

Scope of Study for 4-Poster SLN Application for Fire and Shelter Island, NY

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16 February to 30 June, 2008

Objective & Introduction: This document outlines the proposed scope of study as the experimental portion of the Special Local Need (SLN) application for the 4-Poster acaricide delivery system on Fire and Shelter Islands (Long Island, NY). This study is designed to address the technical concerns about 4-Poster registration and use in New York State as expressed by New York State Department of Environmental Conservation (DEC) and Department of Health (DOH). Permits for deer capture, marking and baiting have been received from the DEC-Bureau of Wildlife, Special Licenses Unit in Albany (DEC LCP#1211). Approval for deer capture and immobilization was also received from the Cornell University Institutional Animal Care and Use Committee (Protocol #2007-00102). Finally, the DEC-Bureau of Pesticides issued an SLN registration for use of the permethrin acaricide (SLN# NY-070005). This proposal includes study area descriptions, and plans for the initial field work that will occur during 16 February to 30 June, 2008. This project is anticipated to continue for at least three years, and additional years may be needed to adequately address all study objectives. Although this Scope of Work was written to address study objectives for the duration of the project, only a portion of the work will be completed under the current contract (by 30 June 2008).

The 4-Poster device is a host applied tick control technology (Pound et al. 2000a). Deer are attracted to the unit by corn and when they feed rub against rollers that apply an acaricide. The blacklegged tick, *Ixodes scapularis* Say, and lone star tick, *Amblyomma americanum* L., are both nuisance and medical pests on Long Island and other regions. White-tailed deer, *Odocoileus virginianus* (Zimmermann), are a keystone host for both these species. By targeting adult ticks where they are most commonly found, deer application is highly effective in terms of amount of material used that ends up in the target area compared to conventional broadcast lawn sprays. The reduction of deer-fed adult ticks ultimately reduces the egg, larval, and nymphal stages of these ticks. Because of the multi-year tick life cycle this control takes several years to be apparent. The proposed study intends to have the 4-Poster units treated with a 10% permethrin product designed specifically for use with the 4-Poster device (4-Poster Tickicide, EPA Reg. No. 39030-12, Y-TEX Corporation, Cody, WY). A three-year field study in Maryland using 4-Poster devices with similar acaricide formulation demonstrated a 91-100% reduction in questing ticks after three years of deployment (Solberg et al. 2003). The 4-Poster device has also been tested in other large field deployments using other acaricides. The USDA Northeast Area-wide Tick Control Project deployed 4-Poster units charged with Amitraz (Pound et al. 2000b, Pound et al. NEATCP – History and Protocol). This large scale test (7 locations in 5 states) also demonstrated large reductions in free-living nymphal ticks (81.7 and 99.5% for blacklegged and lone star ticks, respectively) (Pound et al. NEATCP – History and Protocol). Besides these large scale trials in the Eastern United States, studies in Texas using fenced pastures with 4-Posters have also demonstrated a high degree of success in reducing free-living ticks (Pound et al. 2000).

These studies suggest that the 4-Poster system is of great potential value for reducing tick numbers and associated nuisance and health risks on Long Island and in other heavily infested areas of New York. This proposed study is designed to address the technical concerns of NYS regulatory agencies about the 4-Poster unit and its use. This study will accompany experimental deployment of 4-Poster in two locations in Suffolk County, New York, that have a special local need for tick control. The technical concerns of NYS DEC and DOH were identified in

meeting at Stony Brook on Jan. 23, 2007, which was attended by the study authors, representatives from both departments, outside experts, and affected citizens. These concerns were further clarified with personal correspondence between the study authors and representatives of both departments subsequent to the meeting. The technical concerns are outlined below.

Overview of Technical Concerns: The concerns of NYSDEC and DOH broadly fall into three general categories:

I. Human and wildlife-associated risks due to change in deer movement and behavior.

Voiced concerns include:

- potential impact on vegetation near the deployed stations in both natural and residential settings
- possible increase in deer road crossing leading to more vehicle collisions
- increased contact and potential disease transmission between deer
- changes in deer mortality due to feeding or reduced tick pressure
- use of feeding stations by non-target wildlife.

II. Possible increased human exposure to permethrin via handling and consuming treated deer. Concerns expressed are dermal exposure via the deer hide during handling as well as the possibility of permethrin accumulation in deer tissues that would be orally ingested by consumers of venison.

III. Efficacy of the 4-Poster system in controlling tick densities in human inhabited and visited areas. The 4-Poster label dictates that stations must not be deployed within 100 yards of anywhere a child may be present without adult supervision. It has been agreed that a reduction in tick densities can serve as the best proxy for a reduction in the likelihood of human disease transmission.

Treatment Areas: Shelter Island (2), Western Fire Island (1)

Shelter Island contains approximately 7,000 acres, with nearly 5,000 acres devoted to moderate to high density residential development. On Shelter Island 4-Poster devices will be deployed on approximately 2,400 acres of developed lands with a targeted density of 1 bait station per 100 acres. There will be one 1,200-acre treatment area on the west side of Shelter Island. The north border being Shore Road from Weck's Pond to West Neck Road, and the eastern border being Menantic Road to Burro Hall Lane. A second 1,200-acre treatment block on the north-central part of the island includes the western border along the most southern point of Gardiners Creek to North Ferry Road, and the Southern border being North Ferry Road, Manwaring Road, and Burns Road. Although, only 2,400 acres on Shelter Island are to be monitored, it would be desirable to have the entire area (approximately 7,000 acres) totally treated as this would provide a true test of efficacy by treating as many deer as possible on an island with dense populations of both deer and ticks. The citizens of Shelter Island currently plan on deploying 4-Poster units widely on the island upon issuance of a SLN registration. It is anticipated that 60-65 4-Poster stations would be needed for relatively complete coverage of Shelter Island (including most of Mashomack Preserve).

We intend to work with both Shelter Island and North Haven to try and maintain at least 30-40 deer per square mile in the study areas and in the control site. A verbal agreement regarding nuisance hunting was reached between outside experts, town officials, and DEC personal. There will be no nuisance hunting on Shelter Island between 01 March and 30 September. Between 01 October and 14 December nuisance hunting is permitted on all areas of Shelter Island. Baiting, after-hours hunting, and hunting within 100 yards of '4-Poster' Deer Treatment Devices are prohibited. All laws, rules and regulations that apply to normal seasonal hunting activities (as distinguished from nuisance hunting activities) apply to such seasonal hunting activities. Between 15 December and 28 February nuisance hunting is permitted in all areas of Shelter Island. Baiting and after-hours hunting are permitted in connection with nuisance hunting activities. We will be requesting a 200 yard no-hunting buffer on any property deer are being trapped, this will be coordinated with the Chief of Police. Tagged deer that wander into areas open to deer harvest could be killed as any other deer on the island, but it will be mandatory to report the kill location, and return the animal's ear tags. We will request that hunters not kill deer with GPS collars (10-15 adult female deer per study area). During 2006-07, the Town of Shelter Island removed 478 deer (146 males, 332 females) as part of a herd reduction program to address tick densities and other deer-related concerns.

A third experimental area will be located on western Fire Island, only work towards Objective III (monitoring of tick abundance) is planned for this deployment area. There is no hunting on Fire Island. Over the years of the deployment these devices are likely to be moved around to where they are most effective and deal with changing circumstances. As outlined in the SLN letter we will give notification prior to changes taking place.

Control Site: Village of North Haven

The Village of North Haven is approximately 2.7 square miles, and is situated directly south of Shelter Island. It is surrounded mostly by water, and is accessible from the north by a ferry, and by a two-lane highway from the south. As of the 2000 census, there were 743 residents in 337 households, with 209 families residing in the village. The population density was 105.9 people/km² (274.2 persons/mi²). There are 578 housing units at an average density of 82.3 homes/km² (213.3 homes/mi²).

Deer-related concerns (disease transmission, vehicle accidents, plant damage) are similar for Shelter Island and the Village of North Haven. Both lone star and black-legged ticks are present in North Haven, as for Shelter Island. North Haven has an active nuisance hunting program for deer, and it is estimated there may be 100 deer in the town (37 deer/mi²). As for Shelter Island, the nuisance hunting program will be continued and adjusted to maintain a winter density of 30-40 deer/mi² during our study.

Objective I. Human and Wildlife Risks due to change in Deer Behavior/Movement.

The goal of this objective is to evaluate suburban deer movements and possible impacts associated with 4-Poster devices. Deer will need to be tagged and radio-collared to document use of the 4-Poster stations and potential changes in behavior or movements. Deer will be captured during January through March each year using modified Clover traps (McCullough

1975), rocket nets (Hawkins et al. 1968), drop nets, and dart rifles. During the entire 3+ years of the project, 120 to 150 deer will be captured, collared, and released at treatment and control sites. The goal will be to keep approximately 30 to 45 tagged deer available for the camera census in each of the control and treatment areas. However, during this initial contract (February to June 2008), we anticipate catching 10-15 deer in each of the study areas (30-45 deer in total) if weather for deer trapping is suitable.

During winter 2008, 5 GPS (Televilt, Inc., Sweden) collars will be deployed on each of the two Shelter Island study sites to examine fine scale movements of deer in relation to roads and 4-Poster devices. Collars will be set to obtain one location per hour, and should last approximately 14 months. In addition, 5 deer will be fitted with GPS collars in the control site in North Haven. Deer will be monitored weekly primarily from April through December. Deer locations will also be collected during January through March as time permits within the deer trapping schedule. Actual sample sizes will vary depending on the difficulty in finding collared deer, and access to private property.

Xylazine and ketamine hydrochloride (Roughton 1975; Jacobsen 1983) will be used to tranquilize all deer. Yohimbine hydrochloride (Hsu and Shulaw. 1984; Jessup and Jones 1983) will be used as a reversal agent. While sedated, all deer will be marked with uniquely-numbered cattle ear tags, and GPS radio collars will be affixed to a sample of adult females. Unique tag colors will be used for each treatment and control site.

Previous research indicated the camera census technique may be viable with white-tailed deer in forested (Jacobson et al. 1997) and suburban environments (Boldgiv 2001). Each spring, we will place infrared-triggered cameras across a grid system (approx. one camera per 100 acres) over established bait sites in both control and treatment areas. We anticipate estimating deer density each spring for approximately 1,200-acre blocks at the control and treatment sites. The camera census will continue daily for 7-10 days during late March or early April. Estimates of deer density will be made using capture-recapture methods (Lee and Chao 1994). A sample size of approximately 35-40 marked deer at each study site would be sufficient to allow population estimation with reasonable 95% confidence limits using current capture-recapture population estimation techniques (Programs CAPTURE or NOREMARK; White et al. 1982). This density of marked deer will not be achieved unless the project is funded through 2009. We will also request that the Town of Shelter Island conduct their aerial deer count in late March (by Vision Air Research, Inc.) for comparison to our population analysis from IR-triggered cameras. During November 2005, Vision Air, Inc. estimated there were 570 deer on Shelter Island in 189 groups. In March 2007 (after deer removal), Vision Air, Inc. counted 360 deer in 108 groups.

Deer movements will be monitored via radio-telemetry prior to and during the survey to determine the availability of animals during the camera census, and immigration/emigration rates. Radio-telemetry data on deer movement patterns will provide important information as to the degree of closure of the suburban deer populations.

Data from IR-triggered cameras and tagged deer will provide estimates of survivorship (conversely mortality), and recruitment of fawns each year. The photo samples taken during September from the 24 randomly-selected 4-Poster stations will provide information on buck:doe and fawn:doe ratios. Productivity of deer and sex ratios can be compared for control and

treatment sites, and trends can be monitored within each study area during the 3 years of the project.

During April through November each year (April to June 2008 on the current contract), a random sample of 24, 4-Poster devices will be selected and monitored with infrared-triggered cameras. During one week each month, photos will be down-loaded from the digital memory cards and batteries on the units will be checked. These photos will be used to monitor visitation of non-target wildlife to the 4-Poster bait stations, and the potential for deer-to-deer contact.

The Town of Shelter Island, Village of North Haven, and Suffolk County police, will be asked to track deer vehicle collisions in both control and treatment areas. Actual locations of deer-car accidents will be mapped using GPS coordinates to see if there is any measurable clustering near 4-Poster devices.

Transects for monitoring vegetation damage will be established near the same random sample of 24, 4-Poster devices used for the camera survey. An additional 12 vegetation transects will be deployed at random points in the control area at North Haven. Deer browsing intensity, plant species damaged, and shrub thickness (density board), within distance classes (10-100m, 101-200m, 201-300m) from the 4-Poster devices (treatment) or random points (control). During the current contact, it is anticipated that transects will be sampled one time during June 2008.

Objective II. Investigation of Permethrin Residues in and on Deer from Treated Areas.

Work towards this objective will be initiated in fall 2008 if the current contract is extended. Tissue samples will be available from deer killed during the nuisance harvest in November and December. There are no public deer check stations on Shelter Island, so we will work with Town staff to collect tissue samples and swabs from deer harvested under Bonus Deer Permits issued by DEC. If the entire developed area on Shelter Island is treated with 4-Poster stations, these deer can be sampled outside of the 2,400-acre study sites. The heart, liver, and a sample of muscle of harvested deer will be stored in glass containers, frozen, and tested for permethrin residues at the Animal Health Diagnostic Laboratory at Cornell using a mass spectroscopy technique. Deer from 4-Poster treatment areas will be collected in collaboration with the Town of Shelter Island Deer Management Program during November and December 2008. Deer hides will be wiped with cotton swabs along both sides of the head and neck in areas likely to contact 4-Poster rollers. We will focus on tagged deer that we know have contacted 4-Poster stations based on the IR-camera photos. These samples will be tested for permethrin by a chromatography technique (Miller et al. 1983). The sample size will be approximately 45 animals for the entire duration of the study (about 15 deer per year). This number includes a sample of 5-10 deer from the control site in North Haven so that we can evaluate background permethrin levels (potential contact from lawn spraying).

Objective III. Efficacy of 4-Poster System.

Work towards this objective will begin in June 2008. However, data collection will be completed only if this contract is extended. Free-living black-legged (deer tick), and lone star tick nymphs will be sampled by dragging a 1 x 1 m white widewale corduroy flag across the area to be sampled (e.g., plants, leaf litter) for one minute (Ginsberg et al. 2004). Three 4-Poster stations in each treated area will be selected for tick abundance sampling twice annually in June

and July. By targeting this time of year it will allow sampling of nymphs of both species of interest. The most important criteria in selecting sampling areas is the high potential to be good tick habitat and care will be taken to sample similar habitats between the treated areas and the control site. Another factor to be taken into consideration in selecting sampling sites is the avoidance of areas that have been treated with acaricides, our current strategy is to identify these areas via survey of residents. Fifteen one minute flagging samples will be taken at each of three distances from the station: 10-100, 101-200, and 201-300 m (thus there will be 45 flagging samples, 15 at each distance range, taken per sampled unit). In the control site sampling (a total of 45 minutes of flagging as with sampled areas in the treated areas) will take place in locations with similar deer density and habitat type at the different distances from the control 4-Poster units. Controls will be sampled as soon as possible after the sampling of a treated area for comparison. The best case scenario would be to sample the control site on the same calendar day but this may be impossible due to logistical constraints. The next best option would be to sample the control area as soon as possible during the same time of day the treated area was sampled. Data will be analyzed by comparing tick abundance between the treated area and control as well as examining it for interaction with distance from the 4-Poster station. The density of free living nymphs in the summer of 2008 will be unaffected by the 4-Poster deployment of fall 2007 and spring 2008 and therefore will serve the purpose of a "pretreatment" count. As the sampling effort is confined to the nymph stage during summer there will be no issues of comparing tick monitoring from different parts of the year.

In addition, an effort will also be made to examine ears from hunter-killed deer for ticks. At least 15 ears from Shelter Island and North Haven will be examined in November of each year of the study (starting in fall 2008 if the contract is extended).

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