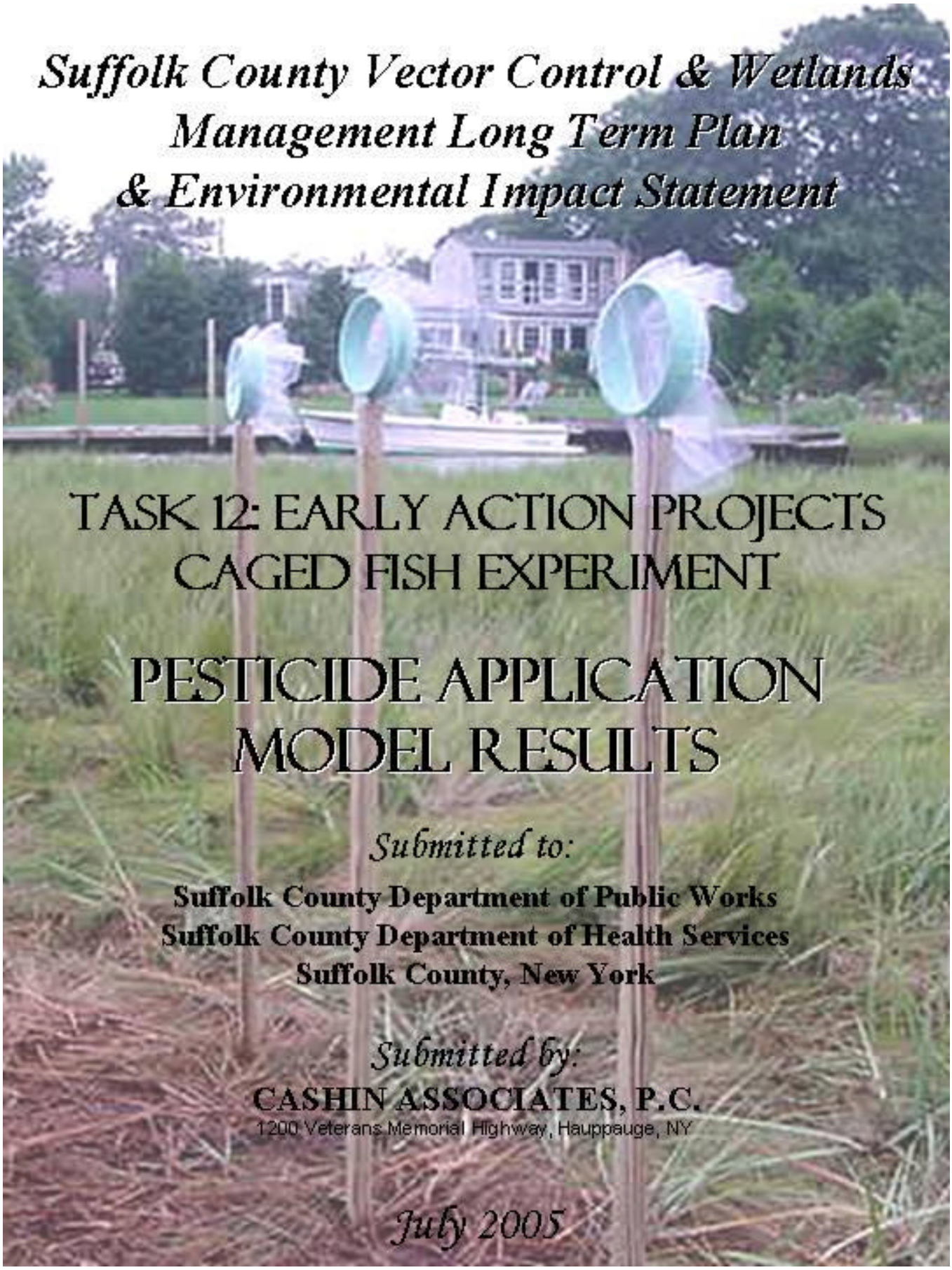

Suffolk County Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement

TASK 12: EARLY ACTION PROJECTS CAGED FISH EXPERIMENT

PESTICIDE APPLICATION MODEL RESULTS

Submitted to:

Suffolk County Department of Public Works
Suffolk County Department of Health Services
Suffolk County, New York

Submitted by:

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July 2005

SUFFOLK COUNTY VECTOR CONTROL AND WETLANDS MANAGEMENT LONG - TERM PLAN AND ENVIRONMENTAL IMPACT STATEMENT

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This report was prepared by RTP Environmental, and was reviewed and edited by Cashin Associates, P.C. (CA).

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LIST OF ABBREVIATIONS AND ACRONYMS

EPA	Environmental Protection Agency
MDL	Minimum detection limit
PBO	Piperonyl Butoxide
RTP	RTP Environmental Associates, Inc.
SCDHS	Suffolk County Department of Health Services
SCVC	Suffolk County Vector Control
ULV	Ultra low volume

Caged Fish: Calculation and Analysis of Pesticide Impacts

1. Introduction

For the August 18 and August 25 adulticide applications associated with the Caged Fish experiment, RTP Environmental Associates, Inc. (RTP) reports on the modeling results for the Modeled air concentrations and pesticide depositing. On the August 18 event, some air concentration samples were collected; these were compared to the model results. Deposition samples were collected for both sampling events, and also were compared to the model results.

Meteorological conditions were also monitored during the field tests. Portable meteorological stations, with instrumentation to obtain on-site wind speed, wind direction, turbulence, temperature, relative humidity and pressure were utilized to document site specific microscale meteorological conditions during the tests. Sensors were placed atop of two towers at about 14 feet above the ground surface. The data collection modules were set to record 15 minute averages for all variables during active spraying. For the August 18th test, one meteorological tower was located near deposition collector 12 (at the air sampling location) and a second tower was located on the barrier beach south of Mastic Shirley. For the August 25th test, only the meteorological station located on the barrier beach was used. The meteorological conditions during the August 18th test included partly cloudy skies with winds from the southwest averaging 5-9 mph. The meteorological conditions during the August 25th test included clear skies with winds from the southeast averaging 2-3 mph.

2. Air Concentrations

RTP performed a literature review to determine the range of models available for predicting environmental quality impacts associated with aerial pesticide applications. Based on the literature search, the AgDISP model developed by the Forest Service currently appears to provide the features most appropriate for predicting the behavior of ultra low volume (ULV) aerial spray applications. The specific requirements of the Suffolk County Program also require model estimates for several receptors under a variety of spray patterns that are common when aerial spraying is performed especially near shoreline environments. Because of these requirements, RTP relied on the AgDISP model to provide estimates of near field dispersion

patterns for aerial spray events and used the ISCST3 Environmental Protection Agency (EPA) approved dispersion model to calculate near and far field ground level air concentration predictions at numerous receptors.

Table 1 provides a summary of the modeling parameters used in the caged fish study. The AgDISP model requires the user to define values for several parameters from helicopter speed to canopy type and density. The values presented in the table match conditions present during the two field spray events. The duration of the spray events on required the ISCST3 model to be divided into three separate area source polygons. The polygons are depicted in Figure 1 for August 18 and figure 2 for August 25. The polygons represent the individual spray swaths that were combined into area sources, and modeled as a one hour (or portion thereof) release to simulate the spray event. This allowed RTP to match actual hourly meteorology values provided by the meteorological station at the barrier beach to be coincident with spray activities. The size of the spray blocks is proportioned to actual spray time and the release of pesticide since the emission rate is in grams per second-square meter. The area release rates were calculated from the specific spray nozzles used by Suffolk County Vector Control (SCVC).

Figure 3 provides the input screen for the AgDISP model for the conditions on August 18, 2004. AgDISP was used to calculate initial particle trajectories based on aircraft turbulence before ISCST3 was used to predict piperonyl butoxide (PBO) concentrations and deposition rates. The concentrations and deposition rates for resmethrin were scaled from the PBO results using a 54 to 18 ratio, the respective percent of PBO and resmethrin in the pesticide mix.

Table 1 - SCVC Aerial Spray Adulticide Application Modeling Parameters

AgDISP	
Helicopter speed	70 mph
Helicopter nozzle orientation	Two nozzles, 64.9% of boom extent
Droplet size distribution	Received from SCVC, hotwire test data
Release rate	0.0047 gal/acre (0.6 oz/acre scourge 54/18 PBO to resmethrin ratio)
Swath width	300 feet
Number of swaths	1
Surface roughness	1.5 meters
Meteorology	Wind speed – 8 mph for 8/18, 3 mph for 8/25 Wind direction – 90 degrees (to flight path) Temperature - 72º F Relative humidity – 90% Stability - nighttime, overcast (neutral) for 8/18 - nighttime, clear (very stable) for 8/25
Canopy	no canopy present
ISCST3	
Source release	Three separate polygon area sources Combination of three cover target areas
Release height	Determined by AgDISP output. Release height based on propwash turbulence
Vertical depth	20 meters (area source initial sigma)
Receptor height	Ground level for both air concentration and deposition
Dispersion coefficients	Urban land use
Application rate	Calculated from oz/min release from nozzles normalized at 1.16E-06 gm/m^2-sec
Droplet size distribution	Received from SCVC, hotwire test data
Meteorology	Use of onsite meteorology recorded from barrier beach locale

Figure 1 – Caged Fish Sampling and Meteorological Equipment Locations for August 18, 2004 Aerial Adulticide Application

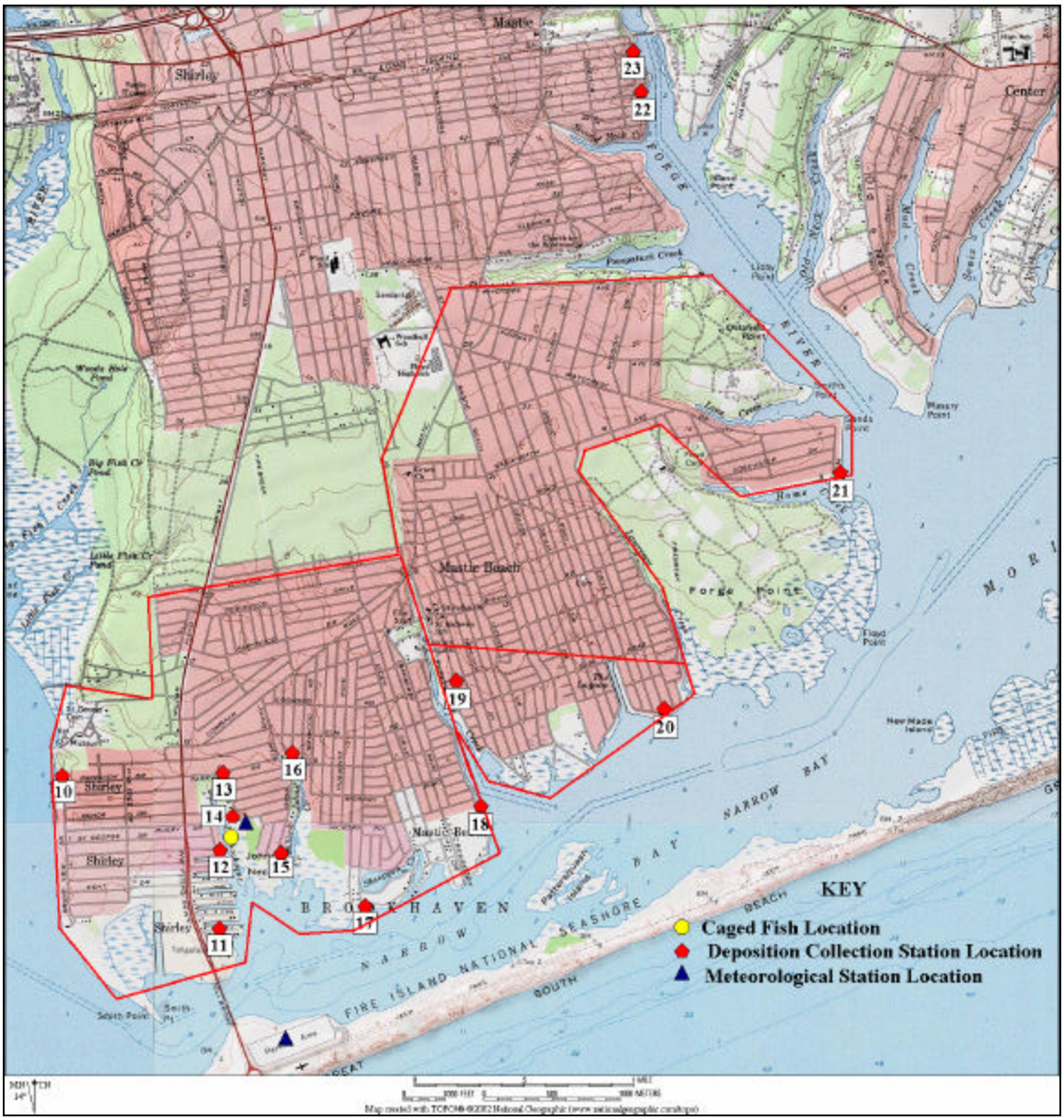


Figure 2 – Caged Fish Sampling and Meteorological Equipment Locations for August 25, 2004 Aerial Adulticide Application

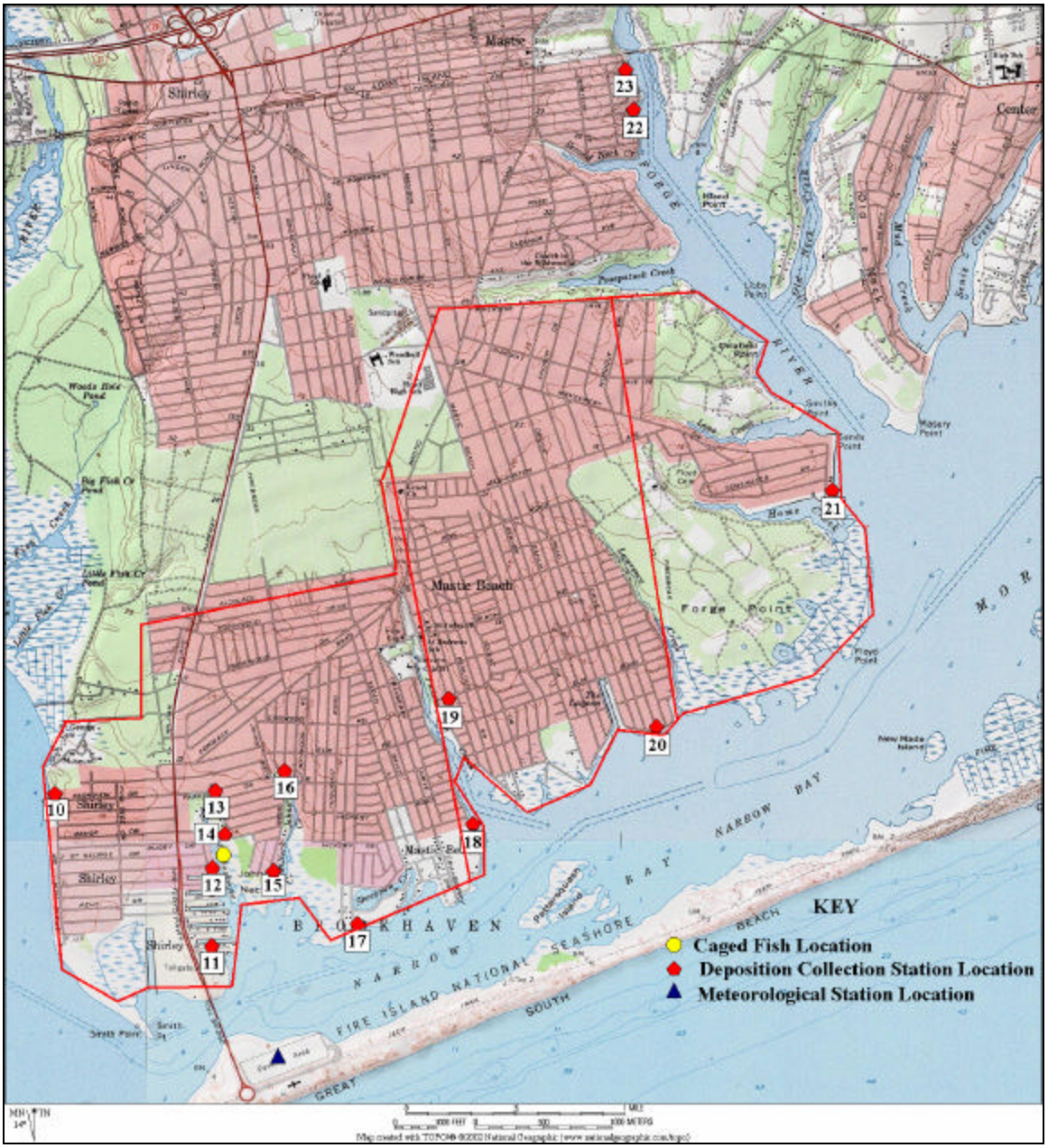


Figure 3 – Example AgDISP Input Screen for August 18, 2004 Spray Event

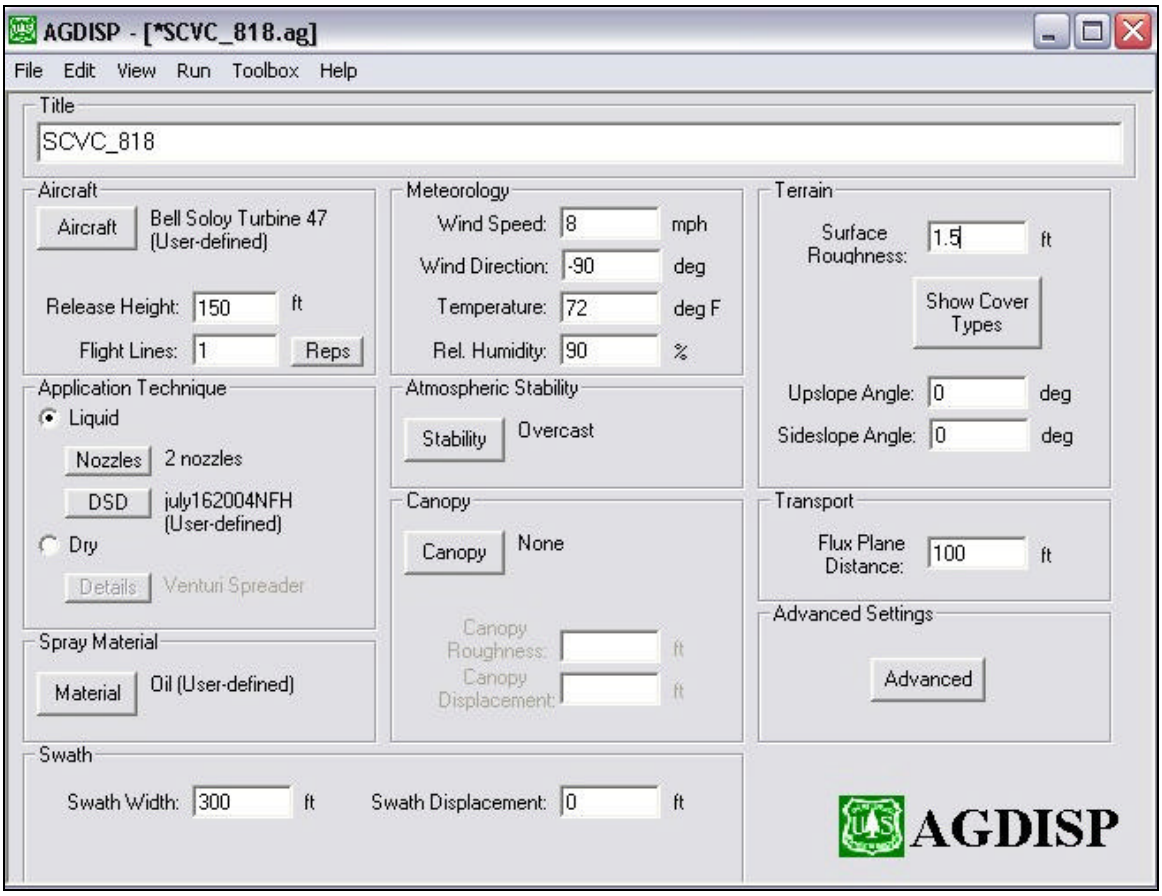
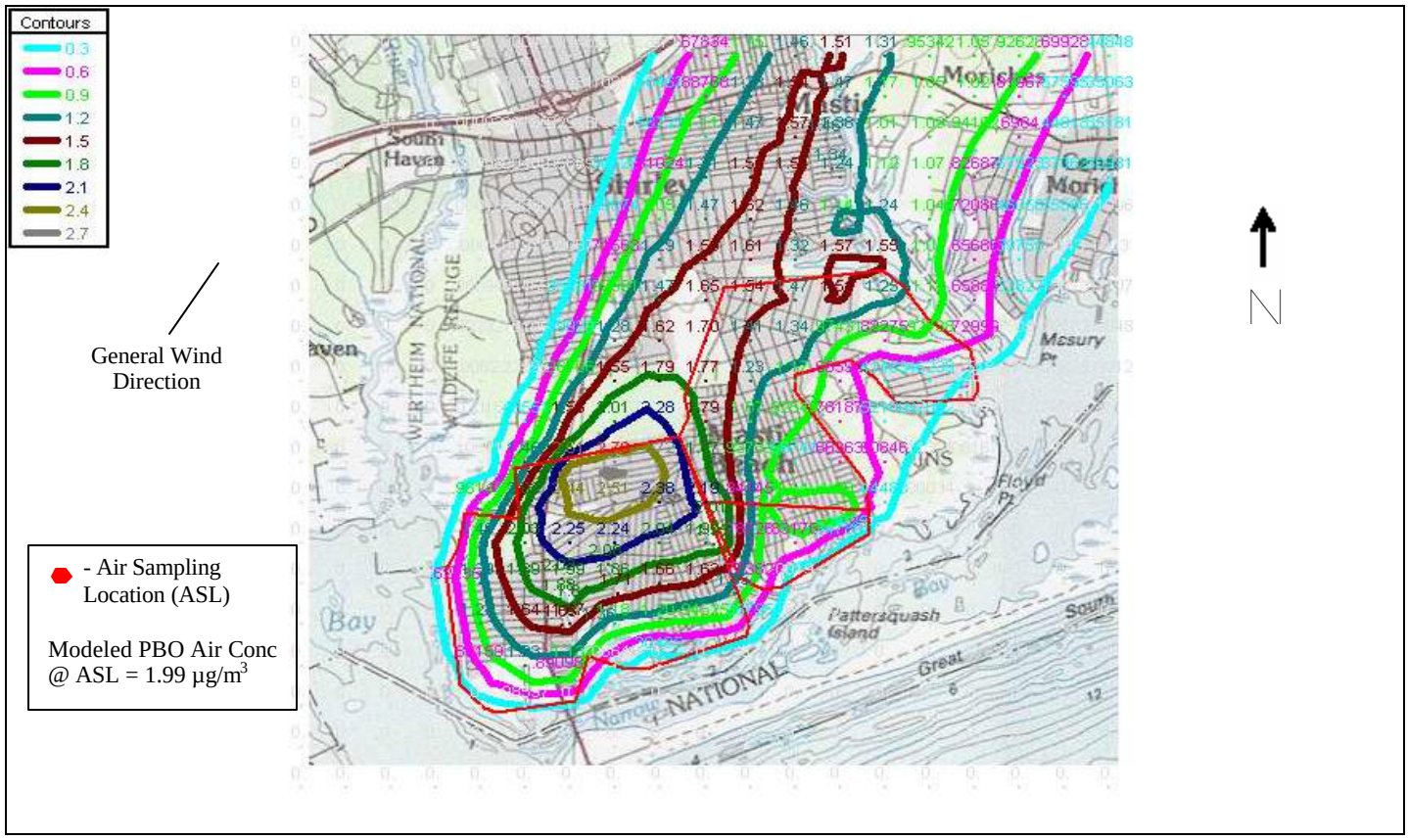


Figure 4 provides the PBO air concentration patterns as predicted by the combination of the AgDISP and ISCST3 models for the August 18, 2004 spray event. As shown, the general patterns reveal a northeast to southwest distribution of air concentrations generally covering the spray areas which, in this case, closely resemble the intended target areas. The peak values are estimated to occur to the northeast of each spray block in an elongated oval area covering the three spray blocks. This pattern was expected in that the average wind direction during the spray event was from the southwest thereby translating the individual spray swaths from the southwest to the northeast over the target area.

The model estimate of the average PBO air concentration during the spray event at the caged fish location was 1.7 µg/m^3. Actual Sample results were at or below the minimum detection limit (MDL) of 6.0 µg/m^3. Thus, model predictions were partially verified, in that the analytical data suggest the concentration was less than 6 mg/m^3. The predicted concentrations for August 25 are

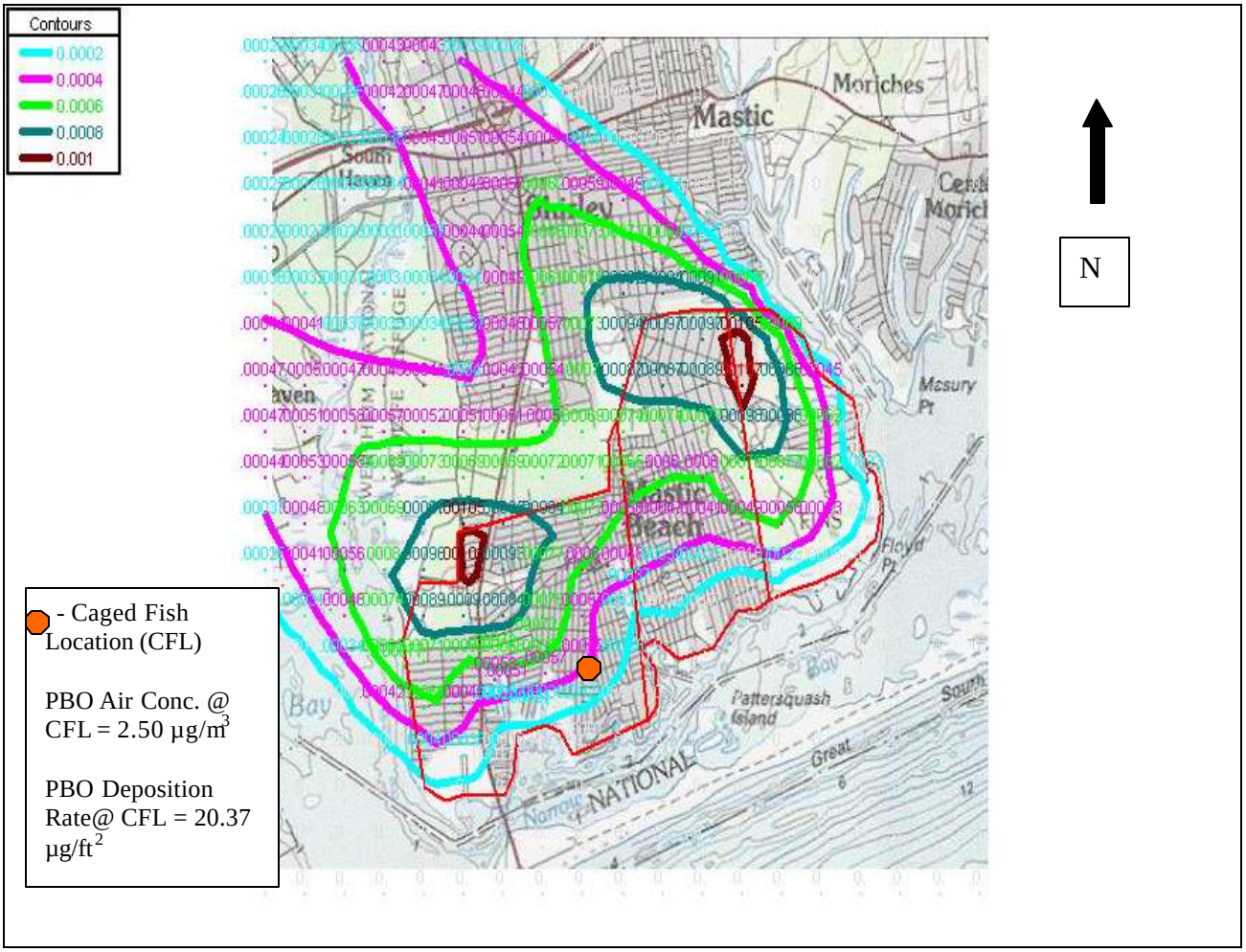
provided in Figure 5. The estimate of the average PBO air concentration during the spray event was 2.5 µg/m^3 at the location of the caged fish.

Figure 4 - Modeled PBO Air Concentrations for August 18, 2004 Aerial Application



Notes: - Contour values are micrograms per cubic meter.
- Spray block is denoted by thin red line.

Figure 5 – Modeled PBO Deposition for August 25, 2004 Mastic-Shirley Aerial Event



3. Deposition Rate Impact

The AgDISP and the ISCST3 models used in calculating the air concentration patterns were also used to calculate deposition rates. The models used the same input parameters for each spray block described above.

Table 2 provides a comparison of the PBO deposition rates predicted by the AgDISP/ISCST3 model combination and the values measured by Suffolk County Department of Health Services (SCDHS) on August 18. Figure 1 provides the actual location of the deposition samples. The model and observed values are in reasonable agreement. The peak observed value overall is 21.7 µg/ft^2 while the model peak predicted value over the entire area is 21.3µg/ft^2. In general, the predicted values tend to exceed observed levels by a factor of three times on average, although the results are not consistent. The results from a subsequent study at Cathedral Pines indicated that the collection plate protocol used for deposition samples may have a negative bias due to aerodynamic effects associated with the chilled surface as well as the half life of pesticides. The extent of the negative bias has been roughly approximated at one third the actual value during the Cathedral Pines test, which is in agreement with the August 18 data.

For the August 18 event, the PBO deposition rate predicted by the model at the caged fish site was 14.0 µg/ft^2. The observed levels at deposition Station 12, the site closest to the caged fish was 21.7 µg/ft^2. The model predicted resmethrin deposition rate at the caged fish site was 4.7 µg/ft^2. The observed level at Station 12 was at or below the sample MDL of 0.2 µg/ft^2.

For August 25, the model and observed values show reasonable agreement at some points and less at others. The model highest predicted deposition rate was 99.0 µg/ft^2, while the highest observed value was 19.5 µg/ft^2. The average ratio of predicted to observed values on August 25th was 14 to 1. In this case, an additional reason for model over prediction versus observed data could be associated with atmospheric decoupling which occurs during light wind stable conditions. The model does not account for decoupling which could be responsible for preventing released pesticides from reaching the ground.

For the August 25 event, the PBO deposition rate predicted by the model at the caged fish site was 20.4 µg/ft^2. The observed PBO level at the caged fish site was 0.7 µg/ft^2. The predicted resmethrin deposition rate at the caged fish site was 6.8 µg/ft^2. The observed level was at or below the sample MDL of 0.2 µg/ft^2.

Table 2 – Measured vs. Predicted Deposition Rates

August 18, 2004	**Deposition Station Location (µg/ft^2)**									
Spray Event	**10**	**11**	**12**	**16**	**17**	**18**	**20**	**21**	**22**	**23**
PBO										
Predicted	3.4	4.8	9.5	11.6	2.0	7.5	2.0	2.7	11.6	10.9
Observed	1.7	< 0.5	21.7	2.4	< 0.5	0.9	< 0.5	9.3	10.9	2.6
	Study Area Maximum Prediction = 21.3							**Avg Ratio of Pred to Obs=2.5:1**		

August 25, 2004	**Deposition Station Location (µg/ft^2)**									
Spray Event	**10**	**11**	**12**	**13**	**15**	**16**	**17**	**18**	**19**	**20**
PBO										
Predicted	55.8	8.0	16.7	52.2	15.2	52.2	0.7	0.0	26.8	0.0
Observed	19.5	2.7	12.0	10.7	< 0.5	3.1	< 0.5	< 0.5	0.5	< 0.5
	Study Area Maximum Prediction = 99.0							**Avg Ratio of Pred to Obs = 13.8:1**		

Notes:
- Adulticide applied is Scourge 54/18 (54% PBO and 18% resmethrin).
- The Minimum Detection Limit (MDL) is 0.5 µg/ft^2 for PBO and 0.2 µg/ft^2 for resmethrin.