

# Risk Assessment Summary -

## Suffolk County Vector Control & Wetlands Management Plan

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# Presentation Outline

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- Overview of assessment
  - Scope
  - Scenarios
  - Methods
- Human health risk assessment
- Ecological risk assessment
- Overall conclusions

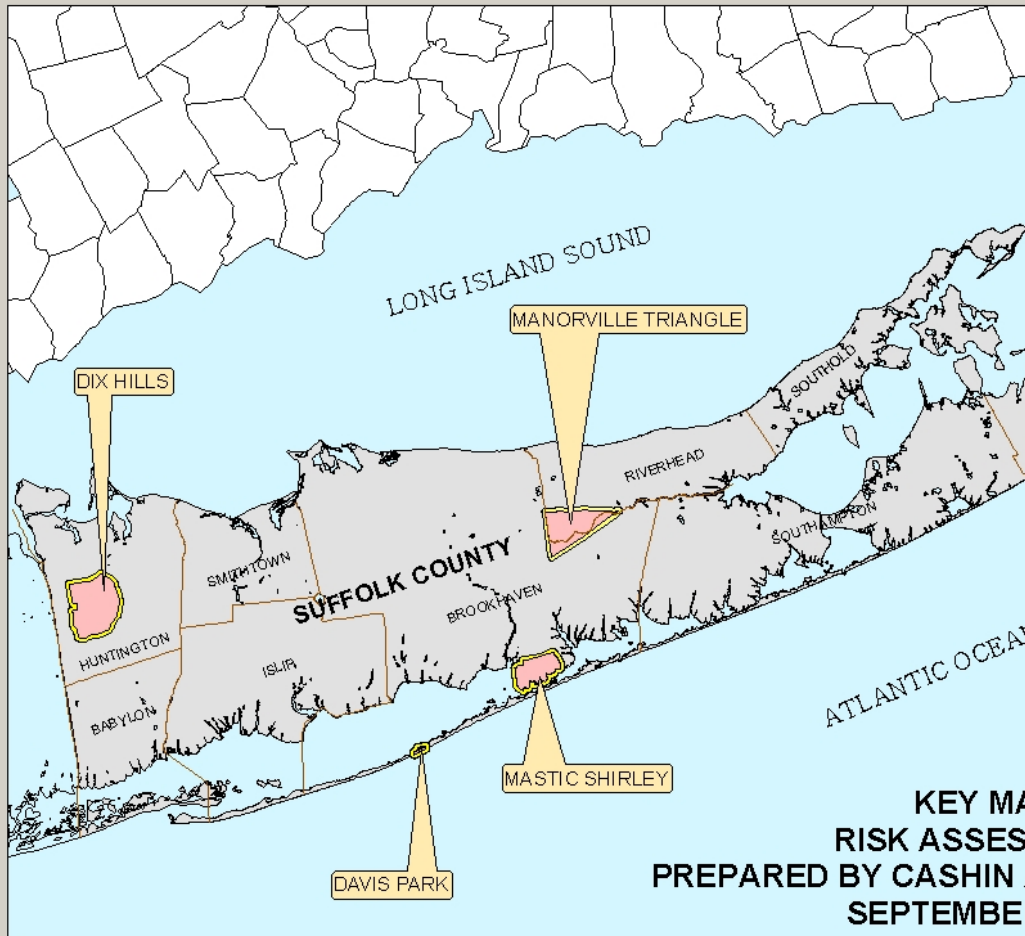
# Risk Assessment Evaluated Consequences of Pesticide Use

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- Tailored to vector control activities
  - Products
  - Application methods
  - Seasonal considerations
- Pesticide-related risks only
  - Disease risk, water management impact addressed elsewhere

# Evaluated Hypothetical Risks in Four Study Areas

- Representative of current & historical application areas
- Paradigms for any future locations



# Evaluated Eleven Pesticides within Three Categories

## ■ Larvicides

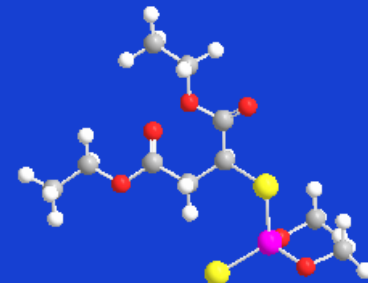
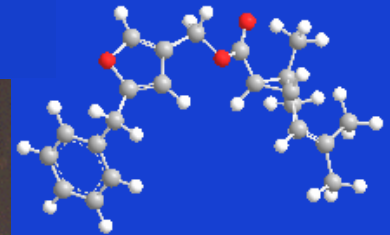
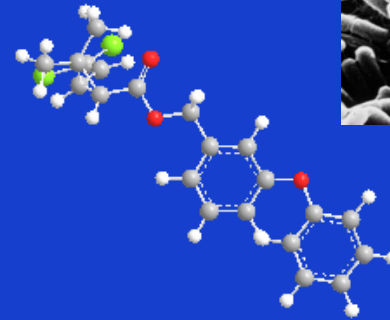
- *Bti, Bs*
- Methoprene

## ■ Adulticides

- 3 Pyrethroids +PBO
- Malathion + degradates

## ■ Repellants

- Garlic oil (nontoxic)



# Evaluated a Variety of Application Scenarios...for Larvicides

Study Area	Method	Frequency		Interval	Season	Time
		Avg	Max			
Davis Park	BP-B, H	2	8	14-30 days	May-Sep	Day
Dix Hills	H, BP-S	1	2	40 days	May-Sep	Day
Manorville	H, BP-S	1	2	NA	Apr-Aug	Day
Mastic Shirley	BP-B, BP-S, H	3	14	7-30 days	Apr-Sep	Day
Mastic Shirley	Truck-ULV	1	5	1-2 x per season	Apr-Sep	Day
Mastic Shirley <sup>1</sup>	Helicopter	7	20	7-30 days	Apr-Sep	Day

NA = not applicable

# .....and Adulticides

Study Area	Method	Frequency		Interval	Season	Time
		Avg	Max			
Davis Park	GC-HS, BP-S	11	14	7 days	Jun-Oct	4-6 pm
Dix Hills	Helicopter	1	1	NA	May, Jun, Aug	Day
Manorville	Helicopter	2	2	14 days	Jun-Sep	Day
Mastic Shirley	Helicopter	2	2	7 days	Jun-Sep	Dusk+3 hr
Mastic Shirley	Truck-ULV	5	8	7 days	Jun-Sep	Dusk+3 hr

NA = not applicable

# Utilized Information from the Field to Characterize Study Areas

- Documentation of study area settings

## Field Visits

- October 2004
- Integral, CA, CE, SCDHS, SCVC
- Manorville, Dix Hill, Mastic Shirley, Davis Park

## Human Health

- Demographics
- Land use
- ID important locales (e.g., schools, parks, home gardens, farms)

## Ecological

- Ecological habitats
- Species surveys
- ID critical habitats & species (e.g., natural areas, RTE species)



# Significant Efforts to Derive County-specific Data on Exposures & Effects

- Deposition modeling
  - RTP air model
- Deposition monitoring
  - “lasagna pans”
  - Air trap
  - Water/sediment
- Biological effects
  - Caged fish & invertebrates
  - Benthic community studies
- Collectively, data -
  - Improve predictive abilities
  - Provide real-world check for results



# Modeling used to Link Release to Potential Exposure

## Air Modeling

- Aerial & truck apps.
- Air concentrations
- Deposition

## Fate & Transport Modeling

- Air, soil, surfaces, water, sediment, plants, animals

## Human Health & Ecological Risk Assessment



$$x = \frac{QKVD}{2\pi u_s \sigma_y \sigma_z} \exp\left[-0.5\left(\frac{y}{\sigma_y}\right)^2\right] \quad 1-1$$

# Risk Assessment Conducted per National Guidance

- Risk (*f*)...
  1. Exposure
    - Co-occurrence of receptor and pesticide
    - Estimate dose
  2. Toxicity
    - Pesticide effects
    - Use dose-response to establish criteria

$$Risk = \frac{Exposure}{Toxicity}$$

# Human Health Risk Assessment

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# Human Health Risks Evaluated for – Two Time Periods

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- Acute
  - During, immediately following spray event
  - Evaluated theoretical worst case
    - Highest out of 300,000 modeled air concentrations in each study area
- Longer-term
  - Over spray season(s)
  - Repeated applications
  - Degradation, accumulation

# .....and for...

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- Six receptor populations
  - Residents, recreational users, workers, students, community gardeners, homeless
- Four age groups
  - Young child, older child, adolescents, adults
- Sixteen unique media-specific exposure routes
- Two exposure conditions
  - Average (typical)
  - Theoretical upper-bound (very unlikely)

# Resulted in Extremely Comprehensive Evaluation

- TOTAL of 97 exposure pathways
- Approximately 3,000 unique risk combinations considered



# Human Health Toxicity Data

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- Derived from review of the scientific literature, EPA reports, ATSDR, international health organizations (WHO)
- Focus on adulticides + PBO
  - Larvicides (low persistence, no off-target drift)
  - Garlic oil (non-toxic)



# Risk Expressed as Hazard Quotient

$$HQ = \frac{Exposure}{Toxicity}$$

- $HQ < 1$  = adverse effects unlikely
- $HQ > 1$  = increased chance
  - Consider other factors

# HHRA Results – All Pathways, All Locations

Pesticide	Acute	Longer-term
Bs	--	--
Bti	--	--
Methoprene	--	--
Sumithrin+PBO	--	--
Resmethrin+PBO	--	--
Permethrin+PBO	--	--
Malathion	Single case HQ >1	--
Garlic Oil	--	--

-- HQs < 1

# Summary of Highest Malathion Risks (all other pathways $\ll 1$ )

Chemical	Young child resident		Community gardener	
	Average	Upper bound	Average	Upper bound
Dix Hills	0.01	0.03	0.01	0.06
Manorville	0.01	0.03	0.01	0.06
Davis Park	0.3	1	0.4	3
Mastic Shirley	0.1	0.4	0.2	0.9

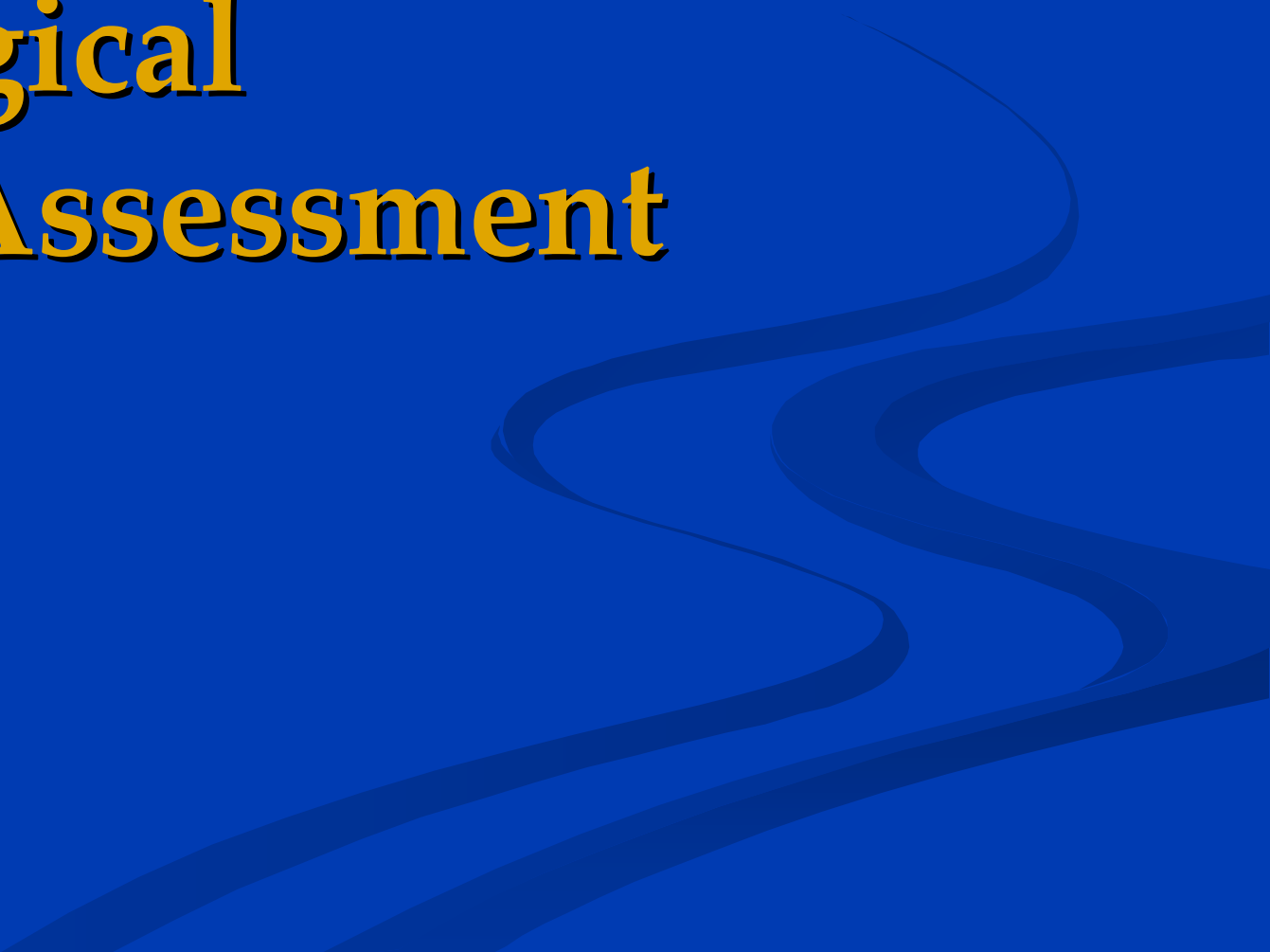
- Only in upper bound exposure condition (1/200 locations in Davis Park)
- Gardening not observed/likely in Davis Park; analysis assumed it occurs
- Very high consumption/reliance on garden for fruit and vegetables
- Air modeling likely over-predicts deposition (2-10x)
- Easily mitigated by simply washing produce

# Overall HHRA Conclusions

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- Proposed use adulticides & larvicides does not pose significant human health risk
  - Calculated exposures below levels of concern
  - Only exception is considered unlikely to occur, easily mitigated
- Results consistent with published findings
  - Public health, epidemiological studies
  - EPA risk assessments
  - Recent, peer-reviewed literature (Env. Health Persp.)

# Ecological Risk Assessment

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# Ecological Risk – Also a Function of Exposure and Toxicity

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- Starting point: assess risks for individual organisms
- If predict risk to individuals, must consider
  - Ecological interactions
  - Ecological consequences

$$Risk = \frac{Exposure}{Toxicity}$$

**Populations, Communities  
are entities of ecological  
relevance  
(not individuals)**

# Suffolk County Ecological Communities

PRELIMINARY DRAFT

Summary of Ecological Habitat Settings within Designated Study Areas  
Task 8 Impact Assessment - Ecological Risk Assessment

Ecological Risk Assessment Habitat Settings	Study Areas			
	Davis Park	Mastic Shirley	Dix Hills	Manorville
<b>Aquatic Settings</b>				
<b>Freshwater</b>				
Lentic				
pond, kettle pond, vernal/ephemeral pool, depression	X	X	X	
lake				
Lotic				
stream		X		
river				
<b>Marine-Estuarine</b>				
Coastal waters				
embayment	X	X		
tidal creek		X		
<b>Transitional Settings</b>				
<b>Inland Wetlands</b>				
riverine wetlands				
wetlands along river/stream channels				
lacustrine wetlands				
wetlands along lakes/reservoirs				
palustrine wetlands				
wet meadows, bogs, bottomlands, red maple swamps		X	X	
<b>Coastal Wetlands</b>				
high marsh, salt meadow	X	X		
intertidal marshes	X	X		
<b>Mudflats/Beach/Dune</b>				
intertidal bars, mudflats	X	X		
dune, fore-dune, scrub pine	X			
<b>Terrestrial Settings</b>				
<b>Upland</b>				
Upland forest and woodlands		X	X	X
Upland old fields, meadows, agricultural lands			X	X
Landscaped/residential		X	X	X
Ruderal field (urban/commercial/disturbed)			X	

- Habitats inclusive of those present throughout county
- Species present can be identified, communities defined

# Freshwater and Marine/Estuarine Habitats & Receptors

- Freshwater: ponds, vernal pools, streams, lakes, rivers, wetlands
- Marine/estuarine: tidal creeks, embayments, coastal wetlands/marshes

Taxon	Habitat Setting		Example Receptors
	Freshwater	Marine/Estuarine	
Sediment invertebrates	X	X	insect larvae, crustaceans
Water column invertebrates	X	X	plankton
Fish	X	X	bluegill, bass, mummichog, striped bass
Birds insect/seed eating	X	X	red-winged blackbird
fish eating	X	X	kingfisher, cormorant
wading	X	X	great blue heron
waterfowl/prober	X	X	mallard, black duck, plover
Mammals	X	X	raccoon
Amphibians	X		frog, salamander
Reptiles	X	X	turtle
Plants	X	X	algae



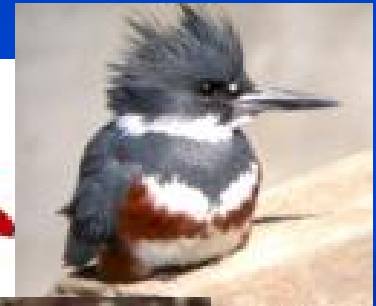
# Terrestrial Habitats & Receptors

- Terrestrial: forests, woodlands, fields (natural/agricultural/landscaped/ruderal)

Taxon	Terrestrial	Example Receptors
Terrestrial invertebrates	X	honeybee
Birds insect/seed eating	X	red-winged blackbird
raptors	X	red-tailed hawk
Mammals	X	field mouse, fox
Amphibians	X	frog, toad
Reptiles	X	snake, turtle
Plants	X	forbs, grasses

# Terrestrial Wildlife Assessment

- Birds/mammals/reptiles
  - Insect eaters (e.g., song birds, bats)
  - Seed/fruit eaters (field mice, song birds)
  - Grazers (e.g., deer)
  - Aquatic predators (e.g., kingfisher, raccoon)
- No risks predicted for any species



# Terrestrial Insect Assessment

- Non-target species
  - Honeybees as surrogate
- Risks predicted - all adulticides
  - Malathion greatest
  - Resmethrin, sumithrin marginal exceedance
- Risk could be over-predicted
  - Air modeling over-predictions (2-10x)
- Risks could be mitigated by avoiding
  - Day-time applications
  - Important habitats



# Aquatic Life Assessment

- Multiple taxa & habitats
- No risks
  - Larvicides,
  - resmethrin, sumithrin, PBO
- Potential risk to individual organisms
  - Aquatic insects (midge, flies), crustaceans (water-fleas, crabs)
  - Malathion; to a lesser extent, permethrin



# Further Assessment of Likely Impact on Ecological Communities

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- Literature review –
  - little or no impact
    - Mesocosms
    - Field studies (MN, CA, Suffolk County)
- Supplemented using EPA community ecological model (AQUATOX)
  - Permethrin
  - Shallow waters (wetlands, pools, ponds)

# Modeled Population Abundance

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- Multiple taxa & species
- Compared to controls
- Changes over time
  - Short-term response
  - Recovery time

# Overall Findings of Aquatic Community Modeling

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- Short-term decreases in abundance
- Full recovery in few months
- No long-term ecological impacts predicted for aquatic organisms

# Overall Conclusions of Risk Assessment

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# Vector Control Agents Pose Few Risks Under Proposed Use Conditions

Pesticide	Human Health	Terrestrial Wildlife	Terrestrial Insects	Aquatic Life
Bs	--	--	--	--
Bti	--	--	--	--
Methoprene	--	--	--	--
Sumithrin+PBO	--	--	X	--
Resmethrin+PBO	--	--	X	--
Permethrin+PBO	--	--	X	Individuals only; short term
Malathion	1 case only; unlikely	--	X	Individuals only short term
Garlic Oil	--	--	--	--

-- = No significant risk, X = potential risk;

# Additional Key Findings Relevant to Management Plan

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- Larvicides = no risks
- Malathion > permethrin >> resmethrin, sumithrin
- Management Plan weighs these factor
  - Plan components
  - type, extent of necessary mitigation strategies

# Questions & Discussion

