W04	Regular	
45.42876	-68.2955	AC33394	AC33386	231102T6R1108	Regular	
45.80226	-69.0138	AC33406	AC33399	231102T6R8W05	Regular	
45.61455	-68.5361	AC33393	AC33385	231102T7R1707	Regular	
45.40503	-68.4298	AC33392	AC33384	231102T8R1506	Regular	
45.40503	-68.4298	AC33391	AC33383	231102T9R1305	Regular	
44.55732	-69.4892	AC33389	AC33381	231102T9R803	Regular	
46.4934	-69.289	AC33472	AC33469	231109T10R1202	Regular	
46.4934	-69.289	AC33471	AC33468	231109T8R901	Regular	
Longitude	**Latitude**	**Glyphosat**	**Sample ID**	**SAMPLE_DESCRIPTION**	**Sample Type**	**2,4-D**
			Max value			2,4-D
			Number detections			2
			Number of quantifiable			0
			Average concentration (ug/L (ppb)			N/A
			Highest detection (ug/L (ppb)			0
			All detections measured in ug/L (ppb)			

Acetochlo	Acetochlo	Acetochlo	Alachlor	Alachlor E	Alachlor O	AMPA	Aminocycl	Aminopyra	Atrazine
0.14	0.02	0.0084	0.11	0.044	0.0068	0.021	0.025	0.03	0.0022
							Q		
					0.0085				
									Q

									Q
									Q
									Q

									Q
									Q
									Q

									Q
									Q
Acetochlo	**Acetochlo**	**Acetochlo**	**Alachlor**	**Alachlor E**	**Alachlor O**	**AMBA**	**Aminocycl**	**Aminopyra**	**Atrazine**
Acetochlor	Acetochlor	Acetochlor	Alachlor	Alachlor ES	Alachlor O	AMBA	Aminocycl	Aminopyra	Atrazine
0	0	0	0	0	1	0	1	0	11
0	0	0	0	0	1	0	0	0	2
N/A	N/A	N/A	N/A	N/A	0.0085	N/A	N/A	N/A	0.0135
0	0	0	0	0	0.0085	0	0	0	0.014

Azoxystrol	Bentazon	Bromacil	Bromoxyn	Carbaryl	Chlorpyrif	Chlorsulfu	Clodinafo	Clopyralid	Clothianid
0.0052	0.0022	0.0041	0.012	0.014	0.06	0.0056	0.013	0.088	0.016

				Q					
Q									

Q									
Q									
Q									

Azoxystrol	**Bentazon**	**Bromacil**	**Bromoxyn**	**Carbaryl**	**Chlorpyrif**	**Chlorsulfu**	**Clodinafo**	**Clopyralid**	**Clothianid**
Azoxystrob	Bentazon	Bromacil	Bromoxyni	Carbaryl	Chlorpyrifo	Chlorsulfu	Clodinafo	Clopyralid	Clothianid
4	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	0	0	0	0	0	0	0	0	0

DEA	DEDIA	DIA	Dicamba	Difenocon	Dimethen	Dimethen	Dimethoat	Disulfoton	Diuron
0.0017	0.1	0.04	0.88	0.011	0.006	0.0072	0.0022	0.0066	0.0053
Q									

Q									
					0.0092				
Q									
0.0047									
Q									

Q									
Q									
Q									

0.0029									
Q									
DEA	**DEDIA**	**DIA**	**Dicamba**	**Difenocon**	**Dimethena**	**Dimethena**	**Dimethoat**	**Disulfoton**	**Diuron**
DEA	DEDIA	DIA	Dicamba	Difenocon	Dimethena	Dimethena	Dimethoat	Disulfoton	Diuron
12	0	0	0	0	1	0	0	0	0
4	0	0	0	0	1	0	0	0	0
0.00515	N/A	N/A	N/A	N/A	0.0092	N/A	N/A	N/A	N/A
0.0066	0	0	0	0	0.0092	0	0	0	0

FDAT (inda	Fipronil	Fipronil de	Fipronil su	Fipronil su	Flucarbaz	Flucarbaz	Flumetsul	Flupyradif	Fluroxypyr
0.0051	0.0024	0.14	0.08	0.04	0.0024	0.0039	0.029	0.045	0.035

FDAT (inda	**Fipronil**	**Fipronil de**	**Fipronil su**	**Fipronil su**	**Flucarbazo**	**Flucarbazo**	**Flumetsul**	**Flupyradif**	**Fluroxypyr**
FDAT (inda	Fipronil	Fipronil de	Fipronil su	Fipronil su	Flucarbazo	Flucarbazo	Flumetsula	Flupyradifu	Fluroxypyr
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	0	0	0	0	0	0	0	0	0

Glutaric a	Glufosinat	Glyphosat	HA	Halosulfu	Hexazinon	Imazamet	Imazamet	Imazamox	Imazapic
0.03	1	1	0.004	0.01	0.0015	0.0025	0.001	0.0057	0.003
					0.0066				
					0.007				
					0.0019				

					Q				
			Q						
			0.0041						

			Q						
Glutaric a	**Glufosinat**	**Glyphosat**	**HA**	**Halosulfu**	**Hexazinon**	**Imazamet**	**Imazamet**	**Imazamox**	**Imazapic**
Glutaric ac	Glufosinat	Glyphosate	HA	Halosulfur	Hexazinon	Imazameth	Imazameth	Imazamox	Imazapic
0	0	0	3	0	4	0	0	0	0
0	0	0	1	0	3	0	0	0	0
N/A	N/A	N/A	0.0041	N/A	0.005167	N/A	N/A	N/A	N/A
0	0	0	0.0041	0	0.007	0	0	0	0

Imazapyr	Imazethap	Imidaclop	Indaziflam	Isoxaben	Isoxafluto	Malathion	Malathion	MCPA	MCPP
0.0035	0.004	0.0018	0.002	0.003	0.13	0.028	0.0024	0.0046	0.0044
0.0044									
0.012									

Q									
0.005									
Q									
Q									
Q									
Q				0.0046					
Q									
0.016									
0.015									
Q									
0.045									
0.011									
0.01									
0.034									
0.048									
0.1									
0.0098									
		0.0043							
0.013									

		Q							
		Q							
0.038									
0.043									
0.019									
0.11									
0.063									

0.017									
0.021									
0.0043									
Imazapyr	**Imazethap**	**Imidaclop**	**Indaziflam**	**Isoxaben**	**Isoxafluto**	**Malathion**	**Malathion**	**MCPA**	**MCPP**
Imazapyr	Imazethap	Imidaclopr	Indaziflam	Isoxaben	Isoxaflutol	Malathion	Malathion	MCPA	MCPP
28	0	3	0	1	0	0	0	0	0
21	0	1	0	1	0	0	0	0	0
0.030405	N/A	0.0043	N/A	0.0046	N/A	N/A	N/A	N/A	N/A
0.11	0	0.0043	0	0.0046	0	0	0	0	0

Metalaxyl	Methomyl	Methoxyfe	Metolachl	Metolachl	Metolachl	Metsulfuro	Nicosulfur	NOA 4078	NOA 4472
0.0035	0.012	0.01	0.024	0.005	0.042	0.01	0.011	0.0052	0.02
				Q					
				0.006					

							Q		
				Q					
				Q					
				Q					
				Q					
				Q					
				Q					
				0.013					
				0.015					
				0.34	0.085				
				Q					
						Q			
				0.02					
Q				Q					
				0.013					

Q				0.37	0.12				
Q				0.4	0.12				
				0.026					
				0.024					
				Q					
				Q					
				0.1	Q				
				0.0068					
				0.018					
				0.016					

			Q	0.34	0.13				
				0.043					
				Q					
Metalaxyl	**Methomyl**	**Methoxyfe**	**Metolachl**	**Metolachl**	**Metolachl**	**Metsulfuro**	**Nicosulfur**	**NOA 4078**	**NOA 4472**
Metalaxyl	Methomyl	Methoxyfe	Metolachlo	Metolachlo	Metolachlo	Metsulfuro	Nicosulfur	NOA 4078	NOA 4472
3	0	0	1	28	5	1	1	0	0
0	0	0	0	16	4	0	0	0	0
N/A	N/A	N/A	N/A	0.109425	0.11375	N/A	N/A	N/A	N/A
0	0	0	0	0.4	0.13	0	0	0	0

Norflurazo	Norflurazo	Oxamyl	Parathion	Phorate su	Phorate su	Picloram	Picoxystro	Prometon	Propicona
0.02	0.02	0.01	0.012	0.024	0.003	0.28	0.0075	0.001	0.01

Norflurazo	**Norflurazo**	**Oxamyl**	**Parathion**	**Phorate su**	**Phorate su**	**Picloram**	**Picoxystro**	**Prometon**	**Propicona**
Norflurazo	Norflurazo	Oxamyl	Parathion	Phorate su	Phorate su	Picloram	Picoxystro	Prometon	Propicona
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	0	0	0	0	0	0	0	0	0

Prosulfuro	Pyrasulfot	Pyroxsular	Saflufenac	Simazine	Sulfentraz	Sulfomet	Sulfosulfu	Tebuconaz	Tebuthiuro
0.005	0.02	0.013	0.01	0.0026	0.035	0.0025	0.0054	0.014	0.0011
									0.0015

		Q							
						Q			
						0.0042			
						0.0055			

Prosulfuro	**Pyrasulfot**	**Pyroxsular**	**Saflufenac**	**Simazine**	**Sulfentraz**	**Sulfomet**	**Sulfosulfu**	**Tebuconaz**	**Tebuthiuro**
Prosulfuro	Pyrasulfoto	Pyroxsular	Saflufenac	Simazine	Sulfentraze	Sulfomet	Sulfosulfur	Tebuconaz	Tebuthiuro
0	0	1	0	0	0	3	0	0	1
0	0	0	0	0	0	2	0	0	1
N/A	N/A	N/A	N/A	N/A	N/A	0.00485	N/A	N/A	0.0015
0	0	0	0	0	0	0.0055	0	0	0.0015

Tembotrio	Terbacil	Terbufos s	Tetracona	Thiametho	Thiencarb	Thifensulf	Tralkoxydi	Tralkoxydi	Triallate
0.073	0.0048	0.011	0.0039	0.02	0.04	0.022	0.0051	0.005	0.3

Tembotrio	**Terbacil**	**Terbufos s**	**Tetracona**	**Thiametho**	**Thiencarb**	**Thifensulf**	**Tralkoxydi**	**Tralkoxydi**	**Triallate**
Tembotrio	Terbacil	Terbufos s	Tetraconaz	Thiametho	Thiencarba	Thifensulfu	Tralkoxydir	Tralkoxydir	Triallate
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0	0	0	0	0	0	0	0	0	0

Triasulfuro	Triclopyr	Trifloxystrobin	
0.0055	0.022	0.02	

Triasulfuro	**Triclopyr**	**Trifloxystrobin**	
Triasulfuro	Triclopyr	Trifloxystrobin	
0	0	0	
0	0	0	58
N/A	N/A	N/A	
0	0	0	

Sample ID	SAMPLE DESCRIPTION	2,4-D	Alachlor OA	Aminocyclopyrac
	Reporting Limit (ug/L (ppb)	0.009	0.0084	0.025
AC33181	231016LRSLITTL06			Q
AC33068	231017BETHE07			
AC33055	231017COLFLS02			
AC33056	231017COLUM03			
AC33059	231017ELSIE06		0.0085	
AC33066	231017HANOVW05			
AC33057	231017MACHI04			
AC33071	231017WOODSS10			
AC33125	231018Allag04N			
AC33151	231018LRSTHEFO09			
AC33127	231018T13R1206			
AC33123	231018T15R902E			
AC33126	231018T15R1105			
AC33129	231019Allag01N			
AC33106	231019Eagle07			
AC33132	231019Walla05			
AC33107	231019Winte08			
AC33170	231020Ashla07W			
AC33274	231020LRSFAIRF03			
AC33272	231020LRSNEWPO01			
AC33273	231020LRSPALMY02			
AC33109	231020Masar01N			
AC33110	231020Masar02W			
AC33111	231020Masar03S			
AC33169	231020Masar06E			
AC33112	231020T8R504N			
AC33168	231020T8R505W			
AC33235	231023Carib03E			
AC33236	231023Limes04			
AC33237	231024Carib01W			
AC33214	231024INDUS01			
AC33224	231024Sincl07			
AC33242	231024Squar06			
AC33227	231024StAga10	Q		
AC33240	231024Stock04S			
AC33243	231024Washb11			
AC33238	231024Westl02			
AC33291	231027Conno07			
AC33289	231027FortK05			
AC33288	231027NewCa04			

AC33290	231027VanBu06			
AC33334	231031ADAMS08			
AC33343	231031DOVER01			
AC33330	231031OQUOS04			
AC33347	231031SEBOE05			
AC33321	231031UPTON13			
AC33419	231101HERMO01			
AC33420	231101KENDU02			
AC33423	231101LINCO05	Q		
AC33424	231101WINN06			
AC33424	231101WINN06			
AC33397	231102MEDWA03			
AC33379	231102T11R701			
AC33386	231102T6R1108			
AC33383	231102T9R1305			
	Total Detections	2	1	1
	Highest Detection	Q	0.0085	Q

Target Herbicide
Excluded from study due to contamination concerns
Q - Present at less than Reporting Limit
All detections measured in ug/L (ppb)

Atrazine	Azoxystrobin	Carbaryl	DEA	Dimethenamid	HA	Hexazinone
0.0022	0.0052	0.014	0.0017	0.006	0.004	0.0015
						0.0066
						0.007
						0.0019
Q			Q			
			Q			
		Q		0.0092		Q
			Q			
					Q	
Q			0.0047		0.0041	
Q	Q					
Q			Q			
	Q					
	Q					

Q			Q			
Q			Q			
			Q			
Q						
Q			0.0029		Q	
Q			Q			
7	3	1	8	1	3	4
Q	Q	Q	0.0047	0.0092	0.0041	0.007

Imazapyr	Imidacloprid	Isoxaben	Metalaxyl	Metolachlor	Metolachlor ESA
0.0035	0.0018	0.003	0.0035	0.024	0.005
0.0044					
					Q
					0.006
0.012					
Q					
					Q
0.005					
Q					
Q					Q
Q		0.0046			Q
Q					
0.016					Q
					0.013
					0.015
Q					0.34
0.045					Q
0.011					
0.01					
0.034					
0.048					
0.1					
0.0098					0.02
	0.0043		Q		Q
0.013					0.013
	Q		Q		0.37
0.038					0.026
					0.024
0.043					
0.019					Q
0.11					
0.063					
					Q
					0.1

					0.0068
					0.018
					0.016
				Q	0.34
					0.043
					0.043
					Q
0.017					
0.0043					
25	2	1	2	1	25
0.11	0.0043	0.0046	Q	Q	0.37

Metolachlor OA	Metsulfuron methyl	Nicosulfuron	Pyroxsulam	Sulfometuron methyl
0.042	0.01	0.011	0.013	0.0025
		Q	Q	
0.085				
				Q
				0.0042
	Q			0.0055
0.12				
Q				

0.13				
4	1	1	1	3
0.13	Q	Q	Q	0.0055

Tebuthiuron	Total Detections
0.0011	
	2
	1
	1
	1
	1
	1
	1
0.0015	3
	1
	1
	1
	1
	6
	1
	3
	3
	1
	2
	1
	2
	6
	2
	1
	1
	2
	2
	3
	4
	3
	2
	2
	5
	2
	2
	1
	2
	1
	1
	2
	2

	1
	2
	1
	2
	1
	1
	1
	6
	1
	1
	1
	1
	1
	2
	1
1	
0.0015	

SAMPLE DESCRIPTION	Universal Sample ID	Atrazine	DEA
Reporting Limit		0.0022	0.0017
231016LRSLONGP01	AC33176		
231016LRSMONSO10	AC33185		
231017COLFLS01	AC33054		
231017STONE12	AC33073		
231017WELD01	AC33062		
231018LRSTHEFO08	AC33150		
231018T15R901E	AC33122		
231019Eagle06	AC33105		
231019T4R1104	AC33262		
231023Presq01	AC33233		
231024StAga09	AC33226		
231025LRSUPPER02	AC33276		
231031MAGAL12	AC33320	0.013	0.0066
231031RICHA01	AC33327	0.014	0.0064
231101LINCO04	AC33422		
231102T6R8W06	AC33400		
231102T9R804	AC33382		
231109T10R1203	AC33470		

Blanks	18
Blanks with Detections	3

All detections measured in ug/L (ppb)

Imazapyr
0.0035
0.0043

Target Forestry Herbicides		
Active Ingredient	Reporting Limit (ug/L (ppb)	Lowest Benchmark (ug/L (ppb)
AMPA	0.021	8900
Aminopyralid	0.03	1360
Glyphosate	1	11900
Imazapyr	0.0035	24
Metsulfuron methyl	0.01	0.36
Sulfometuron methyl	0.0025	0.45

All Pesticides Tested		
Active Ingredient	Reporting Limit (ug/L (ppb)	Lowest Benchmark (ug/L (ppb)
2,4-D	0.009	299.2
Acetochlor and Analytes	0.14	1.43
AMPA	0.021	8900
Alachlor and Analytes	0.11	1.64
Aminopyralid	0.03	1360
Aminocyclopyrachlor	0.025	7400
Atrazine	0.0022	4.6
Azoxystrobin	0.0052	44
Bentazon	0.0022	4500
Bromacil	0.0041	6.8
Bromoxynil	0.012	2.5
Carbaryl	0.014	0.5
Chlorpyrifos	0.06	0.0069
Chlorsulfuron	0.0056	0.35
Clodinafop acid	0.013	2600
Clopyralid	0.088	4700
Clothianidin	0.016	0.05
Deethyl atrazine (DEA)	0.0017	N/A
DEDIA	0.1	N/A
Deisopropyl atrazine (DIA)	0.04	N/A
Dicamba	0.88	61
Difenoconazole	0.011	0.86
Dimethenamid	0.006	8.9
Dimethenamid OA	0.0072	N/A
Dimethoate	0.0022	0.5
Disulfoton sulfone	0.0066	0.14
Diuron	0.0053	0.13
FDAT (indaziflam met)	0.0051	N/A
Fipronil and Analytes	0.0024	0.011

Flucarbazone	0.0024	N/A
Flucarbazone sulfonamide	0.0039	N/A
Flumetsulam	0.029	3.1
Flupyradifurone	0.045	N/A
Fluroxypyr	0.035	7150
Glyphosate	1	11900
Glutaric acid	0.03	N/A
Hydroxy atrazine	0.004	N/A
Halosulfuron methyl	0.01	0.042
Hexazinone	0.0015	7
Imazamethabenz acid	0.0025	N/A
Imazamethabenz ester	0.001	N/A
Imazamox	0.0057	8
Imazapic	0.003	6.22
Imazapyr	0.0035	24
Imazethapyr	0.004	8.1
Imidacloprid	0.0018	0.01
Indaziflam	0.002	N/A
Isoxaben	0.003	10
Isoxaflutole	0.13	4.9
Malathion and Analyte	0.028	0.049
MCPA	0.0046	130
MCPP	0.0044	14
Metalaxyl	0.0035	1200
Methomyl	0.012	0.6
Methoxyfenozide	0.01	3.1
Metolachlor ESA	0.005	N/A
Metolachlor OA	0.042	N/A
Metsulfuron methyl	0.01	0.36
Nicosulfuron	0.011	N/A
NOA 407854	0.0052	N/A
NOA 447204	0.02	N/A
Norflurazon	0.02	9.7
Norflurazon desmethyl	0.02	N/A
Oxamyl	0.01	27
Parathion methyl oxon	0.012	N/A
Phorate sulfone	0.024	0.2
Phorate sulfoxide	0.003	2
Picloram	0.28	550
Picoxystrobin	0.0075	1
Prometon	0.001	98
Propiconazole	0.01	15
Prosulfuron	0.005	1.22
Pyrasulfotole	0.02	28

Pyroxsulam	0.013	2.57
Saflufenacil	0.01	42
Simazine	0.0026	6
Sulfentrazone	0.035	28.8
Sulfometuron methyl	0.0025	0.45
Sulfosulfuron	0.0054	1
Tebuconazole	0.014	11
Tebuthiuron	0.0011	50
Tembotrione	0.073	5.2
Terbacil	0.0048	11
Terbufos sulfone	0.011	0.03
Tetraconazole	0.0039	80
Thiamethoxam	0.02	0.74
Thiencarbazone methyl	0.04	0.8
Thifensulfuron methyl	0.022	1.59
Tralkoxydim	0.0051	2100
Tralkoxydim acid	0.005	2100
Triallate	0.3	14
Triasulfuron	0.0055	190
Triclopyr	0.022	32500
Trifloxystrobin	0.02	2.76

Benchmark Title	Number of Detections	Highest Detection
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	28	0.11
Vascular Plants	1	Below Reporting Limit
Vascular Plants	3	0.0055

Benchmark Title	Number of Detections	Highest Detection (ug/L (ppb)
Nonvascular Plants	2	Below Reporting Limit
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	1	0.0085
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	1	Below Reporting Limit
Vascular Plants	11	0.014
Freshwater Invertebrate Chronic	4	Below Reporting Limit
Nonvascular Plants	0	Not Detected
Nonvascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	4	Below Reporting Limit
Freshwater Invertebrate Acute	0	Not Detected
Vascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
N/A	12	0.0066
N/A	0	Not Detected
N/A	0	Not Detected
Nonvascular Plants	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Vascular Plants	1	0.0092
N/A	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
N/A	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected

N/A	0	Not Detected
N/A	0	Not Detected
Vascular Plants	0	Not Detected
N/A	0	Not Detected
Freshwater Vertebrate Acute	0	Not Detected
Vascular Plants	0	Not Detected
N/A	0	Not Detected
N/A	3	0.0041
Vascular Plants	0	Not Detected
Nonvascular Plants	4	0.007
N/A	0	Not Detected
N/A	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	28	0.11
Vascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	3	0.0043
N/A	0	Not Detected
Vascular Plants	1	0.0046
Vascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
Nonvascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	3	Below Reporting Limit
Freshwater Invertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
N/A	28	0.37
N/A	5	0.13
Vascular Plants	1	Below Reporting Limit
N/A	1	Below Reporting Limit
N/A	0	Not Detected
N/A	0	Not Detected
Nonvascular Plants	0	Not Detected
N/A	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
N/A	0	Not Detected
Freshwater Invertebrate Acute	0	Not Detected
Freshwater Invertebrate Acute	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Nonvascular Plants	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	0	Not Detected

Vascular Plants	1	Below Reporting Limit
Nonvascular Plants	0	Not Detected
Nonvascular Plants	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	3	0.0055
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Nonvascular Plants	1	0.0015
Vascular Plants	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Vertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Vascular Plants	0	Not Detected
Vascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected
Nonvascular Plants	0	Not Detected
Vascular Plants	0	Not Detected
Nonvascular Plants	0	Not Detected
Freshwater Invertebrate Chronic	0	Not Detected

Lowest Determined Human Benchmark (ug/L (ppb)
N/A
3000
490
15000
1500
1630

Lowest Determined Human Benchmark (ug/L (ppb)
400
100
N/A
N/A
3000
16500
N/A
1070
N/A
N/A
89
N/A
1.9
300
N/A
890
580
N/A
N/A
N/A
N/A
60
300
N/A
13
N/A
N/A
N/A
1

440
N/A
6000
460
6000
490
N/A
N/A
600
N/A
N/A
N/A
N/A
811
15000
15000
500
0
300
100
N/A
N/A
200
3000
3000
600
N/A
N/A
1500
7400
N/A
N/A
8.9
N/A
N/A
N/A
N/A
N/A
N/A
270
N/A
600
310
60

6000
270
N/A
830
1630
1400
170
N/A
2
N/A
N/A
43
71
N/A
N/A
30
N/A
150
60
300
220

Pesticide Update

EPA's Office of Chemical Safety and Pollution Prevention

EPA Releases Rodenticide Strategy, Including Final Biological Evaluation on the Effects of 11 Rodenticides on Endangered Species and Associated Mitigation

The U.S. Environmental Protection Agency (EPA) is releasing the final biological evaluation (BE), and associated response to comments, for 11 rodenticide active ingredients. The mitigation measures described in this final BE will also serve as the agency's Rodenticide Strategy as outlined in EPA's Endangered Species Act (ESA) Workplan.

Each year, rodents cause significant damage to property, crops, and food supplies across the United States. They may also spread diseases, posing a serious risk to public health. Rodenticides are used in residential, agricultural, and non-agricultural settings to control a variety of pests including house mice, Norway rats, roof rats, moles, voles, pocket gophers, prairie dogs, ground squirrels, feral hogs, and mongooses.

The 11 rodenticides evaluated in the BE are: chlorophacinone; diphacinone and its sodium salt; warfarin and its sodium salt; brodifacoum; bromadiolone; difenacoum; difethialone; bromethalin; cholecalciferol; strychnine; and zinc phosphide. These rodenticides are intended to control target animals using different biochemical mechanisms (e.g., neurotoxicity, reduced blood clotting). They also have different properties that affect the types of species that may be impacted. For example, some rodenticides may remain in target animals long enough such that predator or scavenger animals that consume the target animals may be affected. The assessment accounts for these different properties across the 11 rodenticides evaluated in the BE.

EPA's final BE finds that the currently labeled uses of the 11 rodenticides evaluated in this assessment remained the same as those in the draft BE, and:

- Will have no effect on 88% of species and 95% percent of critical habitats;
- Are not likely to adversely affect 4-11% of species and 1% of critical habitats;
- Are likely to adversely affect 1-8% of listed species and 4% of critical habitats; and,
- Have a likelihood of future Jeopardy/Adverse Modification (J/AM) of less than 5% of listed species and less than 1% of critical habitats.

The final BE describes several scenarios intended to illustrate how EPA may implement mitigations from the Rodenticide Strategy as each rodenticide goes through registration review and for new active ingredient registrations. It provides additional clarity regarding the applicability of each mitigation measure to each rodenticide product and use, and how EPA anticipates implementing these measures.

The final Rodenticide Strategy does not itself impose any requirements or restrictions on pesticide use. Any mitigation measures needed to address potential likelihood of future J/AM for listed species will only apply in geographically specific areas where listed species with J/AM predictions are located, using EPA's Bulletins Live! Two system, as part of label language, or in the Terms and Conditions of registration. Not all of these measures will be necessary for all uses or products containing these pesticide ingredients. Rather, they are measures from which EPA expects to choose when reducing exposure to listed species and their critical habitats, as necessary, for a specific active ingredient, use site, and application method (i.e., bait station, in-burrow, and broadcast).

During formal consultation, U.S. Fish and Wildlife Service (FWS) will use EPA's effects determinations to inform their biological opinion(s). If FWS determines in its final biological opinion that additional or different mitigation measures are necessary to address any J/AM determinations or to address any incidental take beyond those mitigation measures, then EPA will work to ensure that any necessary registration or labeling changes are made.

The final BE is available in the docket EPA-HQ-OPP-2023-0567 on www.regulations.gov.

Background

In 2020, EPA released a draft human health and ecological risk assessment followed by a public comment period to support EPA's registration review of these 11 rodenticides. Based on that assessment, EPA identified measures to reduce ecological exposures, which included several pilot listed species.

In December 2023, EPA released a draft BE for these 11 rodenticides that provided draft effects determinations for all registered uses. The draft BE included predictions of whether there is a potential likelihood that the rodenticides could lead to a future J/AM finding by the FWS for listed species and designated habitats. In addition, the draft BE identified possible mitigation measures to avoid predicted J/AM and minimize take of listed species.

The final rodenticide BE released today includes revisions after incorporating public comments on the draft BE. Highlights from the revisions include refinements of EPA's predictions of potential likelihood of future adverse modification of critical habitat based on the use pattern and type of rodenticide, clarification of how different use types were combined for effects determinations, and including effects determinations for the most recently listed species. The final BE also includes examples of how EPA envisions implementing mitigations. While EPA included carcass search, scouting for carcasses that have signs of rodenticide exposure, in the draft as a mitigation measure to reduce exposures based on its inclusion in FWS' previous biological opinion on other rodenticides (i.e., Rozol and Kaput), numerous commenters expressed concerns about its applicability and feasibility for many/most of the rodenticides and uses subject to this strategy. As a result, EPA is now specifying it expects to only select the carcass search measure when other mitigation measures are not practical or feasible. EPA has included an example of the limited types of scenarios in which EPA would expect to implement this measure in the final Rodenticide Strategy.

Learn more about how EPA meets its ESA obligations

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

WASHINGTON, D.C. 20460

November 21, 2024

PC Codes: 067701, 067705, 067707, 076901, 086002, 086003, 086601, 112001, 112701, 112802, 19901, 128967, 202901

MEMORANDUM

SUBJECT: **Rodenticides:** Final Biological Evaluation, Effects Determinations, and Mitigation Strategy for Federally Listed and Proposed Endangered and Threatened Species and Designated and Proposed Critical Habitats

FROM: William P. Eckel, Ph.D., Senior Science Advisor
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THRU: Mark Corbin, Branch Chief
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TO: Kent Fothergill, Chemical Review Manager
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The Environmental Fate and Effects Division (EFED) of the United States Environmental Protection Agency (EPA) has completed the Final Biological Evaluation (BE) and associated effects determinations for federally listed and proposed endangered and threatened species (herein referred to as "listed species") and any designated and proposed critical habitats (herein referred to as "CHs") for the currently registered uses of 11 rodenticide active ingredients. EPA also included in its effects determinations its prediction whether there is a potential likelihood that current registrations of the 11 rodenticides may lead to future jeopardy (J) of a listed species or adverse modification (AM) of designated critical habitat (collectively abbreviated as J/AM). While EPA is not required to include J/AM predictions in its effects determinations, EPA is including this analysis with the intention of making the consultation process with the U.S. Fish and Wildlife Service (USFWS) more efficient. EPA expects to consult with USFWS after the finalization of the BE because it includes May Affect (MA) determinations for species and their CHs under its jurisdiction. USFWS will make the final J/AM determinations for listed species and their CHs, respectively. EPA does not anticipate needing to consult with the National Marine Fisheries Service (NMFS) because in this final BE, EPA made No Effect (NE) determinations for all listed species and CHs under the jurisdiction of NMFS.

The conclusions conveyed in this assessment were developed in full compliance with *EPA Scientific Integrity Policy for Transparent and Objective Science*, and EPA Scientific Integrity Program's *Approaches for Expressing and Resolving Differing Scientific Opinions.* The full text of *EPA Scientific Integrity Policy for Transparent and Objective Science*, as updated and approved by the Scientific Integrity Committee and EPA Science Advisor can be found here: https://www.epa.gov/sites/default/files/2014-02/documents/scientific_integrity_policy_2012.pdf. The full text of the EPA Scientific Integrity Program's *Approaches for Expressing and Resolving Differing Scientific Opinions* can be found here: https://www.epa.gov/scientific-integrity/approaches-expressing-and-resolving-differing-scientific-opinions.

Rodenticides: Final Biological Evaluation, Effects Determinations, and Mitigation Strategy for Federally Listed and Proposed Endangered, and Threated Species and Designated and Proposed Critical Habitats

Prepared by:
ENVIRONMENTAL FATE AND EFFECTS DIVISION
OFFICE OF PESTICIDE PROGRAMS

U.S. Environmental Protection Agency
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EXECUTIVE SUMMARY

The purpose of this assessment is to complete final effects determinations including predictions of whether there is a potential likelihood that 11 currently registered rodenticides, currently in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) section 3(g) registration review (RR) process, could lead to a future jeopardy (J) or adverse modification (AM) finding by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), collectively referred to as the "Services" for federally listed endangered and threatened species, those species proposed as listed (collectively referred to as "listed"), and any designated or proposed for designation critical habitat (CH). This final Biological Evaluation (BE) also identifies possible mitigation measures that are intended to avoid potential future jeopardy or adverse modification determinations by the Services and minimize take of listed species. As such, the BE also serves as the EPA's Rodenticide Strategy as outlined in EPA's Endangered Species Act Workplan to guide how the EPA addresses listed species mitigation for rodenticides going forward.

Rodenticides are used to control rodent pests that can cause significant damage to property, crops, and food supplies as well as spread diseases, posing a serious risk to public health. Rodenticides are used in residential, agricultural, and non-agricultural settings to control a variety of pests including house mice, Norway rats, roof rats, moles, voles, pocket gophers, prairie dogs, ground squirrels, feral hogs, and mongooses.

The 11 rodenticides evaluated in the BE are: chlorophacinone, diphacinone and its sodium salt, warfarin and its sodium salt, brodifacoum, bromadiolone, difenacoum, difethialone, bromethalin, cholecalciferol, strychnine, and zinc phosphide. Seven of these rodenticides (*i.e.*, chlorophacinone, diphacinone, warfarin, brodifacoum, bromadiolone, difenacoum, and difethialone) act by disrupting normal blood-clotting mechanisms (referred to as "anticoagulants"[1]); however, there are rodenticides with other modes of action, such as neurotoxicity (*e.g.*, bromethalin and strychnine), disruption of calcium absorption (*e.g.*, cholecalciferol) and impairment of cellular function (*e.g.*, zinc phosphide). Different chemical properties affect the types of species that may be impacted by rodenticides. For example, anticoagulants interfere with blood clotting and cause death from excessive bleeding. Mortality in target animals may occur weeks after ingestion of a lethal dose. Between the time a target animal eats the bait and ultimately dies, they may be consumed by a predator, or their carcass may be consumed by a scavenger after they die. Therefore, predators and scavengers may be exposed to and similarly affected as primary consumers but through exposure to an anticoagulant rodenticide in the target animal. Rodenticides that do not accumulate in the target animal or that do not remain in animals for very long are less likely to affect predators and scavengers. Similarly, rodenticides that kill target rodents faster are also less likely to affect predators and scavengers. The assessment accounts for differences in these properties as they relate to the extent that different types of species may be affected across the 11 rodenticides.

This final BE is comprehensive of all currently registered uses of the 11 rodenticides, all currently submitted toxicity and environmental fate data, and all exposure routes. In addition to the draft BE which EPA released for public comment in November 2023, this analysis builds upon prior FIFRA based

[1] Referred to as first-generation anticoagulants (*i.e.,* chlorophacinone, diphacinone, and warfarin) and second-generation anticoagulants (*i.e.,* brodifacoum, bromadiolone, difenacoum, and difethialone).

risk assessments (USEPA, 2020a – 2020e) and analyses completed for three pilot listed species[2] (herein referred to as the "pilot memo") described in the 4 Proposed Interim Decisions (PIDs) associated with the RR of these 11 rodenticides in November 2022 (USEPA, 2022a – 2022e) for which EPA also took public comment. In this final BE, EPA based the effects determinations solely on existing approved labels (*i.e.*, they do not consider the mitigations identified in the 4 PIDs associated with the 11 rodenticides (USEPA, 2022a – 2022d) or the pilot memo (USEPA, 2022e)). Furthermore, EPA also met regularly with the USFWS for informal consultation and technical assistance during the development of this BE, which informed the methodology, the decision-making processes for species determination including, predictions of the potential likelihood of future J/AM, and the mitigation strategy.

In this final BE, EPA evaluated the effects of the 11 rodenticides to 1827 listed species (including species proposed for listing) and 927 designated and proposed critical habitats in the United States and its territories. For purposes of listed species-specific effects determinations, EPA first grouped each of the 11 rodenticides by mode of action (*e.g.*, anticoagulants, neurotoxins, etc.) and then further grouped by use pattern (*i.e.*, bait station[3], in-burrow, or broadcast). EPA distinguished between these three use patterns because they have different exposure routes to non-target animals. For each species, EPA made effects determinations for each chemical group (*i.e.*, mode of action), consisting of one determination for each of the use patterns associated with that chemical group.

EPA determined whether each of the 11 rodenticides will have No Effect (NE) on, or May Affect (MA), an individual of each listed species or CH. For those species and CHs with MA determinations, EPA performed additional analyses to determine if each rodenticide is Not Likely to Adversely Affect (NLAA) or Likely to Adversely Affect (LAA) an individual species or a CH. EPA made NLAA determinations when effects are either discountable (highly unlikely to occur), insignificant, or wholly beneficial.

The "likely to adversely affect" (LAA) determination means that EPA reasonably expects that at least one individual animal or plant, among a variety of listed species, may be exposed to a rodenticide at a sufficient level to have an adverse effect. The likely "take", which includes unintentional harm or death, of even one individual of a species, is enough to trigger an LAA determination. An LAA determination, however, does not necessarily mean that a pesticide is putting a species in J.

For those species and critical habitats where EPA made an LAA determination, EPA also included its prediction of the potential likelihood of future J/AM. While EPA is not required to include J/AM predictions or mitigation measures in its effects determinations, EPA is including this analysis to help expedite the consultation process with USFWS. The Services make the final J/AM findings in any Biological Opinion they issue at the end of the consultation process.

Although EPA updated effects determinations in the final BE, there were not enough relative changes among the effects determinations (*i.e.*, NE, NLAA, LAA, J, no J, AM, no AM) to impact the overall percentage of species and CH associated with those effects determinations; therefore, the relative

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[2] Species in the pilot memo included the Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*) represented a primary consumer bird, Stephens' kangaroo rat (*Dipodomys stephensi*) represented a primary consumer mammal, and the California condor (*Gymnogyps californianus*) represented a secondary consumer.

[3] EPA evaluated bait stations to control rodents and bait stations designed to target feral hogs. Feral hog bait stations were considered separately because they are designed to exclude smaller non-target species, resulting in different exposure pathways compared with bait stations designed to control rodents.

percentages did not change between the draft and the final BE. EPA determined that the currently labeled uses of the 11 rodenticides evaluated in this assessment:

- Will have no effect on 88% of listed species and 95% of critical habitats;
- Are not likely to adversely affect 4% to 11% of listed species—depending on the chemical and application type—and 1% of critical habitats;
- Are likely to adversely affect 1% to 8% of listed species—depending on the chemical and application type—and 4% of critical habitats; and,
- Have a likelihood of future Jeopardy/Adverse Modification for less than 5% of listed species and less than 1% of critical habitats.

The final Rodenticide Strategy includes mitigation measures that EPA identified to address the predictions of potential likelihood of future J/AM for 78 listed species and five critical habitats (*see* **Table 5-1** of this assessment). These measures "avoid" or "minimize" exposure, as defined by the Endangered Species Act (ESA) Consultation Handbook. EPA removed the following mitigation measures from this final BE because EPA proposed them in conjunction with specific PIDs for implementation nationally through product labeling updates and they will therefore be addressed in registration review instead of this final strategy:

- Restricted use classification
- Packaging first generation anticoagulant rodenticides (FGARs), bromethalin, and cholecalciferol products for consumer use in quantities of one pound or less in ready-to-use non-refillable bait stations
- Broad national product labeling updates to prohibit broadcast and surface spot/scatter application for turf, lawns, golf courses, campsites, and other recreation areas.

EPA received comments on the draft Rodenticide Strategy that additional clarity was needed in finalizing the mitigation strategy, particularly regarding the applicability of each mitigation measure to each rodenticide product and use. Commenters expressed concern that some mitigation measures may not be effective or feasible depending on the listed species, scenario, or use pattern. EPA wishes to clarify that the intent of the Rodenticide Strategy is to outline all known mitigation measures identified to reduce endangered species exposure, and therefore reduce the potential likelihood of future J/AM.

Unlike the Herbicide Strategy, these mitigation measures are not intended to serve as a mitigation menu for rodenticide users in a manner that implies or contemplates that EPA will take a standardized approach to implementation. Rather, these are the suite of measures that EPA has identified from which EPA expects to choose when identifying measures to reduce exposure to listed species and their CH from the 11 rodenticides for a specific active ingredient, use site, and application method (*i.e.*, bait station, in-burrow, and broadcast). EPA plans to implement the final strategy for each of these 11 rodenticides through their ongoing registration review.

The mitigation strategy section of this document provides some examples of how EPA envisions implementation, which were all informed by public comments EPA received on the draft Rodenticide Strategy. For example, while EPA included carcass search in the draft as a mitigation measure to reduce exposures based on its inclusion in USFWS' previous biological opinion on other rodenticides (*i.e.*, Rozol and Kaput), numerous commenters expressed concerns about its applicability and feasibility for many/most of the rodenticides and uses subject to this strategy. As a result, the EPA is now specifying it expects to only select the carcass search measure when other mitigation measures are not practical or feasible. EPA has included an example of the limited types of scenarios in which EPA would expect to implement this measure in the final Rodenticide Strategy.

Additionally, EPA expects most of the mitigation measures would apply in geographically specific areas only (referred to as Pesticide Use Limitation Areas or PULAs) through Bulletins using its web-based system, Bulletins Live! Two (BLT). PULAs focus on areas where pesticide exposures are likely to impact the continued existence of a listed species, which may include a reduction in survival or recovery of the species and designated critical habitat. EPA is refining the species maps that it will use for PULAs and does not plan to implement mitigations in those areas until those maps are refined.

EPA's final BE made LAA determinations for species under USFWS' jurisdiction; therefore, EPA will initiate formal consultation with the USFWS. At the end of the consultation, the USFWS will make their conclusions on J/AM and determine whether there are additional measures necessary to avoid J/AM for each listed species and critical habitat, and the USFWS will issue their Biological Opinion (BiOp). After the BiOp is issued, EPA will implement any additional measures identified in the BiOp.

1 Background

1.1 Nature of the Regulatory Action

This final BE presents EPA's determinations for the effects of 11 rodenticides on listed species and CH in the U.S., including Hawaii, and its territories[4]. EPA first grouped each of the 11 rodenticides and assessed them according to their modes of action. The three first generation anticoagulant rodenticides (FGARs) are chlorophacinone, diphacinone (and its sodium salt), and warfarin (and its sodium salt). The four second generation anticoagulant rodenticides (SGARs) are brodifacoum, bromadiolone, difenacoum and difethialone. Four of the rodenticides (bromethalin, cholecalciferol, strychnine, and zinc phosphide) have unique modes of action not involving the coagulation of blood and are considered individually. EPA then further grouped by use pattern (*i.e.,* bait station[5], in-burrow, or broadcast). EPA distinguished between these three use patterns because they have different exposure routes to non-target animals. For each species and critical habitat (CH), EPA made effect determinations for each chemical group (*i.e.*, mode of action), consisting of one determination for each of the use patterns associated with that chemical group.

This final BE is comprehensive of all currently registered uses of the 11 rodenticides, all currently submitted toxicity and environmental fate data, all exposure routes, and incorporates current label language to assess potential effects from the use of these rodenticides. This analysis builds upon prior FIFRA-based risk assessments (USEPA, 2020a – 2020e) and analyses completed for three pilot listed species (USEPA, 2022e).

EPA first presents its no effect (NE) and may affect (MA) determinations for species and CH; the latter being further refined to not likely to adversely affect (NLAA) or likely to adversely affect (LAA). For LAA species, consistent with the Services' counterpart regulations, EPA made predictions of potential likelihood of future J/AM. For LAA CH, EPA presents its predictions for the potential likelihood of future AM and not likely future AM. While EPA is not required to include J/AM predictions in its effects determinations, EPA is including this analysis with the intention of making the consultation process more efficient. The Services make the final J/AM findings in any BiOp they issue at the end of the consultation process.

EPA is including a Rodenticide Strategy (mitigations) as part of this final BE that focuses on reducing exposures of listed species to 11 rodenticides. This strategy focuses on reducing exposures so that EPA's predictions of the potential likelihood of future J for listed species and potential likelihood of future AM for CHs based on current uses and label restrictions in this final BE would not be likely. The mitigation measures are also intended to minimize take[6] of those species where EPA made LAA determinations.

[4] Candidate species and experimental populations were not considered.
[5] EPA evaluated bait stations to control rodents and bait stations designed to target feral hogs. Feral hog bait stations were considered separately because they are designed to exclude smaller non-target species, resulting in different exposure pathways compared with bait stations designed to control rodents.
[6] Take - to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. [ESA §3(19)] Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. [50 CFR §17.3]

The mitigation measures include measures to “avoid” or “minimize” exposure, as defined by the ESA Consultation Handbook[7]. No “offsets” are proposed at this time; however, EPA is open to considering proposals regarding how offsets may be utilized for rodenticides.

EPA took comment on the draft BE and associated mitigation strategy from November 30, 2023 to February 13, 2024 and a total of 2,016 comments were submitted to the docket. Responses can be found in the RTC document available in the public docket (EPA docket number EPA-HQ-OPP-2023-0365). EPA separately released a draft human health and ecological risk assessment on these rodenticides in 2020, which was followed by a public comment period during which EPA received valuable feedback. In November 2022, EPA proposed measures for multiple rodenticides—including the requirements of tamper-resistant bait boxes and rodent carcass collection—based on the assessment that addressed protections for specific listed species and critical habitat as part of a pilot program and has received valuable feedback on those measures as well. EPA took those comments into consideration when developing the mitigation strategy presented in this final BE. EPA intends to continue discussing the final effects determinations and mitigation measures in this final BE with USFWS and applicants during the consultation process.

Island Eradication Products

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) has consulted with USFWS and NMFS on the use of brodifacoum (an SGAR), diphacinone (an FGAR), and bromethalin for the eradication of rodents on uninhabited and remote inhabited islands to reduce ecological impacts. Such consultations are a prerequisite to the addition of any island to the APHIS conservation labels. Consultation has been completed for Wake and Midway Atolls and is pending for other projects.

APHIS is the registrant for several rodenticide labels for conservation purposes. These include but are not limited to Diphacinone®-50 Conservation (EPA Reg. No. 56228-35), Brodifacoum®-25W Conservation (EPA Reg. No. 56228-36), and Brodifacoum®-25D Conservation (EPA Reg. No. 56228-37) to eradicate or control invasive rodents on certain islands. APHIS is planning to conduct rodent eradication projects for the benefit of seabirds and other wildlife on these islands in the next five to seven years (**Table 1-1**). APHIS is also planning to register a diphacinone bait for mongooses (similar to the Special Local Need Section 24(c) label HI980005, EPA Reg. No. 61282-26) for use in Hawaii, Puerto Rico and the U.S. Virgin Islands.

APHIS conducts its own ESA consultation for these uses with USFWS and NMFS. After consultation is complete, APHIS presents a completed BiOp to EPA before any of these projects are added to their labels. EPA relies on these consultations when considering the FIFRA action. EPA has not included these uses in this nationwide final BE and Rodenticide Strategy.

[7] https://www.fws.gov/media/endangered-species-consultation-handbookEndangered Species Consultation Handbook

Table 1-1. Animal and Plant Health Inspection Service (APHIS) Island Eradication Projects Anticipated in the Next 5 to 7 Years[1]

Island	Specific Site
Pacific U.S. islands	Guam Hawaii (all islands) Midway Atoll, US Minor Outlying Islands Wake Atoll, US Minor Outlying Islands Swains Island, American Samoa
Western U.S. islands	Great Sitkin, AK South Farallon Islands NWR
Eastern U.S. islands	Nantucket, MA Marthas Vineyard, MA Boston Harbor, MA Elizabethan Islands, MA Fort Wool, VA
Dry Tortugas National Park	Loggerhead Key Garden Key Long Key Bush Key Hospital Key Middle Key East Key
Pinellas NWR	Egmont Key Jackass Key Little Bird Key Indian Key Tarpon Key Mule Key
Grassy Key, FL	Grassy Key, FL
Caribbean U.S. islands	Savana Island, US Virgin Islands Mona Island, Puerto Rico Culebrita and Luis Peña Islands, Puerto Rico

[1]Email communication from Emily Ruell (APHIS in Fort Collins, Colorado, May 1, 2023)

1.2 Summary of Previous Rodenticide Assessments that Inform the Biological Effects Determinations

The 11 rodenticides have a long regulatory history and a well-established risk profile that has been subject to repeated external peer review. A summary of regulatory actions and related consultations with the Services are described below. EPA considered previous assessments, mitigations and consultations related to the 11 rodenticides to inform the approach and analysis in this final BE.

In 1991, EPA requested formal consultation with USFWS on 31 registered chemicals with MA determinations made by EPA. The 31 chemicals included 16 vertebrate control agents, of which were eight of the 11 rodenticides assessed in this final BE (*i.e.*, brodifacoum, bromadiolone, bromethalin, chlorophacinone, diphacinone, warfarin, cholecalciferol, and zinc phosphide). In 1993, USFWS published a BiOp for the 31 chemicals, which provided their determinations of the impacts of the registered uses of those chemicals (including the 8 rodenticides) to all listed species at the time of publishing (USFWS, 1993).

In 2008, EPA released the Risk Mitigation Decision (RMD) for Ten Rodenticides (USEPA, 2008). The RMD is the Re-Registration Eligibility Decision (RED) for these rodenticides, which is the previous iteration of RR under FIFRA. An independent Science Advisory Panel (SAP) reviewed the underlying scientific FIFRA-based risk assessments supporting the RMD because some registrants questioned the need for and the basis of the RMD mitigations. EPA's mitigations goals were to: 1) minimize children's exposure to rodenticide products used in homes by requiring that all rodenticide bait products marketed to general and residential consumers be sold only with bait stations, with loose bait (*e.g.,* pellets and meal) as a prohibited bait form and, 2) reduce wildlife exposures and ecological risks, by requiring sale and distribution limits intended to prevent general consumers from purchasing residential use bait products containing four of the ten rodenticides that pose the greatest risk to wildlife (*i.e.,* SGARs: brodifacoum, bromadiolone, difenacoum, and difethialone). Moreover, the 2008 RMD required bait stations for all outdoor, above-ground uses of the 4 SGARs to reduce exposure. The RMD rodenticide mitigations reduced the potential of effects of commensal uses to non-listed and listed species.

In 2012, EPA formally consulted with USFWS on the use of Rozol® Prairie Dog Bait (contains chlorophacinone; USFWS, 2012) on potential effects for listed species. During the consultation process, the registrant, EPA, and USFWS determined appropriate mitigations to avoid the potential likelihood of future J for several listed species. The mitigations included geographic and timing restrictions, carcass search and disposal.

In 2020, to support the RR of the rodenticides, EPA prepared five draft FIFRA-based ecological risk assessments that collectively covered the 11 rodenticides (USEPA, 2020a, 2020b, 2020c, 2020d, 2020e, **Table 1-2**). The 2020 FIFRA-based assessments did not include specific listed species evaluations. EPA concluded that non-target birds, mammals, reptiles, and terrestrial-phase amphibians have the potential of risk (*e.g.*, mortality) from dietary exposure (primary or secondary; *see* **Section 2.2** for definition) to rodenticides. EPA presented multiple lines of evidence to support identified FIFRA-based risk conclusions, including exposure-to-effect ratios (*i.e.*, risk quotients; RQs) that exceed EPA's acute risk levels of concern (LOCs) for primary and secondary consumers within various taxa (*see* the draft FIFRA-based risk assessments; USEPA, 2020a-2020e), monitoring data where rodenticides were detected in non-target animals, and multiple reports of mortality incidents likely associated with rodenticides. For this final BE, the FIFRA-based risk assessments served as the basis for determining which taxa needed further review at the species-specific level to determine whether the action (*i.e.*, the RR of the 11 rodenticides) may affect any listed species or CH.

In 2022, EPA completed four PIDs for the 11 rodenticides which included proposed mitigations that would generally reduce exposure to non-listed and listed species (USEPA 2022a – 2022d) and targeted ESA mitigation to protect three pilot listed-species and one CH. Those three species and one CH were assessed in EPA's pilot memo that included (1) draft effects determinations and predictions of the potential likelihood of future J/AM based on currently registered uses of the 11 rodenticides and (2) proposed mitigations to avoid J/AM for those species and CH (USEPA, 2022e). EPA intended for the pilot memo to not only support the 4 PIDs but to also inform stakeholders how EPA would make predictions of the potential likelihood of future J/AM and would identify any associated mitigations in this final BE. EPA chose the three pilot species because they represented examples of the listed species that may be affected by rodenticides through different routes of exposure (*i.e.,* primary and secondary consumption; *see* **Section 2.2**). The species were the Stephens' kangaroo rat (*Dipodomys stephensi*) and Attwater's prairie-chicken (*Tympanuchus cupido attwateri; also referred to as* "Attwater's greater prairie-chicken") both of which represented primary consumers, and the California condor (*Gymnogyps californianus*), which represents a secondary consumer. EPA also made a draft effects determination in 2022 for the CH of the California condor. EFED predicted the potential likelihood of future J or AM for all three of the species and the CH for some but not all 11 rodenticides. EFED considered public comments and feedback from stakeholders and USFWS on the analyses for the pilot species and determined that the approach used to make the effects determinations and associated predictions of the potential likelihood of J/AM was appropriate for this final BE.

EPA used standard risk assessment procedures to arrive at conclusions supported by multiple lines of evidence, which includes incident data that documents effects in primary and secondary consumers. There were 40 documented incidents involving listed species and SGARs and one involving listed species and FGARs, which are described in detail in this BE and in the 2020 risk assessments. Incidents support the conclusions of our risk assessment that are based on toxicity and exposure modeling. The incidents demonstrate that there are multiple complete exposure pathways from rodenticide use sites to non-target taxa that are both primary and secondary consumers of rodenticides.

Table 1-2. Previous FIFRA- and ESA-based Risk Assessments for the RR of 11 Rodenticides

Rodenticide or group	Document reference
Second generation anticoagulants (SGAR): brodifacoum, bromadiolone, difethialone, difenacoum	DP barcode 453282; 03/17/2020; USEPA, 2020a
First generation anticoagulants (FGAR): chlorophacinone, diphacinone, warfarin	DP barcode 453282; 03/17/2020; USEPA, 2020a
Strychnine	DP barcode 453652; 06/23/2020; USEPA, 2020b
Bromethalin	DP barcode 456755; 03/31/2020; USEPA, 2020c
Cholecalciferol	DP barcode 456480; 03/31/2020; USEPA, 2020d
Zinc Phosphide	DP barcode 455987; 06/24/2020; USEPA, 2020e
Draft Effects Determinations and Evaluation of Proposed Mitigations Intended to Avoid Jeopardizing Three Federally Listed Endangered and Threatened Species and Avoid Adversely Modifying One Designated Critical Habitat	DP barcode 464678; 09/28/2022; USEPA, 2022e

DP=Data Package

1.3 Characterization of Rodenticide Uses

Target pests of the 11 rodenticides include commensal rodents (*e.g.*, mice and rats) and other mammals (*e.g.*, feral hogs, prairie dogs, ground squirrels, marmots). In general, rodenticides may be applied in bait stations, within target-rodent burrows, or broadcast onto the surface of treated areas. The application method varies by application site. Application sites include developed areas, agricultural fields, rangeland, and pastures. Each rodenticide active ingredient has its own unique combination of use sites and application methods. **Appendix A** provides a summary of the uses and modes of action of the 11 rodenticides**.**

A primary use of most of the rodenticides is to control commensal rodents (*e.g.*, house mice, roof rats, and Norwegian rats) in urban and developed areas, and in agricultural settings. EPA requires that all products used for commensal rodent control be in tamper-proof bait stations to protect children, pets, and wildlife. Current labels specify that bait stations are required to be placed within 100 feet of a man-made structure.

Four of the 11 rodenticides (chlorophacinone, diphacinone, strychnine, and zinc phosphide) are used in agriculture settings. Current labels for agricultural use allow broadcast, in-burrow, and bait station use patterns.

Warfarin (an FGAR) is the only rodenticide labeled for use within special bait stations for the control of feral hogs.

EPA also considered geographic prohibitions on the labels when they were applicable to making effects determinations and predictions of potential likelihood of future J/AM.

1.3.1 Additional Use Considerations

EPA also considered other special situations that are impactful to where certain rodenticides are unlikely to be used. For example, some strychnine uses do not have geographic restrictions that preclude use on islands; however, the specific target pests are not known to be located outside of the contiguous United States (CONUS). Similarly, while the broadcast use of chlorophacinone and diphacinone do not have any geographic prohibitions for island use, the target pests are not located on islands but are found in the CONUS. Therefore, broadcast use of these FGARs is not anticipated on islands.

2 Effects Determination Methodology

2.1 Overview

In this final BE,[8] EPA evaluated whether the registrations of the 11 rodenticides pose potential effects to listed species and CH[9] that are within the action area.[10] The 1,827 listed species and 927 CHs assessed in the final BE were current as of October 2024.[11] This evaluation did not include 10(j) species which are plants or animal populations that have been designated as experimental under the ESA (*e.g.,* some populations of Black footed ferret, *Mustela nigripes*, are considered a non-essential experimental population; therefore, regulatory and take prohibitions, and consultation requirements of the ESA are relaxed). Any adjustments to 10(j) species will be resolved during consultation with the USFWS.

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[8] 50 CFR § 402.40(b) states: "Effects determination is a written determination by [EPA] addressing the effects of a FIFRA action on listed species or critical habitat. The contents of an effects determination will depend on the nature of the action. An effects determination . . . shall contain the information described in [50 CFR] § 402.14(c) and a summary of the information on which the determination is based, detailing how the FIFRA action affects the listed species or critical habitat."

[9] This assessment focuses upon currently listed and proposed endangered and threatened and designated and proposed CHs. During consultation, EPA may confer with the USFWS to identify any additional species or critical habitats that are relevant to this action.

[10] The action area includes an exposure area extending from each pesticide use site found across use data layers (UDLs) in all directions out to this distance.

[11] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction

One component of making an effects determination is comparing where species are located to identify where they may overlap with areas where these rodenticides are used, referred to as an overlap analysis. If there is no overlap between a species (or its CH, if designated) and areas where these rodenticides are used, then there is no effect to that species (or its CH). If there is overlap, then as described below, EPA conducts additional analyses for that species. EPA used the best available data to develop its overlap analysis for this BE.

For the draft BE, EPA used the Services' spatial datasets containing range and critical habitat data for species listed under ESA as of February 2022.[12] Therefore, EPA's overlap analysis in the draft BE did not include species and CH that were listed or proposed for listing after that date (between February 2022 and April 2023). For the final BE, EPA updated its species list to include all listed species as of Oct. 2024. The most up to date species range and critical habitat spatial files were from Dec. 2023.[13] For both datasets there were instances in which the Services have not developed a spatial file for some species' ranges or CH. Where data was not available, EPA did not include a quantitative overlap analysis to make its effects determinations, including any predictions of potential likelihood of future J/AM for those species and any AM of CH. Instead, EPA assumed overlap and exposure occurred, and made its determinations based on biological, and not spatial, factors.

EPA similarly used the best available information in making the effects determinations, which reflect potential effects to individuals of a species or their CH. For this analysis, EPA considered direct effects to the species and effects on prey, pollination, habitat, or dispersal (PPHD). The term "direct effects" refers to decreases in the survival, growth, or reproduction of individuals of a listed species due to exposure to one of the rodenticides. EPA also considered impacts on the listed species that may be the result of the effects of one of the rodenticides on organisms for which the listed species depends for PPHD. When making effects determinations for CHs, EPA considered whether there may be potential effects to the physical and biological features (PBFs) of the CH.

EPA determined whether currently registered rodenticide uses will have "no effect" (NE) on a given listed species or CH (*e.g.*, species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects) or "may affect" (MA) the species or CH. For those species and CH that EPA determined MA, EPA further determined whether the action (*i.e.*, RR of the 11 rodenticides): "may affect but is not likely to adversely affect" the listed species or CH (NLAA); or "may affect and is likely to adversely affect" the listed species or CH (LAA). EPA made NLAA determinations when exposure was extremely unlikely to occur or if an effect was insignificant or wholly beneficial. If EPA determined that an effect could not be discounted as extremely unlikely, then EPA made a LAA determination. LAA

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[12] Spatial dataset contains range and critical habitat data for species listed under ESA. Updated routinely, this snapshot represents the data currently used in US EPA's OPP endangered species evaluations. Delineated by the USFWS and NOAA/NMFS, the associated spatial dataset are enhanced with field attributes supporting ESA section 7 implementation by the EPA. Ranges represent anywhere an individual could be found based on the best available information at the time of delineation. Critical habitat represents specific habitat areas essential to conservation and continued existence of a listed species. When multiple files are associated with a species, individual files are converted to polygons, when necessary, and merged into a single file to represent the species as a whole. The last snapshot of the species locations occurred in February 2022.

[13] Range files - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Species_Ranges_Static/FeatureServer
Critical habitat - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Critical_Habitat_Static/FeatureServer

determinations mean that an effect from an exposure to one or more individuals of a species is reasonably certain to occur and that the effect is discernible and adverse. To inform consultation with the USFWS, for those species and CHs with LAA determinations, EPA also included in its effects determinations predictions of whether there is a potential likelihood of future J to a listed species or AM of their CH from the use of one or more of the 11 rodenticides.[14]

As previously mentioned, this assessment uses the best available scientific information on the rodenticides, including but not limited to use, environmental fate and transport, ecological effects, incident data, and monitoring data. EPA used that information and the taxa-based risk assessments (*see* FIFRA-based DRAs for each rodenticide summarized in **Table 1-2**) as the starting point for the effects determinations for the listed species and CHs. The taxa-based methodology identifies the types of species that may be affected by labeled uses of the 11 rodenticides and the important exposure routes associated with potential adverse effects. As needed, EPA refined the taxa-based methodology and considered species-specific information to determine if there are potential effects to any individual of a species or its CH. The taxa-based method is not spatially explicit.

EPA used the taxa-based assessment to focus the species-specific analysis on types of direct effects (*e.g.*, mortality) or effects to PPHD that may be relevant to listed species or CHs. When EPA's FIFRA-based assessment (**Table 1-2**) showed that a RQ exceeded a listed species LOC, it does not automatically mean that the action may affect a specific species or CH. Instead, it means further species-specific review was needed to determine whether rodenticide use may affect a listed species or its CH. An RQ that does not exceed the listed species LOC does not necessarily mean that the species or CH determination is NE because potential effects to PPHD also need consideration. Therefore, EPA considered the life history, distribution of the species, and effects of the 11 rodenticides on organisms on which the listed species depends for PPHD before making the effects determinations. The sections below discuss the approach EPA used to make effects determinations for listed species and CHs.

The FIFRA-based risk conclusions of the rodenticides and the exposure considerations described below form the starting point for the effects determinations made for each listed species and the rationales for the effects determinations that are detailed in this final BE. The primary and secondary exposure concerns for each listed species and CHs are included in **Appendix B** and **Appendix C**.

2.2 Exposure Considerations

The taxa-based risk assessments for the 11 rodenticides (USEPA, 2020a-2020e) concluded that rodenticides do not pose a concern to non-target taxa via drift or runoff, as they are used primarily in bait stations, applied within burrows, or in granular form via broadcast. They do not pose a concern for inhalation or off-field movement via transport through the air because they are all non-volatile. Application of these pesticides incorporated into baits essentially eliminates off-site transport via runoff or drift and thus eliminates runoff and drift exposure concerns.

EPA considered off-site concerns for the 11 rodenticides from exposure to rodenticides through secondary exposure, that is, an animal consuming another animal that had directly consumed one of the rodenticides. Previous taxa-based risk assessments on these rodenticides concluded that non-target birds, mammals, reptiles, and terrestrial-phase amphibians may be at risk from dietary exposure to

[14] 50 CFR 402.40(b)(1) provides that EPA may describe in its effects determination a conclusion whether jeopardy to a listed species or adverse modification of any designated critical habitat is likely.

rodenticides, though the exposure concerns differ by chemical and use type (USEPA, 2020a-2020e). More specifically, those assessments concluded that all 11 rodenticides may pose a risk to non-target mammals that are primary consumers of bait whereas seven anticoagulant rodenticides (FGARs and SGARs), pose a risk to birds, terrestrial-phase amphibians, and reptiles that directly eat bait. Cholecalciferol does not pose an acute risk to birds, terrestrial-phase amphibians or reptiles that consume bait.

In the taxa-based risk assessments, EPA identified potential risk concerns for secondary consumers from all the rodenticides except cholecalciferol, but that potential secondary exposure risks are not equal among the rodenticides. One consideration is that bromethalin, strychnine, and zinc phosphide are all relatively fast acting (*i.e.,* mortality of primary consumers occurs within 1 and 24 hours), while the anticoagulant rodenticides (FGARs and SGARs) may take longer to result in mortality of the target pest. As a result, primary consumers of anticoagulants can accumulate larger amounts of the active ingredient (based on their fate properties), resulting in potentially higher exposure and likelihood of effects to secondary consumers. Another consideration is that there may be a longer period where anticoagulant-contaminated prey may be active, leading to a greater likelihood that secondary consumers that only eat live prey will be exposed; although this feature of the anticoagulants does not impact secondary consumers of carcasses (*i.e.,* scavengers; USEPA 2020a). However, not all anticoagulant rodenticides pose an equivalent potential risk of secondary exposure. In general, SGARs (*i.e.,* brodifacoum, bromadiolone, difenacoum, and difethialone) pose a greater potential risk compared to FGARs (*i.e.,* warfarin, chlorophacinone, and diphacinone) because they only require one feeding to kill the target pest whereas FGARs may require multiple feedings (USEPA, 2011). Multiple lines of evidence support these taxa-based risk conclusions, including RQs for primary and secondary consumers within various taxa that exceed the acute risk LOCs. The following section describes dietary exposure in terms of primary and secondary exposure and potential for effects.

For broadcast uses, the relevant exposure routes are by consumption of bait or treated grain found on the ground (primary consumer), or by consumption of a primary consumer (secondary consumer). For in-burrow uses, the relevant exposure route is by consumption of bait or treated grain found within treated burrows (primary consumer) or by consumption of a primary consumer (secondary consumer). For bait station uses, the relevant exposure routes are by consumption of bait within the bait station (primary consumer), or by consumption of a primary consumer (secondary consumer).

2.2.1 Primary Exposure

Primary exposure is defined as the direct consumption of rodenticide by a targeted rodent, or by non-targeted mammal, bird, reptile, or amphibian. Primary consumption may occur within a bait station, or on the landscape because of broadcast and in-burrow uses. Animals that feed on the ground or live in burrows are most likely to be exposed to rodenticides from primary exposure.

Primary exposure from in-burrow uses is more likely than from bait stations for a wider variety of non-target species given the restricted entrance to bait stations and placement near structures. For burrow uses, labels typically require bait to be placed several inches down into the burrow and cleanup of bait on the soil surface, which limits incidental exposure at the ground surface. Non-target animals that also utilize burrows have the highest likelihood of exposure, as they may enter the burrows of target pests, or their burrows may be treated by mistake. Secondary exposure from in-burrow treatments is limited by the tendency of burrow-dwelling pest species to die in their burrows rather than on the surface (Baldwin, *et al*., 2021).

The main mechanism for the prevention of primary exposure to non-target animals is use of tamper-resistant bait stations, which is required for all commensal rodent control in residential settings. Bait stations exclude animals that are too large to enter the station, or which are behaviorally unlikely to enter an enclosed space on the ground and next to a structure. Bait stations are attractive to rodents and are usually placed in areas of high rodent activity within the required 100-foot distance of a structure.

In general, there is a greater likelihood of exposure to non-target primary consumers from broadcast uses than burrow use or bait station uses given that the bait is scattered across the surface of the landscape. Rodenticides with broadcast use patterns are two of the FGARs (*i.e.*, chlorophacinone and diphacinone) and zinc phosphide. Non-target animals may be exposed by eating baits or pellets while foraging in agricultural fields.

Animals that are extremely unlikely to be exposed to rodenticides via primary consumption include but are not limited to fully aquatic species and terrestrial species whose habitat and feeding patterns suggest exposure is not reasonably certain to occur (*e.g.,* birds whose diet is entirely from the aquatic food web) (*see* **Section 2.6.1**).

2.2.2 Secondary Exposure

Secondary exposure refers to the consumption of rodenticide via predation/scavenging of primary consumer animals (*i.e.*, direct consumption of bait) by predators (*i.e.*, omnivores, carnivores, and scavengers). Examples of these types of species include but are not limited to vultures, owls, foxes, and large cats. EFED assumed that species that consume live animals or carrion may be secondary consumers of rodenticides.

In some cases, top predators or scavengers may consume animals that are themselves secondary consumers of rodenticide-poisoned mammals. This includes listed birds of prey, scavengers, and larger omnivores (*e.g.*, cranes and storks) as well as snakes and carnivorous mammals due to possible secondary and tertiary exposure from consumption of poisoned mammals. This is termed tertiary exposure and may occur in apex species such as the California Condor. For purposes of this final BE, tertiary exposure is treated as functionally equivalent to secondary exposure, with the main difference being that the spatial footprint of tertiary exposure may be greater than the spatial footprint for secondary exposure.

Secondary exposure can occur from all types of rodenticide uses, including bait stations, though secondary exposure from consumption of burrow-dwelling animals is limited by the tendency of burrow-dwelling pest species to die in their burrows rather than on the surface (Baldwin, *et al*., 2021). This exposure pathway is a possibility for all 11 of the rodenticides, but the likelihood of effects due to secondary exposure varies among them due to differences among the chemicals in terms of fate, metabolic, and toxicity properties.

Secondary exposure may include consumption of rodenticide contaminated terrestrial invertebrates because soil-dwelling invertebrates may encounter rodenticides through bait station, in-burrow, or broadcast uses; thus, becoming potential vectors of rodenticides to listed species that consume terrestrial invertebrates. For secondary exposure, it is unlikely that invertebrates represent a significant exposure pathway (*i.e.*, a listed species is unlikely to consume enough exposed invertebrates to elicit effects). In past taxa-based risk assessments, EPA concluded that predators of the target organisms (*i.e.*, rodents) are at significant risk of exposure as secondary consumers of the rodenticides, but predators of non-target organisms were not because of a lower likelihood of sufficient numbers of non-target prey items being contaminated with the rodenticides. EPA determined that consumption of soil dwelling invertebrates (or incidental consumption of soil containing baits) as a secondary route of exposure is extremely unlikely to cause adverse effects to individual listed species and the exposure is unlikely to lead to adverse effects on individual or population levels.

2.2.3 Chemical Specific Exposure Considerations

EPA addressed the differential toxicity, label use patterns, and exposure profiles of the 11 rodenticides by conducting a screen of each taxon of concern (*i.e.*, mammals, birds, reptiles, and amphibians). This screen identified potential for effects to primary and secondary consumers, by active ingredient and use (**Table 2-1**). The initial screen assumes that animals have access to bait (through primary or secondary consumption). EPA determined that exposure is not reasonably expected to occur at levels that could cause effects to listed species because they do not reasonably have access to the bait when applied indoors; therefore, EPA made an NE determination for all listed species and all designated CH for indoor uses and these uses are not considered further. When needed, EPA refined the high-level screen presented in **Table 2-1** with life history data and other considerations to make effects determinations for each listed species.

Table 2-1. Potential for Effects to Primary and Secondary Consumers from Exposure to the 11 Rodenticides by Application Method

Chemical	Bait Station		Burrow		Broadcast	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
FGARs[1,2,3]	Yes[5]	Yes[5]	Yes	Yes	Yes	Yes
SGARs[4]	Yes	Yes	Yes[7]	Yes[7]	NA	NA
Zinc Phosphide[2,3]	Yes	No	Yes	No	Yes	No
Bromethalin	Yes	No	Yes	No	NA	NA
Cholecalciferol	Yes[6]	No	Yes[6,7]	No	NA	NA
Strychnine	NA	NA	Yes	Yes	NA	NA

[1] FGARs are chlorophacinone, diphacinone (and its sodium salt), and warfarin (and its sodium salt).
[2] EPA considers the effects determinations for broadcast use of zinc phosphide, chlorophacinone and diphacinone to be representative of those for the scatter/spot treatments.
3 EPA considers the effects determinations for broadcast use of zinc phosphide, chlorophacinone and diphacinone to be inclusive of those for the agricultural bait station uses. See 3.2.1 and 3.2.6 for information on potential impacts on effects determination for primary consumers.
[4] SGARs are brodifacoum, bromadiolone, difenacoum, and difethialone.
[5] Includes Feral Hog bait station use (warfarin).
[6] Mammals only
[7] For cholecalciferol and two of the SGARs (bromadiolone and difethialone), the only registered burrow uses are structural applications within 100 ft of a building and the bait station effects determinations for these chemicals are considered protective of this use.
NA = not applicable

2.3 Action Area

The action area includes all potential pesticide use sites (represented by Use Data Layers or UDLs[15]) or exposure areas at which effects on listed species or CH are reasonably expected to occur. The action area sets the geographic extent of the Federal action. The 11 rodenticides are primarily used in bait stations, within burrows, and on-field, all in bait formulations. EPA qualitatively considered off-site concerns for the 11 rodenticides mainly from secondary exposure to rodenticides through an animal consuming another animal that directly consumed rodenticides by estimating the size of the range of the secondary consumer or tertiary consumer. The use patterns of the 11 rodenticides preclude spray drift and runoff exposure concerns; thus, EPA did not need to add a buffer to the UDLs to account for these transport mechanisms.

EPA defined the action area as the area encompassing the use of the 11 rodenticides. The action area for this assessment includes the 48 contiguous Unites States (CONUS), Alaska, Hawaii and U.S. Territories including Puerto Rico (PR), Guam (GU), Commonwealth of the Northern Mariana Islands (CMNI), U.S. Virgin Islands (VI), and American Samoa (AS). Collectively, Alaska, Hawaii, PR, GU, CMNI, VI, and AS are referred to as the non-lower 48 [states] (*i.e.*, NL48). To define the action areas spatially, EPA conducted an overlap analysis assuming that the exposure area was limited to the use sites (*i.e.*, areas consistent with allowable rodenticide use).

EPA used the registered uses of rodenticides (**Appendix A**) to identify spatial data that represent potential application sites of rodenticides. The UDLs represent the potential locations of rodenticide applications in the CONUS and NL-48. The CONUS agricultural UDLs are based on 5 years of USDA's Cropland Data Layer (CDL). The draft BE used data from 2012-2017, whereas the final BE used data from 2018-2022, as new data became available since the draft BE (*see* **Appendix E** for additional information on the generation of the UDLs).

Given the widespread list of agricultural uses that are registered for the 11 rodenticides being considered, the Cultivated Layer UDL was used as opposed to the grouped UDLs that are more specific to individual crop groups.

For non-agricultural uses, EPA used UDLs derived from several other sources including the U.S. Geological Survey (USGS) National Land Cover Database (NLCD), and the National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP) data layers. EPA represented developed areas using NLCD Developed or Open Space Developed land use categories (*i.e.*, where developed areas describe areas with man-made impervious cover, like urban or suburban areas. EPA used these Developed and Open Space Developed (OSD) UDLs to represent several rodenticide labeled uses that included structures or urban areas. EPA captured other non-agricultural uses in the UDLs for Ornamentals, Pastureland, Rangeland, Managed Forests, Forest Trees, Christmas Tree Plantations, Nurseries, and Rights-of-Ways. For descriptions about the development and underlying datasets in these Agricultural and Non-Agricultural UDLs see **Appendix E**. A crosswalk of UDLs with rodenticide use patterns is presented in **Table 2-2**.

[15] UDLs are spatial representations of where a pesticide may be used and is often grown out to reflect additional adjacent areas that may be exposed to the pesticide such as from run-off and/or spray drift.

Table 2-2. Crosswalk of UDLs with Rodenticide Use Patterns

<table>
<tr><th>Use</th><th>Rodenticide</th><th>UDLs Considered</th></tr>
<tr><td>Bait Stations</td><td>FGARs
SGARs
Bromethalin
Cholecalciferol
Zinc Phosphide</td><td>Open Space Developed
Developed</td></tr>
<tr><td>Broadcast</td><td>FGARs
Zinc Phosphide</td><td rowspan="2">Cultivated
Rangeland
Pasture
Right-of-Way
Nurseries
Managed Forest
Christmas Trees
Forest Trees</td></tr>
<tr><td>Burrow</td><td>FGARs
Bromethalin
Strychnine
Zinc Phosphide</td></tr>
<tr><td>Feral Hog Bait Station Use</td><td>Warfarin</td><td>Pasture
Rangeland
Managed Forest
Forest Trees
Christmas Trees</td></tr>
</table>

2.4 Overlap Analysis

The extent of overlap for the 11 rodenticides between likely exposure areas and the species' range or CH integrates information on potential use sites with the species locations. This approach considers overlap of the species range or CH with areas of potential use. The potential pesticide use sites are represented using Geographic Information System (GIS) layers developed from several data sources (*see* **Appendix E**). Due to the broad scope of labeled rodenticide uses, EPA did not implement further usage refinements as EPA does not have typical agricultural usage data for rodenticides. For many of the uses assessed, the actual area of use is expected to be less than the entire UDL, so the spatial extent of potential effects predicted in this assessment may be overstated.

This section describes the approach EPA used to determine the extent of overlap and the action area to support the effects determinations and overall potential impacts of the spatial analysis. The full inputs and outputs of the overlap analysis describing the determination of overlap of likely rodenticide exposure area and species ranges and critical habitat can be found in **Appendix F**.

2.4.1 Identifying Listed Species or CHs within the Action Area

For the draft BE, EPA used spatial data representing the listed species range and CH locations from the USFWS and NMFS as of February 16, 2022 (USFWS, 2022). The final BE used species ranges and CH from Dec. 2023. These updates impacted EPA's predictions of the potential likelihood of future J/AM in the draft BE for seven species and no CHs. To identify species or CHs within the action area, EPA looked across the maximum overlap for the individual UDLs and representative exposure areas.[16] This analysis captures the full geographic footprint of the action area by considering the potential exposure area

[16] The Use Data Layer Overlap Tool can be found at: https://www.epa.gov/endangered-species/provisional-models-and-tools-used-epas-pesticide-endangered-species-biological

where effects are reasonably expected to occur for each of the UDLs. A species range or CH is within the action area if it is found within one or more of the UDL exposure areas identified using the maximum overlap across all UDLs.

This overlap analysis was updated between the draft and final BE to account for both updated UDLs as well as updated species ranges and critical habitat. The draft BE used spatial files from February 2022. For the final BE, EPA updated its species list to include all listed species as of Oct. 2024. EPA excluded species that were delisted since the draft BE. The most up to date species range and critical habitat spatial files were from December 2023.[17]

The summary of important changes that were a result of this update are contained in **Appendix C**. However, changes to the final numbers of J/AM calls or individual calls themselves have already been updated in the final BE. Some new species and CH were listed as part of this update and resulted in new ranges and CH being assessed. For the species where EPA already made effects determinations in the draft BE, the updated overlap was compared to the old overlap for species and CH where the overlap was determinative in the predictions of potential likelihood of J/AM (*see* **Appendix C** for more details).

Given the categorical and temporal aggregations of UDLs described in **Appendix E** (*i.e.,* the UDLs may contain more than one crop and are based on 5 years of data), a single location could be accounted for in several UDLs. In the UDL method, this is referred to as “redundancy” in the UDLs. Typically, because of this redundancy, EPA does not add overlaps for a species or CH generated from multiple UDLs. The only exception in this analysis was for the Open Space Developed (OSD) UDL and Developed UDL, since they were meant to be representative of structural uses (*e.g.*, a bait station placed near a building). EPA made a more conservative assumption that looks at the sum of percent overlap from open space developed and developed UDLs to ensure that it did not exceed the overlap thresholds set within the scope of this analysis. Given the resolution of the data, this conservative approach accounts for the possible inaccuracies associated with representing structural uses with a single UDL, either Open Space Developed or Developed. Additionally, EPA had less of a concern with redundancy for both the OSD and Developed layer, since these UDLs are derived from the same base data, but separate categories that are mutually exclusive spatially (*see* **Appendix E** for additional details). For the other UDLs used as part of this analysis, there is spatial redundancy between layers. Given the redundancy across these UDLs, the sum of the individual UDLs would dramatically overestimate the total percent overlap. For this reason, EPA used the maximum value across UDLs at the maximum off-site distance to determine if a species is within the action area. While the use of maximum overlap across exposure areas for the UDLs does not represent the total overlap across all uses, given the existing redundancy of the use site and exposure areas, EPA considers this protective.

Given the known spatial relationship and correlation across the landscape, the general conservativeness of the spatial overlap analysis, and the accuracy[18] of the available UDLs, if the resulting maximum

[17] Range files - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Species_Ranges_Static/FeatureServer
Critical habitat - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Critical_Habitat_Static/FeatureServer

[18] EPA has used this 1% overlap criterion because a known source of error within spatial datasets is positional accuracy and precision. To prevent false precision when calculating area and the percent overlap it rounded to whole number to account for significant digits, where <0.44% is represented as 0 and 0.45% is represented as 1%.

overlap is <1%[19] for a species or CH, EPA made NE determinations for the species or CHs. For any NE determination, no additional analyses are needed (*see* **Section 2.6** below).

2.5 Consideration of Incident Data in the Weight of Evidence

The Incident Data System (IDS) is an Office of Pesticide Programs (OPP) database containing ecological incidents that have been reported to EPA. When available, IDS includes the date and location of an incident, type and magnitude of effects observed in various species, use(s) of pesticides known or suspected of contributing to the incident, and results of any chemical residue analysis or other analyses conducted during incident investigation. The IDS includes reports submitted to the EPA from sources such as state and federal agencies, registrants, members of the public, and other stakeholders.

In the process of making effects determinations, EPA included incidents as a part of the weight of evidence when estimating rodenticide impacts on listed species. EPA considered reported deaths and reported residues as evidence of exposure, and evidence of the potential for take, as defined by the ESA. EPA considered incidents in the making the initial effects determinations.

EPA has conducted numerous comprehensive evaluations of the available incident data, which show thousands of rodenticide related incidents reported since 1968. EPA presented the most recent evaluation in the 4 PIDs associated with the 11 rodenticides (USEPA, 2022a – 2022d) and reflected available incident information, as of March 2020. This final BE utilized the incident analyses from the RR DRAs. The 2020 DRA incident analyses also included open literature reviews of incidents that were not reported to the IDS (USEPA, 2020a - 2020e).

EPA categorizes the IDS incidents according to the certainty that the incident resulted from pesticide exposure. The recent evaluation described above excluded incidents classified as ‘unlikely’, ‘unspecified’, or ‘unrelated’ and only includes incidents with the certainty categories of ‘exposure only’, ‘possible’, ‘probable’, and ‘highly probable.’ The number of actual incidents associated with rodenticides is potentially much higher than what is reported to EPA. Incidents may go unreported since side effects may not be immediately apparent or readily attributed to the use of a chemical. Additionally, there is low likelihood of an animal being found by an individual and reported to EPA, the registrant, or a state agency even in cases where an incident occurs. Although FIFRA Section 6(a)(2) requires registrants to report incidents, incident reports from other sources are largely voluntary. The absence of incident reports does not indicate that the chemical has no effects on wildlife; rather, it is possible that incidents are unnoticed and unreported.

The FIFRA-based risk assessments for the rodenticides summarized over a thousand incidents involving mortality of non-target species, predominantly mammals and birds (USEPA, 2020a - 2020e). The available incident data indicate detectable levels of rodenticides in birds and mammals, including predatory animals that would be considered secondary consumers (*as defined in* **Section 2.2.2**). Listed species, including the San Joaquin kit fox (*Vulpes macrotis*) and Key deer (*Odocoileus virginianus clavium*), and genera proposed for listing, including kangaroo rats (*Dipodomys sp.*), were among the wildlife reported. In the process of making effects determinations, EPA included incidents as a part of the weight of evidence when estimating rodenticide impacts on listed species. EPA considered reported deaths and reported residues within animal tissues as evidence of exposure, and evidence of the

[19] The overlap is rounded to whole numbers due to the precision of the remotely sensed data; therefore <1% represents <0.44% with anything over 0.44% rounding up to 1%.

potential for take, as defined by the ESA. EPA considered each incident in making the initial effects determinations.

The incident data for this final BE is among the most robust data for any group of pesticides, with multiple mortalities associated with multiple active ingredients, demonstrating that the risk hypothesis has been confirmed for non-target effects.

2.6 Method Used for Listed Species Effects Determinations Including Predictions of the Potential Likelihood of Future Jeopardy

In the species-specific assessment, EPA first made generic, taxa-based effects determinations (*i.e.,* NE, MA/NLAA, and MA/LAA determinations) for the 11 rodenticides and use patterns based on the potential for effects to an individual of a listed species. One of the main factors when distinguishing between NE and MA is the potential for direct effects and effects to PPHD, which are based on estimated environmental concentrations (EECs), toxicity endpoints, exposure-to-effect ratios, species life history, and location of the species or CH. As described above, EPA also considers the degree of overlap of the species range and potential exposure areas. For MA determinations, EPA refined assumptions related to overlap and considered the potential likelihood of effects to an individual (considering whether life history may impact this potential likelihood). Additional information is provided below on the overlap analysis and the determinations.

2.6.1 No Effect (NE) and May Affect (MA) Determination Methodology

EPA first made taxa-based NE and MA determinations. For any species that does not have direct effects or effects when considering their PPHD (*i.e.,* when all relevant exposure-to-effect ratios are less than listed species LOCs) or the species is found outside of the action area, EPA made a NE determination. For any species where the taxa-based exposure-to-effect ratios indicate potential direct and/or effects to PPHD, EPA considered the overlap of the species range and each rodenticides' potential exposure area. EPA made NE determinations for species with <1% overlap of the entire range and each individual UDL.[20] For any NE determination, no additional analyses are needed. Since direct effects are not reasonably certain to occur to aquatic and terrestrial plants, aquatic and terrestrial invertebrates, and aquatic vertebrates, EPA made taxa level NE determinations (**Appendix B** and **Appendix C**) for species within these taxa.

There is a potential for effects to mammals, birds, reptiles, and terrestrial amphibians from dietary exposures or if one of these taxa depends on mammals for PPHD. In considering if a species is NE or MA, EPA first considered if any of the species from these taxa are not expected to consume rodenticide baits or are in the aquatic food web. For these species the major considerations for NE included:

- Overlap < 1% across all UDLs,
- Species consumes aquatic-based food items or is a marine species,

[20] EPA has used this 1% overlap criteria because a known source of error within spatial datasets is positional accuracy and precision. To prevent false precision when calculating area and the percent overlap it rounded to whole number to account for significant digits, where <0.44% is represented as 0 and 0.45% is represented as 1%.

- Species consumes insects found within the bark of the trees or wood boring beetles for which exposure is not expected to occur (*e.g.,* ivory-billed and red-cockaded woodpeckers or the akipaloaau),
- Species is fully aquatic (*e.g.,* aquatic amphibians),
- Species is restricted to experimental populations or uninhabited islands (*e.g.,* Guam kingfisher, Slevins skink)

EPA made MA determinations for species that did not meet one of the above considerations. For all species with MA determinations, EPA completed additional analyses to determine if each rodenticide is likely or not to adversely affect at least one individual of a species. EPA's process for NE/MA and MA/NLAA and MA/LAA determinations is outlined in the Key worksheet of **Appendix B.**

2.6.2 Not Likely to Adversely Affect (NLAA) and Likely to Adversely Affect (LAA) Determination Methodology

EPA made NLAA and LAA determinations by incorporating species life history considerations in determining the likelihood that rodenticide use will adversely affect an individual of a listed species (as described in the following sections).

2.6.2.1 Taxa-Level NLAA Determinations

After EPA made high-level taxa-level exposure NLAA determinations for some species (*i.e.*, generic to all chemicals and use patterns and described in the following paragraph), the remainder of the MA species were determined to be NLAA/LAA based on chemical and use pattern specific considerations due to the differential toxicity, labeled use patterns, and exposure profiles of each of the 11 rodenticides (*see* **Section 2.6.2.2**).

For the MA species, EPA made NLAA determinations for species in which exposure is considered discountable or insignificant due to their habitats (*e.g.,* forests, caves, remote habitats) or feeding preferences (*e.g.,* species is not expected to feed on bait or on primary consumers). For these species the major considerations for NLAA included:

- Species does not forage on ground (*e.g.,* fruit-eating or nectivorous species),
- Species consumes flying terrestrial invertebrates which are extremely unlikely to be in contact with the bait (*e.g.,* listed bats),
- Species is presumed extinct (and recommended for delisting) by the Services,[21]
- Species is semi-aquatic or restricted to specific wetland habitats, or riparian zones,
- Species is found in ravines, caves, crevices, slopes, sub-humid forests, restricted to mountaintops, high elevation, or tundra habitats where exposure is extremely unlikely to occur.

2.6.2.2 Refinements to NLAA Determinations

If the species did not pass the initial NLAA determinations (*i.e.*, applicable to all chemicals and used; *see* **Section 2.6.2.1**), EPA then considered additional refinements. For species that could be impacted if

[21] All the species that are presumed extinct are under the authority of USFWS. Species identified as presumed extinct are consistent with the USFWS's most recent national level BiOp (*i.e.,* for malathion; USFWS, 2022).

exposed and that were in the action area, EPA evaluated, on a chemical and use-specific basis, the likelihood and significance of potential effects to differentiate LAA and NLAA determinations based on major considerations including the chemical's toxicity, bioaccumulation potential, as well as the use profile including where the chemical is used and how it can be applied (*i.e.*, bait station, within a burrow, or broadcast). Lastly EPA made NLAA determinations if the use pattern is not expected in the species range or the species is not anticipated to be in the range of the target pest (*i.e.***,** FGAR broadcast applications are only made in the CONUS and strychnine target pests including the Northern pocket gopher (*Thomomys talpoides*) and Camas pocket gopher (*Thomomys bulbivorus*) are assumed to only occur in CONUS).

For burrow applications located away from a structure (*i.e.*, FGARs, bromethalin, strychnine, and zinc phosphide), EPA made NLAA determinations if:

- the species is not expected to enter the burrow due to its size and foraging behavior (*i.e.,* it is unlikely their dietary items will be contaminated by the bait since it is contained to the burrow),
- bait must be placed 6" into the entrance of the burrow, as it is not expected for birds to enter burrow or kick out bait and exposure is not expected to occur[22], or
- applications are intended to be made to active target pest burrows only rather than an inactive burrow- It is unlikely exposure would occur to non-target species if the burrow is already occupied by target pest.

For bait station applications (*i.e.*, FGARs, SGARs, cholecalciferol, bromethalin, and zinc phosphide), EPA made NLAA determinations if:

- the species is a primary consumer and the species' main dietary items are extremely unlikely to be contaminated with bait because the bait is specifically contained within the bait station,
- the species is a primary consumer, and its size precludes its entry into the bait station opening, and
- the species consumes invertebrates and since the bait is contained within the station, invertebrates are not expected to represent a significant exposure.

For broadcast applications (two of the FGARs (chlorophacinone and diphacinone) and zinc phosphide), no additional refined chemical-specific modifiers were applied due to the nature of the application across the surface of the landscape and all species were LAA that were identified in the taxa-based evaluation.

For the remaining MA species, that did not receive an NLAA determination, EPA made LAA determinations on a chemical and use pattern specific basis to take into account the differential toxicity and exposure profiles across the 11 rodenticides. EPA made LAA determinations when the rodenticide can be used within a species' range (overlap $\geq$ 1% for at least one UDL), exposure is reasonably expected to occur, and could lead to a potential adverse effect. Similarly, EPA made LAA determinations for listed species that depend upon mammals and overlap is $\geq$ 1% for at least one UDL and exposure is reasonably expected to occur and lead to a potential adverse effect.

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[22] There is likely little chance for any significant non-target exposure because the target pest (pocket gopher) quickly wall-off disturbed sections of the burrow (Gene Benbow pers. comms 8/28/2023).

For the species where EPA made LAA determinations, EPA completed additional analyses to predict the potential likelihood of future J. EPA's approach to predicting the potential likelihood for future J is described below. This process is further outlined in the Key Worksheet of **Appendix B**.

2.6.3 Methodology Used to Predict the Potential Likelihood of Future Jeopardy

For those species and CH where EPA made LAA determinations, EPA then predicted the potential likelihood of future J to the species (*i.e.*, population level effects as opposed to effects to an individual as described above) or future AM to the CH. The potential likelihood of future J predictions is included in this assessment to better inform the USFWS consultation process and whether any additional mitigation may be necessary. The USFWS will make the final J/AM findings in any BiOp they issue at the end of the consultation process. When EPA assesses whether there is the potential likelihood of future J, it considers exposures and potential effects across the population. EPA considers life history information that may modify the magnitude of effects (MoEs). EPA would also consider any label changes or mitigations agreed upon by the registrants but not yet incorporated onto labels. Additionally, EPA identified mitigations in this biological evaluation that may be necessary to address predictions of potential likelihood of J/AM. The rest of this section explains in more detail the approach to making population-level effects determinations and predictions of the potential likelihood of future J to listed species for each of the 11 rodenticides.

EPA used the USFWS's draft BiOp for malathion (USFWS, 2021) as a guide in this assessment to predict the potential likelihood of future J for species from the registered uses of 11 rodenticides.[23] Although the USFWS malathion BiOp was finalized (USFWS, 2022), EPA used the draft BiOp because the final BiOp contained a no J opinion, whereas the draft BiOp included examples of species where USFWS proposed to find potential likelihood of future J. For purposes of the rodenticide BE, the USFWS malathion BiOp is representative of a national-level assessment for listed species because USFWS has authority for the majority of listed species and CHs within the action area of each rodenticide. Furthermore, in this final BE, EPA only made LAA determinations for listed species under USFWS's authority. EPA also used prior USFWS BiOps on some of the 11 rodenticides (*see* **Section 1.1**; USFWS, 1993 and USFWS, 2012) to serve as a guide for predicting the combination of potential exposure and species life history characteristics that would likely lead to potential likelihood of future J. Finally, EPA met regularly with the USFWS technical assistance during the development of the final BE, which informed the methodology and decision-making processes for species determinations and predictions of the potential likelihood of future J.

EPA predicted the potential likelihood of future J by primarily relying upon overlap[24] and MoE.[25] EPA integrated concepts similar to USFWS "risk modifiers" into the determinations. For each species, EPA assigned a high, medium, or low classification to both overlap and MoE. Like USFWS, if overlap was considered low (<5%), EPA predicted no potential likelihood of future J (no J). If overlap was medium (≥ 5 to ≤ 10 %) or high (> 10%) and MoE was considered low (based on both direct effects and effects to PPHD and relevant risk modifiers), EPA predicted no J. If there were no modifiers that decreased the

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[23] Because all species and CH for which EPA made LAA determinations are under the authority of USFWS, EPA primarily relied upon USFWS' approach when predicting the potential likelihood of jeopardy and AM. During consultation, EPA will consider adjusting the approach as needed for those species and CH under the authority of NMFS.

[24] Referred to by USFWS as "usage"

[25] Referred to by USFWS as "risk"

likelihood of effects or degree of overlap, EPA predicted a potential likelihood of future J (predicted J). If overlap was medium or high and MoE was medium or high, EPA predicted J. Although USFWS incorporated species vulnerability into its malathion determinations, EPA did not consider this factor when predicting the potential likelihood of future J for the rodenticides. EPA may revisit the impact of species vulnerability in predicting the potential likelihood of future J for a species from this action.

For MoE, EPA assigned an initial low or high classification to each species based on the species taxonomy, life history, and other weight of evidence. For example, for mammals or a species which depends upon mammals for PPHD, or had LOC exceedances for direct effects, EPA determined that the initial MoE for population-level effects was high (because the screening-level assessment indicated that exposures are orders of magnitude above effects levels). EPA determined effects to listed non-target species of concern through assessing rodenticide levels in non-target taxa via the consumption of bait, based on both one-day consumption and consumption over multiple days. These effects are divided by the exposure of the rodenticides and used to estimate the MoE for each rodenticide. In addition, EPA then applied various effect modifiers for population-level effects that may influence the initial MoE (*see* **Table 2-3**). **Section 3** provides further detail on chemical and use pattern considerations used by EPA to refine the MoE determinations.

Table 2-3. Magnitude of Effect (MoE) Categories and Effect Modifiers for Predictions of Potential Future Jeopardy[1]

Chemical Class	MoE Classification	MoE Justification
FGARs	High	**Bait Station and Broadcast exposures to mammal and non-mammal secondary consumers:** High MoE based on LOC exceedances at the mortality-based acute dietary No Observed Adverse Effect Concentration (NOAEC) & reproductive effects in the birds that survived (ACR estimated). In addition, species diet is made up of a large proportion of rodent prey.
	High	**Bait Station and Broadcast exposures to non-mammal primary consumers:** High MoE based on LOC exceedances at the mortality-based acute dietary NOAEC & reproductive effects in the birds that survived (ACR estimated).
	High	**Bait Station, Burrow & Broadcast exposures to mammal primary consumers:** Similarity to target pests (direct effects to mammals).
	Low	**Bait Station and Broadcast, exposures to mammal and non-mammal secondary consumers:** Species is an omnivore and consumes other terrestrial vertebrate prey. Since FGARs take multiple feedings to result in mortality and since this species is an omnivore and occasionally only consumes small mammals (eating a wide variety of plant and animal matter) it is not as likely that the target pest will constitute a large proportion of their diet.
	Low	**Burrow, exposures to mammal and non-mammal secondary consumers:** The MoE is low because the vast majority of mortalities are expected to occur belowground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin et al., 2021). Since FGARs require multiple feedings to achieve a lethal dose, there is the potential for prey to be available on the surface with less than lethal concentrations and the capacity to evade predators is the same as before exposure.

Chemical Class	MoE Classification	MoE Justification
SGARs	High	**Bait Station, exposures to mammal and non-mammal secondary consumers:** Collectively, the MoE for SGARs is high, since RQs exceed the LOC for mortality-based endpoints and species diet is made up of a large proportion of rodent prey.
	High	**Bait Station, exposures to non-mammal primary consumers:** Similarity to target pests (direct effects to mammals).
	Low	**Bait Station, exposures to mammal and non-mammal secondary consumers:** Species is an omnivore and consumes other terrestrial vertebrate prey and it is not as likely that the target pest will constitute a large proportion of their diet.
Bromethalin	High	**Bait Station exposures to mammal primary consumers**: Species is a primary consumer and similar to the target pest (mammals).
	Low	**Bait Station exposures to mammal and non-mammal secondary consumers:** Species is a secondary consumer and since bromethalin has low persistence in gut it will not bioaccumulate to high enough concentrations to cause effects.
Cholecalciferol	High	**Bait Station, exposures to mammal primary consumers:** High because of similarity to target pests (direct effects to mammals).
	Low	**Bait Station, exposures to mammal secondary consumers:** MoE is low because cholecalciferol has a low risk of secondary poisoning.
Strychnine	High	**Burrow exposures to mammal primary consumers**: Species is a primary consumer and similar to the target pest (mammals).
	Low	**Burrow exposures to mammal and non-mammal secondary consumers:** The MoE is low because the vast majority of mortalities are expected to occur belowground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin et al., 2021).
Zinc Phosphide	High	**Bait Station and Broadcast exposures to mammal primary consumers:** Similarity to target pests (direct effects to mammals).
	High	**Bait Station and Broadcast exposures to non-mammal primary consumers:** RQs for primary consumers range from 43-546. ZnP is applied as a broadcast application and is available for primary consumers.
	Low	**Bait Station, Burrow & Broadcast exposures to mammal and non-mammal secondary consumers**: Species is a secondary consumer and likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from ZnP is uncommon and is not as persistent compared other rodenticide classes

[1]Only applies to species with LAA effect determinations (*see* **Appendix B** for further detail).

2.7 Method Used for Critical Habitat Effects Determinations and Predictions of the Potential Likelihood of Future Adverse Modification

As of Oct. 2024, there are 927 species with CHs included in this assessment. Among those, there are 147 CHs for the taxonomic groups with potential direct effects or effects to PPHD; that is, birds, reptiles, amphibians, and mammals. There are many similarities between the species analysis and the CH analysis. For example, EPA also used the overlap approach described above to determine the extent of overlap between the action area and CHs. EPA obtained spatial locations of CHs from the USFWS and NMFS.

For each CH, EPA made single overall CH determination that was based on the entire chemical class (*i.e.,* the 11 rodenticides) and all use patterns because effects to both habitat and loss of mammalian prey (details discussed below) are generally similar across all rodenticides and use patterns. EPA based the CH determination on effects to PBFs requiring mammal prey or burrow use, not direct effects (*i.e.,* from primary consumption of bait or secondary consumption of the rodenticide through contaminated prey). EPA accounted for direct effects to species within the CH in species effects determinations and to avoid redundancy, they were subject to overlap considerations specific to that CH. EPA then made rodenticide MOA group/use pattern specific refinements to CHs with predictions of potential likelihood of future AM based on all chemical classes and use patterns. This refinement was based on overlap specific to the use pattern.

EPA made NE determinations for CH if the species and its PPHD are not expected to be impacted within the CH (*i.e.,* if all relevant taxa-based RQs are < LOCs; based on life history information for the species) following the same reasons described in **Section 2.6.1**. This included CH for all plants, fish, and invertebrates. EPA also made NE determinations if all UDLs that are associated with potential rodenticide uses collectively had < 1% overlap.

One key difference between the CH and species analyses is that the Services define PBFs that are necessary for the CH to support the species for which it was designated. EPA concluded that two PBFs are relevant to the use of rodenticides. The first PBF is the availability of mammalian prey because rodenticides are intended to reduce or eliminate rodent populations in local areas. Therefore, EPA considered rodenticide use a potential modification of CH for listed species, in particular predatory mammals, birds, and reptiles that may consume rodents as a large part of their diet. For this analysis, EPA made a distinction between rodent and non-rodent mammalian prey populations. EPA considered it unlikely that the overall availability of non-rodent prey would be substantially impacted within the CH because they are not the target species of the rodenticides. The second PBF is the availability of animal burrows for shelter or other purposes because one of the primary uses of the rodenticides is to reduce or eliminate burrowing rodents. Therefore, EPA considered rodenticide use for burrowing rodents could lead to reductions in rodent populations, which would subsequently lead to a potential decrease in the availability of burrows.

EPA made a NE determination if a species does not consume terrestrial mammalian prey, use burrows, or have a PBF associated with those. Therefore, a MA determination was made if a species consumes terrestrial mammalian prey, uses burrows, or has a PBF associated with those. EPA made a NLAA determination for CH if the availability of mammalian prey and burrow use were part of the species PPHD (based on the EFED life history database), but the USFWS did not indicate that availability of small mammal prey or burrow use were relevant (*i.e.,* based on methodology in Appendix L of the malathion BiOp). For species where PBFs are not defined for a CH, EPA used the best available information on the species life history from the USFWS and the EFED life history database to make NLAA and LAA determinations for critical habitat.

EPA made LAA determinations for species CH with PBFs that include the availability of mammalian prey or burrow use (terrestrial habitat quality) and ≥ 1% spatial overlap of rodenticide use and CH. In some cases, PBF's have not been defined for CH. In those instances, EPA made LAA determinations when there is ≥ 1% spatial overlap and best available information indicates that the species consumes mammal prey or uses burrows. Using similar methods as described in **Section 2.6.3**, EPA then predicted the potential likelihood of future AM, primarily relying upon the extent of spatial overlap between the CH and various UDLs and various effects modifiers that can influence the likelihood of exposure. EPA applied additional modifiers including if the species is an omnivore (*i.e.,* not an obligate to mammal prey) and considered if the species makes their own burrow or inhabits that of another species (*see* further detail in **Section 4**).

3 Species Effects Determination Results

3.1 General Effects Determinations at a Taxa-Based Level

EPA first made effects determinations for listed species at a taxa-based level, considering all 11 rodenticides and routes of exposure following the methods described in **Section 2.6**. The effects determinations include NE determinations for all aquatic and terrestrial plants, aquatic and terrestrial invertebrates, and aquatic vertebrates. The next section describes the taxa-based determinations in more detail.

3.1.1 Overview of No Effect (NE) Determinations

EPA made NE determinations following methods described in **Section 2.6.1** for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects. EPA based NE determinations on low overlap, no direct toxicity and/or no dependence on mammalian or other terrestrial vertebrate prey items for PPHD. Primarily, EPA's NE determinations included the terrestrial and aquatic plants, aquatic and terrestrial invertebrates, aquatic vertebrates, and those mammals, birds, terrestrial-phase amphibians, and reptiles in the aquatic food web for which no direct effects or effects to PPHD were identified. Collectively, these taxa were determined to be NE (see **Section 2.6.1)**. The USFWS 1993 BiOp, which included 8 of the 11 rodenticides, includes similar evidence for NE determinations, and includes such determinations for plants (USFWS, 1993).

Species and CHs with <1% overlap for all UDLs

For any remaining species or CHs after the first step, EPA made NE determinations for all species or CHs with <1% overlap with all UDLs. If a species or CH had 1% or more overlap with at least one UDL and that species may be a primary consumer of bait, a secondary consumer of prey that consumed the bait, or have effects due to loss of PPHD (*e.g.,* species relies on mammal burrows), then EPA made an MA determination. MA determinations are discussed below.

3.1.1.1 Terrestrial, Wetland and Aquatic Plants

EPA made NE determinations based on species where exposure is extremely unlikely to occur at a level that could cause effects and considered species habitat and diet. EPA made NE determinations for all listed plants because direct effects and exposure to this taxon are not expected to occur. This is because the modes of action of the rodenticides (*e.g.*, anticoagulants and neurotoxins) apply to vertebrate animals only, not to plants. To evaluate potential effects to PPHD from the loss of mammal pollinators, EPA evaluated the pollinator vectors for each listed species of plant. Of the listed species of plants, only three rely on pollination from mammals (*see* "Plants" worksheet in **Appendix B**). EPA made NE determinations for the three plant species that rely on mammals. One listed plant (Higuero de sierra, *Crescentia portoricensis*) specifically relies on bats for pollination. Since EPA made an NLAA determination for bats (*see* **Appendix B**), no effects to the Higuero de sierra are expected. The second two species are pollinated by multiple taxa including mammals, birds, and invertebrates. EPA made NE determinations for these two listed plants (Chupacallos and Ufa-halomtan), because the plants have a variety of pollination options; therefore, any effects to mammal or bird pollinators would be negligible in the environment in the context of all potential pollinators in the range of these plants. Effects determinations for plants can be found in the "Plants" worksheet in **Appendix B** and **Appendix C**.

3.1.1.2 Aquatic Animals

EPA made NE determinations for all freshwater and marine fish, aquatic mammals, aquatic amphibians, aquatic reptiles, and aquatic invertebrates. EPA made NE determinations for aquatic animals as exposure is not reasonably certain to occur because the application sites of rodenticides (bait stations and burrows on terrestrial sites) and the formulations of the bait (granules) are unlikely used near aquatic habitats. Pesticide labels generally require that pesticides not be applied to water or below the mean high-water mark in tidal areas unless specifically intended for aquatic use. Also, the target pests (mice, rats, voles, prairie dogs, etc.) are terrestrial species, so application of rodenticides is expected to be only in terrestrial areas. Of the use patterns, only broadcast is subject to exposure to the weather, and this is limited to a few agricultural crops, and to rodenticides that are either immobile or non-persistent, making potential exposure discountable. Furthermore, the DRAs determined that only terrestrial vertebrates have potentially significant exposure, therefore, aquatic organisms are not further considered in this final BE. NE determinations were made for all aquatic animals (USEPA, 2020a-2020e). Effects determinations for aquatic animals can be found in the "Fish", "Mammals", "Amphibians", "Reptiles", and "Aquatic invertebrates" worksheets in **Appendix B** and **Appendix C**.

3.1.1.3 Terrestrial Invertebrates

EPA made NE determinations for all terrestrial invertebrates, as direct effects to the taxa were not reasonably certain to occur. The EPA evaluated the toxicity of terrestrial invertebrates for each rodenticide, with limited data in the FIFRA-based 2020 DRAs, and concluded that rodenticides exhibit low toxicity (USEPA, 2020a-2020e) to terrestrial invertebrates. The low toxicity means effects from exposure are unlikely for ground-nesting bee species that may be exposed to rodenticides through using rodent burrows. Since there is a low likelihood of exposure on-site, and offsite exposures to non-target areas (via spray drift, volatilization and runoff) are not reasonably certain to occur, rodenticides do not pose an appreciable risk to terrestrial invertebrates. The Rozol BiOp (USFWS, 2014) similarly noted that chlorophacinone adverse effects are unlikely for the American burying beetle (*Nicrophorus americanus*), which consumes carrion (USFWS, 2014).

EPA considered the potential for soil-dwelling invertebrates that may encounter rodenticides through burrow, bait station or broadcast uses to be potential vectors for rodenticides to listed species that consume them, thus making terrestrial invertebrate consumption a potential method of secondary exposure. For secondary exposure, it is unlikely that invertebrates represent a significant exposure pathway (*i.e.*, listed species is unlikely to consume enough exposed invertebrates for toxicity). This rationale is further characterized in the following chemical-specific effects determinations sections. Effects determinations for terrestrial invertebrates can be found in the "Terrestrial invertebrates" worksheet in **Appendix B** and **Appendix C**.

3.1.2 Overview of May Affect (MA) Not Likely to Adversely Affect (NLAA) and Likely to Adversely Affect (LAA) Determinations

EPA made an MA determination because of the potential for direct effects from primary exposure to rodenticides from the consumption of bait. Species with MA determinations may also incidentally consume bait while foraging for soil-dwelling invertebrates, which would be considered primary exposure. In addition, EPA anticipates effects for some MA species from secondary exposure from the consumption of birds, mammals, terrestrial-phase amphibians, or reptiles and exposed soil-dwelling invertebrates. Primary exposure could occur for birds that consume bait. EPA assumed that birds that primarily consume seeds are also likely to consume rodenticide bait. This assumption is due to the similarity of some rodenticide use formulations (*e.g.,* broadcast pellets) that may resemble seeds as dietary items. Some mammalian species (*e.g.*, the San Joaquin kit fox) received MA determinations based on the possibility of consumption of rodenticides through consumption of herbivores.
MA determinations were also made for species that have the potential for secondary exposure due to effects to PPHD and from consumption of contaminated prey. At this stage EPA narrowed down the taxa that have the potential for direct effects to include bird, mammals, reptiles and terrestrial-phase amphibians.

3.1.3 Overview of Initial Not Likely to Adversely Affect (NLAA) Determinations

The NLAA determinations are driven by an assumption that rodenticide exposure leads to discountable effects, (*i.e.*, effects are extremely unlikely to occur), insignificant effects, or wholly beneficial effects. These determinations are based on the likelihood of direct effects and exposure occurring based on different habitat characteristics, diet and feeding behaviors, and effects to PPHD. Overall, across taxa, EPA made NLAA determinations if a species was presumed extinct by USFWS. NLAA determinations can be found in **Appendix B** and **Appendix C** and followed the method outlined in **Section 2.6.2**. **Table 3-1** summarizes the initial effects determinations considering all routes of exposure.

Table 3-1. Number of Initial Listed Species Effects Determinations Across All A.I.'s by Taxon[1,2]

Taxon	Number of Species	NE	Initial NLAA Determinations across all A.I.'s
Mammals	100	25	21
Birds	95	25	28
Amphibians[3]	47	12	23
Reptiles	59	25	4
Terrestrial Invertebrates	164	164	0
Aquatic Invertebrates	209	209	0
Plants	946	946	0
Fish	207	207	0
Total	**1,827**	**1,613**	**76**

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.
[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction
[3] "Amphibians" include those species that have both a terrestrial and aquatic phase.
A.I.s=active ingredients; NE = no effect; NLAA = not likely to adversely affect

3.1.3.1 Birds

Initial NLAA determinations for birds included species which inhabit areas or have feeding behaviors which would suggest exposure is extremely unlikely to occur. The main modifiers used for NLAA determinations included:

- species found at high elevations,
- species is presumed extinct (*i.e.,* Palila, thick-billed parrot and white-necked crow),
- species is found on remote uninhabited islands (*e.g.,* Nioha and Laysan finches),
- species gleans insects off foliage or consumes flying terrestrial invertebrates (aerial insectivores) which are less likely to be in contact with the bait,
- species forages in the canopy or subcanopy, or,
- species is nectivorous.

EPA evaluated the remaining species on a chemical and use-specific basis to be NLAA when exposure is not reasonably expected to occur based on major considerations including the chemical's toxicity and bioaccumulation potential, as well as the use profile, including where the chemical is used and if it can be applied as a bait station, in a burrow, or as a broadcast application. Effects determinations for birds can be found in the "Birds" worksheet in **Appendix B**.

3.1.3.2 Reptiles

EPA made an initial NLAA determination for one listed species of reptile (Culebra Island giant anole; *Anolis roosevelti*) because the best scientific and commercial information lead USFWS to conclude that the Culebra Island giant anole is extinct.[26] Effects determinations for reptiles can be found in the "Reptiles" worksheet in **Appendix B** and **Appendix C**.

3.1.3.3 Amphibians

As discussed above, EPA made NE determinations for those amphibians that are fully aquatic (*i.e.,* spends its entire life submersed in water) and/or in the aquatic food web. NLAA determinations for listed amphibians included species which inhabit areas in which exposure is extremely unlikely to occur. In addition to habitat modifiers (*e.g.,* elevation, sub-humid tropical forests, rock crevices/caves, steep ravines), amphibians preferentially feed on live moving prey and are unlikely to eat the bait directly. It is also unlikely the species' main dietary items (live invertebrates) represent a significant exposure pathway. Amphibians did not rise to LAA in the USFWS 1993 BiOp of 8 of the 11 rodenticides (USFWS, 1993), which further supports EPA's effects determinations in this assessment. Effects determinations for amphibians can be found in the "Amphibians" worksheet in **Appendix B** and **Appendix C**.

3.1.3.4 Mammals

Initial NLAA determinations for mammals included species which have feeding behaviors that would suggest exposure is extremely unlikely to occur. EPA made NLAA determinations for all listed bats. Bats mainly prey on flying terrestrial invertebrates, insects that crawl on trees, or other dietary items that are extremely unlikely to be in contact with rodenticide bait (compared to soil-dwelling invertebrates) and exposure is not reasonably expected to occur. EPA made NLAA determinations for mammals, including bighorn sheep and the woodland caribou, that inhabited areas in which rodenticide exposure is extremely unlikely to occur, including remote areas where commensal rodenticide uses were unlikely. EPA made NLAA determinations for mammals that were likely extinct. Effects determinations for mammals can be found in the "Mammals" worksheet in **Appendix B** and **Appendix C**.

3.1.4 Overview of Initial Likely to Adversely Affect (LAA) Determinations

In general, LAA species effects determinations are driven by an assessment of the likelihood of effects from primary exposure to bait; that is, from being attracted to the bait, from incidental consumption foraging for invertebrates (soil-dwelling) and other food items (*e.g.,* seeds) on the ground, or the species might utilize mammal burrows. In addition, LAA determinations were also driven by the potential for secondary and tertiary exposure from the consumption of mammals, birds, terrestrial-phase amphibians, and/or reptiles (*see* **Section 2.2.1** and **2.2.2**) due to the potential for rodenticides to bioaccumulate and persist in tissues of animals that had consumed the bait through primary or secondary exposure (*see* **Section 2.2**). See **Appendix B** and **Appendix C** and the following sections on the specific active ingredients for details on species-specific LAA determinations.

3.2 Overview of Refined Use Pattern and Rodenticide-Specific Effects Determinations

For the remaining species with MA determinations that did not receive an initial NLAA determination (*see* **Section 2.6.2.1**), EPA considered refinements to make chemical and use-specific NLAA/LAA

[26] USFWS. 2023. Culebra Island Giant Anole 5-Year Review. USFWS Southeast Region. https://ecosphere-documents-production public.s3.amazonaws.com/sams/public_docs/species_nonpublish/4087.pdf

determinations due to the differential toxicity, use patterns, and nuances with exposure profiles of each of the 11 rodenticides. For each species-rodenticide/use combination, **Appendix B** and **Appendix C** provides a detailed justification for the NE, NLAA, LAA, and predicted likelihood of potential future J determinations. The following sections begin with an introductory section that goes over previous regulatory decisions, provides background on the chemical risk profile (primarily from FIFRA-based risk assessments), chemical fate information, and the labeled uses of the chemical(s). The next section presents information on incidents involving the chemicals. That is followed by a description of the spatial overlap of labeled uses for the chemicals. Finally, EPA presents the NE, MA, NLAA, LAA determinations with predictions of no likely future J, and LAA determinations with predictions of likely future J made for each labeled-use pattern (*i.e.,* bait station, burrow, broadcast) by taxa (birds, reptiles, amphibians, and mammals).

3.2.1 First-Generation Anticoagulant Rodenticides (FGARs)

3.2.1.1 Introductory Information on FGARs

EPA signed the FIFRA-based draft environmental risk assessment (USEPA, 2020a) for seven anticoagulant rodenticides (AR) for the RR program on March 17, 2020. These include three first-generation ARs (FGARs; warfarin, chlorophacinone, diphacinone). EPA has completed ESA consultation for diphacinone and chlorophacinone for the control of the Black-tailed prairie dog for the formulated products called Rozol and Kaput (respectively). The 1993 USFWS BiOp for vertebrate control agents (USFWS, 1993) included all 3 FGARs (*see* **Section 1.2**).

The potential impact to mammals and birds from FGARs is well-established (USEPA, 2020a) and includes mortality from primary and secondary exposure, as well as longer-term effects on growth and reproduction. Primary exposure is defined as consumption of treated bait by target or non-target organisms. Secondary exposure is defined as predation/scavenging and consumption of exposed primary consumers (*see* **Section 2.2**). Target and non-target taxa that consume ARs via bait boxes bioaccumulate residues of the ARs that are persistent in biological tissues moving from bait boxes into the environment, sometimes far from the treatment area because FGARs do not result in immediate toxicity and may take multiple feedings to result in toxicosis.

The FGARs present an acute hazard[27] to mammals, birds, amphibians, and reptiles. Generally, the likelihood of secondary poisoning of carnivores and scavengers is less for FGARS than for SGARs because FGARs are less persistent in the environment and in the bodies of primarily exposed animals. While reproductive effects in mammals due to exposure to FGARs may be presumed, exposed individuals are more likely to die before having the chance to reproduce. Thus, mortality rather than reproduction will likely drive population-level effects. EPA has evaluated several repeat-dose or extended exposure duration studies. These studies demonstrated that exposure to low doses over an extended period can impact birds and mammals and that chronic exposures to low doses of AR rodenticides may be a concern for all 7 ARs. This analysis (USEPA, 2020a) indicated that toxicity of FGARs is substantially enhanced in studies that utilize repeated exposures, such as reproductive toxicity assays and subacute repeated dose dietary toxicity studies.

[27] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

EPA made effects determinations for warfarin from feral hog bait station use on a nationwide basis because there are not geographic restrictions on the product label; however, EPA notes that the product is currently only approved for use at a local/state level in Texas and Oklahoma.

EPA made effects determinations for chlorophacinone and diphacinone based on bait station, burrow, and broadcast uses. EPA considers the effects determinations for broadcast use of those two chemicals to be representative of those for the scatter/spot treatments because the amount of bait put on the landscape surface during a scatter/spot treatment should be equally as lethal to non-target primary consumers as that for a broadcast application and the bait should be equally accessible to those species for both types of application. EPA expects to further discuss this with USFWS during consultation.

Furthermore, bait station uses of chlorophacinone and diphacinone are permitted in some agricultural areas. Although, EPA made effects determinations for bait station use with chlorophacinone and diphacinone for non-agricultural areas, the effects determination for broadcast use and/or scatter/spot treatments is inclusive of bait station uses in the same location. That said, bait stations use instead of broadcast use in these locations would reduce the exposure to primary consumer terrestrial vertebrates that cannot access the bait within the stations, meaning that there is potentially no J for those species that EPA predicted to have potential likelihood of J for broadcast uses at the same locations. EPA believes effects determinations for secondary consumers are the same in agricultural field settings whether the bait is applied by broadcast or in a bait station. EPA expects to further discuss this with USFWS during consultation.

For mammals, single day feeding and multiple day feedings resulted in acute LOC exceedances. Further information on endpoints used to calculate RQs for the FGARs is available in the FIFRA-based draft environmental risk assessment of seven anticoagulant rodenticides (USEPA, 2020a).

Chlorophacinone and diphacinone have agricultural uses that involve broadcast and rodent burrow application and therefore may cause exposure to a wide variety of animals. The FGARs are also used in bait stations for commensal rodent control. Diphacinone is used in island rodent eradication projects, both as broadcast and in bait stations, under the supervision of federal agencies such as APHIS and USFWS. Warfarin is used in specialized bait stations for the control of feral hogs. In EPA's FIFRA-based risk assessment of broadcast and floating bait station uses for two FGARs (*i.e.*, chlorophacinone and diphacinone) found the uses not to be of concern for aquatic taxa (USEPA, 2020a). However, the FIFRA-based risk assessment concluded that there was a risk concern for terrestrial vertebrates.
FGARs are considered non-persistent to slightly persistent, and moderately mobile to hardly mobile. They are not considered bio-concentrating in aquatic organisms, with the possible exception of diphacinone (LogP = 4.85). The potential for secondary poisoning is influenced by the half-life of the FGAR in the body of the primarily exposed animal. Persistence of AR residues in the bodies of primary consumers is often sufficient to cause mortality in secondary consumers. The first-generation anticoagulants require several days of consecutive feedings to deliver a lethal dose, and death does not occur until 5-7 days after the feeding. Exposure in water is considered negligible because of the use of bait stations. Even in cases where rodenticide bait may be broadcast on the surface, their formulation into baits, low mobility, and/or low persistence and low toxicity to aquatic organisms make aquatic exposures unlikely and potential effects negligible even if exposure did occur (*see* **Section 2.2**). The residue of concern for the FGARs is the parent compound only, due to degradation to non-toxic residues. Because the half-life of diphacinone in rat liver is 35 days (USEPA, 2020a), secondary poisoning by diphacinone is more likely than for the less persistent chlorophacinone (12 days half-life in rat liver).

Additionally, warfarin is less likely to represent a threat to secondary consumers due to lower persistence and lower exposure, respectively.

3.2.1.2 General Conclusions from the Incident Analysis

Since 1971, there are over 2,000 incidents associated with the use of rodenticides recorded in the IDS. 63% of these incidents (804 total) occurred between 2010 and 2018, indicating that exposure and wildlife incidents have continued in recent years. With regards to listed species, incidents have been reported for listed species such as San Joaquin kit fox, bald eagle (*Haliaeetus leucocephalus*), and Key deer. The San Joaquin kit fox has had several recent incidents related to anticoagulant rodenticides.

Due to their robust reporting systems relative to other states, the states of California and New York account for 58 and 21% of reported incidents for the evaluated rodenticides. Open literature studies (Murray, 2017; Serieys et al., 2015; Slankard et al., 2019) on rodenticide incidents suggest that ARs have a significant likelihood to impact non-target wildlife. Anticoagulant rodenticide incidents are generally based on detection of residues in liver tissue and corroborating evidence from carcass necropsy. Analysis of incident reports in the AR DRA (USEPA, 2020a) indicates that secondary exposure to FGARs is occurring and causing mortality, although to a much lesser extent than SGARs. Recent FGAR incidents have been noted in great horned owl (*Bubo virginianus*), barn owl (*Tyto alba*), red-tailed hawk (*Buteo jamaicensis*), bald eagle, and other species. In mammals, FGAR incidents in coyote (*Canis latrans*), mountain lion (*Puma concolor*), bobcat (*Lynx rufus*) and other species confirm the potential for secondary effects. Of the three FGARs, diphacinone had the most reported overall incidents (122) followed by chlorophacinone (54) and warfarin (23; USEPA, 2020a).

Overall, it appears that SGARs rather than FGARs are the drivers of secondary poisoning in wildlife, however diphacinone appears to rank with the SGARs (122 incidents). Of 656 total applicable bird incidents in IDS since 1971, SGARs were involved in 90% and FGARs in 10%. Of 607 total incidents involving mammals in IDS since 1971, 78% were due to SGARs and 22% to FGARS. EPA counted incidents with multiple AR residues separately for each rodenticide (USEPA, 2020a).

The reported incident data show an apparent increase in wildlife exposure and deaths since 1971. This may be attributed to greater effort in seeking out incidents, especially in California. The data presented in this assessment therefore do not necessarily represent an increase in incidents, but instead show that upon closer examination, incidents continue and have apparently not decreased despite the introduction of bait box uses. The available incidents are consistent with the established FIFRA-based risk profile and exposure concerns described in this evaluation.

3.2.1.3 Defining Spatial Overlap

Diphacinone and chlorophacinone may be used in commensal rodent control, agricultural broadcast, and in-burrow uses. Warfarin is used in commensal rodent control, although not as widely today because of the development of resistance in rodent populations. Warfarin is also registered for the control of feral hogs with the use of special hog bait stations.

Overall, the action area for FGARs will be represented by Developed and Open Space Developed UDLs for the commensal rodent control uses, and by agricultural UDLs (cropped land) for diphacinone and chlorophacinone. Overlap analysis of listed species ranges with these UDLs indicates that none of the species has less than 1% overlap. The feral hog bait station use is represented by UDLs for rangeland and managed forest (*see* **Section 2.4**).

3.2.1.4 Birds

EPA considered 95 bird species for exposure to FGARs from bait station, burrow, and broadcast uses. Of these, EPA determined 25 to be NE because of lack of exposure (marine species) or dietary considerations (aquatic food web or insects within the bark of trees) (*see* **Section 2.6.1)**.

Table 3-2 summarizes the effects determinations for birds from FGARs. All NLAA, LAA/No J and LAA/J determinations and justifications for listed birds can be found in the "Birds" worksheet in **Appendix B** following methodology in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**. Conclusions from **Appendix B** are summarized in the following sections; however, the reader is directed to **Appendix B** for additional information.

Table 3-2. Summary of Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Birds within the Action Area

Use Pattern	NLAA	LAA, No J	LAA, J
Bait Station	54	9	7
Feral Hog Bait Station (Warfarin)	68	0	2
Burrow (Chlorophacinone and Diphacinone)	54	15	1
Broadcast (Chlorophacinone and Diphacinone)	28	24	18

NLAA = not likely to adversely affect; LAA = likely to adversely affect; J = jeopardy

NLAA Determinations (Bait Station Use)

EPA made NLAA determinations for 54 listed bird species for bait station uses. The reason for the NLAA determination for these species is that these species are primary consumers that are extremely unlikely to enter the bait station opening for behavioral reasons. For those species that consume invertebrates, since the bait is contained within the station, invertebrates containing residues of FGAR are not expected to represent a significant exposure pathway.

NLAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made NLAA determinations for 68 listed bird species for FGAR (warfarin) feral hog bait station uses. These species are NLAA because the only exposure route is through the consumption of either live poisoned feral hogs or poisoned feral hog carcasses and none of the bird species found within the use area consume them.

NLAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made NLAA determinations for 54 listed bird species for FGAR (*i.e.*, chlorophacinone and diphacinone) burrow uses. The reason for the NLAA determination for these species is that bait must be placed 6 inches into the entrance of the burrow, and EPA does not expect birds to enter the burrow and/or kick out bait on to the surface; therefore, exposure is highly unlikely to occur.

NLAA Determinations (Chlorophacinone and Diphacinone Broadcast Use)

EPA made NLAA determinations for 28 listed bird species for the broadcast uses of the FGARs because these species only consume dietary items, such as fruit, nectar, aquatic organisms, or terrestrial invertebrates, that are unlikely to come into contact with bait.

LAA Determinations (Bait Station Use)

EPA made LAA determinations for 16 listed bird species (secondary consumers) for bait station uses primarily based on the potential for consumption of poisoned mammals.

LAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made LAA determinations for 2 listed bird species for feral hog warfarin bait station uses because of the potential for secondary exposure from consumption of feral hogs.

LAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations for 16 listed bird species for FGAR burrow uses primarily based on the potential for consumption of poisoned mammals.

***LAA Determinations* (*Chlorophacinone and Diphacinone Broadcast Use*)**

EPA made LAA determinations for 42 listed bird species. For secondary consumers this is primarily based on their potential to consume small mammals. For primary consumers this is primarily based on the potential for incidental exposure while the species is foraging on the ground for seeds and other food items.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station Use)

Of the 16 LAA listed bird species, EPA made LAA determinations and predicted the potential likely future J for 7 listed bird species for FGAR bait station uses. These species were determined to be LAA with a prediction of likely future J because FGARs have a high MoE on these species because these species tend to consume mammals on a regular basis and thus have an increased likelihood of secondary exposure to rodenticides.

For the remaining 9 LAA listed bird species, EPA did not predict the potential likelihood of future J for 9 listed LAA bird species for FGAR bait station uses. The Mississippi Sandhill crane (*Grus canadensis*), California clapper rail (*Rallus longirostris obsoletus*), Wood stork (*Mycteria americana*), and Mariana crow (*Corvus kubaryi*) were determined to be LAA with predicted not likely potential future J because despite the fact that they had high overlap (and in the Mississippi Sandhill Crane's case, a high MoE as well), their exposure pathway is through secondary consumption and FGARs take multiple feedings to result in mortality. Furthermore, these species are omnivores (consuming a wide variety of plant and animal matter) and only occasionally consume small mammals; therefore, it is extremely unlikely that the target pest will constitute a large enough proportion of their diet sufficient to reach exposure levels that would cause effects on a population level.

Predictions of the Potential Likelihood of Future Jeopardy (Feral Hog Warfarin Bait Station Use)

EPA made LAA determinations and predicted the potential for likely future J for 2 listed bird species (California Condor and Audubon's crested caracara) for the FGAR warfarin feral hog bait station use. The reason for the predicted J determinations was a high MoE because both species eat carrion. These predicted J determinations are because this use is labeled nationally even though it may only be used locally at this time so there is potential for warfarin use to control feral hogs in the range of California Condor and Audubon's crested caracara.

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations but did not predict the potential likelihood of future J for 15 listed bird species for FGAR (chlorophacinone and diphacinone) burrow uses. The reasons for the not likely future J predictions were low MoE of FGARs on these species. Additionally, FGARs take multiple feedings to result in mortality and since the omnivorous species only occasionally consume small mammals (eating a wide variety of plant and animal matter) it is not as likely that the target pest will constitute a large proportion of their diet. For secondary consumers who hunt the target pest (rodents), while there is the potential for prey to be available on the surface with less than lethal concentrations, their capacity to evade predators is the same as before exposure. Furthermore, a significant majority of reported mortalities occurred belowground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin *et al*., 2021).

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Broadcast Use)

EPA made LAA determinations and predicted the potential for likely future J for 18 listed bird species for the FGARs chlorophacinone and diphacinone broadcast uses. These species were determined to be LAA with likely predicted future J because of high overlap and high MoE. Additionally, some of the species consume prey comprised of rodenticide target species, increasing their adverse effects through secondary exposure.

Broadcast applications pose a chance of exposure to avian primary bird consumers (LAA) and to secondary consumers (LAA). Because of a high MoE for FGARs, EPA predicts the potential likelihood of future J for 18 listed bird species.

EPA made LAA determinations but did not predict the potential likelihood of future J for 24 listed bird species for FGAR (*i.e.*, chlorophacinone and diphacinone) broadcast uses. The reasons for predicted no likely future J were that these species were not from the lower 48 states. Use in these areas is not anticipated since broadcast uses are specific to target species not located on islands and specific to states in the CONUS; therefore, use is not anticipated. Although there are two APHIS labels for target pests found on islands, use will not be allowed until APHIS completes ESA consultation.
EPA's rationales for effect determinations and predictions of future J for listed birds can be found in the "Birds" worksheet in **Appendix B** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.1.5 Reptiles

EPA considered 59 reptile species for exposure to FGARs from bait station, burrow, and broadcast uses. Of these, EPA determined 25 to be NE because of lack of exposure (marine species), diet (aquatic food web), or low overlap with the FGAR action area.

Table 3-3 summarizes the effects determinations for reptiles from FGARs. All NLAA/LAA determinations and predictions of no J/J and justifications for listed reptiles can be found in the "Reptiles" worksheet in **Appendix B** and the "New species" worksheet in **Appendix C** following methodology in **Section 2.6.2.** MoE risk modifiers used for the predictions of potential likely future J are described in **Section 2.6.3.**

Table 3-3. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Reptiles within the Action Area

Use Pattern	NLAA	LAA, No J	LAA, J
Bait Station	20	10	4
Feral Hog Bait Station (Warfarin)	33	1	0
Burrow (Chlorophacinone and Diphacinone)	20	14	0
Broadcast (Chlorophacinone and Diphacinone)	3	24	6

NLAA = not likely to adversely affect; LAA = likely to adversely affect; J = jeopardy

NLAA Determinations (Bait Station Use)

EPA made NLAA determinations for 20 listed reptile species for bait station uses. Reasons for the NLAA determinations included:

- Exposure of an individual is extremely unlikely due to behavioral foraging preferences of consuming live moving prey (*i.e.*, unlikely to enter the bait station and eat bait directly),
- It is unlikely that the species' main dietary items (invertebrates) represent a significant exposure pathway (*i.e.*, unlikely to consume enough exposed invertebrates),
- Although the species consumes other non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians and reptiles), the main exposure route is from the consumption of poisoned target mammals. Since the main dietary item is non-mammalian prey, it is unlikely the species would enter the bait station in search of prey, and
- For listed turtles, it is extremely unlikely that a turtle will enter the bait station opening due to the shape and rigidity of its shell.

NLAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made NLAA determinations for 33 listed reptile species for warfarin feral hog bait station uses. The reason for the NLAA determinations for these species is that the only exposure route is through the consumption of either live poisoned feral hogs or poisoned feral hog carcasses and these species do not consume feral hog.

NLAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made NLAA determinations for 20 listed reptile species for chlorophacinone and diphacinone burrow uses. The reasons for the NLAA determinations included:

- Although the species' diet is comprised primarily of insects, so while they do consume some terrestrial vertebrates, they are not a large part of their diet and it is unlikely that invertebrates represent a significant exposure pathway (*i.e.*, unlikely to consume enough exposed invertebrates),

- For burrowing species, applications are intended to be made to active target pest burrows only, therefore, bait is more likely to go into an active pest target burrow rather than an inactive burrow that might be inhabited by a non-target species,
- FGARs take multiple exposures and it is unlikely that this would occur if the burrow is already occupied by the target pest, and
- The main dietary item of the species is non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians and reptiles), and the main exposure route is from the consumption of poisoned target mammals, it is unlikely the species would enter the mammal burrow in search of prey.

NLAA Determinations (Chlorophacinone and Diphacinone Broadcast Use)

EPA made a NLAA determination for one listed reptile species for chlorophacinone and diphacinone broadcast uses. The species is the Culebra Island Giant Anole (*Anolis roosevelti*) and it is NLAA because the best scientific and commercial information lead the Service to conclude this the species is extinct.

LAA Determinations (Bait Station Use)

EPA made LAA determinations for 14 listed reptile species based on the potential consumption of poisoned mammals.

LAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made LAA determinations for 1 listed reptile species for FGAR warfarin bait station uses because of the potential for secondary exposure from consumption of feral hogs.

LAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations for 14 listed reptile species for FGAR burrow uses primarily based on the potential for consumption of poisoned mammals.

***LAA Determinations* (*Chlorophacinone and Diphacinone Broadcast Use*)**

EPA made LAA determinations for 30 listed reptile species primarily based on the potential to consume small mammals and the potential for incidental exposure while the species is foraging on the ground for seeds and other food items.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station Use)

Of the 14 listed LAA reptiles, EPA predicted the potential for likely future J for 4 listed reptile species for FGAR bait station uses J because they had high MoE from FGARs and high overlap with FGAR UDLs.

EPA made LAA determinations but did not predict the likelihood of J for 10 listed reptile species for FGAR bait station uses. EPA determined the New Mexican ridge-nosed rattlesnake (*Crotalus willardi obscurus*) and Northern Mexican garter snake (*Thamnophis eques megalops*) to be LAA and predicts no J because of low overlap. EPA determined the Virgin Islands tree boa (*Epicrates monensis granti*), Alligator snapping turtle (*Macrochelys temmincki*), San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), Giant garter snake (*Thamnophis gigas*), Eastern indigo snake (*Drymarchon corais couperi*), American crocodile (Crocodylus acutus), Alameda whipsnake (*Masticophis lateralis euryxanthus*), and the Suwannee alligator snapping turtle (*Macrochelys suwanniensis*) to be LAA and predicts no J because FGARs require multiple feedings to result in mortality and since these species have varied diets consisting of many types of organisms it is extremely unlikely that the target pest (rodents) will constitute a large proportion of their diet.

Predictions of the Potential Likelihood of Future Jeopardy (Feral Hog Warfarin Bait Station Use)

EPA made an LAA determination but did not predict the potential likelihood of future J for one listed reptile species (American Crocodile, *Crocodylus acutus*) for the FGAR warfarin feral hog bait station uses because although the MoE of FGARs used to control feral hogs is high for this species because it consumes feral hogs, its overlap with this use is low.

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations but did not predict the likelihood of future J determinations for 14 listed reptile species for the FGARs chlorophacinone and diphacinone burrow uses. The reasons for the predicted not likely future J were because despite high and (in one case) medium overlap there is low MoE. Since FGARs require multiple feedings to achieve a lethal dose, there is the potential for prey to be available on the surface with less than lethal concentrations, and the capacity to evade predators is the same as before exposure. However, the majority of mortalities occur below ground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin *et al*., 2021).

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Broadcast Use)

EPA made LAA determinations and predicted likely potential future J for 6 listed reptile species for the broadcast uses of the FGARs chlorophacinone and diphacinone because of high MoE and high overlap, as well as several of the species having diets which consist predominantly of mammals.
EPA made LAA determinations but did not predict the potential likelihood of future J for 24 listed reptile species for the FGAR chlorophacinone and diphacinone broadcast uses. The reasons for the not likely future J predictions were because of a low MoE of FGARs on those species, low overlap with FGAR use, or both. For species in the non-lower 48 states, no FGAR use is anticipated since broadcast uses are specific to certain target species which are geographically exclusive to states in CONUS. There are 2 APHIS labels for target pests found on islands; however, use will not be allowed until APHIS completes ESA consultation.

EPA's rationales for effect determinations and predictions of future J for listed reptiles can be found in the "Reptiles" worksheet in **Appendix B** and the "New species" worksheet in **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.1.6 Amphibians

EPA considered 47 amphibian species for exposure to FGARs from bait station, burrow, and broadcast uses. Of these, EPA determined 12 to be NE because of lack of exposure (fully aquatic lifestyle and lives in caves). **Table 3-4** summarizes the effect determinations for the FGARs. All NLAA/LAA determinations and predictions of likely future no J/J and justifications for listed reptiles and amphibians can be found in the "Amphibians" worksheet in **Appendix B** and the "New species" worksheet in **Appendix C** following methodology in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-4. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Amphibians within the Action Area

Use Pattern	NLAA	LAA, No J	LAA, J
Bait Station	35	0	0
Feral Hog Bait Station (Warfarin)	35	0	0
Burrow (Chlorophacinone and Diphacinone)	30	5	0
Broadcast (Chlorophacinone and Diphacinone)	23	12	0

NLAA = not likely to adversely affect; LAA = likely to adversely affect; J = jeopardy

NLAA Determinations (Bait Station Use)

EPA made NLAA determinations for 35 listed amphibian species for FGAR bait station uses. Reasons for the NLAA determinations included:

- because they primarily consume live prey so exposure to rodenticide bait is unlikely.
- because exposure of an individual is extremely unlikely due to a behavioral foraging preference for consumption of live moving prey (*i.e.*, unlikely to eat bait directly).
- because amphibians considered did not rise to LAA in the 1993 USFWS BiOp and therefore remain NLAA.
- because it is unlikely that the species' main dietary items (invertebrates) represent a significant exposure pathway (*i.e.*, unlikely to consume enough exposed invertebrates).
- because species is typically found in an isolated, highly unique, or aquatic/semi-aquatic habitat where exposure to rodenticides is unlikely to occur.

NLAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made NLAA determinations for 35 listed amphibians based primarily on reasons described in the previous section for bait station uses.

NLAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made NLAA determinations for 30 listed amphibian species for FGAR burrow uses for the same reasons discussed above in the 'Bait Station Use' section.

NLAA Determinations (Chlorophacinone and Diphacinone Broadcast Use)

EPA made NLAA determinations for 23 listed amphibian species for FGAR broadcast uses for the same reasons discussed above in the 'Bait Station Use' section.

LAA Determinations (Bait Station Use)

EPA did not make any LAA determinations for listed amphibian species from FGAR bait station use and no further analyses are needed.

LAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA did not make any LAA determinations for listed amphibian species from FGAR feral hog warfarin bait station use and no further analyses are needed.

LAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations for 5 listed amphibian species for FGAR burrow uses primarily because the species utilizes small mammal burrows.

LAA Determinations **(*Chlorophacinone and Diphacinone Broadcast Use*)**

EPA made LAA determinations for 12 listed amphibian species primarily based on the potential to for incidental exposure while the species is foraging on the ground for seeds and other food items.

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations and did not predict the likelihood for potential future J for 5 of the listed amphibian species for the burrow uses of the FGARs. These species had high overlap with this use but had a low MoE.

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Broadcast Use)

EPA made LAA determinations and did not predict the likelihood of potential future J for 12 of the listed amphibian species for the bait station uses of the FGARs. These species had either high or medium overlap with this use but had a low MoE.

EPA's rationales for effect determinations and predictions of future J for listed amphibians can be found in the "Amphibians" worksheet in **Appendix B** and the "New species" worksheet in **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.1.7 Mammals

EPA considered 100 mammalian species for exposure to FGARs from bait station, burrow, and broadcast uses. Of these, EPA determined 25 to be NE because of lack of exposure (marine mammals) or diet (aquatic food web).

Table 3-5 summarizes the effect determinations for mammals from FGARs. All NLAA/LAA determinations and predictions of no J/J and justifications for listed mammals can be found in the "Mammals" worksheet in **Appendix B** and the "New species" and "UDL_update (species)" worksheets in **Appendix C** following methodology in **Section 2.5**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-5. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Mammals within the Action Area

Use Pattern	NLAA	LAA, No J	LAA, J
Bait Station	30	18	27
Feral Hog Bait Station (Warfarin)	66	8	1
Burrow (Chlorophacinone and Diphacinone)	24	17	34
Broadcast (Chlorophacinone and Diphacinone)	21	14	40

NLAA = not likely to adversely affect; LAA = likely to adversely affect; J = jeopardy

NLAA Determinations (Bait Station Use)

EPA made NLAA determinations for 30 listed mammal species for FGAR bait station uses. These species were NLAA because they are unlikely to enter bait station due to their body size. All of these species are >400 g which is equivalent to size of a standard laboratory rat.

NLAA Determinations (Feral Hog Bait Station Use)

EPA made NLAA determinations for 66 listed mammal species for the feral hog bait station use of the FGAR warfarin. These species are NLAA because the only exposure route is through the consumption of either live poisoned feral hogs or poisoned feral hog carcasses and these species do not consume feral hog.

NLAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made NLAA determinations for 24 listed mammal species for the burrow uses of the FGARs chlorophacinone and diphacinone. These species include the Key deer (*Odocoileus virginianus clavium*), Columbian white-tailed deer (*Odocoileus virginianus leucurus*), and Sonoran pronghorn (*Antilocapra americana sonoriensis*) which are NLAA because they are unlikely to enter burrows due to their size (species >400 g). Several listed bat and flying squirrel species are also included because of the low likelihood that they would access a burrow. In addition, these species do not consume other mammals (no secondary exposure pathway).

NLAA Determinations (Chlorophacinone and Diphacinone Broadcast Use)

EPA made NLAA determinations for 21 of the listed mammal species for the broadcast uses of the FGARs chlorophacinone and diphacinone. These species are NLAA due to remote habitats or diets which preclude the consumption of bait (*i.e.,* only consume flying terrestrial invertebrates).

LAA Determinations (Bait Station Use)

EPA made 45 LAA determinations for listed mammals based primarily on similarity to target pest, small body size (that would allow entry into bait station), and from the potential consumption of mammal prey.

LAA Determinations (Feral Hog Warfarin Bait Station Use)

EPA made 9 LAA determinations for listed mammal species from FGAR feral hog warfarin bait station uses because of the potential to consume feral hogs.

LAA Determinations (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations for 51 listed mammal species for FGAR burrow uses primarily based on small body size, similarity to target pest and the potential consumption of mammalian prey.

***LAA Determinations* (*Chlorophacinone and Diphacinone Broadcast Use*)**

EPA made LAA determinations for 54 listed mammal species primarily based on the potential to for incidental exposure while the species is foraging on the ground for seeds and other food items and from the consumption of mammal prey.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station Use)

EPA made LAA determinations and predicted the potential for likely future J for 27 listed mammals for FGAR bait station uses because they had high MoE from FGARs and high or medium overlap with FGAR UDLs. Twenty-six of these species are rodents who are likely small enough to access bait stations. The San Joaquin kit fox is also in this group because it feeds primarily on rodents and lives in residential areas where concentrations of bait stations are likely to be higher, so secondary exposure is more likely. EPA made LAA determinations and did not predict the potential for likely future J for 18 listed mammal species for FGAR bait station uses because despite a high MoE of FGARs to these species, there is a low overlap between FGAR usage and the range of these species.

Predictions of the Potential Likelihood of Future Jeopardy (Feral Hog Warfarin Bait Station Use)

EPA made LAA determinations and predicted the potential for likely future J for one listed mammal species from feral hog bait station use of warfarin. EPA predicted the potential likelihood of future J for the Florida panther (*Puma (=Felis) concolor coryi*) due to a diet that consists substantially (21% of its diet) of feral hog.[28] The prediction of the potential for likely future J for the Florida panther is since this use is labeled nationally even though it may only be used locally at this time so there is potential for warfarin use to control feral hogs in the range of California condor and Audubon's crested caracara.

EPA made LAA determinations and did not predict the potential for likely future J for 8 listed mammals from the feral hog bait station use of warfarin because despite a high overlap with this use, the MoE is low for these species. These are species which may eat feral hogs, but which have varied diets so that exposure through their regular consumption of feral hogs is extremely unlikely to lead to population level effects.

[28] https://myfwc.com/wildlifehabitats/wildlife/panther/biology/

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Burrow Use)

EPA made LAA determinations and predicted likely for potential future J for 34 listed mammals for the burrow use of the FGARs chlorophacinone and diphacinone because of a high MoE of FGARs on these species and a high or medium overlap of these species' ranges with FGAR UDLs. These species are similar to the target species and have the potential to be in a burrow where they could be exposed to bait through primary exposure.

EPA made LAA determinations but did not predict the potential for likely future J for 17 listed mammal species for the burrow uses of the FGARs chlorophacinone and diphacinone. Since FGARs require multiple feedings to achieve a lethal dose, there is the potential for prey to be available on the surface with less than lethal concentrations. EPA does not anticipate that FGAR contaminated primary consumers would have a reduced capacity to evade predators due to the need for multiple feedings of the FGAR bait before mortality. However, despite the potential availability of exposed prey, a significant majority of mortalities may occur below ground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin *et al*., 2021). One additional reason for the no J predictions for some of the species was low overlap with FGAR usage.

Predictions of the Potential Likelihood of Future Jeopardy (Chlorophacinone and Diphacinone Broadcast)

EPA made LAA determinations and predicted the potential for likely future J for 40 listed mammals from the broadcast uses of the FGARs chlorophacinone and diphacinone because of high MoE of FGARs on these species and high overlap of these species with FGAR UDLs.

EPA made LAA determinations but did not predict the potential for likely future J for 14 listed mammal species for the broadcast uses of the FGARs chlorophacinone and diphacinone because despite a high MoE of FGARs on these species, there is low overlap between the species' range and FGAR UDLs.

EPA's predictions of the potential likelihood of future J and justifications for listed mammals can be found in the "Mammals" worksheet in **Appendix B** and the "New species" and "UDL_update (species)" worksheets in **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-6 summarizes the number of listed species determinations and predictions of the potential likelihood of future J for all taxa from FGARs.

Table 3-6. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for First Generation Anticoagulant Rodenticides (FGARs)[1,2]

Taxon	Number of Species	Specific Determinations Across Use Patterns and by A.I.											
		Bait Station			Burrow			Broadcast			Feral Hog		
		NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J
Mammals	**100**	**30**	**18**	**27**	**24**	**17**	**34**	**21**	**14**	**40**	**66**	**8**	**1**
Birds	**95**	**54**	**9**	**7**	**54**	**15**	**1**	**28**	**24**	**18**	**68**	**0**	**2**
Amphibians[3]	**47**	**35**	**0**	**0**	**30**	**5**	**0**	**23**	**12**	**0**	**35**	**0**	**0**
Reptiles	**59**	**20**	**10**	**4**	**20**	**14**	**0**	**4**	**25**	**5**	**33**	**1**	**0**

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.

[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction

[3] "Amphibians" includes those species that have both a terrestrial and aquatic phase.

NE = no effect; NLAA = not likely to adversely affect; LAA = likely to adversely affect; J = jeopardy

3.2.2 Second-Generation Anticoagulant Rodenticides (SGARs)

3.2.2.1 Introductory Information on SGARs

EPA signed the DRA (USEPA, 2020a) for seven anticoagulant rodenticides (AR) for the RR program on March 17, 2020. These AR include three FGARs (*i.e.*, warfarin, chlorophacinone, diphacinone) and four SGARs (*i.e.*, bromadiolone, brodifacoum, difenacoum, and difethialone). Based on previous FIFRA-based draft risk assessments, and the 2008 RMD (USEPA, 2008), for each of the 7 ARs, this final BE has been focused on risks to mammals and birds (as well as reptiles and terrestrial amphibians, for which birds serve as a proxy).

The effects to mammals and birds from ARs is well-established (USEPA, 2020a) and include mortality from primary and secondary exposure, as well as longer-term growth and reproductive effects. Primary exposure in this assessment is defined as consumption of treated bait by target or non-target organisms. Secondary exposure is defined as predation/scavenging and consumption of exposed primary consumers. Previous assessments (USEPA, 2020a) have concluded that SGARs present greater secondary exposure concerns than FGARs do, supported by numerous incidents in which animals too large to enter bait boxes are found to contain significant levels of AR residues in liver or other tissues. Target and non-target taxa that consume ARs via bait boxes carry residues of the persistent ARs from bait boxes into the environment, sometimes far from the treatment area because ARs do not kill immediately and some SGARs have persistent biological half-lives, creating secondary exposure opportunities for predators and scavengers (see **Section 2.2.2** for more information).

An acute-to-chronic ratio qualitative assessment of chlorophacinone and difenacoum indicates reproduction concerns for all 7 ARs (USEPA, 2020a). These data show that AR toxicity is substantially enhanced in studies that utilize repeated exposures, such as reproductive toxicity assays and subacute repeated dietary exposure toxicity studies.

The FIFRA-based 2020 DRA also conducted an analysis of wildlife incidents involving the 7 ARs to determine if there are any trends in recent years. Since the 2008 RMD imposed mitigations within the United States (USEPA, 2008), this final BE focuses on reports from the US because the mitigation decision applied only to the US, although there is scientific literature on the effectiveness of similar AR mitigations from several European countries. Data sources include EPA's IDS and scientific reports that specifically addressed the question of wildlife incident trends. EPA obtained literature reports from California, Kentucky and Massachusetts (USEPA, 2020a). The Department of Pesticide Regulation completed the California report in response to a citizen petition.

3.2.2.2 General Conclusions from the Incident Analysis

EPA identified 804 incidents (63% of incidents reported since 1971 in the IDS) between 2010 and 2018, indicating that exposure and wildlife incidents have continued in recent years. Two rodenticides – brodifacoum and bromadiolone – were the primary drivers of incidents, accounting together for roughly 69% of the incidents reported between 2010 and 2018. Brodifacoum and bromadiolone are both SGARs and are expected to be persistent. Based on autopsy reports of poisoned animals, exposure to two or more second-generation ARs is common (*see* USEPA, 2020a). With regards to listed species, incidents have been reported for listed species such as San Joaquin kit fox, bald eagle, and key deer. The San Joaquin kit fox (*Vulpes macrotis*) has had several recent incidents related to anticoagulant rodenticides.

Due to their robust reporting systems relative to other states, the states of California and New York account for 58 and 21% of reported incidents for the evaluated rodenticides. Open literature studies on rodenticide incidents suggest that anticoagulant rodenticides have a significant likelihood to impact non-target wildlife; exposure rates to wild animals in these studies was high, even in remote densely forested regions with no legal uses of SGARs. Anticoagulant rodenticide incidents are generally based on detection of residues in liver tissue and corroborating evidence from carcass necropsy. the reported incident data show an apparent increase in wildlife exposure and deaths from 2010 to 2018. This may be attributed to greater effort in seeking out incidents, especially in California. The California report cited herein was the result of a formal petition by a non-government organization (NGO). The data presented in this assessment therefore do not necessarily represent an increase in incidents, but instead show that upon closer examination, incidents continue and have apparently not decreased.

The SGARs include bromadiolone, brodifacoum, difethialone, and difenacoum. The SGARs represent an acute hazard[29] to all animal taxa (mammals, birds, amphibians, and reptiles) by direct consumption. Due to their persistence in animal tissues, these rodenticides also pose an acute hazard to carnivores (secondary consumers) that eat directly exposed animals. The hazard to secondary consumers is supported by analysis of numerous incidents. Brodifacoum is used in island eradication projects for invasive rodents by APHIS and USFWS.

3.2.2.3 Defining Spatial Overlap

SGARs may be used for commensal rodent control associated with structures. The action area for SGARs will be represented by Developed and Open Space Developed UDLs (see **Section 2.4**). Lastly, for the purposes of this assessment, bait box uses are assumed to be protective of burrow uses as all SGAR labels require outdoor applications to be within 100 feet of man-made structures; therefore, species effects determinations and predictions of potential likelihood of future J determinations were not considered separately for burrow uses.

3.2.2.4 Birds

EPA considered 95 (including species with multiple entity IDs) listed bird species for effects from SGAR bait station uses. Of these, EPA determined 25 to be NE because they are marine species, or because they consumed food items from the aquatic food web, or because they are strictly arboreal (*i.e.,* species that chiefly live and feed in trees), and so are not expected to be exposed (*see* **Section 2.6.1**). EPA then made NLAA determinations for 54 species. For the remaining 16 LAA species EPA predicted the potential for likely future J because the species were likely to consume exposed rodent prey. These include birds of prey and scavengers such as hawks, owls, falcons, crows, cranes, and storks.

[29] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

NLAA Determinations

The remaining 70 species EPA determined to be MA based on possible consumption of bait, or consumption of exposed rodents. Of these, EPA determined 54 to be NLAA because they are unlikely to be exposed, due either to size or behavior (too large or behaviorally unlikely to enter bait station).

LAA Determinations

EPA made LAA determinations for 16 listed bird species primarily based on primary route of exposure being consumption of poisoned target mammals.

Predictions of the Potential Likelihood of Future Jeopardy

For 9 of the species with LAA determinations, EPA did not predict the potential for likely future J.

EPA determined that the remaining 7 species were LAA and predicted the potential likelihood for future J because they were likely exposed through consumption of rodent prey. These include birds of prey and scavengers such as hawks, owls, falcons, crows, cranes, and storks.

Table 3-7. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Birds within the Action Area

Final Effects Determination/Predicted Potential Likelihood of Future Jeopardy Prediction	No. Listed Species	Rationale
NE	25	Marine species, species in the aquatic food web, arboreal species (*i.e.,* species that chiefly live and feed in trees), extinct species
NLAA	54	Excluded from bait stations by body size, or behaviorally unlikely to enter bait station
LAA-Predicted no likely future J	9	Not likely to consume rodents, or have varied diet
LAA – Predicted likely future J	7	Likely to consume exposed rodents or in broadcast use area on islands

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.2.5 Reptiles and Amphibians

NLAA Determinations (Reptiles)

EPA considered 59 listed reptiles for the SGAR bait station uses. Toxicity data for birds were used as a surrogate for reptiles. Of the 59 listed reptiles, EPA determined 25 to be NE, either because no exposure was expected (marine species), because they were terrestrial species in the aquatic food web, or they were terrestrial species that eat vegetation or invertebrates (*see* **Section 2.6.1**). EPA determined 20 reptiles to be MA/NLAA based on the following reasons:

- Exposure of an individual is extremely unlikely due to behavioral foraging preferences of consuming live moving prey (*i.e.*, unlikely to enter the bait station and eat bait directly),
- It is unlikely that the species' main dietary items (invertebrates) represent a significant exposure pathway (*i.e.*, unlikely to consume enough exposed invertebrates),
- Although the species consumes other non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians and reptiles), the main exposure route is from the consumption of poisoned target mammals. Since the main dietary item is non-mammalian prey, it is unlikely the species would enter the bait station in search of prey, and
- For listed turtles, it is extremely unlikely that a turtle will enter the bait station opening due to the shape and rigidity of its shell.

LAA Determinations (Reptiles)

EPA made LAA determinations for 14 listed reptile species primarily based on primary route of exposure being consumption of poisoned target mammals.

Prediction of Potential Likely Future Jeopardy (Reptiles)

EPA predicts that 10 of the LAA reptiles to be no likely future J because, despite a high MoE, they have low overlap with the SGAR action area. These were the New Mexican Ridge-nose rattlesnake and the Northern Mexican garter snake.

EPA predicts that 4 reptiles, all snakes, are likely future J based on high MoE and medium or high overlap with the SGAR action area.

NLAA Determinations (Amphibian)

EPA considered effects to 47 listed amphibian species. Of these, EPA determined 12 were NE based on their fully aquatic life cycle or that they lives in caves. Thirty-five species were considered MA but NLAA for reasons described in **Section 2.6.2** based on only incidental consumption of bait or invertebrates; therefore, no further analyses were conducted.

Table 3-8. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Reptiles/Amphibians within the Action Area.

Final Effects Determination/Prediction of Potential Likelihood of Future Jeopardy Prediction	No. Listed Species	Rationale
NE	Amphibians 12	Fully aquatic life cycle or live in caves
	Reptiles 25	Not exposed (marine species), in aquatic food web, or terrestrial consumers of vegetation or invertebrates

Final Effects Determination/Prediction of Potential Likelihood of Future Jeopardy Prediction	No. Listed Species	Rationale
NLAA	Amphibians 35	Only incidental consumption of bait or invertebrates
	Reptiles 20	Species consumes invertebrates and since bait is confined to the station, it is not likely for species to accidentally consume bait while feeding and invertebrates do not represent a significant exposure pathway
LAA – Predicted no likely future J	Reptiles 10	Low Overlap
LAA – Predicted likely future J	Reptiles 4	Secondary consumers likely to have exposed rodents in their diet, or island species in areas of broadcast application

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.2.6 Mammals

EPA considered 100 mammalian species for exposure to SGARs from bait stations. Of these, EPA determined 24 to be NE because of lack of exposure (marine mammals), diet (aquatic food web or strictly flying insects, all bats) or low overlap with the SGAR action area.

NLAA Determinations

EPA made MA determinations for 75 species because SGARs are intended to kill mammals, but 30 of these EPA determined to be NLAA because the species do not consume rodents and are too large to fit into a bait station.

LAA Determinations

EPA made LAA determinations for 45 listed mammals based on the consumption of poisoned target prey, small body size and/or similarity to target pest.

Predictions of Potential Likelihood Future Jeopardy

Of the 45 LAA species, EPA predicted the potential likelihood for future J for 27 species either because they were small mammals able to enter a bait station (mice, gophers, ground squirrels, voles kangaroo rats, *etc*.) or secondary consumers with rodents in their diet (wolves, foxes, marten, ocelot, panthers, *etc*.).

For the remaining 18 LAA species, EPA did not predict the potential likelihood of future J due to low overlap despite a high MoE, meaning that exposure is discountable.

Table 3-9 presents the effects determinations and predictions of the potential likelihood of future J for the SGARs.

Table 3-9. Summary of Final Effects Determinations and Predictions of Potential Likelihood of Future Jeopardy for Listed Mammals within the Action Area

Final Effects Determination/ Predictions of Potential Likelihood of Future Jeopardy Prediction	No. Listed Species	Rationale
NE	Mammals 25	Lack of exposure (marine mammals), diet (aquatic food web or strictly flying insects, all bats) or low overlap with the SGAR action area
NLAA	Mammals 30	Non-rodent consumers too large to access bait stations
LAA –Predicted no likely future J	Mammals 18	Mammals too large to enter a bait station or not consumers of mammals
LAA – Predicted likely future J	Mammals 27	Small mammals able to enter a bait station or secondary consumers with rodents in their diet

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

Table 3-10. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for SGARs (Bait Station Use)[1,2]

Taxon	Number of Species	NE	NLAA	LAA, No J	LAA, J
Mammals	100	25	30	18	27
Birds	95	25	54	9	7
Amphibians[3]	47	12	35	0	0
Reptiles	59	25	20	10	4

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.

[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction

[3] "Amphibians" include those species that have both a terrestrial and aquatic phase.

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.3 Bromethalin

3.2.3.1 Introductory Information on Bromethalin

EPA signed the FIFRA-based bromethalin DRA on March 31, 2020. Bromethalin is a neurotoxicant that causes adverse effects and histological changes to the central nervous system of the target mammal pests. The 2020 DRA noted that acute toxicity is caused by the uncoupling of mitochondrial oxidative phosphorylation leading to respiratory failure (USEPA, 2020b). Bromethalin is used to control various types of rats and moles. As required by the 2008 RMD (USEPA, 2008), all above ground uses of bromethalin must be in tamper-resistant bait boxes. The bromethalin burrow uses are used within 100 feet of manmade structures, or on open space developed areas. Bromethalin bait must also be placed six inches inside animal burrows. Broadcast uses of bromethalin are not registered.

The bait station exposure analysis is considered protective of bromethalin burrow uses (with the exception of the impregnated artificial worm/grub use, as described below), as listed species are less likely to fit into burrows or be attracted to the bait within the burrows. Animals that cannot fit into the opening of the bait station are not considered to be exposed via direct (primary) consumption of the treated bait. Bromethalin poses an acute hazard[30] to all terrestrial vertebrate taxa (mammals, birds, reptiles, and amphibians). The likelihood of effects from secondary exposure of carnivores is anticipated to be lower than that of the anticoagulant rodenticides, based on the short half-life and rapid elimination from primary consumers. However, there are secondary consumer incidents that are addressed in the FIFRA-based 2020 DRA (USEPA, 2020). EPA thus considers that bromethalin secondary exposure is still possible. In the 1993 USFWS BiOp for vertebrate control agents, the USFWS considered bromethalin and did not determine it to jeopardize any listed species (USFWS, 1993).

The FIFRA-based 2020 DRA summarized that bromethalin poses an acute hazard to all vertebrates that might consume it (aquatic vertebrates are not likely to be exposed to bromethalin). According to the DRA, primary exposure RQ values for mammals consuming bait range from 2.4 to 13, depending on body weight (USEPA, 2020b). For birds, primary exposure RQ values ranged from 2.4 to 20.

According to the FIFRA-based DRA, effects to secondarily exposed mammals are possible, though there are no secondary mammal incident reports. Secondary effects in birds are also possible – three secondary bird incidents have been reported. Bromethalin is fast acting and is rapidly eliminated in the gut of the primary consumer, which could potentially lead to lower chances for secondary exposure than the anticoagulant rodenticides. Overall, effects to secondary and tertiary consumers are considered possible.

3.2.3.2 General Conclusions from the Incident Analysis

Since 1996, 56 wildlife incidents associated with the use of bromethalin were reported in the IDS. There were 52 incidents (93% of the total) reported between 2010 and 2018, indicating that exposure and wildlife incidents have continued in recent years. The bromethalin incidents were mainly of primary consumers, except for five secondary consumer bird incidents. In general, the number of incident reports increased after the implementation of the 2008 RMD (USEPA, 2008) but have begun to decrease since 2016, when the stores of non-compliant products would have been removed from circulation. The

[30] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

states of California and New York account for 67 and 25% of reported incidents for bromethalin. Bromethalin incidents are generally based on detection of residues in tissues and corroborating evidence from carcass necropsy. However, many incidents are not reported either because most animal carcasses are never found by humans, and those that are found may not be reported, let alone analyzed for rodenticides. Additionally, reported incidents will not account for the animals for which exposure to bromethalin was a factor in their death through means such as increased vulnerability to predation, starvation, or accidental death (*e.g.,* hit by a car).

3.2.3.3 Defining Spatial Overlap

Bromethalin may be used in commensal rodent control in bait stations. The action area for bromethalin commensal rodent uses will be represented by Developed and Open Space Developed UDLs. Bromethalin is also used to control burrowing rodents in a variety of settings, including residential lawns, other "non-agricultural areas", agricultural cropland, pastures, forestry land, and rangeland. The in-burrow uses are only applied via below-ground, burrow insertion. The burrow uses include the limited artificial impregnated worm/grub use. The action area for bromethalin burrow uses is represented by the UDL layers Open Space Developed and agricultural lands for commensal rodent uses, and Other Orchards, Managed Forest, Forest Trees, Rangeland, Cultivated Land, Rights-of-Way, and Pasture (*see* **Section 2.4**).

3.2.3.4 Birds

NLAA Determinations

Multiple birds are deemed unlikely to enter burrows because applicators are required to place bait 6 inches below the surface, reducing exposure potential. EPA made NLAA determinations for bird species that overlap only with bromethalin burrow uses other than the limited impregnated artificial worm/grub bromethalin burrow use. Exposures to bromethalin of birds are considered unlikely either on because of behavior (unlikely to enter bait station) or body size (too large to enter bait station).

EPA made NLAA determinations for 54 listed bird species from bromethalin use. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (see **Section 2.6.2**). In addition, EPA determined as NLAA those species that are likely extinct. Overall, the most impactful modifiers that resulted in NLAA determinations included:

- Bait must be placed 6 inches into the entrance of the burrow and it is not expected for birds to enter the burrow and/or kick out bait therefore exposure is not reasonably expected to occur. There is likely little chance for any significant non-target exposure because the target pest (pocket gopher) quickly wall off disturbed sections of the burrow (Gene Benbow, pers. comm., 8/28/2023),
- Species is unlikely to enter into burrow due to size and foraging behavior,
- All above-ground application of these products is prohibited, and
- Species is not in the CONUS and not expected to overlap with the range for the target pests.
- Species overlaps only with bromethalin burrow uses other than the limited impregnated artificial worm/grub bromethalin burrow use.

There are also species that EPA determined as NLAA because the species consumes fruits or gleans insects and snails off the tree foliage or ingests flying insects instead of dietary items on the ground; therefore, these birds are unlikely to be exposed to rodenticides via primary or secondary exposure. Finally, several species, including the bridled white-eye (*Zosterops conspicillatus*), EPA determined as NLAA because they are presumed extinct.

LAA Determinations

EPA made LAA determinations for bromethalin for 16 birds, based on the potential for secondary exposure to bromethalin through the consumption of mammals, birds, terrestrial amphibians, and reptiles containing bromethalin residues, along with potential for direct consumption through consuming carrion. Some of these species are ground feeders that eat grains or seeds, so there is potential for incidental consumption of bait while feeding. Several bird species with LAA determinations were considered omnivorous and opportunistic foragers, which decreased the likelihood of rodenticide exposure.

Predictions of the Potential Likelihood of Future Jeopardy

EPA did not predict the potential likelihood of future J for listed bird species for the limited burrow uses that target moles via impregnated artificial worms/grubs. However, despite the potential availability of exposed prey, a significant majority of mortalities occurred below ground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin *et al*., 2021). There is also lower potential for secondary exposure from these burrow uses because of the shorter half-life of bromethalin, relative to other rodenticides. EPA also took into consideration that many of the birds with LAA determinations had diverse diets, which would reduce the chance that bromethalin exposure would lead to population level effects. EPA did not predict the potential likelihood of future J for species with low overlap with the limited bromethalin impregnated artificial worm/grub burrow use (*see* **Section 3.2.3.3**).

All NLAA/LAA and no J/J determinations and justifications for listed birds can be found in the "Birds" worksheet in **Appendix B** following methodology in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**. Conclusions from **Appendix B** are summarized here; however, the reader is directed to **Appendix B** for additional information.

3.2.3.5 Amphibians and Reptiles

NLAA Determinations

EPA considered reptiles and amphibians unlikely to enter burrows because applicators are required to place bait within open space developed areas where listed species are extremely unlikely to be found, or six inches below the surface, thereby reducing exposure potential. Based on this consideration, EPA made NLAA determinations for amphibian and reptile species that overlap only with bromethalin burrow uses, except for reptiles and amphibians that overlap with the impregnated artificial worm/grub burrow uses. EPA considers exposures of reptiles and amphibians to bromethalin unlikely either because of:

- behavior (unlikely to enter bait station) or
- body size (too large to enter bait station).

Reptiles

EPA made NLAA determinations for bromethalin bait station and burrow uses for 20 reptiles, including turtles and snakes, because exposure is extremely unlikely to occur.

- The species are unlikely to fit into the bait stations or unlikely to be found in most burrow uses where bromethalin is placed because applicators are required to place bait within open space developed areas where listed reptile species are extremely unlikely to occur, or six inches below the surface, making exposure unlikely.
- The species are unlikely to be exposed to bromethalin based on their dietary patterns, as the species are unlikely to eat bait located within bait stations or burrows and are unlikely to eat species that consume the bait in those locations.

One species, the Culebra Island giant anole (*Anolis roosevelti*), is located on a nature preserve managed by the Commonwealth of Puerto Rico Department of Natural and Environmental Resources. However, consultation with the Services is required for potential future rodent eradication projects on the island.

Amphibians

EPA made NLAA determinations for 35 listed amphibian species from bait station uses and made NLAA determinations for 30 amphibians from burrow uses, because exposure is extremely unlikely to occur.

- The listed amphibians partially reside in aquatic or riparian habitats where rodenticide exposure is extremely unlikely to occur.
- The amphibians are also unlikely to encounter bromethalin in the terrestrial phase of their life history, based on the bait station and most burrow use patterns of bromethalin.
- Certain listed amphibians were found in high elevation, remote locations, where rodenticide exposure is unlikely to occur.
- Several amphibian species primarily feed on aquatic invertebrates and zooplankton that are unlikely to be exposed to rodenticides.

LAA Determinations

Reptiles

EPA made LAA determinations for 14 reptiles, based on the potential for secondary exposure through the consumption of mammals, birds, terrestrial amphibians and reptiles exposed to bromethalin.

- Along with potential for direct consumption through consuming or carrion, some of these species are ground feeders that eat grains or seeds, so there is potential for incidental consumption of bait while feeding.
- EPA made LAA determinations for listed reptiles that may be exposed to bromethalin via the limited burrow use via impregnated artificial worms/grubs.

Amphibians

EPA made LAA determinations for 5 amphibians, based on the potential for secondary exposure through the consumption of mammals, birds, terrestrial amphibians and reptiles exposed to bromethalin. EPA made LAA determinations for listed reptiles that may be exposed to bromethalin via the limited burrow use via impregnated artificial worms/grubs.

Predictions of the Potential Likelihood of Future Jeopardy

Reptiles

For all 14 reptile species which EPA determined LAA from bromethalin exposure, EPA predicted to have no likely future J. EPA predicted these reptile species as unlikely to experience adverse effects from bromethalin to the point of J to their population based on one or more of the following factors: low overlap, low MoE, and a diverse diet.

Amphibians

All 5 amphibian species for which EPA determined LAA from bromethalin exposure, EPA predicted to have no likely future J. EPA predicted these amphibian species as unlikely to experience adverse effects from bromethalin to the point of J to their population based on one or more of the following factors: low overlap, low MoE, and a diverse diet.

All NLAA/LAA and no J/J determinations and justifications for listed reptiles and amphibians can be found in the respective species worksheet in **Appendix B** and **Appendix C** following methodology in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.3.6 Mammals

NLAA Determinations

EPA made 30 NLAA determinations for listed mammals for bromethalin bait station uses and 24 NLAA determinations for burrow uses (specifically determining effects from the limited artificial impregnated worm/grub use). Several mammals reside at high elevation or remote locations such as cliffside or rocky slope habitat where rodenticide exposure is unlikely to occur. Several mammalian species primarily feed on aquatic invertebrates and zooplankton, or only live in aquatic habitats such as salt marshes (*e.g.*, the salt marsh harvest mouse; *Reithrodontomys raviventris*) and are thus unlikely to be exposed to rodenticides within their habitat. EPA made NLAA determinations for mammals that lived in uninhabited island locations within the non-lower 48 areas of the United States, including within Hawaii and Puerto Rico, as bromethalin uses are only approved for open spaced developed commensal uses in these locations. Several species live within interior forests or other areas where rodenticide usage is unlikely and exposure potential is low. Several mammalian species, including all listed bats, EPA determined as NLAA because the species consumes fruits and glean insects and snails off the tree foliage, or flying insects instead of dietary items on the ground; therefore, EPA considers these species as unlikely to be exposed to rodenticides via primary or secondary exposure.

LAA Determinations

EPA made LAA determinations for bromethalin for 45 mammals, based on the potential for primary exposure to bromethalin through direct consumption of bromethalin. There is also potential for secondary exposure through the consumption of mammals, birds, terrestrial amphibians and reptiles. Along with potential for direct consumption through consuming carrion, some of these mammalian species are ground feeders that eat grains and seeds, so there is potential for incidental consumption of bait while feeding. Several mammalian species with LAA determinations were considered omnivorous and opportunistic foragers, which decreased the likelihood of rodenticide exposure. Several mammals inhabit the same burrows of target pests, which means they are vulnerable to rodenticide exposure from direct application.

Predictions of the Potential Likelihood of Future Jeopardy

EPA did not predict the potential likelihood of future J for 21 listed mammalian species because there was either low to medium overlap with uses (with the exception of the limited artificial impregnated worm/grub burrow use), or there was high overlap but low likelihood of effects. Therefore, there was low likelihood that the exposure would cause population-level effects.

EPA made LAA determinations and did not predict the potential likelihood of future J for 18 listed mammal species for the limited burrow uses which targeted moles via impregnated artificial worms/grubs. Despite the potential availability of exposed prey, a significant majority of mortalities occurred below ground (82–91%), likely reducing the extent of secondary exposure to occur at the population level (Baldwin *et al*., 2021). There is also lower potential for secondary exposure from these burrow uses because of the shorter half-life of bromethalin, relative to other rodenticides. One additional reason for the no likely future J predictions for the 18 listed mammal species was low overlap with the limited bromethalin impregnated artificial worm/grub burrow use.

EPA made LAA determinations and predicted potential likely future J determinations for 45 listed mammals for bait station uses, and for 30 of those listed mammals from the limited impregnated artificial worm/grub burrow use. The listed mammals exhibited both high MoE and high overlap from bromethalin exposure from bait station uses and the limited impregnated artificial worm/grub burrow use – primary exposure is possible for the predicted J species. Several listed mammalian species are similar to target species, including the deer mice (*Peromyscus* spp.) or pocket gophers (*Thomomys* spp.) and have the potential to enter a bait station or burrow due to size. EPA made LAA determinations for bromethalin with predicted likely J determinations for the Stephens' kangaroo rat (*Dipodomys stephensi)*, which is consistent with the effects determinations EPA made in the pilot memo (USEPA, 2022e).

Table 3-11 presented the listed species effects determinations and predictions of the potential likelihood of future J for bromethalin.

All NLAA/LAA and no J/J determinations and justifications for listed mammals can be found in the listed "Mammals" worksheet in **Appendix B** and **Appendix C** following methodology in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-11. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for Bromethalin[1,2]

Taxon	Number of Species	Initial Determinations across all A.I.'s				Specific Determinations and Predictions Across Use Patterns and by A.I.					
						Bait Station			Burrow		
		NE	MA	NLAA	LAA	NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J
Mammals	100	25	75	22	53	30	21	24	24	18	33
Birds	95	25	70	28	42	54	16	0	54	16	0
Amphibians[3]	47	12	35	0	0	35	0	0	30	5	0
Reptiles[3]	59	25	34	1	29	20	14	0	20	14	0

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.
[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction
[3] "Amphibians" include those species that have both a terrestrial and aquatic phase.
NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.4 Strychnine

3.2.4.1 Introductory Information on Strychnine

EPA signed the FIFRA-based strychnine DRA on June 30, 2020 (USEPA, 2020d). The United States first registered strychnine, an alkaloid compound, in 1947. The sole target pests registered in the U.S. for strychnine are gophers (*Geomyidae* spp.), except in the state of Nevada where a Special Local Need (SLN) registration (also referred to as a Section 24(c) registration) currently allows its use to control the yellow-bellied marmot (*Marmota flaviventris*) and three species of ground squirrel (*Spermophilus* spp.). Strychnine is also sometimes used for the control of invasive animals other than rodents (*e.g.*, feral cats, rabbits) in island eradication projects by federal agencies such as APHIS or USFWS. The federal agencies initiate ESA consultation for each new project (island) under their EPA registrations.

All registered Section 3 strychnine products are formulated as a solid bait. The bait products must be placed either inside underground runways of existing gopher burrows, or into artificial burrows that the gophers are expected to enter. The Section 24(c) product in Nevada is formulated as a paste, which is mixed with bait material (*e.g.,* chopped cabbage or alfalfa) and then placed at least 8 inches in the animal burrow. Baits may be applied in various settings, including residential lawns, other "non-agricultural areas", agricultural cropland, pastures, forestry land, and rangeland. Strychnine does not have any above-ground uses.

Strychnine is a convulsant that acts as a selective competitive antagonist to block post-synaptic glycine receptors predominantly in the central nervous system (USEPA, 2020d). Tetanic convulsions caused by strychnine can lead to rapid asphyxiation and death. Symptoms in mammals can occur within 5 to 30 minutes after ingestion (Borges et al., 1989), with death able to occur within an hour after a lethal exposure (USEPA, 2020).

Based on available toxicity data, strychnine is classified as very highly toxic to birds and mammals on an acute oral exposure basis and highly toxic to birds on a subacute dietary exposure basis. These same data indicate that a broad range of birds and mammals are highly sensitive to strychnine, including passerines, waterfowl, corvids, raptors, rodents, canids, and mustelids, whereas quail (Galliformes) appear to be less sensitive. Therefore, strychnine poses an acute hazard[31] to all terrestrial vertebrate taxa (birds, mammals, reptiles, and amphibians). Chronic effects (*e.g.*, reduced egg production) have also been observed in birds.

The nature of risk to non-target mammals and birds from rodenticides is well-established in the FIFRA-based risk assessments and includes mortality from primary and secondary exposure (*e.g.,* USEPA, 2020d). As strychnine is used for the control of burrowing rodents, which can form a significant proportion of the diet for a number of species, and since the compound is persistent in animal tissues and the environment, it has the potential to be a secondary exposure route for predators that may consume the target species carcasses. Exposure of predators through invertebrates that accumulate strychnine is also possible.

3.2.4.2 General Conclusions from the Incident Analysis

Since 1968, there are 170 strychnine-related wildlife incidents reported in the IDS, with 3 incidents reported as recently as 2020. This indicates that exposure and wildlife incidents have continued to occur even though above-ground uses of strychnine were prohibited by a U.S. Court injunction in 1988 and remain temporarily cancelled. Strychnine incidents are generally based on detection of residues in tissues and corroborating evidence from carcass necropsy or observed tremors in the field. Incident reports include numerous bird and mammal species, primary (*e.g.,* Eastern Bluebird [*Sialia sialis*], American Coot [*Fulica americana*], Eastern Meadowlark [*Sturnella magna*], Blue-winged Teal [*Spatula discors*], Killdeer [Charadrius vociferus], deer, and jack rabbit) and secondary consumers (*e.g.*, Rough-legged hawk [*Buteo lagopus*], Peregrine falcon [*Falco peregrinus*], San Joaquin Kit Fox, eagles, and bear). Collectively, these incidents involve a wide range of species, most of which are primary consumers. Given the large number of unrelated target species involved in some incidents (*e.g.,* 30 blackbirds, 20 mallards), a significant amount of bait was likely applied above-ground, which would represent a misapplication or misuse. For a complete list of affected non-target animals, see the FIFRA-based 2020 DRA (USEPA, 2020d).

3.2.4.3 Defining Spatial Overlap

Strychnine is used to control burrowing rodents in a variety of settings, including residential lawns, other "non-agricultural areas", agricultural cropland, pastures, forestry land, and rangeland. It is only applied via below-ground, burrow insertion. The action area for strychnine is thus represented by the UDL layers Open Space Developed, Other Orchards, Managed Forest, Forest Trees, Rangeland, Cultivated Land, Rights-of-Way, and Pasture (*see* **Section 2.4**).

3.2.4.4 Birds

Toxicity data classifies strychnine as very highly toxic to birds on an acute oral exposure basis and highly toxic on a subacute dietary exposure basis (USEPA, 2020d). A broad range of birds are highly sensitive to strychnine, including passerines, waterfowl, corvids, and raptors, whereas quail (Galliformes spp.) appear to be less sensitive. On a chronic exposure basis, reduced growth and egg production were detected in toxicity tests at concentrations as low as 68.9 mg a.i./kg-diet. Therefore, there is the potential of adverse effects from the use of strychnine for birds.

[31] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

NLAA Determinations

EPA made NLAA determinations for 58 bird species from strychnine use. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA determined as NLAA those species that are likely extinct. Overall, the most impactful modifiers that resulted in NLAA determinations included:

- Since all above ground use is prohibited and bait must be placed 6 inches into the entrance of the burrow and it is not expected for birds to enter the burrow and/or kick out bait therefore exposure is not reasonably expected to occur. There is likely little chance for any significant non-target exposure because the target pest (pocket gopher) quickly wall-off disturbed sections of the burrow (Gene Benbow pers. comms 8/28/2023),
- Species is unlikely to enter into burrow due to size and foraging behavior, and
- Species is not in the CONUS and not expected to overlap with the range for the target pests.

LAA Determinations

EPA made LAA determinations for 12 listed bird species due to the potential for consumption of poisoned target mammals. These species included secondary consumers such as the Northern aplomado falcon (*Falco femoralis septentrionalis*) and the Mexican spotted owl (*Strix occidentalis lucida*).

Predictions of the Potential Likelihood of Future Jeopardy

For the 12 listed bird species identified as LAA, EPA did not predict that any would rise to the potential for likely future J. Despite overlap classifications, EPA made a low MoE classification for these species (*see* **Section 2.6.3**) because although the assessed birds would likely consume just a fraction of a mammal that has consumed its daily diet as strychnine bait or tracking powder, they could receive a dose equivalent to the dose leading to 50% mortality (LD_{50}) and one that exceeds the LOC (0.5) from the consumption of just one mammal. However, the vast majority of mortalities from rodenticide-treated bait burrow uses tend to occur belowground (Baldwin *et al.,* 2021)., likely reducing the extent of secondary exposure that could occur at the population level.

EPA's rationales for effect determinations and predictions of future J for listed birds can be found in the "Birds" worksheet in **Appendix B** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.4.5 Reptiles and Amphibians

Avian toxicity data is used as a surrogate for reptiles and terrestrial-phase amphibians. As mentioned above, strychnine is classified as very highly toxic to birds on an acute oral exposure basis and highly toxic to birds on a subacute dietary exposure basis. These same data indicate that a broad range of birds and mammals are highly sensitive to strychnine, including passerines, waterfowl, corvids, raptors, rodents, canids, and mustelids, whereas quail appear to be less sensitive. Mortality can occur from primary and secondary exposure and strychnine is persistent in animal tissues and the environment (USEPA, 2020d). Therefore, strychnine poses an acute hazard[32] to all animal taxa (birds, mammals,

[32] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

reptiles and amphibians). Chronic effects (*e.g.*, reduced egg production) have also been observed in birds. Potential effects to reptiles and terrestrial-phase amphibians were determined by referencing toxicity data for birds as surrogate data (aquatic amphibians and reptiles were determined to be NE due to a lack of aquatic exposure).

NLAA Determinations

EPA made NLAA determinations for 22 reptile and 30 amphibian species from strychnine use. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA also made NLAA determinations for species that are likely extinct. Overall, the most impactful modifiers that resulted in NLAA determinations included:

- Species specifically consumes invertebrates and does not rely on small mammal burrows (invertebrates do not represent a significant exposure pathway),
- Species is not found in CONUS and not expected to overlap with the range of the target pest,
- Applications are intended to be made to active target pest burrows only; therefore, EPA expected that the species is more likely to go into an active pest target burrow rather than an inactive burrow that might be inhabited by a nontarget species,
- Non-target exposure would not be significant because the primary target pests (*e.g.*, gopher species) can wall off disturbed sections of the burrow (Gene Benbow pers. comms 8/28/2023, Schalau, 2023 and Werner *et al.,* 2005), and
- Species only consumes only other non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians, and reptiles). Since the main dietary item is non-mammalian prey, it is unlikely the species would enter the mammal burrow in search of prey or consume the target species.

LAA Determinations

EPA made LAA determinations for 12 listed reptiles and 5 listed amphibian species from strychnine use because species have the potential to inhabit small mammal burrows and may accidentally consume bait while foraging for invertebrates or the species has the potential to consume poisoned target mammals.

Predictions of the Potential Likelihood of Future Jeopardy

For the 12 listed reptiles classified as LAA, EPA did not predict the potential likelihood for future J for any of the species. Despite overlap classifications, EPA made a low MoE classification for these 12 reptiles because a majority (82–91% per Baldwin *et al.,* 2021) of target species mortalities occur below ground, likely reducing the extent of secondary exposure to occur at the population level. For the 5 listed amphibians classified as LAA, EPA did not predict the potential likelihood for future J. Despite the overlap classifications, EPA made a low MoE determination because invertebrates are not expected to represent a significant exposure route to translate to population level effects and it is unlikely that enough burrows will be treated to result in population level effects.

EPA's predictions of the potential likelihood of future J and justifications for listed reptiles and amphibians can be found in the "Amphibians" and "Reptiles" worksheets in **Appendix B** and the "New species" worksheet in **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.4.6 Mammals

Strychnine is classified as very highly toxic to mammals on an acute oral exposure basis. FIFRA-based risk assessments indicate that mammals are at risk of mortality from the use of strychnine (acute RQs ranging from 64-192). The FIFRA-based 2020 DRA shows that for mammals ranging from 50-3000 g, consuming just a fraction of their daily diet as mammalian prey affected by strychnine would be enough to impart a dose equivalent to the mammal LD_{50} for strychnine and one that exceeds the acute LOC (0.5). There are no 2-generation rat or other chronic toxicity studies available for strychnine to evaluate effects on reproduction or growth in mammals. Although there are no sublethal effects data available, this data gap is not impactful because mortality is the major concern for strychnine.

NLAA Determinations

EPA made NLAA determinations for 24 mammal species from strychnine use. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA also determined species that are likely extinct as NLAA. In addition to the reasons for NLAA described in **Section 2.6.2**, EPA also made NLAA determinations for larger species (*e.g.,* Sonoran pronghorn, *Antilocapra americana sonoriensis* and other listed deer species) that are unlikely to enter a burrow due to their body size (species more than 400 g, approximately the equivalent size of a standard laboratory rat). Additionally, these species are herbivorous; therefore, secondary exposure is not a pathway for these species.

LAA Determinations

EPA made LAA determinations for 51 listed mammals because of similarity to the target species, potential to be in a burrow, or exposure from the consumption of mammalian prey.

Predictions of the Potential Likelihood of Future Jeopardy

EPA predicted the potential likelihood for future J for 33 mammal species from strychnine use based primarily on high overlap with the UDLs selected and high MoE because of similarity to target pest and potential to be in a burrow (*see* **Sections 2.4** and **2.6.3**). These include several species of gophers, kangaroo rats, ground squirrels, beach mice, rabbits, voles, one chipmunk (*i.e.*, Penasco least chipmunk; *Tamias minimus atristriatus*), and one prairie dog (Utah prairie dog; *Cynomys parvidons*).
For the remaining 18 listed LAA mammals EPA did not predict the potential likelihood of future J because of either low overlap or a low MoE (primarily based on the reasoning that the vast majority of mortalities occurred below ground which significantly reduced the extent of secondary exposure at the population level).

EPA's predictions of the potential likelihood of future J and justifications for listed mammals can be found in the "Mammals" worksheet in **Appendix B** and the "New species" and "UDL_update (species)" worksheets in **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-12 summarizes the number of listed species determinations and predictions of the potential likelihood of future J for all taxa from strychnine.

Table 3-12. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for Strychnine (Burrow)[1,2]

Taxon	Number of Species	NE	NLAA	LAA, No J	LAA, J
Mammals	100	25	24	18	33
Birds	95	25	58	12	0
Amphibians[3]	47	12	30	5	0
Reptiles	59	25	22	12	0

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.
[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species.
https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction
[3] "Amphibians" include those species that have both a terrestrial and aquatic phase.
NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.5 Cholecalciferol

3.2.5.1 Introductory Information on Cholecalciferol

EPA signed the FIFRA-based DRA for cholecalciferol on March 31, 2020 (USEPA, 2020c). In 1984, the United States first registered cholecalciferol (3β,5*Z*,7*E*)-9,10-secocholesta-5,7,10(19)-trien-3-ol), a sterol also known as vitamin D3 that is used as a rodenticide. Based on the FIFRA-based DRA, the parent compound cholecalciferol is the sole residue of concern for assessing risk. Cholecalciferol may be applied as pellets or bait blocks, which must be placed inside tamper-proof bait stations if used above-ground. Below-ground, cholecalciferol can be placed in rat burrows in pellet-form. Labeled target species for cholecalciferol are Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), and house mice (*Mus musculus*). Ingestion results in hypercalcemia due to mobilization of calcium from bone matrix into blood plasma (Pelfrene, 1991) leading to metastatic calcification of soft tissues (Fraser, 1995).

Based on available toxicity data, cholecalciferol may be considered practically non-toxic to birds on an acute oral exposure basis but is slightly to highly toxic to birds on a subacute dietary exposure basis. Additionally, according to the Wildlife Exposure Factors Handbook (USEPA, 1993), the daily food intake for birds ranges from 5.1 to 141 g/day. In comparison, the concentration leading to 50% mortality (LC_{50}) from the acute dietary toxicity study with bobwhite quail was 495 mg a.i./kg-diet (USEPA, 2020) and is well above levels of daily food intake, indicating low likelihood of toxicity to birds on a subacute dietary exposure basis. The compound is highly toxic to mammals on an acute oral exposure basis (USEPA 2020). Exposure to non-target birds and mammals is expected to be minimal when cholecalciferol is used according to label instructions (*i.e.*, mandatory placement of pellets or bait blocks inside tamper-proof bait stations or below-ground placement of pellets inside rodent burrows with mandatory retrieval of unconsumed bait). However, although label language may help to reduce the likelihood of exposure for non-target organisms, it is not precluded by label statements. Since chronic toxicity data are not available, the likelihood of adverse effects from repeated exposure to cholecalciferol cannot be fully characterized.

Acute RQs for cholecalciferol exceed the acute LOC of 0.5 for mammals. However, acute RQs for birds, which serve as surrogates for reptiles and terrestrial-phase amphibians, do not exceed the acute risk LOC. Chronic toxicity data are not available for terrestrial vertebrates; therefore, the likelihood of adverse effects from chronic exposure has not been quantified. Additionally, secondary exposure from consumption of cholecalciferol-affected target species is uncertain but expected to be low (USEPA, 2020c). Non-target plants and animals other than birds and mammals, including aquatic organisms, terrestrial plants and terrestrial invertebrates are not expected to be at risk from use of cholecalciferol due to a lack of exposure (USEPA, 2020c).

3.2.5.2 General Conclusions from the Incident Analysis

Registrants of cholecalciferol have reported a substantial number of incidents of domestic animal poisoning for cholecalciferol. As of the FIFRA-based 2020 DRA, there was one wildlife incident for cholecalciferol in the IDS database in which a juvenile female striped skunk was found in a dumpster in Corte Madera, California (Incident# I029093) on May 22, 2016. A rehabilitation center treated the affected animal with fluids and antibiotics; however, due to the severity of its condition (lethargic and inability to stand), they later euthanized the animal. The liver showed detection of cholecalciferol at >2.6 mg/kg. As of the 2020 DRA, there were no reported aggregate incidents for wildlife or plants.

3.2.5.3 Defining Spatial Overlap

Cholecalciferol is used to control commensal rodents in and around human-made structures. It has no agricultural uses. It is sold in bait stations and is available to the public; therefore, the action area for cholecalciferol is understood to be areas of human habitation. This is represented by Developed and Open Space Developed UDL layers, which cover large portions of CONUS and NL48 (*see* **Section 2.4**). Lastly, for the purposes of this assessment, bait box uses are assumed to be protective of burrow uses as all cholecalciferol labels require outdoor applications to be within 100 feet of man-made structures; therefore, species effects determinations and predictions of the potential likelihood of future J were not considered separately for burrow uses.

3.2.5.4 Birds

In both studies with bobwhite quails (*Colinus virginianus*) and mallard ducks (*Anas platyrhynchos*), the 14-d LD_{50} values are >2,000 mg/kg bw and would classify cholecalciferol as practically non-toxic on an acute oral exposure basis (USEPA, 2020). On a sub-acute dietary exposure basis, cholecalciferol may be classified as slightly to highly toxic to birds. In an acute dietary study with the Mallard, the LC_{50} value was 1,178 mg a.i/kg diet (slightly toxic), whereas in a sub-acute dietary study with the Bobwhite, the LC_{50} value was 495 mg a.i./kg-diet (highly toxic). No data are available to assess avian chronic toxicity from exposure to cholecalciferol. EPA generally considers exposure of birds to current uses of cholecalciferol as unlikely based either on bird behavior (unlikely to enter bait station) or body size (too large to enter bait station).

NLAA Determinations

Due to low toxicity of cholecalciferol to birds on a dose-basis and a low likelihood of consuming enough bait on a daily basis to meet dietary levels of effect, EPA made NLAA determinations for this taxon for cholecalciferol. The cholecalciferol NE and NLAA determinations for birds can be found in the “Birds” worksheet in **Appendix B** and are summarized in **Table 3-13**.

3.2.5.5 Reptiles and Amphibians

As discussed in **Section 2.6.1**, EPA made NE determinations for all fully aquatic species or those in the aquatic-based food web. For the remaining species, since birds are surrogates for terrestrial-phase amphibians and reptiles and cholecalciferol is of relatively low toxicity to birds (*see* **Section 3.2.5.4**), EPA made NLAA determinations for all reptiles and terrestrial-phase amphibians. The cholecalciferol NE and NLAA determinations for reptiles and amphibians can be found in the "Amphibians" and "Reptiles" worksheets in **Appendix B** and the "New species" worksheet in **Appendix C** and are summarized in **Table 3-13**.

3.2.5.6 Mammals

With a rat LD_{50} of 11.8 mg a.i./kg bw, cholecalciferol is classified highly toxic to mammals on an acute oral exposure basis. Therefore, cholecalciferol poses an acute hazard[33] to all mammals that might consume it. According to the FIFRA-based 2020 DRA, primary exposure RQ values for mammals consuming bait range from 1.34 to 24, depending on body weight. According to the DRA, effects to secondarily exposed mammals are possible, but the data to support this route of exposure are limited.

EPA predicted the potential likelihood of future J for mammal species whose range includes Developed or Open Space Developed UDLs, and which are small enough to enter bait stations (house mouse size or smaller) or burrows. This prediction rests on the assumption that a significant number of individuals of a given listed species and size could enter bait stations and/or burrows and consume cholecalciferol to cause population-level effects.

EPA's rationales for effect determinations and predictions of the potential likelihood of future J for mammals can be found in in **Appendix B** and **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

NLAA Determinations

EPA made NLAA determinations for 30 mammal species from cholecalciferol use (*see* **Table 3-13**). An assessment of the likelihood of direct effects and exposure occurring based on different habitat characteristics drove EPA's NLAA determinations. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA also determined species that are likely extinct as NLAA. NLAA determinations resulted from a low likelihood that species will be exposed in multiple feedings on rodent prey.

LAA Determinations

EPA made LAA determinations for a total of 45 listed mammal species primarily based on similarity to target pest, small body size and the potential to consume mammalian prey.

[33] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

Predictions of the Potential Likelihood of Future Jeopardy

Of the 45 total LAA species, EPA predicted the potential likelihood of future J for 24 mammal species from cholecalciferol use due to a high MoE (similarity to target pest; *see* **Section 2.6.3**) and high or medium overlap with the UDLs selected to represent cholecalciferol use (*see* **Sections 2.4** and **3.2.5.3)**. These species include several species of pocket gophers, kangaroo rats, beach mice, and one shrew (Buena Vista Lake ornate shrew; *Sorex ornatus relictus*).

For the remaining 21 LAA species, EPA did not predict the potential likelihood of future J due to either low overlap or a low MoE due to cholecalciferol having a low likelihood of effect from secondary poisoning (*see* **Sections 2.4** and **2.6.3**).

EPA's rationales for effect determinations and predictions of future J for listed mammals can be found in **Appendix B** and **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-13 summarizes the number of listed species determinations and predictions of the potential likelihood of future J for all taxa from cholecalciferol.

Table 3-13. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for Cholecalciferol (Bait Station)[1,2]

Taxon	Number of Species	NLAA	LAA, No J	LAA, J
Mammals	100	30	21	24
Birds	95	70	0	0
Amphibians[3]	47	35	0	0
Reptiles	59	34	0	0

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species. The details on these can be found in **Appendix B** and **Appendix C**.
[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction
[3] "Amphibians" include those species that have both a terrestrial and aquatic phase.
NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

3.2.6 Zinc Phosphide

3.2.6.1 Introductory Information on Zinc Phosphide

EPA signed the FIFRA-based zinc phosphide (ZnP) DRA in June 24, 2020 (USEPA, 2020e). Zinc phosphide is an inorganic rodenticide used to control gophers, mice, rats, lagomorphs (*e.g.*, jack rabbits), prairie dogs, and squirrels. The USDA first registered zinc phosphide as a pesticide in the U.S. in 1947. Zinc phosphide formulations include dusts intended for mixing into baits, solid baits, and tracking powders, which may be applied as a ground or aerial broadcast treatment. Registered uses include: indoor and outdoor residential and agricultural areas (including in and around homes, lawns, bulbs, in and around outside buildings/barns, and rights-of-ways/fencerows/ hedgerows), indoor and outdoor commercial or institutional premises and equipment, golf courses, and reforestation areas. To minimize exposure of children to rodenticide products used in homes, EPA requires that all rodenticide bait products marketed to general and residential consumers be sold only with bait stations (USEPA, 2008). All zinc phosphide products labeled for field use (except those limited to underground baiting for pocket gophers and moles) are restricted use pesticides (RUP) and may only be applied by certified applicators (USEPA, 2008).

EPA made effects determinations for chlorophacinone and diphacinone based on bait station, burrow, and broadcast uses. EPA considers the effects determinations for broadcast use of those two chemicals to be representative of those for the scatter/spot treatments because the amount of bait put on the landscape surface during a scatter/spot treatment should be equally as lethal to non-target primary consumers as that for a broadcast application and the bait should be equally accessible to those species for both types of application. EPA expects to further discuss this with USFWS during consultation.

Furthermore, bait station uses are permitted in some agricultural areas. Although, EPA made effects determinations for bait station use for non-agricultural areas, the effects determinations for broadcast use and/or scatter/spot treatments are inclusive of bait station uses in the same location. That said, bait stations use instead of broadcast use in these locations would reduce the exposure to primary consumer terrestrial vertebrates that cannot access the bait within the stations, meaning that there is potentially no J for those species that EPA predicted to have potential likelihood of J for broadcast uses at the same locations. EPA believes effects determinations for secondary consumers are the same in agricultural field settings whether the bait is applied by broadcast or in a bait station. EPA expects to further discuss this with USFWS during consultation.

Zinc phosphide's mode of pesticidal action is via an acid hydrolysis reaction that produces phosphine (PH_3), a toxic gas. After ingestion, reactions in the gut result in PH_3 release and absorption into the digestive tract (USEPA, 2020e). The residues of concern for zinc phosphide are the parent compound and phosphine gas (particularly within the gut of an animal). Phosphine is expected to form once zinc phosphide is ingested; therefore, exposures and toxicity are assessed by considering consumption of zinc phosphide formulated products. Zinc phosphide that is not ingested by target or non-target organisms would be slowly converted into phosphine gas by hydrolysis under environmentally relevant pH conditions where zinc phosphide is applied. Phosphine gas released slowly in the environment under relatively neutral pH conditions is expected to dissipate in the atmosphere or adsorb to soils before it can reach levels of toxicological concern.

Based on available toxicity data, zinc phosphide is highly toxic to birds and mammals on an acute oral and sub-acute dietary exposure basis. Other than acute and sub-acute toxicity data for birds and mammals, no other toxicity data are available for zinc phosphide. The FIFRA-based 2020 DRA assessed risk to birds and mammals from zinc phosphide exposure by considering primary (via direct consumption by non-target animals of formulated products containing zinc phosphide) and secondary exposure (via consumption of target mammals that have consumed zinc phosphide formulated products).

The main effects from zinc phosphide are generally from direct primary consumption. Secondary effects due to consumption of target species by predators and scavengers is less of a concern than with other rodenticides because zinc phosphide decomposes readily in the digestive tract and does not accumulate in muscles. Furthermore, zinc phosphide's emetic effect (useful since most rodent species are less capable of vomiting) and a tendency for predators to avoid digestive tracts containing this pesticide may reduce both primary and secondary exposure. Lastly, mortality in target species occurs soon after consumption (less than one day; USEPA, 2020e). Labels for the outdoor broadcast uses of zinc phosphide held by the APHIS generally require that zinc phosphide not be used near occupied ranges of numerous listed species to reduce exposure to non-target species.

The FIFRA-based DRA presents multiple lines of evidence to indicate that zinc phosphide poses a risk of mortality to birds, terrestrial-phase amphibians, reptiles and mammals from both primary and secondary exposure to zinc phosphide, including; 1) bait formulations of zinc phosphide (*e.g.*, treated oats) are expected to be attractive to birds and mammals and possibly some reptiles, 2) zinc phosphide is broadcast in agricultural areas where non-target wildlife, including where birds, terrestrial-phase amphibians, reptiles and mammals are likely to visit, 3) dietary (RQ=43) and dose-based (RQ range: 70-546) screening-level risk estimates for birds consuming bait (RQ = 43) exceed the acute risk LOC of 0.5 by orders of magnitude, 4) dose-based RQs (range: 38-85) exceed the acute risk LOC by orders of magnitude for mammals, and 5) only a small fraction of a daily diet is needed to reach the LD_{50} for birds and mammals (>1.4%-2.6%).

3.2.6.2 General Conclusions from the Incident Analysis

Fifty-seven incident reports are available in the IDS for zinc phosphide documenting bird mortalities, which are assumed to be from consuming bait (USEPA, 2020e). In total, the reported incidents involve mortalities of thousands of birds associated with bait. More than half of those incidents have been reported since the RED in 1998, with six incidents occurring within the last five years. Separate incidents reported in 2015 and 2016 involved the deaths of thousands and hundreds of snow geese (respectively). Three incident reports are available documenting mortalities of non-target mammals which are assumed to be from consuming bait. Two additional incidents may be associated with primary or secondary consumption. Most of the incident reports have a certainty index of highly probable or probable, indicating a high degree of confidence that they were associated with zinc phosphide exposure. 2008 is the date of the most recent mammalian mortality incident. Sixty-three incident reports of registered use or unknown legality (39 highly probable) for zinc phosphide indicate that affected birds were likely exposed by primary consumption, as none of the species affected were predators of mammals (USEPA, 2020e). The majority of the mortalities were turkeys (hundreds) and geese (thousands). These reports confirm primary exposure and adverse effects in birds. There were fewer (six) incident reports for mammals, including raccoon, red fox and gray squirrel. Of the 25 reported mortalities, 20 were gray squirrels. The incident report confirmed that the single red fox incident resulted from secondary exposure from consumption of dead mice. Overall, these incidents do not provide strong support of effects to mammals from secondary exposure; however, evidence of effects from primary exposure to non-target mammals is more evident by the squirrel incidents.

3.2.6.3 Defining Spatial Overlap

Zinc phosphide is used to control commensal rodents in and around human-made structures. It is applied using bait stations, as well as broadcast and burrow insertion in agricultural areas. The action area for zinc phosphide is thus understood to be areas of human habitation, cropland, managed forest, rangeland, rights-of-way, *etc*. Zinc phosphide use is represented by the UDL layers Developed, Open Space Developed, Nurseries, Managed Forest, Christmas Trees, Forest Trees, Rangeland, Cultivated Land, Rights-of-Way, and Pasture. Bait station uses are represented by Open Space Developed and Developed UDLs (*see* **Section 2.4**).

3.2.6.4 Birds

The FIFRA-based DRA concluded that zinc phosphide poses an acute hazard[34] to all terrestrial vertebrates that might consume it (USEPA, 2020e). Primary exposure RQs for mammals calculated on dose-basis ranged from 38 to 85 (USEPA, 2020e). For birds, primary exposure RQs calculated on a dose- and dietary-basis ranged from 43 to 546.

Effects to secondarily exposed birds are possible (dietary-based RQs 1.3-8.3), but only if 1) the entire carcass including gut contents is consumed and 2) too little time (<1 hour) has passed for the zinc phosphide to have completely reacted in the gut. Overall, effects to secondary and tertiary consumers are considered unlikely due to the reactive nature and non-persistence of zinc phosphide. However, secondary consumers that often consume some prey items whole (*e.g.,* owls and some other raptors) or whose diet is significantly composed of target species (*e.g.,* species that are obligate consumers of target species) may be exposed.

Exposures to zinc phosphide used in bait stations is considered likely only for small mammals, since the bait stations are designed to be attractive to rodents. Exposure of birds to zinc phosphide used in bait stations is considered unlikely either on behavioral (unlikely to enter bait station) or body size (too large to enter bait station). Exposures from broadcast or in-burrow uses are possible for all vertebrates that might visit the agricultural or other outdoor use sites. Such species are LAA on the basis of exposure of at least one individual.

Burrow baiting with zinc phosphide can include the placement of bait at or near the surface of the burrow and the exposure potential has elements of both the broader bins of broadcast and burrow. For birds, EPA only made predictions of the potential likelihood of future J for broadcast use. EPA considered it unlikely that a primary consumer bird would enter a burrow and routinely feed around the openings of active burrows to rise to the level of a population-level effect.

NLAA Determinations (Bait Stations)

EPA made NLAA determinations for 54 listed bird species from zinc phosphide bait station use. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA determined species that are likely extinct as NLAA. Overall, the most impactful modifiers that drove EPA NLAA determinations included:

- Species is a primary consumer and the species' main dietary items are extremely unlikely to be contaminated with bait because the bait is specifically contained within the bait station,
- Species is extremely unlikely to enter the bait station opening, and
- For those species that consume invertebrates, since the bait is contained within the station, invertebrates are not expected to represent a significant exposure pathway.

NLAA Determinations (Burrow Applications)

EPA made NLAA determinations for 54 listed bird species from zinc phosphide as a burrow application. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably

[34] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition, EPA determined species that are likely extinct as NLAA. Overall, the most impactful modifiers that drove EPA NLAA determinations included:

- Bait must be placed 6 inches into the entrance of the burrow and it is not expected for birds to enter the burrow and/or kick out bait; therefore, exposure is not reasonably expected to occur, and
- Species is unlikely to enter the burrow due to its size and foraging behavior.

NLAA Determinations (Broadcast Applications)

EPA made NLAA determinations for 28 listed bird species for broadcast uses of zinc phosphide following the modifiers described in **Section 2.6.2**. Overall, the most impactful modifiers that drove these NLAA determinations included:

- Species endemic to an island/island system where exposure is unlikely to occur; and/or,
- Species' diet primarily composed of non-mammal food items such as flying invertebrates which are unlikely to be found on the ground where bait is located.

LAA Determinations (Bait Station)

EPA made LAA determinations for 16 listed bird species for bait station uses primarily based on the consumption of poisoned mammals.

LAA Determinations (Burrow)

EPA made LAA determinations for 16 listed bird species for bait station uses primarily based on the consumption of poisoned mammals.

LAA Determinations (Broadcast)

EPA made LAA determinations for 42 listed bird species primarily based on the potential to consume small mammals and the potential for incidental exposure while the species is foraging on the ground for seeds and other food items.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station)

Of the 16 LAA listed bird species, EPA did not predict the potential likelihood of J for any of the species. Despite overlap classifications, these 16 birds had a low MoE because RQs range from 1.3-8.3 based on consumption contaminated prey (100% of diet). However, for secondary poisoning, is the likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes.

Predictions of the Potential Likelihood of Future Jeopardy (Burrow)

Similar to bait station conclusions, of the 16 LAA listed bird species, EPA did not predict the potential likelihood of J for any of the species. Despite overlap classifications, these 16 birds had a low MoE because RQs range from 1.3-8.3 based on consumption contaminated prey (100% of diet) and EPA determined that the species being considered were unlikely to enter the burrows of target species. However, for secondary poisoning, the likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes.

Predictions of the Potential Likelihood of Future Jeopardy (Broadcast)

Of the 42 LAA listed bird species, EPA predicted the potential likelihood of J for 26 of these species from broadcast applications of zinc phosphide primarily based on a high MoE for primary consumers and either a high or medium overlap with the species range and UDLs selected to represent zinc phosphide broadcast use (*see* **Sections 2.4** and **2.6.3**).

For the remaining 16 LAA species, EPA did not predict the potential likelihood of J because of either low overlap or a low MoE. EPA made a low MoE classification for all secondary consumers because the likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes (*see* **Section 2.6.3**).

EPA's rationales for effect determinations and predictions of future J for listed birds can be found in the "Birds" worksheet in **Appendix B** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.6.5 Reptiles and Amphibians

As mentioned above, zinc phosphide poses an acute hazard[35] to all vertebrates by which it may be consumed. There is a high MoE for birds, and thus for taxa represented by birds (*i.e.*, reptiles and terrestrial-phase amphibians) as well. Exposures from broadcast or in-burrow uses are possible for all vertebrates that might visit the agricultural or other outdoor use sites. EPA determinations for reptiles and terrestrial-phase amphibians referenced toxicity data for birds as surrogate (aquatic amphibians and reptiles were determined to be NE due to a lack of aquatic exposure).

EPA's rationales for effect determinations and predictions of future J for listed reptiles and amphibians can be found in **Appendix B** and **Appendix C** following the methods in **Section 2**. MoE risk modifiers followed the methods in **Section 2.6.3**.

NLAA Determinations (Bait Stations)

EPA made 35 NLAA determinations for listed amphibian species and 20 NLAA determinations for listed reptile species from zinc phosphide use in bait stations. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). Overall, the most impactful modifiers that drove EPA NLAA determinations were:

- Species only consumes only other non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians, and reptiles). Since the main dietary item is non-mammalian prey, it is unlikely the species would enter the mammal burrow in search of prey or consume the target species.

[35] Hazard only reflects relative toxicity. The hazard is not synonymous with likely effects to individuals or populations because it does not consider the likelihood or magnitude of exposure.

- For those species that consume invertebrates, since the bait is contained within the station, invertebrates are not expected to represent a significant route of exposure.

NLAA Determinations (Burrow Application)

EPA made 30 NLAA determinations for listed amphibians and 20 NLAA determinations for listed reptiles for zinc phosphide use in burrows. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**) or if the species is presumed to be extinct (*i.e.,* Culebra Island giant anole; *Anolis roosevelti*). Overall, the most impactful modifiers that drove EPA NLAA determinations were similar to those for bait station use and included:

- Species only consumes only other non-mammalian terrestrial vertebrate prey (*e.g.*, birds, amphibians, and reptiles). Since the main dietary item is non-mammalian prey, it is unlikely the species would enter the mammal burrow in search of prey or consume the target species,
- Applications are intended to be made to active target pest burrows only, it is more likely to go into an active pest target burrow rather than an inactive burrow that might be inhabited by a nontarget species. In addition, EPA anticipated that this species only use their own burrows (USFWS, 1993), and
- Species specifically consumes invertebrates and does not rely on small mammal burrows.

LAA Determinations (Bait Station)

EPA made 14 LAA determinations for listed reptiles and 0 LAA determinations for listed amphibians for zinc phosphide bait station use. LAA determinations in reptiles are based on the potential for a species to consume poisoned mammals.

LAA Determinations (Burrow)

EPA made 14 LAA determinations for listed reptiles and 5 LAA determinations for listed amphibians for zinc phosphide use in burrows. LAA determinations are based on the potential for a species to consume poisoned mammals and/or the potential for a species to utilize a small mammal burrow.

LAA Determinations (Broadcast)

EPA made 25 LAA determinations for listed reptiles and 12 LAA determinations for listed amphibians for zinc phosphide use in burrows. The LAA determinations are based on the potential for a species to consume poisoned mammals and/or potential for incidental exposure to the bait while foraging on the ground for seeds and other food items.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station)

Of the 14 LAA listed reptiles, EPA did not predict the potential likelihood of future J for any of the species. Despite overlap, EPA made a low MoE classification because:

- Zinc phosphide is rapidly converted to phosphine gas in the GI tract and by the time the reptile completely digests its prey, it is extremely unlikely that there would be enough phosphine gas available to cause effects at a population level,
- Species consumes a wide variety of non-mammalian prey (*e.g.,* Alligator snapping turtle, *Macrochelys temmincki* and the American crocodile, *Crocodylus acutus*),

Since EPA did not make any LAA determinations for amphibians from zinc phosphide bait station use no further analysis was conducted.

Predictions of the Potential Likelihood of Future Jeopardy (Burrow)

Of the 14 LAA listed reptiles and 5 LAA listed amphibians EPA did not predict the potential likelihood of future J for any of the species. Despite overlap, EPA made a low MoE classification for the similar reasons described for bait box use. However, for the 5 amphibians classified as LAA, EPA also made a low MoE classification because they all consume invertebrates, and they are not expected to be a significant exposure route and it is highly unlikely enough burrows will be treated to result in an effect at the population level.

Predictions of the Potential Likelihood of Future Jeopardy (Broadcast)

Of the 25 LAA listed reptiles and 12 LAA listed amphibians, EPA did not predict the potential likelihood of future J for any of the species from broadcast applications of zinc phosphide. Despite overlap, EPA made a low MoE classification (*see* **Section 2.6.3**) because:

- Secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes,
- Species consumes a wide variety of non-mammalian prey (*e.g.,* Alligator snapping turtle, *Macrochelys temmincki* and the American crocodile, *Crocodylus acutus*), and
- Species mainly feeds on foliage, seeds, and fruits of grasses and forbs in an area of about 150 feet surrounding burrows and because it is herbivorous is less likely to directly consume bait that has been broadcast on the ground and translate into a population-level effect (*i.e.,* Gopher tortoise, *Gopherus agassizi*); and/or,
- Species consumes invertebrates (*i.e.,* amphibians) and invertebrates are not expected to represent a significant exposure route and translate to population level effects; therefore, accidental ingestion of bait while foraging is not expected to result in population-level effects.

EPA's predictions of the potential likelihood of future J and justifications for listed reptiles and amphibians can be found in **Appendix B** and **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

3.2.6.6 Mammals

Screening-level dose-based RQ values for mammals for zinc phosphide (38-85) exceed the acute LOC by orders of magnitude. Additionally, only a small fraction of a daily diet for a mammal is needed to reach a median lethal dose (>2.6% would exceed the LD_{50}) or to exceed the LOC (>1.3% would exceed the LOC). Exposures to zinc phosphide used in bait stations is considered likely only for small mammals, since the bait stations are designed to be attractive to small rodents. Exposures from broadcast or in-burrow uses are possible for all vertebrates that might visit the agricultural or other outdoor use sites. As with birds, effects to secondarily exposed mammals are possible; however, this again this depends on consumption of the poisoned animal before all the consumed zinc phosphide has dissipated as a gas as a result of hydrolysis. Overall, EPA considers effects to secondary and tertiary consumers improbable due to the reactive nature and non-persistence of zinc phosphide. However, secondary consumers that consume their prey whole or whose diet is significantly composed of target species (*e.g.*, species that are obligate consumers of target species) may be exposed.

NLAA Determinations (Bait Stations)

EPA made 30 NLAA determinations for listed mammals for zinc phosphide use in bait stations. EPA made NLAA determinations for species that inhabit areas where exposure is not reasonably expected to occur at levels that could cause effects (*see* **Section 2.6.2**). In addition to the reasons for NLAA described in **Section 2.6.2**, EPA also made NLAA determinations for larger species (*e.g.,* Sonoran pronghorn, *Antilocapra americana sonoriensis* and other listed deer species) that unlikely to enter a bait station due to their body size (species more than 400 g, approximately the equivalent size of a standard laboratory rat). Additionally, these species are herbivorous; therefore, EPA does not anticipate secondary exposure to the rodenticides.

NLAA Determinations (Burrow)

EPA made 24 NLAA determinations for zinc phosphide use in burrows. In addition to the reasons for NLAA described in **Section 2.6.2**, EPA also made NLAA determinations for larger species (*e.g.,* Sonoran pronghorn, *Antilocapra americana sonoriensis* and other listed deer species) that unlikely to enter a burrow due to their body size (species more than 400 g, approximately the equivalent size of a standard laboratory rat). Additionally, these species are herbivorous; therefore, EPA does not anticipate secondary exposure to the rodenticides.

NLAA Determinations (Broadcast)

EPA made 21 NLAA determinations for zinc phosphide broadcast for species where exposure is not reasonably expected to occur based on the reasons for NLAA described in **Section 2.6.2**.

LAA Determinations (Bait Station)

EPA made 45 LAA determinations for listed mammals from zinc phosphide use in bait stations primarily based on similarity to target pest, small body size (that would allow entry into the bait station), and species consumes mammals.

LAA Determinations (Burrow)

EPA made 51 LAA determinations for listed mammals from zinc phosphide use in burrows primarily based on similarity to target pest, the species has a potential to be in a burrow, or the species consumes mammals.

LAA Determinations (Broadcast)

EPA made 54 LAA determinations for listed mammals from zinc phosphide use in burrows. The LAA determinations are based on the potential for a species to consume poisoned mammals and/or potential for incidental exposure to the bait while foraging on the ground for seeds and other food items, and similarity to the target pest.

Predictions of the Potential Likelihood of Future Jeopardy (Bait Station)

Of the 45 LAA mammals, EPA predicted the potential likelihood of future J for 24 listed mammals from zinc phosphide use in bait stations. These species had a high MoE due to similarity to target pest and a high overlap and included listed gophers, kangaroo rats and beach mice.

For the remaining 21 LAA listed mammals, EPA did not predict the potential likelihood for future J because of a low overlap or low MoE (*see* **Section 2.4** and **2.6.3**). EPA made a low MoE classification for all secondary consumers because secondary poisoning from zinc phosphide is uncommon and it is not as persistent as other chemical classes.

Predictions of the Potential Likelihood of Future Jeopardy (Burrow)

Of the 51 LAA determinations for listed mammals, EPA predicted the potential likelihood of future J for 33 species from zinc phosphide burrow uses. This was based on a high MoE due to similarity to target pest and potential for species to be in a burrow and a medium or high overlap.

For the remaining 18 LAA listed mammals, EPA did not predict the potential likelihood of future J from zinc phosphide burrow uses. This was based on either low overlap or a low MoE. Of the 18 species, 15 are secondary consumers and EPA made a low MoE classification for all secondary consumers because the likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes (*see* **Section 2.6.3**).

Predictions of the Potential Likelihood of Future Jeopardy (Broadcast)

Of the 54 LAA listed mammals, EPA predicted the potential likelihood of future J for 35 species. This was based on a high MoE due to similarity to target pest and a medium or high overlap.
For the remaining 19 listed LAA mammals EPA did not predict the potential likelihood of future J. This was based on low overlap or a low MoE. EPA made a low MoE classification for all secondary consumers because the likelihood of effect is dependent in part on the consumption of the GI tract of the poisoned animal by the predator or scavenger and secondary poisoning from of zinc phosphide is uncommon given that the compound is not as persistent compared to other rodenticide classes (*see* **Section 2.6.3**).

EPA's rationales for effect determinations and predictions of future J for listed mammals can be found in **Appendix B** and **Appendix C** following the methods in **Section 2.6**. MoE risk modifiers followed the methods in **Section 2.6.3**.

Table 3-14 summarizes the number of listed species determinations and predictions of the potential likelihood of future J for all taxa from zinc phosphide.

Table 3-14. Number of Listed Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy for Zinc Phosphide[1,2]

Taxon	Number of Species	NE	Bait Station			Burrow			Broadcast		
			NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J	NLAA	LAA, No J	LAA, J
Mammals	100	25	30	21	24	24	18	33	21	19	35
Birds	95	25	54	16	0	54	16	0	28	16	26
Amphibians[3]	47	12	35	0	0	30	5	0	23	12	0
Reptiles	59	25	20	14	0	20	14	0	9	25	0

N/A = Not a Registered Use Pattern

[1] EPA made effects determinations and predictions of the potential likelihood of future jeopardy for listed species and the details on these can be found in **Appendix B** and **Appendix C**.

[2] Reflects listed species current as of Oct. 2024. This includes accounting for delisted species. https://www.fws.gov/press-release/2023-10/21-species-delisted-endangered-species-act-due-extinction

[3] "Amphibians" and "Reptiles" include those species that have both a terrestrial and aquatic phase.

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; J = Jeopardy

4 Critical Habitat Effects Determinations Results

This assessment includes 927 listed species with CHs. Among those, there are 147 CHs for the taxonomic groups with potential direct effects or effects to PPHD; that is, birds, reptiles, amphibians, and mammals. For those CH, USFWS is responsible for 124, NMFS is responsible for 13, and both Agencies are responsible for the remaining ten.

Section 2.7 of this assessment explains the method used to make effects determinations for CHs. The rationales for the NE, MA, NLAA and LAA determinations and predictions of potential likelihood of future AM made for CH are found in the "Critical Habitat" worksheet in **Appendix B** and **Appendix C**. The major considerations included:

- overlap of the CH and exposure area by the UDLs that represent rodenticide use areas,
- availability of mammalian prey, and
- terrestrial habitat quality (availability of burrows).

4.1 No Effect (NE) Determinations

NE determinations for CH are based on areas where exposure is not reasonably expected to occur at levels that could cause effects. Habitat modification and effects on PPHD are not expected to occur for plants, fish, or invertebrates; therefore, these taxa received NE determinations.

The most common risk modifiers for NE determinations included:

- CH with < 1% overlap with all UDLs and
- CH areas where exposure is not reasonably expected to occur at levels that could cause effects (*e.g.,* estuarine/marine habitats or habitats of species in the aquatic food web).

In total, EPA made a NE determination for 878 of the species CHs.

The NE determinations and justifications for CH can be found in the “Critical Habitat” worksheet in **Appendix B** and **Appendix C**.

4.2 May Affect (MA) Determinations

For all CHs with MA determinations, overlap was >1%. EPA made a MA determination if a species consumes terrestrial mammalian prey, uses burrows, or has a PBF associated with either of those. EPA used best available information for six species (three mammals, two birds, and one reptile) with undefined PBFs.

In total, EPA made a MA determination for 49 of the species CHs.

The MA determinations and justifications can be found in the “Critical Habitat” worksheet in **Appendix B** and **Appendix C** and follows the methodology described in **Section 2.7**. For all CH determined by EPA as MA, risk modifiers were applied, and CHs were then determined as NLAA or LAA.

4.2.1 Not Likely to Adversely Affect (NLAA) Determinations

EPA’s NLAA determinations were driven by an assessment of the likelihood of effects to PPHD and exposure occurring based on different habitat characteristics. EPA made a NLAA determination for CH if the availability of mammalian prey and burrow use were part of the species PPHD (based on the EFED life history database), but the USFWS did not indicate that availability of small mammal prey or burrow use were relevant (*i.e.,* based on methodology in Appendix L of the malathion BiOp) EPA used best available information about mammal prey and burrow use for the CH of six species determined to be MA (three mammals, two birds, and one reptile) with undefined PBFs.

In total, EPA determined that 9 of the MA species CHs are NLAA, all lacking PBFs for mammal prey or burrow use or information suggesting their importance in cases where PBF’s were undefined.
NLAA determinations and justifications can be found in the “Critical Habitat” worksheet in **Appendix B** and **Appendix C**. NLAA determinations followed the methodology outlined in **Section 2.7**.

4.2.2 Likely to Adversely Affect (LAA) Determinations

EPA’s LAA determinations were based on a CH having a PBF for mammal prey or burrow use and >1% spatial overlap of UDLs and CH. EPA used best available information about mammal prey and burrow use for the CH of six species determined to be MA (three mammals, two birds, and one reptile) with undefined PBFs.

In total, EPA determined that 40 of the MA species CHs are LAA. Thirty-four of those species had a PBF for either mammal prey or burrow use. The other six did not have PBF’s defined by USFWS; however best available information indicated that those species either consume mammal prey or use burrows.

EPA’s LAA determinations and justifications for CH can be found in the “Critical Habitat” worksheet in **Appendix B** and **Appendix C**. LAA determinations followed the methodology outlined in **Section 2.7**.

4.3 Critical Habitats with Predictions of Potential Likelihood of Future Adverse Modification Determinations

EPA's predictions for the potential likelihood of future AM of CH are based on the MoEs described previously, the extent of spatial overlap between the CH and various UDLs, various effects modifiers that can influence the likelihood of exposure, and if mammals or burrows are identified as an essential PBF for the species CH. The main effect modifiers for CH included:

- the CH's species relies on making its own burrow (*e.g.,* Choctawhatchee beach mouse; *Peromyscus polionotus allophrys),*
- the CH's species uses structural features including but not exclusive to small mammal burrows for shelter or other reasons (non-obligate relationship, *e.g.*, several listed frogs and salamanders), and
- the CH's species does not exclusively rely on mammalian prey (*e.g.*, Whooping crane; *Grus americana*), or its diet includes large herbivorous mammal prey, which are not affected by rodent prey availability (*e.g.*, Canada Lynx (*Lynx canadensis*) and Jaguar (*Panthera onca*)).

EPA predicted the potential likelihood of future AM for five CHs after considering effects modifiers, including those described above. Those CH species with the potential likelihood of future AM are:

- California tiger salamander (*Ambystoma californiense*)
  - Small mammal burrows are an essential PBF for this species
- Alameda whipsnake (*Masticophis lateralis euryxanthus*)
  - Small mammal burrows are an essential PBF for this species
- Mexican spotted owl (*Strix occidentalis lucida*)
  - Mammals are a main dietary item and the maintenance of available prey species is an essential PBF
- Northern spotted owl (*Strix occidentalis caurina*)
  - Mammals are a main dietary item and the maintenance of available prey species is an essential PBF
- Louisiana pinesnake (*Pitouphis ruthveni*)
  - Mammals are a main dietary item and the maintenance of available prey species is an essential PBF

EPAs predictions of potential likelihood of future AM of the CH of each of the five species is shown by chemical group and use type in **Table 4-1**.

Table 4-1. Critical Habitat Effects Determinations and Predictions of the Potential Likelihood of Future Adverse Modification by CH species and Use Pattern[1]

CH species	Bait Station[2]		Burrow[3]		Broadcast[4,5,6]		Feral Hog Bait Station[7]	
	LAA/No AM	LAA/AM	LAA/No AM	LAA/AM	LAA/No AM	LAA/AM	LAA/No AM	LAA/AM
California tiger salamander	NA	Yes	NA	Yes	NA	Yes	Yes	NA
Alameda whipsnake	Yes	NA	NA	Yes	NA	Yes	Yes	NA
Mexican spotted owl	Yes	NA	NA	Yes	NA	Yes	Yes	NA
Northern spotted owl	Yes	NA	NA	Yes	NA	Yes	Yes	NA
Louisiana pinesnake	Yes	NA	NA	Yes	NA	Yes	Yes	NA

[1] Reflects species with CH as of Oct. 2024.
[2] FGARs, SGARs (inclusive of burrow use of chlorophacinone and diphacinone next to structures), zinc phosphide, bromethalin, and cholecalciferol
[3] FGARs, zinc phosphide, strychnine, and bromethalin
[4] FGARs and zinc phosphide
[5] EPA considers the effects determinations for broadcast use of zinc phosphide, chlorophacinone and diphacinone to be representative of those for the scatter/spot treatments.
[6] EPA considers the effects determinations for broadcast use of zinc phosphide, chlorophacinone and diphacinone to be inclusive of those for the agricultural bait station uses. See 3.2.1 and 3.2.6 for information on potential impacts on effects determination for primary consumers.
[7] Warfarin
NA = Not applicable; AM = Adverse Modification

EPAs predictions of the potential likelihood of future AM for CH and justifications can be found in the “Critical Habitat” worksheet in **Appendix B** and **Appendix C** and followed the methodology in **Section 2.7**. **Table 4-2** provides a summary of the total number of CHs and the number of CHs with NE, NLAA, LAA/predictions of potential no likely future AM, and LAA/predictions of potential of likely future AM.

Table 4-2. Number of Critical Habitat Effects Determinations and Predictions of the Potential Likelihood of Future Adverse Modification by Taxon[1,2]

Taxon	Number of Species with Critical Habitat	NE	NLAA	LAA/No AM	LAA/AM
Mammals	49	32	2	15	0
Birds	34	26	3	3	2
Amphibians[1]	35	20	1	13	1
Reptiles	29	20	3	4	2
Terrestrial Invertebrates	64	64	0	0	0
Aquatic Invertebrates	111	111	0	0	0
Plants	484	484	0	0	0
Fish	121	121	0	0	0
Total	**927**	**878**	**9**	**35**	**5**

[1] "Amphibians" include those species that have both a terrestrial and aquatic phase.

[2] Reflects species with CH as of Oct. 2024.

NE = No Effect; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect; AM = Adverse Modification

5 Final Rodenticide Strategy

In addition to the effects determinations that include predictions of the potential likelihood of future J/AM contained in the final BE, EPA also included the final Rodenticide Strategy. Prior to finalizing this strategy, EPA issued a draft strategy for public comment that include measures designed to reduce exposures of listed species to the 11 rodenticides.[36] After considering the public comments on the draft strategy, EPA has made refinements in the final strategy.

The final Rodenticide Strategy includes the mitigation measures that EPA identified to address the predictions of potential likelihood of future J/AM for 78 listed species and five critical habitats. These identified mitigation measures would reduce the potential for exposure to listed species from these rodenticides and may be implemented during registration review and prior to completion of the USFWS BiOp. The mitigation measures are also intended to minimize take of those species where EPA made LAA determinations.

It is important to note that certain identified mitigation measures are applicable to a specific species-chemical-use combination. The identified mitigation measures are presented in Table 5-1. This strategy identifies mitigation measures to address exposure routes of concern for bait station, in-burrow, and broadcast application methods. The measures “avoid” or “minimize” exposure, as defined by the ESA Consultation Handbook.[37] No “offsets” are proposed at this time, but EPA is open to considering proposals on how the Agency may be able to use offsets for rodenticides.

At the end of the consultation, the USFWS will make their conclusions on J/AM and determine whether there are additional measures necessary to avoid J/AM for each listed species and critical habitat, and the USFWS will issue their BiOp. After the BiOp is issued, EPA will implement any additional measures identified in the BiOp.

5.1 Background on Registration Review of Rodenticides

EPA completed four FIFRA proposed interim decisions (PIDs) for the registration review of the 11 rodenticides within the scope of this BE in November 2022 (USEPA, 2022a-2022d), which included proposing measures to protect human health and the environment from those rodenticides. Most of the mitigation measures proposed in the four PIDs are broad (*i.e.*, generally applicable wherever the labels allow their use) protective measures intended to be applied through pesticide labeling to reduce exposures to humans and non-target species nationally. In addition, EPA expects that these proposed measures may reduce exposure to listed species. The final BE and Rodenticide Strategy reflect current labels, which do not yet include mitigation proposed in the PIDs. As a result, some of the mitigation measures in the final strategy are the same as those proposed in the four PIDs.

The November 2022 PIDs also proposed targeted ESA mitigation to protect certain listed species. This work furthered the goals outlined in EPA’s April 2022 Endangered Species Act (ESA) Workplan by including protections for ESA species earlier in its FIFRA registration review process. The rodenticide early mitigation Pilots described in its November 2022 update specified EPA’s focus on addressing

[36] Brodifacoum, Bromadiolone, Bromethalin, Cholecalciferol, Chlorophacinone, Difenacoum, Difethialone, Diphacinone, Strychnine, Warfarin, and Zinc Phosphide
[37] https://www.fws.gov/media/endangered-species-consultation-handbook

effects to mammals and birds that consume rodenticide bait (*i.e.*, primary consumers) and to birds, mammals, and reptiles that consume primary consumers (*i.e.*, secondary consumers).

Consistent with that goal, EPA proposed mitigation measures in the PIDs for the three species evaluated in the pilot memo (USEPA, 2022e). EPA evaluated each of the 11 rodenticides' potential effects on individuals and populations of the Stephens' kangaroo rat (SKR), Attwater's prairie chicken (APC), and the California condor (CC) and their designated critical habitat. EPA chose these three species because they represent listed species that may be affected by rodenticides through different routes of exposure, like primary consumption, by the SKR and APC, and secondary consumption, by the CC. EPA predicted that the currently labeled uses of the rodenticides have the potential likelihood for future J to these species or AM of their designated critical habitat. However, including the appropriate mitigation measure(s) for a particular use in its BE, EPA predicted that there is not a potential likelihood that the use of rodenticides would result in future J to these species, or AM of their critical habitat if these measures are implemented. EPA also predicted that these same measures would reduce exposures to other listed species (beyond the three pilot species) and their designated critical habitats predicted to be J/AM by the use of rodenticides in this final BE.

The proposed mitigation measures for the three listed species in the Pilot were targeted for specific geographic areas most relevant to each of the species, with the intention of implementing mitigation measures where they are most needed while still retaining use options for rodenticide users. Additionally, because EPA selected the three pilot species to be largely representative of other species that have similar exposure routes and therefore, similar effects, these mitigation measures were proposed in the PIDs with the intention of considering extending them to other listed species as appropriate after evaluating population level effects for all listed species and their critical habitat in the final BE.

In comments on the draft BE and strategy, EPA received comments that additional clarity was needed in finalizing the mitigation strategy, particularly regarding the applicability of each mitigation measure to each rodenticide product and use. Commenters expressed concern that some mitigation measures may not be effective or feasible depending on the listed species, scenario, or use pattern. EPA wishes to clarify that the intent of the rodenticide strategy is to outline the known mitigation measures identified to reduce endangered species exposure, and therefore reduce the potential likelihood of future J/AM. Unlike the Herbicide Strategy, these mitigation measures are not a mitigation menu for rodenticide users. Rather, these are the suite of measures that EPA has identified from which EPA expects to choose when identifying measures to reduce exposure to listed species and their CH from the 11 rodenticides for a specific active ingredient, use site, and application method (*i.e.*, bait station, in-burrow, and broadcast). Section 5.2.2 provides some examples of how EPA envisions implementing the strategy.

EPA continues to assess human health and ecological risks of concern as well as benefits of the use of rodenticides in the ongoing registration review for these pesticides.

5.2 Description of Mitigation Measures to Reduce the Potential Likelihood of Future Jeopardy and Adverse Modification and to Minimize Take

The mitigation measures described below are those that EPA has identified for consideration where EPA has predicted a potential likelihood of future J/AM. Having considered public comments, EPA has made several updates to the strategy. The following section outlines the mitigation measures that EPA has identified to address the predictions of potential likelihood of future J/AM.

5.2.1 Changes Since the Draft BE

In the mitigation strategy in the draft BE, there were three sections: *Rodenticide PID Proposed Mitigation Measures, ESA Pilot Memo Proposed Mitigation Measures,* and *Updated Listed Species Mitigation Measures for this Draft Rodenticide Strategy.* The Agency outlined mitigation measures it was considering to reduce exposure to listed species and their CH side-by-side with the mitigation measures that EPA was considering in the PIDs to protect human health and non-listed non-target species under registration review activities. However, in this final BE and strategy, EPA is only identifying measures to avoid predicted J/AM to listed species. Any mitigation proposed to address ecological risk concerns identified through the registration review process under FIFRA will be addressed in registration review. There were multiple comments received related to PID mitigation measures. Those comments will be addressed in a response to comments document that is anticipated with the next registration review milestone.

For clarity, the following mitigation measures were removed from this final BE because they were proposed in conjunction with the PID for implementation nationally through product labeling updates and will therefore be addressed in registration review instead of this final strategy:

- Restricted use classification
- Packaging FGARs, bromethalin, and cholecalciferol products for consumer use in quantities of one pound or less in ready-to-use non-refillable bait stations
- Broad national product labeling updates to prohibit broadcast and spot for turf, lawns, golf courses, campsites, and other recreation areas.

5.2.2 Listed Species Mitigation Measures for this Final Rodenticide Strategy

The final effects determinations indicate that mitigation measures would be applicable for 78 listed species and five CHs to avoid or further minimize exposure from this group of 11 rodenticides collectively. In other words, not all rodenticides and uses have the same predictions of the potential likelihood of future J/AM determinations. The following is a suite of measures that EPA has identified from which it expects to choose when identifying measures to reduce exposure to listed species and their CH for a specific active ingredient, use site, and application method (*i.e.*, bait station, in-burrow, and broadcast).

1. Restrict the use of bait stations to only those that exclude listed species by size or behavior. Beyond the standard bait stations now in use, custom bait stations for the exclusion of listed species (primarily mammals) could be used within their ranges. An example is the bait station recommended by the state of California in PRESCRIBE for use within the range of the SKR. This mitigation is intended to reduce the potential for primary exposure.

2. Prohibition of broadcast and below-ground in-burrow applications in locations where needed to protect listed species such as a “pesticide sensitive area” within the USFWS designated range of listed species. This mitigation is intended to reduce the potential for primary exposure to specific listed species.

3. Prohibition of broadcast and below-ground in-burrow application within and beyond the range and/or critical habitat for species that have the potential to consume rodenticides via secondary consumption. This mitigation is intended to reduce the potential for secondary exposure.[38]

4. Restricting bait station placement to within five feet of man-made structures in areas with listed mammals that are small enough to enter bait stations. This mitigation measure would reduce the likelihood that bait stations will be placed in the species habitat. This mitigation measure is intended to reduce the potential for primary exposure.

5. Prohibiting application directly to water. This prohibition is already included on many labels[39] and would not apply to conservation uses (*i.e.*, island eradication). This measure would ensure that rodenticides do not enter water bodies, which are not an approved use site. This mitigation measure is intended to reduce the potential for primary exposure.

6. Mandatory or advisory post-application follow-up statements for carcass search, collection, and disposal within the species' range and/or designated critical habitat. This mitigation measure could be used for all active ingredients and use patterns. For below-ground in-burrow applications made in fields and other non-structural use sites, users would need to monitor open burrows at specific times depending on the toxicity characteristics of the active ingredient (*e.g.,* how quickly the rodenticide causes mortality could be considered). This mitigation measure is intended to address secondary exposure by reducing rodenticide exposures of predators and scavengers with a high potential for secondary poisoning.

7. Post-application follow-up statements for bait-spill or bait kick-out. Removing spilled bait or bait that has been ejected from a burrow or disturbed by an animal is intended to reduce primary exposure by removing rodenticide bait at the soil surface.

8. Prohibiting use in areas or at times of the year when listed secondary consumers might be exposed (*i.e.*, if species are active or in the area). USFWS determined this measure was needed to protect listed species in the previous biological opinions for the rodenticide products Rozol Prairie Dog Bait and Kaput-D Prairie Dog Bait. This measure would reduce exposure to predators and scavengers and is intended to reduce the potential for secondary exposure.

9. Covering the burrow hole after applications made in fields and other non-structural use sites for appropriate species that live in closed burrow systems (*i.e.*, pocket gopher). This mitigation measure is intended to reduce exposure to primary consumers that might enter the burrow. This would not apply to all target species and would depend on their behavior. This measure would not apply to target species that live in open burrow systems (*i.e.*, Norway rat).

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[38] Following the PID, EPA has reconsidered the Pilot mitigation measure prohibiting application outside the range and or critical habitat (i.e., "*do not apply via broadcast application within 200 yards by air or 40 yards by ground from range and critical habitat when air currents are moving toward those areas. When air is calm or moving away from the range or critical habitat, apply on the side nearest those areas and proceed away"*) since drift of rodenticide product is not anticipated. Therefore, this is no longer being considered as a mitigation measure.
[39] The water prohibition is in alignment with currently registered use patterns of the rodenticides and for consistency, this statement will be added to all national labels during the registration review process.

10. Updating the Terms and Conditions of Registration to include a clause that EPA will notify registrants upon issuance of the Biological Opinion if additional measures would be necessary and that the registrants agree to amend their product labeling or cancel their registrations as EPA determines are necessary based on any applicable final Biological Opinion.

11. Require the applicator to report dead or dying non-target animals to EPA's website (https:/www.epa.gov/pesticide-incidents) as soon as possible. This helps monitor take and ensures that wildlife incidents are tracked, so that adjustments to the label or bulletin instructions may be made.

As explained previously, EPA expects most of the measures would apply in geographically specific areas only (referred to as Pesticide Use Limitation Areas or PULAs) through Bulletins using its web-based system, Bulletins Live! Two (BLT). PULAs focus on areas where pesticide exposures are likely to impact the continued existence of a listed species, which may include a reduction in survival or recovery of the species and designated critical habitat. EPA is refining the species maps that it will use for PULAs and does not plan to implement mitigations in those areas until those maps are refined. The eleven mitigation measures identified above are summarized in Table 5-1 by applicability to address primary or secondary exposure, as well as whether the EPA has identified implementation through BLT or a general label statement.

Table 5-1. Summary of Recommended Mitigation Measures[40]

Mitigation Measures	Primary	Secondary	Routes of Implementation
1. Restrict the use of bait stations to only those that exclude listed species by size or behavior.	Yes	NA	PULA
2. Prohibition of broadcast and below-ground in-burrow applications in locations where needed to protect listed species such as "pesticide sensitive area" within the USFWS designated range of listed species.	Yes	NA	PULA
3. Prohibition of broadcast and below-ground in-burrow application within and beyond the range and/or CH for species that have the potential to consume rodenticides via secondary consumption.	NA	Yes	PULA
4. Restricting bait station placement to within five feet of man-made structures in areas with listed mammals that are small enough to enter bait stations.	Yes	NA	PULA

[40] Registrants have inquired if these mitigation measures are applicable if they were to amend consumer product labels to indoor-only bait stations. Indoor use will not reasonably result in exposure to listed species or CH; therefore, those use patterns are NE for all species. Accordingly, EPA has not identified J/AM for indoor uses and none of the listed species' mitigation in this strategy is relevant for indoor uses.

Mitigation Measures	Primary	Secondary	Routes of Implementation
5. Prohibiting application directly to water.	NA	NA	Label Statement
6. Mandatory or advisory post-application follow-up statements for carcass search, collection, and disposal within the species' range and/or designated critical habitat.[41]	NA	Yes	PULA (Mandatory); Label Statement (Advisory)
7. Post-application follow-up statements for bait-spill or bait kick-out.	Yes	NA	Label Statement (bait spill); PULA (kick out)
8. Prohibiting use in areas or at times of the year when listed secondary consumers might be exposed.	NA	Yes	PULA
9. Covering the burrow hole after applications made in fields and other non-structural use sites for appropriate species that live in closed burrow systems.	Yes	NA	PULA
10. Updating the Terms and Conditions of Registration to include a clause that EPA will notify registrants upon issuance of the Biological Opinion, if additional mitigation measures are required.	Yes	Yes	Terms and Conditions of Registration
11. Mandatory or Advisory reporting of dead or dying non-target animals to the Agency's website as soon as possible.	Yes	Yes	PULA (Mandatory); Label Statement (Advisory)

In addition, EPA understands that island eradication programs are currently underway (led by USDA APHIS) and that consultation with USFWS has occurred for these uses on certain registered rodenticides. EPA anticipates the mitigation measures being considered in this final strategy could help increase the efficiency of future consultations on rodenticide use for species conservation. EPA acknowledges that some mitigation measures may not apply to conservation uses because they will be handled under a separate consultation.

Application of Measures to Species and Chemicals:

It is important to note that certain mitigation measures are applicable to a specific species-chemical combination only. The following section provides examples of EPA's thinking on how it envisions selecting which measures from Table 5-1 to implement for a specific use.

[41] EPA anticipates the carcass search measure will only be selected when other mitigation measures are not practical or feasible. The Agency does not expect this mitigation measure to be widely used.

Example Mitigation Implementation Measures:

In this strategy, EPA identified the above mitigation measures to address the predictions of potential likelihood of future J/AM for the rodenticides. EPA recognizes that not every mitigation measure is applicable for every species, location, and use pattern, and these factors are being taken into consideration during the implementation of this strategy through registration review. In addition, EPA recognizes that not every mitigation measure is feasible for all users and that the effectiveness of the mitigation measures varies. Below are some practical examples of how EPA envisions implementing the strategy:

1. Restricting the use of bait stations to only those that exclude listed species by size or behavior would not work to address J/AM for all listed species. If a listed species has a similar size or behavior to the target pest (for example, Alabama Beach Mouse) this would not be a feasible measure and therefore another mitigation measure should be implemented. As an alternative, EPA would consider implementing a five-foot placement restriction for residential use or a geographic area.
2. Limiting bait station placement to within five feet of structures is not feasible for facilities that must comply with stringent phytosanitary requirements, such as food processing facilities. In such cases, post-application follow-up statements such as bait spill/kickout or carcass search may be the mitigation measure EPA identifies as the preferred measure for this particular use pattern. For example, this measure may be identified as appropriate for the Pacific Pocket Mouse.
3. A prohibition of broadcast and below-ground in-burrow applications in locations where needed to protect listed species could be implemented via a PULA or could be limited to a clearly defined area needed for a particular listed species. For example, to address potential likelihood of J for the Salt Marsh Harvest Mouse, a restriction of use on or near sand dunes may be identified as the preferred measure for this species.
4. Timing restrictions prohibiting use in areas or at times of the year when listed primary or secondary consumers might be exposed can be adjusted on a species-specific basis. For example, if a species hibernates or migrates, the timing restriction can be adjusted accordingly. This measure may be identified as appropriate for the Preble's Meadow Jumping Mouse, which is a is a true hibernator. The listed mice usually enter underground hibernacula (hibernation nests) in September or October and emerge the following May after a potential hibernation period of 7 or 8 months. If the product label were to instruct users to apply rodenticide from October 1 to March 15, then the timing overlap with the listed mouse activity would be the month of October. In this scenario, an application timing restriction could be put in place for the month of October only where overlap with the listed mouse occurs, limiting application from November 1 to March 15th**.**

EPA plans to implement the strategy through registration review with the intent of avoiding predicted potential likelihood of J/AM for listed species and AM of critical habitat. EPA will continue its current practice of providing opportunities for public input on proposed decisions, including mitigation that may come from this strategy. Should alternative mitigation measures be identified that are effective, practical, and feasible, EPA would similarly consider them during registration review and there would also be opportunities for the registrants ("applicants") to raise these during formal consultation with

USFWS. Ultimately, during consultation, the USFWS will make their conclusions on potential for J/AM and determine if any further measures are needed to avoid the potential for future J/AM for each use, species, and critical habitat.

6 Overall Conclusions

This final BE makes effect determinations including predictions of potential likelihood that current registrations of 11 rodenticides may lead to a future J or AM. EPA considered all registered use patterns (*i.e.*, bait station, broadcast, and in-burrow) and the landscapes where the rodenticides are used: urban structures, agriculture, and other contexts (forest, rangeland, etc.).

The analysis focused on vertebrate species because of their sensitivity to rodenticides and their potential exposure in the terrestrial environment. EPA held regular meetings with USFWS for technical assistance. Species that were not expected to be exposed due to habitat factors (*e.g.*, strictly arboreal birds/species that chiefly live and feed in trees) or dietary factors (*e.g.*, bats) were judged to be NE or NLAA. Terrestrial species that live or feed on the ground were carefully examined to determine if their habitat, feeding habits, or behaviors made their exposure less likely (and therefore NLAA) or whether they were likely to consume rodenticides on the ground, in burrows or to enter bait stations. Those species for which exposure could not be discounted by habitat, behavior, or diet were found to be LAA. After making effect determinations, EPA predicted a potential likelihood of future J for 78 species because exposure could not be precluded, and current restrictions do not mitigate exposure. EPA also predicted that five species whose critical habitat PBFs were adversely affected by rodenticide use (*i.e.*, requirement of rodents in the diet or use of target species' burrows) have a potential likelihood of future AM of their critical habitat. **Appendix D** provides a summary of species that EPA predicted the potential likelihood of J by exposure route (primary or secondary exposure), use pattern, and active ingredient. **Appendix G** shows the geographic area of the species range and CH for those that EPA predicted the potential likelihood of J/AM.

EPA included a Rodenticide Strategy (mitigation measures) as part of this final BE that focuses on reducing exposures of listed species to the 11 rodenticides. This strategy focuses on reducing exposures so that EPA's predictions of the potential likelihood of future J for listed species and potential likelihood of future AM for CHs based on current uses and label restrictions in this final BE would not be likely. The mitigation measures are also intended to minimize take of those species where EPA made LAA determinations. This strategy describes mitigation measures to address exposure routes of concern for bait station, in-burrow, and broadcast application methods. The mitigation measures include measures to "avoid" or "minimize" exposure, as defined by the ESA Consultation Handbook.

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8 List of Acronyms

AM	Adverse Modification
APHIS	Animal and Plant Health Inspection Service
BE	Biological Evaluation
BiOp	Biological Opinion
BLT	Bulletins Live! Two
C-CAP	Coastal Change Analysis Program
CDL	Cropland Data Layer
CH	Critical Habitat
CONUS	Contiguous United States
EECs	Estimated Environmental Concentrations
EFED	Environmental Fate and Effects Division
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FGAR	First Generation Anticoagulant Rodenticides
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographic Information System
IDS	Incident Data System
J	Jeopardy
LAA	Likely to Adversely Affect
LC_{50}	Concentration leading to 50% mortality
LD_{50}	Dose leading to 50% mortality
LOC	Level of Concern
MA	May Affect
MoE	Magnitude of Effect
NE	No Effect
NGO	Non-government organization
NL48	No lower 48 [states]
NLAA	Not Likely to Adversely Affect
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEC	No Observed Adverse Effect Concentration
OSD	Open Space Developed
OPP	Office of Pesticide Programs
PBF	Physical or Biological Features
PID	Proposed Interim Decision
PPHD	Prey, Pollination, Habitat and/or Dispersal
RED	Re-Registration Eligibility Decision
RQ	Risk Quotient
RMD	Risk Mitigation Decision
RR	Registration Review
RUP	Restricted Use Pesticide

SAP	Science Advisory Panel
SGAR	Second Generation Anticoagulant Rodenticides
UDL	Use Data Layer
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Appendix A. Summary of Rodenticide Uses

Table A-1. Summary of Rodenticides and Current Uses

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Brodifacoum	112701	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant bait stations; can only be applied by certified applicators).	In and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited. Product can be used both in and outdoors in a bait station.	Various mouse, vole and rat species including house mice, harvest mice, Norway rat, roof rat, cotton rat, Mexican woodrat, Polynesian rat, Southern plains woodrat, whitethroat woodrat & meadow vole
Bromadiolone	112001	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant bait stations are mandatory for above ground uses; can only be applied by certified applicators). Do not broadcast bait; burrow baiting with this a.i. is prohibited. Used outdoors in a bait station.	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited. Product can be used both in and outdoors>	Various mouse and rat species including house mice, harvest mice, deer mice, white-footed mice, Norway rat, roof rat, cotton rat, Mexican woodrat Polynesian rat, Southern plains woodrat, whitethroat woodrat, bushytail woodrat & meadow vole *In CA cannot be used on cotton rat, Eastern harvest mice, golden mice, Polynesian rat, meadow vole, white-throated woodrat, Southern plains and Mexican woodrat

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Bromethalin	112802	Neurotoxicant (Uncouples mitochondrial oxidative phosphorylation leading to respiratory failure)	Bait Stations (tamper-resistant bait stations are mandatory for above ground uses)	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	Various mouse and rat species, including harvest mice, house mice, white-footed mice, deer mice, cotton rat, Norway rat, Polynesian rat, roof rat, Southern plains woodrat, whitethroat woodrat, Mexican woodrat, bushytail woodrat
			Burrow Use (apply 6" in burrow)	Lawns, parks, around homes, golf courses, ornamental gardens, nurseries, and other non-crop grassy areas.	Mole species including the Eastern mole, starnose mole, meadow vole
Chlorophacinone	067707	Anticoagulant (Vitamin K antagonist)	Broadcast (except in CA; any applications in CA must be covered by a shingle or grass to prevent exposure to non-target species)	Orchards and groves, vineyards, non-crop areas, nurseries, tree/forestry plantations, rangeland, and fallow agricultural land	Bushytail woodrats, cotton rat, house mice, meadow vole, Mexican woodrat, Mountain vole, Norway rat, pine vole, Polynesian rat, roof rat, Southern plains woodrat, whitethroat woodrat, California and Richardson ground squirrels, Columbian ground squirrel
			Burrow Use (apply 6" in burrow)	Rangeland and adjacent non-crop areas (CO, KS, MT, NE, NM, MD, OK, SD, TX, WY)	Black-tailed Prairie Dogs, Pocket Gophers

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Chlorophacinone	067707	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant, tracking powder & floating (CA only))	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	California ground squirrel, chipmunks, various mouse, vole and rat species including white-footed mice, house mice, deer mice, cotton rat, Mexican woodrat, Norway rat, Polynesian rat, roof rat, Southern plains woodrat, white-throated woodrat, bushytail woodrat, meadow vole, pine vole, black-tail jack rabbit, Golden mantled ground squirrel, ground squirrels, jack rabbits, meadow mice, muskrats, mountain vole, California vole *In CA cannot be used on cotton rat, Eastern harvest mice, golden mice, Polynesian rat, meadow vole, white-throated woodrat, Southern plains and Mexican woodrat
Cholecalciferol	202901	Binds to Vitamin D receptors which leads to increase in serum calcium and results hypercalcemia (this chemical is Vitamin D_3)	Bait Stations (tamper-resistant if used above ground)	In and within 100 feet of man-made structures including homes, temporary and permanent residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public building, transport vehicles (ships, trains, aircraft), docks and ports of terminal and related structures. Fence and perimeter baiting beyond 100 feet of a structure is prohibited.	Bushytail woodrats, cotton rat, house mice, meadow vole, Mexican woodrat, Norway rat, Polynesian rat, roof rat, Southern plains woodrat, whitethroat woodrat, meadow vole

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Cholecalciferol	202901	Binds to Vitamin D receptors which leads to increase in serum calcium and results hypercalcemia (this chemical is Vitamin D_3)	Pellet applications to burrows (of target rodents) no less than 6 inches into active Norway/roof rat burrows. Do not broadcast bait.	Apply to active rodent burrows within or beyond 100 feet of buildings and man-made structures (including those described above).	Norway rats, roof rats and house mice
Difenacoum	119901	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant bait stations; can only be applied by certified applicators)	In and within 100 feet of man-made structures including homes, permanent and temporary residences, food processing facilities, industrial and commercial buildings, trash receptables, agricultural and public buildings, transport vehicles, docks and port of terminal and related structures. Fence and perimeter baiting beyond 100 feet, burrow and broadcast baiting are prohibited.	Norway rat, roof rat, house mice, cotton rat, Eastern harvest mice, golden mice, meadow vole, Mexican woodrat, Polynesian rat, Southern plains woodrat and white-throated woodrat
Difethialone	128967	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant bait stations; can only be applied by certified applicators)	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	Bushytail woodrats, Cotton rat, Deer mouse, Harvest mice, House mouse, Meadow vole, Mexican woodrat, Norway rat, Polynesian rat, Roof rat, Southern plains woodrat, White-footed mouse, Whitethroat woodrat

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Diphacinone	067701	Anticoagulant (Vitamin K antagonist)	Broadcast	CRP lands, forests	California ground squirrel
			Bait Stations (tamper-resistant bait stations)	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	Norway rats, roof rats, house mice
Strychnine	076901	Neurotoxicant (Inhibits post synaptic glycine receptors in spinal cord and causes involuntary skeletal muscle contraction)	Applications to burrows (of target rodents) and both agricultural and non-agricultural areas. Strychnine cannot be applied on geographic ranges of any Federally protected pocket gopher subspecies or populations.	Below ground applications to artificial burrows in rangelands, pastures, croplands, forests and non-agricultural areas to control pocket gophers. Also used in orchards, alfalfa fields, hay fields, pastures, rangelands, and other non-crop areas.	Mazama pocket gopher, Northern pocket gopher, plains pocket gopher, Southern pocket gopher, yellow-faced pocket gopher, botta pocket gopher, camas pocket gopher, mountain gopher, Towsend's pocket gopher, valley pocket gopher and other *Thomomys* and Geomys *sp.* (Special Local Needs Use in NV specifically for yellow-bellied marmots, Richardson, Beldin's and Piute ground squirrels)
Warfarin	086002	Anticoagulant (Vitamin K antagonist)	Feeding station where hogs must lift the doors with their snouts to access bait (do not apply directly to ground)	Pastures, rangelands, forest and non-crop areas.	Feral hogs
			Applications to burrows (of target rodents)	Active burrow systems on lawns, turf areas, golf courses, and other non-food grassy areas	Various mole species including Eastern mole, starnose mole, and Townsend's mole

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Warfarin	086002	Anticoagulant (Vitamin K antagonist)	Bait Stations (tamper-resistant)	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	Cotton rat, harvest mice, house mice, meadow vole, Norway rat, Polynesian rat, roof rat, deer mice, pine vole, mountain vole, white-footed mice, Mexican woodrat, Southern plains woodrat
Zinc phosphide	088601	Mechanism of Action is unclear; Possibly acts through gut hydrolysis of zinc phosphide, which produces toxic phosphine gas (PH_3) which impairs a suite of cellular functions	Broadcast (Ground & Aerial)	Used in and outdoor residential and agricultural areas (including in and around homes, lawns, bulbs, in and around outside buildings/barns, and rights-of-ways/ fencerows/ hedgerows), indoor and outdoor commercial or institutional premises and equipment, golf courses, and reforestation areas.	Banner-tailed kangaroo rat, Belding ground squirrel, black tail jack rabbit, black-tailed prairie dog, California ground squirrel, California vole, Columbia ground squirrel, Cotton rat, Desert woodrat, Dusky-footed woodrat, Eastern woodrat, Florida woodrat, Franklin's ground squirrel, Golden-mantled ground squirrel, Ground squirrels, Gunnison's prairie dog, house mouse, prairie dog, house mouse
			Bait Stations (tamper-resistant)	Can be used in and within 100 feet from manmade structures including permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings and related structures. Fence and perimeter baiting beyond 100 feet from structure is prohibited.	House mice, Norway rat, Roof rat, Cotton rat, Eastern harvest mice, Golden mice, Polynesian rat, Meadow vole, White-throated woodrat, Southern plains woodrat, Mexican woodrat

Rodenticide Active Ingredient	PC Code	Mode of Action	Current Application method	Current Use sites	Target Pest(s)
Zinc phosphide	088601	Mechanism of Action is unclear; Possibly acts through gut hydrolysis of zinc phosphide, which produces toxic phosphine gas (PH_3) which impairs a suite of cellular functions	Applications to burrows (of target rodents can be applied 6" in burrow and around mouth of holes leading to burrow system)	Active burrows in non-crop areas, non-feed crop areas, ornamental lawns, ornamental turf (golf courses), residential lawns; also for use between tree rows, drainage ditches, rock walls, rock outcrops, fence rows and low spots in tree orchard at surface of trail or mouth of hold leading to burrow system.	Moles, pocket gophers (*Thomomys sp.*), and various rat, mouse and vole species

Appendix B. Endangered and Threatened Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy and Critical Habitat Effects Determinations and Predictions of the Potential Likelihood of Adverse Modification

The attached Excel spreadsheet (**067701+_NoTGCode_Final BE_Appendix B_11-21-2024**) includes the species-specific and CH effects determinations. For species with LAA determinations based on potential effects to an individual, **Appendix B** also includes EPA's predictions of the likelihood that rodenticide use will result in potential future J of the species. For CHs with LAA determinations, **Appendix B** also includes EPA's predictions of the likelihood that rodenticide use will result in potential future AM of the CH.

Appendix C. November 2024 Updates: Endangered and Threatened Species Effects Determinations and Predictions of the Potential Likelihood of Future Jeopardy and Critical Habitat Effects Determinations and Predictions of the Potential Likelihood of Adverse Modification

EPA recognizes that UDL and Listed species/CH designations are frequently updated and may change during the process of conducting at BE and during the BiOp process. Therefore, EPA has updated both the underlying agricultural data used in the overlap analysis (*i.e.* Use Data Layers), the listed species range and critical habitat GIS files, as well the listed species considered in the BE to the most current information at the time of the final BE.

The attached Excel spreadsheet (**067701+_NoTGCode_Final BE_Appendix C_11-21-2024**) includes the species-specific and CH effects determinations for those listed by the Services between the draft BE (*i.e.*, April 2023) and November 2024. EPA used the most recent (Dec. 2023) spatial files for range and critical habitat for the effects determinations of (1) the new species and CH and (2) to re-evaluate the effects determinations made in the draft BE for the species and CH listed prior to April 2023. For the existing species where EPA already made effect determinizations in the draft BE, the updated overlap was compared to the old overlap for species and CH where overlap was determinative in EPA's predictions of potential likelihood of J/AM (*see* **Appendix C** for more details).

Appendix C identifies species and critical habitats that were listed or designated during the interval between draft and final BE. Those new species and CH are incorporated into the final BE. It also identifies species and CH that have been delisted since October 2023 and that were included in the draft BE, but now are excluded in the final BE.

Finally, **Appendix C** also presents the updated overlap results (Dec. 2023).

Updated Use Data Layers (UDLs):

In terms of the UDL, EPA updated the agricultural Use Data Layers to account for the more up to date USDA Cropland Data Layer. These UDLs represent data from the 2018-2022 CDL. When necessary multiple land cover classes are combined into a single layer; see data sources for additional details. The agricultural classes were further refined by comparing county level National Agricultural Statistics Service (NASS) 2017 Census of Agriculture (CoA) acreage reports to county level UDL acreages. However this analysis for the final BE just used the cultivated layer, which is derived directly from the 2021 CDL. The NL48 UDLs and non-Ag UDLs (*i.e.*, Open space developed and Developed) were not updated in the interval between the draft and final BE.

Updated Species Ranges and Critical Habitats:

The draft BE used spatial files from February 2022. For the final BE, EPA updated its species list to include all listed species as of Oct. 2024. The most up to date species range and critical habitat spatial files were from Dec. 2023[42]

[42] Range files - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Species_Ranges_Static/FeatureServer
Critical habitat - https://services.arcgis.com/cJ9YHowT8TU7DUyn/arcgis/rest/services/Critical_Habitat_Static/FeatureServer

Appendix D. Summary of Jeopardy Species by Use Pattern and Active Ingredient

Table D-1. Summary of Jeopardy Species by Use Pattern and Active Ingredient[1]

Species	Use and A.I. Associated with J/AM	Primary or Secondary Exposure
Reptiles		
Puerto Rican boa	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Louisiana pine snake	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Eastern Massasauga (rattlesnake)	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Black pine snake	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
New Mexican ridge-nosed rattlesnake	Broadcast (FGAR)	Secondary
Birds		
California condor	Bait Station (FGAR and SGAR) Feral Hog bait station (warfarin) Broadcast (FGAR)	Secondary
Hawaiian (alala) Crow	Bait Station (FGAR and SGAR) Broadcast (ZnP) Burrow (FGAR)	Primary/Secondary
Audubon's crested caracara	Bait Station (FGAR and SGAR) Feral Hog bait station (warfarin) Broadcast (FGAR)	Secondary
Mexican spotted owl	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Northern spotted owl	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
California spotted owl	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Hawaiian (koloa) duck	Broadcast (ZnP)	Primary
Hawaiian goose	Broadcast (ZnP)	Primary
Hawaiian common gallinule	Broadcast (ZnP)	Primary
Micronesian megapode	Broadcast (ZnP)	Primary
Puerto Rican plain pigeon	Broadcast (ZnP)	Primary
Hawaiian coot	Broadcast (ZnP)	Primary
Puerto Rican nightjar	Broadcast (ZnP)	Primary
Yellow-shouldered blackbird	Broadcast (ZnP)	Primary
Guam rail	Broadcast (ZnP)	Primary
Nightingale reed warbler (old world warbler)	Broadcast (ZnP)	Primary
Elfin-woods warbler	Broadcast (ZnP)	Primary
Friendly ground-dove	Broadcast (ZnP)	Primary
Mao (= maomao) (honeyeater)	Broadcast (ZnP)	Primary
Attwater's greater prairie-chicken	Broadcast (FGAR, ZnP)	Primary
Lesser prairie-chicken	Broadcast (FGAR, ZnP)	Primary

Species	Use and A.I. Associated with J/AM	Primary or Secondary Exposure
Cape Sable seaside sparrow	Broadcast (FGAR, ZnP)	Primary
Masked bobwhite (quail)	Broadcast (FGAR, ZnP)	Primary
San Clemente loggerhead shrike	Broadcast (FGAR, ZnP)	Primary
Florida grasshopper sparrow	Broadcast (FGAR, ZnP)	Primary
Florida scrub-jay	Broadcast (FGAR, ZnP)	Primary
Gunnison sage-grouse	Broadcast (FGAR, ZnP)	Primary
Greater sage-grouse	Broadcast (FGAR, ZnP)	Primary
Yellow-billed Cuckoo	Broadcast (FGAR, ZnP)	Primary
Streaked horned lark	Broadcast (FGAR, ZnP)	Primary
Mammals		
Pacific Marten, Coastal Distinct Population Segment prev. Humboldt Marten	Broadcast (FGAR)	Secondary
Florida Panther	Feral Hog bait station (warfarin)	Secondary
Ocelot	Broadcast (FGAR)	Secondary
San Joaquin kit fox	Bait Station (FGAR and SGAR) Broadcast (FGAR)	Secondary
Black-footed ferret	Burrow (FGARs and ZnP) Broadcast (FGAR)	Secondary
Sierra Nevada red fox	Broadcast (FGAR)	Secondary
Sonoran pronghorn	Bait Station (FGAR and SGAR) Broadcast (FGAR, ZnP)	Primary
Columbian white-tailed deer	Bait Station (FGAR and SGAR) Broadcast (FGAR, ZnP)	Primary
Roy Prairie pocket gopher	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Olympia pocket gopher	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Tenino pocket gopher	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Yelm pocket gopher	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Stephens kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
San Bernardino Merriam’s kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Choctawhatchee beach mouse	Bait Station (FGAR, SGAR, cholecalciferol,	Primary

Species	Use and A.I. Associated with J/AM	Primary or Secondary Exposure
	bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	
Perdido Key beach mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Alabama beach mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP)	Primary
St. Andrew beach mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Anastasia Island beach mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Southeastern beach mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Salt marsh harvest mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Pacific pocket mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Giant kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Morro Bay kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Tipton kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Fresno kangaroo rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Prebles meadow jumping mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary

Species	Use and A.I. Associated with J/AM	Primary or Secondary Exposure
Buena Vista Lake Ornate Shrew	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Broadcast (FGAR, ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP)	Primary
Utah Prairie Dog	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Riparian Bush Rabbit	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Point Arena Mountain Beaver	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Riparian Woodrat	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Pygmy Rabbit (prey Columbia basic pygmy rabbit)	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Northern Idaho Ground Squirrel	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Amargosa vole	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
New Mexico meadow jumping mouse	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Penasco least chipmunk	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Florida salt marsh vole	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Silver rice rat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP)	Primary
Key Largo cotton mouse	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Key Largo woodrat	Bait Station (FGAR, SGAR, cholecalciferol, bromethalin, and ZnP) Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Texas kangaroo rat	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary
Lower Keys marsh rabbit	Burrow (FGARs, bromethalin, strychnine, and ZnP) Broadcast (FGAR, ZnP)	Primary

[1]This evaluation did not include 10(j) species which are plants or animal populations that have been designated as an experimental under the Endangered Species Act (ESA) (*e.g.,* some populations of Black footed ferret, *Mustela nigripes*, are considered a non-essential experimental population; therefore, regulatory and take prohibitions, and consultation requirements of the ESA are relaxed). Any adjustments to 10(j) species will be resolved during consultation with the USFWS.

Appendix E. Generation of the ESA Agricultural Use Data Layers (UDLs) from the Cropland Data Layer (CDL)

1. Agriculture Uses

Use site footprint layers represent the application sites for agricultural and non-agricultural label uses. The best available data to spatially characterize specific agricultural crops in the continuous United States (CONUS) is the Cropland Data Layer (CDL), produced by the U.S. Department of Agriculture. Several methods have been employed to minimize data errors within the CDL. The CDL is a landcover dataset that has over 100 cultivated classes that were grouped into 13 general classes. Lumping classes reduces the likelihood of errors of omission and commission between similar crop categories. In selecting how to group crops from the CDL, EPA referred to the grouping used by the U.S. Geological Survey (Baker and Capel, 2011) and the Generic Endangered Species Task Force. This information considers environmental factors that influence the location of crops and the error matrices provided by USDA with the original CDL data.

The draft BE used the 2017 cultivated UDL identifies cultivated land cover for the lower 48 states and based on land cover information derived from USDA's Crop Data Layer from 2013 through 2017 (Boryan *et al*., 2011; USDA, 2017). The final BE used the Cultivated layer from the 2021 CDL (updated analysis presented in **Appendix C**).

- **Cultivated land:** Cultivated/Fallow is spatial represented using all cultivated land as identified in USDA's Cultivated layer from Cropland Data Layer. It is based on the most recent five years of CDL data. Generally speaking, a pixel is identified as "Cultivated" if in at least two out of the five years of CDL data it has been previously identified as growing a crop. The exception is that all pixels identified as cultivated in the most recent year are assigned to the 'Cultivated' category regardless of whether they were cultivated in the previous four years of CDL data. The Cultivated Layer is a raster, geo-referenced data layer that has a ground resolution of 30 meters (Boryan, Claire, Yang, Z., and Di, L., IGRSS, 2012)

    a. Agricultural UDL Data Sources for the Non-lower 48 contiguous United States (NL48)

The Cultivated Layer UDL just covers CONUS so additional datasets were needed to create a similar agricultural layer for the NL48. EPA primarily used the 2011 National Land Cover Dataset (NLCD) to represent many agricultural uses in the NL48. Where NLCD wasn't available, the National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP) dataset and corresponding landcover classes were used. Details on the data sources NL48 agricultural UDL are below:

- **Alaska (AK)**
    - National Land Cover Dataset (NLCD) Cultivated Class (82)
- **Hawaii (HI)**
    - National Oceanic & Atmospheric Administration (NOAA) Coastal Change Analysis Program (CCAP), Cultivated Class (6)
- **Puerto Rico (PR)**
    - NLCD Cultivated Class (82)
- **Guam (GU)**
    - CCAP Cultivated Class (6)

    - Current CoA is not available for GU
- **Marianas (CNMI)**
    - CCAP Cultivated Class (6)
    - Current CoA is not available for CNMI
- **American Samoa (AS)**
    - CCAP Cultivated Class (6)
    - Current CoA is not available for AS
- **Virgin Islands (VI)**
    - CCAP Cultivated Class (6)
    - Current CoA is not available for VI

Additional agricultural use was captured in UDLs that represent uses beyond typical cultivation, which include Pasture and Rangeland:

Pasture: The CDL and NLCD map a pasture class, that is primarily grassland pastures.
CONUS

- The Pasture UDL includes a group of CDL classes that include categories for Alfalfa, Other Hay/Non-Alfalfa, Switchgrass, Pasture/Grass, Pasture/Hay, Pasture/Hay, and Vetch.

- Additionally, this includes NLCD 2016 pasture class.

Alaska:

- NLCD 2016 pasture class everywhere

Hawaii:
- CCAP 2011 pasture class 7

Puerto Rico:
• NLCD 2001 pasture class 81

Guam:
• CCAP 2011 pasture class 7

Marianas:
• CCAP 2004 pasture class 7 42 Version 1.1 Last updated January 2023

American Samoa:
•CCAP 2010 pasture class 7

Virgin Islands:
•CCAP 2012 pasture class 7

Rangeland: The grazing cattle land use is added to additional land cover types, such as forests, shrublands, wetlands, etc.
CONUS:

•CDL (2013-2017) and NLCD 2016 pasture classes everywhere

•Excludes the cultivated agricultural grasses (captured in the alfalfa layer described above)

•Undeveloped NLCD classes within Bureau of Land Management (BLM) and United States Forest Service (USFS) grazing allotment boundaries

•Exclude NLCD developed, water, and cultivated

Alaska:
•NLCD 2016 pasture class everywhere
•Undeveloped NLCD classes within BLM grazing allotment boundaries
•No USFS grazing allotment boundaries available for AK

Hawaii:
• CCAP 2011 pasture class 7
• No BLM or USFS grazing allotment boundaries available for HI

Puerto Rico:
• NLCD 2001 pasture class 81
•No BLM or USFS grazing allotment boundaries available for PR

Guam:
• CCAP 2011 pasture class 7
•No BLM or USFS grazing allotment boundaries available for GU

Marianas:
• CCAP 2004 pasture class 7 42 Version 1.1 Last updated January 2023
• No BLM or USFS grazing allotment boundaries available for CNMI

American Samoa:
•CCAP 2010 pasture class 7
•No BLM or USFS grazing allotment boundaries available for AS

Virgin Islands:
•CCAP 2012 pasture class 7
•No BLM or USFS grazing allotment boundaries available for VI

2. Non-Agricultural UDL Data Sources CONUS and NL48

Non-agricultural label uses include a wide range of landcover and land use categories. Each label use was carefully considered and cross-walked with the best available land cover data. Where available, EPA used the 2011 National Land Cover Dataset (NLCD) to represent many non-agricultural labeled uses (see below). Where NLCD wasn't available, EPA used the NOAA C-CAP and other datasets outlined below.

- **Developed**

Developed land cover is used to spatially represent certain non-agricultural label uses

- **CONUS**
    - NLCD class 22-24
- **Alaska**
    - NLCD class 22-24
- **Hawaii**
    - CCAP class 2-4
- **Puerto Rico**
    - NLCD class 22-24
- **Guam**
    - CCAP class 2
- **Marianas**
    - CCAP class 2
- **American Samoa**
    - CCAP class 2
- **Virgin Islands**
    - CCAP class 2

- **Open Space Developed**

Open Space Developed (OSD) is used to spatially represent certain non-agricultural label uses

- **CONUS**
    - NLCD class 21
- **Alaska**
    - NLCD class 21
- **Hawaii**
    - CCAP class 5
- **Puerto Rico**
    - NLCD class 21
- **Guam**
    - CCAP class 5
- **Marianas**
    - CCAP class 5
- **American Samoa**
    - CCAP class 5
- **Virgin Islands**
    - CCAP class 5

- **Noncultivated**
    - **CONUS**
        - Spatially represented as the inverse of all cultivated land as identified in USDA's Cropland Data Layer (2017).
    - **Alaska (AK)**
        - Spatially represented as the inverse of the National Land Cover Dataset (NLCD) Cultivated Class (82)
    - **Hawaii (HI)**

        - Spatially represented as the inverse of the National Oceanic & Atmospheric Administration (NOAA) Coastal Change Analysis Program (CCAP), Cultivated Class (6)
    - **Puerto Rico (PR)**
        - Spatially represented as the inverse of the NLCD Cultivated Class (82)
    - **Guam (GU)**
        - Spatially represented as the inverse of the CCAP Cultivated Class (6)
    - **Marianas (CNMI)**
        - Spatially represented as the inverse of the CCAP Cultivated Class (6)
    - **American Samoa (AS)**
        - Spatially represented as the inverse of the CCAP Cultivated Class (6)
    - **Virgin Islands (VI)**
        - Spatially represented as the inverse of the CCAP Cultivated Class (6)
- **Forest Trees**

Forested areas managed for timber extraction, forested areas, forest tree plantations

- **CONUS**
    - Cropland Data Layer (CDL) class 70, Christmas Trees
    - Include all the following LandFire Existing Vegetation Type (EVT) classes; "Recently Logged-Herb and Grass Cover", "Recently Logged-Shrub Cover", "Recently Logged-Tree Cover", "Managed Tree Plantation-Northern and Central Hardwood and Conifer Plantation Group", or "Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group"
    - Include any of the following United States Geologic Survey (USGS) National Gap Analysis Program (GAP) Public Model Ready Events; "Thinning", "Other Mechanical", "Clearcut", "Harvest", or "Reforestation"
    - Include any of the following USGS GAP Land Cover classes; "Recently Logged Areas", "Harvested Forest - Grass/Forb Regeneration", "Harvested Forest-Shrub Regeneration", "Harvested Forest - Northwestern Conifer Regeneration", "Managed Tree Plantation", "Evergreen Plantation or Managed Pine", "Deciduous Plantations"
    - Include either of the following USGS GAP Protected Areas Database classes where NLCD indicates "Forest" (41-43); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or Off Highway Vehicles (OHV) use" and "4 - no known mandate for protection"
- **Alaska**
    - Include either of the following USGS GAP Protected Areas Database classes where NLCD indicates "Forest" (41-43); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"

- Include any of the following USGS GAP Public Model Ready Events; "Thinning", "Other Mechanical", "Clearcut", "Harvest", or "Reforestation"
- AK LandFire EVT and GAP land cover do not have classes indicative of forest management

▪ **Hawaii**
  - Include the following LandFire EVT class; “Hawai'i Managed Tree Plantation”
  - Include either of the following USGS GAP Protected Areas Database classes where CCAP indicates "Forest" (9-11); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"
  - HI GAP land cover and USGS GAP Public Model Ready Events for HI do not have classes indicative of forest management

▪ **Puerto Rico**
  - Include the following GAP land cover classes; “Abandoned dry forest plantation”, “Woody agriculture and plantations: Palm plantations”
  - Include either of the following USGS GAP Protected Areas Database classes where CCAP indicates "Forest" (9-11); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"
  - PR LandFire EVT is not available

▪ **Guam**
  - Include either of the following USGS GAP Protected Areas Database classes where CCAP indicates "Forest" (9-11); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"
  - LandFire EVT, GAP land cover, and USGS GAP Public Model Ready Events are not available for Guam

▪ **Marianas**
  - Include either of the following USGS GAP Protected Areas Database classes where CCAP indicates "Forest" (9-11); "3 - managed for multiple uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"
  - LandFire EVT, GAP land cover, and USGS GAP Public Model Ready Events are not available for the Marianas

▪ **American Samoa**
  - LandFire EVT, GAP land cover, and USGS GAP Public Model Ready Events are not available for the Marianas
  - USGS GAP Protected Areas Database does not indicate areas indicative of forest management

▪ **Virgin Islands**
  - Include either of the following USGS GAP Protected Areas Database classes where CCAP indicates "Forest" (9-11); "3 - managed for multiple

uses - subject to extractive (*e.g.*, mining or logging) or OHV use" and "4 - no known mandate for protection"

- LandFire EVT, GAP land cover, and USGS GAP Public Model Ready Events are not available for the Marianas

- **Christmas Trees**

Cropland Data Layer (CDL) class 70, Christmas Trees, are used for CONUS. These are not characterized anywhere else.

- **CONUS**
  - Cropland Data Layer (CDL) class 70, Christmas Trees
- **Alaska**
  - No Christmas Tree land cover data are available
- **Hawaii**
  - No Christmas Tree land cover data are available
- **Puerto Rico**
  - No Christmas Tree land cover data are available
- **Guam**
  - No Christmas Tree land cover data are available
- **Marianas**
  - No Christmas Tree land cover data are available
- **American Samoa**
  - No Christmas Tree land cover data are available
- **Virgin Islands**
  - No Christmas Tree land cover data are available

- **Nurseries**

Non-agricultural Nurseries represent a land use that is not exclusive to any nationwide land cover class. Nurseries are mapped by using geocoded Dun and Bradstreet (D&B) business database addresses. Label uses that are covered by this UDL found on ornamentals, shrubs/vines, and non-food trees, grown in a non-agricultural setting (*e.g.* Retail Nurseries, Garden supple stores or retail horticultural locations). This UDL does not include labels represented by agricultural nursery uses such as trees grown for food, tree plantations or transplanted trees, shrubs, and ornamentals. These agricultural nurseries are captured in the agricultural UDLs described above.

- **CONUS**
  - Using the Dun and Bradstreet business database, select all records with any SIC Codes starting with “018” (Horticultural Specialties) or “526” (Retail Nurseries, Lawn and Garden Supply Stores)
  - Selected points are then buffered by their facility size attribute. Where facility size is absent, substitute the Census of Agriculture’s average acreage by county, calculated using Nursery Totals. If a county’s nursery acreages are undisclosed, then an average of all county averages is used. A circular buffer is applied, where radius is solved for using the areas previously described. In an effort to

map production facilities only and not business offices, use the ‘Location Type’ attribute to categorize locations.

- **Alaska**
  - EPA used Dun and Bradstreet business database in the same method as applied to CONUS.
- **Hawaii**
  - EPA used Dun and Bradstreet business database in the same method as applied to CONUS.
- **Puerto Rico**
  - EPA used Dun and Bradstreet business database in the same method as applied to CONUS.
- **Guam**
  - No Dun and Bradstreet business data were available for Guam.
- **Marianas**
  - No Dun and Bradstreet business data were available for Marianas.
- **American Samoa**
  - No Dun and Bradstreet business data were available for American Samoa.
- **Virgin Islands**
  - EPA used Dun and Bradstreet business database in the same method as applied to CONUS.

- **Right-of-Ways**

NLCD developed classes are sufficient for most scenarios. NLCD developed classes are insufficient in cases of rural minor roads, rural transmission lines, and rural pipelines.

- **CONUS**
  - All NLCD developed classes everywhere (21-24)
    - *** For generating Euclidean distance for CONUS Right-of-Ways (ROW), NLCD Developed classes do not have Euclidean distance algorithms applied. NLCD Developed classes are included in the footprint as a zero value in the final Euclidean distance file. The other component ROW classes do have Euclidean distance algorithms applied.*
  - ESRI Railroads
  - United States Census Bureau’s Master Address File (MAF) Topologically Integrated Geographic Encoding and Referencing database (TIGER) transmission (MAF/TIGER Feature Class Code (MTFCC) code L4020) and pipeline (MTFCC code L4010) data
  - Bonneville Power Administration’s (BPA) Right-of-Way data
  - Navteq roads
- **Alaska**
  - See ConUS method (without BPA data)
- **Hawaii**
  - All National Oceanic & Atmospheric Administration (NOAA) Coastal Change Analysis Program (CCAP) developed classes everywhere (2-5)
  - ESRI Railroads

        - TIGER transmission (MTFCC code L4020) and pipeline (MTFCC code L4010) data
        - NAVTEQ roads
    - **Puerto Rico**
        - See ConUS method (without BPA data)
    - **Guam**
        - All CCAP developed classes everywhere (2-5)
        - No ESRI Railroads data available for Guam
        - TIGER transmission (MTFCC code L4020) and pipeline (MTFCC code L4010) data
        - No NAVTEQ roads data available for Guam

    - **Marianas**
        - All CCAP developed classes everywhere (2-5)
        - No ESRI Railroads data available for Marianas
        - TIGER transmission (MTFCC code L4020) and pipeline (MTFCC code L4010) data
        - No NAVTEQ roads data available for Marianas
    - **American Samoa**
        - All CCAP developed classes everywhere (2-5)
        - No ESRI Railroads data available for American Samoa
        - No TIGER data available for American Samoa
        - No NAVTEQ roads data available for American Samoa
    - **Virgin Islands**
        - All CCAP developed classes everywhere (2-5)
        - No ESRI Railroads data available for Virgin Islands
        - No TIGER data available for Virgin Islands
        - No NAVTEQ roads data available for Virgin Islands

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Appendix F. Determination of Overlap of Likely Rodenticide Exposure Area and Species Ranges and Critical Habitat

The attached appendix **(067701+_NoTGCode_Final BE_Appendix F_11-21-2024)** is a compressed file (.zip) and contains the codes as well the input and output folders associated with the spatial overlap analysis for this Rodenticides effort.

Appendix G. Geographic Extent of Jeopardy Species and Adverse Modification of Critical Habitat. Determination of Overlap of Likely Rodenticide Exposure Area and Species Ranges and Critical Habitat

EPA created maps showing the geographic extent of the species and CHs that it predicted as potential likely future J or AM from the currently registered use of the 11 rodenticides (**Figure G-1** to **Figure G-3**; inclusive of all applicable taxon). The entire range of each species and CH is presented, not accounting for overlap with areas that represent rodenticide use areas. EPA notes that **Figure G-1** to **G-3** represent the maximum spatial extent because, as described earlier, it is currently developing a process to refine PULAs, and EPA expects the result will be that many PULAs will be smaller than the species ranges.

Figure G-1 presents the entire geographic ranges of primary consumer bird and mammal species that EPA has predicted to be potential likely future J from one or more rodenticides and/or use patterns. **Figure G-2** presents the entire geographic ranges of secondary consumer bird, mammal, and reptile species that EPA has predicted to be potential likely future J from one or more rodenticides and/or use patterns**. Figure G-3** presents the entire geographic ranges of the CH of two birds, two reptiles, and one amphibian that EPA has predicted to be potential likely future AM from one or more rodenticides and/or use patterns. These figures indicate that mitigations to protect listed species and CH will not be required in the entire United States.

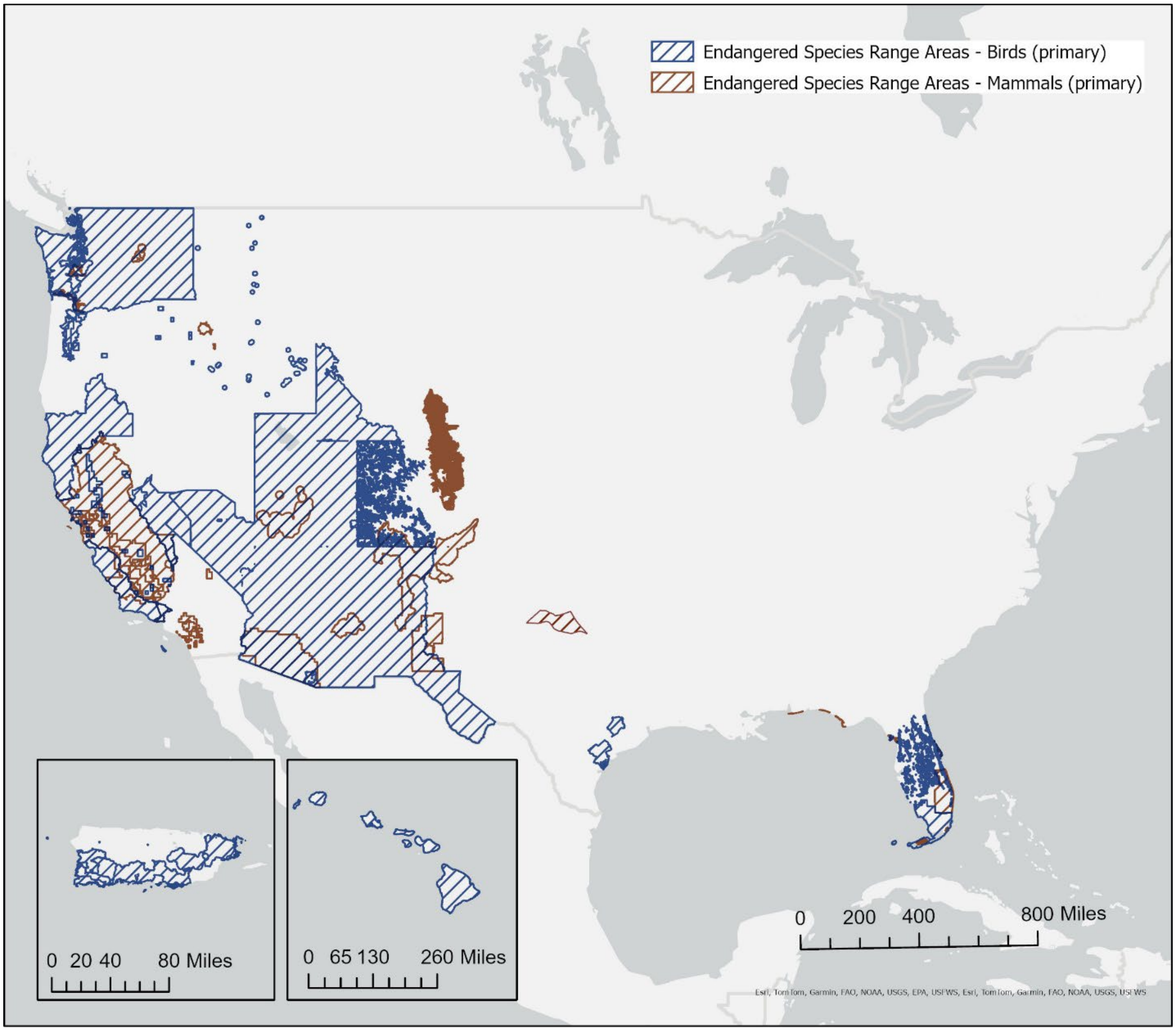


Figure G-1 Geographic extent of species range, for primary consumers that EPA predicted as potential likely future J. Birds are blue and mammals are brown. There are no species' ranges contained in areas of the CONUS that are not displayed in the above map. Similarly, there are no ranges for species in AK.

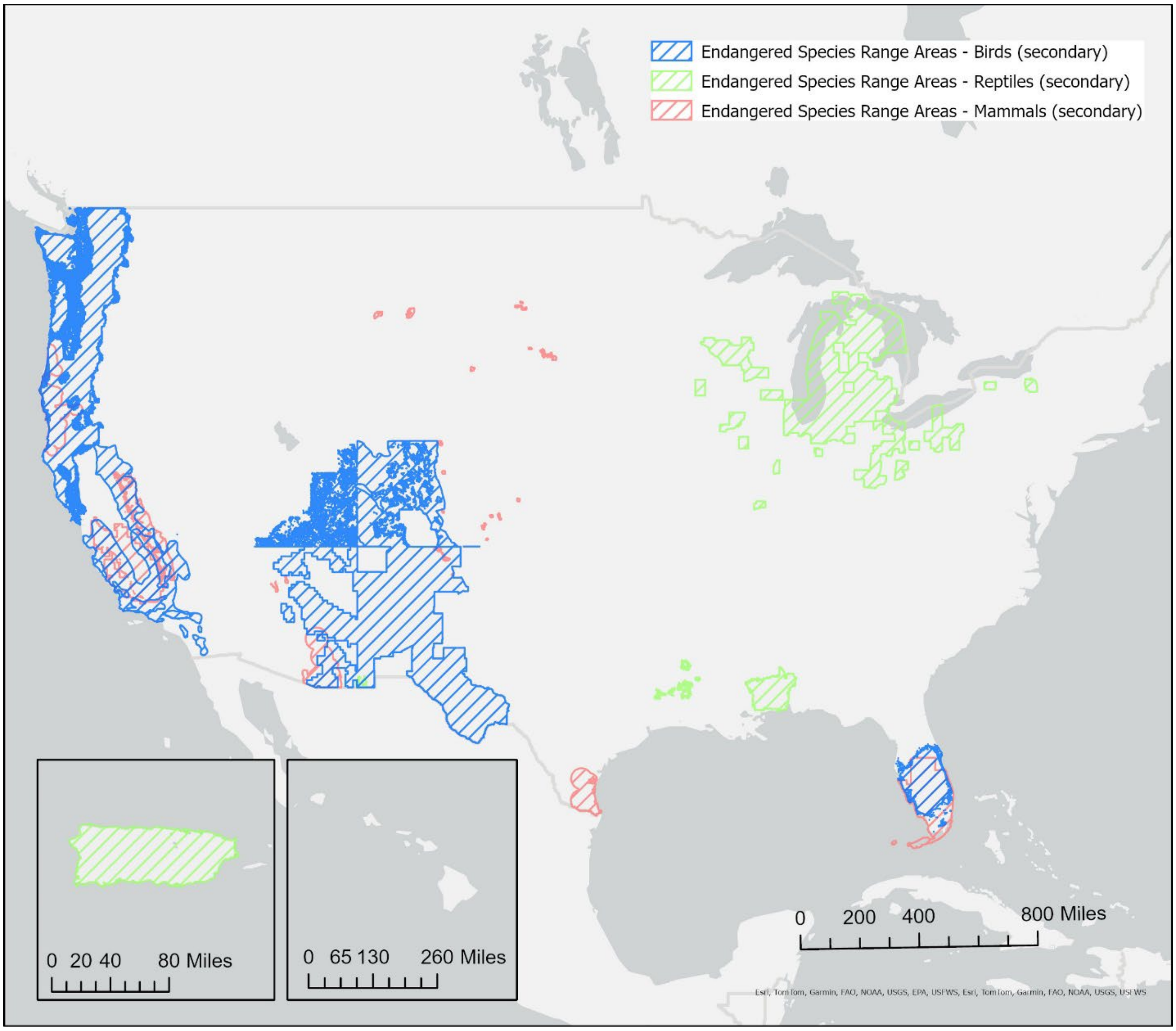


Figure G-2. Geographic extent of species range, for secondary consumers that EPA predicted as potential likely future J. Birds are blue, mammals are red, reptiles are green. There are no species' ranges contained in areas of the CONUS that are not displayed in the above map. Similarly, there are no ranges for species in AK.

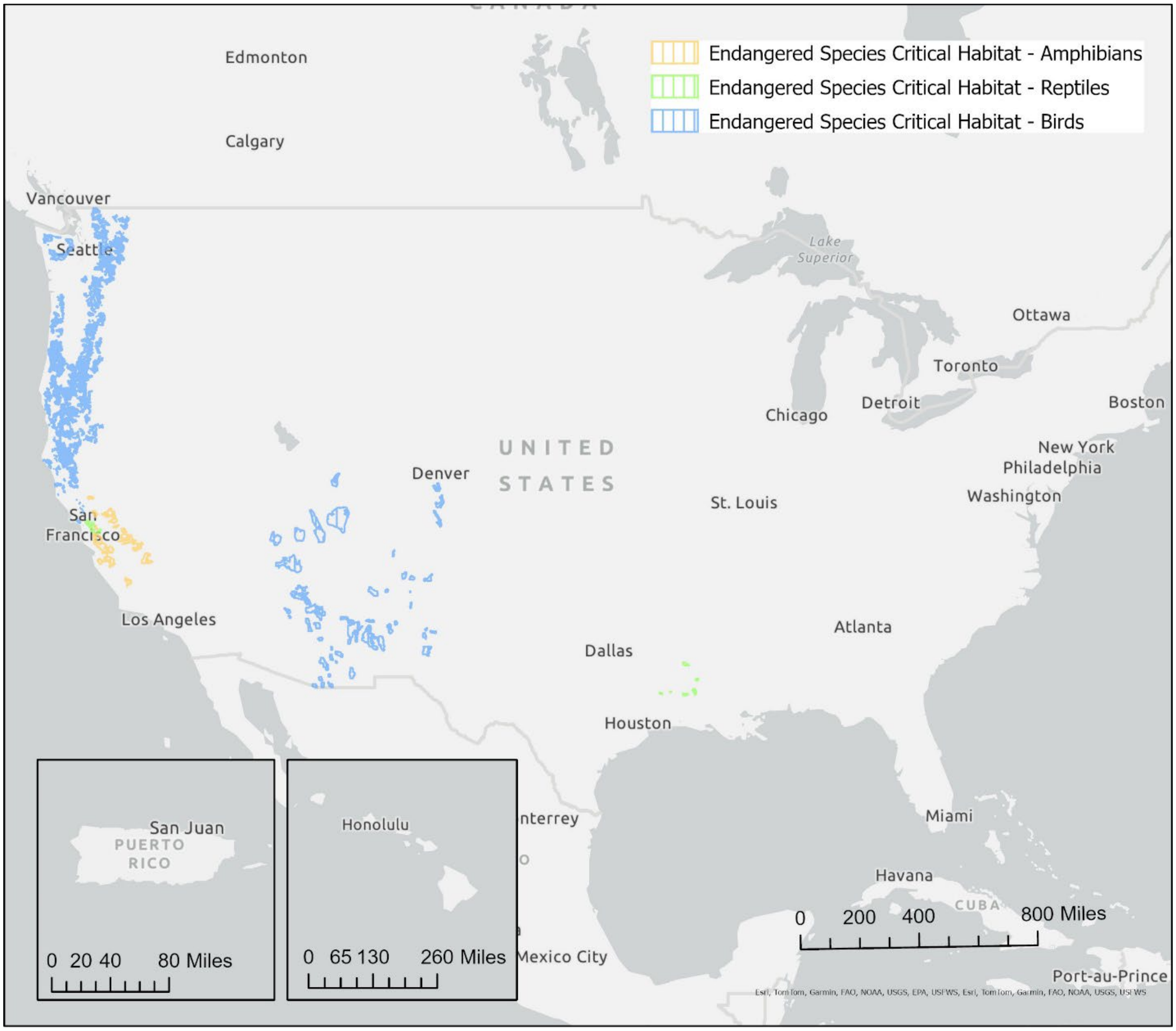


Figure G-3 Geographic extent of CH for species that EPA predicted as potential likely future AM. Birds are blue, amphibians are yellow, and reptiles are green. There are no species' critical habitats contained in areas of the CONUS that are not displayed in the above map. Similarly, there are no critical habitats for species in AK.

Office of:

Town Manager
Tax Assessor
Tax Collector
Town Clerk
Treasurer
Code Officer
Finance Director
Harbor Clerk

"Where Mountains Meet the Sea"

TOWN OF CAMDEN
1791 INCORPORATED 1891

Town Office

P.O. Box 1207
29 Elm Street
Camden, Maine 04843
Phone (207)236-3353
Fax (207)236-7956
http://www.camdenmaine.gov

I certify that the following Article of the Town of Camden Special Town Meeting, held on November 5, 2024, was approved by voters with the total number of votes cast being:
2913 yes
626 no

ARTICLE 3

Shall the Town of Camden amend the Camden Code by adding Chapter 194, Pesticides?

NOTE: *The proposed Chapter would require notification and reporting on the application of pesticides in Camden by State-licensed pesticide applicators. The full text of the proposed ordinance amendments is in the Town Clerk's Office and the Town Website and is available for inspection during regular business hours.*

Katrina Oakes
Katrina Oakes
Town Clerk, Camden, Me

11/18/2024
Date

PROPOSED NEW CODE CHAPTER 194

RELATING TO THE MANAGEMENT. USE and APPLICATION OF HERBICIDES and PESTICIDES

Purpose: To educate the community about the types of herbicides and pesticides being applied in the community, by requiring notification to abutters prior to the application of herbicides/pesticides by licensed applicators and requires licensed applicators to provide an annual report of the types and quantity of herbicides and pesticides applied in Camden.

Pursuant to 30-A M.R.S. § 3001, the State of Maine allows municipalities, through their home rule authority, to enact ordinances dealing with municipal affairs. Pursuant to 22 M.R.S. § 1471-U, Maine municipalities may enact ordinances that apply to pesticide storage, distribution, or use.

§ 194.1 Applicability. This Code shall apply to the outdoor application(s) of any pesticide by Maine licensed applicators on any land in the Town of Camden. The effective date of this Chapter shall be January 1, 2025.

§ 194.2 Definitions.

Application- The spreading of pesticides over or on any outdoor area by any means in liquid or dry form including but not limited to broadcasting, pasting, ground spraying, aerial spraying, foliar application, soil injection, and surface utilization.

Herbicide- See Pesticide

Licensed Applicator- Any person licensed by the State of Maine and regulated by the rules of the Maine Board of Pesticide Control, as may be amended, to apply pesticides as defined, including but not limited to private, agricultural and commercial (master and/or operator) applicators and/or anyone under the direct supervision of a certified applicator.

Pesticide- Any substance or mixture of substances intended to kill, prevent, repel, mitigate, control, or desiccate species designated as a pest, including, but not limited to plants, weeds, insects, or other organisms, and including but not limited to herbicides, fungicides, insecticides, rodenticides, disinfectants, and antibiotics, and any fertilizer mixture which contains any of the foregoing. The term shall also mean any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant. Pesticides shall include, but not be limited to registered, limited and general use pesticides as may be defined in State law and as regulated by the Maine Board of Pesticide Control.

§ 194.3 Notice. Prior to the application of any pesticide by a licensed applicator, the applicator shall provide written notice at least two (2) days in advance of the application to the Town of Camden's Planning and Development Department, the direct abutters with whom a property line is shared, and those properties within two-hundred feet (250') of the application area including those properties across public and private rights of ways or streets.

A. **Notice Content.** The written notice shall include the proposed date and time of the application and shall list the trade names and USEPA registration number of the pesticides that will be applied and shall indicate which pest is being treated. The notice shall also provide a property sketch of the proposed application locations. The notice shall also include the name of the licensed applicator and contact information.

§ 194.4 Signage. Prior to application, but at least thirty (30) minutes before, the licensed applicator shall place and/or post warning signage or placards in conspicuous locations near abutting properties and near public and private streets or right of ways notifying the public and abutting property owners of imminent application of pesticides. Signage shall include the date and time of the application and the trade name and USEPA registration number of the pesticide applied. The wording shall be legible to the average person. Such signage shall be placed every 50' along abutting property lines and/or along public or private streets or right of ways. Signs shall be a minimum of one square feet in printed area and shall be placed a minimum of one foot above the grade, ground or vegetation, and shall remain in place per the State of Maine Board of Pesticide Control's requirements but at a minimum of seven days from the date and time of application. Such signage shall be in addition to any requirements of the Maine Board of Pesticide Control.

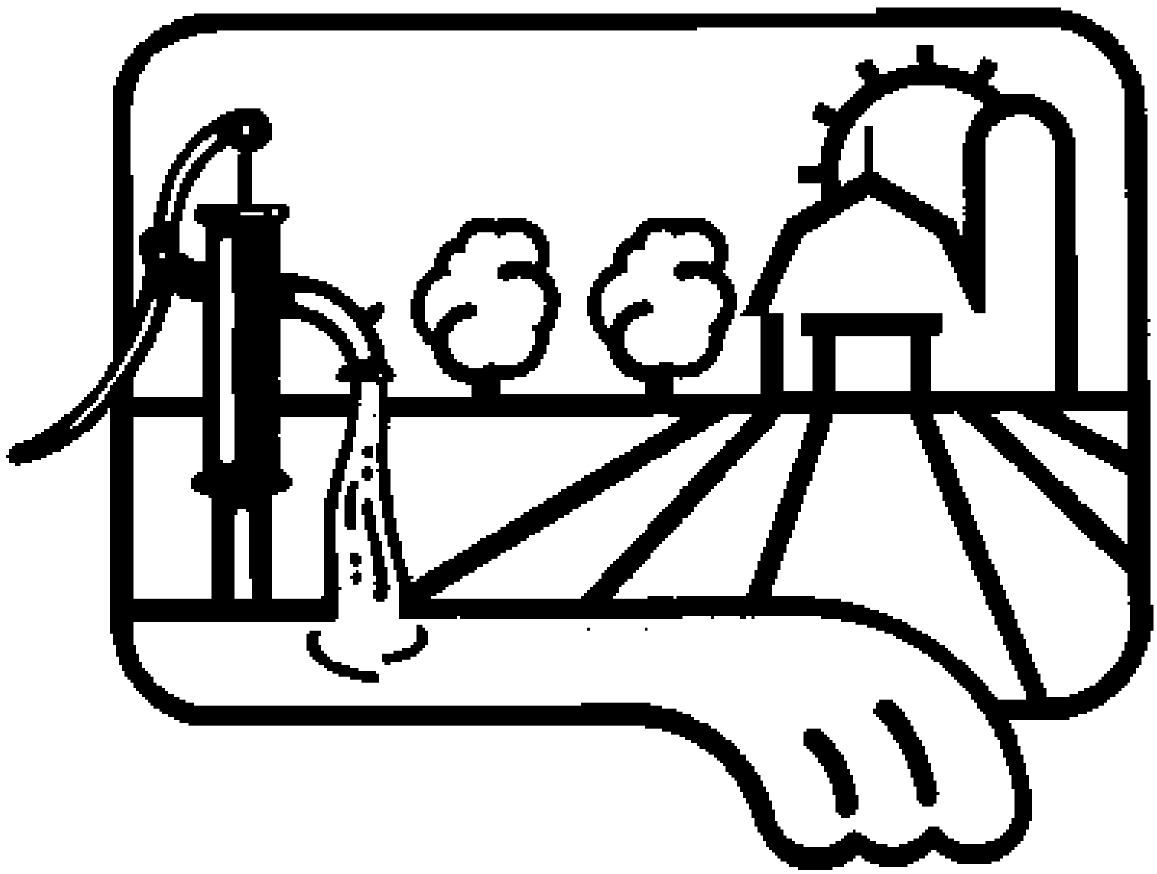
§ 194.5 Annual Reporting. In addition to complying with the Maine Board of Pesticides Control rules regarding recordkeeping and reporting, State of Maine licensed applicators doing business in Camden are required to submit an annual summary report to the Town's Planning and Development Office on or before February 1st of each year. The report shall contain the following information for applications of pesticides performed in the Town during the prior calendar year: target site, pesticide brand name, EPA registration number, total undiluted formulation (in pounds or gallons), pests being treated, and total area treated as listed and as amended on the Commercial Applicator Annual Summary Report required by the Board of Pesticide Control.

§ 194.6 Enforcement. The Code Enforcement Officer or their designee shall be responsible for enforcing the provisions of this Chapter. Upon determining that a violation of any provision of this Chapter has occurred, the CEO shall provide written notice to the violator to identify the violation and shall specify a course of remedial action which may include a provision for consent agreements as specified in Chapter 290. Violations shall be subject to the penalties prescribed in 30-A M.R.S. § 4452.

Appeals. An appeal from the action of the Code Enforcement Officer. or their designee, under this chapter may be sought through the provisions of Article VII in Chapter 290, Zoning

8.8.2024

10c



STATE OF MAINE

GENERIC STATE MANAGEMENT PLAN FOR PESTICIDES AND GROUND WATER

1994

Revised
January 1998 and December 2006

STATE OF MAINE

GENERIC STATE MANAGEMENT PLAN
FOR PESTICIDES AND GROUND WATER

1994

Revised
January 1998 and December 2006

Prepared by:
Tammy L. Gould, Pesticides Planner
Maine Board of Pesticides Control

Revised in 2006 by:
Heather P. Jackson, Water Quality Specialist
Maine Board of Pesticides Control

TABLE OF CONTENTS

APPENDICES

ACKNOWLEDGMENTS

The Maine Board of Pesticides Control and its staff thank the following individuals for offering their assistance, expertise, and patience in completing and revising this plan.

2006 Revisions

Rodney McCormick, Maine Department of Agriculture, Marketing
David Rocque, Maine Department of Agriculture

Ground Water Planning Committee (1997 Revisions)

David Bell, Maine Blueberry Commission
David Braley, Maine Department of Human Services, Drinking Water Control Program
Michael Corey, Maine Potato Board
James Corliss, Maine Christmas Tree Association
Neil Crane, Maine Association of Conservation Districts and Maine Farm Bureau
Wes Davis, Central Maine Power Co.
James Dill, University of Maine Cooperative Extension
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Steve Goodwin, Maine Vegetable-Small Fruit Growers Association
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Robert LaRoche, Maine Department of Transportation
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Debra Vanderbeek, New England Council for Plant Protection

Ground Water Planning Committee (1992-94)

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Ron Dyer, Maine Department of Environmental Protection
Rick Eastman, Maine Landscape and Nursery Association
John Fogler, Dairy Farmer
Steve Goodwin, Maine Vegetable-Small Fruit Growers Association
Carl Haag, S.D. Warren Co.

William Johnson, Maine Pomological Society
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Ed McLaughlin, Maine Blueberry Commission
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Others who have contributed to this plan or previous drafts

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John Harker, Maine Department of Agriculture, Food, and Rural Resources
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Rick Kersbergen, University of Maine Cooperative Extension
Rob Koethe, U.S. EPA, Region I
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Edward Lavery, U.S. EPA Region I
Russell Libby, Maine Department of Agriculture, Food, and Rural Resources and Maine Organic Farmers and Gardeners Association
Terry Mingo, Maine Department of Human Services, Drinking Water Control Program
Michele Notarianni, U.S. EPA, Region I
Steve Pinette, Maine Department of Environmental Protection
Tony Pisanelli, U.S. EPA, Region I
David Poe, Soil Conservation Service
David Rocque, Soil and Water Conservation Commission
Andrews Tolman, Robert G. Gerber, Inc., Core Member of the Pesticide SMP Advisory Committee
Andrew Triolo, U.S. EPA, Region I
Tom Weddle, Maine Geological Survey

CONCURRENCE SIGNATURES

The following agency representatives have read the *Maine Generic State Management Plan for Pesticides and Ground Water* and concur with their agency's responsibilities as stated in the plan.

______________________________ Maine Dept. of Agriculture	______________________________ Maine Dept. of Environmental Protection
______________________________ Maine Dept. of Human Services	______________________________ University of Maine Cooperative Extension
______________________________ U.S. Environmental Protection Agency	

STATE LIAISON

The purpose of a state liaison is to have a single contact point responsible for the transmittal and receipt of official correspondence and information. The single contact point for all formal communications concerning the State Management Plan process between the U.S. Environmental Protection Agency and the State of Maine shall be:

Henry Jennings, Acting Director
Maine Board of Pesticides Control
State House Station #28
333 Deering Building, AMHI Complex
Augusta, Maine 04333-0028
Tel: (207)287-2731

INTRODUCTION

Ground water is an essential resource to Maine's citizens. Over half of the U. S. population relies on ground water for drinking water, and in rural Maine, ground water is the dominant source of drinking water. Because pesticides and other agricultural chemicals have been found in wells in many states, including Maine, the U.S. Environmental Protection Agency (EPA) developed a *Pesticides And Ground-Water Strategy* to prevent unacceptable contamination of ground water resources from the normal, registered use of pesticides. Part of this strategy includes the recommendation that states develop state management plans (SMPs). The *Maine Generic State Management Plan (SMP) for Pesticides and Ground Water* is the foundation on which pesticide-specific state management plans (Pesticide SMPs) are built.

The Maine Board of Pesticides Control (BPC) collaborated with other state agencies to develop a strategy for preventing ground water contamination by pesticides. The first Generic SMP was completed in July 1994. Following the adoption of the *Hexazinone State Management Plan for the Protection of Ground Water* (July 1996), the Board noted a number of deficiencies in the original Generic Plan. The original committee which worked on the Generic SMP was re-formed in January 1997 and the revised *Maine Generic State Management Plan for Pesticides and Ground Water* was adopted by the Board on January 30, 1998. This plan was revised again in 2006.

Plan in Brief

The *Generic State Management Plan for Pesticides and Ground Water* outlines the government agencies involved with ground water resource protection, describes their roles within the planning process, and describes how overlapping authorities will be coordinated. To ensure compliance with Pesticide SMPs, agency enforcement roles are set forth.

The basis for ground water assessment and protection planning is formed through the characterization of Maine's ground water resources and the description of pesticide use patterns. Emphasis is placed on contamination prevention measures, such as best management practices, user education and technical assistance. If these measures are not successful, the BPC may consider other means to control pesticide use. To help determine what controls are needed and to allow for public participation, the BPC will create a unique Pesticide SMP Advisory Committee for each Pesticide SMP it chooses to write. This committee will respond to EPA or BPC mandates by developing pesticide-specific management plans. The response and regulatory framework shows how the BPC will define and respond to contamination situations based both upon a contaminant's percent of an established health standard and upon the percentage of sites sampled with the presence of a contaminant.

A two-phase ground water monitoring program is described in this plan; the program goal being assessment of potential contamination problems and once a pesticide is detected, assessment of the extent of the problems. Pesticide management practices are then implemented in response to identified contamination trends.

SECTION I
BACKGROUND

Ground water is an important national resource which provides about one-fourth of all water used in the United States. Nearly half of the U.S. population relies on ground water for drinking water, and in rural areas, ground water may be the only, or at least the dominant, source of drinking water.[1] In Maine, approximately 90% of public water suppliers obtain some or all of their supply from ground water.[2]

In the past, most people believed that ground water was protected from contamination by soil and rock formations.[3] This belief changed in the 1970s when agricultural chemicals were found in wells in several states. Monitoring surveys flourished throughout the 1980s and demonstrated the impact of pesticides on ground water quality. Since the 1970's, public agencies have been attempting to devise a comprehensive and rational strategy which both serves the needs of pesticide users while addressing environmental concerns. In December 1987, the U.S. Environmental Protection Agency (EPA) proposed such a strategy in *"Agricultural Chemicals in Ground-Water: Proposed Pesticide Strategy."*

Agricultural Chemicals in Ground-Water: Proposed Pesticide Strategy

The strategy initially proposed by EPA consisted primarily of an environmental goal, a contamination prevention policy and program, and a response policy and program. While EPA asserted that it would continue to take uniform action nationwide on pesticide use and disposal practices, the Agency encouraged the development of strong state roles in the local management of pesticide use to protect ground water. State Management Plans (SMPs) were identified as the preferred vehicle by EPA because states, which are closer to local conditions, could better evaluate and respond to local variations in use and vulnerability. The EPA believed that SMPs would be an effective way to provide adequate protection of ground water resources without restricting pesticide use unnecessarily.

The incentive for states to prepare these plans came from the federal pesticide registration process. The future use of registered pesticides, identified by EPA as a threat to ground water, would depend on the presence and adequacy of a state's management plan. In some situations, EPA would require a state-specific label or supplemental labeling with SMP-prescribed, pesticide management measures. In other cases, EPA would take steps, including statewide

1 [1]U.S. Environmental Protection Agency, "Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy", December 1987, pp. 13.

2 [2]Personal conversation with Jeff Folger, Maine Department of Human Services, Drinking Water Control Program, January 3, 1997.

3[3]U.S. Environmental Protection Agency, op.cit., pp. 21.

cancellation, to control the use of a pesticide that poses a significant ground water threat if there was no adequate SMP that could reasonably be expected to prevent or reduce the threat of unacceptable contamination.[4] The possibility of special state management measures in lieu of EPA cancellation has been the driving force behind SMP development nationwide.

Pesticides And Ground-Water Strategy

After nearly four years, EPA published the final *Pesticides And Ground-Water Strategy* in October 1991. The final strategy reflected many of the comments received from the industry, environmental groups, and the states and incorporated EPA's new statement of principles for programs dealing with ground water. Increased emphasis on prevention of ground water contamination is at the heart of these new principles. That commitment is demonstrated in the stated goal of the *Pesticides And Ground-Water Strategy*, which is "to prevent contamination of ground water resources that presents an unreasonable risk of adverse effects to human health and the environment resulting from the normal, registered use of pesticides."[5]

As in the proposed strategy, the centerpiece of the final strategy is the development and implementation of SMPs for specific pesticides of concern. EPA would now apply Pesticide SMPs as a label requirement so that a product can be legally used only in states with an approved plan. And, unlike the proposed strategy, the final *Pesticides And Ground-Water Strategy* encompassed not only agricultural pesticides, but all pesticide products which may pose a threat to ground water from outdoor uses.

EPA also went on to define two types of state management plans: Generic SMPs and Pesticide SMPs. Generic SMPs provide basic information in twelve identified areas regardless of a specific pesticide. Pesticide SMPs contain all the information appropriate to a Generic SMP plus all the information specific to an identified pesticide. A Generic SMP is used to put in place the resources and coordinating mechanisms that will be required to develop and implement a Pesticide SMP. By designing a voluntary Generic SMP, the State can facilitate the timely and cost-effective developments of Pesticide SMPs as the need arises.

Subsequent national and regional guidance documents looked to these state management plans to complement and enhance other state ground water protection programs, such as the comprehensive state ground water protection program, the nonpoint source pollution strategy, coastal zone pollution management program, and wellhead protection program. In all, keys to the success of any state management plan will be 1) the authority and ability to implement ground water contamination prevention measures, 2) the authority to implement some type of remediation in the event of contamination, and 3) the authority and resources to conduct a monitoring program to evaluate the effectiveness of both prevention and restoration measures.

4[4]Ibid., pp. 108.

5 [5]U.S. Environmental Protection Agency, *Pesticides and Ground-Water Strategy,* October 1991, pp. 11.

History of the Maine Generic State Management Plan for Pesticides and Ground Water

Maine has long taken the initiative and addressed the problems of pesticide use and ground water contamination before they threatened the livelihood and lifestyle of Maine, its citizens, and its environment. Since 1988, the Board of Pesticides Control (BPC) has collaborated with representatives of the Department of Agriculture, Maine Geological Survey, Department of Environmental Protection, and Department of Human Services to develop the state's strategy for preventing ground water contamination by pesticides. In 1990, the BPC hired a full-time planner to coordinate the elements of the strategy and to write the plan.

Two draft plans were completed by the spring of 1991. The second draft plan (April 1991) received wide public comment. Several public meetings were held in agricultural areas in the state to gather input. The BPC, reacting to the comments received, authorized the formation of a planning committee that would better represent the diverse interests of the agricultural community. With the publication of the final strategy, that group was expanded to include non-agricultural pesticide users as well. Building upon the existing drafts, a proposed plan was released in August of 1993 and subjected to another round of hearings and comments. The first *Maine Generic State Management Plan for Pesticides and Ground Water* was formally adopted by the BPC at their regular monthly meeting in June 1994.

Immediately following its adoption, Maine's Generic SMP was put to the test with a pesticide of local concern: hexazinone. Following detections of this herbicide in ground water samples, including wells serving two elementary schools, the blueberry industry, sole users of hexazinone-products in Maine, met with the BPC in early 1994 to discuss an action plan. Simultaneously, a citizen-initiated petition drive was underway to ban the use of all formulations of the herbicide. Hearings on the petition were held by the BPC in July 1994. After considering all the testimony, the BPC decided to retain use of hexazinone in Maine but, following the process outlined in the Generic SMP, directed the formation of a Pesticide SMP Advisory Committee to develop management options for hexazinone.

The process of creating the *Hexazinone State Management Plan for the Protection of Ground Water* (July 1996) gave the BPC first-hand experience in developing a Pesticide SMP and brought to light some inadequacies and obstacles not foreseen when the Generic SMP was written. Also, the BPC was committed to a biennial review of the Generic SMP in the 1994 document. In January 1997, the original Ground Water Planning Committee, the group of agricultural and nonagricultural pesticide users in Maine, was invited to participate in a revision of the Generic SMP. The 1997 revisions reflected what was learned about pesticides and ground water planning during previous years. This plan was again updated in 2006, as seen here.

SECTION II
STATE PHILOSOPHY AND APPROACH TO PESTICIDE MANAGEMENT FOR GROUND WATER PROTECTION

Maine's approach to pesticide management for ground water protection is one which emphasizes prevention of ground water contamination, defined in relation to 1) health-based reference points or 2) other EPA established water quality standards and aquatic life criteria, particularly where ground water is closely connected to surface water ecological systems. The Maine Ground Water Management Strategy recognizes that cleanup of contaminated ground water may be impractical for both technical and financial reasons, so prevention is the only practical course.

All ground water in Maine is currently classified as a present or future source of public drinking water. While this classification system necessitates equal protection of all ground water resources statewide, additional protection effort will be given to priority waters identified by the Maine Department of Environmental Protection, currently identified as wellhead protection areas and ground water supplying base-flow to Class AA and Class A watersheds. However, the BPC, lead agency for the development and implementation of this plan and Pesticide SMPs, wishes to remain flexible in its allocation of prevention, monitoring, and response resources in order to fulfill its more specific mandate for protection of public health and the environment from the adverse effects of pesticide use.

This Generic SMP is both a planning tool in Pesticide SMP development and a guidance document for the BPC when dealing with other pesticide-in-ground-water issues. This dual use allows for a uniform approach to pesticide and ground water management regardless of pesticide or current management strategy.

The BPC remains committed to maintaining registration of vital pesticide products. Pesticides which are identified by EPA as worthy of a Pesticide SMP will be considered for plan development on a case-by-case basis in Maine. The value to their user communities and evident or potential environmental and public health impacts will be considered when prevention and response mechanisms are tailored to the identified pesticides. For pesticides where cost, pest control or environmental benefits may not be realized by developing a Pesticide SMP, the BPC retains the option of not developing one. Instead, the BPC may prohibit future sale and use of that pesticide in Maine. Conversely, beyond what pesticide-specific plans are encouraged by EPA, the state may chose to address pesticides of local concern in a manner similar to that established in this plan.

SECTION III
COOPERATING AGENCIES

States, not the federal or local governments, have the central role in developing and implementing state management plans. This requires states to have the requisite legal authorities and to coordinate existing programs. Cooperation must be developed among a variety of federal, state, county, and local agencies to achieve effective implementation.

Listed below are the government agencies involved with pesticides, ground water, and implementation of Generic and Pesticide SMPs. A review of applicable statutory authorities is included as well as a description of their existing ground water protection or pesticide control programs. The agencies are divided into three groups: (1) agencies with Pesticide SMP implementation roles; (2) agencies with technical assistance roles; and (3) agencies with ground water protection programs, but no direct implementation or technical assistance roles.

Agencies with Pesticide SMP Implementation Roles

U.S. Environmental Protection Agency (EPA)

The EPA is responsible for regulating pesticide use, for protecting the quality of the nation's ground and surface water, and for regulating the storage, disposal, and response to releases of pesticides. EPA used the legal authorities and mandates of several federal acts in creating 1991's *Pesticides And Ground-Water Strategy* and developing 1996's proposed State Management Plan rule.

A. Legal Authorities Necessary to Implement SMPs

7 U.S.C. §136 et seq.
The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
FIFRA regulates the registration and use of pesticides. FIFRA allows EPA to address ground water concerns about pesticides on a national level and through cooperative agreements with the states.

33 U.S.C. §466 et seq.
Clean Water Act (CWA)
The CWA was established to protect the integrity of this nation's surface and ground waters. Grants to protect ground water are awarded to states for development and implementation of state wellhead protection programs, for development of statewide ground water protection strategies, and for nonpoint source pollution programs.

42 U.S.C. §300f et seq.
The Safe Drinking Water Act (SDWA)
The SDWA is designed to ensure the safety of public drinking water supplies. The Act requires EPA to establish both national drinking water quality standards (MCLs) and monitoring requirements for suppliers of public water. 1986 Amendments to the SDWA authorize states to establish Wellhead Protection Programs for the protection of public drinking water wells and to authorize the designation of sole source aquifers by EPA. 1996 Amendments introduce source water protection as a goal. This plan incorporates drinking water standards in its policy for responding to contamination (See Section VIII, "Response Framework".)

42 U.S.C. §6901 et seq.
The Resource Conservation and Recovery Act (RCRA)
RCRA regulates the disposal of hazardous wastes which include pesticides or pesticide-contaminated material deemed no longer useful.

42 U.S.C. §9601 et seq.
The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA established a trust fund to finance responses to non-routine releases of hazardous substances. CERCLA also allows for assessment and recovery of damages from liable parties. For pesticide spills or illegal applications which may cause ground water contamination, this statute is important. CERCLA is also the only law which provides for the "temporary provision of an alternate water supply" under such circumstances.

B. Existing Programs

There are several offices in EPA Headquarters which oversee the above programs. The Office of Pesticide Programs (OPP) administers FIFRA, while the Office of Water (OW) administers the SDWA. Other divisions of EPA are also responsible for administration of other ground water protection strategies and pollution prevention programs. The *Pesticides and Ground-Water Strategy* (October 1991) and proposed State Management Plan rule (June 1996) draw from these regulatory authorities and lay the foundation for this management plan.

C. Role in this Plan

1. EPA may finalize the proposed State Management Plan rule and identify those pesticides whose future use will be subject to the requirements of an SMP.

2. EPA will review this Generic SMP and approve Pesticide SMPs, when submitted.

2. EPA should continue to provide technical support and guidance documents to the states on implementation of the state management plans.

3. EPA should continue to provide assistance to states to establish Comprehensive State Ground Water Protection Programs consistent with the State Management Plan approach and implement multi-year program plans which build upon and further integrate state ground water protection strategies, wellhead protection programs, nonpoint source programs, and other ground water related programs.

4. EPA should continue to evaluate the environmental fate of pesticides and to regulate products, via the registration process, which pose a ground water threat, on a national basis.

5. EPA should continue to provide financial assistance to develop or maintain state management plans and pesticide specific plans.

6. Quality assurance/ Quality control (QA/QC) document approval.

<u>Maine Department of Agriculture, Food, and Rural Resources, Board of Pesticides Control</u>

The Board of Pesticides Control (BPC) was established to protect the public health and safety of Maine's citizens and to protect the public interest in the soils, water, forests, wildlife, agriculture, and other resources of the state by assuring scientific and proper use of pesticides. The Board and its staff are charged with registration of pesticide products, licensing of applicators, and enforcement to ensure that pesticides are properly used.

A. Legal Authorities Necessary to Implement SMPs

7 M.R.S.A. §606(2)(F)
Prohibited Acts; Unlawful alteration, misuse, divulging of formulae, transportation, disposal and noncompliance
Section (F) is the basis for enforcement by the Board in that it prohibits any person from applying pesticides in a manner inconsistent with pesticide rules and regulations.

7 M.R.S.A. §607-A(2)(C)&(3)
Review or reregistration; Review process and Effect of review on reregistration
Section (2)(C) states that the BPC, in conjunction with the Department of Environmental Protection, Department of Inland Fisheries and Wildlife, Department of Human Services, and the Department of Conservation, shall review registration of pesticides by conducting a water residue survey, inclusive of wells and surface water, to determine the kinds and amount of pesticides present. If the review indicates a negative environmental impact, then the BPC shall "require implementation of...safeguards prior to reregistration."

7 M.R.S.A. §609
Refusal to register, cancellation, suspension, legal recourse
This section gives the Board the power to change or cancel the registration of a pesticide via the rulemaking process when the Board determines that a pesticide or its labeling does not comply with the rules or regulations of this chapter.

7 M.R.S.A. §610(2)
Determination; rules and regulations; restricted use pesticides; uniformity
Section (2) gives the BPC broad authority to promulgate rules in conformance with their statutory authority.
7 M.R.S.A. §611(3)
Enforcement; Repeated violations
Section (3) allows the Board to identify persons who repeatedly violate pesticide use laws and recommend them to the Maine Attorney General for action. This section also discusses enforcement procedures.

7 M.R.S.A. §616-A
Penalties
This section provides for penalties for civil violations of not more than $1,500 for the first violation and $4,000 for each subsequent violation within a four-year period. For private applicators, penalties may not exceed $500 for a first violation or $1,000 for any subsequent violation within a four-year period for violations of record keeping or the return and disposal of pesticide containers.

7 M.R.S.A. §620

Cooperation

This section is Maine's planning authority for this state management plan. It allows for grants, cooperative agreements, and the preparation and submittal of plans to EPA under state statute and FIFRA.

22 M.R.S.A. §1471-D(8)(A)-(I)

Certification and licenses; revocation

This section provides the conditions under which a pesticide applicator may be found in violation or license may be revoked. They include having used a pesticide "in a careless, negligent or faulty manner or in a manner which is potentially harmful to the public health, safety or welfare of the environment."

22 M.R.S.A. §1471-H

Inspection

This section is the basis for this strategy's ground water monitoring program. It provides for inspection of "any public or private premises" for the purpose of inspecting equipment, storage areas, and "sampling pesticide residues on crops, foliage, soil, water or elsewhere in the environment."

22 M.R.S.A. §1471-M(4)

Designation of critical areas

Section (4) allows the Board to designate critical areas "where pesticide use ... present[s] an unreasonable threat to [the] quality of the water supply."

B. Existing Programs

The Board of Pesticides Control has a number of existing programs which protect the integrity of Maine's ground water resources. Among the programs are pesticide registration, applicator certification and licensing, returnable container regulations, and obsolete pesticide disposal.

Registration of Pesticides

The BPC has formal authority to regulate pesticide use through the state registration process. All pesticides sold or used in the state of Maine must be registered by both the EPA and the BPC and carry one of three use classifications: general use, restricted use, or state limited use. General use pesticides are commonly found in hardware, department, and farm stores. They may be bought and used by the general public on their own property without training or certification. Restricted use pesticides may be sold only by licensed pesticide dealers and may be purchased and used only by licensed pesticide applicators. State limited use pesticides may be used only under a special permit granted by the BPC. Tied to permission to use such limited use pesticides may be reasonable terms and conditions, otherwise known as "management practices," which are designed to protect the health, safety, and general welfare of the environment and public health above and beyond the label guidelines. This management plan addresses the importance of restricted use and limited use classifications as part of the overall prevention strategy in subsequent chapters.

Applicator Certification and Licensing

To ensure that pesticides are used properly, the BPC has adopted rules related to the certification and licensing of pesticide applicators. Persons must be licensed to (1) use or supervise the use of any restricted or limited use pesticide or (2) make custom applications of general use pesticides, or (3) apply a pesticide in connection with their duties as an official or employee of federal, state, or local government. To become licensed in Maine, individuals must first earn *certification*, a credential which shows proficiency in pest management, pesticide use, and safety. Questions concerning ground water vulnerability and pesticide leaching potential were added in 1990 to the core exam for certification. Once certified, an applicator applies for a license appropriate to his/her intentions and is required to attend recertification programs to maintain licensure. For more on certification, see Section VI, "Prevention Strategies."

Returnable Pesticide Container Regulations

In response to environmental concerns about the proliferation of empty pesticide container dumps on the edges of fields and to prevent the possibility of point source pollution of ground and surface waters from the improper disposal of these containers, the BPC has been charged with regulating the return and disposal of limited and restricted use pesticide containers. In 1984, the BPC adopted regulations which (1) established a deposit collected pending the return of all glass, metal, or plastic restricted and limited use pesticide containers over one-half pint in size, (2) required stickers to be affixed on all such containers at the time of sale, (3) required triple rinsing or the equivalent of containers prior to their return, and (4) specified places where rinsed containers may be returned for refund of deposit in addition to the dealer location. These regulations cover both instate and out-of-state purchases to ensure that waste rinsate concentrations are minimized and that containers are disposed of in an environmentally sound manner.

Obsolete Pesticide Disposal Program

Disposal of banned and unusable pesticides has been a problem in Maine and throughout the country since EPA began to take certain pesticides off the market in the early 1970s. The BPC has endeavored to assist conscientious citizens in disposing of unusable pesticides at no charge to them. This activity began in 1972 when a convoy of DOT trucks was organized to haul the remains of a pesticide manufacturing plant to Massachusetts for safe storage in a naval center and later disposal.

In the early years, the BPC had a five ton truck and its employees went to farms and homes to collect pesticides whenever a citizen called. The chemicals were then stored until funds were available to hire a contractor to dispose of them at licensed out-of-state facilities. The largest effort occurred in 1989 when there was a one-time legislative appropriation of $100,000 that resulted in the disposal of 22 tons of primarily agricultural products.

Since 1996, the BPC has used special general fund appropriations and federal grants to conduct programs to collect and properly dispose of obsolete pesticides. Each year a hazardous materials contractor is hired to be present for one day at each of four regional sites. Homeowners, non-corporate farmers and greenhouse operators can participate free of charge and must submit an inventory form in advance to the BPC. When the week of collections is scheduled, shipping papers are mailed to each participant listing the pesticides they may bring in on the specified date. The program is limited to obsolete pesticides, defined as banned pesticides, and products that have become caked, frozen or are liquids more than 10 years old. Pesticides that can be used legally are generally not accepted although chlorpyrifos products with residential uses were accepted starting in the year 2000.

A total of 143,990 pounds of chemicals, from more than 866 individuals, have been delivered to a local hazardous waste contractor through these efforts, the latest in 2004. Another two collections are planned for 2007. In addition, two special projects have been conducted to transport 2,4,5-T and dinoseb to out-of-state facilities under federal disposal programs required by EPA suspension orders.

C. Role in this Plan

1. The BPC will be the lead agency for developing, enforcing, and implementing state management plans, acting as the liaison between EPA and state agencies for this program.

2. The BPC will continue to regulate pesticides to minimize the potential for ground water contamination.

3. The BPC will continue to provide ground water education for pesticide applicators through its certification programs and to work cooperatively with other state agencies in educating licensed and non-licensed applicators.

4. The BPC will oversee the development and implementation of a ground water monitoring program for pesticides, as specified in this plan and in Pesticide SMPs.

5. The BPC will assist pesticide users, to the best of its ability, to properly dispose of contaminated material resulting from pesticide spills and obsolete, canceled and unusable pesticides.

6. The BPC will respond to contamination problems and will assist in identifying and enforcing means to mitigate the problem.

Maine Department of Agriculture, Food and Rural Resources, Division of Animal Health and Industry

The Division of Animal Health and Industry is responsible for responding to complaints or problems involving agriculture, including those of surface and ground water pollution.

A. Legal Authorities Necessary to Implement SMPs

17 M.R.S.A. §2805
Farms or farm operations not a nuisance
An updated version of the "Right-to-Farm" Law, this statute authorizes the commissioner of Department of Agriculture, Food and Rural Resources to investigate all complaints involving a farm or farm operations, including complaints involving ground and surface water pollution. If the commissioner believes the subsequent problem to be a nuisance, there are a number of steps, including finally referral of the matter to the Office of the Attorney General, to assure that the farm or farm operation adopts best management practices. This section also establishes an Agricultural Complaint Response Fund to investigate complaints and to abate conditions potentially resulting from farms or farm operations.

B. Existing Programs

When a ground water problem from agriculture arises, the Division of Animal Health and Industry, working with other appropriate state and federal agencies, makes site-specific recommendations that should be adopted by the farmer to solve the problem. If formal enforcement is necessary to achieve adoption of the solution, the Division of Animal Health and Industry refers the matter to the appropriate agency, including the Maine Department of Environmental Protection or the Office of the Attorney General.

The Division of Animal Health and Industry is currently working with other state and federal agencies in implementing the Agricultural Nonpoint Source Strategy, the Department of Agriculture's contribution to the state's overall NPS strategy. Included are Best Management Practices (BMPs) to control sediment, nutrient, manure, and pesticide nonpoint source pollution. The strategy has both regulatory and non-regulatory components, with emphasis on voluntary programs such as research, targeted educational programs, technical assistance, and financial incentives.

C. Role in this Plan

1. The Division of Animal Health and Industry will coordinate development of crop- and/or pesticide-specific Best Management Practices with other state and federal agencies.

2. The Division of Animal Health and Industry and the BPC will coordinate resource grants and educational programs to maximize outreach efforts.
3. The Division of Animal Health and Industry will notify the BPC of all complaints involving pesticides and ground water.

4. The Division of Animal Health and Industry and the BPC will coordinate on-site investigation of pesticide complaints.

5. The Division of Animal Health and Industry and the BPC will coordinate enforcement for adoption of BMPs according to the scenarios outlined in Section VIII of this strategy.

<u>Maine Department of Environmental Protection (DEP)</u>

The Maine Department of Environmental Protection is responsible for protecting the state's natural resources. In particular, two of the Department's three bureaus, the Bureau of Land and Water Quality (BLWQ) and the Bureau of Remediation and Waste Management (BRWM), have responsibilities related to this plan. The BLWQ has the responsibility of maintaining standards for the protection of Maine's surface and ground waters. The BRWM oversees hazardous material and waste regulations in the state.

A. Legal Authorities Necessary to Implement SMPs

38 M.R.S.A. §410-H through §410-K
Nonpoint Source Pollution Program
These sections establish the state's nonpoint source pollution program by defining what nonpoint source pollution is, by defining best management practice guidelines, and by designating lead agencies for implementation of components of the state program. The Department of Agriculture, Food and Rural Resources is designated the lead agency to implement the *Strategy For Managing Nonpoint Source Pollution from Agricultural Sources and Best Management Systems Guidelines,* (October 1991), a plan to reduce and prevent nonpoint source pollution from agricultural activities.

38 M.R.S.A. §413
Waste discharge licenses
This section prohibits the direct or indirect discharge of any pollutant to water without first obtaining a discharge license. Two types of aquatic pesticide permits are exempted, including application of aquatic pesticides by the Department of Inland Fisheries and Wildlife and the treatment of public water supplies with copper sulfate or its compounds where swimming and fishing are not allowed.

38 M.R.S.A. §465-C
Standards of classification of ground water
Maine has adopted two standards for classification of ground water. The first, Class GW-A, is of the quality that it can be used for public drinking water supplies. The second, Class GW-B, is for all other supplies not suitable for public drinking water.

38 M.R.S.A. §470
Classification of ground water
This section classifies all ground water in Maine as Class GW-A. Also, this section gives the Maine Legislature the final authority on ground water classification.

38 M.R.S.A. §571
Corrupting Waters Forbidden
This section makes it a Class A, Criminal offense to intentionally corrupt a private or public water supply. (Note: The word ground water is not used; "well" and "spring" are used.)

38 M.R.S.A., Chapter 13
Hazardous Matter, Substance, and Waste Statutes
This chapter contains all the state statutes related to the proper transportation, storage, and disposal of material deemed hazardous matter, hazardous substances, and hazardous wastes. The section also discusses emergency response to spills, the identification of responsible parties, and remedial actions. Chapter 13, in essence, is the state's companion statute to CERCLA and RCRA and will guide response actions to pesticide disposal and spill cleanup.

B. Existing Programs

Critical to the process of controlling ground water contamination by pesticides is the development of nonpoint source (NPS) pollution control measures. In November 1989, Maine DEP finalized the state's *Nonpoint Source Pollution Management Plan*. The NPS Plan recognizes that land users can control nonpoint source pollution by the development and implementation of Best Management Practices (BMPs). Several task forces developed BMPs, including an agricultural task force (see "Department of Agriculture, Food, and Rural Resources, Office of Agricultural, Natural and Rural Resources" above).

C. Role in this Plan

1. Maine DEP will continue to provide expertise in the development and implementation of state management plans to ensure that they remain consistent with current ground water regulations and Comprehensive State Ground Water Protection Planning.

2. Maine DEP will be the lead agency in pesticide spill response and ground water remediation as a result of such spills.

3. Maine DEP will evaluate ground water resources for classification purposes and ensure that pesticide use does not violate the existing ground water classification and protections for that water body and/or watershed.

Maine Department of Human Services, Bureau of Health

The Bureau of Health, Drinking Water Program is responsible for maintaining the integrity of public water systems and protecting them from contaminants which may adversely affect human health. The Maine Health and Environmental Testing Laboratory, one of the laboratories used for ground water sample analyses, is a division of the Bureau of Health.

A. Legal Authorities Necessary to Implement SMPs

22 M.R.S.A. §2608
Information on private water supply contamination; interagency cooperation
The Department of Human Services will provide information and consultation to private citizens who report contaminated wells or request information on potential contamination of a site. They are to work with the Maine Department of Environmental Protection to determine an appropriate response to the contamination, including investigation of the site and ground water remediation.

22 M.R.S.A. §2611, et seq.
Safe Drinking Water Act
This act is the state companion to the Federal Safe Drinking Water Act. It protects all types of public water supplies in the state as well as authorizes the Department of Human Services to promulgate and enforce primary and secondary drinking water standards. Selected sections are listed below.

22 M.R.S.A. §2611
Drinking water regulations
This section gives the Department of Human Services authority to promulgate and enforce primary and secondary drinking water standards. Their scope of authority includes identification of contaminants and establishment of maximum contaminant levels.

22 M.R.S.A. §2612
Approval of construction or alteration, training, inspection, regulations and records; Operation and maintenance of public water systems
This section gives the Department of Human Services the authority to review and approve all new sources of public drinking water as well as require public drinking water systems to submit samples for water quality monitoring. Frequency of sampling has been subsequently established by rule.

22 M.R.S.A. §2614
Imminent hazards to public health
When an imminent hazard exists, the Commissioner of Human Services may issue an emergency order to the supplier of public drinking water to take action in one or more areas: 1) prohibit distribution and supply, 2) repair/install purification equipment, 3) notify users of the imminent hazard, or 4) analyze the water further to discover the extent of the hazard. This section provides the only well-closing authority available to the Generic SMP and applies only to public drinking water supplies.

B. Existing Programs

The Bureau of Health is mandated to promulgate and enforce primary and secondary drinking water standards for public water supplies. These standards may be no less stringent than the most recent National Primary Drinking Water Regulations. The Bureau of Health has also established non-enforceable guidelines, known as Maximum Exposure Guidelines (MEGs), for a variety of drinking water contaminants (See Section VIII, "Response Framework").

Since 1977, the Bureau of Health has been required to review and approve all new sources of public drinking water. The Bureau of Health, Drinking Water Program is the lead agency for the Wellhead Protection Program and will continue to work with municipalities in the identification and protection of wellhead protection zones and public drinking water supplies. The Drinking Water Program will also be the lead agency for the Source Water Assessment Program as required by 1996 amendments to the federal Safe Drinking Water Act.

<u>Wellhead Protection Program</u>

Public water supplies have been identified as an important municipal and state resource. The 1986 amendments to the Safe Drinking Water Act recognized the need to provide extra protection to these important resources and mandated the establishment of Wellhead Protection Programs (WHPPs) to provide guidance to municipalities, water utilities, and districts to prevent contamination of public drinking water wells and their ground water recharge areas. At its simplest, a wellhead protection plan consists of an inventory of potential sources of ground water contaminants and a point-and-circle delineation of wellhead protection areas. Wellhead protection planning is voluntary in Maine, but it has been used as an incentive for waivers from the Phase II and Phase V monitoring requirements.

C. Role in this Plan

1. The Bureau of Health will notify the BPC of pesticide residues detected in public water supplies and the location of the affected wells.

2. The Bureau of Health will notify the BPC of pesticide residue detections in private wells and the location of the affected wells.

3. The Bureau of Health will work with the BPC Toxicologist in the development of MEGs and health advisory levels for those pesticides for which no MCL or MEG has been established.

4. The Bureau of Health and the BPC will continue to work together in the issuance of waivers from Phase II and Phase V monitoring requirements.

University of Maine Cooperative Extension (UMCE)

The University of Maine Cooperative Extension, a division of the U.S. Department of Agriculture, has sixteen regional offices in Maine organized roughly along county lines.

A. Legal Authorities Necessary to Implement SMPs

None.

B. Existing Programs

The UMCE offers a variety of educational and training programs designed to safeguard surface and ground water quality from pesticides and nutrients. The Pesticide Applicator Training (PAT) Program run by the UMCE is a key element of Maine's applicator certification and licensing program. New pesticide applicator training materials, as well as drift management materials, have been developed which include modules on ground water protection, nonpoint source pollution, and water quality. Working in conjunction with other state and federal agencies, the UMCE published *"Best Management Practices for Agricultural Producers: Protecting Ground Water From Nutrients and Pesticides"* in 1989. UMCE Crop and Water Quality Specialists also research pesticides and their movement to ground and surface waters. This new information is being incorporated into training and recertification programs.

C. Role in this Plan

1. The UMCE will utilize its existing educational and outreach programs to inform growers and applicators about water quality protection and the requirements of state management plans.

2. The UMCE will continue outreach programs which inform growers about BMPs and other ground water protection measures.

3. As new materials are developed by the UMCE, information on water quality protection and the intent and requirements of state management plans will be incorporated.

Agencies with Technical Assistance Roles

U.S. Department of Agriculture (USDA)

The USDA, through its various divisions, provides both technical assistance to individual landowners and a range of incentives that can affect the way landowners choose to manage their land and water resources. USDA divisions in Maine include the University of Maine Cooperative Extension (UMCE), Natural Resources Conservation Service (NRCS), Farm Services Agency (FSA), and Agricultural Research Service (ARS).

The NRCS and UMCE offer education and technical assistance to private landowners to solve natural resource management problems. (For a further discussion UMCE's of implementation role, see "University of Maine Cooperative Extension" earlier in this section.) NRCS provides free services, including assistance with planning, preserving, and improving water quality. ASCS provides cost-share programs for landowners to implement soil and water conservation plans. USDA has also funded a nonpoint source, hydrologic unit program in Maine.

U.S. Department of the Interior (DOI)

The U.S. Geological Survey (USGS), a division of the DOI, has the principal role for gathering hydrogeologic information on, and assessing the quality of, the nation's aquifers. Through cooperative programs with states, the USGS compiles information for planning, developing, and managing the nation's water resources. USGS topographic maps are used in the design of Maine's ground water monitoring program (See Section VII, "Ground Water Monitoring).

Maine Department of Conservation, Maine Geological Survey (MGS)

Maine Geological Survey undertook the three-year program, *"Pilot Study: Pesticides in Ground Water*," in the 1980's. MGS is tasked with the collection and analysis of information relating to the nature, extent, and quality of aquifers and aquifer recharge areas in Maine . MGS serves as a primary source of information and expertise on ground water resources and monitoring. Data concerning water resources are mapped and made available to requesting agencies.

University of Maine, Maine Agricultural Experiment Station (MAES)

The Maine Agricultural Experiment Station is charged with serving the land grant research mission of the University of Maine.[6] Through basic and applied research programs, MAES scientists work to provide solutions to problems being encountered by the State's agriculture, forestry and aquaculture enterprises, as well as rural communities in general. MAES' research mission is clearly stated in its motto: RESEARCH FOR MAINE AND ITS PEOPLE.

MAES has several ongoing research projects which study fate and transport of pollutants such as agricultural chemicals and waste materials through soil and water systems, investigate means of reducing the need for chemical applications, and refine methods of analyzing contaminant concentrations in water, soil, and food. MAES researchers also serve the public interest through involvement as technical consultants. Although MAES has no direct role in the

1[6] MAES Faculty Handbook, 1988.

implementation of this plan, it will continue to conduct research which may facilitate implementation and management of this plan.

Maine Soil and Water Conservation Districts

Maine's sixteen Soil and Water Conservation Districts (SWCDs) provide technical assistance along with educational programs, focusing on such topics as soil erosion prevention, flood control, water quality, and water conservation. The Districts provide further technical assistance under the guidance of NRCS to individual citizens in planning and installing conservation practices. The Districts also initiate and conduct demonstration projects which encourage the adoption of conservation plans. The SWCDs maintain a variety of databases, including soil surveys, hydrologic data, and commodity information, all of which are important in evaluating the pesticide leaching potential within a given geographic area.

Regional Planning Councils

Maine's eleven Regional Planning Councils provide technical assistance to municipalities in implementing state and federal comprehensive planning requirements and in preparing municipal plans. Recent planning efforts of the councils have included programs on ground water management, with assistance projects ranging from ground water hazard identification maps to draft ordinances for the control of nonpoint source pollution. The councils will continue to be an important source of information to municipalities as ground water management and wellhead protection become integrated into municipal comprehensive planning efforts.

Other Agencies with Ground Water Programs

Executive Department, Maine State Planning Office

In 1985, the Maine Ground Water Standing Committee was created to coordinate the state's diverse ground water interests. The Committee, staffed by the Maine State Planning Office, was charged with assessing priorities and ensuring the implementation of the state's ground water management and protection programs. In June of 1989, the Maine Ground Water Standing Committee published the "Maine Ground Water Management Strategy," a comprehensive look at the threats to Maine ground water with a multi-point policy statement on how ground water could best be protected. The Strategy states as its Primary Goal:

"....to protect, conserve, and manage Maine's ground water re- sources to protect the public health, safety, and general welfare; to meet future water supply needs; and to sustain economic growth."[7]

To achieve this goal, seven broad-based policies, listed in Figure III-A, were established to guide state, regional, and local planners in the protection of ground water. These policies have served as the foundation of many of the premises and guidelines used in this plan. Today, these policies are coordinated and integrated under the larger umbrella of the state's CSGWPP. The Ground Water Standing Committee was dissolved in 1991 and the responsibilities of the committee were transferred to the Land and Water Resource Council, Water Resources Committee, which now oversees ground water policy development and provides a common contact point for the various agencies involved with ground water matters.

In 1992, the State Planning Office once again became involved with ground water protection when it was designated as the lead coordinating agency for preparing the Maine Coastal Nonpoint Source Program. The Coastal Zone Amendments and Reauthorization Act of 1990[8] required all coastal states to prepare a Coastal Nonpoint Pollution Control Program which is submitted to both EPA and the National Oceanic and Atmospheric Administration (NOAA). Each state Coastal Nonpoint Pollution Control Program must, as a minimum, provide for the implementation of enforceable management measures to control identified sources of nonpoint pollution in conformity with guidance issued by EPA and NOAA. The Coastal Nonpoint Pollution Control Plan was submitted to EPA and NOAA in 1995. This program is integrated with both the statewide Nonpoint Source Management Plan and the various reports prepared under the Clean Water Act, at least as far as they relate to coastal waters.

Since 1996, the State Planning Office has also provided assistance to individual communities in Maine with the development of comprehensive management plans that address, among other things, the protection of existing and future drinking water resources. These water resources may include ground water and/or recharge areas.

Under the guidelines developed to implement Maine's Comprehensive Planning Program, communities may designate ground water resources *significant* to the community. Significant ground water resources may be those under a densely developed section of the community utilizing private wells or ground water selected for a future public water supply. The comprehensive management plan should then identify whether the significant ground water resource will be protected by exclusionary methods or through strict control of potential sources of contamination.

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2 [7] Dutram, Paul W., et al., "Maine Groundwater Management Strategy," Maine Groundwater Standing Committee, June 1989, pp. 6.

3[8] 16 USC 1455(b).

MAINE GROUND WATER POLICIES

Policy 1 *There shall be no discharges of pollutants to ground water unless land use activities which have the potential to discharge pollutants to the soil conform to state and local regulations which address the attenuative capacity of local geological deposits to provide protection for ground water quality.*

Policy 2 *When ground water is polluted, sources of pollution shall be removed or contained so that the restoration of ground water quality to drinking water standards or better may proceed by natural processes, or by the application of technology when physically and economically feasible.*

Policy 3 *No development or use of land shall unreasonably cause or exacerbate salt water intrusion, or changes in historic ground water flow patterns and water table height.*

Policy 4 *The State Ground Water Classification System, with assessments of current and future ground water use, should be used by State agencies, municipalities, and water districts in protecting ground water systems.*

Policy 5 *It is the responsibility of municipalities to require the appropriate siting of new facilities and activities and performance standards for all facilities and activities not regulated by the State that may pose a threat to local ground waters in order to minimize damage.*

Policy 6 *Ground water and surface water are components of a single hydrologic system. Neither one should degrade the quality classification of the other.*

Policy 7 *Public water supplies, because they serve many people and businesses from single sources, are important municipal and State resources. Municipalities and water utilities should cooperate in the identification and protection of existing and future well head and recharge areas.*

Figure III-A: Maine Ground Water Policies[9]

4[9] Dutram, Paul W., et al., op. cit., pp. 6-7.

Municipalities

Under the constitution of the state of Maine, municipalities have broad "home-rule" powers to enact ordinances, including police power and land use ordinances. Under FIFRA, the authority to regulate pesticides is specifically delegated to the states, but not to local governments. The right of municipalities to regulate pesticides and application practices has been a controversial issue, being settled finally by both state and federal supreme court decisions.

In 1983, the town of Lebanon, Maine passed an ordinance prohibiting any commercial, non-agricultural use of herbicides in its town unless approved by a town meeting vote. In 1986, Lebanon denied Central Maine Power's request to spray its electrical rights-of-way and the case was brought to court. In 1990, the Maine Supreme Court finally upheld the town ordinance and firmly established the right of municipalities in Maine to regulate pesticides.[10] It was not until June 1991, that the U.S. Supreme Court also upheld a municipality's right to regulate pesticides beyond FIFRA.[11]

Meanwhile, in 1988, the Maine Legislature had passed a law requiring municipalities in Maine with pesticide ordinances to file them with the BPC in order for them to be deemed valid. Thirteen municipalities have filed copies of their ordinances with the BPC. The ordinances vary from bans on herbicide use on road sides to comprehensive pesticide prohibitions, including one which protects aquifers within two municipal-designated districts. The latter also requires an applicator to notify the code enforcement officer 60 days in advance of any plan to apply a restricted use pesticide within one of the districts. Although municipalities have no direct responsibilities under this plan, municipal comprehensive planning efforts, combined with ordinance powers, will play an important role in future land use patterns and pesticide regulation in Maine.

(See Section IIIA from Tammys stuff to compare to section III above)

SECTION IV
NATURAL RESOURCE CHARACTERIZATION AND BASIS FOR ASSESSMENT AND PLANNING

This section of the plan describes, in brief, Maine's ground water resources and soil characteristics and describes the BPC's basis for assessment and planning as it relates to pesticides and ground water management.

5[10] Central Maine Power v. The Town of Lebanon, 571 A.2d 1199 (Me. 1990)
6[11] Wisconsin Public Intervenor v. Ralph Mortimer, 115L Ed. 2d. 253, 111 S Ct. 2476.

Natural Resource Characterization: Ground Water

General Geology of Maine's Ground Water Sources

Maine obtains useful supplies of ground water from two sources of very different geologic origin: unconsolidated surface sediments deposited by glaciers over the last 25,000 years and underlying consolidated bedrock formations that began forming hundreds of millions of years ago.

The bedrock that forms the foundation of Maine was created by the same geologic processes active in the world today, including sedimentation, volcanic activity, intrusion of molten rock, metamorphism, and weathering and erosion. Regardless of their diverse origins, these bedrock formations have very similar ground water-bearing characteristics because crustal deformation has left them brittle and fractured.

Unconsolidated sediments that overlie the bedrock formations are largely products of continental glaciers that once spread across Maine and New England as far south as Long Island, New York. Much of what is seen today was deposited during the last 25,000 years by the most recent period of glaciation that ended in Maine around 10,000 years ago. Advance of the mile thick ice across the land left widespread deposits of mixed clay, silt, sand, cobbles, and boulders called till. The ice sheet's melting left more restricted deposits of sand and gravel, found primarily in valleys and low-lying areas, which are important sources of ground water today.

As the climate warmed and the ice sheet melted away, the weight of the ice had so depressed the Earth's crust in Maine's coastal region that the ocean flooded the area. Eventually, the land surface rebounded faster than the ocean flooding, and the sea level retreated back to a level approximately 180 feet below present sea level. Subsequently, sea level rose towards its present day shoreline. Throughout this area of temporary marine transgression, glacio-marine silt and clay deposits now cover the glacial till as well as sand and gravel deposits. Although clay and silt are not a source of abundant ground water in Maine, they are important because their low permeability has a strong influence on the occurrence and quality of ground water in the underlying sand and gravel and bedrock aquifers.

Geologic Maps

USGS topographic, 7.5 minute maps, available through the Maine Geological Survey (MGS), show elevation, culture, and drainage. These maps are used as the base maps for various studies, including the development of the BPC's assessment monitoring program as described in Section VII. MGS also has available reconnaissance and detailed surficial and bedrock geologic maps. These maps show sand, gravel, and other unconsolidated materials which overlie the bedrock in Maine and the nature of the underlying bedrock, respectively. They can be used for detailed geologic studies and planning for siting studies.

Ground Water Maps

Significant sand and gravel aquifer maps and reports are currently available from the Maine Geological Survey. These maps show the locations of sand and gravel aquifers which provide a yield of greater than 10-gallons per minute to a properly installed well. They can be used as a basis for detailed hydrogeological siting studies and planning and for providing information on aquifer favorability.

Ground Water Classification in Maine

Ground water in Maine is divided into two classification categories: GW-A, ground water of a quality that can be used for public water supplies, and GW-B, all other supplies not suitable for public drinking water. Maine's legislature, which has the role of formally classifying ground water, has classified all ground water in the state of Maine as GW-A. While this classification system does not recognize that all ground water is not of equal value and that it is not desirable to restrict land use activities equally throughout the state, GW-A, expressed as a goal for all ground water, prevents the further degradation of waters by prohibiting discharges which would cause ground water to violate established standards.

The Maine Department of Environmental Protection has attempted to identify ground waters which have higher value based in part on their current or future use. These waters are known as "priority waters" and fall into two broad categories: (1) wellhead protection areas and (2) ground water which is hydrologically connected to surface water in Class AA and Class A watersheds. Where these areas overlap pesticide use sites, the BPC will consider if additional protections are needed when writing a Pesticide SMP.

Natural Resource Characterization: Soils

Formation of Maine Soils

As mentioned previously, Maine soils began to form when the last glacier deposited its rock and soil materials either as glacial till or as water-sorted sediments along glacial streams, rivers, lakes, or the ocean. During the period of temporary marine transgression, higher ridges protruded above the ocean surface as islands, while the areas covered by sea water received a blanket of fine ground water-deposited sediments. The result of this inundation is a complex pattern of soils, derived from glacial till, fine sediments, sands and gravels, along the Maine coast and inland to the elevation of the limit of the marine transgression.

Soils currently recognized in Maine formed as a result of various weathering processes which are an interaction of climate, time, topography, and vegetation on parent material. The diversity of Maine soils reflects not only the various parent materials but also the weathering of the parent material and their position in the landscape.

Relevance of Soils to Pesticide Application

The ability of the soil to treat or attenuate potential contaminants associated with pesticides or any other chemical depends on many factors, including its texture, structure, consistency, drainage class, organic matter content, and depth to bedrock or hardpan. In general, the soils best suited to protect ground water from contamination are those which have these features:

- fine texture,
- good soil structure,
- friable,
- well drained,
- relatively high organic matter contents, and
- relatively greater depth to bedrock or hardpans.

It is important to understand soil characteristics and their limitations. It may be possible to modify some characteristics so that the soils offer a better buffer for ground water, such as altering the drainage by diverting surface water away from a field or altering organic content by adding organic matter to coarse textured soils.

Soil Maps

The easiest way to learn about the soil characteristics of a given site is to refer to soil maps prepared by the Natural Resources Conservation Service (NRCS). These maps are published in books, or online at http://www.soils.usda.gov/survey/, and include a detailed description of the soil and soil characteristics. These books, called Soil Surveys, are completed for many counties in Maine and include most of the organized areas. If a soil survey is not published for a county, contact the local Soil and Water Conservation District office for soils information. The NRCS, housed in District offices, may be in the process of preparing soil maps for that area.

It is important to keep in mind that NRCS soils maps are sometimes useful for large-scale pesticide users, but for smaller farmers or homeowners, these maps are not site specific enough. For instance, many areas soil mapped by NRCS use map units of 15 - 40 acres in size. Any soil area smaller than that minimum size is lumped into the larger map unit and considered an inclusion. Even the higher detail NRCS soil maps have minimum map unit sizes of about 3 acres. That means a 2-acre garden, lawn, etc. may be on completely different soils than the soil map indicates. Even for the bigger user, the map unit may be an association with 3 named soils. One needs to be able to determine the soil where a pesticide use is to occur. Ideally, a pesticide user should have a high intensity soil survey made by a Maine Certified Soil Scientist to provide site specific information, especially for sensitive areas such as over potential aquifers.

Basis for Assessment and Planning

Because all ground water in Maine is classified as suitable for public drinking water, theoretically, all ground water should receive equal protection. The designation of priority waters provides a basis for resource prioritization, however, the majority of Maine agriculture lies outside these areas. Rather than prioritizing protection efforts on the ground water resource, the BPC has instead formed its basis for assessment and planning on vulnerability by focusing on

(1) ground water monitoring data and (2) commodities or pesticide use sites where pesticides with a high potential to leach are used.

Ground water monitoring projects by the BPC have provided a wealth of information about ground water quality and site characteristics which may lead to contamination. The BPC, utilizing small, well-designed studies, has been able to identify locations in the state where ground water quality has been impaired through use of a specific pesticide. However, ground water monitoring is expensive and ongoing projects are difficult to maintain. Also, because of the limited scope of many of these studies, statewide generalizations can seldom be made. See Section VII, "Ground Water Monitoring," for a further discussion of the role of monitoring.

Computer models have also been tried in Maine with varying success. In 1989, the MGS, U.S. EPA, Region I, and the BPC initiated the *Maine Agricultural Chemical - Ground Water Mapping Pilot Project.* The primary objective of this project was to test vulnerability systems, in this case Agricultural DRASTIC, for predicting ground water contamination in an intensely farmed region in northeastern Aroostook County. A secondary objective was to assess the usefulness of geographic information systems (GIS) in pesticides-in-ground-water studies.

In conclusion, the study provided no support for using the Agricultural DRASTIC methodology in developing a county-wide or regional pesticide/ground water quality management plan on the computed relative vulnerability of ground water. GIS proved to be an extremely useful tool for the organization and integration of mapped and tabular data. However, the effectiveness of GIS was limited due to the long time period necessary to gather and enter map data into the system. Once more map data are available, using GIS for sensitivity and vulnerability assessments will be more cost- and time-effective.[12]

The most useful computer model available for assessing vulnerability is the National Pesticide/Soil Database and User Decision Support System for Risk Assessment of Ground and Surface Water Contamination, better known as NPURG. NPURG gives the user the opportunity to quickly evaluate the relative leaching and surface loss potentials for multiple pesticides on one or more specific soil types.

NPURG has been made available free of charge to landowners through county Cooperative Extension and Soil and Water Conservation District offices in Maine. The DHS, Drinking Water Program is currently using NPURG to identify those pesticides with a low leaching potential in order to provide waivers to public water systems for Phase II and Phase V monitoring requirements. Until better models or more cost effective means are identified, the BPC will continue using NPURG as a planning tool in vulnerability assessments. For a further description of NPURG, selected sections of the users manual and sample data sheets can be found in Appendix B.

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1 [12] Williams, John S., Nancy A. Beardsley, et al., "Assessment of Ground Water Contamination Vulnerability from Agricultural Chemical Use in Northern Maine: The Maine Agricultural Chemical - Ground Water Mapping Pilot Project" (Final Draft Report), January 1992, pp. 1-2, 6.

SECTION V
PESTICIDE USE IN MAINE

Maine Agriculture and Land Use

The story of Maine agriculture in the past, the present, and the future is one of adaptation to the changing world around us. Maine has changed from a state where more than half the households were farm-based, to one where about 7,200 farms in Maine produce more food than the state consumes in total. Unlike the isolated conditions of a hundred years ago, Maine products now compete in markets around the world.

Since 1840, the U.S. Department of Commerce, Bureau of the Census, has been conducting a national agricultural census. The census now is conducted on a 5-year cycle, collecting data for years ending in 2 and 7. The agricultural census is the leading source of consistent, comparable, statistical information about the nation's agricultural production at the county, state, and national levels.

According to the last available census (2002), farms control approximately 1.3 million acres of land in Maine. The average farm in Maine is approximately 190 acres. About 94% of the farms in Maine are owned by individuals or families, but only slightly less than half of the operators describe their principal occupation as farming. Clearly, the Maine farm today represents a unique scenario, blending the tradition of the family farm with contemporary rural economic conditions.

Farm acres in Maine are divided primarily among woodland (51.2%) and cropland (39.1%), with the remaining acres divided between pastureland, rangeland, and other land. Although not the leading money crop, hay, including alfalfa and grass silage, dominates Maine cropland with over 209,955 acres. Potatoes follow second with over 64,000 acres concentrated primarily in Maine's northern Aroostook County. Wild blueberries continue to be eastern Maine's primary commodity with approximately 86.8% of Maine's bearing acres in Washington and Hancock counties. Figure V-A lists some of those crops in Maine grown on over 1,000 acres and the counties with significant acreage.

In additional to the traditional farm settings, Maine has approximately seventeen million acres of commercial forest lands. Approximately half of these lands are owned by the state's seventeen industrial timber/paper companies. Herbicides are used in management practices designed to control competition and increase yields of desired species. Such practices include initial site preparation, softwood release, and precommercial thinning, with a majority of the herbicide use for softwood release. In 1996, approximately 47,500 acres of forest land were treated with herbicides, less than one percent of total commercial forest land.[13]

1[13]Compilation of 1996 Notices of Aerial Pesticide Application, Board of Pesticides Control

CROPLAND AND COMMODITY ACREAGE

Item		2002 acres
Land in farms		1,369,768
Total woodland		702,555
Total cropland		536,839
Hay-alfalfa, other tame, small grain, wild, grass, silage, green chop, etc.	(Maine)	209,955
	(Arrostook County)	33,073
	(Kennebec County)	27,980
	(Somerset County)	23,152
	(Penobscot County)	24,130
Fall potatoes	(Maine)	64,474
	(Aroostook County)	59,418
	(Penobscot County)	3,011
	(Oxford County)	1,384
Corn for silage or green chop	(Maine)	24,351
	(Androscoggin County)	2,759
	(Kennebec County)	4,044
	(Penobscot County)	6,811
	(Somerset County)	4,029
	(Waldo County)	3,314
	(York County)	6,759
Wild blueberries*		
	(Maine)	23,000
	(Washington County)	16,844
	(Hancock County)	3,126
	(Waldo County)	1,494

* Maine has between 50,000 to 60,000 acres of wild blueberries with approximately half of the acres bearing fruit on any given year.

Apples	(Maine)	3,891
	(Androscoggin County)	955
	(York County)	414
	(Oxford County)	657
Sweet corn	(Maine)	1,970
	(Androscoggin County)	254
	(York County)	(D)
	(Cumberland County)	240
Dry Beans	(Maine)	367

(D) Withheld to avoid disclosure of data for individual farms.

Figure V-A: Cropland and Commodity Acreage

Agricultural Chemical Use In Maine

There are a number of reporting and survey mechanisms in existence which contribute to understanding the sales and use of Maine's approximately 6500 registered pesticide products. Sales data combined with spray and crop recommendations begin to create general geographic patterns. This section of the management plan describes the reporting and survey methods currently being utilized in Maine, summarizing the most recently available data.

U.S. Department of Commerce, Census of Agriculture

Although the Census of Agriculture primarily deals with livestock and crop production data, it also yields statistics related to agricultural chemical use. Figure V-B summarizes the data gathered on agricultural chemical use from the 1992 Census of Agriculture. Specific county breakdowns are given in the census, but not by pesticide.

Pesticide Sales Database

Since 1977, annual restricted and limited use sales reports have been required as part of the licensing procedure in Maine for restricted use pesticide dealers. Unfortunately, resources have not always been available to provide proper maintenance and management of the data, and early efforts at compiling the sales data were sporadic at best.

In 1990, this data compilation process was further complicated by the addition of general use pesticide sales data. Responding to concerns about lawn care and structural pesticides and their use, the Maine legislature instituted general use pesticide dealer licenses in 1989. Annually, these dealers must report on the sales of general use pesticides sold in packages of one quart or greater or five pounds or greater. There are over 600 licensed general use pesticide dealers in Maine, and the data which they generate are voluminous.

The most recently available compilation effort was undertaken with the 1995 sales data. The list of products reported was screened and narrowed for those products used in agriculture. A preliminary tabulation of active ingredients and their percentages within the formulations were researched and added to the database. The results for those active ingredients sold in amounts over 1,000 pounds are in Appendix C, "1995 Agricultural Pesticide Sales Data."

AGRICULTURAL CHEMICALS USED, INCLUDING FERTILIZER AND LIME IN 1992[14]

2[14]Ibid., pp. 21.

Item	1992
Total farms in Maine (number)	5,776
Land in farms (acres)	1,258,297
Any chemicals, fertilizer, or lime used (farms)	3,631
Commercial fertilizer (farms)	3,181
(acres on which used)	257,402
Sprays, dusts, granules, fumigants, etc., to control	
Insects on hay and other crops (farms)	1,692
(acres on which used)	133,702
Nematodes in crops (farms)	143
(acres on which used)	13,401
Diseases in crops and orchards (farms)	885
(acres on which used)	87,945
Weeds, grass, or brush in crops and pasture (farms)	1,482
(acres on which used)	146,504
Chemicals used for defoliation or for growth control of crops or thinning of fruit (farms)	560
(acres on which used)	61,640

Figure V-B: Agricultural Chemicals Used, Including Fertilizer and Lime

In 1997 the Maine Legislature enacted two laws which will significantly change how sales data is both collected and tabulated. The first requires the BPC to begin annual tabulations of both the pesticide sales data and commercial applicator annual summary reports. This bill, originally intending to establish specific pesticide use reduction goals for the State, was modified in workshop sessions to require the compilation of this baseline data. However, unlike recent tabulations, the sales data will be tabulated only according to trade name and EPA Registration number, not active ingredient.

The second law enacted shifted the burden of general use pesticide sales reporting from individual licensed dealers to wholesalers. With 600 licensed general use pesticide dealers in Maine, both the number of reports and the variation within those reports made compilation difficult. The BPC estimates that there may be as few as 50 wholesalers who distribute general use pesticides in Maine. This smaller number will eventually lead to a better trained, reporting group and eliminate many data errors up front. In the near future, however, the BPC anticipates a small decline in data quality while wholesalers are being identified and informed of their new reporting requirements. Sales reports from restricted use pesticide dealers remained unchanged.

Applicator Record Keeping and the 1990 Farm Bill

In Maine, nearly all certified applicators are required to keep and to maintain application records, although only commercial applicators are required to report on pesticide use to the BPC (See below -- Commercial Applicator Annual Summary Reports). Certified private applicators, until 1993, were required to keep records only for outdoor applications with powered equipment. These records are not submitted to the BPC, although they are available for inspection by the BPC staff.

The 1990 Farm Bill included a provision requiring that all agricultural users of restricted use pesticides maintain records of their use. A Federal Register notice, published May 12, 1992, listed the proposed elements for each record. They include:

- The brand name or product name, formulation, and the EPA registration number of the product applied;
- The total amount and rate of application;
- The address or location, the size of area treated, the target pest, and the crop, commodity, or stored product to which the restricted use pesticide was applied;
- The month, day, and year on which the application occurred; and
- The name, address, and certification number of the certified applicator who applied or who supervised the application.

The record keeping provision includes a requirement that USDA and EPA survey restricted use pesticide records annually to develop a comprehensive report on pesticide use to Congress. While this will allow the Federal government a better opportunity to estimate pesticide use regionally and nationally, the 1990 Farm Bill, as with Maine law, does not provide for the gathering of statewide, site-specific data, a key piece of information in ground water vulnerability assessments.

Non-agricultural Pesticide Use

Agriculture, although the largest sector of pesticide use in the state, is by no means the only contributor to outdoor pesticide use. Outdoor applications of pesticides occur to:

- Lawns and golf courses,
- Ornamental trees and shrubs,
- Utility and railroad rights-of-way,
- Roadsides, and
- Homes and industrial buildings.

The following sections characterize several nonagricultural sites of primary importance in Maine.

Roadsides and Rights-of-way

Roadside vegetation management is conducted primarily by the Maine Department of Transportation (MDOT) and the Maine Turnpike Authority, although some cities and towns also undertake limited projects. In 1996, MDOT used herbicide applications on slightly over 9,100 miles of roadside to control vegetation under guardrails and larger species which could interfere with highway safety.[15]

Vegetation control is also conducted along utility, railroad, and timberland access rights-of way. Most utility companies combine handcutting and backpack herbicide applications on a three- to four-year rotation to control tree growth.[16] Larger trees, over eight to ten feet tall, are mechanically cut. The stumps of those species capable of resprouting are treated with a herbicide. Central Maine Power, Maine's largest electric utility, uses these practices to control vegetation along it's 2,200 miles of transmission lines.[17] Herbicides are also used along Maine's railroads. In 1995, over 5,400 acres adjacent to railroad tracks were sprayed to control vegetation.[18]

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3 [15]Maine Department of Transportation 1996 Commercial Applicator Annual Summary Report, Board of Pesticides Control.

4 [16]Cline, Michael L., et. at., "Pesticide Reduction: A Blueprint for Action," Maine Audubon Society, June 1990, pp. 23-25.

5[17]Commission to Study the Use of Herbicides, op. cit., pp. 31.

6 [18]RWC, Inc. 1995 Commercial Applicator Annual Summary Report and Variance Request Permit, Board of Pesticides Control.

Lawns and Golf Courses

According to 1988 EPA estimates, products used to control turf pests in lawns, parks, gardens, and golf courses constitute a large and growing market. Generally known as lawn care pesticides, their sales nationally have increased to over $700 million annually and result in sixty-seven million pounds of active ingredient being applied. EPA estimates that professional lawn care companies, treating mostly residential lawns, do a $1.5 billion annual business.[19]

In Maine, there are over 750 individuals licensed to control turf pests, including commercial lawn care applicators and golf course superintendents. In 1989, licensed pesticide dealers sold approximately 450,000 pounds of granular lawn care formulation for use by commercial applicators and homeowners on residential and commercial sites in Maine. By 1995, total pounds of granular formulations sold had risen to over 750,000 pounds.

Commercial Applicator Annual Summary Reports

The best means available to estimate non-agricultural pesticide use are commercial applicator summary reports. Annually, companies must file a report summarizing their pesticide applications. For a number of years, the University of Maine Cooperative Extension assumed management responsibilities for these data which they used in preparing pesticide recommendations. Beginning in 1998, the BPC will be responsible for compiling these data and reporting annually to the Maine Legislature.

Household Pesticide Use

Very little is known about homeowner pesticide use in Maine or nationwide. Maine's pesticides sales database is limited because only products in packages greater than one quart or five pounds need be reported. This leaves many household pesticides unreported.

In March 1988, EPA contracted Research Triangle Institute to design and conduct the National Home and Garden Pesticide Use Survey (NHGPUS). The NHGPUS was a one-time, cross-sectional survey of the use of pesticides in and around homes in the United States. Data were collected on a list of items, including which pesticides were used and what they were used for. The NHGPUS found an average of 3.84 (+/- 0.5) pesticide products per household, estimating the total number of pesticide products in storage at residences nationwide at nearly 325,000,000.[20]

In 1993 the BPC surveyed more than 1,000 people attending two of Maine's largest garden shows about their pesticide-use habits. Three hundred revealed they were either certified applicators or persons who refrain from pesticide use. Of the remaining 724 participants (considered *at-home applicators*), 85 percent acknowledged they use pesticides around the home

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7 [19]U.S. General Accounting Office. "Lawn Care pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue," (GAO/RCED-90-134), March 1990, pp.8.

8 [20]U.S. Environmental Protection Agency, "National Home and Garden Pesticide use Survey," April 1992, pp. 1-2, 6.

and garden. An astounding 15 percent of these at-home applicators, after reporting they do not use any pesticides, proceeded to supply information on the frequency and types of pesticides they regularly applied. Further, less than half of the at-home applicators surveyed, whether aware or oblivious of their use of pesticides, acknowledged they wear personal protective equipment (gloves, goggles, mask) when making an application.[21]

Based on surveys such as those described, the potential impact of homeowner pesticide use on ground water quality cannot be overlooked. Pesticide use and disposal practices by homeowners remains relatively unchecked by regulatory officials until a complaint is received or a problem investigated, and quantitatively determining their impact on ground water quality is nearly impossible. Section VI, "Prevention Strategies and Information Dissemination," discusses avenues available to educate homeowners about proper pesticide use and ground water protection.

SECTION VI
PREVENTION STRATEGIES AND INFORMATION DISSEMINATION

As stated in Section II, Maine's management plan for pesticides in ground water emphasizes prevention over post-contamination remediation. This section of the plan describes the education and pesticide control strategies that will be used to prevent contamination and the means which will be used to inform pesticide users about the requirements of Pesticide SMPs.

Best Management Practices

Regardless of how a pesticide is regulated or managed, the user will continue to be in the unique position of directly controlling the use of pesticides in the field. Thus, the user has the responsibility to seek better understanding of ground water concerns. At a minimum, as required by federal and state law, a user must follow the instructions found on the label of each pesticide product and, when required, be trained and certified in the proper use of the pesticide.[22] In addition to what is required by law, there may be certain methods, measures or practices that the user can perform to help prevent, reduce, or correct ground water contamination. These methods or measures are known as Best Management Practices (BMPs).

Rarely will the use of a single pesticide BMP be sufficient to adequately address a particular ground water concern. More frequently, a number of BMPs, individually selected to

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9 [21]Maine Board of Pesticides Control, “BPC Widens Focus on At-Home Applicators; Homeowners are Maine’s Largest and Least Accountable Users of Pesticides,” *BPC Communicator*, Vol. 8, No. 1, April 22, 1997, pp. 1.

1 [22]U.S. Environmental Protection Agency, op. cit., pp. 109.

fit the unique characteristics of each site and operation, will be required. These groups of BMPs are referred to as a Best Management System (BMS).[23]

The *Maine Nonpoint Source Pollution Management Plan* (Maine Dept. of Environmental Protection, November 1989) identified several major source categories in which strategies could be developed to control nonpoint source (NPS) pollution. These included agriculture, silviculture, and transportation facilities and support. Several task forces were formed to develop and, subsequently, implement the BMPs identified for each source category. In October 1991, the Maine Agriculture Nonpoint Source (NPS) Task Force completed worked on *Strategy for Managing Nonpoint Source Pollution from Agricultural Sources.* This document described, in general terms, pesticide BMPs and encouraged their adoption.

A 1996 study conducted by the University of Maine evaluated grower adoption rates for these pesticide BMPs. In the study potato producers' use of BMPs in four areas -- sediment, pesticides, nutrients and manure -- was evaluated. The overall adoption rates for most of the pesticide BMPs were extremely positive. Four of the 13 possible BMPs -- becoming a certified applicator, safely disposing of extra spray, reading and following label directions, and avoiding drift -- had a 100% adoption rate. The study also found that if growers were familiar with the term BMP, they were more likely to select a less leachable pesticide.[24]

Since 1991, specific BMPs for the use of the herbicides atrazine and hexazinone have been developed by subcommittees of the Maine Agriculture NPS Task Force. The BPC will continue to work with these groups to develop pesticide-specific BMPs and to educate users about them.

Education of Users

Pesticides user education remains at the forefront of any ground water protection strategy. There are numerous avenues available to educate the wide variety of pesticide users in the State -- from utilization of radio, television, and newspapers to educate the public about its role in groundwater protection to site-specific technical assistance programs for farmers that directly address pesticide use patterns in relation to soil and cropping practices. The first part of this section addresses some of the education tools currently available and some which, hopefully, will be available in the future. Any of these education means can be tailored to a specific pesticide. Their unique role in Pesticide SMPs will be detailed when these plans are developed.

<u>Certification and Training</u>

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2 [23]Maine Agriculture NPS Task Force, "Strategy for Managing Nonpoint Source Pollution from Agricultural Sources," October 1991, pp. 9.

3 [24]Jemison, Jr., J.M., M.H. Wiedenhoeft, and E.B.Mallory, "Best Management Practices Evaluation Project: Potato Industry, " <u>Proceedings of Water Pollution/Agriculture Conference: What Farmers Need to Know About Water Pollution,</u> Augusta, Maine, April 2, 1997. A copy of the report is attached in Appendix I.

The cornerstone of educational efforts in ground water protection is applicator recognition of the contributing factors to contamination. The primary avenue in achieving this is through certification of applicators (see Section III, "Cooperating Agencies" for a description of certification and licensing). Since the Fall of 1989, a section called "Pesticides and the Environment" has been included in the core *Pesticide Education Manual*, developed by Pennsylvania State University and adapted for use in Maine by the University of Maine Cooperative Extension and the Maine Board of Pesticides Control. "Pesticides and the Environment" covers topics such as pesticide fate in the environment, and reducing hazards to ground water. Ground water-related questions are included in the core exam as well.

Ground water protection is a regular component of recertification efforts in Maine. There have been numerous presentations on the protection of ground water including presentations given at the annual Agricultural Trades Show and potato and blueberry seminars. As Pesticide SMPs are implemented, additional training classes on the requirements of such state management plans have been and will continue to be offered to assist applicators in meeting the mandates. The BPC will work with affected commodity groups and trade associations to ensure that Pesticide SMP training is offered to their memberships.

Outreach Efforts

However, not every pesticide user in Maine uses restricted or limited use pesticides. Hundreds of thousands of pounds of general use pesticides are used each year in Maine, therefore efforts to reach general use consumers and applicators are an important intervention step. Listed below are some of the avenues available to inform licensed applicators and other pesticide users about the Generic SMP, Pesticide SMPs and ground water protection measures.

Newsletters and Mailings

The Board of Pesticides Control periodically produces a newsletter, *The BPC Buzz*, for the regulated pesticide community, media, environmental groups, and other interested parties. *The BPC Buzz* can service outreach efforts on a regular, per- issue basis, apprising its readership, primarily applicators, with the general goals of the Generic SMP, as well as with specific announcements of federal regulations and product reregistrations. The newsletter is especially useful for explaining the rationale behind pesticide regulations.

Commodity-specific newsletters are also published and distributed by UMCE. The potato newsletter, *Spudlines*, is published three to four times a year and has a circulation of 700-800. *Pest Alert* is published weekly during the summer for commercial potato growers, and also has a circulation of 700-800. UMCE also publishes *The Orchard Newsletter, Vegetable and Berry News,* and *Wild Blueberry News.* The now defunct *Cows and Crops,* the newsletter for dairy, had addressed BMPs, atrazine use, and ground water protection on several occasions. Cooperative Extension regional offices also publish monthly newsletters that address specific regional concerns and keep their readers informed about changes in state and federal regulations. Beyond newsletters, UMCE continually reaches users by providing updates to their brochures and conducts specific mailings on items of urgency and importance to applicators and users in Maine.

In addition to newsletters published by the BPC and UMCE, many of the agricultural and pesticide user associations in Maine publish newsletters for their constituents. The Pomological Society, Maine Potato Board, Northeast Weed Science Society, and Forest Products Council are just some in Maine and New England that have their own newsletters. The BPC has the capability to use these additional trade-specific publications to inform their readers about regulatory changes in their field, although direct mailings have proven to be more effective in reaching individual members. As Pesticide SMPs are implemented, if warrented, the BPC will be able to address specific commodity concerns through these association's newsletters and direct mail pieces.

Talks to Civic and Growers Groups

Other avenues of public education are talks to civic and growers groups. The BPC Director addresses regulators, environmental groups, and growers on a host of topics. BPC’s water quality specialist gives presentations to growers and watershed management groups, and BPC's pesticide toxicologist gives presentations before growers groups, agriculture educators and university-level students. Any of these avenues may afford an entree to the discussion of state management plans.

UMCE Specialists are available to speak to interested groups on a variety of either crop-specific or pest-specific problems. Pesticide dealers in Maine often host growers' meetings, inviting a member of the BPC or UMCE staff to address the group about a particular topic. Also, ten Cooperative Extension regional offices in Maine offer Master Gardener Programs for homeowners and small commercial growers. Even though these classes are not part of the certification program, pesticide use is discussed with participants and applicable state and federal laws are explained. The BPC certification specialist does a pesticide awareness program for master gardeners that includes a section on ground water protection.

Public Service Announcements (PSAs)

Public service announcements (PSAs) can be used to educate the general public about proper pesticide use and ground water protection. In 1992, UMCE sponsored a series of drinking water protection PSAs on television stations in Maine. These focused primarily on identification of sources of contamination. The BPC has developed a pesticide label comprehension PSA with the Maine Broadcasting System which ran as part of their "Color Me Green" campaign during the summer of 1993.

Informational Brochures

The BPC and UMCE currently publish a variety of brochures that address crop, pest, ground water, and safety-related topics. Aside from being available through the mail from any of their offices, UMCE field representatives and BPC pesticide inspectors carry this literature with them for distribution and discuss these issues with applicators, dealers, and growers during visitations and inspections. This one-to-one contact is important; the opportunity to explain recommendations and to leave instructions in the hands of the farmer, applicator, or dealer is often more effective than other training or education methods. For single copies of any of the materials listed below, readers are encouraged to contact the BPC at (207)287-2731 or the UMCE at (800)287-0279 or, outside Maine, at (207)581-3880.

Cooperative Extension Weed and Pest Control Guides

UMCE, in cooperation with extension offices in other New England states, has published a variety of commodity-specific weed and pest control guides. These guides serve as an invaluable source of information to farmers and applicators on their choice of an appropriate pesticide. The characteristics of specific pesticides are discussed and recommendations for their use to control certain commodity problems are given. In the early 1990's guides began to address ground water protection and the factors which contribute to leaching: soil, pesticide, and water table characteristics. NPURG ratings on the leachability of pesticides are now common place in most guides. Guides for potatoes, corn and forage crops, commercial vegetable production, small fruit, nursery crops, turf, problem weeds and brush, and Christmas trees are currently available. The BPC anticipates working with UMCE to develop editions which highlight the requirements of Pesticide SMPs and remind users of any special use restrictions in Maine.

"Best Management Practices for Maine Agricultural Producers"

An early and substantial effort to produce ground water protection publications lead in 1989 to UMCE's *"Best Management Practices for Maine Agricultural Producers: Protecting Ground Water from Nutrients and Pesticides"* (not to be confused with BMPs as described earlier in this section). Its readable text, timely recommendations and easy-to-understand worksheets have been valuable in the initial training of farmers and applicators about the factors involved in pesticide contamination of ground water. It has been distributed widely and over 400 individuals are on UMCE's mailing list for updates to the manual.

In addition to the above publications, a Drift Management Resource Notebook and Pesticide Applicator Log Book have also been developed and distributed by UMCE. Numerous state training programs have been held for producers to assist them in complying with drift management and record keeping regulations.

"Before You Use Pesticides"

Homeowners have historically been the most difficult group to reach with educational materials about pesticides and ground water. In 1991, the BPC published *"Before You Use Pesticides,"* which features a signature character who sets a lighter tone for discussing concerns about homeowner use of pesticides. Topics include subjects viewed by EPA and BPC surveys as least understood by the home users of pesticides.

Label comprehension, the difference between a pest and pest infestation, risks and benefits to pesticide use, storage and disposal, spill control, and proper disposal of obsolete pesticides are just some of the topics discussed.

"Ground-Water Facts for Maine Residents"

The Maine Department of Environmental Protection, Bureau of Land and Water Quality has produced a brochure for the general public which describes what ground water is, threats to ground water, and steps the average citizen can take to protect it. This brochure is distributed by the BPC at its informational booths and to callers with pesticides and ground water questions. A companion brochure, *"Ground-Water Facts for Municipal Officials"* is also available and distributed to community planners with wellhead protection issues.

Farm*A*Syst

The Farmstead Assessment System, better known as Farm*A*Syst, is a series of twelve worksheets that help farm owners assess how effectively farmstead practices protect their drinking water. The worksheets provide farm owners with a numerical score on different farmstead practices which might be affecting their well water. The numerical score then allows farm owners to look at each potential source of contamination in light of particular site conditions, to compare potential sources to see where improvements are needed most, and to determine where to spend time and money most effectively to protect the ground water that supplies drinking water wells. With each worksheet is a fact sheet that contains suggestions about things which can be done to modify farmstead practices and places to go for additional information and help. While field practices also have the potential to contaminate ground water, the Farm*A*Syst series is not designed to address this concern. The specific focus of Farm*A*Syst is the potential impact of farmstead practices and structures on drinking water supplies.

Farm*A*Syst was developed by the University of Wisconsin, Cooperative Extension; Minnesota Extension Service; and the U.S. Environmental Protection Agency, Region V. Because of differences in Maine geology and farming practices, the University of Maine Cooperative Extension assembled a work group, consisting of representatives from DAFRR, BPC, NRCS, MGS, and DEP, to review the worksheets and fact sheets and to make them applicable to Maine conditions and regulations. The Maine edition was completed in 1994 and is being used by Cooperative Extension in one-on-one grower education efforts.

Technical Assistance and Research

Technical Assistance

A variety of technical assistance programs and specialists are available to pesticide applicators and landowners who wish to minimize pesticide use and protect their ground water resources. Long before this plan was conceived, many efforts were being made in instructing farmers and applicators in their role in preserving natural resources for future agricultural and nonagricultural uses.

University of Maine Cooperative Extension

The UMCE provides technical assistance and educational programs to growers in the areas of crop production, pest control, and water quality. Extension specialists are available for a variety of commodities, including potatoes, tree and small fruit, horticulture, forestry, and agricultural engineering. The UMCE Pest Management Office is staffed by an Insect Diagnostician, a Plant Disease Diagnostician, and a Pest Management Specialist; all of whom help growers to identify and treat pest problems. In 1991, the UMCE added a Water Quality Specialist to their staff to educate landowners and the general public on surface and ground water protection. A substantial number of educators have also been trained in WIN-PST, the Windows Pesticide Screening Tool developed and supported by the USDA-NRCS National Water and Climate Center. WIN-PST is one of the few vulnerability assessment programs available and assists land users in choosing the pesticide, based on their soil type, which will be least likely to leach. (For more information about WIN-PST, see Appendix B.)

USDA Natural Resources Conservation Service (NRCS)

In addition to WIN-PST, the Natural Resources Conservation Service provides technical assistance to land users in the areas of erosion control, water quality, crop management, soil management, environmental assessments, and other special programs. In Maine, NRCS is staffed with an Agronomist, a Biologist, an Economist, a Water Resources Specialist, a Forester, a Plant Materials Specialist, a Geologist, and other soil and engineering specialists. Additional technical specialists at the regional and national NRCS offices are also available to Maine upon request. NRCS assists land users in developing site-specific plans and carries out soil surveys, national resource inventories, and river basin and watershed programs. Its Resource Conservation and Development program is focused on solving community or group problems. NRCS maintains a detailed set of standards and specifications in each of the sixteen field offices called, *"Field Office Technical Guide."* These guides describe how agricultural, erosion, and water quality practices should be installed and how these practices should fit together into systems for solving total-farm problems.

Soil and Water Conservation Districts

Maine's sixteen Soil and Water Conservation Districts (SWCDs) are subdivisions of state government, created to provide for the conservation of our state's soil and water resources. Governed by a five-member board of supervisors, elected or appointed from constituents living within each district's boundary, SWCDs utilize a unique combination of federal, state, and local resources to carry out their mission.

It is through district offices that NRCS technical staff assist land occupiers, a cooperative effort to solve local soil and water conservation problems. SWCDs can also employ their own technical and/or administrative staff to work in concert with NRCS staff, when necessary, to meet local needs. Federal and state research funds are often funneled to SWCDs because of their strategic locations, technical capability, and close working relationships with cooperating agencies and land occupiers within district boundaries. Examples include Washington County's Integrated Crop Management (ICM) Program, designed to minimize the use of pesticides on blueberries. Another county office, Hancock County, has conducted a study of Velpar (hexazinone) transport in blueberry field soils.

UMCE Research and Assistance Projects

Numerous research projects currently are being conducted in Maine by the UMCE. A Hydrologic Unit Project at the Fish River Lakes in Aroostook County, Maine, is providing detailed technical assistance to farmers in pest and soil management. Other projects include a hydrologic unit project in the Meduxnekeag River/Houlton, Maine, area and a demonstration project for the use of organic wastes in Androscoggin County, Maine.

The UMCE is also conducting a number of integrated pest management (IPM) programs for Maine crops such as potatoes, broccoli, sweet corn, blueberries, apples, and small fruit. Integrated crop management (ICM) projects are also being conducted on many farms in Maine. ICM is a cost-share program through FSA with the goal of obtaining a 20% reduction in pesticide and nutrient application over three years.

Pesticide Control Measures

Many of the prevention measures mentioned in the previous sections are ongoing programs. In some instances, current efforts and programs may not be sufficient to prevent ground water contamination and more stringent measures may be needed as part of a Pesticide SMP. The regulatory alternative to best management practices, education, and technical assistance is a multi-tier approach to pesticide control measures. Which measures are chosen as part of a Pesticide SMP will depend, in large part, on the decisions made by the Pesticide SMP Advisory Committee.

Pesticide SMP Advisory Committee

The Pesticide SMP Advisory Committee will assist and advise the BPC on technical decisions related to the development of Pesticide SMPs. The committee will be composed of permanent members (known as "Core" members) and individuals with knowledge specific to the Pesticide SMP under development. A policy statement describing the membership and duties of the Pesticide SMP Advisory Committee can be found in Appendix D.

When considering appropriate prevention measures, a Pesticide SMP Advisory Committee will consider the following information:

- the scope of crop and non-crop uses in Maine,
- current application practices in Maine,
- chemical characteristics of the pesticide,
- economic impact on user community(ies),
- available sales and use data in Maine,
- availability of efficacious chemical and non-chemical alternatives,
- environmental impact on Maine's ecosystem,
- practicality of changes in application practices,
- potential health impacts and the product's toxicity,
- geographic specificity of use which may yield identifiable geologic characteristics, and
- past ground water monitoring data or the practicality of monitoring when no data exist.

Pesticide Control Measures

Below is a description of all available pesticide control measures. These options may be used individually or under the larger umbrella of a Pesticide SMP as depicted in Figure VI-A. All options, except adoption of a Pesticide SMP (which is considered a policy adoption by the Board), require rulemaking under the Maine Administrative Procedures Act; therefore, there will be an opportunity for public input at all of these levels.

Pesticide State Management Plan (SMP)

Although required for continued use of pesticides identified by EPA, the state may choose to write a Pesticide SMP for products which present a threat to ground water in Maine. A Pesticide SMP details how the resources, prevention and response measures, as generally described in this Generic SMP, would be utilized to protect ground water from a specific pesticide. A Pesticide SMP may or may not be regulatory in nature; it may simply be used as the coordinating mechanism for resources and programs. Maine's experience with hexazinone, however, showed that a Pesticide SMP may have both regulatory and non-regulatory components which work together to protect ground waters. The regulatory components of a Pesticide SMP are described in detail below.

Restricted Use Classification

One of the first regulatory avenues the BPC can utilize in the control of pesticides of state concern is reclassification onto Maine's Restricted Use List. When a pesticide is registered as restricted use in Maine, it can be sold only by appropriately licensed dealers and be bought only by applicators licensed to apply restricted use products. In this way, the BPC can be assured that users of such pesticides have been trained in proper application techniques and that applicators have an understanding of the factors that contribute to ground water contamination.

Pesticides which are identified by EPA as requiring a Pesticide SMP will be classified as Federally Restricted Use, therefore these products will be automatically added to the Maine's State Restricted Use list. The Ground Water Planning Committee, the group responsible for this Generic SMP, continues to work on criteria to classify a pesticide as restricted use based on ground water concerns in Maine.

Special Restriction of Pesticide Use

The BPC may also promulgate rules to impose special restrictions on pesticide use. These "special restrictions" would prescribe management practices, such as mandatory setback areas from wells or surface waters, without site-specific considerations. In 1981, the BPC set a precedent for such actions by adopting 01-026 CMR Chapter 41, "Special Restrictions on Pesticide Use - Captan," which required prior notification of application. In 1984, another Special Restriction was promulgated requiring setbacks from potable water sources for aldicarb (Temik). The benefits of this action were twofold: 1) it went beyond the label requirements in providing protection of wellheads and sources of drinking water, yet 2) it allowed continued use by applicators with minimal regulation or change in application practices. In 1996, special restrictions designed to protection ground water were adopted for the herbicide, hexazinone. Today, three special restrictions on pesticide use are found in 01-026 CMR Chapter 41 of the BPC's rules (Appendix J).

State Limited Use Classification

A more site-specific means available to the BPC is the control of highly leachable pesticides through classification as Maine Limited Use pesticides. Once reclassified as a limited use pesticide, the product may then be sold to and used by only licensed persons holding a use permit granted by the Board of Pesticides Control. Permit forms and additional information requirements would be determined by the Board of Pesticides Control.

To expedite the permit process, the Board of Pesticides Control may delegate to the BPC staff their authority for granting limited use permits. The staff of the BPC, with the assistance of other state agencies or a preexisting Pesticide SMP Advisory Committee would review all permits and assess their potential impact upon ground water in the use area. Where there is an indication that the combination of site, soil, use pattern, and pesticide characteristics may create a high potential for pesticide leaching, certain management practices may be attached to the permit before issuance or the permit may be denied. For an applicator to purchase and use the pesticide, the measures detailed in the permit would have to be followed. Failure to follow them could result in revocation of the permit and possible enforcement action.

Should a pesticide present a clear and present threat to the ground water supply, the staff of the BPC may refer those applications to the Board for additional review. If the Board decides that any use of the pesticide in that given area is a significant threat to the ground water, then the Board may reject the permit application, thus creating a localized moratorium. The petitioner may ask the Board to reconsider its decision at the next regular meeting. Further appeals must be made in accordance with Title 22, M.R.S.A. §1471-K, "Appeals."

Critical Areas

In 1975, the BPC was empowered by statutory authority to designate critical areas. These critical areas are to include, but not be limited to:

> "....areas where pesticide use would jeopardize endangered species or critical wildlife habitat, present an unreasonable threat to [the] quality of the water supply, be contrary to a master plan for the area where such area is held or managed by an agency of the State or Federal Government, or would otherwise result in unreasonable adverse effects on the public health, welfare or the environment of the area."[25]

In April of 1989, rules were adopted which established the criteria and procedures for designating critical areas. Section 3(D) of the rule allows for the designation of critical areas where, "without additional restrictions, [pesticide use] is likely to significantly risk the quality of surface and ground water supplies used for human consumption."[26] These additional restrictions are decided upon by the Board and may include prohibition of pesticide use. To date, two locations in Maine, the Deblois Fish Hatchery Critical Pesticide Control Area and the Dennys River Critical Pesticide Control Area, have been designated; neither case was designated because of an imminent threat to the ground water.

State Cancellation of Registration

The most restrictive action the BPC can take with respect to a pesticide is the cancellation or suspension of registration in Maine. This action has the equivalent result as the state refusing to develop a Pesticide SMP. For products which contribute to widespread contamination and with only few, if any, important uses in Maine, this may be considered a viable option. Certainly, it is to be considered in only a very few and very extreme cases.

Title 7, M.R.S.A., §609(2) generally describes the situations in which the state may refuse, cancel, or suspend registration. It says:

> "If the board determined that any federally registered pesticide...might cause unreasonable adverse effects on the environment, it may refuse to register the pesticide as required in

4 [25]Title 22, M.R.S.A., '1471-M(4).

5 [26]01-026CMR Chapter 60, Sec. 3(D).

section 607, or if the pesticide is registered under section 607, the registration may be canceled or suspended as provided in Section 1."[27]

Any cancellation or suspension is considered rulemaking and must be done in accordance with the Maine Administrative Procedures Act.

Pesticide SMP Information Dissemination

Because the user is ultimately responsible for management of pesticides, measures prescribed in a Pesticide SMP must be communicated to pesticides users as well as appropriate industry groups and regulatory officials. Because information dissemination is so closely related to education about prevention measures, it has been included as part of this section.

Workshops

Prior to the development of any Pesticide SMP, one or more workshops will be held (1) to make growers and users aware of the change in regulatory status of the product and (2) to gather grower and user input on issues affecting plan development. These workshops will be held in areas of the State where the pesticide in question is used and will be heavily publicized.

Recertification Meetings

As mentioned previously, recertification meetings will be used to convey ground water protection information to licensed applicators. Recertification meetings will be the primary means used to inform users about the requirements of Pesticide SMPs.

Mailings to Commodity Groups

Copies of Pesticide SMPs may be mailed to affected commodity organizations and user groups. Commodity publications will be used as an additional means of making users aware of their obligations under pesticide-specific management plans. The BPC currently maintains a database of commodity and user organizations and will update it on a regular basis.

Direct Mailing to Applicators

When the number of applicators affected by a Pesticide SMP is limited or the requirements of a Pesticide SMP are highly technical, the BPC will consider direct mailing of information to applicators in the affected user groups. In addition, *The BPC Communicator*, which is mailed to each applicator four times a year, will be used to inform them about the existence and requirements of state management plans.

Role of Other Groups in Informing Users

6[27]Title 7, M.R.S.A., '609, ''2.

The educational roles of the University of Maine Cooperative Extension, Natural Resources Conservation Service, and Soil and Water Conservation Districts have previously been outlined in this section and Sections III, “Cooperating Agencies.” In addition to those groups, the BPC will work closely with commodity organizations and pesticide dealers.

Commodity Groups

The BPC encourages commodity and trade organizations to take the initiative in educating their members about the requirements of Pesticide SMPs. The BPC will work with these organizations and tailor recertification meetings to specific crop/use concerns. As mentioned previously throughout this plan, commodity and trade organizations will play a major role in Pesticide SMP development.

Pesticide Dealers

Pesticide dealers are in a unique position to provide one-on-one assistance to growers and users. In Maine, all persons who sell restricted or limited use pesticides must be licensed, therefore the BPC will educate dealers about the requirements of Pesticide SMPs and encourage them to then educate their patrons.

SECTION VII
GROUND WATER MONITORING

Ground water monitoring is defined as "the set of activities that provide chemical, physical, geological, biological, and other environmental data needed by environmental managers/decision-makers to assist in developing and implementing ground water protection policies and programs."[28] Maine's ground water monitoring program, subject to the limitations of the BPC's finite resources, consists of a baseline assessment component for determining the existence of contamination and a pesticide-specific component, within Pesticide SMPs, to define the extent of contamination and to measure the success or failure of prevention and response programs. In addition to data gathered by the BPC, this program attempts to incorporate data currently being gathered by other state agencies.

Assessment Monitoring

The last statewide assessment of pesticides in ground water occurred in 1994 with the BPC’s *1994 Pesticides in Ground Water Monitoring Program*. It was designed to assess the occurrence of pesticides in private domestic wells which were within ¼ mile down gradient of active pesticide use sites. A description of the program and results are found in Appendix E.

1 [28]U.S. Environmental Protection Agency, “Pesticide State Management Plan Guidance for Ground Water Protection” (Review Draft), July 1992, pp. 3-10 - 3-11.

In conclusion, the BPC learned that pesticide contamination of ground water occurs areas near active use sites, however at levels which do not currently present a health threat to the citizens of Maine when compared to health-based standards established by the U.S. Environmental Protection Agency and the Maine Department of Human Services. Nearly 25% of wells within ¼ mile, downgradient of a pesticide use site may have detectable amounts of one or more pesticides present. The likelihood of contamination varies across commodities, with wells near blueberry, corn and potato growing areas at higher risk. And, although rights-of-way were the only non-agricultural use sites included in the study, agricultural sites present the greatest probability of pesticide contamination of ground water because of both the nature and the quantity of pesticides used in crop production.[29]

The BPC plans, subject to funding, to replicate the 1994 study methodology on five- to seven-year intervals to determine ground water quality trends.

Pesticide-Specific Monitoring

Pesticide-specific monitoring has several uses. First, this monitoring can be used to assess whether specific contaminants detected in the Assessment Monitoring phase or during other routine ground water monitoring show widespread trends of concern. For example, follow-up monitoring was conducted for two pesticides, hexazinone and metalaxyl, after numerous detections during the 1994 study. A triple-data point sampling principle was used whereby positives of concern are evaluated by sampling two other sites in the same watershed with similar geological and pesticide use characteristics of the first site. If either of these additional sample points confirms the original concern, then the sampling effort may continue to expand using the same triple-data point sampling principle until the scope of the problem in adequately evaluated.

Second, pesticide-specific monitoring can be used to evaluate the effectiveness of pesticide management changes implemented in response to contamination trends already identified. This type of monitoring will most often be conducted under a Pesticide SMP and described in detail within one. The BPC may also initiate pesticide-specific monitoring without a Pesticide SMP as it gathers data on pesticides of state concern or prior to development of a pesticide-specific plan.

Incorporation of Other Monitoring Efforts

While the BPC will continue to recommend response actions based upon data collected only by the agency, many more ground water monitoring programs exist in the state, each providing a unique perspective on ground water quality. The BPC believes that all ground water

2 [29]Maine Board of Pesticides Control, "1994 Pesticides in Ground Water Monitoring Program: Final Report," September 1995, pp.10.

monitoring data are useful. The BPC will solicit monitoring data from other sources and evaluate the usefulness of the data based upon the source, collection and analytical protocols.

Department of Human Services, Health and Environmental Testing Laboratory

Public Water Systems

Public water systems are required to regularly monitor their water for contaminants, including pesticides, under the Phase II and Phase V Safe Drinking Water Act monitoring requirements. Efforts will be made to ensure that pesticides detected in such routine monitoring activities will be reported to the BPC for follow-up investigation and determination of the source.

Private Wells

Water samples from private wells are occasionally sent to the Health and Environmental Testing Laboratory for analysis when the owner believes there is a possibility of pesticide contamination. Efforts also will be made to see that the location of samples showing contamination are reported to the BPC for further investigation and inclusion into the monitoring database. (See Section III, "Cooperating Agencies," Department of Human Services, Bureau of Health.)

Sample Analyses, QA/QC and Data Collection

The University of Maine Department of Food Science Laboratory will be the primary lab for sample analyses. As part of the Cooperative Agreement with EPA, the BPC maintains and regularly updates a quality assurance/quality control program with the Food Science Laboratory for the collection of samples related to pesticide enforcement activities. The current QA/QC program will be followed for the collection of all samples related to both Generic and Pesticide SMPs.

Where technologically possible, monitoring will be conducted using *immunoassay tests* to detect initial contamination. Until recently, full-scale monitoring programs would have been cost prohibitive, but the recent introduction of immunoassay tests for pesticides allows broad screening at 10-20 times less cost than conventional chromatography techniques, and they can be processed in as little as 90 minutes. Currently, immunoassay tests are available for such known contaminants as aldicarb, the triazines, carbofuran, hexazinone and alachlor, with many others under development. Gas chromatography/atomic emissions detection (GC/AED) analysis will continue to be conducted as a screen for other chemicals and as a confirmation of the reliability and accuracy of the immunoassay method.

EPA has encouraged states to adopt their Minimum Set of Data Elements for Ground Water Quality (MSDE). Although the BPC does not utilize monitoring wells, some construction and location data has been collected for all private domestic wells from which samples have been taken since 1994. In 1996, the BPC purchased hand-held, global positioning system (GPS) units for field staff collecting samples. The BPC now maintains longitude, latitude, altitude and position accuracy data for all sites from which it collects samples.

SECTION VIII
RESPONSE FRAMEWORK

This section of the Generic SMP describes the response framework through which pesticide-specific response actions will occur. The need to prescribe response actions, implement prevention measures, and coordinate monitoring data requires a policy which simultaneously addresses many different fronts in the state's ground water protection strategy. This section outlines such policy and provides guidance for BPC decisions and recommendations in the development of Pesticide SMPs.

Reference Points

The U.S. EPA has adopted the use of Maximum Contaminant Levels (MCLs) as defined under the Safe Drinking Water Act as standards for determining unacceptable contamination of ground water. Where no MCL exists, EPA will use interim drinking water protection criteria as its reference point.[30]

In Maine, the Department of Human Services, Bureau of Health (BOH), has developed a series of Maximum Exposure Guidelines (MEG) which complement EPA's effort. For non-carcinogenic products, the MEG is based on the No Observable Effects Level (NOEL) for adverse effects in laboratory animals divided by appropriate safety factors. For carcinogens, the MEG is equivalent to the dose at which one would predict one additional cancer death per 100,000 individuals. Where no MCL exists or has yet to be adopted, the MEG will be used as the reference point for determining an appropriate response. If neither the MCL nor the MEG has been established, the BPC and BOH will work together to prepare an appropriate response to the contamination problem. Appendix F, "Pesticide Drinking Water Guidelines," lists those pesticides for which MCLs and/or MEGs have been established.

Very few currently registered pesticides have EPA-established aquatic life criteria, therefore it is not practical to routinely use these criteria as reference points. In areas where the ground water is hydrologically connected to Class AA and Class A surface waters and pesticides with established aquatic life criteria are used, these criteria may be used in determining appropriate response actions. Appendix G, "Maine Water Quality Criteria for Pesticides," lists those for which aquatic life criteria have been established.

1[30]U.S. Environmental Protection Agency, loc. cit.

Detection Level Action Guidelines

Detection level action guidelines are divided into two groups: (1) for individual wells/sites, the detection level action guidelines are based upon a percentage of the MCL or MEG; or (2) for multiple wells/sites, the detection level action guidelines are based upon the percent of sampled wells/sites with confirmed pesticide detections. Figure VIII-A outlines the detection levels and recommended response actions which will be evaluated for applicability and implemented when an action level is reached based on the average percent MCL or MEG. For situations where ground water monitoring in proximity to application sites results in multiple detections below 50 percent of the MCL or MEG, Figure VIII-B will be evaluated for applicability and actions implemented.

Action Level	Contaminant Concentration	Recommended Response
A	At or above the detection limit yet below 50% of the MCL or MEG	◆ Follow-up by BPC inspector (see following text after table) ◆ Review of use and application practices by Department of Agriculture, UMCE
B	Between 50% and 100% of the MCL or MEG	◆ Site investigation by NPS-Pesticide Response Team ◆ Additional monitoring within local area (see Section VII, "Ground Water Monitoring, Pesticide-Specific Monitoring.") ◆ Mitigation of site-specific problem -or- modification in site-specific pesticide use practices through referral to Ag NPS Program, temporary pesticide control measure through emergency rulemaking or change in an existing limited use permit and/or Pesticide SMP
C	At or above 100% of	◆ Site investigation by

	the MCL or MEG	expanded NPS-Pesticide Response Team ◆ Expanded monitoring effort within local area (see Section VII, "Ground Water Monitoring, Pesticide-Specific Monitoring.") ◆ Mitigation of site-specific problem -or- further modification in site-specific pesticide use practices (as described above)

Figure VIII-A: Detection Level Action Guidelines for Single Well/Site

Action Level	Percent of Sampled Wells/Sites with Confirmed Detections[31]	Recommended Response
A	At or below 10% of sampled wells/sites	◆ Additional monitoring within local area (see Section VII, "Ground Water Monitoring, Pesticide-Specific Monitoring.") ◆ Review use, application practices and other available monitoring data by Department of Agriculture, UMCE, pesticide user groups ◆ Investigate and define geology/hydrology of sites with confirmed detections
B	Between 11% and 25% of sampled wells/sites	◆ BPC may request user group intervention ◆ Modification of pesticide use practices through review and/or revision of IPM strategies for pesticide's target pests (UMCE); review, revise and/or develop BMPs for specific pesticide (Agriculture NPS Task Force subcommittee); review

2 [31]Samples collected and analyses performed pursuant to BPC monitoring plan and established EPA protocols.

		and/or revise existing Pesticide SMP (BPC) ◆ Assess IPM and BMP education needs and implement (See Section VI, “Prevention Strategies and Information Dissemination.”)
C	At or above 25% of sampled wells/sites	◆ BPC forms Pesticide State Management Plan (SMP) Advisory Committee to review and/or develop Pesticide SMP

Figure VIII-B: Detection Level Action Guidelines for Multiple Wells/Sites

Two situations present unique challenges when determining appropriate response actions are:

- pesticides which have a MCL or MEG below 10 parts per billion (ppb), and

- multiple detections of a material at concentrations below 50% of the MCL or MEG.

Pesticides which have a MCL or MEG below 10 part per billion (ppb) present a challenge because the statistically sound detection limit of laboratory analysis for many of these materials is often near or above the established MCL or MEG. Since a small change in the detected concentration, such as 1 ppb, could mean the difference between confirmed detection and detection above the MCL, it may be prudent to take preventative action sooner than in other cases. For pesticides with an MCL or MEG below 10 ppb, response action may be accelerated to compensate for the potential threat to human health.

Also, situations where pesticides are detected in multiple wells/sites at concentrations below 50% of their MCL or MEG should not be overlooked. Low level detections in multiple wells/sites are an opportunity to determine and implement appropriate actions to protect ground water resources in a given area.

Since recommended responses contained in Figure VIII-B require actions to be taken at low percentages of wells/sites detections, valid data must be gathered to define multiple detection situations. A statistically sound sampling method for sampling in proximity to use sites must be employed. For the purposes of defining situations of multiple detections of a specific material, data from BPC monitoring programs will be used. BPC data is preferred because the EPA requires a Quality Assurance Project Plan (QAPP) for data collected under state management plans and few, if any, agencies beyond the BPC collect data using a QAPP. In cases where data is obtained by monitoring conducted by other entities, the integrity of the data will be evaluated and the Board may recommend the user groups lead response actions.

Response to Contamination

Once pesticides are detected in ground water at a concentration corresponding to or exceeding the action levels shown in Figure VIII-A and Figure VIII-B, an appropriate response should be made to prevent further degradation of the ground water. The general descriptions below provide a probable course of action. Each of the elements described in Figure VIII-A and Figure VIII-B will need to be expanded upon and tailored to the products identified for Pesticide SMPs.

Notification of Well Owners/Users

All private domestic well owners/users who submit to water sampling during the course of an investigation or routine monitoring program will receive notification of results in writing from the BPC. For wells with detectable concentrations of pesticides, this notification will include summary of the health effects associated with the contaminant prepared by the BPC Toxicologist. The BPC Toxicologist will also be available to answer questions from the public regarding the health effects of pesticides in drinking water. Notification of public well users is handled by the Department of Human Services, Drinking Water Control Program by the protocol described in the Safe Drinking Water Act .

Follow-up by the BPC

For site-specific issues, an initial response may include a visit to the land user by a BPC inspector for an evaluation of the pesticide application and storage practices. The BPC inspector may be able to identify a point-source pollution problem or identify some particular use practice which may be the contributing factor. Appropriate educational materials may be sent to the land user or distributed at the time of the inspection to encourage further protection and to prevent further degradation.

Site Investigation

For single-site or multiple-site contamination, the investigation may be turned over to the state's Agricultural Nonpoint Source Pollution (Ag NPS) Program and their NPS-Pesticides Response Team. Investigation would involve an on-site visit by the team, incorporating, at minimum, persons with knowledge of pesticides and expertise in ground water. Agencies involved with the NPS-Pesticides Response Team include, among others, Cooperative Extension, Natural Resources Conservation Service, the Department of Agriculture, the Department of Environmental Protection, and the Board of Pesticides Control. Site-specific situations determine the appropriate persons to be included on the Response Team.

The NPS-Pesticides Response Team would review use and application practices and attempt to further isolate the source of contamination. If the land user has a Best Management System, the team would attempt to determine which of the individual BMPs are being utilized. If no BMPs are being utilized, then some may be recommended to the land user. The team will report their findings and site recommendations to the BPC.

Presently, there is no corresponding non-agricultural response unit. In cases where contamination is detected at non-agricultural sites, the BPC and staff will work closely with the landowner and trade association to find a resolution to the situation.

Mitigation of Site-specific Problem

Site investigation may reveal that the pollutants are coming from a point source, such as a pesticide spill in a storage area. The BPC will work with the land user to eliminate and/or reduce the flow of pollutants from the point source and ensure that the proper authorities are notified. The site will be referred to the Maine DEP for remediation and clean-up, if necessary.

Modification of Current Prevention Strategy

The BPC will meet to review available monitoring data and the findings and recommendations of the BPC inspector and/or the NPS-Pesticides Response Team (or similar group). When applicable, the BPC may seek some type of pesticide use modification. The BPC has several avenues available to affect use modification.

Referral to the Agriculture NPS Task Force

It has been recognized that the BPC has little site-specific control over general and restricted use pesticides beyond what ground water protection measures may be on the pesticide label. The adoption of BMPs by the land user is essentially the only means available (without additional regulation) for protecting ground water in areas where restricted and general use pesticides are used.

To affect use modification of a general or restricted use pesticide, the BPC will rely on the Agriculture NPS Task Force and its subcommittees for two items: (1) the development and/or review BMPs for individual pesticides and (2) on a case-by-case basis, the voluntary adoption of site-specific BMPs. Voluntary adoption of site-specific BMPs is sought, but an avenue of legal enforcement, thought the Agriculture NPS Strategy, is available should BMPs not be adopted. Land users and applicators will receive regular inspections by the BPC and/or NPS inspection staff to provide assistance and to ensure compliance. Continued ground water monitoring until resolution of the problem will evaluate the effectiveness of the BMPs.

This program does not expressly cover non-agricultural uses of pesticides. Where non-agricultural uses are involved, the BPC will work with affected landowners in the state to adopt management practices which may mitigate ground water contamination. Most likely, though, some type of special restriction on pesticide use may have to be adopted for particular non-agricultural use(s).

Temporary Pesticide Control Measures

Should voluntary cooperation be ineffective or the degree of contamination, single or multiple sites, be such that immediate action is needed in cases of contamination through legal use, then the BPC may initiate emergency rulemaking to reclassify the pesticide as State Limited Use or to impose special restrictions for a maximum of ninety (90) days. At the end of ninety (90) days, pending no further rulemaking, the pesticide reverts back to its original classification without special restrictions.

Revision of Existing Limited Use Permits or Pesticide SMP

If the pesticide is currently managed in a Pesticide SMP or a State Limited Use Pesticide, then the BPC, with the assistance of the Pesticide SMP Advisory Committee, may revise the prescribed management practices stipulated in the Pesticide SMP or on the permit. Additional restrictions as part of a Pesticide SMP may require rule making under the Maine Administrative Procedures Act (MAPA). For holders of limited use permits, restrictions may be imposed without the process of the MAPA. In this situation, the land user may appeal the additional requirements at the next regular meeting of the BPC. Further appeals may be made in accordance with Title 22, MRSA, §1471-K, "Appeals."

Development or Revision of Pesticide SMP

While other actions in this section may have a more immediate impact, the long-term solution to ground water protection for some chemicals involves the development and/or revisions to a Pesticide SMP. A Pesticide SMP Advisory Committee may recommend permanent changes to the existing Pesticide SMP when it has been shown to be inadequate to protect ground water. In the absence of a Pesticide SMP, the BPC may call for a Committee and charge them with considering the development of one so as to put into place a statewide prevention strategy to prevent further contamination.

Alternative Drinking Water for Private Domestic Well Users

The BPC has been relatively successful at working with registrants to provide alternative water supplies and/or filters when contamination above health-based standards has been detected. The BPC hopes to continue to work with registrants in this stewardship capacity, however, the BPC recognizes that this may not always be possible.

The BPC has discussed in detail options which would provide affected homeowners with safe drinking water. One such option includes the establishment of an alternative drinking water fund. Under it, owners of private domestic wells which have been contaminated due to proximity to a pesticide use area would petition the BPC for funding to supply alternative drinking water or to remedy wells with filtration systems. Because of the necessity to provide potable water in an expeditious manner, the Director of the BPC would be able to authorize allocations in a set limited amount. Long-term remediation would be taken up by the BPC. Unfortunately, this program may require a substantial amount of funding, the source of which has not been identified.

Impact on Land Users

It may be determined that ground water contamination can only be prevented by an outright moratorium on pesticide use within a specific area. Alternatives to using a given pesticide, although some may be more costly or less effective, will have to be developed. In some cases, no alternatives may be found, and the land user may be restricted to non-chemical pest control means.

The Agricultural NPS Strategy recognizes the financial impact the BMP implementation could have on farmers. In the strategy, two types of financial assistance are recommended: 1) cost sharing, to lessen the financial burdens of some mechanical or labor intensive BMPs, and 2) direct compensation for lost production and decreased land values when farm land is removed from production. However, the Board has already determined that the availability of compensation programs will not be a pre-condition for declaring a use moratorium, and a lack of money for such programs will not impede the implementation of this plan.

SECTION IX

ENFORCEMENT

Agency Roles in Enforcement

To ensure that requirements of Pesticide SMPs are followed, enforcement action may be necessary to achieve compliance. The BPC is the lead agency for label and Pesticide SMP requirement enforcement.

The BPC will monitor compliance with and enforce ground water protection labeling as part of its use, marketplace, and dealer inspections. The BPC will focus use inspections on those commodities and growers who use pesticides which require a state management plan. Marketplace and dealer inspections will focus on products which require a Pesticide SMP as part of the labeling. Applicators who violate the label or other State or Federal statutes related to this plan will be subject to enforcement action as outlined in the BPC's enforcement protocol (attached in Appendix H).

The BPC has considered enforcement authorities available under other State and Federal statutes and will attempt to coordinate enforcement activities with EPA and other State agencies, as appropriate, to make full use of those statutes. The Department of Environmental Protection, the state's lead agency for ground water protection, will be notified of all action taken by the BPC. Enforcement for nonpoint source pollution violations may be referred to either the Department of Agriculture, Food, and Rural Resources or the Department of Environmental Protection. Legal authorities necessary for proper enforcement have been outlined in Section III, "Cooperating Agencies."

Penalties

In 1990, the legislature increased penalties for violating BPC regulations. For any person who commits a civil violation, the maximum fine is $1,500 for the first violation and $4,000 for each subsequent violation within a four-year period. For private applicators, the penalty may not exceed $500 for a first violation or $1,000 for any subsequent violation within a four-year period related only to violations of record keeping or the return and disposal of pesticide containers. For the first time in 1990, a criminal violation section was added to the BPC penalty regulations. It provides for a "fine not to exceed $7,500 and...imprisonment not to exceed 30 days, or both, for each violation" for an applicator who "intentionally or knowingly violates" pesticide laws.[32]

1 [32]Title 7, M.R.S.A., '616-A.

SECTION X
PUBLIC PARTICIPATION

One of the EPA requirements for this plan is that the public be given ample opportunity to provide input and comment on the methods chosen to prevent contamination and the proposed regulatory framework. This section describes the provisions being made to involve the public in Generic and Pesticide SMP development.

Generic SMP Development

On September 14, 1993, the Board of Pesticides Control (BPC) mailed 148 copies of the *Maine Generic State Management Plan for Pesticides and Ground Water - Proposed Plan* to Ground Water Planning Committee members and others who, during the previous three years, had expressed an interest in the development of the plan. This began a three-month, public comment period that invited review and critique of the plan. Following a news brief in the October 1993 *BPC Communicator*, fifteen additional copies were mailed out upon request while numerous individuals stopped by to pick up a copy at the BPC Augusta office. In all, a total of 240 copies of the plan were distributed.

Three public informational gathering meetings were then scheduled at locations around the state. A press release advising of the availability of the plan and public meeting schedule was mailed to all the major newspapers. Public meetings were held in Machias on November 4, 1993 (one in attendance), in Presque Isle on November 9 (fourteen in attendance) and Lewiston on November 16 (two in attendance). In general, those present at the meetings asked questions about the proposed plan and other topics while only one individual offered a couple of minor comments. Two articles concerning the meetings and the plan appeared in the *Bangor Daily News* in late October and early November.

Following this and future revisions of the Generic SMP, the BPC is planning to hold one, public informational gathering meeting (location to be determined) and accept comments on the revised plan for 60 days. Again, the availability of a revised plan will be heavily publicized and single copies will be free of charge to interested individuals.

Pesticide SMP Development

The route for public participation following Pesticide SMP development depends primarily on the proposed requirements. If proposals in the plan require the BPC to seek additional legal authorities, then the BPC will provide for public comment through rulemaking, following the guidelines in the Maine Administrative Procedures Act (MAPA).[33] The MAPA provides for ample public comment, including input from both public hearings and written comments. If the Pesticide SMP proposals do not require the BPC to seek additional authorities,

1 [33]5 M.R.S.A., Chapter 375, Subchapter II.

then a public participation program, similar to that conducted for Generic SMPs, will be followed.

SECTION XI
RECORD KEEPING, REVIEW, AND REPORTING

The best test of a plan is its day-to-day use. Documenting the plan's progress not only provides a source of data to share with EPA and other cooperating agencies, but also provides a basis with which to assess implementation and effectiveness. Incorporating what is learned back into the plan makes it a living document, not an inanimate object carved in stone. This section of the plan outlines the BPC's commitment to keep records, report results to the EPA or appropriate agencies, and to use that information in the review of Generic and Pesticide SMPs.

Records and Reporting

The BPC will maintain all records relating to the development and implementation of either a Generic or a Pesticide SMP for a minimum of four years. The information maintained will include:

- results from ground water sampling and monitoring;
- the number of persons reached by outreach and education efforts;
- the number of, and a summary of, inspections performed to determine compliance with ground water labeling or Pesticide SMP provisions, including a determination of whether provisions were being followed;
- the number of, and a narrative summary of, completed enforcement actions related to non-compliance with ground water labeling or Pesticide SMP provisions;
- a summary of significant findings;
- an assessment of whether use of specific pesticide(s) has substantially changed over a given period;
- identification of any special issues within the state regarding either the Generic or any Pesticide SMPs;
- identification of needed modifications to either the Generic or Pesticide SMPs;
- a description of available projected resources for the next year;
- a description of any response actions taken for detections of specific pesticides.

The BPC will make available to EPA and others, upon request and appropriate allowance of time, any and all records related to the development and implementation of state management plans.

Plan Review and Update

Every four years, the BPC will give thorough reconsideration to the strategies and implementation items listed in the Generic SMP. In its review of the Generic SMP, the BPC will consider, in addition to many of the items listed above, the following items:

- Does the plan still reflect the current state philosophy on ground water management?
- Are the roles of the Cooperating Agencies still the same?
- Are there new or modified Prevention Strategies that need to be incorporated?

The BPC will also consider comments from the public on the future direction of the Generic SMP and incorporate comments on its performance into a quadrennial republication.

Each Pesticide SMP Advisory Committee will biannually review its respective plan. This will include an assessment of the adequacy of the plan and a discussion as to whether the plan is actually serving to protect the ground water resources. Considering many of the points listed above, each committee may then recommend changes for the BPC to consider. Biannual updates will also be published for inclusion.

APPENDIX A
ACRONYMS

Below is a list of acronyms found within this management strategy. Bureaus, divisions, and agencies include their respective departments in parentheses.

ARS Agricultural Research Service (USDA)

BOH Bureau of Health (DHS)
BLWQ Bureau of Water Quality Control (DEP)
BMP Best Management Practice
BMS Best Management System
BPC Board of Pesticides Control (DAFRR)
BRWM Bureau of Remediation and Waste Management (DEP)

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CES Cooperative Extension Service (USDA)
CFR Code of Federal Regulations
CMR Code of Maine Regulations
CPP Comprehensive Planning Program
CWA Clean Water Act

DAFRR	Maine Department of Agriculture, Food, and Rural Resources
DECD	Maine Department of Economic and Community Development
DEP	Maine Department of Environmental Protection
DHE	Division of Health Engineering (DHS)
DHS	Maine Department of Human Services
DOC	Maine Department of Conservation
DOI	U.S. Department of the Interior
DOT	Maine Department of Transportation
DRASTIC	Depth of water, recharge, aquifer media, soil media, topography, impact of unsaturated zone, conductivity of the aquifer Computer Modeling Program
DWC	Drinking Water Control (DHS)
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FSA	Farm Services Agency (USDA)
Generic SMP	Generic State Management Plan
GIS	Geographic Information System
H&ETL	Health & Environmental Testing Laboratory (DHS)
ICM	Integrated Crop Management
IPM	Integrated Pest Management
MAES	Maine Agricultural Experiment Station
MAPA	Maine Administrative Procedures Act
MCL	EPA Established Maximum Contaminant Level
MEG	Maine Exposure Guideline
MGS	Maine Geological Survey (DOC)
MRSA	Maine Revised Statutes Annotated
MSDE	Minimum Set of Data Elements for Ground Water Quality
NOEL	No Observable Effects Level
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service (USDA)
OCP	Office of Comprehensive Planning (DECD)
ODW	Office of Drinking Water (EPA)
OPP	Office of Pesticide Programs (EPA)
Pesticide SMP	Pesticide-specific State Management Plan
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act

RPC	Regional Planning Council
SDWA	Safe Drinking Water Act
SMP	State Management Plan
SPO	Maine State Planning Office
SWCD	Soil and Water Conservation District
UM	University of Maine
UMCE	University of Maine Cooperative Extension
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey (DOI)
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WIN-PST	Windows pesticide screening tool for protection of GW (USDA)

APPENDIX B
WIN.PST

USDA-NRCS National Water and Climate Center's Windows Pesticide Screening Tool (WIN-PST), formerly called The National Pesticides/Soils Database and User Support System for Risk Assessment of Ground and Surface Water Contamination (NPURG) – provides leachability ratings of active ingredients as "high", "intermediate", "low" or "very low."

APPENDIX C
MAINE AGRICULTURAL PESTICIDE SALES DATA

1995 AGRICULTURAL PESTICIDE SALES DATA
(active ingredients with sales over 1,000 pounds)

Active Ingredients	Total Sales (pounds, active ingredient)
Chlorothalonil	374,190
Mancozeb	289,661
Maneb	229,344
Sulfuric Acid[34]	139,907
Glyphosate	112,334
Atrazine	76,223
Aliphatic Petroleum	63,729

1 [34]Sulfuric acid is reported as gallons sold in Maine. No calculation based on pounds of active ingredient was performed.

Captan	50,782
Maleic Hydrazide	44,898
Metribuzin	42,890
Metolachlor	41, 459
Diquat	41, 174
Methamidophos	33,832
Phosmet	33,636
Hexazinone	28,779
Disulfoton	27,719
Copper	26,912
Copper Hydroxide	23,623
Napropamide	23,438
Pendimethalin	23,282
Chlorpyrifos	22,150
Linuron	17,587
Azinphos-Methyl	16,831
EPTC	16,295
Endosulfan	15,443
Carbaryl	12,539
Metiram	12,328
2,4-D	12,257
MCPA	11,114
Chlorpropham	11,018
Metalaxyl	10,936
Imidacloprid	10,422
Bacillus Thuringiensis[35]	9,232
Simazine	8,664
Ethoprop	8,370
Cyanazine	7,862
Parathion	7,800
Paraquat	6,418
Propargite	5,901
Alachlor	5,895
Triclopyr	5,212
Piperonyl Butoxide (PBO)	4,720
Benomyl	4,669
Thiophanate-Methyl	4,661
Copper Oxychloride	4,440
Triforine	4,248
Dicamba	3,905
Formentanate Hydrochloride	3,478
Methoxychlor	3,463
Methyomyl	3,422
Malathion	2,893

2 [35]Bacillus Thuringiensis, or *Bt*, is reported as gallons sold in Maine.

Triphenyltin Hydroxide	2,832
Dimethenamid	2,700
Metam-Sodium	2,639
Cryolite	2,602
Sulfur	2,532
Permethrin	2,515
Diazinon	2,362
Fonofos	2,240
DCPA	2,133
Dodine	2,061
Propamocarb	1,961
Oxamyl	1,904
Bentazon	1,715
Trifluralin	1,710
Acetochlor	1,520
Isofenphos	1,453
Triadimefon	1,445
Endothall	1,432
Sethoxydim	1,432
Thiocarb	1,416
PCNB	1,281
Ziram	1,125
Fenvalerate	1,046

2003 AGRICULTURAL PESTICIDE SALES DATA (active ingredients with sales over 1,000 pounds)	pounds of AI sold	Rounded pounds of AI sold
MANCOZEB	431611.66	431611.66
SULFURIC ACID	293752.08	293752.08
CHLOROTHALONIL	185996.1575	185996.16
PETROLEUM OIL	61308.5	61308.50
MALEIC HYDRAZIDE	44995	44995.00
DIQUAT	34655	34655.00
ATRAZINE	32853.325	32853.33
METIRAM	30532.8	30532.80
CAPTAN	24989.5	24989.50
GLYPHOSATE	23975.7	23975.70
METRIBUZIN	23939.7	23939.70
SULFUR	23922	23922.00
PHOSMET	17063.45	17063.45
PENDIMETHALIN	16295.4	16295.40
HEXAZINONE	14740	14740.00
2,4-D	14450.787	14450.79
METHAMIDOPHOS	14280	14280.00
MCPA	12340.5	12340.50

2003 AGRICULTURAL PESTICIDE SALES DATA (active ingredients with sales over 1,000 pounds)	pounds of AI sold	Rounded pounds of AI sold
S-METOLACHLOR	12125.79	12125.79
COPPER HYDROXIDE	10977.312	10977.31
NAPROPAMIDE	10770	10770.00
CHLORPYRIFOS	9787.25	9787.25
MEFENOXAM	9294.57	9294.57
IMIDACLOPRID	9195.93	9195.93
ETHOPROP	8946.5	8946.50
LINURON	8866.25	8866.25
KAOLIN	7101.25	7101.25
PENTACHLORONITROBENZENE	7060	7060.00
CHLORPROPHAM	7048.49622	7048.50
THIOPHANATE-METHYL	6541.07	6541.07
PARAQUAT	6517.5	6517.50
METAM-SODIUM	6326.1	6326.10
TRIPHENYLTIN	5142.048	5142.05
CYFLUTHRIN	4341.78	4341.78
CYMOXANIL	3818.4	3818.40
PROPICONAZOLE	3360.5568	3360.56
THIABENDAZOLE	3329.2	3329.20
DIURON	3236.4	3236.40
CARBARYL	2974	2974.00
METHOMYL	2742.675	2742.68
SIMAZINE	2519.91	2519.91
DIAZINON	2400.26	2400.26
DISULFOTON	2201	2201.00
TETRACHLOROISOPTHALONITRILE	2002.5	2002.50
GLUFOSINATE-AMMONIUM	1967	1967.00
AZOXYSTROBIN	1917.48	1917.48
AZINPHOS-METHYL	1815	1815.00
MCPP	1728.6122	1728.61
ESFENVALERATE	1689.41	1689.41
BUTANOIC ACID	1685	1685.00
COPPER OXYCHLORIDE	1630.64	1630.64
FENVALERATE	1590.6	1590.60
PCNB	1585	1585.00
FLUTOLANIL	1557.75	1557.75
FOSETYL-AL	1520.8	1520.80
TERBACIL	1512	1512.00
SETHOXYDIM	1482.25	1482.25
CARBOFURAN	1360	1360.00
ENDOSULFAN	1295	1295.00

2003 AGRICULTURAL PESTICIDE SALES DATA (active ingredients with sales over 1,000 pounds)	pounds of AI sold	Rounded pounds of AI sold
BT	1186.74	1186.74
ENDOTHALL	1036.75	1036.75
VINCLOZOLIN	1012	1012.00
LAMBDA-CYHALOTHRIN	984.85	984.85

APPENDIX D
PESTICIDE STATE MANAGEMENT PLAN (PESTICIDE SMP) ADVISORY COMMITTEE

Background

The *Pesticides and Ground-Water Strategy* (October 1991) states that EPA may choose to require pesticide-specific state management plans (Pesticide SMPs) for pesticides of national ground water concern. Furthermore, the Board of Pesticides Control may choose to plan for pesticides not recognized by EPA which present unique groundwater concerns for the State of Maine. For these reasons, the Board recognizes its need for experts who can assist and advise them on technical decisions related to the development of Pesticide SMPs, and therefore, establishes a volunteer Pesticide SMP Advisory Committee.

Membership

A Pesticide SMP Advisory Committee will be composed of both Core and Pesticide-specific members. A member of the Board, in most cases a member which represents the public, will also chair the committee. The BPC Toxicologist and other necessary staff will serve in an advisory capacity. Other Core members will be persons from the following technical fields with prior knowledge or experience with pesticide issues:

- a hydrogeologist[36],
- a soil scientist[37], and
- a water quality scientist.

The Board will solicit and review resumes for Core membership and will formally appoint these members at their regular public meetings.

1 [36]A hydrogeologist is defined as a specialist in the occurrence and movement of ground water.

2 [37]A soil scientist is defined as a person certified as a soil scientist by the Maine Board of Certification for Geologists and Soil Scientists who has expertise in soil taxonomy, morphology, and mapping.

Pesticide-specific members will provide expertise in evaluation of pesticide use practices on the environment, production, and pest management. These members will be representatives of commodity and user groups in Maine related to the pesticide in question and additional technical experts, such as, but not limited to, a wildlife biologist, an ecologist, experts provided by the registrant, or an economist. In addition, citizens or representatives of citizens whose drinking water supply may have been affected by the pesticide or who live in areas where the pesticide is used will be asked to join the committee. Pesticide-specific members will vary depending on the pesticide in question, making each Pesticide SMP Advisory Committee a unique collection of individuals.

When agricultural issues are involved, a member of the Department of Agriculture will be called upon to assist with the coordination of issues related to Best Management Practices. In addition, commodity specialists with IPM or pest management experience for each potentially affected commodity will also be included. Other pesticide-specific members with needed expertise will be invited to participate either by the BPC or by a Pesticide SMP Advisory Committee.

Duties

A Pesticide SMP Advisory Committee's primary duty is to respond to a mandate from either EPA or the BPC to develop a pesticide-specific state management plan. A Pesticide SMP Advisory Committee's first duty is to determine whether the value of a pesticide product to Maine users warrants development of a Pesticide SMP. Should a product warrant development of a Pesticide SMP, the Committee will develop the plan and submit it to the BPC. The Committee may not be able to reach a full consensus on all issues involved with a Pesticide SMP. Therefore, a plan may be presented to the Board with options where the opinions vary, and it will remain the responsibility of the BPC to select the option which is feels is most suitable. The Committee will assist the BPC with the public comment and/or hearing process as necessitated by the Pesticide SMP. Should the Committee decide not to develop a Pesticide SMP, they will then prepare their reasons for such a decision and submit them to the BPC for opportunity for public input. A graphical depiction of this process is located in Figure D-1.

When considering appropriate prevention and response measures, a Pesticide SMP Advisory Committee will consider the following information:

- the scope of crop and non-crop uses in Maine,
- current application practices in Maine,
- chemical characteristics of the pesticide,
- economic impact on user community(ies),
- available sales and use data in Maine,
- availability of efficacious chemical and non-chemical alternatives,
- environmental impact on Maine's ecosystem,
- practicality of changes in application practices,
- potential health impacts and the product's toxicity,

- geographic specificity of use which may yield identifiable geologic characteristics, and
- past groundwater monitoring data or the practicality of monitoring when no data exist.

Each Pesticide SMP Advisory Committee will biannually review its respective Pesticide SMP, as new information necessitates a re-evaluation of the prevention and response strategies adopted in the Pesticide SMP. Each Committee may then recommend changes to the BPC.

Term

Core members of the Pesticide SMP Advisory Committee will be appointed by the BPC for three (3) years of service. Pesticide-specific members will not be members in standing and will be called upon, as needed, in the development of Pesticide SMPs.

Meetings

An entire Pesticide SMP Advisory Committee, both Core and Pesticide-specific members, will meet as EPA requires Pesticide SMPs or at the specific request of the BPC.

Compensation

The Pesticide SMP Advisory Committee is voluntary and no compensation for services is available. However, all reasonable travel expenses will be reimbursed, subject to the approval of the staff director, in a manner consistent with State travel.

[Editor's Note: Complete copies of this report may be obtained from the Board of Pesticides Control offices. No appendices are attached here.]

APPENDIX E. 2005 PESTICIDES AND GROUND WATER MONITORING PROGRAM

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1. SUMMARY

The results of Maine's statewide pesticides and ground water monitoring program indicate that pesticide contamination of drinking water in private wells sometimes occurs at levels below established health advisory levels in areas near active pesticide use sites. However, the frequency of positive detections is low.

This monitoring program is repeated every five to seven years by the Maine Board of Pesticides Control (BPC) during the winter when the ground water table is lowest. The first monitoring survey was conducted in 1994 and the percentage of private drinking water wells with detections of a pesticide was 24% (31 of 129). The percentage of positive detections in the second survey, conducted in 1999, dropped to 9% (17 of 194). In addition, samples collected in 1999 from wells located adjacent to cornfields contained no detectable levels of pesticides, as compared to 14% in 1994, and there were fewer samples from wells located adjacent to potato and blueberry fields with detectable levels of pesticides. The number of different pesticides detected also decreased from ten in 1994 to four in 1999.

In 2005, 11% of the sampled wells were found to have low levels of a pesticide or pesticides (14 of 127) or 10% of the samples, since some wells were sampled twice if two different crops were near. Eight different pesticides were detected. As with the 1994 and 1999 surveys, hexazinone continues to be the most commonly found pesticide active ingredient (AI) in sampled drinking water wells.

2. STUDY OBJECTIVE

The objective of these studies is to assess the occurrence of pesticides in private drinking water wells located within ¼ mile down gradient of an active agricultural pesticide use site. Section VII, Ground Water Monitoring, of the January 1998 State of Maine Generic State Management Plan for Pesticides and Ground Water requires that statewide ground water monitoring be conducted every five to seven years to assess ground water quality trends. The 2005 Pesticides and Ground Water Monitoring Program was conducted in accordance with that plan.

3. STUDY DESIGN

3.1 Selection of Pesticides, Crops, and Crop Locations

The following data sources were used to determine what pesticide active ingredients and the associated crops would be targeted for 2005 sampling and the number of samples to collect near each commodity.

- 2003 Pesticide Dealer Reports – provided estimates of pounds of pesticide active ingredients (AIs) sold in Maine for agriculture;
- USDA-NRCS National Water and Climate Center's Windows Pesticide Screening Tool (WIN-PST), formerly called The National Pesticides/Soils Database and User Support System for Risk Assessment of Ground and Surface Water Contamination

(NPURG) – provided leachability ratings of active ingredients as "high", "intermediate", "low" or "very low"; and

- University of Maine Cooperative Extension Crop Specialists – provided expertise in determining what products and what relative amounts are used on particular crops.

Evaluation of the data gathered from the above sources resulted in the following sample allocations among pesticide use sites:

Use Site	Approx. Pounds of Leachable AIs sold in 2003[1]	Percent of Total AI	# of Samples (guide)	# of Samples Actual[2]
Potatoes	119,524	53.70%	78.4	67
Corn (forage and sweet)	49,611	22.30%	32.6	34
Blueberries	20,738	9.30%	13.6	11
Small Grains	25,691	11.50%	16.8	17
Orchard	845	0.38%	0.55	3
Christmas Trees	2,197	0.99%	1.45	2
Strawberries	3,877	1.74%	2.5	3
	Total: 222,483		**146[3]**	**137**

[1] Only "high" and "intermediate" leachers were tallied in this table. Some AIs were also included as part of this study if they had a "low" leachability rating coupled with high quantity sales.

[2] For quality assurance reasons, more than one sample was collected each from the christmas tree and orchard categories.

[3] Total number of samples collected was determined through the use of statistical analysis. The formula used is included in the Appendix as Figure 1.

Individual USGS 7.5-minute topographical maps containing known pesticide use sites previously identified by each of the five BPC field inspectors were randomly selected as areas for sampling. Each topographical map was numbered and entered into a database with the corresponding use site(s) associated with that map. A random number generator was then used to select map numbers containing the individual use sites. For example, the maps that had small grains grown within their boundaries were pooled together, then 17 of those map numbers were randomly chosen, with duplicates allowed.

If more than one field of the target crop existed on the randomly chosen topographical map, a numbered 10x10 grid was placed over the map and a random number list generated for each map directed the sampler to subsections of the map to further randomize the process. If there were no candidate use sites within the subsection, another subsection corresponding to the next number on the random list was searched for a candidate site. If there was more than one candidate use site within the subsection, the sampler assigned a number to each site and selected the sample site using a secondary random number table. A flow chart and accompanying standard operating procedure (SOP) for selecting a sample site are included in the Appendix as Figure 2. Figure 3 in the Appendix shows the sample distribution throughout the state.

3.2 Well Selection, Criteria, and Sampling

3.2.1 Random Selection of Wells

If more than one well was available for sampling, that met the criteria below, the wells were numbered and a random number table was used to select the well. This process prevented the sampler from introducing bias such as choosing the well closest to the field or farthest from the field. In many cases use of the random number table at this point was not necessary as it was difficult to find people home during the day to allow for sampling and that was a limiting factor.

3.2.2 Well Criteria

Once a specific sampling location was selected, the property was assessed to determine if the drinking water supply for that site met the following criteria:

- Private Residence (not a school, hospital, etc.) with people currently living there;
- Within ¼ mile of the target crop site (which must have had the target crop grown on it within the last year);
- Downgradient of or at equal elevation with the crop site;
- No filters or water treatment systems; and
- No water bodies (streams, ponds, rivers, etc.) between the crop site and the residence.

3.2.3 Sampling Methodology

Samples were collected from domestic water supplies (private residences) during the months of January, February and March. Residents were questioned as to any filtration systems on their water system, such as carbon (charcoal) filters, water softeners, reverse-osmosis filters, etc. If there were no filters, samples were collected from any cold-water tap. The cold water was allowed to run for 5 – 10 minutes to ensure that the water was collected from the well and not the pressure tank. If there were filters on the system, the sample was collected from a tap before the filter, such as from an outside tap.

Samples were collected in one-liter amber glass bottles, certified as pre-cleaned for collection of pesticide samples, with Teflon-lined caps. New latex gloves were donned at each sample site and worn during the collection process. Samples were kept under BPC custody in iced coolers or in a refrigerator until delivery to the analytical laboratory. Chain of Custody forms were filled out prior to leaving the sample site. Figure 4 in the Appendix is an example of the form used and shows the data collected at the time of sampling. The standard operating procedure (SOP) used to collect the sample and complete the Chain of Custody is also included as part of Figure 5.

3.3 Analytical Methodology

The University of Maine Food Chemical Safety Laboratory (UMFCSL) analyzed most of the samples collected during this study. The State's Health and Environmental Testing Laboratory (HETL) and APT Laboratory in Pennsylvania were also used. Samples were analyzed for the active ingredients that tend to be used on the crop located within ¼ mile of the sample collection site. The following table provides pertinent information relative to sample analysis.

Crop	Analyte	Leachablity[1]	Method[2]	MDL (ppb)[3]	Trade Name
Potatoes	Chlorothalonil	Low	SPE/GCMS	0.1	Bravo
	Endosulfan	Low	SPE/GCMS	0.1	Thiodan
	Ethoprop	High	SPE/GCMS	0.1	Mocap
	Metalaxyl	High	SPE/HPLC	1.0	Ridomil
	Metribuzin	High	SPE/GCMS	0.05	Sencor, Lexone
	Linuron	Intermediate	SPE/HPLC/PDA	2.0	Lorox
Forage/ Sweet Corn	Acetochlor	Intermediate	SPE/GCMS	0.05	Harness, Surpass
	Alachlor	Intermediate	SPE/GCMS	0.05	Lasso
	Atrazine	High	SPE/GCMS	0.05	AAtrex
	Chlorpyrifos	Low	SPE/GCMS	0.05	Lorsban
	Simazine	High	SPE/GCMS	0.1	Princep
	Dicamba	High	515.2/552	0.5	Banvel
	Methomyl	High	SPE/HPLC-PDA	2.0	Lannate
	Metolachlor	High	SPE/GCMS	0.05	Dual
	Atrazine metabolites	High	SPE/GCMS	2.0	metabolites
	2,4-D	Intermediate	515.2/552	3.0	
	Bentazon	High	515.3	5.0	Basagran
	Pendimethalin	Low	SPE/GCMS	2.0	Prowl
Blueberries	Chlorothalonil	Low	SPE/GCMS	0.1	Bravo
	Hexazinone	High	SPE/GCMS	0.1	Velpar, Pronone
	Hexazinone Metabolite B	N/A	SPE/GCMS	0.2	metabolite
	Fenbuconazole	Low	SPE/GCMS	0.1	Indar
	Phosmet	Low	SPE/GCMS	0.1	Imidan
	Propiconazole	Intermediate	SPE/GCMS	0.1	Orbit
	Captan	Low	SPE/GCMS	0.1	Captan
	Diuron	Intermediate	SPE/HPLC/PDA	1.0	Karmex
	Terbacil	High	SPE/GCMS	0.1	Sinbar
Small Grains	MCPA	High	LLE/GCMS	0.2	Rhomene
	Dicamba	High	LLE/GCMS	2.0	
	2,4-D	Intermediate	LLE/GCMS	0.2	
	Mecoprop	High	LLE/GCMS	0.2	
Orchard	2,4-D	Intermediate	LLE/GCMS	0.2	
	Captan	Low	SPE/GCMS	0.1	Captan
	Phosmet	Low	SPE/GCMS	0.1	Imidan
	Simazine	High	SPE/GCMS	0.1	Princep
Christmas Trees	Diazinon	Low	SPE/GCMS	0.05	Diazinon
	Metolachlor	High	SPE/GCMS	0.1	
	Simazine	High	SPE/GCMS	0.1	Princep
Strawberries	Terbacil	High	SPE/GCMS	0.1	Sinbar
	Dacthal	High	515.2	0.1	Dacthal
	Captan	Low	SPE/GCMS	0.1	Captan

	Napropamide	Intermediate	SPE/GCMS	0.1	Devrinol

[1] Leachability based on rating by WIN-PST.

[2] SPE/GCMS = solid phase extraction/gas chromatography with mass spec
SPE/HPLC/PDA = SPE/high performance liquid chromatography with photodiode array detector
LLE/GCMS = Liquid/Liquid extraction (with methylene chloride)/ GCMS

[3] ppb = parts per billion = (ug/L)

3.4 Quality Assurance/Quality Control

Field blanks, split samples, and duplicate samples were analyzed as part of this study for quality control purposes. Sample collectors prepared sample blanks (for a total of six blanks) using distilled water. Six duplicates were collected and three corn samples were split between HETL and UMFCSL. The samples were handled and labeled as if they were private well samples. All quality control samples were mixed in randomly with the private well samples to ensure that the laboratory did not treat QC samples differently. QA/QC results were all acceptable.

In addition to BPC QA/QC, all three laboratories maintain their own quality assurance/quality control (QA/QC) plans.

4. RESULTS

4.1 General

Of the 137 samples collected from 127 private drinking water wells (some wells were sampled for both small grain pesticides and potato pesticides counting as two samples from one well), 13 samples had detectable levels of one pesticide and one sample had a detectable level of two pesticides. At least one pesticide was detected in 14 of 127 wells. **Of all of the wells, 11% had positive detections, and 10% of the samples had positive detections.** There were no detections above any published EPA maximum contaminate levels (MCL), EPA health advisory levels (HAL), or Maine's maximum exposure guidelines (MEG).

There are basically two types of health based acceptable levels for pesticides in drinking water; these are the standards (EPA's MCLs) and the guidelines (EPA's HALs and Maine's MEGs). MEGs are set by the Environmental Toxicology program in the Maine Centers for Disease Control (MeCDC). MCLs are enforceable for public water systems, as defined by the Safe Drinking Water Act, and in setting them, the best available technology to achieve the level has to be considered. The MCLs and the guidelines (HALs and MEGs) are all used for guidance in private well situations.

The following table breaks down positive detections by use group:

Commodity Group	Number of samples collected	Samples with Positive Detections	
		Number	**Percent**
Potatoes	67	2	3.0%
Corn	34	4	11.8%
Blueberries	11	6	54.5%
Small Grains	17	1	5.9%
Orchards	3	0	0.0%
Christmas Trees	2	0	0.0%
Strawberries	3	1	33.3%
Totals:	**137**	**14**	**10.2%**

A total of eight different pesticide active ingredients were detected. The following table details results by active ingredient:

Use Site	Pesticides Analyzed	Trade Name	Range of Sample Concentrations (ppb)
Potatoes	Chlorothalonil	Bravo	**0.25 (1 sample)**
	Endosulfan	Thiodan	All ND (Non-Detect)
	Ethoprop	Mocap	All ND
	Metalaxyl	Ridomil	**1.61 (1 sample)**
	Metribuzin	Sencor, Lexone	All ND
	Linuron	Lorox	All ND
Corn (forage and sweet)	Acetochlor	Harness, Surpass	**0.10 – 0.12 (2 samples)**
	Alachlor	Lasso	All ND
	Atrazine	AAtrex	**0.24 – 0.42 (2 samples)**
	Bentazon	Basagran	All ND
	Chlorpyrifos	Lorsban	All ND
	Simazine	Princep	All ND
	Dicamba	Banvel	All ND
	Methomyl	Lannate	All ND
	Metolachlor	Dual	**0.07 (1 sample)**
	Atrazine metabolites		All ND
	2,4-D	Weedar64(and others)	All ND
	Pendimethalin	Prowl	All ND
Blueberries	Chlorothalonil	Bravo	All ND
	Hexazinone	Velpar, Pronone	**0.13 – 3.52 (6 samples)**

	Hexazinone Metabolite B	metabolite	**0.94 (1 sample)**
	Fenbuconazole	Indar	All ND
	Phosmet	Imidan	All ND
	Propiconazole	Orbit	All ND
	Captan	Captan	All ND
	Diuron	Karmex	All ND
	Terbacil	Sinbar	All ND
Small Grains	MCPA	Rhomene	All ND
	Dicamba		All ND
	2,4-D	Weedar64(and others)	**0.41 (1 sample)**
	Mecoprop		All ND
Orchard	2,4-D		All ND
	Captan	Captan	All ND
	Phosmet	Imidan	All ND
	Simazine	Princep	All ND
Christmas Trees	Diazinon	Diazinon	All ND
	Metolachlor		All ND
	Simazine	Princep	All ND
Strawberries	Terbacil	Sinbar	All ND
	Dacthal	Dacthal	**3.56 (1 sample)**
	Captan	Captan	All ND
	Napropamide	Devrinol	All ND

4.2 Results by Active Ingredient

4.2.1 Chlorothalonil

All 67 samples from wells near potato fields were analyzed for chlorothalonil, and one sample showed a detectable level (0.25 ppb). EPA's health advisory level (HAL) for chlorothalonil in drinking water is 150 ppb. The two year old, 200 feet deep, drilled well was located approximately 200 feet downgradient of the closest field. In accordance with the recommended response outlined in Section VIII - Response Framework of the BPC's Generic State Management Plan for Pesticides and Ground Water, BPC spoke with the farmer and reviewed his use and application practices. Chlorothalonil was used during the summer of 2005 after our sample was taken, but had not been used for at least seven years previous to our sample collection, and there are no other farmers nearby. This positive detection may have been a lab error.

4.2.2 Metalaxyl

Because metalaxyl analysis requires the laboratory to use a different method from the one for most of the rest of the potato pesticide active ingredients, and therefore charge more money, only five samples were analyzed. One sample from a dug well approximately 140 feet from a potato field contained 1.61 ppb metalaxyl. The depth of the well is unknown. Since the level detected in this survey was less than Maine's MEG of 420 ppb, and since metalaxyl is seldom used on potatoes due to resistance, a determination was made that no further investigation was necessary.

4.2.3. Acetochlor

All 34 samples from wells near corn fields were analyzed for acetochlor. Two of the samples were found to have positive detections of 0.10 ppb and 0.12 ppb. The MEG for acetochlor in drinking water is 20 ppb. One of the samples was collected from a 55 year old drilled well of unknown depth, approximately 500 feet from the corn field. The farmer has not had a spill, and only used Harness once, following the label. The land has recently been sold for development. The other sample was collected in a different town from a 13 year old, 90 feet deep drilled well. This well was approximately 900 feet from the corn field. It was difficult to track down the various farmers in the area, but it appears that it has been at least a number of years since this product may have been used. One of the farmers is now an organic grower, and another is moving toward selling off land for development.

The manufacturer, Monsanto, paid for these two wells to be resampled the following winter. Their results were non detect.

4.2.4. Atrazine

All 34 samples from wells near corn fields were also analyzed for atrazine. Atrazine was found in two wells at 0.24 ppb and 0.42 ppb. The maximum contaminant level (MCL) is 3 ppb. The first well is a 214 feet deep, 52 year old, drilled well. Metolachlor was also found in this sample (see below). The farmer for this field said he did have a spill of herbicide in the late 70's or early 80's that he thinks was atrazine. Atrazine has been detected at this site in the past. He has used a product called Bicep that contains both atrazine and metolachlor in recent years and that might have been applied heavily at the edges of the field as the sprayer was turning around. The spray was stopped during turnarounds but the boom emptied possibly causing more chemical release than normal in those areas. Roundup, which is not considered to be a leacher, is now being used on this field instead of atrazine and metolachlor. The second well with 0.42 ppb atrazine is located in a different town and is a 20 years old, drilled well approximately 150 feet deep, and approximately 300 feet from the corn field. The farmer has decided that corn will no longer be grown in this location in the future.

4.2.5 Metolachlor

Metolachlor was also assayed in all 34 samples taken near corn and it was found in one well at 0.07 ppb. EPA's HAL is 100 ppb. This was the same well where atrazine was found (see first well in the atrazine section above).

4.2.6 Hexazinone

Hexazinone has been detected in Maine's ground water for over 20 years. The fact that it was detected in 54.5% of the samples collected for blueberry pesticide analysis was not unexpected.

The levels detected were well below the EPA HAL of 400 ppb, and further investigation, related to this study, was not warranted. Refer to other BPC reports on hexazinone for more information.

4.2.7 2,4-D

2,4-D was looked for in all 17 samples collected near small grains. It was detected once at 0.41 ppb. EPA's MCL is 70 ppb. The well is approximately 100 feet downgradient from the field. Other information about the well is unknown. It was discovered that the farmer has not used pesticides in recent years, and the homeowner was questioned about using a pesticide on their lawn or garden.

4.2.8 Dacthal

Samples for Dacthal analysis had to be sent to APT Laboratories in Pennsylvania. Due to the extra cost, only two samples were analyzed and one had a positive detection of 3.56 ppb. The analytical method looked for the sum of parent Dacthal plus metabolites. It is likely that the 3.56 ppb is mostly metabolites that pose little hazard in drinking water at that level. The farmer said Dacthal was used near the tested well in 2004. He said there was no spill. It is assumed that this product was used normally as it is frequently found in ground water in Rhode Island after normal use there.

4.3 Site Factors and Frequency of Detections

Information about well depth and distance to active pesticide use site was collected during this assessment. The following tables summarize that information. Numbers listed in non-bold font indicate all sites sampled. Numbers listed in bold parentheses indicate the number of sites with detectable levels of at least one pesticide active ingredient.

Use Site	**Well Depth (feet)**					
	< 100	100- 199	200 – 299	300 – 399	> 400	Unknown
Potatoes	15	16	5 **(1)**	3	--	28 **(1)**
Sweet/Forage Corn	10 **(1)**	8 **(1)**	4 **(1)**	1	--	11 **(1)**
Blueberries	4 **(2)**	2 **(1)**	1	--	--	4 **(3)**
Small Grains	4	5	--	--	--	8 **(1)**
Orchard	--	1	--	--	--	2
Christmas Trees	2	--	--	--	--	--
Strawberries	--	2 **(1)**	--	--	--	1

Use Site	**Well Construction**				
	Drilled	Dug	Driven Point	Spring	Unknown
Potatoes	57 **(1)**	5 **(1)**	1	2	2
Sweet/Forage Corn	23 **(4)**	3	--	3	5
Blueberries	11 **(6)**	--	--	--	--
Small Grains	13	--	--	--	4 **(1)**

Orchard	3	--	--	--	--
Christmas Trees	2	--	--	--	--
Strawberries	3 **(1)**	--	--	--	--

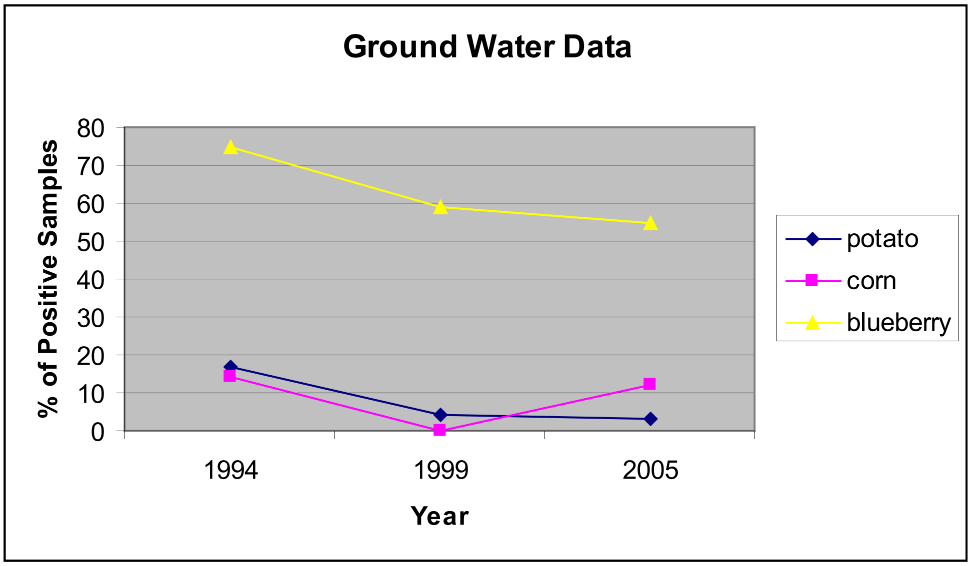
Use Site	**Distance from Active Use Site (feet)**			
	< 100	100 – 499	500 – 999	1000 – 1500
Potatoes	14	40 **(2)**	8	5
Sweet/Forage Corn	2 **(1)**	16 **(1)**	12 **(2)**	4
Blueberries	3 **(1)**	5 **(4)**	1	2 **(1)**
Small Grains	6	9 **(1)**	--	2
Orchard	1	1	--	1
Christmas Trees	1	1	--	--
Strawberries	1	1 **(1)**	1	--

4.4 Comparison of 1994, 1999 and 2005 Data

The following tables and graph compare the results of the initial ground water study conducted in 1994 to the one in 1999 and this assessment:

Commodity Group	**Number of samples collected**			**Number of Samples with Positive Detections**			**Percent of Samples with Positive Detections**		
	1994	**1999**	**2005**	**1994**	**1999**	**2005**	**1994**	**1999**	**2005**
Potatoes	47	102	67	8	4	2	17%	4%	3%
Corn	49	51	34	7	0	4	14%	0%	12%
Blueberries	20	22	11	15	13	6	75%	59%	55%
Small Grains	3	9	17	0	0	1	0%	0%	6%
Orchards	1	5	3	1	0	0	100%	0%	0%
Christmas Trees	5	4	2	0	0	0	0%	0%	0%
Strawberries	0	3	3	--	0	1	--	0%	33%
Rights-of-Way	3	0	0	0	--	--	0%	--	--
Market Garden	1	0	0	0	--	--	0%	--	--
Totals:	**129**	**197**	**137**	**31**	**17**	**14**	**24%**	**9%**	**10%**

No detections were above HAL/MEG/MCL for any of the three years except for diazinon found near an orchard in 1994. Diazinon was not used on the orchard but was applied by the well owner around the well to control ants.


Ground Water Data
% of Positive Samples
80
70
60
50
40
30
20
10
0
1994
1999
2005
Year
potato
corn
blueberry

Use Site	Pesticide AIs Analyzed	Range of Sample Concentrations (ppb)		
		2005	**1999**	**1994**
Potatoes	Atrazine	*--(not sampled)*	--	**0.13**
	Chlorothalonil	**0.25**	All ND	--
	Disulfoton	--	All ND	--
	Endosulfan	All ND	**0.13**	All ND
	EPTC	--	All ND	--
	Ethoprop	All ND	All ND	**0.08**
	Imidacloprid	--	All ND	--
	Linuron	All ND	--	--
	Maleic Hydrazide	--	All ND	--
	Metalaxyl	**1.61**	All ND	**0.63 – 6.51 (6 samples)**
	Metribuzin	All ND	**0.10 - 0.60 (4 samples)**	All ND
	Propamocarb	--	All ND	--
Corn	2,4-D	All ND	--	--
	Acetochlor	**0.10 – 0.12 (2 samples)**	All ND	**--**
	Alachlor	All ND	All ND	**1.70**
	Atrazine	**0.24 – 0.42 (2 samples**	All ND	**0.10 – 1.90 (6 samples)**
	Bentazon	All ND	All ND	--
	Chlorpyrifos	All ND	All ND	--
	Cyanazine	--	All ND	--
	Dicamba	All ND	All ND	--
	Dinoseb	--	*No use on Corn*	**3.50 (point source)**
	Methomyl	All ND	All ND	--
	Metolachlor	**0.07**	All ND	**0.30 – 10.20 (2 samples)**
	Pendamethalin	All ND	All ND	**--**
	Simazine	All ND	--	--
Blueberries	Azinphos-Methyl	--	All ND	--
	Chlorothalonil	All ND	**--**	**--**
	Fenbuconazole	All ND	**--**	**--**
	Total Hexazinone	**0.13 – 4.46 (6 samples)**	**0.22 - 1.97 (13 samples)**	**0.09 – 5.97 (15 samples)**
	Phosmet	All ND	All ND	--
	Propiconizole	All ND	**0.18**	*Not used in 1994*
	Captan	All ND	**--**	--
	Diuron	All ND	**--**	--
	Terbacil	All ND	All ND	--
Small Grains	**2,4-D**	**0.41**	--	--
	Dicamba	All ND	--	--
	MCPA	All ND	All ND	--
	Mecoprop	All ND	--	--

Orchard	2,4-D	All ND	--	**--**
	Captan	All ND	--	**--**
	Diazinon	--	*Not an orchard pesticide*	**7.35 (point source)**
	Fenarimol	--	All ND	--
	Oxamyl	--	All ND	--
	Phosmet	All ND	--	--
	Simazine	All ND	All ND	--
Christmas Trees	Diazinon	All ND	All ND	--
	Metolachlor	All ND	--	--
	Simazine	All ND	All ND	--
Strawberries	Captan	All ND	--	--
	Carbofuran	--	All ND	--
	Dacthal	**3.56**	--	--
	Metalaxyl	--	All ND	--
	Napropamide	All ND	All ND	--
	Terbacil	All ND	--	--

5 CONCLUSIONS

The percentage of samples collected from private drinking water wells with detectable levels of pesticide active ingredients decreased from 24% in 1994 to 9% in 1999. In 2005 10% of the samples collected contained one or more pesticides. The number of different pesticides detected decreased from ten in 1994 to four in 1999, but increased in 2005 to eight pesticides. Slight changes in the laboratory method detection limits over the years influence these numbers, as does varying weather patterns. Hexazinone continues to be the most commonly found active ingredient in Maine drinking water wells.

Overall, the results of this survey show that pesticides continue to be detected in drinking water wells located within ¼ mile of active pesticide use sites. However, the frequency of detections in Maine appears lower than the national average, and positive detections have been below any MCLs, HALs, and MEGs. Developing and using agricultural best management practices will hopefully continue to keep the frequency and levels of detections low.

APPENDIX

Figure 1. Statistical Formula for Sample Size

DETERMINATION OF SAMPLE SIZE

In determining the number of groundwater sample units needed for this monitoring program, the following formula^[38] was used:

$$n = \frac{P(1-P)}{\frac{A^2}{Z^2} + \frac{P(1-P)}{N}}$$

Where:

n = sample size required
N = size of the population samples are being taken from (i.e., the total number of wells)
P = estimated percentage of the population possessing the attribute of interest (i.e., percentage of population with detectable levels of pesticides)
A = Accuracy desired, expressed as a decimal (i.e., ..0.01, 0.03, 0.05, etc.)
Z = number of standard deviation units corresponding to the desired confidence interval (see table below)

Z values:

Confidence Interval (CI)	**Z**
99%	2.5758
95%	1.9600
90%	1.6449
85%	1.4395
80%	1.2816

According to University of Maine Cooperative Extension crop specialists there are about 2,271 farms growing the crops focused on for this survey in Maine. According to the 2003 NASS, the average size of each farm is 190 acres, which, if the farm were square, would make a 2,880 ft x 2,880 ft farm:

[38] *Air University Sampling and Surveying Handbook,* April 1996 Internet edition, www.au.af.mil/au/hq/selc/smpIntro.htm, downloaded 12/4/98

We then make an assumption that wells on only one side of the farm would be downgradient (one side would be upgradient, and two sides would be at the same elevation). Allowing for four properties along that downgradient side, that would make:

4 “high risk” properties per farm * 2271 farms of interest in Maine = 9,084 “high risk” properties in Maine.

The 1994 Pesticides in Ground Water study determined that 24% of “high risk” wells had detectable levels of pesticides, and the 1999 found 9%. The average of 24% and 9% is 16.5%.

We have decided that our accuracy desired will be ±5%, and our confidence level will be 90%. By plugging in our knowns into our sample size equation, we get:

$$N = 9{,}084$$
$$P = 0.165$$
$$A = 0.05$$
$$Z = 90\% = 1.6449$$

So:

$$n = 145.79 \text{ samples}$$

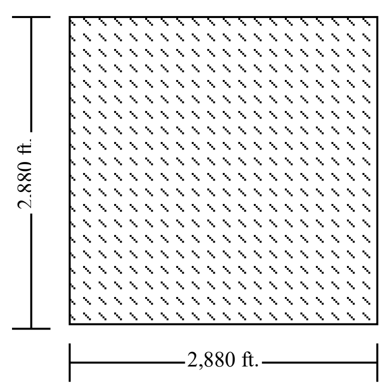


Figure 2. A flow chart and accompanying standard operating procedure (SOP) for selecting a sample site

SOP for Ground Water Sampling Site Selection
Related to Maine's "Generic State Management Plan for Pesticides and Ground Water"

Prepared by: Julie Chizmas

Revised by: ____________________ Date: ___________
Heather Jackson

Reviewed by: ___________________ Date:____________
Henry Jennings

Approved by: ___________________ Date:____________
Robert Batteese

STATE OF MAINE
BOARD OF PESTICIDES CONTROL

SOP for Ground Water Sampling Site Selection
Related to Maine's "Generic State Management Plan for Pesticides and Ground Water"

1. Select a Quad/Crop combination from the Sampling Quads list that was prepared in Augusta.

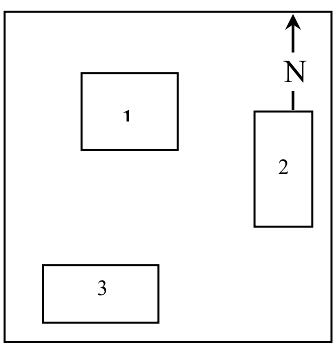
2. Place mylar overlay over quad.

3. Select a new Primary Random Number list (the one with 100 numbers on it).

4. Starting with the first random number (top left hand corner), check the corresponding cell on the quad to see if the crop is potentially present with residences close by.

5. Keep working through the random numbers from top to bottom until you identify a good target cell. At this point you'll need to drive to the target location.

6. If, once you get to the target location, you find that there is more than one field with your target crop in that cell, number the potential fields from north to south and/or east to west. Then go to your secondary random number list and go through the numbers in one column until you select a field:

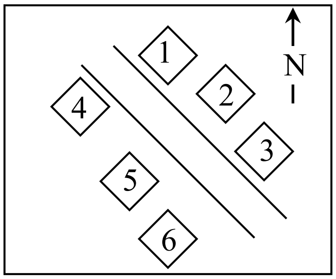


8	There is no field #8
3	There is field #3: go to it
4	
9	
1	
6	
7	
2	

7. Once at the target location, look for properties meeting the following criteria:

A. Private Residence (not a school, hospital, etc.) with people currently living there;
B. Within ¼ mile of the target crop site (which must have had the target crop grown on it within the last year);
C. Down gradient or level with the crop site; and
D. No water bodies (streams, ponds, rivers, etc.) between the crop site and the residence.

8. If more than one well meets the ¼ mi. criteria, number the potential houses from north to south and/or east to west (depending on road direction). Then go to your secondary random number list and go through the numbers in one column until you select a sample site:



5	No one's home
9	There is no #9
2	They are home: sample site
8	
10	
4	
6	
3	

NOTE: If you used the secondary random number list to choose a field, then use the next column of numbers to choose a sample site; do not use the same list as you used for field selection.

9. If none of the qualified wells work out for sampling, and there was more than one field with the crop of interest in the cell, then go to the next field on the list you used to randomly determine the first field picked and start over with Step 7 to find a qualifying sample site:

8	There is no field #8
3	NO QUALIFYING SAMPLE SITES
4	There is no field #4
9	There is no field #9
1	There is field #1: go to it
6	
7	
2	

10. If none of the qualified wells work out for sampling, and there was only one field with the crop of interest in that cell, then go back to Step 5 to find another promising target cell.

11. After you have collected the sample from the site, CROSS OUT THE PRIMARY RANDOM NUMBER LIST YOU USED TO FIND THE CELL ON THE QUAD. Do not re-use those lists for locating other samples. If you have to collect more than one sample from one quad, you must use a different primary random number list.

Figure 3. Sample Distribution throughout Maine

County	Number of Samples Collected
Androscoggin	6
Aroostook	69
Cumberland	1
Franklin	1
Hancock	0
Kennebec	8
Knox	2
Lincoln	4
Oxford	7
Penobscot	7
Piscataquis	13
Sagadahoc	1
Somerset	3
Waldo	3
Washington	6
York	6

Figure 4. Sample Data Collection Sheet

Well ID: ______ USGS Map #: ______ Grid #: ______	**2005 WATER SAMPLE INFORMATION SHEET**	Maine Board of Pesticides Control 28 State House Station Augusta, Maine 04333-0028 (207) 287-2731

SECTION 1: CROP

- ☐ Potatoes
- ☐ Small Grains
- ☐ Forage Corn
- ☐ Orchard
- ☐ Sweet Corn
- ☐ Christmas Trees
- ☐ Blueberries
- ☐ Strawberries

SECTION 2: ANALYSIS

Check more than one box if applicable.

- ☐ Group 1
- ☐ Group 2
- ☐ Group 6
- ☐ Group 8
- ☐ Group 9
- ☐ Group 11
- ☐ HETL

SECTION 3: WELL IDENTIFICATION

Name: ______

Address: ______

______, ME ______

Phone: ______

Directions to the Residence: ______

______

______

Well Location: ______

______

SECTION 4: WELL USE AND CONSTRUCTION INFORMATION

Well Use: ☐ Private ☐ Other ______ Approximate Age of Well: ______ yrs.

Well Construction: ☐ Dug ☐ Drilled ☐ Spring ☐ Driven ☐ Other ______ ☐ **Unknown**

Well Depth at Completion: *exactly* ______ ft. ☐ **Unknown** Depth of Casing: *exactly* ______ ft. ☐ **Unknown**

Is the Well Screened? ☐ No ☐ Yes -- Screened Intervals: Top: ____ ft. Bottom: ____ ft. ☐ **Unknown**
Top: ____ ft. Bottom: ____ ft.

SECTION 5: SAMPLE INFORMATION

SAMPLE ID: ______ Sample Date: ______ Sample Time: ______ AM PM

SECTION 6: WELL LOCATION

Latitude: N ___ ___° ___ ___.___ ___ ___' Time: ___ ___:___ ___:___ ___ AM PM

Longitude: W ___ ___ ___° ___ ___.___ ___ ___' EPE: ______ ft.

**Altitude will be determined at BPC office using info above and topographic map.*

Distance from well to crop: ______ ft. Elevation of well with respect to crop: ☐ Downgradient ☐ Equal Elevation

SECTION 7: COMMENTS

SECTION 8: SAMPLE AUTHORIZATION

The undersigned hereby voluntarily consents to the collection of well water samples from the property described in the above Sections for the purpose of gathering information in connection with the statutory responsibilities of the Maine Board of Pesticides Control.

Well Owner/User: ______ Title: ______

Sampled By: ______ Date: ______

Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Date/Time:	Received by:	Date/Time:

White Copy = BPC Office Yellow Copy = Laboratory Pink copy = Well Owner/User or Agent

Figure 5. Ground Water Sampling Standard Operating Procedure (SOP)

1. A site location and a site ID (or well ID) are chosen at the Augusta office after the appropriate planning procedures have been followed (see Experimental Design section in "Quality Assurance Project Plan for Maine Board of Pesticides Control Water Quality Program and Related Laboratory Work"). Samples are to be collected from private domestic water supplies that are within ¼ mile down gradient from, or of equal elevation with, a pesticide use site.
2. Residents must be questioned as to any filtration systems on their water system, such as carbon (charcoal) filters, water softeners, reverse-osmosis filters, etc. If there are no filters, then samples may be collected from any cold-water tap (please remove the aerator, if possible). Cold water must be run for 5 – 10 minutes to ensure that a sample from the well is obtained as opposed to one that's been sitting in the pressure tank. If there are filters on the system, the sample must be collected from a tap before the filter (an outside tap is usually a safe choice); the water should still be run for 5 – 10 minutes prior to collection.
3. Samples are to be collected in 1-Liter amber glass bottles with teflon-lined caps, certified as precleaned for the collection of pesticide samples. Latex or nitrile gloves must be worn when collecting the sample; a fresh pair of gloves is needed at each site. For the best adhesion, labels should be placed on the bottles prior to filling the bottle with water. Fill sample bottles completely. Bottles must be labeled with sample ID, date of collection, sample collector initials, analysis to be performed, and sample location (town). Caps must be also labeled with the sample ID. Keep in mind that the "Site ID" or "Well ID" will be determined later.
4. Samples are placed in a cooler with ice packs or in a refrigerator to ensure that samples are kept in the dark and as close to 4°C as possible.
5. Make sure site information is recorded and signed by the property resident before leaving the site. Site information of interest, also available on a form, includes the following:

Well ID - This is a unique, 8-digit number assigned by the BPC Augusta office for each site that is sampled. Please do not write anything on the Well ID line.

USGS Map #: Please write the number of the 7.5-minute topographic map in which the site is located. The number of each topographic map you are given will be on the back of the map.

Grid Number: The number on the mylar overlay in which the site is located (for stratified random sampling projects).

SECTION 1 and 2: CROP/ANALYSIS

Crop/Analysis: Please check which crop is near the well. If there is more than one commodity within ¼ mile of the well, please list only the primary one, and list others in SECTION 7: COMMENTS. If there is a special pesticide use on a nearby commodity, please make a note of it in the COMMENTS section.

SECTION 3: WELL IDENTIFICATION

Name and Mailing Address: This is for the name and mailing address of the person to whom the analytical results are to be sent (usually the homeowner or renter). If, in the case of a rental situation, the results are to be sent to the landlord/owner, put the landlord/owner's name and mailing address here. Please note in SECTION 7: COMMENTS if the results are being sent to someone other than the well user.

Directions to the residence: Please write the route or road on which the site is located and the municipality in which the site is located, if different from that indicated in the mailing address. Use SECTION 7: COMMENTS if additional space is required.

Well Location: Please write the general location of the well, like in the basement, behind the house, etc.

SECTION 4: WELL USE AND CONSTRUCTION INFORMATION

Well Use: Please check the applicable box. All the wells tested in this survey should be private (used only by the homeowners/renters). If the well is not public, please check "Other", and write what it is used for.

Approximate Age of Well: Please give the age of the well, in years.

Well Construction: Check the applicable box or fill in "Other". If the well user doesn't know, check "Unknown".

Well Depth at Completion: Enter the exact depth in feet of the well only if the exact depth is known; estimates are not allowed. If unknown, please check the "Unknown" box.

Depth of Casing: Enter the exact depth in feet of the casing only if the exact depth is known; estimates are not allowed. If unknown, check the "Unknown" box.

Is the Well Screened? A screened well is one with openings or perforations in the casing at specified depths so that ground water is only drawn only from that depth. Most drinking water wells in Maine are **not** screened. Wells that may be screened are driven point wells through sand and gravel aquifers and drilled wells that are drilled only into the overburden and not to the bedrock. If the well is screened, please try to find out the screening intervals.

SECTION 5: SAMPLE INFORMATION

SAMPLE ID: This is the standard, 11-digit, alphanumeric code used by the inspection staff during sampling events: YYMMDDabcXX.

Sample Date: The date the sample was collected.

Sample Time: The time the sample was collected. If military time is not used, please circle AM or PM.

SECTION 6: WELL LOCATION

Latitude: Write the GPS reading, as it reads on the display.

Longitude: Write the GPS reading, as it reads on the display.

Time: The time displayed on the GPS unit when the latitude and longitude were marked.

EPE: The Estimated Position Error, as it reads on the GPS display.

Note: Due to past issues with the GPS altitude readings, the well altitude will be determined at the BPC office using topographical maps and the given latitude and longitude.

Distance from Well to Crop: Write the estimated distance (in feet) from the crop listed in Section 1 to the well.

Elevation of Well with Respect to the Crop: Please check whether the well is down gradient from the commodity, or at the same elevation as the commodity.

SECTION 7: COMMENTS

In addition to using this space as previously indicated, please record any additional observations or comments, such as the phone number to the residence sampled.

SECTION 8: SAMPLE AUTHORIZATION

Please have the well owner/user read the authorization statement and sign were indicated. A title is not needed unless the person who is signing is an employee or agent, such as a babysitter or farm hand. The sampler should also sign were indicated and date the document.

CHAIN-OF-CUSTODY

Please use the shaded area at the bottom of the Water Sample Information Sheet to track the transfer and receipt of samples.

WATER SAMPLE INFORMATION SHEET DISTRIBUTION

White Copy	=	BPC Office
Yellow Copy	=	Laboratory
Pink Copy	=	Well owner/user or agent

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6. Deliver samples to the University of Maine at Orono Food Chemical Safety Laboratory (or other lab) as soon as possible and no later than three days after collection. Samples can be delivered to the Food Chemical Safety Laboratory on

Monday, Tuesday, Wednesday, and Thursday. If a Friday delivery is required, deliver no later than noon. Do not deliver samples on Saturday or Sunday. Other laboratories may have different schedules.

APPENDIX F
PESTICIDE DRINKING WATER GUIDELINES
(all units are parts per billion)

Common Name	MEG[39]	MCL[40]
Aciflurofen	10	
Alachlor	2	2
Aldicarb	2	7[41]
Aldicarb sulfone		7[3]
Aldicarb sulfoxide		7[3]
Ametryn	60	
Amiben	105	
Ammonium Suflamate	1500	
Atrazine	3	3
Azinphos-Methyl	25	
Baygon	3	
Bentazon	17.5	
Bromacil	25	
Butachlor	20	
Butylate	360	

1 [39]"Summary of State and Federal Drinking water Guidelines," Maine Department of Human Services, Bureau of Health, Environmental Toxicology Program, revised September 1992.
2 The Maximum Exposure Guidelines (MEGs) are health-based guidelines intended to help risk managers, homeowners, and others make decisions regarding the suitability for human consumption of drinking water contaminated by chemicals.
3 The MEG for a carcinogenic compound in drinking water is the concentration of that compound in drinking water that is expected to result in a mizimum lifetime cancer risk of one additional cancer case per 100,000 individuals. The MEG for a non-carcinogenic compound in drinking water is the concentration of that compound in drinking water below which no adverse health effects are expected to occur over a lifetime of exposure.
4 This MEG list has not been promulgated by rule-making and therefore the MEGs are not legally enforceable drinking water "standards." The MEGs represent the Bureau of Health's most recent recommendations for maximum levels of contaminants in drinking water. (Dr. Robert A. Frakes, State Toxicologist, October 1992.)
5 [40]"Drinking Wate regulations and health Advisories," Office of Water, U.S. Environmental Protection Agency, Washington, D.C., October 1996.
6 [41]MCL is currently in draft status.

Common Name	MEG[39]	MCL[40]
Captan	100	
Carbaryl	164	
Carbofuran	40	40
Carboxin	700	
Chlordane	0.27	2
Chlorothalonil	15	
chlorpyrifos	20	
Cyanazine	1	
2,4-D	70	70
Dacthal	3500	
Dalapon	200	200
DDT	0.83	
Diazinon	0.63	
Dibromochloropropane	0.2	0.2
Dicamba	200	
1,2-Dichloropropane	5	5
1,3-Dichloropropene	2	
Dieldrin	0.02	
Dimethrin	2100	
Dinitrophenol	31	
Dinoseb	2	7
Diphenamid	200	
Diphenylamine	175	
Diquat	20	20
Disulfoton	0.3	
Diuron	14	
Endosulfan	42	
Endothall	140	100
Endrin	2	2
Ethylene dibromide (EDB)	0.005	0.05
Ethylenethiourea (ETU)	3	
Fenamiphos	1.8	
Fluometuron	90	
Folpet	320	
Fonofos	14	
Glyphosate	700	700
Heptachlor	0.08	0.4
Heptachlor epoxide	0.04	0.2
Hexachlorophene	2	
Hexazinone	210	
Lindane (BHC)	0.2	0.2
Malathion	40	
Maleic Hydrazide	3500	
Maneb/Mancozeb/Zineb	10	
MCPA	2.5	

Common Name	MEG[39]	MCL[40]
Methomyl	50	
Methoxychlor	100	40
Methyl parathion	2	
Metolachlor	100	
Metribuzin	175	
Oxamyl	175	200
PCNB	71	
Paraquat	30	
Parathion	8.6	
Pentachlorophenol	1	1
Phorate	0.2	
Picloram	300	500
Prometon	100	
Pronamide	50	
Propachlor	92	
Propanil	40	
Propazine	14	
Propham	120	
Propiconazole	9	
Resorcinol	140	
Rotenone	4	
Simazine	4	4
Tebuthiuron	500	
Terbacil	90	
Terbufos	0.9	
Thiram	10	
Toxaphene	0.3	3
Trifluralin	2	
Ziram/Ferbam	25	

APPENDIX G
MAINE WATER QUALITY CRITERIA FOR PESTICIDES[42]

		Aquatic Life (Fg/l)			Human Health (Fg/l)	
Chemical Name	cmcfresh	cccfresh	cmcsalt	cmcfresh	hh wo	hh o
B-Lindane					0.0137	0.046
Chlorpyrifos	0.083	0.041	0.011	0.0056		
Demeton		0.1		0.1		
Guthion		0.01		0.01		

1 [42]Maine Department of Environmental Protection, "Maine Water Quality Criteria for Toxic Pollutants," 1995.

Malathion		0.1	0.1	
Methoxychlor		0.03	0.03	40
Parathion	0.065	0.013		

cmc = contaminant maximum concentration
ccc = contaminant chronic concentration
hh wo = human health water and organism
hh o = human health organism

APPENDIX H
BOARD OF PESTICIDES CONTROL
ENFORCEMENT PROTOCOL

ADOPTED 9/19/84
AMENDED 9/7/90
AMENDED 6/3/1998

The Board adopts the following enforcement protocol to be utilized in routine enforcement matters arising under the Board's statutes and regulations.[43]

1. Persons wishing to report potential violations should refer such matters, as soon and in as much detail as possible, to the Board's staff. Where such reports are submitted by telephone, the Board requests that confirmation be made in writing. As a general rule, where requested by the individual making the report, the Board shall keep the identity of that person confidential, except as the Attorney General may advise in a particular case that such information is subject to public disclosure under the Maine Freedom of Access Law.

2. As soon as practicable after receipt of a report of a potential violation, the Board's staff shall investigate. The precise method and extent of investigation shall be at the discretion of the staff, considering the potential severity of the violation and its consequences, the potential the violation may have for damage to the environment or human health, and other matters which may place demands upon staff resources at the time.

3. Following staff investigation, if the staff determines that a violation has occurred of sufficient consequence to warrant further action, the Board staff may proceed as follows:

---

1 [43]In emergency or other unusual situations, the Board and/or its staff may depart from this protocol, in a manner consistent with State law, when necessary to the handling of particular enforcement actions.

a. In matters not involving substantial threats to the environment or public health, the Board's staff may discuss terms of resolution with the Attorney General's office and then with the violator without first reporting the matter to the Board. This procedure may only be used in cases which there is no dispute of material facts or law, and the violator freely admits the violation(s) of law and acknowledges a willingness to pay a fine and resolve the matter. The terms of any negotiated proposed resolution shall be subject to the Board's subsequent review and approval, as provides in section 6b.
b. In matters involving substantial threats to the environment or the public health or in which there is dispute over the material facts or law, the Board's staff shall bring the matter to the attention of the Board. The staff shall prepare a written report summarizing the details of the matter. Copies of the report shall be mailed to the alleged violator and any complainants so they may make comments. The report and any comments will then be distributed to the Board prior to their next available meeting. The staff will also notify the alleged violator and other involved parties about the date and location of the meeting at which the alleged violation will be considered by the Board.

4. At the Board meeting, the Board shall hear from its staff and, if requested, from the alleged violator(s) and/or their attorneys, as well as from other interested members of the public, to the extent reasonable under the circumstances and in a manner which the Board's chairman shall direct. Ordinarily, such a meeting will not be conducted as a formal adjudicatory hearing. Before making a decision regarding any action(s) which it may wish to take in response to an alleged violation, the Board may choose to go into executive session to discuss with its counsel the various enforcement options available to it and other related matters which are not subject to public disclosure under the Freedom of Access Law. However, all Board decisions shall be made on the public record and not in executive session.

5. Following receipt of the staff report and other information presented to it and completion of whatever further inquiry or deliberations the Board may wish to undertake, the Board shall make a decision regarding which course(s) of action, as described in Section 6, it deems appropriate in response to the alleged violation. Any such decision will ordinarily be based upon the Board's judgment as to whether a violation of its statutes or regulations appears to have occurred which is of sufficient consequence to warrant an enforcement action, but shall not require that the Board be satisfied to a legal certainty that the alleged violator is guilty of a particularly defined violation. In disputed matters, the ultimate decision as to whether a violation is factually and legally proven rests with the courts.

6. If the Board makes the determination that a violation appears to have occurred which warrants an enforcement action, the Board may choose among one or more of the following courses of action:

a. In matters involving substantial violations of law and/or matters resulting in substantial environmental degradation, the Board may refer the matter directly to the Attorney General for the initiation of enforcement proceedings deemed appropriate by the Attorney General. Also, with regard to more routine violations with respect to which the Board finds sufficient legal and/or factual dispute so that it is unlikely that an amicable administrative resolution can be reached, the Board may choose to refer the matter directly to the Attorney General.

b. On matters warranting enforcement action of a relatively routine nature, the Board may authorize and direct its staff to enter into negotiations with the alleged violator(s) with a view to arriving at an administrative consent agreement containing terms (including admissions, fines and/or other remedial actions) which are satisfactory to the Board, to the Attorney General and to the alleged violator(s). The Board will not ordinarily determine in the first instance the precise terms which should be required for settlement but may indicate to the staff its perception of the relative severity of the violation. In formulating a settlement proposal, the staff shall take into consideration all of the surrounding circumstances, including the relative severity of the violation, the violations record and other relevant history of the alleged violator(s), corrective actions volunteered by the alleged violator(s) and the potential impact upon the environment of the violation. The staff shall consult with the Attorney General's office before proposing terms of settlement to the alleged violator(s). Following successful negotiation of an administrative consent agreement with the alleged violator(s), the staff shall report back to the Board the terms of such agreement for the Board's review and, if it concurs, ratification. All administrative consent agreements shall become final only with the Board's and the Attorney General's approval.

c. In the event that an administrative consent agreement cannot be arrived at as provided in paragraph b., the staff shall report the matter back to the Board for further action by it. Such action may include referral to the Attorney General for appropriate action.

d. In addition, in appropriate cases, the Board may act to suspend the license of a certified applicator as provided in its statute, may act to refuse to renew the license of a certified applicator and/or may request that the Attorney General initiate proceedings in the Administrative Court to revoke or suspend the license of any such applicator. Where provided for by its statute, the Board shall give the licensee involved the opportunity for a hearing before the Board in connection with decisions by it to refuse to renew a license or to suspend such license.

7. Whereas the Board is establishing this protocol in order to clarify and facilitate its proceedings for the handling by it and its staff of enforcement matters, the

Board recognizes that the Attorney General, as chief law enforcement officer of the State, may independently initiate or pursue enforcement matters as he deems in the best interests of the State and appropriate under the circumstances.

APPENDIX J
(other BPC rules may be found at
http://www.state.me.us/agriculture/pesticides/laws/regs.htm)

01 DEPARTMENT OF AGRICULTURE, FOOD AND RURAL RESOURCES

026 BOARD OF PESTICIDES CONTROL

Chapter 41: SPECIAL RESTRICTIONS ON PESTICIDE USE

SUMMARY: This chapter describes special limitations placed upon the use of (1) aldicarb (Temik 15G) in proximity to potable water bodies; (2) trichlorfon (Dylox); (3) hexazinone (Velpar, Pronone) and (4) aquatic herbicides in the State of Maine.

Section 1. ALDICARB (TEMIK®)

The registration of aldicarb (Temik 15G) is subject to the following buffer zone requirements:

A. Aldicarb (Temik 15G) shall not be applied within 50 feet of any potable water source if that water source has been tested and found to have an aldicarb concentration in the range of one to ten parts per billion (ppb). The 50 foot buffer would be mandatory for one year with a required retesting of the water at the end of the period.

B. Aldicarb (Temik 15G) shall not be applied within 100 feet of any potable water source if that water source has been tested and found to have an aldicarb concentration in excess of 10 ppb. The 100 foot buffer would be mandatory for one year with a required retesting of the water at the end of this period.

Section 2. TRICHLORFON (DYLOX)

The registration of trichlorfon (Dylox) is subject to the following regulations:

A. Limited Use List

Any formulation containing trichlorfon (Dylox) is classified as a limited use pesticide.

B. Notice

Any person who applies trichlorfon (Dylox) by aircraft or air-carrier application equipment or who contracts or arranges for such applications of trichlorfon (Dylox) shall provide notice in conformity with this regulation.

I. Notice shall be given to:

a. All persons who maintain a home or fruit or vegetable garden on property which abuts the application site; or

b. To the public.

II. Notice pursuant to B(I)a shall be given in writing at least twenty-four (24) hours and not more than two months prior to application.

III. Notice pursuant to B(I)b shall be given by publication in a newspaper of general circulation in the area of the state affected at least twenty-four (24) hours and not more than two months prior to application.

IV. Notice shall be in the form provided by the Board and will contain at minimum:

a. The name of the chemical to be applied;

b. The boundaries of the application site;

c. The name and address of the person supplying notice;

d. Any medical or environmental warnings contained on the product labeling plus, if it is not already included on the label, a sentence stating that the compound has demonstrated some mutagenic effects in bacterial cell cultures; and

e. Instructions directing those persons notified to contact the person supplying notice if they wish to obtain information regarding precise time of application.

V. Arrangements for more specific notice pursuant to Section B(IV)e shall be made by the individual parties involved.

C. Permits

A permit to use such limited use pesticide may be issued by the Board when it finds that the criteria of Chapter 40, Section 2(c) are satisfied. The Board may impose reasonable conditions on such permits as it deems necessary to protect the health, safety and general welfare of the environment and the people of the State of Maine. Conditions may include, without limitation, requirements for demonstrating that the pest infestation will cause substantial economic harm if it goes untreated by the limited use pesticide, for posting areas to be treated and for observing no-spray buffers.

Section 3. HEXAZINONE (VELPAR, PRONONE)

The registration of hexazinone is subject to the following limitations and conditions.

A. Prohibition of Certain Air-Carrier Application Equipment

It shall be unlawful to apply any liquid pesticide mixture containing the active ingredient hexazinone with any application equipment that utilizes a mechanically generated airstream to propel the spray droplets unless the airstream is directed downward.

B. Licenses Required

I. No person shall purchase, use or supervise the use of any pesticide containing the active ingredient hexazinone unless they have obtained a private or commercial pesticide applicators license from the Board.

II. No person shall:

a. Distribute any pesticide containing the active ingredient hexazinone without a restricted use pesticide dealer's license from the Board; or

b. Distribute any pesticide containing the active ingredient hexazinone to any person who is not licensed as a private or commercial pesticide applicator by the Board.

C. Records and Reporting

Dealers distributing pesticides containing the active ingredient hexazinone shall keep records of such sales and provide reports to the Board as described in Chapter 50, "Record Keeping and Reporting Requirements."

Section 4. AQUATIC HERBICIDES

The registration of pesticides for which there is an aquatic herbicide use on the product label shall be subject to the following limitations and conditions.

A. Board Publication of List

The Board of Pesticides Control will publish by May 23, 2003 and by March 15th of each year thereafter a list of herbicide products registered in Maine for which the manufacturer has verified that there is an aquatic use on the pesticide label. Based on available information, the Board may exempt from this list pesticides that it determines are not for use in the control of aquatic vegetation. Pesticides labeled solely for use in aquariums and antifouling paints, are specifically exempt from this list.

B. Licenses Required

I. No person shall purchase, use or supervise the use of any aquatic herbicides identified on the Board's annual listing unless they have obtained a private or commercial pesticide applicator's license from the Board.

II. No person shall:

a. Distribute any aquatic herbicides identified on the Board's annual listing without a restricted use pesticide dealer's license from the Board; or

b. Distribute any aquatic herbicides identified on the Board's annual listing to any person who is not licensed as a private or commercial applicator by the Board.

C. Disclosure

The Board will make a disclosure form available to dealers distributing any aquatic herbicides identified on the Board's annual listing. The Board requests that dealers present to customers the disclosure form that advises purchasers that an aquatic discharge license must be obtained from the Maine Department of Environmental Protection before any application may be made to any surface waters of the State as defined in 38 M.R.S.A. Section 361-A(7) including any private ponds that may flow into such a body of water at any time of year.

D. Records and Reporting

Dealers distributing any aquatic herbicides identified on the Board's annual listing shall keep records of such sales and provide reports to the Board as described for restricted use pesticides in Chapter 50, "Record Keeping and Reporting Requirements."

STATUTORY AUTHORITY: 5 M.R.S.A. § 8051 *et seq*.
7 M.R.S.A. §§ 601-610;
22 M.R.S.A. §§ 1471-A, 1471-B, 1471-C, 1471-D, 1471-M.

EFFECTIVE DATE:
March 8, 1981 (Captan)

AMENDED:
May 7, 1981 (Trichlorfon)
January 2, 1984 (Aldicarb)
May 8, 1988 (Trichlorfon)
August 5, 1990 (Captan)
August 17, 1996 (Hexazinone)
October 2, 1996

EFFECTIVE DATE (ELECTRONIC CONVERSION):
March 1, 1997

AMENDED:
May 7, 1997 - Section 3(B)(II)

CONVERTED TO MS WORD:
March 11, 2003

AMENDED:
May 12, 2003 - Section 4 added

NON-SUBSTANTIVE CORRECTIONS:
June 24, 2003 - summary only

AMENDED:
February 2, 2004 - Section 4, 1st paragraph and sub-section A, filing 2004-31

APPENDIX K
SUMMARY OF COMMENTS

On September 25, 1997, copies of the proposed revised *Maine Generic State Management Plan for Pesticides and Ground Water* were distributed to Ground Water Planning Committee members, Hexazinone SMP Advisory Committee members, Board members, staff and other interested parties with a memo announcing the commencement of a 60-day comment period. A notice was also included in the Fall *BPC Communicator*, and, for the first time, information about plan availability was placed on the Internet at the BPC's home page. Several additional requests for plans were received and, in total, approximately 90 copies of the plan were distributed.

A public information gathering meeting was held on October 24 in Houlton. Aside from a few introductory remarks by a BPC staff member, only one other person spoke at the meeting. That person, a member of the Ground Water Planning Committee, expressed support for the plan and process used to create it.

Three sets of written comments were received prior to the November 26 deadline. One set of comments was from another Ground Water Planning Committee member and generally expressed support for the revised Generic SMP. Another set of comments was from a former member of the Hexazinone SMP Advisory Committee who expressed harsh words about the plan and process and the Board's ability to adequately protect ground water.

The final set of comments was received from a member of the Hexazinone SMP Advisory Committee who questioned why the relative magnitude of detections as a percent of the MCL or MEG had not been considered when calculating the percentage of sampled wells or sites with confirmed detections in Figure VIII-B (pp. 55). He reasoned that as technology allows lower detection levels and as the percentage of sites with detections may therefore increase, would these percentages stay meaningful? The Ground Water Planning Committee wrestled greatly over this detail during the plan revision process. Because prevention is the overriding goal of the Generic SMP, the Committee decided ultimately that any detection was meaningful. Even at small percentages of the MCL or MEG, the group felt steps, as simple as user awareness and education, could be initiated to prevent the potential for a more serious contamination problem.

Pesticide Update

EPA's Office of Chemical Safety and Pollution Prevention

EPA Releases Draft Guidance to Support Registration of Pre-saturated Disinfecting Wipes

Today, the U.S. Environmental Protection Agency (EPA) released for public comment draft guidance to support registration and evaluation of efficacy claims for pre-saturated antimicrobial towelettes on hard non-porous surfaces such as stainless steel, metal, glass, hard plastic, or sealed wood, commonly seen in the market as "disinfecting wipes," using a recently approved standard test method. Existing test methods used to evaluate the efficacy of disinfecting wipes were originally designed to test liquid formulations and had to be modified to accommodate wipes. The standard test method — published by ASTM International in September 2023 — provides a specific and consistent way to evaluate efficacy of antimicrobial towelettes (i.e., disinfecting wipes). The draft guidance document identifies this standard test method, ASTM E3363, as the agency's recommended test method for evaluating the efficacy of antimicrobial wipes with disinfectant claims against bacteria, given it is both effective and widely accepted by registrants. The draft guidance also provides registration guidance for pesticidal claims for disinfecting wipes. Until this guidance is finalized, registrants should continue to reference OCSPP 810.2200 to support product registration.

Under federal law, antimicrobial pesticides that claim to kill harmful microbes must be registered with EPA before they can be sold or distributed in the United States. The agency must receive and review appropriate efficacy data to support these claims. EPA is responsible for regulating disinfectants and other antimicrobial pesticides used in healthcare and other settings pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The new guidance being released addresses efficacy testing for pre-saturated antimicrobial towelettes intended to be used as disinfectants on hard, non-porous surfaces against bacteria.

Disinfecting wipes are to be tested with the formulation offered for sale, using the product packaged in the same packaging intended to be marketed. Disinfecting wipes are a unique combination of antimicrobial chemical and towelette substrate pre-packaged as a unit in fixed proportions for application. Therefore, the complete product, as packaged in the manner to be offered for sale, must be tested according to the directions for use to ensure efficacy as a disinfecting wipe.

This guidance is not intended to address dry-to-wet towelettes (e.g., spraying a disinfectant on a dry cloth), and/or other deviations from pre-saturated towelettes. Those product types will be handled on a case-by-case basis. This guidance is also not intended for use sites such as drinking glasses, dishes, utensils, cutting boards, or soft and porous surfaces. Formulations beyond pre-saturated disinfecting wipes may fall outside of the scope of this test guidance. In these cases, registrants are encouraged to consult with the agency prior to conducting efficacy testing.

The draft guidance is available for public comment in docket EPA-HQ-OPP-2024-0414 at www.regulations.gov for 60 days.

Pesticide Update

EPA's Office of Chemical Safety and Pollution Prevention

EPA Makes Thousands of Records on the Agency's Review of Studies on Pesticides Publicly Available

Today, the U.S. Environmental Protection Agency announced it made available more than 4,500 Data Evaluation Records (DERs) in ChemView, a public portal that houses data and review of toxic chemicals. A DER is the documented EPA review of studies submitted during the request to register a pesticide or during the registration review process, and does not contain confidential business information. The studies may include product chemistry, toxicology, ecological effects, human exposure, spray drift, environmental fate, and residue chemistry.

EPA has not routinely released most DERs to the public. Prior to today's announcement, to obtain a DER not included as part of EPA's registration review docket, including most product chemistry DERs, a requester would need to submit a Freedom of Information Act (FOIA) request separately for each DER. Releasing this batch of DERs that have previously been requested through the FOIA process, which are largely product chemistry DERs, aims to reduce the need for submitting FOIA requests for these DERs in the future.

To access DERs in ChemView, select "EPA Assessments" in the output selection box. Results can be filtered using an EPA-issued study number with the document information filter, or product code with the chemical identifier filter. EPA plans on exploring ways to proactively add DERs to ChemView as they are developed.

To learn more, visit ChemView.EPA.gov.