Exhibit A

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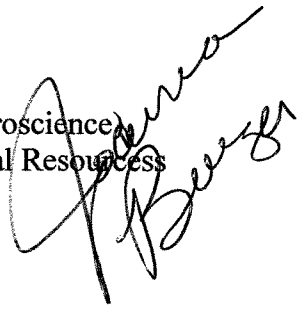
NORTHERN PINE SNAKE and the WAL-MART SUPERSTORE PROPOSED DEVELOPMENT: CAFRA APPLICATION 1500-04-001.2

REPORT OF DR JOANNA BURGER
Distinguished Professor of Biology
Division of Life Sciences (Cell Biology and Neuroscience)
Department of Ecology and Evolution and Natural Resources
Rutgers University



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PREPARED FOR: R. S. Gasiorowski, Attorney at Law
Gasiorowski & Holobinko
54 Broad Street
Red Bank, NJ 07701
732 212 9930
jiacoves@gmail.com

BRIEF BIOGRAPHY. I obtained my BS from the State University of Biology at Albany in 1963, my MS in Science Education and Zoology from Cornell University in1964, my PhD in Ecology and Behavioral Biology from the University of Minnesota in 1972, and an Honorary PhD from the University of Alaska at Fairbanks in 2006. I have taught ecology, behavior, and ecological risk at Rutgers University since 1973. My research interests are primarily in ecology and social behavior of vertebrates, interactions between humans and other organisms, eco-toxicology, ecological and environmental assessment and monitoring, and ecological and human health risk assessment. I have over 400 papers in these fields, and published or edited 20 books, including *Whispers in the Pines* about pinelands ecology and wildlife, including the New Jersey Pine Barrens (Rutgers University Press). I serve on the Editorial Boards of several environmental and eco-toxicology journals, including *Environmental Research*, *Environmental Monitoring and Assessment*, *Science of the Total Environment*, *Journal of Toxicology and Environmental Health*, *Environmental Bioindicators*, and *Journal of Nuclear Energy and Power Generation Technologies*. I have served on committees for the National Academy of Sciences, Environmental Protection Agency, and U.S. Fish and Wildlife Service, as well as serving on the Endangered and Non-Game Committee for the State of New Jersey since the late 1970s. I am a Fellow in the American Association for the Advancement of Science (AAAS), American Ornithologists Union, International Ornithological Union, and the International Union of Pure and Applied Chemistry. I have received the Brewster Medal from the American Ornithologists Union, and the Distinguished Achievement Award of the Society for Risk Analysis for ecological and environmental evaluations and risk assessment.

I have studied the ecology and behavior of the Northern Pine Snake since 1985, and have published over 25 research papers on Pine Snakes, many with R. T. Zappalorti of Herpetological Associates. These studies have covered many aspects of Pine Barrens ecology and Pine Snake life histories, including reproduction, development, feeding and hibernation. I have studied habitat and nest site selection, and hibernaculum (winter den) characteristics. Our study of hibernating Pine Snakes is the longest of its kind, and we have published more peer-reviewed papers on Pine Snakes than anyone else in the world.

DOCUMENTS REVIEWED. I have reviewed a number of documents (see Document List), and a complete list of my publications relevant to Pine Snakes (Burger Publication List) at the end of this document. The citations in the report will be found in the Reference list, the Documents list, or in the Burger Publications List.

ABSTRACT OF OPINION. I have been asked to evaluate mitigation measures proposed in a potential settlement of a dispute between the Department of Environmental Protection (NJDEP) and Jaylin Holdings, LLC over the Department's denial of a Coastal Area Facilities Review Act (CAFRA) permit for construction of a Wal-Mart store on a site within the CAFRA zone of Ocean County, New Jersey (designated CAFRA Application No. 1500-04-001.2). These proposed measures, which include the acquisition and treatment of land other than the development parcel, are justified by the permit applicant on the basis of a Conceptual Habitat Evaluation Method for Northern Pine Snakes (Conceptual Method) prepared by the New Jersey Endangered and Nongame Species Program (ENSP) and applied to this case in reports by the permit applicant's consultants and, it appears, by ENSP. Together, the Conceptual Method and its use to validate off-site mitigation measures, such as proposed in this case, constitute a new and untested No Net Loss of Habitat Value methodology.

After review of the relevant documents, it is my expert scientific opinion that the proposed measures are not scientifically justified; the weight of evidence supports the conclusion that the mitigation measures will not be effective in protecting Pine Snakes on a local, meta-population or regional basis; the No Net Loss of Habitat Value methodology is fundamentally flawed; and the methodology's application in this case is also fundamentally flawed. It is my expert opinion that the proposed development plan for the Wal-Mart store on the subject property, both with or without the proposed mitigation measures, will adversely affect the threatened species habitats of Pine Snakes both on the development parcel and in the surrounding area. More specifically, I conclude that:

1. The proposed mitigation sites will not benefit the local population or meta-population of Pine Snakes using the proposed Wal-Mart site because these mitigation sites are, with only one exception, separated by excessive distance and fatal barriers to Pine Snake movement. The proposed mitigation scheme is aimed at a completely different meta-population of Pine Snakes and therefore cannot mitigate population impacts at the proposed development site.

2. The specific methodologies used to assign Habitat Value Units to land and to compare disparate parcels to reach a conclusion of "No Net Loss of Habitat Value" for Pine Snakes are untested for Pine Snakes, are not accepted within the scientific community, have not been subjected to peer review or public comment or adopted as state policy, and suffer from fundamental flaws.

3. The land-management mitigation measures proposed for these properties are untested, are not accepted within the scientific community, and suffer from fundamental flaws, both in the short-term and the long-term.

4. The value of the existing habitat of the development parcel, which includes known Pine Snake locations and critical habitat components (especially a hibernation site), is undervalued in the habitat evaluation, and the applicant did not conduct a survey adequate to determine the full range of Pine Snake use of the property. In contrast, the designated mitigation properties are not known to be inhabited by Pine Snakes, and some portions of the mitigation properties are not likely to be suitable habitat used by Pine Snakes.

5. The behavior of Pine Snakes is not adequately considered in the proposed measures and development plan, particularly the importance of a known hibernation site.

6. The proposed development will damage the Pine Snake population using the existing habitat of the development parcel, and will probably destroy the value of this habitat altogether. Among other things, the proposed "buffer" around the known Pine Snake hibernaculum on the development parcel is arbitrary and insufficient in size and shape.

7. The mitigation measures are unlikely to be effective in improving the habitat value of the mitigation parcels, and, in some cases, adding habitat value (e.g. mitigation measures such as increased open areas) does not actually improve the habitat or increase its value to Pine Snakes.

It is both highly unusual and disturbing that a new and untried methodology such as the Conceptual Model and No Net Loss of Habitat Value methodology for Pine Snakes, on which the proposed settlement relies, has not been presented to New Jersey's Endangered and Nongame Species Advisory Committee (a panel of experts established by statute, on which I sit) as a method of evaluating habitat or agreeing to decreases in habitat value of sites with known Pine Snakes (or any other species), has not been peer reviewed within the scientific community, and has not been presented to the public as a general method for public comment. Important matters dealing with the endangered and threatened wildlife conservation are normally taken before the Endangered and Nongame Species Committee, yet this was not done.

MAIN POINTS OF MY OPINION

My Evaluation of the CAFRA permit application, the proposed mitigation measures, and associated materials is based on several layers of examination, all relating to Pine Snakes, and not to other aspects of the permit. These issues include:

A. Regional and Landscape Issues
B. No Net Loss of Habitat Value Methodology
C. Development Plan for the Site Itself: Loss of Known Pine Snake Habitat
D. Mitigation Parcels and the Enhancement Plan for the Mitigation Properties
E. Local Scale Pine Snake Behavior and Ecology

The main findings and conclusions of my review for each of these layers is outlined below, and documentation and discussion for each of the points follows the initial list:

A. Regional and Landscape Issues

1. Pine Snakes in the New Jersey Pine Barrens are limited to meta-populations that are bounded by barriers to movement and inter-breeding. These barriers include unsuitable habitat and hostile habitat, such as major roads, housing developments, and industrialization, as well as excessive distance of travel. Within such a meta-population, there are one or more local populations, which use distinct or partially overlapping habitats and are capable of interacting with one another without facing these barriers.

2. A local population on one site that is not connected to, and part of the same meta-population as snakes using another site, will not benefit by mitigation on these other sites.

3. With the exception of one mitigation site, the mitigation parcels are too distant from the proposed Wal-Mart site for Pine Snakes to travel between these sites, and the sites are separated from the Wal-Mart site by at least one major highway barrier to these sites (Route 70). Thus these mitigation properties, even with their enhancements, will not aid the population (or meta-population) on the Wal-Mart site. This conclusion is verified by the ENSP's own mapping of Species-Based Habitat Patches (NJDEP 2009).

4. Pine Snake populations that are connected by suitable habitat that is currently unprotected or protected only by agreements or good intentions of current landowners (without legally binding or codified protections) are not assured of continued protection. Thus, a sound mitigation plan cannot rely on the potential corridors and additional habitat that might be provided by any agreement with the Heritage Minerals, which is not legally protected.

B. No Net Loss of Habitat Value Methodology

1. The No Net Loss of Habitat Value methodology has not been used previously or tested in New Jersey as a viable method that does, in fact, result in no net loss of suitable habitat or populations. It has also not been used with Pine Snakes (except for the current application). It has not been peer-reviewed or tested in the field. Development of such a No Net Loss of Habitat methodology for any species requires field testing, intra- and inter-observer reliability confirmation, and independent replication.

2. The No Net Loss of Habitat Value methodology has not been generally accepted by the scientific community or by the State of New Jersey as a basis for mitigation, either in regulations, reports (except NJDEP 2009a and the current one), or with respect to Pine Snakes or other wildlife. It has not been presented to the Endangered and Nongame Species Committee (advisory to DEP), nor to the public, either as a scientific postulate or as a means of meeting the applicable regulatory habitat protections.

3. CAFRA regulations require conservation of the "local population" of protected wildlife. The No Net Loss of Habitat Value is not referenced in the CAFRA regulations. Nor do the regulations set forth any methodology that would permit on-site habitat destruction in exchange for off-site habitat enhancement.

4. The No Net Loss of Habitat methodology does not include any objective basis or written protocol for assigning habitat values to specific sample points. Instead, it relies on the subjective judgment of the assessor. So, while the methodology identifies seven habitat features as criteria for evaluation of the field-based assessment, it does not provide any explicit, rigorous or scientifically tested method for assigning values to those criteria. This defect is replicated in the methodology's combining of the three means of evaluation – remote sensing, on-site inspection, and threat assessment. While the (subjective) values given for the first two means are mathematically averaged, the third is not, but seems to be treated as some kind of personal "gut-check."

5. The methodology does not address the complexities required to assign and compare habitat values among different properties. The methodology treats all properties as fungible, applying the seven evaluation criteria independently of one another and in the same (subjective) fashion to all distinct sites. In fact, the value of the same soil type, for example, may vary from site to site depending on other factors, such as vegetation, fire history, or the proximity of other soil types. All of this is ignored in the methodology.

6. The No Net Loss of Habitat Value methodology examines only the hypothetical increase or decrease in habitat value, without respect to the baseline habitat value originally present at the site. This method is faulty because the same habitat

management activities are not necessarily related in a linear, 1:1 fashion in habitats with different baseline conditions.

C. Development Plan for the Site Itself: Loss of Known Pine Snake Habitat

1. The proposed Wal-Mart site is prime, critical habitat for Pine Snakes. In fact, it is very likely that more snakes are using the site than found by the developer's consultant, due to the biology of Pine Snakes and the inadequate survey methods used.

2. Pine Snakes are dependent on hibernation sites known to the snakes for continuance of local and meta-populations. Artificial dens are less likely to succeed in this case and are generally inferior to natural dens.

3. The habitat evaluation of the site is flawed because the actual presence of snakes is not accounted for in the evaluations.

4. The current plan does not provide for a sufficient buffer around the hibernation site, as required by CAFRA regulations. The buffer in this case is to be only 164feet. This distance has no basis in science, the biology of Pine Snakes, or experience working with Pine Snakes.

5. The buffer is not only too small, but it is shaped to provide only a narrow access to the hibernaculum. The relatively narrow "neck" of approach that would be provided by the development plan for the Pine Snakes reduces the viability and usefulness of the hibernation site, particularly for young snakes that have difficulty locating hibernation sites.

6. The narrow buffer, albeit accompanied by a fence to prevent snake movement, will result in undue disturbance around the hibernation site. While snakes are hibernating in the winter, they sometimes come to the surface if the temperatures warm up (in January or February). Construction near the hibernaculum will cause a disturbance, even in winter.

7. In addition to reducing total Pine Snake habitat, the retention basin reduces the area required by the snakes for movement from the remaining habitat. Further the retention basin blocks off some of the wetlands edge area to the snakes, a habitat they often use in the summer for foraging.

8. The habitat value evaluation of the site is flawed because it is dependent upon the subjective judgment of DEP personnel in collaboration with the Wal-Mart consultants (who often averaged scores or agreed on a lower value than NJDEP initially concluded) without benefit of any objective, written criteria for arriving at the mean values for the value of mitigation.

9. There is no provision for additional study before construction to ascertain a better estimate of Pine Snake use of the site or of the hibernaculum, there is no provision for the enhancements and property acquisition to be completed before construction, and there is no study to determine that the enhancements actually worked (before destruction of habitat on the Wal-Mart site). No construction on the Wal-Mart site should be initiated without these studies.

D. Mitigation Parcels, and the Enhancement Plan for the Mitigation Properties

1. The properties used for mitigation, with only one exception, will not benefit the snakes using the proposed Wal-Mart site. This conclusion is verified by ENSP (NJDEP 2011, p. 8). These mitigation properties are far removed from the Wal-Mart site, and Pine Snakes (as noted in NJDEP reports) will not travel the distance required. Moreover, these mitigations sites are separated from the Wal-Mart site by major highways, including Route 70. Such busy roads are recognized by the scientific community and NJDEP as barriers for Pine Snakes. Indeed, the mitigation proposal concedes this point with respect to Beckerville Road (less busy than Route 70), as it provides for creating a densely shaded, heavily forested barrier in an attempt to keep any snakes on the mitigation property from moving towards this road.

2. There is no evidence that Pine Snakes are present on the mitigation properties, or have been in the recent past.

3. The baseline value (or current value) of the mitigation parcels was determined only for the purposes of determining the incremental improvement, and not on the absolute value of the property as Pine Snake habitat. Although the mitigation parcels met the "minimum requirements" of the methodology, there was no scientific basis provided for treating these properties as minimally sufficient or any comparative evaluation of the Wal-Mart site versus the mitigation parcels. The known features of these mitigation properties, such as the lack of Pine Snake sightings, altered soils, and invasive vegetation, indicates they have a lower baseline value than the proposed Wal-Mart site.

4. The evaluation of the mitigation parcels was not based on any written documentation of the methodology for averaging across the three evaluation means (remote sensing, on-site inspection, and threat assessment) to arrive at the mean for each sampling point, nor for how mitigation was evaluated (scored).

5. The evaluation of the habitat value of the mitigation parcels was conducted by only one person from DEP, and was done in conjunction with personnel from EcolSciences, the consultant for the applicant. This does not allow for an independent evaluation of a previously untested methodology

6. There is no real-world experience on which to conclude that the habitat improvement measures proposed for each site will be effective in attracting Pine Snakes or increasing the population of Pine Snakes in the region. Moreover, no studies will be done to determine efficacy, and no corrective steps are identified to be carried out if they do not work as assumed.

7. I have grave concerns about the efficacy of the mitigation measures themselves.
   a. The mitigation measures are all to be completed at one time (during construction or restoration), and there is no assurance that they will be continued or maintained.
   b. Cutting trees to open the forest may not be effective in the first place, but even if it is in the short term, habitat succession will occur and trees are likely to grow back.
   c. Putting sand on the site for nesting has several problems, including the temporal lag in suitability (Pine Snakes require sand within a narrow range of compaction, with a few roots to stabilize the sand, making digging feasible).
   d. There is no guarantee that planting of either native trees or grasses will succeed in producing Pine Snake habitat, and/or that corrective measures will be made if not initially successful.
   e. There will be a time lag between restoration of trees or grasses and their usefulness to Pine Snakes.
   f. Mitigation on block 77, lots 2-6 (parts thereof) may not be amenable to restoration of native vegetation because of prior agricultural use and sludge dumping on site.

8. An in-depth examination of Block 77, lots 2-6 (parts thereof) clearly indicates why the mitigations proposed will not be effective for Pine Snake restoration.

E. Local Scale Pine Snake Behavior and Ecology

1. Pine Snakes are Threatened in New Jersey partly because they are a large snake that has specific habitat requirements that include a matrix of habitats to nest, breed, bask, forage, and hibernate. Suitable habitats are decreasing, forcing the snakes into sup-optimal habitats.

2. Established Pine Snake hibernacula and nesting areas that are known to be in use recently should be protected because consistent, long-term data are not available to support the feasibility of "created nesting areas".

3. Pine Snakes normally do not travel more than 3 miles, and will thus not be likely to move to any of the distant mitigation parcels.

4. Restricted pathways or corridors (e.g. to the known hibernation site on Wal-Mart property), and to other nearby sites (e.g. toward Crossley) reduce the likelihood that the snakes will travel there, and will expose them to increased predation.

5. Pine Snakes dig long burrows that lead to their nest chamber; these are thus vulnerable to inappropriate sand compaction and vegetation features (lack of shallow roots to prevent collapse).

6. Pine Snakes dig burrows in areas where there is some low vegetation that can provide some cover while digging their nests (females take several days, and rest in the hot part of the day).

7. Pine Snakes use scent trails of other snakes to find hibernation sites, and perhaps nesting sites, and these will not be present in created nesting areas or in constructed hibernation sites, particularly if there are no snakes around presently. Without scent trails, hatchling Pine Snakes would be less likely to find a suitable hibernaculum.

8. Pine Snakes are long-lived and philopatric (return to same site to nest and to hibernate), and any attempt to disrupt their patterns (by destroying a hibernaculum, or lessening its value) could lead to increased mortality, decreased reproductive success, and population declines.

9. As recognized by all concerned, major highways are a barrier for Pine Snakes. Pine Snakes will readily cross the railroad, and indeed use this habitat for basking, nesting in rare cases along the edge, and for protection from heat. The presence of this open habitat is a positive feature of the Wal-Mart site that is not considered.

ARGUMENT, DOCUMENTATION, AND DISCUSSION CONCERNING MAIN POINTS

A. Regional and Landscape Issues

1. Pine Snakes in the New Jersey Pine Barrens are limited to meta-populations that are bounded by barriers to movement and inter-breeding. These barriers include unsuitable habitat and hostile habitat, such as major roads, housing developments, and industrialization, and excessive distance of travel. Within such a meta-population, there are one or more local populations, which use distinct or partially overlapping habitats and are capable of interacting with one another without facing these barriers.

A meta-population consists of a group of spatially separated populations of the same species which interact at some level, through the rare and unpredictable movement of individuals from one place to the other. In the case of the Pine Snake, these were formerly larger continuous populations that have become fragmented through habitat loss and barriers (e.g. roads, housing developments). As habitats shrink into smaller habitat islands, smaller populations dwindle and become extinct.

NJDEP (NJDEP 2009a, 2010a) recognizes that New Jersey Pine Snakes occur in meta-populations, often bounded by barriers that limit the movement of snakes, and limit inter-breeding between different meta-populations. Pine Snakes are classified as "Threatened" partly because of their restricted range, threats from habitat fragmentation, and threats from small patch size, among others (NJDEP 2009a, Burger and Zappalorti 2011). The smaller the patch, the less available habitat there is for Pine Snake breeding, and for their behavioral and ecological requirements. When suitable habitat for a known population is further restricted (as would happen both on the Wal-Mart site, and for the adjacent populations), the meta-population is adversely impacted.

The Threatened status of Pine Snakes was challenged by the New Jersey Builders Association in 2009. NJDEP reviewed the conservation status, breeding biology, and threats to the species (NJDEP 2009a), and the petition to remove them from the Threatened list was denied (NJDEP 2009b). Thus the threats to populations of Pine Snakes continue to be real.

2. A meta-population on one site that is not connected to and part of the same meta-population as snakes using another site will not benefit by mitigation on these other sites.

One basic tenet of population biology is that populations that are separated by barriers such that no animals can move from one population to another will remain an isolated population (or in this case a meta-population). NJDEP uses the term meta-population to refer to those snakes that live within an area and are separated from other meta-populations by barriers (e.g. major roads, NJDEP 2009a).

3. With the exception of one mitigation site, the mitigation parcels are too distant from the proposed Wal-Mart site for Pine Snakes to travel between these sites, and the sites are separated from the Wal-Mart site by at least one major highway barrier to these sites (Route 70). Thus these mitigation properties, even with their enhancements, will not aid the population (or meta-population) on the Wal-Mart site. This conclusion is verified by the ENSP's own mapping of Species-Based Habitat Patches (NJDEP 2009).

To understand and protect meta-populations of Pine Snakes, one must identify their meta-population patches, the area occupied by each meta-population (defined in NJDEP 2009). Only snakes within the meta-population can inter-breed. Thus, any habitat improvements to aid that population must be done in habitats used by that population. Mitigations made elsewhere will not aid that population.

The meta-population on the Wal-Mart site is separate from all but one of the mitigation sites by major highways, particularly Route 70. Route 70 in this area has been measured by NJDEP to have traffic of more than 10,000 vehicles per day in March and September, and have higher volumes during summer months when snakes are most active. This volume of traffic provides a deadly barrier for Pine Snakes. Railroad tracks do not serve as a barrier as they use these habitats for basking and easily cross over them.

Thus, the meta-population on the Wal-Mart site will not benefit from mitigations on the mitigation sites (with the exception of the one adjacent site). The No Net Loss of Habitat Value analysis used by EcolSciences (EcolSciences 2010a,b) and NJDEP (NJDEP 2011), therefore, relies upon mitigation on other meta-populations of Pine Snakes, not on the Wal-Mart site or its meta-populations.

There is agreement by the applicant, its consultants, and NJDEP that Pine Snakes will not cross Rt. 70. Thus any mitigation on the mitigation properties (with the exception of the one adjacent to the site) will not have a positive impact on the meta-population of Pine Snakes on the Wal-Mart site. Instead, by all previous NJDEP reports, Pine Snake habitat will be destroyed and this will have an adverse effect on this Pine Snake meta-population (NJDEP 2005a, b, 2010b, c, d). Any improvements (even if they were successful) on sites that are not part of the Wal-Mart site Pine Snake meta-population will not help the local population.

4. Pine Snake populations that are connected by suitable habitat that is currently unprotected or protected only by agreements or good intentions of current landowners (without legally binding or codified protections) are not assured of continued protection. Thus, a sound mitigation plan cannot rely on the potential corridors and additional habitat that might be provided by any agreement with the Heritage Minerals, which is not legally protected.

The Wal-Mart property, recognized by all documents, including those from the developer, their consultants, and State reports, is clearly Pine Snake habitat (EcolSciences 2006, 2009a, 2010a, NJDEP 2005a, b, 2006, 2010a, b, c). Although the various documents disagree slightly about the percent of the habitat that is prime habitat, there is no disagreement about the suitability of all habitats on site. Further, there is suitable habitat around the site, particularly the Crossley Preserve, as well as on the site known as the Heritage Minerals Site. Although there is a settlement agreement reached several years ago between the Heritage Minerals developer and NJDEP which might have led to the permanent protection of land lying between the development and other nearby suitable habitat, that agreement has never been carried out. The land is not currently protected and there is no assurance it will be in future. A valid mitigation plan, therefore, cannot rely on the assumption that the Heritage Minerals properties are protected from future development impacts.

In addition, Route 70 separates the intervening Heritage Minerals land from all but one of the mitigation properties. Any future protection of habitat on the Heritage Minerals site will benefit the meta-population of Pine Snakes on the Wal-Mart site, as indicated by the fact that one of the snakes radio-tracked by EcolSciences spent time on both sites (EcolSciences 2006). However, both the habitat available to the Wal-Mart Pine Snake population, and corridors connecting the Wal-Mart site to other suitable Pine Snake habitats, are separated from all but one of the mitigation properties and, therefore, cannot serve as the link between the proposed Wal-Mart site and these mitigation lands.

B. "No Net Loss of Habitat Value" Concept

Development of such a No Net Loss of Habitat methodology for any species requires field testing, intra- and inter-observer reliability confirmation, and independent replication. None of these have taken place with respect to the No Net Loss of Habitat Value methodology proposed for use in this case.

The granting of the permit is dependent upon the DEP accepting the concept of No Net Loss of Habitat Value of habitat. The NJDEP report and review for DLUR File No. 1500-04-0012 (Wal-Mart site; Jan 11, 2011) has implicit in it several assumptions, which are untested and require discussion by a broad community of DEP, policy-makers, scientists, conservationists, and the public. These assumptions are:

a. No Net Loss of Habitat Value is an acceptable process generally.

b. No Net Loss of Habitat Value can be quantified on the basis of the change in habitat value, whereby improvements in one place (mitigation parcels) can compensate for losses in another (the proposed Wal-Mart Site).

c. Additional increments can be added to any habitat with any Collective Point Score (CPS) and still improve the habitat using the proposed methodology.

None of these assumptions is clearly accurate in this context, and none have been tested in the field or subjected to expert and public review. Nor has NJDEP used this approach before, whether for scientific purposes or to justify the granting of a permit that would allow a developer to harm Threatened or Endangered species habitats under CAFRA rules.

Moreover, No Net Loss of Habitat Value can mean three different things: (1) there can be no net loss of habitat on a property being developed (e.g. mitigation must be done on site so that there is no net loss in value (and this has been done with Gopher Tortoises in Florida, for example; (2) there can be no net loss of habitat in a specific area within the same meta-population; or (3) there can be no net loss in the overall region, which encompasses multiple meta-populations. In this case the mitigation is for a different population (version 3). Thus, the definition is being stretched to mean "in the general region" with no regard to reasonable meta-population boundaries.

Further, it may well be that a No Net Loss of Habitat Value methodology may work for birds, in contrast to reptiles. Many bird species are able to move easily across barriers, such as roads, because they can fly, and are also able to assess habitat quality from a flight position, whereas snakes do not have this advantage, relying more on touch and smell. Regardless of species, however, the No Net Loss of Habitat Value methodology needs to be examined fully by a range of state biologists, other scientists, conservationists, and the public, and tested in the field, before acceptance or application.

1. The No Net Loss of Habitat Value methodology has not been used previously or tested in New Jersey as a viable method that does, in fact, result in no net loss of suitable habitat or populations. It has also not been used with Pine Snakes (except for the current application).

The idea of No Net Loss of Habitat Value has not been used or tested in New Jersey for any wildlife species, much less for species such as Pine Snakes with very specific local and landscape requirements. While NJDEP staff have discussed the idea, they have never formalized the general methodology prior to this case, and they have never presented such a methodology and its justification to the scientific community or the public. Nor have they tested such a methodology in the field.

A suitable preliminary test would be to visit a large number of habitats with and without known Pine Snake populations and compute habitat values using a proposed, objective set of criteria in order to determine whether there is a statistically valid relationship between those with and without Pine Snakes, and a correlation between the relative Pine Snake abundance and the habitat value scores. A sufficiently large body of data points would allow statistical sensitivity analyses with which to establish rational methods for tabulating, combining, and comparing scores for various habitat parameters (such as soil type, vegetation cover, etc.) across diverse sites. None of this has been done.

Importantly, the Wal-Mart site plan does not call for an examination of whether the mitigation measures result in increasing Pine Snake populations, and whether the relative habitat value point scores (and the mitigation improvement scores) actually relate to Pine Snake populations on the mitigation sites. Given the secretive nature of Pine Snakes, determining the efficacy of the measures they propose would take several years (see section D. 9), including a well-designed study to assess Pine Snake populations and their use of hibernacula.

2. The No Net Loss of Habitat Value methodology has not been generally accepted by the scientific community or by the State of New Jersey as a basis for mitigation, either in regulations, reports (except NJDEP 2009a and the current one), or with respect to Pine Snakes or other wildlife. It has not been presented to the Endangered and Nongame Species Committee (advisory to DEP), nor to the public, either as a scientific postulate or as a means of meeting the applicable regulatory habitat protections.

The No Net Loss of Habitat Value concept may have been discussed internally by NJDEP, but NJDEP has not presented this methodology to the Endangered Nongame Species Advisory Committee, the body established by statute to advise the NJDEP on Threatened and Endangered wildlife conservation issues and to create the list of Threatened and Endangered species. It is to this committee that the Endangered and Non-Game Program comes for advice about management (and policy) about protecting these species. The methodology has not been published in the New Jersey Register nor described or discussed in any public documents that any public or conservation

organizations could respond to or discuss. Nor has the methodology ever been presented for review by the scientific community or the public, much less reached the level of being codified in general procedures for Endangered or Threatened species. The methodology, therefore, has not been accepted in the scientific community for application in a case such as this, where NJDEP proposes to authorize activities destructive of Threatened species habitats based on the No Net Loss of Habitat Value model.

The relevant CAFRA regulations setting out requirements for applicants who wish to justify developments that may impact Threatened or Endangered Species habitats provide that "The impacts shall be assessed using accepted ecological principles and scientific literature on each species ...." N.J.A.C. 7:7E-C.1(c). In my expert opinion, the proposed habitat assessment, in relying on the No Net Loss of Habitat Value methodology presented in this case, does not meet this standard.

3. CAFRA regulations require conservation of the "local population" of protected wildlife. The No Net Loss of Habitat Value is not referenced in the CAFRA regulations. Nor do the regulations set forth any methodology that would permit on-site habitat destruction in exchange for off-site habitat enhancement.

The CAFRA regulations do not allow for or discuss the No Net Loss of Habitat Value concept, much less a specific methodology, for any species, as is proposed in this case for Pine Snake habitats. The CAFRA regulations bar the granting of a permit for development "unless it can be demonstrated, through an Endangered or Threatened Wildlife or Plant Species Impact Assessment as described at N.J.A.C. 7:7E-3C.2, that endangered or threatened wildlife or plant species habitat would not directly or through secondary impacts on the relevant site or surrounding area be adversely affected." N.J.A.C. 7:7E-3.38(b). The section describing an Endangered or Threatened Wildlife or Plant Species Impact Assessment states that the assessment "shall demonstrate that the proposed development will not negatively affect the population(s) or habitat of endangered or threatened wildlife species that resulted in identification of the site, or an area abutting the site, as endangered or threatened wildlife species habitat ...." N.J.A.C. 7:7E-3C.1(a). This section further provides that "The impact assessment shall consider the likely affects of the proposed development on the local populations of the particular species on or abutting the site." N.J.A.C. 7:7E-3C.1(c). The regulations make no reference to a No Net Loss of Habitat Model, to region-wide conservation of habitat (as opposed to on-site and local population conservation), or to mitigation as a means of permitting adverse impacts to on-site and abutting populations.

4. The No Net Loss of Habitat methodology does not include any objective basis, or written protocol, for assigning habitat values to specific sample points. Instead, it relies on the subjective judgment of the assessor. So, while the methodology identifies seven habitat features as criteria for evaluation of the field-based assessment, it does not provide any explicit, rigorous or scientifically tested method for assigning values to those criteria. This defect is replicated in the methodology's combining of the three means of evaluation – remote sensing, on-site inspection, and threat assessment. While the (subjective) values given for the

first two means are mathematically averaged, the third is not, but seems to be treated as some kind of personal "gut-check."

The methodology depends on observers assigning habitat values to each site using seven criteria, and from three means of evaluation or perspectives (remote sensing, on site observation, and threat assessment) (NJDEP 2010e). However, the methodology provides no objective basis or written protocol for assigning values for each criterion in each case. Nor does it provide a rational basis for comparing the values given via each of the three perspectives. Indeed, examination of the NJDEP memo applying the methodology to this case (NJDEP 2011) shows that the remote sensing and site observation figures are not even mathematically averaged, and the threat assessment is not included consistently in the averaging to reach the combined score. In effect, it appears to be a subjective "gut-check" for each reviewer.

The method of arriving at the Collective Point Score is difficult to repeat, even using the data presented in the EcolSciences (2010a) report. For example, the methodology used by NJDEP (2010e) suggests that there is a relationship between all three scores arrived at via remote sensing, on-site inspection, and threat assessment. For the method to be useful there must be a predictable relationship that any consultant or other scientist could repeat. Further, it should be clear whether they place an equal weight on the two quantitative scores, or if one is more highly valued than the other (i.e. does the field score count more, in some cases but not others?)

One obvious difficulty with the methodology applied by EcolSciences (2010a) is that there is no consistency or transparency in the way the category of threat affected the Collective Point Score (CPS) for each sampling point. In trying to decipher the methodology of arriving at the CPS from their reports, I averaged the Remote Sensing Interpretation and the Field-based Assessment values (which were both quantitative) to compute a mean score, and then examined the relationship between this mean score, the threat assessment EcolSciences used, and their final Collective Point Score (see below). As is clear from Table 1, the relationship is not consistent. I would have expected that if there was no Threat, then the CPS should be the same as or higher than the means for the two values (remote sensing, field visit). However this was not always the case.

In Table 1, I computed the mean score for the two measures (Remote Sensing Interpretation and the Field-based Assessment), and I compared it to their Collective Point Scores given for all the points considered in the evaluation (EcolSciences 2010a) as a function of level of threat (from their table). Surprisingly, the difference between the mean score I computed and their CPS are not in the same direction (e.g. sometimes the level of threat decreased the score, and sometimes it increased the score). In the table, the first number is the mean score (mean of Remote Sensing and Field Value) that I computed, and the second number is the Collective Point Score as given in their report (EcolSciences 2010e). Increases are shown with a *.

I would have expected that the more severe the threat, the more the score would be lowered, but this was not always the case. Even for sampling points where they judged there to be no threat, some scores increased, and others decreased.

Table 1. Relationship of mean Collective Point Score (only for mean of remote sensing and field visit scores) as related to their computed mean Collective Point Score (EcolSciences 2010a) arranged by their estimation of threat category.

No Threat	Low Threat	Medium Threat	High Threat
5.8 to 5.5	*4.35 to 5	6.1 to 6	4.8 to 4.5
4.6 to 3	5.15 to 5	5.8 to 5.8	9.2 to 8.0
4.1 to 3		5.3 to 5.3	
3.0 to 3		4.35 to 4.4	
6.9 to 7		*.7.85 to 8	
*7.7 to 8		8.35 to 8.2	
*3.65 to 5			
4.25 to 4			
4.4 to 4			
*9.9 to 7			

The application of this methodology to the proposal is not transparent. It is hard to imagine how "no threat" can both increase and decrease the value, or how a "medium threat" can have no effect. It is not that the method is flawed, but that the methodology requires more details (which is only apparent after someone has actually used it, as in the Wal-Mart case). The methodology may not be flawed, and may prove useful, but more details are essential to ensure appropriate valuation, and determination of the Collective Point Scores.

Further, more information on how threat status was determined is necessary. The threats to the Wal-Mart property, for example, are listed as high for one point, and moderate for the other (and the threats had little effect on the final CPS) (EcolSciences 2010a). Yet, in my opinion, the threats to these are all high, because there is no agreed-upon "protected or preserved" habitat on the Heritage Minerals Site to insure adequate movement of snakes between the Wal-Mart property and the Crossley Preserve (where Pine Snakes are present and protected).

Such a methodology requires careful descriptions and quantification, testing and evaluation with respect to each species, before it can be applied, without being capricious and arbitrary. A reasonable methodology would provide objective protocols for assigning values for each criterion to each site. In sum, the application of the methodology is highly subjective and lacks sufficient objective criteria to produce reliable results.

5. The methodology does not address the complexities required to assign and compare habitat values among different properties. The methodology treats all properties as fungible, applying the seven evaluation criteria independently of one another and in the same (subjective) fashion to all distinct sites. In fact, the value of the same soil type, for example, may vary from site to site depending on other factors, such as vegetation, fire history, or the proximity of other soil types. All of this is ignored in the methodology.

The methodology does not consider the habitat differences among different sites that render the procedure of simply assigning values and multiplying these values by the acreage of a site misleading. It is unreasonable to assume that taking a sub-optimal Pine Snake habitat (one rated a 2.5 or a 5 by the Conceptual Habitat Evaluation Method (NJDEP 2010e)) and improving it with various habitat alterations suggested by the methodology, will produce habitat that is actually of equal value to that which is lost from a site actually used by Pine Snakes. Yet this is the fundamental assumption of the methodology and the mitigation proposal in this case. In reality, there is not a linear relationship between the Combined Point Score of the methodology and habitat quality.

Consider the following example: Suppose a developer wishes to remove over half of a suitable Pine Snake habitat (one actually used by Pine Snakes), losing 51.8 Habitat Units (HUs). The developer wants to mitigate an area that equals a gain of 52 HUs. According to the methodology, the developer can take a marginal habitat with a Collective Point Score (CPS) of 5/ha to begin with, add some sand over 60 ha with a value of 2.5 CPS/ha, and thus multiply 60 X 2.5 CPSs to arrive at a value of 150 HUs gained. Equally, the developer could cut a small patch of trees out of every ha of 40 ha, with a value of 1.25 CPS for a HU of 50 gained. These examples indicate that the methodology's arithmetic does not equate to real-world habitat value.

The methodology assumes that additional increments can be added to any habitat with any Collective Point Score (CPS) and still improve the habitat (using their methodology). There is no evidence for this assumption, since some optimal habitats, that have sufficient nesting areas and hibernation sites can not have Pine Snake population increases beyond the carrying capacity (see Fig. 1). Population regulation is a complex topic, and environmental features are not the only factors affecting them – competition within and among species, prey numbers and density, prey type, and other factors affect them. In other words, Pine Snake populations can not be increased beyond the carrying capacity, regardless of increases in necessary or optimal habitat characteristics. Pine Snakes only require a certain amount of nesting habitat (and additional habitat beyond this will not increase the populations). Similarly, increased openings in forests, if there are already sufficient open places, will not increase the number of Pine Snakes.

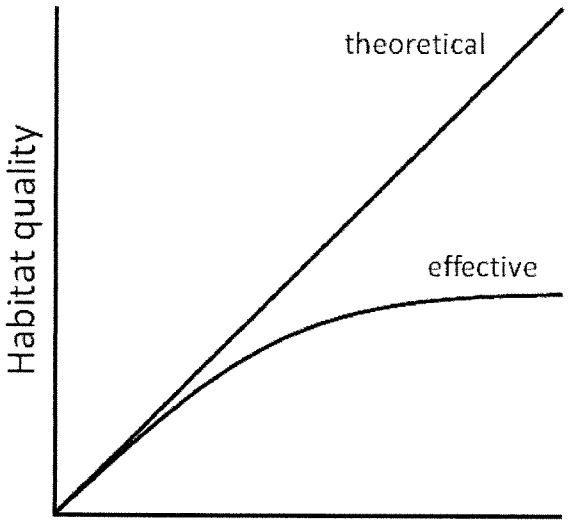

Fig. 1. Relationship of the theoretical increase in habitat quality, and the effective increase.

The theoretical increase in habitat quality (which might result from an incremental increase in mitigation) is likely not the case. Once Pine Snake habitat has reached the optimal conditions, new mitigation may not increase its actual habitat quality (unless nesting sites are in short supply). For example, forest thinning to create sunny patches will reach a saturation point quickly, as Pine Snakes only require a small amount of these areas. Adding more open patches will reach saturation quickly, and there will be no added value (e.g. At the Beckerville site where open old fields are nearby).

Some habitats with a low or middling CPS according to the model will not experience an introduction or increase in Pine Snake populations due to the "enhancement" measures because their use or population growth on the site is limited by other factors, such as predators, barriers to movement, territory size, or prey base. Moreover, some habitats with a high CPS do not need mitigation, as there is a value of CPS beyond which mitigations or improvements will not increase the populations of Pine Snakes because such other factors are limiting population growth. To impose "enhancement" methods on these sites does not actually mitigate, or provide No Net Loss of Habitat Value, for sites that are sub-optimal to begin with, or have been degraded. In still other cases, particular enhancement methods, such as opening habitat by removing trees, might also not be necessary or improve the habitat value. (For example, Bass River State Forest is optimal habitat for Pine Snakes, yet one could imagine adding sand somewhere to arrive at an added value, when in fact, the added sand would not increase Pine Snake populations because there already are enough nesting areas.) Yet in all these cases, an applicant would be able to demonstrate No Net Loss of Habitat through the math of this methodology.

6. The No Net Loss of Habitat Value methodology examines only the hypothetical increase or decrease in habitat value, without respect to the baseline habitat value originally present at the site. This method is faulty because the same habitat management activities are not necessarily related in a linear, 1:1 fashion in habitats with different baseline conditions. .

In the No Net Loss of Habitat Value methodology, different sites are treated equally in calculating habitat value gain for given management measures or practices. But in practice, the exact same habitat management practice may not generate the same habitat improvement utility in locations with different baseline conditions. Improving a site that is only minimal habitat for Pine Snakes, in place of degradation or habitat loss at a site that is optimal habitat may not result in stabilization of Pine Snake populations or protection of meta-populations.

One of the difficulties with the No Net Loss of Habitat Value methodology is that one might suggest that the valuation should first be done on the Field Values, or on the mean of the Remote-sensing Values and the Field Values, by examining the incremental change with mitigation (rather than multiplying the CPS by the acreage involved). Some discussion is needed about the relative importance of the remote sensing evaluations and the field evaluations. The remote-sensing data may be more useful in determining which sites to actually visit for examination. That is, if the site is not an appropriately-valued site from the remote sensing, then a visit may not be required.

On the other hand, the evaluation by the DEP personnel on site brings to bear all the important characteristics needed for Pine Snake behavior and ecology (Table 2). How the evaluators rated the two components (remote sensing, field site) is not transparent, nor clear enough to be repeated elsewhere (EcolSciences 2010a, NJDEP 2011). How "threat" was integrated is also not clear (see Table 1 above).

For example (see Table 2), using only the HU scores (which take into account acreage) may over-estimate the value of the mitigations (initial values from EcolSciences2010a). That is, a low CPS multiplied over a large area increases the HU markedly.

Table 2. Relationship of Mean Collective Point Score (CPS) and improvement values (analyzed from data in from EcolSciences 2010a,b).

Site	Area (ha)	Pine Snake habitat (ha)	Mean Collective Point Score	Gain from mitigation	Mean CPS after mitigation
Wal-Mart Site	17.0	12.7	5.2		
Block 75.01, lot 3	8.6	8.3	8.1	G = 1.5	9.6
Block 73, Lots 31 and 32	14.7	11.0	3.8	G = 1	4.8
Block 73, Lot 21	6.3	4.9	7.5	G = 2	9.5
Block 77, Lot 27	4.5	3.7	7.5	G = 1.5	9.0
Block 77, lots 2-6 (or parts thereof)	35.7	19.6	4.75	G = 1	5.75

It is obvious from this table that most of the mitigation parcels (after mitigation) will seemingly have relatively high Mean Collective Point Scores, yet no Pine Snakes have ever been located on these remote mitigation parcels (although they are listed in documents as potential Pine Snake habitat (Natural Heritage Letters).

If we consider another way of looking at the data (Table 3), and use their computed gain (from EcolSciences 2010a,b), the relative gains per parcel are much less than the loss from the Wal-Mart site, suggesting that the overall value gained is not equaling the losses in habitat quality (see table below; and here the word quality refers to quality for the snakes, not the habitat value quantified in their reports). These two methods indicate that considerably more attention needs to be devoted to considering different approaches to examining the methods, and their ramifications for protection of populations of Pine Snakes.

Assuming that all the sites (Wal-Mart plus the mitigation parcels) meet the minimum requirements for Pine Snake habitat (NJDEP 2010e), and are connected to other Pine Snake habitat within the meta-population, then one might argue that the relative change (in percent) is a good measure of actual improvement. That is, for the moment, accepting both the initial habitat value as computed by EcolSciences, and the relative gain (2010 a), then the percent change in habitat value may be an important measure. As is clear from Table 3 (right hand column), the increase in percentage of value of any mitigation parcel is not as great as the percent loss at the Wal-Mart site. In

other words, decreasing a known occupied habitat by a great value is not compensated by increasing unoccupied habitats by slight or moderate percentages.

Table 3. Relationship of percent change in habitat value (HU units) for the Wal-Mart property compared to the mitigation sites. L=Lost, G=Gain.

Site	Area (ha)	Pine Snake habitat	Total Habitat Value	Gain#	% gain or loss##
Wal-Mart Site	17.0	12.7	66.04	L = 51.8 G=4.3*	L=71 %
Block 75.01, lot 3	8.6	8.3	67.23	G =12.5	G = 19 %
Block 73, Lots 31 and 32	14.7	11.0	42.17	G = 2.0	G = 5 %
Block 73, Lot 21	6.3	4.9	14.70	G = 6.0	G = 41 %
Block 77, Lot 27	4.5	3.7	27.75	G = 5.6	G = 20 %
Block 77, lots 2-6 (or parts thereof)	35.7	19.6	93.1	G – 24.2	G = 26 %

Data from page 2 of EcolSciences 2010a
My calculation from EcolSciences 2010a data
* Some mitigation planned on Wal-Mart site.

C. Development Plan for the Site Itself: Loss of Known Pine Snake Habitat

1. The proposed Wal-Mart site is prime, critical habitat for Pine Snakes. In fact, it is very likely that more snakes are using the site than found by the developer's consultant, due to the biology of Pine Snakes and the inadequate survey methods used.

There is no disagreement that the Wal-Mart site is prime habitat and contains critical habitat components for Pine Snakes, or that Pine Snakes actually live there. Even the most recent field study by the developer (EcolSciences 2006) found Pine Snakes on the site. And they did so even though the study was only between May and November 2005 (NJDEP 2010c, EcolSciences 2006). In my experience, and based on 25 years of study of Pine Snake hibernacula (Burger et al. 2007, Burger and Zappalorti 2011), Pine Snakes often come up and bask near hibernation sites in March, particularly if the weather is warm, although they may finally emerge in April.

Trapping and drift fences were placed on the site by EcolSciences from May 7 (after snakes would have left the hibernaculum) until July 15, and again from August 31 to November 2. Further they conducted on-site visits when they checked the traps (EcolSciences 2006). Setting up the fences, and checking the drift fences only after May 7 would have missed the snakes that were congregating at the hibernation entrance (basking until it was warm enough to move off into the uplands). While snakes also bask at the den entrance in the fall, drift fences placed around the hibernation den in the early spring would have been more effective, and would probably caught more snakes that were using the den. Further, they did not even place drift fences around the hibernaculum in the fall once they discovered it. Due diligence would have required them to place a drift fence around the den site the following late winter to see if there were other Pine Snakes there.

Since Pine Snakes are cryptic (camouflaged), secretive, and spend a great deal of time below ground (both during hibernation and at other times of the year), they are relatively difficult to find during above-ground visual and opportunistic searches. Thus encounters with or observations of snakes, including coming from a hibernation site or crossing a road, are usually indicative of a greater population than the number of snakes actually observed. Thus, it is highly likely that the population of Pine Snakes on a given piece of property is greater than the number of snakes observed.

EcolSciences (2006) state in their report that "it is reasonable to postulate that, for over four months of trapping and searches, the two captured Pine Snakes are the only representative of this species that were present on-site in 2005". This is not a reasonable conclusion, and calls into question their experience with Pine Snakes. No study ever finds all the snakes on a property, and this is particularly so where the study did not start before egress from the hibernaculum, did not extend for the full season, was for only one year, and they did not encircle the hibernaculum with drift fences to determine if there were other snakes. Pine Snakes are notoriously difficult to locate. There is no evidence that these two snakes are the only ones on the Wal-Mart property, and indeed it is more likely than not that these two snakes represent a larger population. That one of the tracked snakes travelled from off-site to reach this hibernation site indicates that it is a known and used site, and it is likely other snakes use it (see below). Indeed, the consultants did not place a drift fence around the hibernaculum in the spring which would have enhanced the likelihood of detecting snakes that used the hibernaculum. Nor is there evidence that they did so in the fall, even though one snake moved to it the hibernaculum on site.

2. Pine Snakes are dependent on traditional hibernation sites known to the snakes, for continuance of meta-populations. Artificial dens are unlikely to succeed in this case and are generally inferior to natural dens.

Natural Pine Snake hibernacula occur in either old mammal burrows, in rotten logs, or in rotting tree roots. In all cases the snakes excavate deeper and build or make tunnels and side chambers which go deeper and horizontally into soil (Burger et al. 1988). These natural hibernacula are not easily located because there is only a small

hole (or two) into the ground, and the entrance often is covered over with blowing leaves. Entrances to natural hibernacula are thus camouflaged, and not obvious. The snakes locate them partly by scent trails left by Pine Snakes using them during the summer or winter (Burger1989a, 1990).

Artificial hibernacula can be an important management tool, and are critical to use when necessary (Frier and Zappalorti 1983, Zappalorti and Reinert 1994). However, they have several disadvantages. Artificial hibernacula must be "seeded" with Pine Snakes, so the snakes leave scent trails leading back to the hibernacula when they emerge in the spring. In the present case, this would require the capture and removal of Pine Snakes from the local population using the proposed Wal-Mart site and their insertion into a distinct area which, if used at all by Pine Snakes, is used by a different meta-population. Translocation of Pine Snakes in this manner is untested, but experience with other snake species with fidelity to their hibernacula suggests it is harmful to the trans-located snakes (Reinert 1991).

Artificial hibernacula also have a large above-ground component, which makes them visible to both people and predators. While they provide a good place for the snakes to hibernate, their visibility makes it possible for predators and poachers to find them and monitor them in the spring (or fall), looking for snakes basking near the entrance. Thus, it is my professional judgment that natural hibernation sites are superior to artificial ones, and should be protected.

In our study of 7 hibernacula for 25 years (= 175 examinations of hibernacula), we have found 1 Pine Snake only 13 times out of the 106 times these hibernation sites were occupied (12 % of the time). Further, in one of our dens, a single snake was found in a den in one year, and 14 were located the following year; in another, a single snake in a den in one year was followed by 10 Pine Snakes two years later. These data suggests that it is more than likely that finding one snake in a den is indicative of there being more snakes in the den (see Table 4 below).

These data also show that a hibernaculum that is not used in one year, for whatever reason, may be used even ten years later (Burger et al. 2007). Dens can be used both during the summer as summer dens (to rest, to avoid predators, or to seek shade), as well as during the winter (Burger et al. 1988). Thus, a den which may not be used in the winter by hibernating snakes may well continue to be used by snakes in the summer, and at some later date it is again used as a hibernation site. This makes it even more important to protect known hibernacula.

3. The habitat evaluation of the site is flawed because the actual presence of snakes does not markedly change the evaluations.

The development of the original "Conceptual Habitat Evaluation Method for Pine Snakes" (NJDEP 2010e) was intended for places where there was no information on the actual presence of Pine Snakes. It does not, therefore, take into account the actual presence of snakes, and of a particularly critical habitat feature, such as a hibernaculum.

4. The current plan does not provide for a sufficient buffer around the hibernation site, as required by CAFRA. The buffer in this case is to be only 164 feet. This distance has no basis in science, the biology of Pine Snakes, or experience working with Pine Snakes.

The CAFRA regulations require that developments provide "a sufficient buffer area to ensure continued survival of the population of the species as well as areas that serve an essential role as corridors for movement of endangered and threatened wildlife." N.J.A.C. 7:7E-3.38(a). The current development proposal does not provide any justification for its extraordinarily small buffer (compare, for example, the Pinelands Comprehensive Management Plan's typical 300-foot buffer for protected species). Indeed, ENSP have previously concluded that the proposed buffer in this case is inadequate to protect the hibernaculum, and this finding was included in the NJDEP's denial of a CAFRA permit for this same development plan in 2010. (NJDEP 2010a, NJDEP 2010c). I concur with this conclusion.

5. The buffer is not only too small, but it is shaped to provide only a narrow access to the hibernaculum. The relatively narrow "neck" of approach for the Pine Snakes reduces the viability and usefulness of the hibernation site, particularly for young snakes that have difficulty locating hibernation sites.

EcolSciences clearly found that one of their radio-tagged Pine Snakes went into a hibernaculum on the proposed Wal-Mart Site (EcolSciences 2006). This indicates that there is at least one hibernaculum on the site. Hibernation sites, along with nesting habitat, are among the critical habitat features needed for stable Pine Snake populations (NJDEP 2009a, Burger and Zappalorti 2011).

The Wal-Mart proposal will result in a restricted "neck" or entrance into the hibernaculum. That is, a Pine Snake will have only a small area that it must pass through to reach this hibernaculum. Young snakes that are already stressed in terms of the time they require to find a meal before hibernating (Burger 1991a), and finding a place to hibernate, may have more trouble finding such a site. When there are many "scent trails" of adult snakes coming in toward the hibernaculum from several directions, the hatchlings have a higher likelihood of encountering one, than if there is only one scent trail through the bottleneck (Burger 1990). On the other hand, if a hatchling fails to find the main trail into this restricted "neck", then it may encounter the fence or barrier, turn in the wrong direction and actually move away from the site. Failing to find a safe hibernation site is fatal.

6. The narrow buffer, albeit accompanied by a fence to prevent snake movement, will result in undue disturbance around the hibernation site. While snakes are hibernating in the winter, they sometimes come to the surface if the temperatures warm up (in January, February). Construction near the hibernaculum will cause a disturbance, even in winter.

It is difficult to imagine that the construction of the magnitude envisioned for the Wal-Mart site would not result in undue disturbance to the Pine Snakes using the hibernaculum. The 300 foot Buffer was designed to protect the snakes from this disturbance. While Rt. 37 is closer than the required buffer, it only occurs on one side (in a straight line), and is not as restrictive as the 270 degree circle close to the hibernaculum.

Although Pine Snakes hibernate, they do not necessarily remain below ground continuously from early November until April. Instead, they come up to bask if the temperatures warm up, even in January. On a warm year they can come up (although they might bask at the surface and then go down at night), anytime in March and April.

Construction so close to a hibernaculum will entail churning up the soil, and other direct physical effects on the surface of the soil, destroying any long-term scent trails that are so necessary for snakes to locate hibernacula and summer dens. Construction may remove a viable den for snakes using it during both winter and summer.

7. In addition to reducing total Pine Snake habitat, the retention basin reduces area required by the snakes for movement from the remaining habitat. Further the retention basin blocks off some of the wetlands edge area to the snakes, a habitat they often use in the summer to forage.

Because CAFRA prevents destroying wetlands, the retention basin is being built on upland habitat, which is prime Pine Snake foraging habitat. This basin not only reduces the available foraging/resting habitat, but further restricts the pathway to the hibernaculum site, and to other suitable Pine Snake habitat on surrounding lands.

8. The habitat value evaluation of the site is flawed because it is dependent upon the judgment of DEP personnel in collaboration with the Wal-Mart consultants (who often averaged scores or agreed on a lower value than NJDEP initially concluded) without benefit of any objective, written criteria for arriving at the mean habitat values for the value of mitigation.

See above under "No Net Loss of Habitat Value" discussion.

9. There is no provision for additional study before construction to ascertain a better estimate of Pine Snake use of the site or of the hibernaculum, there is no provision for the enhancements and property acquisition to be completed before construction, and there is no study to ascertain that the enhancements actually worked (before destruction of habitat on the Wal-Mart site). No construction on the Wal-Mart site should be initiated without these studies.

First, in several sections above I mentioned that the study conducted by the consultants (EcolSciences 2006) was insufficient to identify the extent of Pine Snake use of the Wal-Mart property. There is likely a greater use of both the hibernaculum and the site by Pine Snakes.

Second, in the NJDEP Environmental Review, it is noted that (quoted from NJDEP 2011, page 8):

> "In order for "no net loss" of pine snake habitat to be achieved, the implementation of the proposed habitat acquisition and enhancements must be carried out and completed prior to the initiation of the proposed development. Otherwise, the losses of pine snake habitat associated with the development would not be offset by enhancement projects and pine snakes would experience a loss in habitat value or a period of time."

In my opinion, if this were done properly, it would take several years to complete the habitat acquisition and enhancement work because many of the enhancements require vegetation (grasses, trees) to become established, and nesting habitat (soil amendments) to achieve suitable compaction (with adequate small shrubs and herbs to provide shade and stability to the soil) (see D. 9). The NJDEP (2011) report clearly states that if these enhancements are not done, Pine Snake habitat and populations will suffer "for a period of time."

There are no proposed studies to determine if the enhancement measures are successful (in terms of habitat features) or if Pine Snakes use the enhanced habitats. This final statement in the NJDEP (2011) document thus suggests that there will be loss of both Pine Snake habitat, and populations on the Wal-Mart site.

Finally, it is disturbing that the previous NJDEP (2010c) report, states rather clearly that (quote from section on illegal collection, page 5)(and here I quote),

> "Over time, however, this concern would likely diminish since we expect that the pine snakes would eventually abandon the den site due to the daily disturbances (noise, moition, etc) associated with the road and shopping center"

Nothing has changed since the NJDEP (2010c) report, which concludes that the hibernaculum would likely be abandoned. Such abandonment clearly leads to a major decline of Pine Snake habitat and a specific requirement (hibernaculum), thereby likely leading to population declines.

D. Mitigation Parcels and the Enhancement Plan for the mitigation Properties

1. The properties used for mitigation, with only one exception, will not benefit the snakes using the proposed Wal-Mart site. This conclusion is verified by ENSP (NJDEP 2011, p. 8). These mitigation properties are far removed from the Wal-Mart site, and Pine Snakes (as noted in NJDEP reports) will not travel the distance required. Moreover, these mitigations sites are separated from the Wal-Mart site by major highways, including Route 70. Such busy roads are recognized by the scientific community and NJDEP as barriers for Pine Snakes. Indeed, the mitigation proposal concedes this point with respect to Beckerville

Road (less busy than Route 70), as it provides for creating a barrier to keep any snakes on a mitigation property from moving towards this road.

This concern has been identified and discussed above. Here I add information on the range of Pine Snakes.

Current data on the movement of Pine Snakes on the Stafford Business Park suggests the following (Zappalorti et al. 2009, 2010, Burger and Zappalorti 2011). Based on data from 20 radio-tracked Pine Snakes, their activity home ranges during a 2009 study varied from about 28.9 to 391.4 hectares (71.0-acres to 967-acres). The greatest distance between any two of the radio-tracking points was about 5 km (3-miles), with an average distance of 2.3 km (standard error of 2.4 km, Zappalorti et al. 2009). In 2010, the activity home range size of 16 radio-tracked northern Pine Snakes ranged from 91.35-hectares to 407.77-hectares (69.52-acres to 1104.99-acres). Of the 16 radio-tracked Pine Snakes, 11 had home ranges greater than 100-hectares, whereas four snakes had home ranges larger than 200-hectares (Zappalorti personal observations). These data suggest that in the normal course of an adult Pine Snake active season for a year, no snake was observed to travel more than 5-km away from any other location within its home range. In other words, an adult Pine Snake should not be expected to move more than 4 or 5-km from any point within its established home range, especially if it had to travel through highly unsuitable or developed lands with paved roads. Assumptions that snakes evicted from the Wal-Mart site will travel these distances to find the mitigation sites, are unrealistic.

2. There is no evidence that Pine Snakes are present on the mitigation properties, or have been in the recent past.

The only evidence for possible Pine Snake populations on the mitigation sites (other than the one adjacent to the Wal-Mart site) is the listing by the Natural Heritage Program, which is based on suitable habitat, not actual sightings of Pine Snakes (Natural Heritage Letters). This absence of sitings casts serious doubt on the likelihood that the mitigation parcels will serve to create or expand existing Pine Snake populations.

3. The baseline value (or current value) of the mitigation parcels was determined only for the purposes of determining the incremental improvement, and not on the absolute value of the property as Pine Snake habitat. Although the mitigation parcels met the "minimum requirements" of the methodology, there was no scientific basis provided for treating these properties as minimally sufficient or any comparative evaluation of the Wal-Mart site versus the mitigation parcels. The known features of these mitigation properties, such as the lack of Pine Snake sitings, soil, and vegetation features, indicates they have a lower baseline value than the proposed Wal-Mart site.

This comment stands alone – although all reports acknowledge that Pine Snakes have been reported on the proposed Wal-Mart site (as well as a hibernaculum), the

comparison among the sites is largely discussed in terms of the incremental change that results from mitigation.

4. The evaluation of the mitigation parcels was not based on any written documentation for the criteria for averaging across the three evaluation means (remote sensing, on-site inspection, and threat assessment) to arrive at the mean for each sampling point, nor for how mitigation was evaluated (scored).

The reports (NJDEP 2011, EcolSciences 2010a,b) assign a value of the mitigation measures, and then multiply that times the appropriate acreage on each site. While this may be an appropriate method, there is no documentation in the Conceptual Model (NJDEP 2010e) that quantifies this. There is only the statement that "improvements to habitat quality based upon future proposed enhancement carried on a site, to augment habitat or abate threats, are also quantifiable using this method"

The first problem with this statement is that it says on the site (not on parcels 6 miles away), and the second problem is that there is no clear indication of which of the qualities are to be used (the ones listed under remote, those listed under field, or the threat basis?). There is no clear section or indication about how mitigation measures should be carried out, or even that they can be carried out elsewhere. Future versions of the Conceptual Habitat Evaluation (for this or other species) should include a clear mitigation section.

5. The evaluation of the habitat value of the mitigation parcels was conducted by only one person from DEP, and was done in conjunction with personnel from EcolSciences, the consultant for the applicant. This does not allow for an independent evaluation of a previously untested methodology

I have serious concerns about DEP personnel visiting a potential development site WITH the development consultants, and agreeing on values for the CPS scores (and components of these scores). And even if they were to visit the site together, I believe it is inappropriate for the DEP personnel to agree to a score somewhere between the two scores (especially when the habitat value for the development site is rated lower by the consultant). When multiple people score a habitat, their scores should be recorded independently and documented independently, prior to any discussions. Further, I might suggest that this approach of applicants and permit agency (NJDEP) assessing the habitat value together would achieve more balanced and acceptable recognition by eliciting participation of an independent ecologist.

6. There is no real-world experience on which to conclude that the habitat improvement measures proposed for each site will be effective in attracting Pine Snakes or increasing the population of Pine Snakes in the region. Moreover, no studies will be done to determine efficacy, and no corrective steps are identified to be carried out if they do not work as assumed.

The basis for this finding is discussed above and in items 8 and 9 below.

7. I have grave concerns about the efficacy of the mitigation measures themselves.

a) The mitigation measures are all to be completed at one-time (during construction or restoration), and there is no assurance that they will be continued and maintained

Habitat modifications and mitigations are to be completed at the time of development, and there are no assurances that the necessary ones will be continued, or that if not successful, will be corrected or maintained. Even if successful in creating suitable habitat, the artificially modified mitigation habitats are not likely to remain as constructed and will require periodic maintenance and management.

b) Cutting trees to open the forest may not even be effective, but even if it is in the short term, habitat succession will occur, trees will grow back.

Cutting trees to open habitat for Pine Snakes may be effective under some conditions, but there is no indication that this will be effective on these parcels, that succession will not occur (reducing the openness), and that even if it does, invasive species may move in requiring long-term intensive management which needs to be built into any mitigation plan

c) Putting sand on the site for nesting has several problems, including the temporal lag in suitability (Pine Snakes require sand compaction within a narrow range, with a few roots to stabilize the sand, making digging feasible).

The natural sand cover of the Pine Barrens is not a uniform layer but has structure, compactness, and surface topography. Not all sands or sandy areas are suitable for Pine Snake nesting. Pine Snakes are well-known excavators (Carpenter 1982), particularly for nest sites (Burger and Zappalorti 1986b, 1991, 1992) and for enlarging or modifying chambers and tunnels for hibernation sites (Burger et al. 1988). Sand of a particular type and consistency are required, especially for digging nests. The nests that Pine Snakes dig are unlike any constructed by turtles; turtles in NJ normally dig a nest directly into the ground, and do not dig long or extensive tunnels before constructing the nest. Thus mitigation measures that have been successful with turtles are not applicable.

The tunnels of Pine Snakes can be very long. In our study of nesting behavior of Pine Snakes the average tunnel length was 147 cm, with some being as long as 258 cm (= 101 inches, or 8.4 feet, Burger and Zappalorti 1991). This means that female Pine Snakes may well need areas 10 feet or more in diameter, where they can easily yet safely dig, without collapse of burrows. Further, many nests have side chambers where other females lay their eggs, increasing the total area needed for digging in stabilized soil of the right compaction with appropriate fine plant roots. Thus, tunnels are long and undulate slightly to provide traps to prevent water from entering the nest chamber (Burger and Zappalorti 1986b). Construction may take 2-3 days on the part of the female (Burger and Zappalorti 1986b, 1991). Sand that is dumped on a site will not be suitable for Pine

Snakes, at least for many years, because it will not have the right consistency and compaction and fine roots (of *Hudsonia* and other ground cover) to stabilize the soil to support the tunnels and chambers. Thus the placing of sand will not immediately provide nesting habitat for Pine Snakes.

In our Pine Snake nest study, average tunnel depth was 32.8 cm with some being as deep as 43 cm (= 17 inches, Burger and Zappalorti 1991). The NJDEP report (NJDEP 2011) said that "the soil placed on the site should be a minimum of 15 inches in order to allow for tunnel/chamber excavation (and they used Burger and Zappalorti 1991 as the source). As mentioned above, in the text of that paper (page 154), we note that mean tunnel depth (32.8cm, or 12.9 inches) was significantly deeper than the egg chamber. This means, in general terms, that about half of the values would be at greater than this depth. While the mean depth of the nest chamber itself was only 22 cm (or 8.7 inches), Pine Snakes must be able to dig the entire tunnel to the chamber, without it collapsing. 15 inches of sand depth is insufficient. Presumably the 15 inches was taken from the table (Table 1 of Burger and Zappalorti 1991), without reading the accompanying text or considering the added depth of some of the tunnels leading to the nest chamber.

In examining the diagrams below, of actual Pine Snake nest structures, it is clear that more than one female can lay in one nest tunnel/chamber system. In this case, second and third females may dig around or under the existing chambers with eggs, which would require sufficient soil stability (see Fig. 2 below).

In any case, the efficacy of this mitigation procedure for Pine Snakes has not been examined as it has not been tried (see 9 below). Over time, sand acquires structure and horizons of different compaction, extending down several meters, while the surface of sand is regularly sculpted by wind, water, and wildlife. Moreover, the sand under the nests provides essential drainage. This critical feature of Pine Snake habitat is not accounted for merely by the depth of the superficial sand layer.

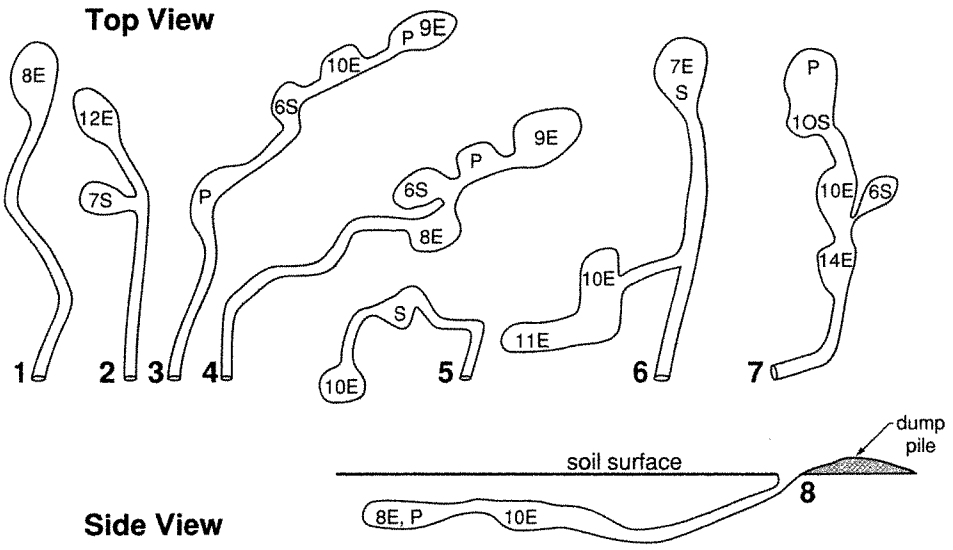

Fig. 2. Diagram of Pine Snake nest structure. E=eggs P=Pine Snake present (after Burger and Zappalorti, 1991)

d) There is no guarantee that planting of either native trees or grasses will succeed in producing Pine Snake habitat, and that corrective measures will be made if not initially successful

It is well known that disturbed habitats, like many of the mitigation sites, often have a wide range of exotic and invasive species, and that even if these are removed, the seed bank for exotic species remains. Thus, although native species can (and will, according to the plan) be planted, without continual care and long-term management, the exotics will move back in.

e) There will be a time lag between restoration of trees or grasses and their usefulness to Pine Snakes.

Any mitigation measures will have a temporal time lag because it will take the trees and grasses a while to get established. The sand will need to settle and develop both consistency and compactness, and acquire low herbs (e.g. *Hudsonia*) and shrubs before it becomes suitable for Pine Snake nesting. This process has not been adequately tested, but based on my experience digging near nesting and hibernation sites, it requires years, maybe decades. It does not occur quickly.

f) Mitigation on block 77, lots 2-6 (parts thereof) may not be amenable to restoration of native vegetation because of prior agricultural use and sludge dumping on site.

Some discussion needs to be devoted to whether restoration on this block will be effective because of past agricultural use and the application of sewage sludge. If it is not, what measures will be undertaken to correct this situation. The extensive use of

sludge on agricultural fields may negate the effectiveness of the mitigation measures, judging by its current failure to support diverse or natural vegetation (see 9 below).

8. An in-depth examination of Block 77, lots 2-6 (parts thereof; known as the Beckerville sites) clearly indicates why the mitigations proposed will not be effective for Pine Snake restoration.

As mentioned above, it is questionable whether the mitigation procedures will be effective, even in the long term. This can be illustrated by an in-depth examination of the proposed mitigation measures for Block 77, lots 2-6 (and parts thereof), which accounts for a total of 24.2 Habitat Value gained from mitigation (EcolSciences 2010a, NJDEP 2011). The 24.2 habitat value (or HUs) gained by mitigation on this parcel is 46 % of the total gained by mitigation in the Wal-Mart proposal (total gained of 53 HUs in the NJDEP document, 2011). As described in the applicant's mitigation proposal, enhancements are being proposed in three distinct areas of this property.

The first is a 4.0-ha area that borders Beckerville Road and extends 100 meters away from the road and into the site. Habitat enhancements in this area will include (quoted from NJDEP 2011).

> "removing debris piles, removal of existing deciduous trees non-native to the Pinelands, and replanting the entire area with a mixture of native pine (*Pinus*) and oak (*Quercus*) species (species mix to be determined). This area will be planted as a dense forest stand so that pine snakes are not attracted to the area to bask or nest. Planting this portion of the parcel with native trees increases its value to Pine Snakes in an amount that has been estimated to be 1.0 HU/ha, using the Department's HEM, for a total increase of 4.0 HUs."(NJDEP 2011).

There are at least three problems with the above enhancements: 1) there is no reason to assume that Pine Snakes will not go through dense trees (thus exposing them to traffic on Beckerville Road, 2) there are no clear assurances that the planting of these trees will succeed and be maintained, and 3) there is no clear basis for valuing this as 1 HU/ha.

While a thick stand of pine and oak may prevent Pine Snakes from basking there, there is no evidence that a stand of thick pine trees and oak will prevent Pine Snakes from moving through this area, or resting there (particularly during the hot part of the day, when they may seek shelter from the sun). Thus, if the habitat restoration were to be effective, Pine Snakes would use the habitat.

The second problem is severe, and one that affects all the enhancements proposed or this site. This property was once farmland, and sludge was applied to the furrows in the plowed land (T. Lettman, pers comm.), and is evident on the photograph below (where the snow is present, Fig. 3). The tilling of the soil (still evident today by the photograph taken in early Feb. 2011) means that the soil horizon has been disturbed, and

the soil no longer has the profile or consistency of Pine Barrens soils. It is now a disturbed site that may be more typical of non-Pine Barrens soils.

Fig. 3. February 2011 photograph from Beckerville Road of the area slated for dense forest enhancement. The snow is in the furrows left by agriculture 30 + years ago.

The effect of disturbed soil is enormous, and results from a disturbance of the soil profile, the opportunity for much stronger organic matter assimilation (due to repeated agriculture), and added nutrients due to the addition of sludge. The result is that once abandoned, succession on such lands usually results in the presence of invasive species that are not native to a given habitat. And this is so with the Beckerville mitigation properties. Although there are a few native Pine Barrens plants (mainly Bluestem Grass) by the road, the main vegetation on the site designated for planting pine and oaks is currently Fall Witch Grass (*Digitaria cognata*), a grass that is native to south New Jersey, but is NOT native to the Pine Barrens. The planting of native trees will likely not succeed, because no trees have moved in here for the length of time since it was abandoned (an indication of the difficulty of succession on disturbed soils that had added sludge), and if the trees succeed in changing the conditions, it is likely that invasive trees will move in. Habitat restoration of such sites requires very extensive modifications and conditioning before any planting can be considered, as well as commitment to long term maintenance, even when a desired habitat mix is achieved (Forman and Godron 1986).

Finally, there is little basis to assign a value of 1 HU/ha for this enhancement, and there is no assurance that it will even be effective.

The second enhancements are those proposed in a 4.5-ha section of the field that abuts the area described above.

The following is quoted from the NJDEP (2011) document.

> "In this area the debris piles and existing non-native orchard trees should be removed. The ground will be scarified and the area revegetated with a mixture of warm season grasses (35% Switch Grass, 25% Little Bluestem, 25% Broom Sedge and 15% Indian Grass) obtained from local Pinelands nurseries and using local genotypes (where applicable). Additionally, a sparse planting of native pine (*Pinus*) and oak (*Quercus*) species (species mix and density be determined) would be carried out in this area. In the most southerly portion of this area (furthest from the road) the applicant is proposing to create nesting habitat for pine snakes by bringing in 100 yd^3 of sandy soil. To my knowledge the intentional creation of pine snake nesting habitat by "importing" sandy soil to an area has not been attempted in New Jersey, however this method has been successfully used to create Wood Turtle nesting habitat in the state (Zarate *per. comm.*). Because the availability of suitable nesting habitat is a limiting factor for this species in New Jersey (Golden et. al. 2009), the creation or enhancement of such habitat could provide great value to individual pine snakes in the area. In order to make the created nesting habitat useful for pine snakes, the depth of the soil placed on the site should be a minimum 15 inches in order to allow for tunnel/chamber excavation by pine snakes (Burger and Zappalorti 1991). Additionally, the total area of the created nesting habitat should be no less than 0.25 acres and therefore the amount of soil required for this extent of nesting habitat creation is closer to 500 yd^3. The soil used for nest site creation should be either Lakehurst, Woodmansie, or Lakewood soil, and should be obtained from a local source and be free of plants non-native to the Pinelands. Based upon this habitat enhancement there would be 2.5 HUs/ha applied to this 4.5-ha area for a total increase in pine snake habitat value of 11.3 HUs" (NJDEP 2011)

There are at least four problems with these enhancements: 1) the mere scarification of the ground will not result in the removal of a seed bank that is present (of non-native species), 2) there are existing invasive species (Fall Witch Grass, non-native Honeysuckle) on site which require more extensive management than proposed, 3) native trees, although planted, may not become established, and 4) Pine Snakes require more sand than the 15 inches they propose to deposit (Burger and Zappalorti 1991). The deposited sand may not acquire appropriate characteristics for decades or more, but more importantly the underlying ground structure at some sites, and its lower permeability, will not accommodate water the same way as sand. This creates a high potential for suboptimal or lethal water saturation at the nest. In hibernacula, the snakes must be able to reach about six feet below the surface in an environment with very good drainage to prevent excessive moisture.

Scarification of the ground, without removal of soil and its attendant seed bank, will allow the germination of the invasive species that now reside in the soil. Invasive species, mostly non-natives, possess superior adaptive characteristics allowing them to out-compete native species.

Restoration of warm season grasses is not a trivial matter, and requires elimination of existing vegetation and seed banks, soil preparation, seeding, and intensive maintenance. This habitat at present has extensive cover of Fall Witch Grass (a non-Pine Barrens weedy species), as well as an extensive ground cover of non-native Honeysuckle (invasive). This is a serious problem because of the density of these plants, their well-established populations, and their extensive root systems (see Fig.4). The "warm season grasses" they wish to plant will have difficulty competing with the invasive Fall Witch Grass (a cool season grass) already on site – in mid-February, even with snow on the ground, it was beginning to green up on the bare spots. Thus, even the scarification will not remove the Witch Grass, and it will out-compete the warm season grasses.

Fig. 4. Photograph of non-native tree with extensive Honeysuckle vines growing against it on this parcel (photograph taken in mid February 2011).

Non-native Honeysuckles are a widespread invasive problem, resistant to many eradication approaches. When it is established to the degree it is here, it is difficult to remove, and scarification will not do the job. The Honeysuckle will likely prevent the growth of native Pine Barrens understory, and keep the habitat as disturbed.

Native trees will likely not become established because of the presence of the invasive Honeysuckle, and the presence of a seed bank of Black Cherry and highly

invasive Tree-of-Heaven (*Ailanthus altissima)* (both species now well-established at this highly modified location). Both grow faster than the pines and oaks they wish to plant, and will likely out-compete any native trees planted.

There are no plans to either determine that the habitat mitigations are successful, or to undertake corrective action. Further, there is no indication of deer control, and young saplings or short trees are subject to browsing by deer, often killing them.

The creation of Pine Snake nesting by adding soil will not be effective, particularly in the time frame needed. The problems with adding soil and creating nesting sites for Pine Snakes are discussed extensively above (section D.8.c). The main difficulty with this enhancement is that the soil, even if obtained from the Pine Barrens, will not initially have characteristics appropriate for high quality nesting areas. As mentioned above, Pine Snakes need soil of a certain compaction, with roots for stability, and deep enough for all snakes to dig their tunnels and nest chambers (not just for the "average" snake). Merely placing or dumping soil (albeit the right type) on land will not result in usable nesting habitat because of the above factors, but also because it takes a long time for dumped soil to become appropriate in terms of organic matter.

The Pine Snake nesting habitats that I have studied over time were all on habitats where there was a mosaic of open sand and some low ground cover (for shallow roots), and the appropriate compaction, but also with the appropriate organic matter. The sand was not white, but had the aged color of yellowish-white, with a few splotches of black (organic matter deposited over time).

Finally, it is not clear to me how they arrived at a value of 2.5/ha. The field criteria listed in the DEP document (NJDEP 2010e) gives 7 characteristics (using a scale of 1-10 for each). Does this mean each of the seven are worth 1.4? Or how are the mitigation "gains" measured. Are some of the seven more valuable than others (if so, which ones?). Are each of the seven worth 1.4 points (and each needs to be 1.4 to reach a perfect score of 10?

The third enhancements are to the 5.9-ha forest patch that exists on the eastern portion of the site (as depicted in Figure 8 of the applicant's mitigation proposal) was visited by Dave Golden, of ENSP on August 26, 2010.

> "This portion of the forest is somewhat densely stocked and it is ENSP's expert opinion that the value of this habitat for pine snakes would be increased by mechanical forest thinning resulting in a residual canopy cover of 65%. This thinning should be carried out using equipment that exerts low ground pressure and during the months of November through March. All cut materials should be removed from the site, but a single brush pile of branches and trunks (measuring 10 to15-feet in diameter and 6 to 8 feet high) should be left on site to serve as a refugia for snakes and other wildlife. Only course woody debris should be left in this pile (no 'chipped' materials). If the applicant includes these activities on this portion of the forest we would

consider the increase of value to pine snake habitat to be 1.5 HUs/ha. Therefore, this 5.9-ha area would be assigned a total increase in habitat value of 8.9 HUs.

There are two problems with this enhancement: 1) there is no guarantee that once thinned, the trees will not grow back (they surely will), and 2) there is no indication that open areas are required here. Thus the thinning will not be a permanent measure. And is the thinning to include removal of the roots, or will they remain to grow new above-ground parts? However, my greater concern is that there is no indication that thinning is needed. There are plenty of nearby open areas on this property for snakes to bask, if so needed. It is not clear how the 1.5 HUs/ha were determined (and no justification is given).

The DEP report (NJDEP 2011) further states:

> "For the enhancements of this site to be valuable to pine snakes, the applicant must also include measures to assure that off-road vehicles (ORVs) would be prevented from access to the site. Therefore, the total potential pine snake enhancement value of 24.2 HUs would be applied to this site if the applicant includes needed measures to prevent ORVs from entering the site. Piles of large stumps placed across access roads seem to be an effective way to reduce or prevent ORV access, and provide a secondary benefit of creating habitat for reptiles and other wildlife. Therefore, ENSP recommends using stump piles to block access to the site as the preferred method of dealing with the ORV access issue. However, other approaches may also be acceptable."

The problem with this approach is that ORV users are very inventive, and any measures to prevent ORV use have to be on-going, and have to adapt to new conditions (see Burger et al. 2007). It is also necessary to continually monitor to determine if there are other places they can go around barriers. Given the size of the property, and its frontage on the Beckerville Road, it is unclear how entry could be prevented (especially during the time trees are growing). And it is unclear, whether there will be continual monitoring to address ORV use when it begins. Preventing ORV entry into critical Pine Snake habitat is a continuous process of keeping ahead of the inventiveness of ORV drivers, and of enforcement.

Finally, it is unclear how the failure to prevent ORV will impact the other HUs granted.

E. Local Scale Pine Snake Behavior and Ecology

1. Pine Snakes are Threatened in New Jersey partly because they are a large snake that has specific habitat requirements that include a matrix of habitats to nest, breed, bask, forage, and hibernate. Suitable habitats are decreasing forcing the snakes into sup-optimal habitats.

The threats to Pine Snakes are well documented (NJDEP 2009a, Burger and Zappalorti 2011), and the need for their Threatened status was clear from the NJDEP decision to keep them on the Threatened species list (NJDEP 2009b).

2. Established Pine Snake hibernacula and nesting areas that are known to be in use recently should be protected because consistent, long-term data are not available to support the feasibility of "created nesting areas'.

The importance of protecting known snake hibernacula has been described above, largely because they can be used for at least 25 years (our data), can be used one year and not the next or vice-versa, and can be unused for up to ten years and then be used again (Burger et al. 2007).

Further, females will continue to use the same nest site for many years (Burger and Zappalorti 1992). Over an eleven year study, we found that 43 of 45 females returned to the same EXACT nest site to lay eggs, many in consecutive years. Two females used the same exact site for seven consecutive years, one used the same site for nine years straight, and another female dug a nest in the same exact spot over an eleven year period. This indicates that females are faithful to their known nesting area.

Similarly, Pine Snakes will continue to use the same hibernation sites year after year (Burger et al. 2007). We even had one Pine Snake who we captured repeatedly over 23 years in the same hibernaculum (and the previously known oldest Pine Snake in the wild was 15 years old). The longevity of Pine Snakes in the NJ Pine Barrens is important, because, when coupled with their continuous use of the same hibernaculum site for many years (Burger and Zappalorti 2011), it indicates the importance of protecting these sites, such as the hibernaculum site on the Wal-Mart property.

3. Pine Snakes normally do not travel more than 3 miles, and will thus not be likely to move to any of the distant mitigation parcels.

   See section D.1 above.

4. Restricted pathways or corridors (e.g. to the known hibernation site on Wal-Mart property), and to other nearby sites (e.g. toward Crossley) reduce the likelihood that the snakes will travel there, and will expose them to increased predation.

While clearly not the responsibility of Wal-Mart, the corridors between this site and others (e.g. Crossley Preserve) need to be wide enough to allow movement between these areas in order to protect the meta-population.

5. Pine Snakes dig long burrows that lead to their nest chamber; these are thus vulnerable to inappropriate sand compaction and vegetation features (shallow roots to prevent collapse).

Unlike many other reptiles, Pine Snakes in the New Jersey Pine Barrens dig nests that include a long tunnel with a chamber at the end (Burger and Zappalorti 1991). This is a delicate process since the tunnels could collapse while the female is digging, or before she reaches the place where she will dig a nest chamber and lay the eggs. While other reptiles (turtles) dig a nest that is mainly vertical in the ground, shallow, and does not contain a long tunnel, Pine Snakes can dig a tunnel that is up to 100 inches long. The sand must be the appropriate compaction with fine roots to stabilize the soil. Sugar sand or sand that is too compacted will not be effective (Burger and Zappalorti 1991). In my experience, Pine Snakes do not immediately use excess sand dumped somewhere (during construction, for example), but require it to settle, and allow some succession of small herbs (such as *Hudsonia)*. Inferences drawn from successful turtle management are not transferable to Pine Snake nesting sites.

Fig. 5. Photograph of female Pine Snake in her nest chamber with recently laid eggs. Note the roots above her.

6. Pine Snakes dig burrows in areas where there is some low vegetation that can provide some cover while digging their nests (females take several days, and rest in the hot part of the day.

Female Pine snakes can take 2-3 days to dig their nest. They normally rest during the hottest part of the day, seeking shade beneath low herbs or shrubs (Burger and Zappalorti 1991). Thus, it is important for there to be nearby low shrubs or herbs where they can hide from poachers or predators.

7. Pine Snakes use scent trails of other snakes to find hibernation sites, and perhaps nesting sites, and these will not be present in newly created nesting areas or in constructed hibernation sites, particularly if there are no snakes around presently. Without scent trails hatchling Pine Snakes would be less likely to find suitable hibernation sites.

One difficulty with the mitigation measures is that many of them will not have immediate effects (planting trees or grasses, depositing soil for nesting), and others will have secondary effects. For example, Pine Snakes rely on scent trails of other Pine Snakes to find hibernation and nesting sites (Burger 1990, Burger and Zappalorti 2011), and if these are disturbed around natural hibernacula (as in the case of the one on the Wal-Mart site), or they do not exist (in the case of fresh sand laid down for nesting or created hibernacula), then the snakes will not find the site easily or quickly.

8. Pine Snakes are long-lived and philopatric (return to same site to nest and to hibernate), and any attempt to disrupt their patterns (by destroying a hibernaculum or lessening its value) could lead to increased mortality, decreased reproductive success, and population declines.

The long-term studies of Burger and Zappalorti (see reference list) indicate that Pine Snakes are philopatric to both hibernation sites and nesting sites. These places have proven successful in the past, and Pine Snakes continue to return year after year. Pine Snake females can assess the safety or success of nesting in a particular place because, if they nested there before, there are scent trails, and the hatched egg shells from the previous year, and sometimes the hatched shells (indicating successful hatching) of other females' eggs.

Pine Snakes can assess the safety of a hibernaculum by a lack of odors of predators (other snakes, mammals such as skunk, raccoon), and the presence of abundant Pine Snake odor trails. I demonstrated experimentally that Pine Snake hatchlings can distinguish and avoid the odor of predators (both Fox and Kind Snakes, Burger 1989a, Burger et al. 1991).

Snakes that return to a hibernaculum, or a nesting area, and find it no longer suitable (either because of physical disruptions or predators) will have to expend

more time and energy looking for another suitable site, and may not fine it in time to hibernate or lay eggs for the season.

Table 4. Pine Snake use of Hibernation Sites. Locations are not given to prevent poaching. Given is the number of snakes found each year (after Burger et al. 2007, Burger and Zappalorti 2011).

YEAR	Loc 1	Loc 2 Site A	Loc 2 Site B	Loc 2 Site C	Loc 2 Site D	Loc 2 Site E	Loc 3
1986	13	10	8	0	6	-	-
1987	1	13	12	3	1	-	-
1988	10	16	6	0	0	-	0
1989	10	15	16	0	0	-	21
1990	23	18	6	2	9	-	28
1991	14	7	10	0	5	11	27
1992	12	2	0	0	0	7	11
1993	12	0	3	0	0	0	18
1994	11	1	0	0	0	11	15
1995	6	0	0	0	0	11	15
1996	7	10	0	1	0	9	6
1997	7	11	0	0	0	2	10
1998	0	13	0	1	0	1	16
1999	2	16	1	0	0	0	15
2000	3	11	0	0	1	0	19
2001	4	6	2	0	3	0	17
2002	0	10	0	0	4	0	11
2003	0	5	1	1	0	0	4
2004	0	14	4	0	5	0	8
2005	2	25	11	1	0	0	2
2006	1	27	8	0	1	0	6
2007	0	7	3	0	4	0	6
2008	2	7	0	1	0	0	5
2009	1	7	0	0	0	3	2
2010	14	10	12	0	3	0	2

Note: In den 3, we missed the snakes because we dug them up in mid April, and had undoubtedly missed them because they had already left.

9. As recognized by all concerned major highways are a barrier for Pine Snakes. Pine Snakes will readily cross the railroad, and indeed use this habitat for basking, nesting in rare cases along the edge, and for protection from heat. The presence of this open habitat is a positive feature of the Wal-Mart site that is not considered.

Railroad beds, particularly abandoned ones or ones that are infrequently used, are important to Pine Snakes for resting, basking or even seeking shelter from the hot sun. Thus the railroad tracks on the edge of the Wal-Mart property is an advantage to snakes on and off the property. The value of this habitat feature was not considered in the evaluation.

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MAPS REVIEWED:

Vegetation Maps – Wal-Mart site and mitigation sites

Wal-Mart site and current state ownership

Wal-Mart site and mitigation parcels

Block 73, lot 21.

Block 73, lots 31 and 32

Block 77, lots 2,4,5,6

Block 77, lot 27 (adjacent to development

Heritage Minerals sites

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