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Chapter 2: Alternatives

2.1 Introduction

This chapter describes the various actions that could be implemented for future management of white-tailed deer in Valley Forge NHP. It includes a description of Valley Forge NHP's deer density goal and the threshold for taking action, which are needed to fully understand the action alternatives (i.e., Alternatives B, C, and D). This is followed by an overview of the alternatives selected for detailed analysis. Next, detailed descriptions of each alternative are presented, followed by a discussion of adaptive management and how it could be applied to the alternatives. The remainder of the chapter addresses alternatives that were considered but dismissed from detailed analysis, and the preferred and the environmentally preferred alternatives are identified.

2.2 Deer Density Goal and Threshold for Taking Action Under Alternatives B, C, and D

Before an action alternative may be fully developed or implemented, the park must first determine (1) when action needs to be taken (i.e., when loss or damage to forest vegetation reaches unacceptable levels), and (2) how many deer would be treated or removed. Response to a confirmed case of CWD is defined by the distance of the confirmed case from the park boundary and location of the park relative to a state-established CWD containment zone. The following discussion describes both the deer density goal (which would be used to determine the number of deer that would be removed) and the threshold for taking action (which is related to vegetation damage from deer browsing). These also represent key elements of the adaptive management approach in establishing desired outcomes and facilitating determination of management success in achieving plan objectives.

2.2.1 Threshold for Taking Action

The point at which action would be needed is called the “threshold for taking action” or “action threshold.” Forest regeneration has been selected as the primary measure of plan success. Because the deer population is to be managed based on the success of forest regeneration, tree seedlings must be monitored to determine at what point the browsing impacts would warrant implementation of the selected management alternative.

Herbaceous cover also would be monitored but not used initially as an action threshold. After data exist to aid in determining how and which herbaceous indicators should be used, herbaceous cover could be added as an action threshold through adaptive management, described later in this chapter.

The appropriate action threshold for Valley Forge NHP is based on available research on forest regeneration and the regeneration standard adopted by the Pennsylvania Regeneration Study (PRS). This study is a component of the Forest

Forest regeneration has been selected as the primary measure of the success of this plan.

Inventory and Analysis (FIA) Program being implemented nationwide by the U.S. Forest Service. The FIA program has collected data in Pennsylvania forests since the 1950s; however, sampling occurred on a “periodic” basis every 10-15 years (McWilliams et al. 2004). In 2000, the FIA program partnered with the Pennsylvania Bureau of Forestry to implement a new system of inventory and monitoring to “evaluate composition and abundance of tree seedlings and associated vegetation” on an annual basis in Pennsylvania forests. The standard adopted by the PRS for adequate regeneration is 25 tree seedlings per 12.57 square meters or 8,000 tree seedlings per acre (McWilliams et al. 2004).

The proposed tree regeneration threshold for Valley Forge NHP is based on the guidelines provided by the PRS and adopted across Pennsylvania. Monitoring to determine when the threshold has been reached would be conducted in 28 forest vegetation plots, each containing twelve 1-square-meter quadrants (Appendix A). Acceptable tree seedling recruitment levels occur when at least 70% of the forest plots (20 of 28 plots) have 24 seedlings or more in their twelve 1-square-meter quadrants. These figures are slightly lower than those adopted by PRS due to the size of established monitoring plots. Due to the design of the plots, this also results in 8,079 tree seedlings per acre.

Threshold for CWD Response

Response to a confirmed case of CWD is defined by the distance of the confirmed case from the park boundary and location of the park relative to a state-established CWD containment zone¹. The three CWD response thresholds proposed for the park are: (1) closest confirmed case of CWD is greater than 60 miles from the park boundary; (2) closest confirmed case of CWD is less than or equal to 60 miles but more than 5 miles from the park boundary and the park is not within a state-established CWD containment zone; (3) closest confirmed case of CWD is less than or equal to 5 miles from the park boundary or the park fell within a state-established CWD containment zone. Three implementation zones have been established reflecting appropriate thresholds for increasing CWD response. Refer to the CWD Response Plan for a full description of CWD implementation zones.

2.2.2 Initial Deer Density Goal

As of 2009, the deer density within the park is estimated to be 241 deer per square mile. Within the Mid-Atlantic Region, low deer density has been defined as 13 to 21 deer per square mile and high deer density as 56 to 64 deer per square mile (Horsley and Marquis 1983). To maintain natural forest regeneration, estimates of appropriate deer density range from 10 to 40 deer per square mile (Tilghman 1989; Marquis, Ernst, and Stout 1992; deCalesta 1994; Horsley and Marquis 1983; Sage, Porter, and Underwood 2003). The range in deer density recommendations reflects the diversity of forest types across Pennsylvania and the Mid-Atlantic Region as well as differences based on forest management goals. Generally, recommended deer density is lower in timber management areas compared to unmanaged areas in order to maintain natural regeneration (McWilliams et al. 2004). Current deer density at the park far exceeds all recommendations in the scientific literature related to appropriate deer density for maintaining natural forest regeneration.

31-35 deer per square mile would be an appropriate target density for this plan.

¹ Defined by the Commonwealth of Pennsylvania as a buffer zone around the 5-mile radius surveillance area established when 2 or more CWD-positive cases are documented. The buffer area would have a radius at least as large as the surveillance zone radius. State priorities within the containment zone are to contain the disease and reduce the prevalence rate.

The deer density goal at Valley Forge NHP refers to an appropriate density of deer that would allow for natural forest regeneration. This density would be used as a goal under any of the action alternatives that include deer population control. In 1983, based on the definitions above, deer density at Valley Forge NHP was moderate (31-35 deer per square mile) and habitat was considered in good condition (Cypher, Yahner, and Cypher 1985). The science team agreed that, based on the quality of vegetation, the 1983 deer density of 31-35 deer per square mile would be an appropriate target density for this plan. This range is an initial goal, meaning that it could be adjusted during the life of the plan (up or down) based on the level of successful tree regeneration and deer population monitoring to ensure that the goals are met, as described in Section 2.9: Adaptive Management Approaches Included in the Alternatives.

2.3 Overview of Alternatives

The alternatives selected for detailed analysis are summarized below. NEPA requires federal agencies to explore a range of reasonable alternatives and to analyze what impacts the alternatives could have on the human environment, which the act defines as the natural and physical environment and the relationship of people with that environment. The analysis of impacts is presented in Chapter 4: Environmental Consequences and is summarized in Table 8 at the end of this chapter.

The alternatives under consideration must include a no-action alternative, as prescribed by NEPA regulations at 40 CFR 1502.14. The no-action alternative (Alternative A) in this document is the continuation of the park's current deer management activities, including continuation of limited CWD surveillance. The three action alternatives (Alternatives B, C, and D) contain actions to support forest regeneration and to protect, conserve, and restore native plant communities and other natural and cultural resources.

These alternatives also include the full implementation of the park's CWD Response² Plan (Appendix C). CWD response actions include disease surveillance (for detection), as well as actions to assess disease prevalence and distribution, minimize the likelihood of spread to surrounding communities and amplification within local deer populations, and if possible, promote elimination of CWD. All actions would be closely coordinated with the PGC and Pennsylvania Department of Agriculture (PDA) due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

Action alternatives were developed by the interdisciplinary planning team, with feedback from the public and the science teams during the planning process. These alternatives meet, to varying degrees, the management objectives for Valley Forge NHP and also the purpose of and need for action, as expressed in Chapter 1: Purpose of and Need for Action. Because these action alternatives would meet the park's objectives and would be technically and economically feasible, they are considered "reasonable."

² Response to CWD includes disease surveillance (detection) actions as well as short-term actions to assess disease prevalence and distribution, minimize the likelihood of spread to surrounding communities and amplification within local deer populations, and if possible, promote elimination of CWD.

2.3.1 No-action Alternative

Under **Alternative A, No-Action**, existing deer management and monitoring efforts would continue. These actions include continued deer population and vegetation monitoring, maintaining small fenced areas to protect selected vegetation, roadkill removal, public education, coordination with the PGC, and continuation of limited CWD surveillance as described in the CWD Response Plan. No new actions would occur to reduce the effects of deer overbrowsing or to address CWD. A detailed description of Alternative A is provided in Section 2.4.

2.3.2 Action Alternatives

Alternative B, Combined Nonlethal Actions: In addition to the actions included under Alternative A, Alternative B would incorporate nonlethal actions to protect native plant communities, promote forest regeneration, gradually reduce the deer population in the park, and enhance CWD surveillance. This would include rotational fencing of selected forest areas of the park. The location of fenced areas would be selected based on the availability of forested areas of appropriate size (e.g., where a 10-acre enclosure could be rotated four times to cover 40 acres of forest), to be inclusive of the different forest types in the park, to promote park-wide distribution, and facilitate easy maintenance. The fencing would be rotated as forests within fenced areas reached acceptable levels of regeneration. The rotational fencing would be implemented in conjunction with reproductive control to gradually reduce and then maintain the deer population at an appropriate density. Reproductive controls would be implemented via a chemical reproductive control agent, when an acceptable agent becomes available. Until such an agent is available, the rotational fencing would be the sole means of promoting regeneration of the park's vegetation. It is expected that both actions would occur throughout the life of this plan (15 years). When the initial deer density goal is achieved and acceptable levels of tree seedling recruitment have been reached it may be possible to eliminate or reduce rotational fencing. This would be assessed using adaptive management.

If a confirmed case of CWD were detected within 5 miles of the park boundary or the park fell within a state-established CWD containment zone, then surveillance would be enhanced using tonsillar biopsy to test deer and remove CWD-positive members of the population. A detailed description of Alternative B is provided in Section 2.6.

Alternative C, Combined Lethal Actions: In addition to the actions included under Alternative A, Alternative C would incorporate lethal actions to protect native plant communities, promote forest regeneration, and quickly reduce the deer population in the park. The additional actions would include direct reduction of the deer population and maintenance at an appropriate deer density. Population reduction and maintenance would be implemented through sharpshooting and capture and euthanasia of individual deer in certain circumstances where sharpshooting would not be appropriate.

If a confirmed case of CWD were detected within 5 miles of the park boundary or the park fell within a state-established CWD containment zone, then lethal reduction actions already being taken would be accelerated to achieve the target deer density more quickly. Additionally, a one-time population reduction action, to a density of not less than 10 deer per square mile, may be considered for the purposes of disease detection and monitoring. This action would be based on the state's success in reducing deer populations within the containment zone outside the park boundary. A detailed description of Alternative C is provided in Section 2.7.

Alternative D, Combined Lethal and Nonlethal Actions: In addition to the actions included under Alternative A, Alternative D would incorporate lethal and nonlethal actions to protect native plant communities, promote forest regeneration, and quickly reduce the deer population in the park. This would include all of the actions included under Alternative A, as well as the reproductive controls included in Alternative B, and the lethal actions included in Alternative C. Initially, this alternative would use lethal reduction via sharpshooting and capture/euthanasia to quickly reduce the deer population and achieve the initial deer density goal. Population maintenance would be conducted via reproductive control when an acceptable agent becomes available. Until an acceptable and effective reproductive control agent becomes available, population maintenance would be conducted using lethal methods.

If a confirmed case of CWD were detected within 5 miles of the park boundary or the park fell within a state-established CWD containment zone, then lethal reduction actions, if already being implemented, would be accelerated to achieve the target deer density more quickly. If reproductive control were already being implemented, then the park would return to lethal removal actions until CWD monitoring, conducted for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents, revealed no additional CWD-positive deer within the park. At that time, if an appropriate reproductive control agent were available, the park would implement reproductive control methods for population maintenance. Additionally, during the CWD response, a one-time population reduction action could be implemented to achieve a deer density of not less than 10 deer per square mile. This action would be based on the success of state agencies in lowering deer densities to less than 31-35 deer per square mile in areas surrounding the park for the purposes of disease management. A detailed description of Alternative D is provided in Section 2.8.

2.4 Alternative A: No-action (Existing Management Continued)

As a mandated alternative, the no-action alternative “sets a baseline of existing impact continued into the future against which to compare impacts of action alternatives” (Director’s Order 12, Section 2.7). Under the no-action alternative, Valley Forge NHP would continue to implement current management actions, policies, and monitoring efforts related to deer and their effects. Current actions within the park include monitoring to record deer impacts and deer population numbers within the park, vegetation and deer population monitoring, small fenced areas to protect selected vegetation, roadkill removal, public education, and coordination with the PGC. Limited CWD surveillance also would be continued under the no-action alternative. The actions included in this alternative would continue to be coordinated with actions taken by other agencies and landowners.

2.4.1 Current Actions

Vegetation Monitoring

Vegetation monitoring, described in Appendix A of this document, would continue. This monitoring comprises 30 paired plots (fenced and unfenced) on Mount Misery and Mount Joy (Figure 3). Vegetation monitoring would continue to detect changes in the abundance and species composition of the forest understory plant community over time. As noted in Chapter 1, the NPS Mid-Atlantic I&M Network established an additional 21 long-term forest monitoring plots between 2007 and 2009 as part of its Vital Signs Monitoring Program. An additional seven plots are scheduled to be established in 2010, and an overall

data summary will be provided in 2011. Monitoring of the original 30 paired plots would continue at least until new plots have been established for a period of time that allows for some meaningful comparison of data between existing and new plots.



Staff within NPS, Mid-Atlantic Inventory and Monitoring Network collect data on forest health within the park on an annual basis.

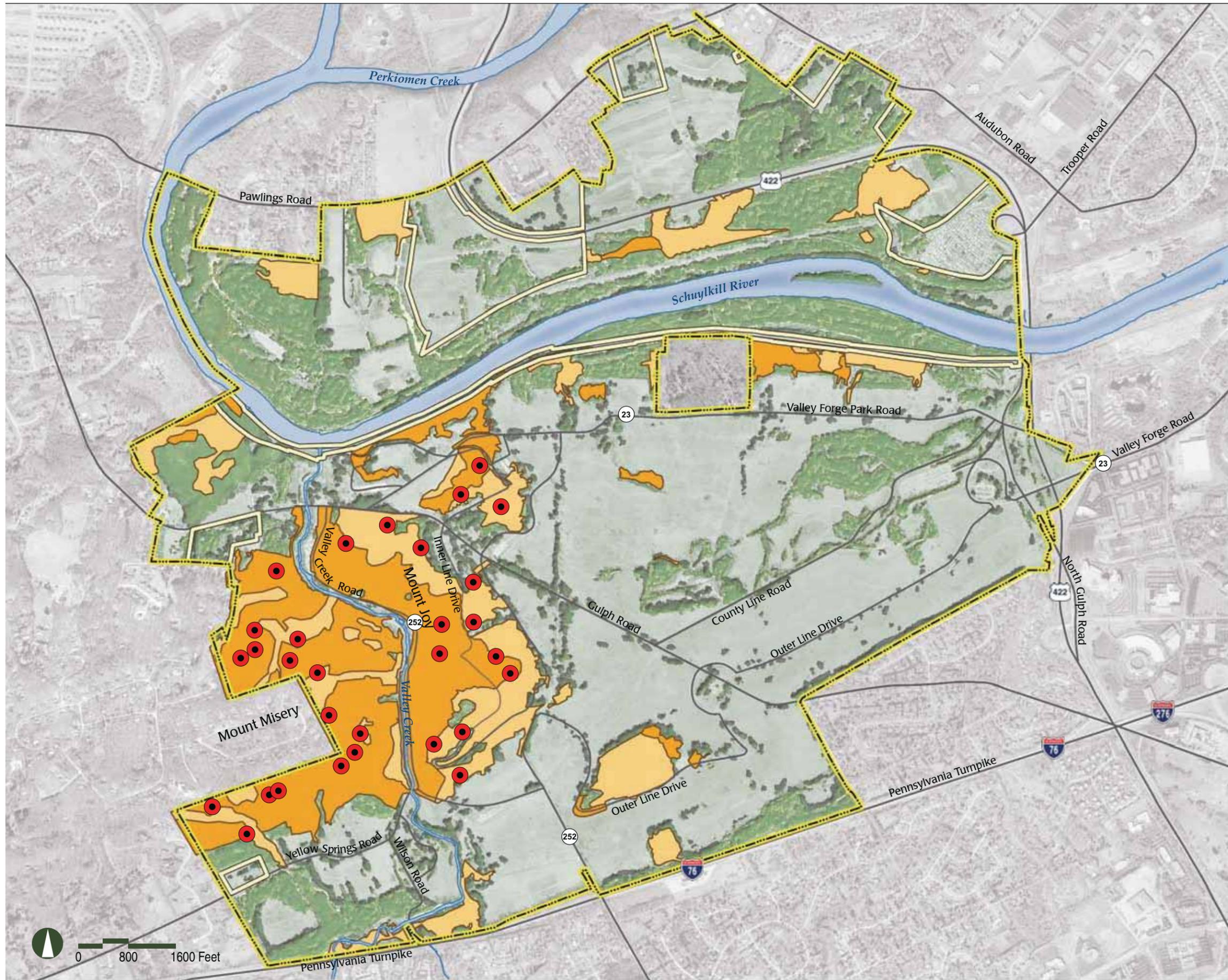
Deer Population Monitoring

Deer population monitoring, described in Appendix A of this document, would continue. This monitoring includes fall spotlight counts to determine trends in the deer population over time, and spring compartment counts to estimate the number and distribution of deer in the park over time.

Small Fenced Areas

Fencing would be maintained around small areas that contain sensitive vegetation or represent areas where management actions involving vegetation require fencing for successful establishment and/or maintenance. Additional fencing may be installed on a very limited basis as necessary. As of the end of 2007, the park had fenced approximately 40 areas covering an estimated 3.1 acres.

The park contains three plants that are listed by the state as endangered, threatened, or rare and four plant species considered of special concern due to their determination by the Pennsylvania Natural Heritage Program as critically imperiled, imperiled, or vulnerable. The two state-listed endangered plant species, possumhaw viburnum (*Viburnum nudum*) and broadleaf ironweed (*Vernonia glauca*), have been fenced to prevent extirpation from the park. Some special status plant species may be fenced in the future based on the results of continuing efforts to inventory and document the location and distribution of these species. Others are believed to be safe from deer browse due to their location or palatability. These species are discussed in greater detail in Chapter 3: Affected Environment. Approximately 3.0 acres along Valley Creek are also fenced. This protection promotes the establishment and regeneration of a forested riparian buffer along Valley Creek. Fencing of riparian buffer areas is considered necessary to protect them from deer browse.



-  Park Boundary
-  Inholdings
-  Dry Oak Forest
-  Successional Tuliptree Forest
-  Fenced Plots



Figure 3
Location of Fenced Long-term Monitoring Plots on Mount Joy and Mount Misery

Roadkill Removal

When deer carcasses are reported on roadways in the park, law enforcement staff respond and remove the carcass to the side of the road. Periodically, law enforcement staff also respond when deer struck by vehicles are severely injured and must be euthanized. An independent contractor removes deer carcasses from the park and takes them to a local landfill to deposit. This service costs the park \$35 per carcass. Basic data is collected by the contractor for each deer carcass including date, location of removal, season, gender, and approximate age (juvenile or adult). This contractor is responsible for pick-up of deer carcasses across most of Chester and Montgomery Counties for the PGC. In limited situations where access to the carcass is difficult or not in a highly visible area, surface disposal may be acceptable. In these circumstances, every effort would be made to reduce the visibility of the carcass by visitors or park neighbors.



On average, 87 deer are struck by vehicles within the park each year. Fifty percent of these occur between October and November.

Removal of deer struck by vehicles would continue as described above as long as CWD was not confirmed within 60 miles of the park boundary. As many of these deer as possible would be tested for CWD. If CWD were confirmed within 60 miles of the park boundary or the park fell within a state-established CWD containment zone, then NPS staff would assume full responsibility for removal of deer struck by vehicles and appropriate testing and disposal of carcasses. All deer would be tested for CWD. CWD testing and carcass disposal would be closely coordinated with the state. The CWD Response Plan provides more detailed information on handling and disposal of potentially CWD-positive deer carcasses.

Public Education

The park would continue to provide public education on deer and other natural resources to elementary, high school, and college students, as well as other interested citizens. These educational programs are provided by request and tailored to ensure that they meet the needs and educational levels of the audience. If CWD were confirmed within 60 miles of the park boundary, educational programs would be modified to include disease.

Coordination with Pennsylvania Game Commission

The park coordinates with the PGC primarily on law enforcement issues (e.g., poaching), disease response (e.g., CWD), and education (e.g., providing education on regulatory changes to park neighbors). The PGC also maintains data on deer harvest, deer control permits, CWD testing, and other statistics on a state-wide basis.

CWD Response

All management alternatives, including the no-action³ alternative, contain actions to promote early detection of CWD and facilitate cooperation and data sharing with the PGC. In 2007, opportunistic and targeted surveillance actions, to facilitate detection of CWD, were categorically excluded by the NPS. This allowed parks, like Valley Forge NHP, to quickly initiate surveillance for CWD. In 2008, funding was received from the NPS-Biological Resource Management Division (BRMD) to purchase CWD testing supplies for opportunistic surveillance and other activities, as appropriate.

³ The no-action alternative includes opportunistic and targeted surveillance. Opportunistic surveillance actions involve taking diagnostic samples for testing from deer found dead or removed through a park management activity. Targeted surveillance actions involve the lethal removal of deer that exhibit clinical signs consistent with CWD.

Additional details related to disposal of carcasses and minimizing environmental contamination is provided in section 2.5 CWD Response Plan and a full version of the CWD Response Plan is provided in Appendix C.

Based on recommendations of the CWD science team, the CWD Response Plan for Valley Forge NHP makes the following assumptions related to CWD:

1. All response actions, across implementation zones, would be closely coordinated with the PGC and PDA due to the scale of management identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

2. The park would become part of the state's actions once a containment area has been established regardless of proximity of the confirmed case to the park boundary.

3. CWD is likely present within the park if the zone 1 threshold is reached.

Opportunistic Surveillance

The park initiated opportunistic surveillance in 2008, following NPS recommendations (NPS 2002b, 2009a). Opportunistic surveillance involves taking diagnostic samples for testing from deer found dead or removed through a park management activity. Opportunistic surveillance has little, if any, negative impact on current populations. This action is consistent with “active lethal surveillance” described in Pennsylvania’s *Chronic Wasting Disease Management Plan* (PCWDTF 2007).

A standard operating procedure (SOP) for identifying and removing appropriate tissue samples for testing is currently being developed, supplies have been purchased, and training of park staff was initiated in 2007. The SOP follows CWD surveillance guidance for Valley Forge NHP (i.e., sample collection, storage, and submission, safe handling procedures, shipping, etc.) and training is being provided by the NPS-BRMD (NPS 2009a). Tissue samples would be tested by the NPS-BRMD at no charge for at least 5 years. Alternate testing facilities are located at the New Bolton Center, University of Pennsylvania’s veterinary diagnostics laboratory and the Pennsylvania Veterinary Laboratory (Harrisburg, PA). It is estimated that up to three weeks may be required to complete CWD testing regardless of the service provider. The park also would continue to coordinate with the PGC and/or agricultural agencies regarding surveillance methods and test results.

It is assumed that animals killed in collisions with vehicles may be a biased sample that is likely to be a more sensitive measure for identifying animals carrying the disease. Based on an average of 87 deer-vehicle collisions reported annually between 1997 and 2007, it is estimated that a minimum of 51 deer (4% of total park deer population estimate of 1,277 individuals) would be tested annually. The number of deer tested may be limited by use of a contractor to remove dead deer from park roadways, the need to euthanize some animals due to injury (possible head shots), and the condition of some road-killed deer which may cause them to be unsuitable for testing. Sample size also may vary depending on selection of the preferred deer management strategy.

If CWD were confirmed within 60 miles of the park boundary or the park fell within a state-established CWD containment zone, then all deer killed by vehicles would be tested annually. NPS staff would assume full responsibility for pick-up of deer carcasses and ensure appropriate testing and disposal. To minimize the potential for environmental contamination deer would be removed from the landscape as soon as possible and temporarily stored in an area with an impervious surface. Collection of tissue samples would occur on a plastic tarp or other impervious surface to minimize transfer of body fluids to the ground. CWD-negative deer would be disposed of through landfilling. CWD-positive deer would be disposed of via landfilling or incineration as described in Section 2.5 CWD Response Plan.

Targeted Surveillance

If a case of CWD were confirmed within 60 miles of park boundary but greater than 5 miles outside the park boundary and the park did not fall within a state-established CWD containment zone, Valley Forge NHP would continue to implement opportunistic surveillance as described above. Additional actions would include training of NPS employees, volunteers and others to recognize and report deer

exhibiting clinical signs of CWD, monitoring for deer exhibiting clinical signs, and implementation of targeted surveillance consistent with NPS guidance (NPS 2009a). Targeted surveillance entails lethal removal of deer that exhibit clinical signs consistent with CWD. Targeted surveillance has negligible negative effects on the entire population, removes a potential source of CWD infection, and is an efficient means of detecting new centers of infection (Miller et al. 2000).

Trained personnel (staff and volunteers) would conduct visual surveys for deer exhibiting clinical signs of CWD during their daily work activities, which often involve travel throughout the park or direct interaction with deer (e.g. deer counts, deer-vehicle collision response). NPS staff would remove deer exhibiting clinical signs of CWD under the existing protocol for euthanasia of wildlife using an appropriate firearm. Lethal removal actions are generally taken to address animals exhibiting signs of disease (e.g., rabies, severe mange) which pose a threat to human health and safety or animals with a serious injury (e.g., deer-vehicle collision). Testing for CWD may necessitate targeting the body rather than the head for removal efforts.

One limitation to targeted surveillance is that clinically affected animals presumably shed infectious prions before they are visibly ill. Thus, environmental contamination and direct transmission may occur before the animal is removed (NPS 2009a). This action is consistent with “targeted surveillance” described in Pennsylvania *Chronic Wasting Disease Response Plan* (PCWDTF 2007).

Increased coordination with the PGC and PDA would be initiated and samples pooled to ensure adequate sample size to reach the desired detection level and to monitor and evaluate changes in CWD presence to the park. The desired detection level established in the state CWD response plan is 99% confidence in detecting CWD if it is present at a prevalence of at least 1%. Targeted surveillance may reduce the sample size required to achieve the desired level of detection as evidenced by the fact that nearly half of the CWD-positive populations in Colorado have been detected using this method (Conner, Krum, and Miller 2005). It is estimated that the number of deer tested through targeted surveillance under Alternative A would vary depending on the number of deer exhibiting clinical signs. Tissue samples would be tested by the NPS-BRMD at no charge for at least 5 years.

To promote detection of CWD if it is present, opportunistic, targeted, and enhanced targeted surveillance occur under all alternatives.

NPS staff would assume full responsibility for pick-up of deer carcasses and ensure appropriate testing and disposal. To minimize the potential for environmental contamination deer would be removed from the landscape as soon as possible and temporarily stored in an area with an impervious surface. Collection of tissue samples would occur on a plastic tarp or other impervious surface to minimize transfer of body fluids to the ground. CWD-negative deer would be disposed of through landfilling. CWD-positive deer would be disposed of via landfilling or incineration as described in Section 2.5 CWD Response Plan.

Enhanced Targeted Surveillance

If a confirmed CWD case occurred within 5 miles of the park boundary OR the park (or portions thereof) fell within a state-established CWD containment zone, opportunistic and targeted surveillance activities described above would continue. Additional actions would include enhanced targeted surveillance in the form of dedicated staff and volunteer time to monitor the park deer population for clinical signs of CWD on a regular basis.

2.4.2 Implementation Costs

The costs associated with Alternative A would primarily cover deer and vegetation monitoring, CWD surveillance (opportunistic, targeted, and enhanced targeted), maintenance of small fenced areas (e.g. riparian buffer fencing), and removal of deer from roadways. These estimates are considered minimum costs and do not include inflation over time. Costs assume knowledge of existing park activities and experience of park staff. Costs associated with CWD response vary significantly based on the distance of a confirmed case of CWD from the park boundary and location of the park relative to a state-established CWD containment zone. Recurring annual costs associated with Alternative A are estimated to total between \$14,828 and \$32,567. Costs over the life of the plan (15 years) are estimated to total between \$253,482 and \$403,257.

Cost over the life of the plan includes one-time and periodic costs (e.g., start-up costs, costs incurred every five years) in addition to the sum of annual recurring costs over 15 years. See Appendix D for a detailed breakdown of the costs associated with Alternative A.

2.5 Elements Common to the Action Alternatives

CWD response within the park would represent one component of broader-scale CWD response efforts by the state. The action alternatives contain all of the elements described above under Alternative A. These elements are:

- Vegetation monitoring
- Deer population monitoring
- Small fenced areas
- Roadkill removal
- Public education
- Coordination with PGC
- CWD response – opportunistic, targeted, and enhanced targeted surveillance

All of the action alternatives contain additional activities including the use of volunteers and enhanced CWD response. These additional actions common to all the action alternatives are described below.

2.5.1 Use of Volunteers

Under all of the action alternatives, Valley Forge NHP would solicit the help of volunteers, as is its current practice with other park programs. As an example, volunteers could assist in the implementation of activities such as closing off areas to the public, or assisting in the removal and processing of deer carcasses. Volunteers would not be involved in activities involving the use of firearms for the purposes of lethal removal. Limitations of the use of volunteers for specific actions are described below.

Lethal Reduction

As noted in Chapter 3, Affected Environment, Valley Forge is located in a major eastern metropolitan area. Throughout most of the 20th century the area was characterized by agricultural production. However, in the past two decades these areas have yielded to substantial suburban development. Farms and open spaces have been replaced by residential, commercial, and office development serving local residents as well as greater Philadelphia commuters. Over 1,262,000 people live in the Counties of Chester and Montgomery adjacent to the park. The area surrounding the park is built up, characterized by low to mid density residential and commercial land uses. Threading between the park and commercial areas is the regional highway network interconnecting several heavily traveled expressways including the north-south US 422, which passes through the park and the east-west PA Turnpike, I-76/I-276, which passes along the park's southern boundary, connecting Philadelphia to the rest of the state. The 3,500-acre park is one of the few, large, contiguous, protected areas in southeastern Pennsylvania that has a variety of habitat types including a river, numerous streams and forested wetlands, eastern deciduous forest, and tall-grass meadows and serves as an oasis for native wildlife. In addition, hiking is permitted along the 28-mile trail system in the park and other recreational activities, such as biking, horseback riding, fishing, and similar active and passive recreational activities take place, where authorized, throughout the park.

Because of the nature of the unconfined recreational activities, landform restrictions which would not enable complete closure of access, and related safety concerns, use of volunteer sharpshooters for lethal reduction is considered inappropriate at Valley Forge under all alternatives that incorporate use of lethal reduction as a management activity. Although volunteers would be excluded from using firearms, they may assist in other activities such as the transport and processing of carcasses, maintenance of bait stations, and implementing park closures. On-site volunteer training would be provided by NPS staff to support volunteer involvement.

While some other areas administered by the NPS have proposed or begun the implementation of use of volunteers as sharpshooters in lethal reduction activities, not all locations within National Park System Units are suitable for use of volunteers to engage in such activities. Typically, those national park system units that are allowing for participation of volunteers as sharpshooters are located in areas with scattered and sparse populations. Additionally, these areas have expanses of wilderness and backcountry that are less likely to have concentrations of users that may inadvertently enter closed areas.

Additionally, sharpshooters meeting NPS requirements (qualified federal employees or contractors) would be required to demonstrate the necessary proficiency and experience in wildlife population management including lethal reduction actions. As a result of challenges associated with park topography, human population density along the park boundary, the nature of recreational use in the park, and the number of deer to be removed, it is essential that accuracy and demonstrated professional experience by sharpshooters be assured for maximum success in lethal removal and to ensure public safety.

Administration of Reproductive Control Agents

In limited circumstances, volunteers could be involved in activities related to the administration of reproductive agents under the direct supervision of NPS employees. Volunteers would not be permitted to fire dart rifles but may be involved in wildlife handling activities and the handling/transport of chemical agents.

Volunteers would minimally be required to attend an NPS approved course on wildlife restraint and chemical immobilization (at no cost to the NPS). However, additional requirements and/or NPS qualification standards may apply depending on the activity. Handling of chemical agents would require technical training or licensing that volunteers would have to possess (e.g., veterinary license). The use of volunteers to administer reproductive agents involves less risk of harm to volunteers and to others than the actions required in lethal reduction. As a result, volunteers may take more active roles in implementation of this option if such volunteers meet required training standards.

2.5.2 CWD Response Plan

Integration of the CWD Response Plan into the plan/EIS is considered necessary due to an elevated risk of CWD and because of planning efficiencies and cost savings associated with integration. The direct relationship between the plan/EIS objectives, alternatives, and impact analysis and the goals, response strategies and environmental impacts of the CWD Response Plan make integration both feasible and cost-effective. It should be clearly stated that CWD is not currently known to be present in the park or the Commonwealth of Pennsylvania and that integration of CWD response represents an effort on the part of the NPS to be proactive and fully prepared given the high level of risk. The Valley Forge NHP CWD Response Plan was developed in cooperation with the PGC and all actions, across implementation zones, would be closely coordinated with the PGC and the PDA due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles). Cooperation with state efforts to address CWD would continue as long as these actions are not in conflict with NPS or park mission and mandates and both the NPS and PGC acknowledge that actions taken within the park boundary may be conducted independently of state actions. A full version of the Valley Forge NHP CWD Response Plan is provided in Appendix C.

Response to CWD includes disease surveillance (detection) actions as well as short-term actions to assess disease prevalence and distribution, minimize the likelihood of spread to surrounding communities and amplification within local deer populations, and if possible, promote elimination of CWD.

Background

As deer populations increase, risks related to transmission of contagious diseases within these higher density populations are a concern (Joly et al. 2006; Samuel et al. 2003). CWD is a fatal, neurological disease that has been identified in free-ranging as well as captive mule deer (*Odocoileus hemionus*), white-tailed deer, elk (*Cervus elaphus*), and most recently moose (*Alces alces*). CWD is in the family of diseases known as the transmissible spongiform encephalopathies (TSEs) or prion diseases. Other TSEs include scrapie in sheep, bovine spongiform encephalopathy (BSE or mad cow disease), and Creutzfeldt-Jakob disease (CJD) in humans. CWD causes brain lesions that result in progressive weight loss, behavioral changes, and eventually death in affected individuals. CWD could substantially reduce infected cervid populations by lowering adult survival rates and destabilizing long-term population dynamics. Recent research on infected and non-infected mule deer in Colorado indicated that the estimated average life expectancy of adult mule deer, once infected with CWD, was only 1.6 years compared to 5.2 years for uninfected deer (Miller et al. 2008). While much is still unknown about the way this disease spreads among natural hosts there is the potential for long-term, population-level effects.

Signs of CWD in deer include changes in behavior and body condition. Affected animals can lose their fear of humans, show repetitive movements, and/or appear depressed but quickly become alert if startled. CWD results in rapid loss of body condition despite having an appetite, and in the end stages of the disease affected

animals become emaciated (NPS 2009a). Once signs of CWD appear, it can vary from a few days to nearly a year until death, although in wild populations it is likely that animals late in the clinical stages of the disease live only days. Although the precise origin of CWD will probably never be determined, it is strongly suspected that CWD is a nonnative disease among cervids (NPS 2009a, 2002b).

CWD was considered isolated to the West and Midwest regions of the United States until 2005, when it was confirmed in both New York and West Virginia. Since that time, staff at Valley Forge NHP have tracked the occurrence and detection efforts within Pennsylvania and surrounding states. As of 2008, the nearest confirmed case of CWD in free-ranging deer was in West Virginia, over 200 miles from the park. Additionally, two captive populations have recently been diagnosed with the disease in New York. No cases of CWD have been confirmed in Pennsylvania in either farmed or free-ranging deer populations. The entire state, however, is considered to be at high risk (PCWDTF 2007) due to the presence of CWD in an adjacent state. A full CWD risk assessment for Valley Forge NHP is provided in Appendix C.

CWD Response Goals

The goals of the CWD Response Plan at Valley Forge NHP are:

1. Determine the ongoing risk of CWD infection in the white-tailed deer population of Valley Forge NHP based on known disease risk factors.
2. Develop adaptive management protocols for the detection of CWD presence, prevalence, and distribution, as well as response to the disease based on the proximity of a confirmed case of CWD to the park boundary and proximity of the park to a state-established CWD containment zone.
3. Cooperate and coordinate with state wildlife and agricultural agencies to promote 99% confidence of detecting the disease if it is present in the area at a prevalence of at least 1% and respond to positive or confirmed cases. It is assumed that data from both state and federal lands would need to be pooled to achieve a sample size sufficient to ensure a high level of confidence in detection of CWD if it is present and assess prevalence if CWD is confirmed as present.
4. Minimize the likelihood of CWD becoming established within the park's deer population and if CWD becomes established, minimize the likelihood of amplification and spread and promote elimination of CWD, if possible, from the park or state-established CWD containment zone.
5. Promote communication with state wildlife and agricultural agencies, other stakeholders, and the public to ensure timely distribution of accurate information related to CWD and associated response actions.

Thresholds for Response

Response to a confirmed case of CWD would be defined by the distance of the confirmed case from the park boundary and location of the park relative to a state-established CWD containment zone. The three CWD response thresholds for the park are: (1) closest confirmed case of CWD is greater than 60 miles from the park boundary; (2) closest confirmed case of CWD is less than or equal to 60 miles but more than 5 miles from the park boundary and the park is not within a state-established CWD containment zone; (3) closest confirmed case of CWD is less than or

equal to 5 miles from the park boundary OR the park falls within a state-established CWD containment zone. Three implementation zones have been established reflecting established thresholds for increasing CWD response (Figure 4).

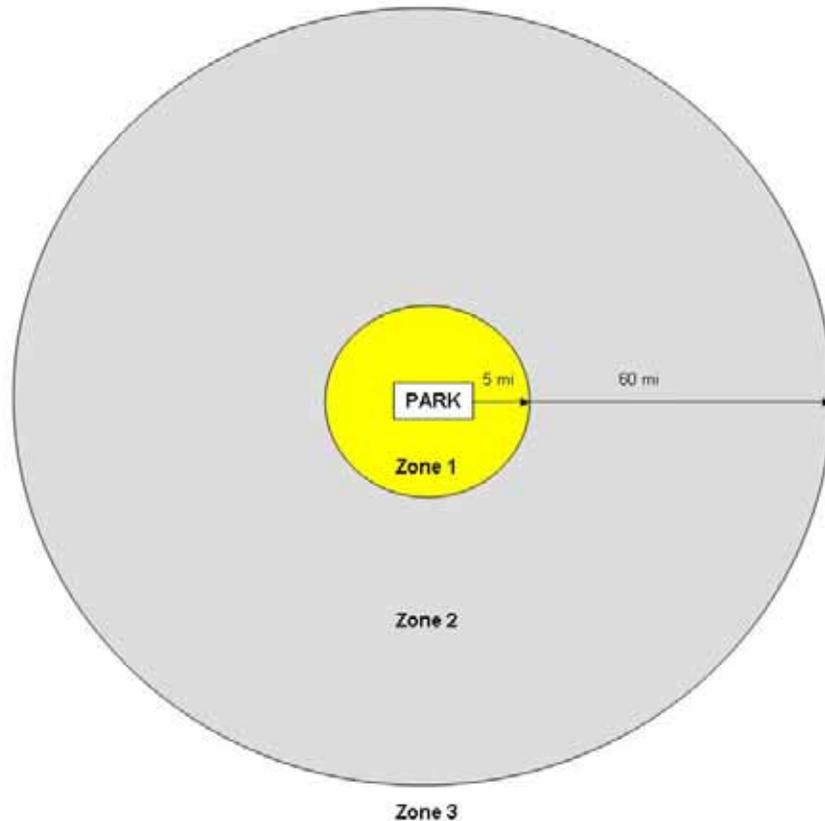


Figure 4: CWD Implementation Zones at Valley Forge NHP

Note: Figure not to scale

Response includes disease surveillance (detection) actions as well as actions to assess disease prevalence and distribution, minimize the likelihood of spread to surrounding communities and amplification within local deer populations, and if possible, promote elimination of CWD. All actions, across implementation zones, would be closely coordinated with the PGC and PDA due to the scale of the area identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles). Response actions described in this plan would only be implemented by the NPS within the park boundary.

Implementation Zones 3 and 2 were determined based on current NPS guidance (b 2002, 2007d). These zones reflect different levels of staff readiness and CWD detection effort when the closest confirmed case is greater than 5 miles from the park boundary and the park does not fall within a state-established containment zone. Implementation Zone 1 represents NPS response to a confirmed case of CWD within 5 miles of the park boundary or when the park falls within a state-established CWD containment zone.

Implementation Zone 1 is based on the maximum distance female deer within the park are known to travel (Lovallo and Tzilkowski 2003), the average male dispersal distance within the Ridge and Valley Province of Pennsylvania, and is consistent with

the 5-mile radius surveillance and containment zones established in the PA CWD Response Plan (PCWDTF 2007). Evaluation of deer movements relative to the park boundary between 1997 and 1999 indicated the maximum distance female deer traveled from the park boundary was 1.23 miles (6,512 feet) and 5 miles is expected to contain most doe movements. The PGC also evaluated dispersal distance and dispersal rate for male deer across the state between 2002 and 2003. Average dispersal distance of young males, in areas similar to Valley Forge NHP, was 4.35 miles (Long et al. 2005). Therefore, a 5-mile boundary was selected for Zone 1.

According to the Pennsylvania CWD Response Plan (PCWDTF 2007, 2008) a 5-mile radius surveillance area (79 square miles) will be established by the state around the first positive case of CWD and intensive CWD testing will be conducted to confirm presence of the disease. If additional positive cases are detected, a containment zone will be established by the state, adding a buffer area around the 5-mile radius surveillance area. The buffer area will have a radius at least as large as the surveillance area radius (PCWDTF 2007). Inclusion of the park within a state-established containment zone as an element of the response threshold for Implementation Zone 1 is based on the CWD Science Team recommendation that the park become part of the state's actions once a containment area has been established regardless of proximity of the confirmed case to the park boundary. This plan also assumes that CWD is likely present within the park if the Zone 1 threshold is reached.

CWD Response

Response actions within Implementation Zones 2 and 3 are described under the no-action alternative (Alternative A) and consist of opportunistic, targeted, and enhanced targeted surveillance.

If a confirmed CWD case occurs within Implementation Zone 1 (less than or equal to 5 miles of the park boundary OR the park fell within a state-established containment zone), surveillance activities described in Zones 2 and 3 above would continue. Live testing and culling of CWD-positive deer or active lethal surveillance would be implemented depending on the deer management alternative selected for implementation.

Under Alternative B (combined nonlethal actions), live testing and culling of CWD positive deer would be implemented simultaneously with reproductive control actions. Under alternatives that include lethal actions (Alternatives C and D), the park would initiate a rapid reduction of the deer population to quickly achieve the target deer density. This may include a one-time reduction of the population for the purposes of disease detection and monitoring. All actions would be conducted in cooperation with the state to ensure a coordinated response.

Test and Cull

Tonsillar biopsy has been used in limited situations to test live deer and remove CWD-positive members of the population (NPS 2009a; Wolfe et al. 2004). Under the combined nonlethal deer management alternative (Alternative B), a test and cull approach would be used to enhance CWD detection and monitoring efforts. The technique requires capture, general anesthesia, tonsillar biopsy, and the ability to test large proportions of the park's deer population (NPS 2009a). Initial treatment of deer with a reproductive control agent under Alternative B, requires capture for the purpose of marking individuals as "treated." Therefore, a test and cull approach is considered reasonable with minimal additional effort. Training on tonsillar biopsy techniques and appropriate handling and storage of tissue samples would be provided by the NPS-BRMD.

Tissue samples for live tests would be obtained during handling of deer for the purpose of marking the deer as “treated” with a reproductive control agent. Animals would be individually marked to ensure CWD-positive animals could be relocated. CWD-positive animals would be lethally removed from the population by qualified federal or state employees and/or contractors. The expected number of animals to be tested annually would be the same as the number initially treated with a reproductive control agent under Alternative B.

Limitations of this approach include the fact that animals initially captured and marked as “treated” with a reproductive control agent would not be anesthetized and handled for subsequent reproductive control treatments (delivered remotely). These individuals would be excluded from CWD testing after the first year, which may result in large variations in sample size over time. Additionally, reproductive control, as described under Alternative B, excludes male deer from the surveillance effort. Dispersal of male deer may be one of the primary means of CWD spread. Variation in sample size and exclusion of male deer from the sampling effort may increase the potential of failing to detect the disease if it is present.

Active Lethal Surveillance

The term “active lethal surveillance” refers to lethal removal of deer within the park for the purposes of assessing disease presence, prevalence, and distribution. These actions may also minimize the likelihood of CWD becoming established, minimize the likelihood of amplification and spread if the disease is introduced, and promote elimination of CWD, if possible. Specific actions associated with active lethal surveillance are rapid reduction of the deer population to achieve the initial target deer density (31-35 deer per square mile) and a one-time reduction in population to a density consistent with the surrounding environment but not less than 10 deer per square mile.

NPS guidance suggests reducing population numbers as an appropriate management tool when population density is above that identified in park management plans and/or the need to know CWD prevalence with a high degree of accuracy is necessary (NPS 2007d). Use of population reduction as a method for controlling disease in wildlife is based on the premise that infectious disease is a density-dependent process (Wobeser 1994). In captive situations, where animal density is high, the prevalence of CWD can be substantially elevated compared to that seen in free-ranging situations. The rate of disease transmission depends on factors such as contact rate among deer, total number of deer, and the number of infected deer (WDNR 2003). Thus it is hypothesized that increased animal density and increased animal to animal contact enhances the transmission and spread of CWD. Decreasing animal densities may decrease the transmission and incidence of the disease (NPS 2009a). The success of using population reduction as a method for controlling disease is directly related to early detection, response time, and the intensity, consistency, and duration of the control effort (WDNR 2003). This method may be more effective in managing isolated areas of disease than when disease is widely distributed. Therefore, removal efforts are considered most appropriate in situations focused on intensive control of smaller areas.

Rapid Reduction to Initial Target Deer Density. Alternatives C (combined lethal actions) and D (combined lethal and nonlethal actions), authorize lethal removal of deer on federally owned lands within the park boundary. Active lethal surveillance would allow for a more rapid reduction of the deer population to achieve the initial target deer density of 31-35 individuals per square mile. It is expected that this action would result in achieving the initial target deer density twice as fast as population

Active lethal surveillance would be considered for the purposes of assessing disease presence, prevalence, and distribution. These actions minimize the likelihood of CWD becoming established, minimize the likelihood of amplification and spread if the disease is introduced, and promote elimination of CWD, if possible.

reduction would occur as described under Alternatives C and D. Achieving the initial target deer density more quickly would minimize the probability of amplification within local deer populations and reduce the probability of spread to other deer populations. A deer density of 31-35 deer per square mile is considered appropriate as an initial target related to CWD, as well as the plan/EIS, because it is consistent with deer density in the surrounding community and therefore, is not likely to create a refuge for deer or their associated diseases. Data collected by NPS staff during the spring 2009 deer count estimated deer density outside the park boundary at 35 deer per square mile. This data also indicates an average deer density outside the park boundary of 28 deer per square mile between 2001 and 2009. Reducing the number of deer to a density far below that outside the park may increase the likelihood of potentially CWD-positive deer repopulating the park from surrounding areas.

The action generally would be carried out as described under Alternative C: Combined Lethal Actions of the plan/EIS. However, testing for CWD may necessitate targeting the body rather than the head for removal efforts. With training, head shots may be taken and still preserve tissues needed for CWD testing. Sharpshooting activities would initially target areas immediately surrounding the positive case to ensure removal of animals that have been in contact with CWD-positive animals to potentially decrease the local prevalence of CWD. Areas where deer movements across the park boundary into surrounding communities are frequent (southeastern, southwestern, and northwestern boundaries), and areas with high concentrations of deer (central and southwestern areas) also may be targeted for removal activities to reduce the probability of spread and promote elimination of the disease, if possible. During initial removal efforts, both male and female adult deer would be targeted due to the increased probability of infection in older animals and the spread potential posed by males. Additional removals in year 1 and 2 would be based on available staffing and resources. This action is consistent with the Level 1 response described in Pennsylvania's *Chronic Wasting Disease Response Plan* (PCWDTF 2007).

One-time Reduction Action. Implementation of a one-time reduction of the deer population to not less than 10 deer per square mile would be based on the state's success in reducing deer populations within the containment zone outside the park boundary. As noted above, for the purpose of disease response, the NPS does not want to reduce the number of deer within the park to a density far below that outside the park because it may increase the likelihood of potentially infected deer repopulating the park from surrounding areas. However, the NPS also does not want to maintain a deer density significantly higher than that in surrounding communities, because that may increase the likelihood of disease amplification and spread into the park. This approach allows the park flexibility in working cooperatively with the state to address CWD if they are able to achieve a population density lower than 31-35 deer per square mile in areas surrounding the park. A deer density of 10 deer per square mile is considered appropriate as a lower limit for this action because it is consistent with recommendations in the scientific literature related to appropriate deer density to ensure adequate forest regeneration, which range from 10-40 deer per square mile. It is also consistent with the stated objective of the plan/EIS to maintain a deer population in the park. The action generally would be carried out as described above under rapid reduction to initial target deer density. Additional removals that are part of the one-time reduction would be based on available staffing and resources and may take more than one year to achieve, depending on the state's actions to reduce the deer population outside the park.

All deer removed in the reduction action would be tested for the presence of CWD and samples from both the NPS and state would be pooled. It is assumed that an adequate number of samples would be collected within the park and combined with state samples

to reach the state's desired detection/prevalence level without having a significant impact on the park deer populations. If additional positive cases were not found within the CWD containment zone, the park would continue surveillance actions described for Zones 3 and 2 under the no-action alternative (Alternative A) for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents and continue to contribute to the CWD monitoring efforts of the state.

If additional positive cases are detected and assuming the park has achieved its initial target deer density and/or successfully implemented a one-time reduction for the purposes of disease response, the NPS would continue to contribute all deer obtained through opportunistic, targeted, and enhanced targeted surveillance, as well as those obtained through deer management actions, to the state sampling effort. Live testing and culling of CWD-positive deer from the park would continue under Alternative B of the plan/EIS.

Relationship to White-tailed Deer Management Plan Alternatives

All deer management alternatives described in plan/EIS include opportunistic, targeted, and enhanced targeted CWD surveillance. Surveillance actions described for Zones 2 and 3 would be implemented under any of the deer management alternatives, based on proximity of the nearest confirmed case of CWD to the park boundary and location of the park relative to a state-established CWD containment zone. Live testing and culling of CWD-positive animals is included as a surveillance technique within implementation Zone 1 under Alternative B (Combined Nonlethal Actions).

The no-action alternative (Alternative A) and Alternative B (Combined Nonlethal Actions) do not allow for active lethal surveillance methods. Excluding active lethal surveillance may be an appropriate action if the threat of CWD was low and there were very limited resources to dedicate to disease recognition. However, to maintain consistency with public input, park staff felt it was important to provide one completely nonlethal management alternative outside of the no-action alternative.

Active lethal surveillance is included as a surveillance and response technique within Implementation Zone 1 only in deer management alternatives that include lethal removal actions (Alternatives C and D). Lethal actions described under these alternatives to directly reduce the deer population would be accelerated to achieve the target deer density. If the target deer density had already been achieved and a confirmed case of CWD occurred within Implementation Zone 1 under Alternative C, then population maintenance at the target deer density would continue to be implemented using lethal reduction methods. Under Alternative D, population maintenance would be conducted using lethal reductions methods until CWD surveillance, conducted for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents, revealed no additional CWD-positive deer within the park. At that time, if an acceptable reproductive control agent is available, the park would implement reproductive control methods for population maintenance. A summary of the relationship between CWD surveillance and response actions and deer management strategies is provided in Table 3.

Table 3 Relationship between CWD Surveillance and Response Actions and Deer Management Strategies Described in the Plan/EIS

Alternative	Opportunistic Surveillance ^a	Targeted Surveillance ^a	Enhanced Targeted Surveillance	Test and Cull	Active Lethal Surveillance	Coordination with State Agencies
Alternative A (No-action)	X	X	X			X
Alternative B (Combined Nonlethal Actions)	X	X	X	X		X
Alternative C (Combined Lethal Actions)	X	X	X		X	X
Alternative D (Combined Lethal and Nonlethal Actions)	X	X	X		X	X
Implementation Zone	Zone 3	Zone 2	Zone 1			All actions, across implementation zones, would be closely coordinated with the PGC and PDA due to the scale of management identified as necessary to address CWD (minimum 79 mi ²) relative to park size (5.3 mi ²).
Implementation Threshold Description	Confirmed case of CWD more than 60 miles from park boundary.	Confirmed case of CWD within 60 miles but greater than 5 miles from park boundary; park does not fall within a state-established CWD containment zone.	Confirmed case of CWD within 5 miles of park boundary or park falls within a state-established CWD containment zone.			

^a Actions are cumulative. Therefore, once opportunistic sampling is initiated in Zone 3, it continues to be implemented in Zones 2 and 1. Once targeted surveillance is implemented in Zone 2 it continues to be implemented in Zone 3.

Carcass Disposal

Disposal of carcasses would continue via landfilling, surface disposal, and/or donation for human consumption, under the no-action alternative (Alternative A) and all action alternatives (Alternatives B, C, D), as long as a confirmed case of CWD does not occur within 60 miles of the park boundary (Implementation Zone 3).

If CWD is confirmed within 60 miles of the park boundary or the park falls within a state-established CWD containment zone, then NPS staff would assume full responsibility for removal of deer struck by vehicles from the roadway and/or obtained through response actions. Staff would collect biological data (e.g., sex, age), and ensure appropriate testing and disposal as described below for Implementation Zones 2 and 1.

If the presence of CWD is confirmed within Implementation Zones 2 or 1, then carcass disposal would occur in accordance with NPS Public Health Program guidelines for donation of meat from an “Area Affected by CWD” for the purpose of human consumption (NPS 2006a) and the Pennsylvania *Chronic Wasting Disease Response Plan* (PCWDTF 2007). Public health guidelines require that those persons

actually consuming the meat be fully informed and take full responsibility for any long-term unanticipated effects of eating meat from animals coming from a CWD-affected area. Donation of meat to food pantries for the purposes of redistribution would likely prohibit the park from being able to obtain informed consent from final consumers. Therefore, donation as a disposal option within Implementation Zone 2 would be precluded. If a CWD-positive deer is confirmed within Zone 1, these guidelines clearly preclude the donation of meat to food pantries, soup kitchens or any entity that intends to redistribute the meat (NPS 2006a).

Therefore, disposal of carcasses within Zones 2 or 1 would follow guidelines provided by the Pennsylvania *Chronic Wasting Disease Response Plan* (PCWDTF 2007). It is acknowledged that these guidelines are considered preliminary and are expected to be more fully developed over time. Developing science is expected to dictate the disposal of CWD-positive deer in Pennsylvania. Park staff would remain in close contact with appropriate state agencies regarding disposal of CWD-positive deer and integration of the park and state approaches to carcass disposal. The Pennsylvania *Chronic Wasting Disease Response Plan* (PCWDTF 2007) currently identifies three disposal methods appropriate for CWD-positive carcasses: landfilling, incineration, and alkaline (tissue) digestion. These methods are consistent with recommendations provided by the CWD science team and are described in greater detail below.

Landfilling

Landfilling is the preferred means of carcass disposal. Landfilling would occur at a site which meets modern sanitary landfill standards, such as the presence of engineered liners, caps, and leachate and gas collection systems. This disposal option is suggested as the most cost effective and most capable of handling large number of animals. A disadvantage to landfilling is that while it is generally considered effective at containing prions associated with CWD, this method of disposal does not immediately destroy prions. It is expected that prions in the landfill would degrade over time, but it is not known how long it would take to completely inactivate all prions (PCWDTF 2007).

A standard operating procedure would be developed to address operational procedures, such as delivery, covering, and placement in relation to the leachate collection system. Currently, the state has not initiated discussions with landfill operators regarding disposal of CWD-positive deer. If landfills are unwilling to accept CWD-positive deer, then storage of carcasses until test results are available would be necessary. Only carcasses that test negative would be disposed of via landfilling.

Storage of carcasses would occur through use of a refrigerated storage trailer, capable of storing at least 100 deer for up to three months. The box car/truck would be located within a secured area at the park maintenance yard. Under all management alternatives, deer carcasses would be tagged with a unique identifying mark to facilitate tracking of test results. Under alternatives that include lethal removal (Alternative C and D), deer would be processed and stored in identified lots (e.g. 10 deer per lot) to maximize efficiency. If test results revealed a CWD-positive animal, the entire lot to which it belonged would be disposed of in an approved manner. Processing areas and tools would be decontaminated between lots to prevent potential CWD contamination among lots. Under other alternatives, where large numbers of carcasses would not be expected, processing areas and tools would be decontaminated as appropriate.

Incineration

Incineration may be used to dispose of carcasses that test positive for CWD. The incineration process would be completed by the Pennsylvania Animal Diagnostic Laboratory System (PADLS). The European Union recommends that temperatures of at least 1,562 degrees Fahrenheit (850 degrees Celsius) be maintained for at least two seconds, to denature the CWD prion and incinerate carcasses (PCWDTF 2007). The PADLS incineration facility uses a controlled furnace, which is equipped with a primary and secondary combustion chamber. This equipment is similar to that found in other pathological incinerators and animal crematories. This method is relatively expensive and may have a limited capacity, but it can effectively meet the temperature criteria listed above (PCWDTF 2007). Should additional incineration capacity be needed, the Pennsylvania Department of Environmental Protection and/or PGC would be consulted for additional incineration sites. Ashes associated with incineration would be disposed of by PADLS or via landfilling.

Alkaline Digestion

Alkaline Digestion may be considered in the future for the disposal of CWD-positive deer carcasses. Although commonly called a digester, this method of carcass disposal is based on alkaline hydrolysis. The basis of this technology is the use of sodium or potassium hydroxide solutions under pressure and at elevated temperatures (approximately 300 degrees Fahrenheit or 150 degrees Celsius) to hydrolyze proteins into peptides and amino acids. As TSEs are believed to be caused by an abnormal prion protein, this technology is ideally suited for inactivation and disposal of infected animals and tissues derived from them. Currently, an approved digestion facility does not exist within Pennsylvania although construction of one is being considered at PADLS, New Bolton Center.

Minimizing Environmental Contamination

Although it is unlikely that CWD prions can be completely removed from the landscape once introduced, actions can be taken to minimize potential environmental contamination. These actions at Valley Forge NHP would remain consistent with the constantly improving state of knowledge on this subject. Within Implementation Zone 1, the following additional activities would occur under all deer management alternatives, including the no-action alternative, to minimize environmental contamination during carcass handling and disposal.

- Surface disposal would be eliminated as a carcass disposal method.
- Temporary storage areas for carcasses would be impervious to minimize the transfer of body fluids onto the ground.
- Deer carcasses obtained through lethal removal actions (Alternatives C and D) would not be gutted and would be removed from the landscape immediately.
- Deer carcasses obtained through other means (e.g., deer-vehicle collisions) would be removed from the landscape as soon as possible (many are unreported and thus may not be noticed immediately).
- Baiting as a tool for facilitating delivery of reproductive control agents under Alternative B or lethal removal actions under Alternatives C and D would be limited (reducing fecal concentration on the landscape).
- Handling of deer for the purpose of obtaining samples for CWD testing would occur on plastic tarps or other impervious surface to minimize the transfer of body fluids onto the ground.

2.6 Alternative B: Combined Nonlethal Actions

A combination of nonlethal actions would be implemented under Alternative B, in addition to the actions described under Alternative A, to protect native plant communities, promote forest regeneration, slowly reduce deer numbers in the park, and provide response to CWD. The additional actions would include constructing large-scale, rotational fences and implementing reproductive control of does when an acceptable chemical reproductive control agent becomes available. (See page 2-27 below for a list of criteria to be met for an acceptable agent.) Qualified contractors⁴ would construct the fencing and contractors or park staff would administer the chemical reproductive control agent included in this alternative. Actions implemented under Alternative A to address CWD also would continue. Additional actions would include live testing and removal of CWD-positive deer from the population if CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone.

During the development of the alternatives, it was determined that implementation of any of the nonlethal actions alone would be insufficient to address forest regeneration and would not meet the objectives of the plan/EIS. For example, a reproductive control agent that meets NPS criteria for implementation currently does not exist. Additionally, population models run by the NPS and PGC estimate that, once implemented, the use of reproductive controls alone would take 18-19 years to achieve the deer density goal. This is longer than the life of the plan (15 years). However, rotational fencing would allow some areas of the park to regenerate while research on chemical reproductive control agents advances to the point it can be implemented and, once implemented, to reduce deer density to the desired density goal. Therefore, Alternative B is comprised of the combination of nonlethal actions in order to attempt to achieve forest regeneration.

2.6.1 Additional Actions Proposed Under Alternative B

Rotational Fencing

In addition to the small fenced areas that are common to all alternatives, Alternative B would include rotational fencing to advance reforestation in select areas of the park. The science team recommended that the minimum area that would need to be fenced at one time to meet the park's forest regeneration goal would be 10%–15% of the total forested area in the park. This is equivalent to 4%-6% of the total park area. Therefore, the NPS would construct 9-15 exclosures, each covering between 10-20 acres, or a total of 140-210 acres of forest (of the park's approximately 1,400 acres of forest). Rotational fencing would be scattered throughout the park, targeting areas dominated by deciduous forests, while avoiding habitats like riverine floodplain forests that are subject to frequent disturbance (e.g., flooding). When defining exclosure locations and the amount of fencing required, park staff would consider the proposed locations in relation to historic structures, cultural landscapes, visitor use areas, park boundaries, accessibility,

⁴ In addition to other federal contracting requirements, for the purposes of this plan, a contractor is a fully-insured business entity, nonprofit group, or other governmental agency engaged in wildlife management activities that include trapping, immobilization, and lethal removal through sharpshooting and chemical euthanasia. The contractor must possess all necessary permits and be able to pass any needed security clearances.

known archeological resources, the trail system, and maintenance requirements. High-use visitor areas, areas with the potential for adverse visual impacts, and areas with high maintenance requirements (e.g., floodplains) would be avoided as much as possible. Large fenced areas would be at least 100 feet from the park boundary and neighboring properties to provide adequate construction area and minimize impacts to neighboring properties. Potential locations for rotational fencing are shown on Figure 5. Final locations would be determined after archeological site surveys are completed.

The rotational fences would be a minimum of 8-10 feet high and would consist of woven wire with 3- to 4-inch openings to allow most small animals to move freely through the fence. It is expected that technical details (e.g., type of footer, post type and spacing, etc.) related to fence installation would vary widely based on factors such as topography, geologic substrate, access, potential visibility, and presence of archeological resources. This information would be provided on a site by site basis through development of a detailed implementation plan. Electric fencing would not be used in the park based on concerns for visitor safety and potential impacts on other native wildlife, difficulty in accessing a power source, and long-term maintenance requirements.



Removal of small trees, shrubs, and other native species from the forest understory has led to a decline in other wildlife that depend on it for food, shelter, cover, and nesting sites.

Deer would be driven out of the fenced areas by park staff before completing the fencing. Visitors would not be able to use the areas enclosed by fences during or after construction. All rotational fencing would be monitored by park staff and maintained by contract with a local fence company. Monitoring would consist of visual inspection for fence integrity and would be coordinated with vegetation monitoring activities. If any deer were found within a fenced area, they would be removed, as would any other animals that appeared to be trapped within the rotational fencing.

It is estimated that it would take at least 10-15 years to achieve an acceptable level of regeneration within the fenced areas (8,079 tree seedlings per acre) and for

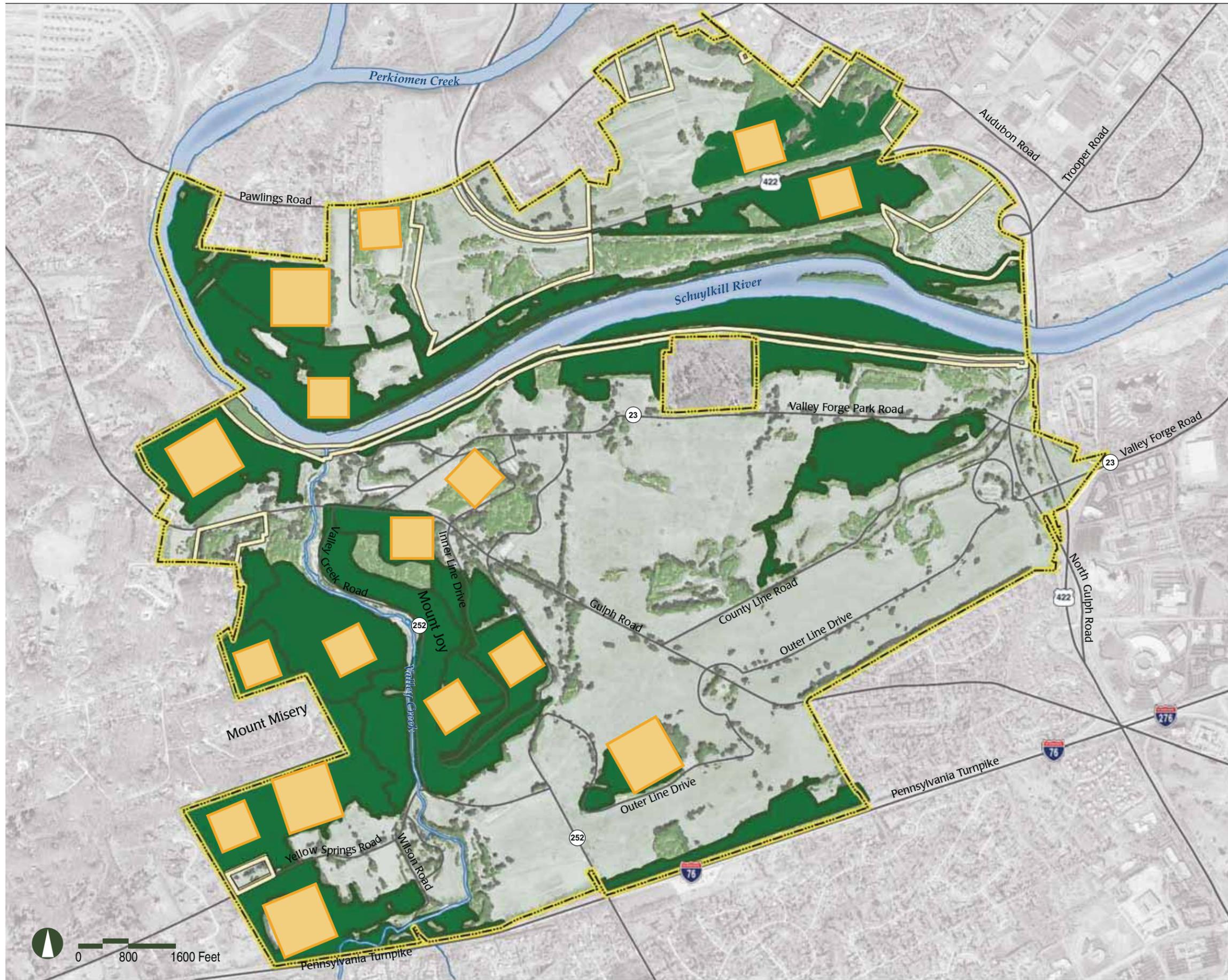
seedlings to exceed the typical deer browsing height (approximately 60 inches) (Horsley et al. 1983). Once monitoring within the fenced area indicated that adequate regeneration was occurring and tree seedlings exceeded browse height, the rotational fencing would be moved to immediately adjacent areas in order to reuse one side of the previous fenced area, thus minimizing relocation and labor costs. It is assumed that fencing would not be rotated within the life of this plan.

In Pennsylvania, once deer overbrowsing has been eliminated, forest recovery times are estimated to be between 10 years and several centuries (Latham et al. 2005). As described by Latham et al. (2005): “Partial structural recovery consists of the restoration of quick-responding understory species such as blackberries and raspberries and the increase in abundance and height of other woody (e.g. tree seedlings) and herbaceous species that are preferred as food by deer. It can be reached relatively quickly in stands where deer browsing impacts have been low and of relatively short duration. It can be achieved somewhat more slowly, but still within 10 years, after deer density reduction in most overbrowsed stands if the canopy is open enough to allow substantial amounts of light to reach the forest floor” (p. 113). At Valley Forge, long-term monitoring indicates that after 10 years, 30% of fenced plots exhibited an acceptable level of regeneration (Diefenbach et al. 2008). Therefore, 10 years is considered a minimum timeframe for recovery, however an interval of 15 years is considered more realistic due to several factors.

First, forests at the park are even-aged and unharvested, therefore they exhibit fairly closed canopy conditions, reducing the amount of light reaching the forest floor. This condition may slow recovery start time and regeneration may be expected to occur more slowly and only in patches, due to the localized availability of light. The amount of light reaching the forest floor is the primary determinant of recovery start time – which occurs when light conditions can support reestablishment and growth of tree seedlings and other forest understory species (Latham et al. 2005). After recovery begins, rate of recovery is influenced by a variety of environmental factors such as condition of seed supply, time since last removal of canopy trees, extent of fern or nonnative plant cover, native forest species growth rates, soil chemistry, soil moisture, and insect outbreaks and disease (Latham et al. 2005).

Second, in some areas, development of a dense herbaceous layer dominated by nonnative, invasive plants may further reduce the amount of light reaching the forest floor and increase the competition lag time. Competition lag time refers to the amount of time required for a species to reestablish a self-sustaining population and is influenced by how effectively individuals of that species can acquire essential resources and preempt them from other plants (Latham et al. 2005). Generally, increased competition for resources (light, moisture, nutrients) with nonnative plants may delay recovery start time for tree seedlings and even when seedlings have overtopped competing species it may take longer for trees to exceed the deer browse height.

Lastly, forests with the greatest number of long-term monitoring plots are located in the dry oak forest type and successional tuliptree forest type. Variation in tree regeneration may also be related to the periodicity of seed production by overstory trees (Horsley et al. 1994). For example, tuliptree (yellow poplar) has good seed crops almost annually, but seed viability is seldom more than 5%. Oaks have a good seed crop at 3-5 year intervals; however, bumper acorn crops occur irregularly and may be as infrequent as 10 years apart. It is generally believed that significant numbers of oak seedlings originate only in mast years, when the number of acorns produced exceeds those eaten by mammal and insect predators (Lorimer 1993).



- Park Boundary
- Inholdings
- Proposed Rotational Fencing Plots
- Forested Areas > 20 acres



Figure 5
Proposed Rotational Fencing Plot Locations

Reproductive Control of Does

As of 2009, Valley Forge NHP's deer population is estimated at 1,277 deer. In order to control the growth of this deer population, it is necessary to target does for treatment (Warren 2000). It is more feasible to target a percentage of the females than all of the males. All of the males would need to be treated, as it would only take a few male deer to impregnate multiple females. During the development of the alternatives, it was determined that surgical sterilization was not appropriate as either a stand alone alternative or in combination with other [lethal] actions for Valley Forge NHP. Therefore this alternative describes actions associated with chemical reproductive control only. For more discussion on why surgical sterilization was dismissed, see Section 2.10.4: Options Considered but Rejected.

The use of reproductive control in wildlife management has been assessed for several decades across multiple species. Its use has gained more attention, as the public has become more involved in wildlife management decisions. Interest in reproductive control as an innovative alternative to traditional management methods has led to the current state of the science (Baker et al. 2004). In order for reproductive control agents to effectively reduce population size, treatment with an agent must decrease the reproductive rate to less than the mortality rate. In urban deer populations, mortality rates are generally very low (approximately 10%). Therefore, it would be necessary to treat 70-90% of the female deer, with a highly effective product, to successfully reduce or halt population growth (Rudolph et al. 2000).

It is important to note that some of the most critical elements of a successful, population level, reproductive control program focus on ecological and logistical questions rather than on the biological action of fertility control agents in individual animals. It should also be noted that the field of wildlife contraception is constantly evolving as new technologies are developed and tested. Two categories of reproductive control technology were considered: immunocontraceptives (vaccines) and non-immunological methods (pharmaceuticals). Immunocontraceptives offer significant promise for future wildlife management (Rutberg et al. 2004).

Several chemical reproductive control agents are being developed and tested for use in deer population control (Fraker et al. 2002). These include porcine zona pellucida or standard PZP vaccine (Miller et al. 2009, Naugle et al. 2002; Turner, Kirkpatrick, and Liu 1996; Kilpatrick et al. 1992); uniquely formulated PZP, such as SpayVac®; GnRH vaccine (Miller et al. 2000, 2001; Curtis et al. 2002; Fraker et al. 2002); prostaglandin F_{2α} (DeNicola, Kesler, and Swilhart 1997a); and Leuprolide (Baker et al. 2002, 2004). Each of these agents is described briefly in Table 4 and in more detail in Appendix E, which provides an overview of available reproductive control technologies for deer management.

While no product has been approved by the U.S. Food and Drug Administration (FDA) specifically for the purpose of controlling reproduction in white-tailed deer, this is not a requirement for use of such products. Several FDA-approved products are available for therapeutic (medical) use in either domestic animals (prostaglandin F_{2α} or PGF_{2α}) or humans (Leuprolide). These products can be used with a veterinary prescription under the Animal Drug Use and Clarification Act of 1994. The prescribing veterinarian and the client (the national park unit) must clearly understand how and why the drug would be used in an off-label manner. It is the responsibility of the prescribing veterinarian to give an appropriate meat withdrawal period for food-producing animals that may enter the human food chain. The veterinarian may determine there is no meat withdrawal period for a particular drug. If this is the case, the animal may not need to be marked. If there is a meat withdrawal period, then the animal needs to be appropriately marked.

Table 4 **Reproductive Control Agents**

Issue	Standard (Native) PZP Vaccine	SpayVac® PZP Vaccine	GnRH Vaccine (e.g., GonaCon)	Leuprolide (GnRH agonist)
Mode of Action	Blocks sperm penetration and fertilization; estrous cycles continue	Blocks sperm penetration and fertilization; estrous cycles continue	Prevents secondary hormone (luteinizing hormone [LH] and follicle stimulating hormone [FSH]) secretion, which stops folliculogenesis and ovulation	Prevents secondary hormone (LH and FSH) secretion, which stops folliculogenesis and ovulation
Mode of Administration	Injection	Injection	Injection	Injection
Number of Doses	Twice initially and annual booster	Once initially and booster every 3-5 years	Likely a single injection initially; if and when antibodies decline, retreatment would be required	Current formulation - annually
Timing	Treated prior to breeding season to allow sufficient time for antibody development	Treat prior to breeding season and allow sufficient time for antibody development	Treated prior to breeding season and allow sufficient time for antibody development	Treated immediately prior to breeding season on an annual basis

Other reproductive control agents are currently available only for research use and are made available under an Investigational New Animal Drug exemption by the FDA or experimental use permit from the EPA if the product will be labeled as a pesticide. The important aspect of a research setting is that new information regarding the safety and efficacy of the experimental drug is carefully and systematically gathered by a researcher.

The current status of research related to chemical reproductive control technologies (immunological and non-immunological) provides results that are highly variable related to key elements such as contraceptive efficacy and duration of contraceptive effect (Appendix E). As stated above, there are also logistical issues related to the administration of these drugs that could have significant implications related to the success of implementation and sustainability of a reproductive control program. Therefore, only when the following criteria are met would reproductive control be implemented as a management tool.

- 1) It would have multiple-year efficacy (3-5 years at 85-100% efficacy) to minimize the cost and labor required to administer the drug to a large number of deer every year.
- 2) It would be able to be delivered remotely (darting) to avoid capturing the animal and to increase the efficiency of distribution.
- 3) It would not leave hormonal residue in the meat which would prevent the meat from being used for human consumption. Successful achievement of

this criterion would be represented by either FDA or EPA regulatory approval, including product labeling.

- 4) It would have limited behavioral impacts on the deer population (definition/discussion included in Appendix E).

Such an agent is not currently available; however, evaluation of existing agents with criteria for an acceptable agent revealed that Leuprolide met more of the criteria than other chemical reproductive control agents (Table 5). Therefore Leuprolide, a currently available agent with single-year application, was used for purposes of the analysis and cost estimate for this plan. It is assumed an acceptable reproductive control agent would be available within life of plan (Rutberg, pers. comm. 2009). Until an acceptable agent is made available, rotational fencing would still be implemented.

Table 5 Evaluation of Fertility Control Agents based on Selection Criteria for Valley Forge NHP

Agent	Criteria 1	Criteria 2	Criteria 3	Criteria 4
Immunocontraceptives				
Standard "Native" PZP	No ^a	Yes	No	Yes
SpayVac®	Possibly ^b			
GnRH	Possibly ^c	No	No	Yes
GnRH Agonists				
Leuprolide Acetate	No	Yes	Yes	Yes
Histrelin Acetate	No	No	Yes	Unknown
GnRH Toxins	Unknown	Unknown	Unknown	Unknown
Steroid Hormones	No	No	No	Unknown
Contraceptives	No	Yes	Yes	Possibly ^d

^a Initial research on one-shot, multiyear PZP vaccine has demonstrated 88.3% efficacy in Year 1 and 75% efficacy in the second year post-treatment (Turner et al. 2008). Research is currently on-going to evaluate effectiveness in year 3 and beyond. Dr. Allen Rutberg has indicated that "based on the design of the vaccine and our experience with horses, it's unlikely that the vaccine would have much effect past the third year" (Rutberg 2009). However, research on this vaccine is still developing and is expected to continue into the future.

^b SpayVac® has demonstrated 80%-100% efficacy for up to 5-7 years in horses and deer (Fraker 2009; Miller et al. 2009; Killian et al. 2006c). The term "possibly" is used because long-term studies (>5 years) have been conducted only in captive deer and had a small sample size in each treatment group (N=5) (Miller et al. 2009).

^c Recently published research on one-shot, multiyear GnRH vaccine in penned/captive deer indicates GonaCon™ is 88-100% effective in Year 1 and 47-100% effective in year 2 and 25-80% effective up to 5 years post-treatment (Miller et al. 2008). The term "possibly" is used because the multi-year formulation has been used only in captive deer, had a small sample size, and lacks confidence intervals on the data.

^d Possibly is used here to reflect concern related to aborted fetuses on the landscape. Although primarily a human dimensions impact, abortion can have a negative impact on doe health if it occurs later in gestation. Additionally, if a fetus is aborted early when males are still in rut they may re-breed, extending the period of rut and failing to result in infertility.

Under Alternative B, when the criteria for use of a chemical reproductive control agent are met, the park would initiate a reproductive control program. The park would monitor the status of ongoing reproductive control research on a periodic basis through consultation with subject matter experts and review of new publications in the literature. When advances in technology could benefit deer management in the park and established criteria were met, the final choice of an appropriate chemical reproductive control agent would be determined. This determination would be made based on how well the criteria for an acceptable control agent are met and by availability, cost, efficacy, duration, and safety at the time the action was implemented. The determination of an appropriate control agent is discussed further in Section 2.9: Adaptive Management Approaches Included in the Action Alternatives.

Administration of the Reproductive Control Agent

Timing of Application

Leuprolide (or a similar agent) would need to be administered in the two months prior to the deer rut (the breeding season). At Valley Forge NHP, the application of Leuprolide would occur primarily in September and October.

Number of Does Treated

To effectively reduce population size, treatment with a reproductive control agent must decrease the reproductive rate to less than the mortality rate. At Valley Forge NHP, annual mortality rate between 1997 and 1999 was 17% (Lovallo and Tzilkowski 2003). Based on research of reproductive controls in free-ranging deer populations, it would be necessary to treat at least 90% of the does annually in order to halt population growth (Hobbs, Bowden, and Baker 2000; Rudolph, Porter, and Underwood 2000). After five years of application at this rate of treatment, the park population model suggests that a population reduction of up to 33% could be expected. After ten years, a reduction in population of up to 60% could be expected.

As of 2009, Valley Forge NHP's deer population is estimated at 1,277 deer. It is estimated that approximately 50% of the deer in the park are does (NPS 2009b). Therefore, a minimum of 574 does (90% of 638) would need to be treated annually. Given that 574 does would need to be treated, any technique requiring capture would be extremely difficult to implement over the two-month period during which Leuprolide (or a similar agent) must be administered. Initial treatment would likely include the need to anesthetize and permanently mark individual deer to prevent entry of meat into the human food chain. Experience with capture and tagging at Valley Forge NHP suggests that it requires approximately 4.6 hours to dart, treat, and release a single deer. Therefore, during the first year, the park could treat no more than four does per day (with two teams of two to three people). When available, a reproductive control agent with multiple year efficacy and a remote delivery mechanism would significantly improve the ability of the NPS to successfully treat and tag a large number of deer. Subsequent years may not require as much time for each deer as they would already be tagged and would only require additional treatments.

Application Procedures

Depending on the reproductive control agent to be used, treated does would need to be marked for non-consumption or to facilitate identification of which does have been treated, to avoid multiple treatments of the same does. This can be accomplished using ear tags stating "Not for Human Consumption." However, previous experience at Valley Forge NHP indicates that a large proportion of ear tags can be accidentally pulled out. Therefore the park would use both ear tags and vinyl collars. With the ear tag/vinyl collar technique, each doe must be captured and

handled at least once initially and may require additional annual treatment. Tracking and capturing previously treated does would require time to locate the doe or to lure it to a trap site so that it could be treated. After does have been handled one or more times, successfully capturing them for subsequent treatments can become very difficult (Rudolph, Porter, and Underwood 2000).

Telemetry darting would be the primary capture method used for the purposes of this plan. With this method, a tranquilizer is fitted with a radio transmitter, which allows the animal and the dart to be located after the tranquilizer has taken effect. The dart is then recovered, the doe marked, the reproductive control agent administered, and the doe released. Some handling-related mortality could occur under this method, due to tranquilizer use and stress on the doe (DeNicola and Swihart 1997b; Kilpatrick, Spohr, and DeNicola 1997); however, no more than 5% mortality would be expected based on previous studies (Lovallo and Tzilkowski 2003). If mortality surpasses 5%, an alternative capture method would be implemented, which may include the use of traps or nets (see Section 2.9: Adaptive Management Approaches Included in the Alternatives). Remote delivery of the reproductive control agent in subsequent years (booster shots) would reduce stress to the deer related to capture and handling and minimize safety risks for employees/contractors.

One method that is being developed to deliver treatments without the physical capture or handling of does is a remote dart application (biobullet) delivered with a dart-type gun (similar to a shotgun or rifle). With this method, the biobullet remains with the doe, so it is not necessary to recover spent darts. Factors for consideration with this method include the maximum distance to the doe that allows the needed penetration for delivery, consistency in dosage delivery, and accurate documentation of which deer have been treated. Leuprolide has not yet been successfully delivered using a remote dart application.

Previous efforts to dart and tag deer at Valley Forge NHP required 4.6 hours per deer and did not use bait to concentrate deer. Based on this level of effort, it is estimated that it would require four to five months to treat 574 animals (estimated 143 days at 4 deer treated per day with two teams of two to three people). Given the large number of does that would need to be treated, bait piles could be used to concentrate does in certain locations so that the darting could be done as efficiently as possible (PGC 2006b). As many does as possible would be treated daily until 90% of the does had been treated, however this may not be achieved within the two month timeframe prior to the rut as required for Leuprolide. The areas targeted for treatment would be chosen based on maximizing deer presence and accessibility, while minimizing visitor inconvenience. The treatment of does would be conducted during the off-peak visitor hours (dusk to dawn) and weekdays to the extent possible, but would need to occur in the period immediately preceding the deer rut (September and October).

Training

Regardless of the technique implemented, qualified federal employees or contractors with demonstrated experience in the administration of reproductive controls would perform these activities under the supervision of a qualified veterinarian (as appropriate). Training would include safety measures, particularly related to use of the dart gun and storage, handling, and administration of required chemicals (anesthesia and fertility control agent), to protect both visitors and NPS employees. If more than one shooting location were used to remotely administer controls with dart guns, these areas would be adequately separated for safety reasons. Federal employees or contractors also would be qualified to handle live deer in order to

prevent disease transmission or any harm to the animal or the employee. In limited circumstances, volunteers could be involved in activities related to the administration of reproductive agents under the direct supervision of NPS employees. Volunteers would minimally be required to attend an NPS approved course on wildlife restraint and chemical immobilization, at no cost to the NPS (see Section 2.5.1: Use of Volunteers for more information).

CWD Response

Live testing and culling of CWD-positive deer would be implemented under Alternative B, in addition to the actions described under Alternative A. This action would occur only if a confirmed case of CWD were documented within 5 miles of the park boundary or the park fell within a state-established CWD containment zone and only if the reproductive control element of Alternative B was being implemented.

Cull: to remove from the population using lethal methods.

Tonsillar biopsy would be used to live test deer and determine their status as CWD-positive or -negative (NPS 2009a; Wolfe et al. 2004). This technique requires capture, general anesthesia, training in biopsy techniques, and the ability to test large proportions of the population (NPS 2009a). Initial treatment of deer with a reproductive control agent, would require capture and general anesthesia for the purpose of permanently marking individuals. Tissue samples for live tests would be obtained during handling of deer for the purpose of marking the deer as “treated” with a reproductive control agent. Animals also would be individually marked to ensure CWD-positive animals could be identified for future handling. Radio-collars may be used to facilitate relocation of CWD-positive deer. Conducting tonsillar biopsies is expected to require minimal additional labor and materials. Training on tonsillar biopsy techniques and appropriate handling and storage of tissue samples would be provided by the NPS-BRMD. NPS-BRMD also would conduct CWD testing at no charge for at least 5 years.

Animals that tested positive for CWD would be relocated and removed from the population by qualified federal or state employees and/or contractors. The expected number of animals to be tested annually would be the same as the number initially treated with a reproductive control agent under Alternative B.

To minimize the potential for environmental contamination under this alternative, baiting as a tool for facilitating delivery of reproductive control agents would be eliminated to reduce fecal concentration on the landscape. Handling of deer for the purpose of obtaining tissue samples would occur on plastic tarps or other impervious surface to minimize the transfer of body fluids onto the ground. Deer that died as a result of treatment and handling activities would be removed from the landscape immediately and disposed of as described in Section 2.5 CWD Response Plan.

Limitations of this approach include the fact that animals initially captured and marked as “treated” with a reproductive control agent, would likely not be anesthetized and handled for subsequent reproductive control treatments. These individuals would be excluded from CWD testing after the first year, which may result in large variations in sample size over time. Additionally, reproductive control, as described under Alternative B, excludes male deer from the surveillance effort. Dispersal of male deer may be one of the primary means of CWD spread. Variation in sample size and exclusion of male deer from the sampling effort may increase the potential of failing to detect the disease if it is present.

2.6.2 Monitoring

Rotational Fencing

As deer were excluded from within the rotational fencing, open (nonfenced) areas would be monitored for changes in vegetation due to the probability of increased browsing pressure. In addition, at least one monitoring plot would be established within each fenced area. Specific monitoring activities within the fenced areas would measure the level and type of regeneration occurring. Methods used to monitor vegetation within rotational fencing would be the same as described under Alternative A. Fencing would not be rotated until monitoring indicated adequate regeneration had occurred and the new vegetation had exceeded the height of the browse line (60 inches). For additional information on the monitoring protocol, see Appendix A.

Reproductive Control

The success of reproductive control would be monitored at both the population and individual animal level. The park would continue its fall spotlight surveys and spring compartment surveys, at which time observations would indicate if population growth had occurred. Additional observations would be made through the collection of data from treated deer that are killed on park roadways, related to the number of fetuses present, which would indicate if treated animals were infertile. Using protocols being implemented by the PGC to estimate deer reproductive rates state-wide, reproductive tracts from dead female deer would be removed and each uterus examined. The number and sex of fetuses present would be recorded. Age of fetuses would be determined based on measurement of crown-to-rump length and be used to calculate conception dates. Pregnancy rate would be defined as the percentage of does sampled that were pregnant. Reproductive rate would be defined as the average number of fetuses per doe. Adjustment of the initial target population levels, in either direction, would be made based on monitoring results of the park's forest regeneration.

2.6.3 Implementation Costs

Costs of implementing Alternative B would include the same costs described under Alternative A (vegetation and deer population monitoring, small fenced areas, roadkill removal, public education, and CWD response), plus costs of constructing, monitoring, and maintaining rotational fencing, implementing reproductive controls and fertility monitoring, and initiating testing and culling of CWD-positive deer, if CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone. The overall cost of implementing Alternative B would depend on factors such as the number of deer treated, methods used, number of personnel, monitoring costs, and the distance of a confirmed case of CWD from the park boundary (Implementation Zone 3, 2, or 1). Recurring annual costs associated with Alternative B are estimated \$246,103 and \$1,163,907. Costs over the life of the plan (15 years) are estimated between \$8,056,657 and \$14,025,682.

Cost over the life of the plan includes one-time and periodic costs (e.g., start-up costs, costs incurred every three years) in addition to the sum of annual recurring costs over 15 years. See Appendix D for a detailed breakdown of the costs associated with Alternative B.

2.7 Alternative C: Combined Lethal Actions

Alternative C would include the actions described under Alternative A, and would add lethal actions to rapidly reduce the deer population size to the initial deer density goal of 31-35 deer per square mile and maintain the population at an appropriate density over time. Qualified federal employees or contractors⁵ would conduct sharpshooting to reduce the deer population. Sharpshooting is the authorized shooting of animals by specially trained professionals using appropriate weapons for means of effective and efficient lethal control. Individual deer would be captured and euthanized in certain circumstances where sharpshooting would not be appropriate, such as in close proximity to an occupied building. Population maintenance also would be conducted using appropriate lethal methods.

CWD response actions described under Alternative A also would continue under Alternative C. Additionally, should a confirmed case of CWD be documented within 5 miles of the park boundary, or if the park fell within a state-established CWD containment zone, active lethal surveillance would be implemented for the purposes of disease detection and monitoring (CWD presence, prevalence, and distribution). Specific actions associated with active lethal surveillance are rapid reduction of the deer population to achieve the initial deer density goal (at twice the rate proposed above) and a one-time reduction in population to a density consistent with the surrounding environment but not less than 10 deer per square mile. Implementation of a one-time reduction of the deer population to no less than 10 deer per square mile would be based on the state's success in reducing deer populations within the containment zone outside the park boundary. All actions would be closely coordinated with the PGC and PDA due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

2.7.1 Additional Actions Proposed Under Alternative C

Sharpshooting: the authorized shooting of animals by specially trained professionals using appropriate weapons for means of effective and efficient lethal control.

Sharpshooting

Sharpshooting would involve the use of qualified federal employees or contractors to shoot deer within the park in designated areas, generally using firearms. Methods, removal numbers, and gender preferences are described below.

Methods

Qualified federal employees or contractors would be used to implement this action. They typically would be expected to work with park staff to coordinate all details related to sharpshooting actions, such as setting up bait stations, locating deer, sharpshooting, and preparation of carcasses for disposal/donation. Disposition of the deer (donation of meat and/or disposal of waste or carcasses) would be conducted by park staff (e.g., transport to processor and coordination with meat recipient).

⁵ In addition to other federal contracting requirements, for the purposes of this plan, a contractor is a fully-insured business entity, nonprofit group, or other governmental agency engaged in wildlife management activities that include trapping, immobilization, and lethal removal through sharpshooting and chemical euthanasia. The contractor must possess all necessary permits and be able to pass any needed security clearances.

In most locations, high-power, small caliber rifles would be used from close range. Every effort would be made to ensure humane treatment of individual deer. Deer injured during the operation would be euthanized as quickly as possible to minimize suffering.

Sharpshooting would primarily occur at night (between dusk and dawn) during late fall and winter months when deer are more visible and few visitors are in the park. In some restricted areas, sharpshooting may be done during the day if needed, which could maximize effectiveness and minimize overall time of restrictions. In this case, the areas would be closed to park visitors. In both cases, qualified federal employees or contractors would be located in elevated positions (e.g., tree stands) or in clearly marked, high clearance government vehicles on park-owned roadways or trails as appropriate. Spotlights would be used during night operations. The public would be notified of any park closures in advance, exhibits related to deer management would be displayed at the Welcome Center, and information would be posted on the park's website to inform the public of deer management actions. Visitor access would be limited, as necessary, while reductions were taking place, and NPS personnel would patrol public areas to ensure compliance with park closures and public safety measures. Noise suppression devices and night vision equipment would be used to reduce disturbance to the public and park neighbors. Activities would be in compliance with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, Firearms, and Explosives.

Bait stations could be used to attract deer to safe removal locations and would consist of small grains, apples, hay, or other food placed on the ground. The stations would be placed in park-approved locations, away from public use areas, to maximize the efficiency and safety of the reduction program. The amount of bait placed in any one location could range from 20 to 100 pounds, depending on the bait used and the number of deer in the immediate area (DeNicola 2004).

Training

Qualified federal employees or contractors with demonstrated expertise and training in the implementation of successful wildlife/deer management actions including firearms handling, storage, and use, lethal removal techniques, and wildlife capture and handling, would perform these activities. These individuals also would need to demonstrate firearms proficiency, based on NPS firearms qualifications, on a regular basis throughout the project. On-site training would include park orientation and required safety measures to protect both visitors and NPS employees. As described in Section 2.5.1: Use of Volunteers, volunteers would be excluded from using firearms, but may assist in other activities such as the transport and processing of carcasses, maintenance of bait stations, and implementing park closures. On-site volunteer training would be provided by NPS staff to support volunteer involvement.

Disposal

As long as there were no confirmed cases of CWD within a 60-mile radius of the park, Valley Forge NHP would continue to use a contractor to dispose of roadkill deer via landfill. Deer removed through lethal reduction would be transported by NPS staff and/or contractors to a central location for temporary storage during removal actions and collection of biological data and tissue samples for CWD testing (opportunistic surveillance as described under Alternative A). Deer would be transported by NPS staff on a daily basis to a butcher (potentially several meat processing facilities would be needed depending on capacity) for daily processing. Processing would include gutting and preparation of meat. The meat from these deer would be provided directly from the meat processing facility to a local food bank or

food pantry for the purpose of redistribution for human consumption. In limited situations where access to the carcass is difficult or not in a highly visible area, surface disposal may be acceptable. In these circumstances, every effort would be made to reduce the visibility of the carcass by visitors or park neighbors. If for some reason, other than the occurrence of CWD, a deer is unsuitable for donation and surface disposal is excluded, then disposal would occur via landfill.

If a confirmed case of CWD were documented within 60 miles of the park boundary or the park fell within a state-established CWD containment zone then meat donation and surface disposal would be precluded as disposal methods. Handling and disposal of potentially CWD-positive deer is described below under CWD Response.

Number of Deer Removed

As of 2009, Valley Forge NHP's deer population is estimated to be 1,277 individuals, or 241 deer per square mile for the estimated 5.3 square miles (3,450 acres) of park. NPS staff would determine the number of deer to be removed from the park based on the population model developed by Dr. Christopher Rosenberry (PGC Deer Management Section Supervisor) during science team discussions, the most recent population survey, and a population goal of 31-35 deer per square mile. The current population model is a simple, deterministic model to guide deer removals for Valley Forge NHP. The model uses population parameters (e.g., initial population size, reproductive rate, survival rate, population structure) from the park and nearby locations to generate population estimates and responses to removals. The model assumes 1.8 embryos per doe and 0.4 embryos per fawn based on PGC data from Wildlife Management Unit 5C (includes Valley Forge area) between 2004 and 2006. Also based on data from the PGC, the model assumes survival from birth to one year of age to be 0.65 and an annual adult survival rate of 0.85. In addition to model expectations, population-monitoring efforts would be used to track deer population response to deer removals and site-specific data would be inputted to the model as it becomes available to improve model output⁶.

Model estimates indicate that it would take up to four years to reach the initial deer density goal, given the size of the population, limited accessibility to some areas of the park, and changes in population movements as the removals were implemented. The planned removals are outlined below.

- Years One and Two — The population model estimated that approximately 500 deer would need to be removed annually for the first two years. This would reduce the deer population to an estimated 645 by the end of the second year (122 deer per square mile).
- Years Three and Four — The population model estimated that, with concentrated efforts, approximately 300 deer would need to be removed annually during the third and fourth years of implementation. At this rate, the population would be approximately 169 by the end of the fourth year (32 deer per square mile). This would result in the deer density goal. The range in the number of deer that could be taken during these two years provides

⁶ Additional model assumptions include: 1) Starting population age/sex demographics based on iterative process using default population parameters until age/sex proportions stabilized, 2) Deer population numbers represent number of deer in population just prior to removal, 3) Age/sex classes are removed in proportion to their abundance, 4) No density dependence response is included because population change would occur in relatively short time interval and reproduction parameters are assumed to be relatively high at present.

the park with the ability to adjust to changes in the rate of population increase. Therefore, if changes prevented the target density from being achieved at the end of the third year, the number of animals taken could be adjusted so that this goal could be achieved in the fourth year.

- **Subsequent Years** — Assuming that the deer density goal is achieved by the end of four years, lethal reduction would remain as a means of maintaining the population at appropriate levels. The population model estimated removal of 20 to 50 animals on an annual basis to maintain a population density of 31-35 deer per square mile. There would be a preference for removing does because this would maintain the population level more efficiently over the long term. Buck-only removal would not control population growth as deer populations are largely dependent on the number of does with potential for reproduction. Management during subsequent years is discussed in greater detail later in Section 2.9: Adaptive Management Approaches Included in the Alternatives.

The level of effort required to achieve the deer density goal in four years is considered reasonable based on experience within the Fairmount Park System. Between 2001 and 2007, approximately 1,600 deer were removed from Fairmount Park via sharpshooting. During the first two years of implementation, nearly 1,000 deer were removed (429 in 2001, 571 in 2002). Since 2002, on average, 100-200 deer have been removed annually (Bessler, pers. comm. 2007).

However, several factors could influence the number of years to reach the initial deer density goal. As the deer population decreased through successful reduction efforts, deer might adapt to sharpshooting operations and become more evasive, increasing the effort necessary to reach the removal numbers in any year. Existing reproduction and mortality rates might differ from the estimate used in this projection, as well. The model assumes 1.8 embryos per doe and 0.4 embryos per fawn based on PGC data from Wildlife Management Unit 5C (includes Valley Forge area) between 2004 and 2006. Also based on data from the PGC, the model assumes survival from birth to one year of age to be 0.65 and an annual adult survival rate of 0.85. If reproduction rates were higher and mortality lower than estimated, more deer would need to be removed, potentially increasing the time to reach the initial density goal. The converse would be true if reproduction rates were lower and mortality rates higher than estimated, resulting in fewer deer having to be removed, and efforts could take less time. Immigration of deer into the park also could have an effect on the number of deer to be removed, especially if the goal was toward a low population density (Porter, Underwood, and Woodward 2004).

The number of females in the population also would influence reproduction rates. Due to the preferential removal of does, as described below, recruitment into the population should decrease because fewer females would be reproducing. However, as the habitat improves, reproductive rates may increase as well.

Gender Preference

Focus on female deer or does is necessary to stabilize or reduce populations. However, due to the size of the deer population, during the first two years of sharpshooting, both female and male deer across age classes would be removed based on opportunity. Thereafter, at least 15 does should be taken for every 10 bucks (West Virginia University 1985). There would be a preference for removing does because this would reduce the population level more efficiently over the long term. Buck-only removal would not control population growth.

Records would be kept on the age and gender of all deer removed from the park to aid in defining the local population composition. This information would be compared with data used in population models to improve model accuracy.

Capture and Euthanasia

Capture and euthanasia would only be used in circumstances where sharpshooting would not be appropriate due to safety or security concerns, such as within close proximity to an occupied building. This is expected to be used for 1% or less of the total number of deer removed. The preferred technique for this method would be for qualified federal employees or contractors to trap deer, approach them on foot, and euthanize them. Activities would occur at dawn or dusk when few visitors are in the park.

Deer would be captured with traps and euthanized as humanely as possible. Euthanasia methods could include a combination of penetrating captive bolt gun and potassium chloride, firearm technique, or other humane technique. Several methods of wildlife trapping could be used, including but not limited to box traps. Most trapping methods involve using bait to attract deer to a specific area or trap. Box traps involve a confined space that would safely hold the deer so that staff could approach it. The method of capture would be selected based on the specific circumstances (location, number of deer, accessibility, and reasons why sharpshooting was not advised) for each deer to be removed.

Deer also could be immobilized by darting with a tranquilizer gun (Schwartz et al. 1997). This method could be used in cases where deer had not been successfully attracted to a trap area. Similarly, if for some reason the penetrating captive bolt gun or firearm technique could not be used to euthanize a trapped animal, injecting a lethal dose of a drug (under supervision of a veterinarian or NPS park practitioner) could be used. However, when chemicals are used for either immobilization or for euthanasia, the meat from that animal may not be donated as food. If this is the case, the carcasses would be disposed of at a local landfill. In limited situations where access to the carcass would be difficult or not in a highly visible area, surface disposal may be acceptable. In these circumstances, every effort is made to reduce the visibility of the carcass by visitors or park neighbors.

Qualified federal employees or contractors with demonstrated experience in lethal removal actions and trained in the use of methods and tools associated with humane euthanasia (penetrating captive bolt guns, firearms, and/or tranquilizer guns) would perform these actions. Training would include safety measures to protect both visitors and NPS employees. Federal employees or contractors would also be qualified to handle live deer in order to prevent disease transmission and prevent any harm to an animal or an employee. Appropriate safety measures would be followed when setting traps.

Because capture and euthanasia would typically result in increased stress levels in captured deer compared to sharpshooting, this method of population control would only be used in select situations, such as within close proximity to an occupied building, and would supplement the sharpshooting method described earlier.

The number of deer removed by capture and euthanasia would be recorded, including the age and sex, location of removal, circumstance requiring removal and capture, and lethal method used.

CWD Response

CWD response actions as described under the no-action alternative would continue under Alternative C. Active lethal surveillance for the purposes of assessing disease presence, prevalence, and distribution would also be implemented if CWD were documented within 5 miles of the park boundary, or the park fell within a state-established CWD containment zone. All actions would be closely coordinated with the PGC and PDA due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

The term active lethal surveillance refers to lethal removal of deer within the park for the purposes of assessing disease presence, prevalence, and distribution. These actions may also minimize the likelihood of CWD becoming established, minimize the likelihood of amplification and spread if the disease is introduced and promote elimination of CWD, if possible. Specific actions associated with active lethal surveillance include rapid reduction of the deer population to achieve the initial target deer density (31-35 deer per square mile) and a one-time reduction in population to a density consistent with the surrounding environment, but not less than 10 deer per square mile.

Rapid Reduction to Initial Target Deer Density

Active lethal surveillance would allow for a more rapid reduction of the deer population to achieve the initial target deer density of 31-35 individuals per square mile. It is estimated that this action would achieve the initial target deer density approximately twice as fast as population reduction would occur, as described under deer management actions described above for Alternative C. Achieving the initial target deer density more quickly would minimize the probability of amplification within local deer populations and reduce the probability of spread to other deer populations. A deer density of 31-35 deer per square mile is considered appropriate as an initial target related to CWD, as well as the plan/EIS, because it is consistent with deer density in the surrounding community and therefore, is not likely to create a refuge for deer or their associated diseases. Data collected by NPS staff during the spring 2009 deer count estimated deer density outside the park boundary at 35 deer per square mile. This data also indicates an average deer density outside the park boundary of 28 deer per square mile between 2001 and 2009. Reducing the number of deer to a density far below that outside the park may increase the likelihood of potentially CWD-positive deer repopulating the park from surrounding areas.

Rapid reduction of the deer population would be carried out as described under deer management actions described above for Alternative C. More rapid reduction would be achieved by increasing the number of individuals or teams conducting lethal removal activities within the park under Alternative C. Testing for CWD may necessitate targeting the body rather than the head for removal efforts. With training, head shots may be taken and still preserve tissues needed for CWD testing (Cottrell, pers. comm. 2008b). Sharpshooting activities would initially target areas closest to the positive case to ensure removal of animals that may have been in contact with CWD-positive animals and potentially decrease local prevalence of CWD. Areas where deer movements across the park boundary into surrounding communities are frequent (southeastern, southwestern, and northwestern boundaries), and areas with high concentrations of deer (central and southwestern areas) may also be targeted for removal activities to reduce the probability of spread and to promote elimination of CWD, if possible. During initial stages of active lethal surveillance efforts, both male and female adult deer would be targeted due to the increased probability of infection in older animals and the spread potential posed by males. Additional

removals in year 1 and 2 would be based on available staffing and resources. This action is consistent with the level 1 response described in the Pennsylvania Chronic Wasting Disease Response Plan (PCWDTF 2007).

Number of Deer Removed

To achieve the deer density goal of 31-35 deer per square mile in half the time proposed under Alternative C, the population model estimated that approximately 650 deer would need to be removed in years 1 and 2. This assumes the 2009 population size of 1,277 deer. The planned removals are outlined below.

- Years 1 and 2 - The population model estimated that between 650 and 665 deer would need to be removed annually for the first two years. This would reduce the deer population to an estimated 185 by the end of the second year (35 deer per square mile). This would achieve the deer density goal.
- Subsequent Years - The population model estimated removal of 35-50 animals on an annual basis to maintain a population density of 31-35 deer per square mile.

One-time Reduction Action

Implementation of a one-time reduction of the deer population to no less than 10 deer per square mile would be based on the state's success in reducing deer populations within the containment zone outside the park boundary. As indicated above, for the purpose of disease response, the NPS plans to maintain a deer density similar to the surrounding area. This would be accomplished by working cooperatively with the state to address CWD and to determine if the state is able to achieve a population density lower than 31-35 deer per square mile in areas surrounding the park. A deer density of 10 deer per square mile is considered appropriate as a lower limit for this action because it is consistent with recommendations in the scientific literature related to appropriate deer density to ensure adequate forest regeneration, which range from 10-40 deer per square mile. It is also consistent with the stated objective of the plan/EIS to maintain a deer population in the park. This reduction action would be carried out as described above under rapid reduction to achieve the target deer density. Additional removals that are part of the one-time reduction would be based on available staffing and resources and may take more than one year to achieve, depending on the state's actions to reduce the deer population outside the park.

Implementation of a one-time reduction of the deer population to no less than 10 deer per square mile would be based on the state's success in reducing deer populations within the containment zone outside the park boundary.

All deer removed for the purposes of disease response (rapid reduction or one-time reduction) would be tested for the presence of CWD and samples from both the NPS and state would be pooled to reach the state's desired detection/prevalence level without having a significant impact on the park deer populations. If additional positive cases were not found within the CWD containment zone, the park would continue surveillance actions for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents and continue to contribute to the CWD surveillance efforts of the state. If at the end of that period and there were still no positive cases of CWD, the park would return to an acceptable deer density for forest regeneration (currently estimated at 31-35 deer per square mile).

To minimize the potential for environmental contamination, baiting as a tool for facilitating lethal removal actions would be eliminated (reducing fecal concentration on the landscape), and temporary storage of carcasses and handling of deer for the purpose of obtaining tissue samples would occur on plastic tarps or other impervious surface to minimize the transfer of body fluids onto the ground.

If additional positive cases were detected, and the park had achieved its initial target deer density and/or successfully implemented a one-time reduction for the purposes of disease response, the NPS would continue to contribute all deer obtained through opportunistic, targeted, and enhanced targeted surveillance, as well as those obtained through deer management actions, to the state sampling effort.

Under this alternative, deer would be disposed of as described in the CWD Response Plan (Appendix C).

2.7.2 Monitoring

The same monitoring protocol would be used for sharpshooting and capture and euthanasia.

Vegetation

Vegetation monitoring, as outlined in Alternative A, would continue to document any changes in forest regeneration that might result from a reduced deer population. It is expected to take up to 10 years to observe significant changes in tree regeneration after achieving the initial deer density goal. The number of deer to be removed would be evaluated annually based on the success of previous removal efforts, refinement of the park population model and projected growth of the population, and vegetation and deer monitoring results.

Monitoring data would be collected annually from a subset of plots to provide interim information on vegetation recovery. Monitoring data would be summarized every five years. Every five years after the deer density goal was reached, a full cycle of monitoring would be completed to measure the effect the reduction in the deer population had on vegetation regeneration. If the park objectives were met and forest regeneration were successful at the deer density goal, removal efforts would be maintained at the level necessary to keep the deer population at the target density. Adjustment of the initial removal goal, in either direction, could be made based on monitoring results of the park's forest regeneration or other environmental conditions (see Section 2.9: Adaptive Management Approaches Included in the Action Alternatives).

Deer Population

Deer population numbers would be monitored through the ongoing monitoring efforts discussed in Appendix A. Fall spotlight counts would be used to document trends in population size. Spring compartment counts would be used to estimate deer population size and density and determine if deer were congregating in specific areas. In addition, basic biological information and data needed to refine the accuracy of the population model would be collected from as many deer as possible during processing of carcasses. Basic measurements would include live weight, chest girth, total body length, hind leg length, age, and sex. When possible, information related to reproductive rate (number of fetuses per doe) would be collected as described on page 2-34 and Appendix A.

2.7.3 Implementation Costs

Costs of implementing Alternative C would include the costs described under Alternative A (vegetation and deer population monitoring, small fenced areas, roadkill removal, public education, and CWD response), plus the cost of sharpshooting, capture/euthanasia, and initiation of active lethal CWD surveillance if CWD were confirmed within five miles of the park boundary or the park fell within a state-

established CWD containment zone. The overall cost of implementing Alternative C would depend on factors such as the number of deer removed, methods used, personnel or contractor costs, and the distance of a confirmed case of CWD from the park boundary (Implementation Zone 3, 2, or 1). Recurring annual costs associated with Alternative C are estimated between \$56,113 and \$176,817. Costs over the life of the plan (15 years) are estimated between \$1,461,332 and 1,528,832.

Cost over the life of the plan includes one-time and periodic costs (e.g., start-up costs, costs incurred every three years) in addition to the sum of annual recurring costs over 15 years. See Appendix D for a detailed breakdown of the costs associated with Alternative C.

2.8 Alternative D: Combined Lethal and Nonlethal Actions

Alternative D would include all actions described under Alternative A, plus a combination of additional lethal and nonlethal actions from Alternatives B and C to quickly reduce the deer population and then maintain it at an appropriate density over time. The lethal actions would include both sharpshooting and capture/euthanasia to quickly reduce the deer population to the initial deer density goal of 31-35 deer per square mile. Population maintenance would be conducted via reproductive control, as described in Alternative B, if/when an acceptable chemical reproductive control agent becomes available. If an acceptable and effective reproductive control agent does not become available, population maintenance would be conducted using lethal methods, as described in Alternative C.

CWD response actions described under Alternative C also would continue under Alternative D, including active lethal surveillance actions. All actions would be closely coordinated with the PGC and PDA due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

2.8.1 Additional Actions Proposed Under Alternative D

Lethal Reduction

Under Alternative D, the lethal reduction described under Alternative C would be implemented to quickly reduce the deer population to the initial deer density goal. Lethal methods also may be used periodically as a population maintenance tool if monitoring indicates that the reproductive control application has been ineffective in maintaining the deer population at the desired density or if an acceptable reproductive control agent is not available.

Reproductive Control

When an acceptable chemical agent becomes available, reproductive control of does through the use of a chemical reproductive control agent would be implemented, as described under Alternative B, to maintain the lowered deer population level after sharpshooting efforts had reduced the population size. Ideally, implementation would begin simultaneously with sharpshooting. However, for the purposes of this analysis, it is estimated that the use of reproductive controls would begin during the fourth year of lethal reduction. The success of implementing reproductive controls on a population that has undergone reduction efforts for several years would depend

on advances in reproductive control technology, sensitivity of the deer population to humans, methods used by the qualified federal employees or contractors, changes in immigration with reduced deer density, and general deer movement behavior (Porter et al. 2004; Naugle et al. 2002). It should be expected that getting close enough to administer remote injections would become increasingly difficult after reduction efforts, due to deer behavior changes in response to previous human interaction (Underwood 2005).

Assuming reproductive control was initiated when the park's deer population density was 31 to 35 deer per square mile, the park's total deer population would be no more than 186 animals. Assuming that the sex ratio composition of the reduced deer population was approximately 50:50, there would be 93 does in the population. This number of deer would be close to the maximum size suggested for application of reproductive controls in free-ranging deer populations. The majority of the does (90%, or 84 does) would need to be treated and marked for identification for subsequent retreatment. It is estimated that up to four deer per day could be treated (taking about 21 days), given the increased effort to locate deer with lower deer numbers [(35 deer per square mile x 5.3 square miles = 186 deer) (186 deer x 0.5 percent does = 93 does) (93 does x 90 % treated = 84 does to be treated) (84 does/4 does per day = 21 days)]. The population would continue to be monitored for growth. If the deer population increased during the reproductive control application under this alternative, periodic lethal reduction would be initiated to maintain the population density at the identified goal.

CWD Response

Under Alternative D, CWD response actions would occur as described under Alternative C and include active lethal surveillance. If CWD were documented within 5 miles of the park boundary, or the park fell within a state-established CWD containment zone and reproductive control were being implemented to maintain deer populations, then the park would return to lethal removal methods to maintain the deer population at the target deer density. Lethal actions would continue to be used until CWD surveillance, conducted for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents, revealed no additional CWD-positive deer within the park. At that time, if an appropriate reproductive control agent is available, the park would implement reproductive control methods for population maintenance as described under Alternative D. All actions would be closely coordinated with the PGC and PDA due to the scale identified as necessary to address CWD (minimum 79 square miles) relative to park size (5.3 square miles).

Under this alternative, deer carcasses would be disposed of as described in the CWD Response Plan (Appendix C).

2.8.2 Monitoring

Sharpshooting and Capture and Euthanasia

Monitoring for this alternative would be the same as is described under Alternative C.

Reproductive Control

Monitoring for this alternative would be the same as is described under Alternative B.

2.8.3 Implementation Costs

Costs of implementing Alternative D would include the costs described under Alternative A (vegetation and deer population monitoring, small fenced areas, roadkill removal, public education, coordination with PGC, and initiating CWD monitoring), plus the costs of implementing lethal reduction to achieve the target deer density and reproductive control to maintain the population, as described under Alternatives B and C. If CWD were confirmed within 5 miles of the park boundary, or the park fell within a state-established CWD containment zone, costs associated with implementing active lethal CWD surveillance would be the same as described under Alternative C. The overall cost of implementing Alternative D would depend on the number of deer removed and/or treated, methods used, personnel/contractor costs, and the distance of a confirmed case of CWD from the park boundary (Implementation Zone 3, 2, or 1). Recurring annual costs associated with Alternative D are estimated between \$112,363 and \$176,817 in years 1-4 (lethal actions) and between \$108,363 and \$194,517 during years 5-15 (reproductive control). Costs over the life of the plan (15 years) are estimated between \$2,036,082 and \$2,925,282.

Cost over the life of the plan includes one-time and periodic costs (e.g., start-up costs, costs incurred every three years) in addition to the sum of annual recurring costs over 15 years. See Appendix D for a detailed breakdown of the costs associated with Alternative D.

2.9 Adaptive Management Approaches Included in the Action Alternatives

Adaptive management is a systematic approach for improving resource management by learning from management outcomes.

All of the action alternatives (B, C, and D) described in this chapter incorporate adaptive management approaches to meeting the objectives of the plan. Each alternative includes a management action followed by a period of monitoring to evaluate the results of the action. By using an adaptive management approach, managers would be able to change the timing or intensity of management treatments to better meet the goals of the plan as new information is obtained. The adaptive management approach and its integration into the action alternatives are more fully described below.

Successful management of natural systems is a challenging and complicated undertaking. All DOI bureaus are encouraged to “use adaptive management to fully comply” with the CEQ’s guidance that requires “a monitoring and enforcement program to be adopted . . . where applicable, for any mitigation” (516 DM 1.3 D (7); 40 CFR 1505.2). In addition, DOI has recently outlined the adaptive management approach in a technical guide developed to provide guidance to all DOI bureaus and agencies (Williams, Szara, and Shapiro 2007).

Adaptive management is based on the assumption that current resources and scientific knowledge are limited. Nevertheless, an adaptive management approach attempts to apply available resources and knowledge and adjusts management techniques as new information is revealed. Holling (1978) first described the principle of adaptive management as requiring management decisions and policies to be viewed as hypotheses subject to change.

2.9.1 Using the Adaptive Management Process

Adaptive management is a systematic approach for improving resource management by learning from management outcomes (Sexton et al. 1999). An adaptive approach involves exploring ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions (Murray and Marmorek 2004). Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems (Bormann et al. 2006).

Under the approach outlined by the DOI guidance, adaptive management should be used when decisions must be made despite uncertainty and there is a commitment to using this approach. In addition to these two primary conditions, adaptive management should be used when (1) there is a real management choice to be made, (2) there is an opportunity to apply learning, (3) clear and understandable objectives can be identified, (4) the value of information gained is high, (5) uncertainty can be expressed as models that can be tested, and (6) monitoring is in place or can be put in place to reduce uncertainty (Williams, Szara, and Shapiro 2007). The deer management situation at Valley Forge NHP meets all of these conditions.

There are two phases involved for a successful adaptive management plan: the set-up phase and the iterative phase.

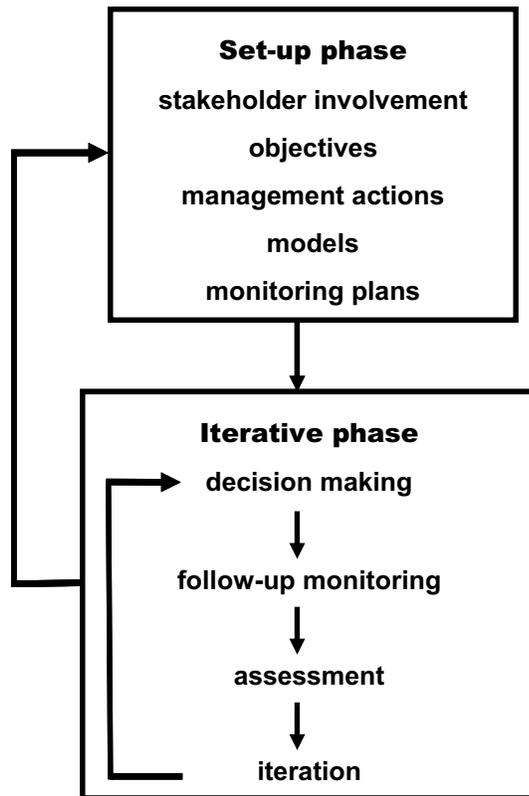


Figure 6. The Two-phase Approach to Adaptive Management
(modified from Williams, Szara, and Shapiro 2007; per Williams, pers. comm. 2008)

Set-up Phase

Step 1: Stakeholders are identified and conferred with during the initial public scoping meeting. The park completed this step at the initial public scoping meetings in November 2006 as part of the NEPA process. Interested members of the public, local government representatives, and the media attended these meetings.

Step 2: Specific, measurable, achievable, results-oriented, and time-fixed objectives are developed. These objectives were prepared at the initial scoping meetings as part of the NEPA process and are detailed in Chapter 1, pages 2-4.

Step 3: Alternative management actions are produced. The interdisciplinary team discussed the management alternatives at their alternatives meeting in January 2007. These alternatives are also described in this plan/EIS.

Step 4: Operational models are developed to test hypotheses. Deer overabundance and climax forest dynamics were the models selected as major factors that are preventing forest regeneration.

Step 5: Monitoring plans are created to test the operational models. The vegetation data in the deer exclosures and the long-term monitoring plots would be used to assess the models' success. This is the point that Valley Forge NHP has reached in the adaptive management process.

Iterative Phase

Step 6: After completion of the plan/EIS and the Record of Decision, the management action (preferred alternative) would be implemented.

Step 7: Monitoring data is collected after implementation of the management action.

Step 8: The monitoring data is analyzed and published.

Step 9: A decision is made as to whether to modify the management action based on the monitoring data.

2.9.2 Adaptive Management Approaches

Under this plan/EIS, the following six steps would constitute the iterative phase of the adaptive management approach. For illustrative purposes, Alternative D is used as an example for each of these steps.

1. **Monitor the baseline data** — Existing conditions would be recorded and monitored to establish a set of baseline conditions for future comparison.
2. **Apply the management action** — Deer would be managed using an action alternative described in this document; for example, Alternative D could initiate lethal reduction and reproductive control, when an agent was available and met the criteria established in this plan/EIS.
3. **Monitor the effectiveness of each management action** — Monitoring would determine whether the management actions were achieving the desired outcome. For example, is forest regeneration occurring as the initial deer density goal is achieved? Is reproductive control reducing or limiting growth of the deer population?

4. ***Monitor for effects of management actions on other resources*** — Resources in the park would be monitored during and after management actions to determine whether there were any unacceptable effects.
5. ***If monitoring indicates that the goal of forest regeneration is not at an acceptable level, reconsider the management actions*** — For example, under Alternative D, this could result in establishing a new deer density goal and using a combination of lethal reduction and reproductive control of does to achieve the new density. Similarly, if an action were found to have unintended effects on deer or other components of the environment, modifications would be considered.
6. ***If the management action is effective, and the forest is regenerating, consider modifications to the intensity of the action*** — For example, if deer density was reduced through reproductive control, the number of deer treated might be able to be reduced while still producing the same effect.

The adaptive management approach would be used in the following areas.

Vegetation Management

The action threshold could be modified based on the best available data for forest regeneration in a similar forest type, results of monitoring plot data, and deer density changes. Monitoring data would be compared to expectations (that forest regeneration would increase as deer density decreased). It is expected that it would take at least six years after the initial deer density goal was achieved until forest regeneration results would be seen in the monitored plots. If results after six years did not meet the objectives and goals of the plan, or ongoing monitoring indicated that there were other factors limiting forest regeneration, adjustments would be made to the existing vegetation management. These adjustments could include silviculture, nonnative species management, or responses to the effects of global warming. Silviculture would be used if it were determined that the existing forest structure was preventing sunlight and/or water from reaching new seedlings. If this were the case, additional actions would be taken to provide the necessary resources to promote forest regeneration, such as the creation of canopy openings. Enhanced nonnative species management may also be needed to promote forest regeneration. These species currently dominate the forest floor and may outcompete new seedlings. Finally, as the science and effects related to climate change become clearer, the park may modify its vegetation management to continue to promote forest regeneration in the changing climate.

Deer Density Goal

Under Alternative D, the number of deer to be removed annually would be adjusted based on the results of the previous year's removal effort, the monitoring of forest regeneration, deer population surveys, and growth projections. The approximate number of deer to be removed would be defined by the difference between the estimated deer population density and the initial density goal selected (e.g., 31-35 deer per square mile). Using this example, if the initial deer density was 241 deer per square mile (1,277 deer), then approximately 206-210 deer per square mile (1,092-1,113 deer) would have to be removed. However, because this density goal could not be achieved in one year, annual removal goals would be revised based on the number of deer remaining in the population after each year's removal actions and factoring in an annual growth rate. This process of determining the number of deer to be removed each year would be repeated until the population density goal was reached.

Because the goal is to manage for successful forest regeneration within the park, however, and not for deer density, the results of removal would be documented annually, so that the number of deer to be removed could be adjusted based on the response of the vegetation to a lower deer density. If monitoring indicated that vegetation was not regenerating, management actions would be adjusted. The following are examples of how this adaptive management approach could be implemented based on different outcomes:

- If forest regeneration occurred prior to meeting the initial deer density goal, the goal would be adjusted upward to the density that would still allow regeneration to occur.
- If the initial deer density goal of 31-35 deer per square mile was not reached within 6 years, additional efforts would be made to reach the desired density through the use of other methods of removal, such as increasing the use of capture and euthanasia in areas where sharpshooting was not effective.
- If insufficient forest regeneration occurred within six years after the initial deer density goal was reached, then the density goal could be lowered by five additional deer per square mile, with a six-year monitoring period before further reductions were made in density goals.
- In addition, if insufficient forest regeneration occurred after the deer density goal was reached, then methods and protocols would be reviewed to identify the variables that were limiting expected results, and the methods used would be adjusted as necessary to correct for such factors.

Reproductive Control

Reproductive control via a chemical reproductive control agent is one of the proposed measures under Alternatives B and D. There is limited information regarding its effectiveness as a tool for long-term management of large, free-ranging deer populations. As science catches up to the need for management, additional agents could be developed and tested for reproductive control on free-ranging deer. The park could review the science at that time to determine if other agents were appropriate for the park. The size, scale, and location of the application would depend on the specifications and efficacy of the drug.

CWD Response Plan

As noted earlier in this chapter, the science related to CWD-positive animals is emerging. The CWD Response Plan included in this plan/EIS is based on existing science and the Commonwealth of Pennsylvania's current CWD response plan. As the knowledge-base on CWD issues increases or the state updates its plan, Valley Forge NHP would make necessary adjustments to its own plan.

Implementing Elements of the Plan/EIS

A number of the elements of the plan/EIS are based on recent vegetation monitoring, the current deer density at the park, existing technology, and knowledge of deer population dynamics and CWD. During the life of the plan it is assumed that knowledge and experience with these issues will increase at the park, within the state, and across the NPS. Improved knowledge and experience may result in adjustments being made to the timing of lethal reduction, the implementation of reproductive controls, the implementation of the CWD Response Plan, or any of the other elements included in the plan/EIS. Changes in timing would be made in cooperation with the commonwealth and only when there was scientific evidence to support such an action.

2.10 Options Considered but Rejected

The following options were considered but rejected as explained below.

2.10.1 Public Hunting

Public hunting was considered but not carried forward for further analysis because it is inconsistent with existing laws, policies, regulations, and case law regarding hunts in units of the national park system.

NPS for the most part has maintained a strict policy of prohibiting hunting in units of the national park system. In the 1970s, Congress passed the General Authorities Act and the Redwood Amendment, which clarified and reiterated that the single purpose of the NPS Organic Act is conservation. While the Organic Act gives the secretary of the interior the authority to destroy plants or animals for the purposes of preventing detriment to park resources, it does not give the secretary authority to permit the destruction of animals for recreational purposes.

In 1984, after careful consideration of congressional intent with respect to hunting in national parks, the NPS adopted a policy that allows public hunting in national park areas only where “specifically mandated by Federal statutory law” (36 CFR 2.2). The NPS reaffirmed this approach in its *Management Policies 2006*.

Congress has not authorized hunting in any legislation for Valley Forge NHP. The likelihood that the law would be changed by Congress, or that NPS would change its long-standing service-wide policies and regulations regarding hunting in parks is remote and speculative.

In addition to legal and policy-related concerns, public hunting was evaluated based on cost, efficiency, safety, and the likelihood of achieving long-term management goals. A public hunt has not been shown to be more cost-effective or efficient than other reduction methods, such as sharpshooting by agency personnel, which is currently allowed under NPS laws and policies. Cost comparison studies in which differences in effects were considered show that the range of costs for sharpshooting substantially overlaps the range of costs reported for public hunts, suggesting that there is minimal to no cost saving by using citizen hunters. Net and average deer removal costs are as follows (Doerr, McAnnich, and Wiggers 2001; Warren 1997):

- Public hunts - net cost ranges from \$83 to \$237 per deer removed, with an average of \$117/deer
- Sharpshooting - net cost ranges \$72 to 260 per deer removed, with an average of \$121/deer.

In addition, sharpshooters are found to be more successful than hunters in meeting ungulate reduction goals (0.55 deer/hour for sharpshooting over bait vs. a hunter success rate of 0.03 deer/hour) (Doerr, McAnnich, and Wiggers 2001). This is at least in part because sharpshooters are encouraged to kill several animals, while hunters are only allowed to shoot up to their tag limit. Local experience also indicates that during public hunts the use of firearms is more efficient than the use of archery as a tool for lethal removal. Efficiency is defined as the number of hunter hours required to harvest a single deer (Prusack, pers. comm. 2007). During controlled public hunts within nearby Chester County parks between 2002 and 2007, firearm efficiency was 23 hunter hours per deer compared to 97 hunter hours per deer for archers (Prusack, pers. comm. 2007). As indicated above, sharpshooting with firearms is the most efficient.

Public hunting was considered but not carried forward for further analysis because it is inconsistent with existing laws, policies, regulations, and case law regarding hunts in units of the national park system.

At Gettysburg National Military Park, in 2006, a team of three sharpshooters spent 20 nine-hour days in the park. During this time they removed 115 deer. This equates to 5 hours per deer (Bolitho, pers. comm. 2007).

In addition, it is suggested that sharpshooting offers safety features that a typical public hunt does not. For example, sharpshooting over predetermined bait sites can establish shooting lanes and backstops. Sharpshooting also can take place when park visitation is low or absent, reducing or eliminating public safety concerns. The extensive planning and oversight that would be required to ensure a level of safety comparable to wildlife professionals engaged in sharpshooting activities would likely make a public hunt less feasible.

At Valley Forge NHP, safety of park visitors and security in developed areas would reduce the area and thus feasibility of public hunting. For example, due to existing developed areas and necessary buffer zones around roads and parking areas, more than 20% of the park would be off limits to public hunting. The topography of the park would further limit public hunter access to more remote areas of the park and may cause difficult line of sight issues and unsafe judgment calls. These necessary safety and security restrictions, as well as the landscape of the park, would make it difficult to meet the purpose, need, and objectives of this planning effort.

Finally, a number of studies have shown that retaining adequate hunter numbers is difficult, especially as ungulate densities drop and management enters the maintenance phase. Hansen and Beringer (1997) and Kilpatrick and Walter (1999) both documented a significant decrease in hunter applications for managed firearm hunts lasting more than two consecutive days and a hunt conducted in the same area for a consecutive year. Without consistent annual hunter effort, long-term management through public hunting would likely be unsuccessful.

In conclusion, the NPS considered and rejected a public hunt as a reasonable alternative for this plan as other alternatives could be implemented without changing current laws and policies; would better meet the purpose, need, and objectives of the plan; would raise fewer safety and cost concerns; and are more effective management tools

2.10.2 Fencing the Entire Park

This option would involve fencing the entire park to prevent deer from entering or leaving Valley Forge NHP. The minimum fence height would need to be approximately 8 feet to prevent deer from jumping over the barrier. Fencing would prevent deer from being pushed into Valley Forge NHP from surrounding areas during hunting season, and it also would prevent deer entering the adjacent neighborhoods from the park. However, vegetation within Valley Forge NHP would continue to suffer the effects of deer browse, the deer population within the fenced area would continue to increase, and the health of the contained population would eventually suffer. Therefore, all deer within the fence either would need to be removed or the deer population within the fence would need to be managed with other methods to meet the objectives of the plan/EIS.

Seven state roads run through the park and must remain open. The Schuylkill River flows through the park and cannot be fenced. Therefore, fencing the entire park is not practicable. Fencing would reduce visitor access and adversely affect the cultural landscape at Valley Forge NHP, and fencing options would be further limited by the extent of archeological resources.

Furthermore, if deer were pushed out of the park and the park was fenced, the impact on the surrounding environment would be unacceptable. The increased deer browse in the surrounding community would result in substantial property damage, the potential for increased deer-vehicle collisions, and the loss of forest communities throughout the immediate area. For these reasons, fencing the entire park was dismissed as a management option.

2.10.3 Surgical Reproductive Control

This option would involve a tranquilizing agent administered to female deer via a dart by qualified personnel. Once the tranquilizing agent had taken effect, surgery in the field would be performed by a qualified veterinarian to remove or disconnect select reproductive organs, effecting permanent infertility. The majority of existing research on surgical reproductive control as a deer management tool has focused on computer modeling or implementation in relation to small, isolated, low density deer populations and is not considered directly applicable to the large, free-ranging, high density deer population at Valley Forge NHP. In Highland Park, Illinois a deer sterilization program was implemented to test the efficacy of the technique to control the towns deer population (Mathews et al. 2005). The technique had shown promise at the Milwaukee City Zoo as a means to control deer populations in a small area (Mathews et al. 2005). Overall deer density at Highland Park was relatively low, with 31 deer per square mile of forested habitat being the highest density reported – significantly lower than the deer density at Valley Forge NHP. Mathews et al. (2005) also concluded that sterilized deer in Highland Park, IL died at a significantly higher rate than control [unsterilized] deer and moved more than fertile deer. Overall, this option would take a great deal of time per deer, when compared to the alternatives considered in this document and the number of deer that would need to be treated makes it technically unfeasible as a stand alone alternative. Finally, the mortality rate associated with the procedure (6%) is greater than the acceptable level of mortality for this proposal (5%) (Mathews, Paul-Murphy, and Frank 2005). Based on these reasons, surgical reproductive control was dismissed as a management option.

In March 2009, the internal scoping team met with veterinary staff with the NPS Biological Resource Management Division to discuss the potential use of surgical sterilization in combination with lethal actions. Discussion focused on the potential number of deer that would require treatment, the length of time required to achieve the deer density goal if implemented in combination with lethal actions, mortality of treated females, available science on population level effects particularly for large, free-ranging deer populations, baseline data on park deer required to fully develop a combined alternative involving surgical sterilization, and potential implications of using a non-reversible management action given the risk of CWD. Surgical reproductive control was dismissed as an element of a combined alternative because (1) the mortality rate associated with the procedure (6%) is greater than the acceptable level of mortality for this proposal (5%) (Mathews, Paul-Murphy, and Frank 2005); (2) there is little available science on population level effects; and (3) existing scientific data suggests sterilization may only be successfully applied in largely closed deer populations where there is little net movement of deer into the area and precise control can be exercised over the capture process (Miller, Cooch, and Curtis 2006). It was also noted that other population parameters upon which accurate population models would rely, such as mortality/survival, and for which relatively accurate data currently exists could potentially change significantly in the future should CWD be introduced. Therefore, the use of an irreversible management action based on population parameters that could potentially change significantly in the future was not recommended.

2.10.4 Reintroduction of Predators

Relationships between predators and prey are complex, and the impact of predators on herbivore populations is variable (McCullough 1979). Reintroduction of large predators, such as gray wolves (*Canis lupus*) or cougars (*Puma concolor*) would not be feasible as a management option at Valley Forge NHP due to the lack of suitable habitat. Wolves have home ranges averaging 30 square miles when deer are the primary prey (Mech 1990) which is much larger than Valley Forge NHP's 5.3 square miles.

Moreover, the park is surrounded by developed areas and the proximity to humans is not appropriate for reintroduction of large predators. Coyotes (*Canis latrans*) are present in the park and bobcats (*Lynx rufus*) potentially could be supported by habitats within the park. However, these predators have been shown not to exert effective control on white-tailed deer populations (Coffey and Johnston 1997). Based on these reasons, the reintroduction of predators was dismissed as a management option.

2.10.5 Capture and Relocation

Live-capture and relocation as an alternative may have limited success in controlling a small, isolated population, or in removing animals from one area to augment populations in other areas where the deer population is below desired levels (Coffey and Johnston 1997). Live-capture and relocation can be stressful (DeNicola and Swihart 1997b) and result in high mortality rates in the relocated deer (Ishmael et al. 1995; Porter 1991). In Pennsylvania, the PGC does not support capture and relocation of white-tailed deer populations, and the deer population would be subject to state purview once removed (Cottrell 2008a).

Additionally, recent NPS guidance related to CWD, reflected in the Valley Forge CWD Response Plan, prohibits all translocations of deer in or out of NPS units without extensive CWD surveillance (NPS 2002b). Pennsylvania's CWD Response Plan also establishes strict importation requirements including participation in a recognized CWD herd certification program for at least three years. Therefore, capture and relocation was dismissed as a management option.

2.10.6 Repellents, Plantings, and Other Deterrents

Chemical repellents and the selection of plants that are not palatable to deer are good options for individual homeowners to discourage deer from destroying residential yards and gardens. These repellents can be sprayed on or attached to nearby vegetation, thus protecting individual plants or larger areas (Coffey and Johnston 1997). Repellents are removed by rainfall, requiring repeated applications. At high deer densities, repellents may be totally ineffective (Maryland DNR 2002). Therefore, it would be impractical to effectively manage deer using repellents in a large park setting. Visual and sound deterrents also are available to scare deer away from areas (API 2000). Again, visual and sound deterrents and planting of unpalatable plants would be impractical in a large park setting and could have impacts on visitor experience. Therefore, using repellents, select plantings, and other deterrents was dismissed as a management option.

2.10.7 Supplemental Feedings

Providing supplemental food to deer is often suggested as a way of reducing damage to natural or ornamental vegetation. Much of the information available involving supplemental feeding practices relates to emergency feeding of deer during winter or on private lands often for recreational purposes. Providing alternative food sources may provide temporary relief from browsing on plants needing protection but would not provide a long-term solution. Few studies have evaluated foraging behavior of deer relative to a supplemental food source (Doenier et al. 1997). Existing research indicates the deer continue to rely on standing browse regardless of the amount/availability of supplemental food. Additionally, impacts of browsing may be more significant in areas where deer concentrate around food sources provided as supplements to natural forage (Doenier et al. 1997). Overall, no scientific evidence could be found to suggest that in large, free-ranging deer populations supplemental feeding could reasonably be expected to allow the park to achieve its target level of tree regeneration. In addition, supplemental feeding on a park-wide basis would be logistically and economically impractical (Maryland DNR 2002). For these reasons, supplemental feeding was dismissed as a management option.

2.10.8 Poisons

Currently, there are no toxicants, poisons, or lethal baits registered for deer control. While quick-acting lethal chemicals are available, there are no safe methods for delivering lethal dosages to free-ranging deer. The use of toxicants carries many hidden risks that may be socially unacceptable and is not considered a humane alternative. These include potential human health risks, particularly if poisoned free-roaming deer occur in areas open to legal hunting, as well as risks to untargeted animals, including pets that might eat baits or scavenge carcasses of poisoned deer (Bishop et al. 1999). For these reasons, the use of poisons was dismissed as a management option.

2.10.9 Use the Deer Population as a Research Model

During public scoping, a research alternative was suggested that was based on the premise that Valley Forge NHP would “serve a more valuable role in determining the long-term consequences of having an ‘overabundant’ deer population if it were left without a proactive management scheme in place.” Such an alternative would closely evaluate the potential utility of a coordinated effort to link different experimental “treatments” with a “control” that would allow for research questions as yet unanswered to be better addressed. As stated in the research proposal, however, “the scale of the study is small, the proposed treatments would not and could not control deer populations at VAFO” (Rutberg, Kirkpatrick, and Fraker 2002).

NPS staff at Valley Forge NHP have monitored forest health and impacts from deer browsing for nearly 25 years, and evidence shows that the forest is no longer naturally regenerating due in large part to browsing impacts. To continue following a purely research-oriented path would not meet the plan/EIS objectives. For these reasons, this research-only alternative was dismissed as a management option. Research proposals, including those involving deer, would be evaluated through procedures and guidelines provided by the NPS Research Permit and Reporting System.

2.11 Consistency with Sections 101(b) and 102(1) of the National Environmental Policy Act

The National Environmental Policy Act requires an analysis of how each alternative meets or achieves the purposes of the act, as stated in Section 101(b). Each alternative analyzed in a NEPA document must be assessed as to how it meets the following purposes:

- 1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- 2) Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- 3) Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- 4) Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- 5) Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- 6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

CEQ has created regulations for federal agencies' implementation of NEPA (40 CFR Parts 1500–1508). Section 1500.2 states that federal agencies shall, to the fullest extent possible, interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in the act [sections 101(b) and 102(1)]; therefore, other acts and NPS policies are referenced as applicable in the following discussion of how well the proposed alternatives meet each of the six purposes above.

2.11.1 Alternative A: No-action

Alternative A would meet the purpose of NEPA to some extent because limited protection of certain rare species and habitats would be continued. However, this alternative would not fulfill the responsibilities of each generation as the trustee of the environment for succeeding generations and preserving important aspects of our national heritage (criteria 1 and 4), because damage to forest vegetation, rare species, historic structures, and archeological resources would continue as a result of excessive browsing by high numbers of deer. The expected long-term, adverse impacts to resources would not ensure healthful, productive, or aesthetically pleasing surroundings (criterion 2). The park would continue to attain a wide array of beneficial uses (criterion 3), although there would be continued degradation of natural and cultural resources. There would be an adverse impact on resources by allowing excessive deer browsing, which would not do anything to maintain a balance between population and resources (criterion 5). Alternative A would not enhance the quality of renewable forest resources (criterion 6).

2.11.2 Alternative B: Combined Nonlethal Actions

This alternative would meet some of the criteria within the life of the plan, primarily in the latter years, as fencing and reproductive controls took effect. Members of the

planning team noted that the fencing would protect part of the environment. However, it would provide only limited direct protection for forest resources (only 10-15% of the forested area of the park would be protected by exclosures over the life of the plan). This alternative would also rely heavily on a technology (reproductive control) that might not be successfully implemented for a large free-ranging deer population.

Members of the planning team believed that the gradual progress this alternative provides would meet some but not all of the criteria. In particular, the lack of protection for a large percentage of the park, and the time it would take for any reproductive control to be effective, would mean that succeeding generations might not see desired results for some time (criterion 1), and probably not within the 15-year life of this plan. The large-scale exclosures would detract from aesthetically pleasing surroundings (criterion 2). The installation and movement of fencing could result in damage and loss of resources (e.g., archeological resources) and this alternative would rely on technology (chemical reproductive agents) that has not been proven in large, free-ranging deer populations as a population management tool, both potentially leading to undesirable consequences (criterion 3). The rotational fencing would limit the choices available to the public as fenced areas would be inaccessible to the public (criterion 4). This alternative would minimally help by maintaining a balance between population and resources by reducing adverse browsing impacts (criterion 5). The limited history of reproductive control success in a large, free-ranging population such as the park's and the limits on how much forest vegetation can be included in exclosures means that it would not be possible to completely approach the maximum attainable recycling of resources (criterion 6).

2.11.3 Alternative C: Combined Lethal Actions

Alternative C would succeed to some extent in meeting all of the criteria within the life of the plan. By immediately reducing deer browsing pressure, the alternative would allow vegetation in the park to regenerate for the benefit and enjoyment of future generations (criterion 1). The planning team noted that the immediate reduction in the deer population and subsequent improvements in the natural environment provided a great deal of benefit. There would be some safety concerns associated with implementing Alternative C. By implementing proper controls, however, these concerns could be minimized. The result would be safer conditions on local roads and more aesthetically pleasing conditions throughout the park (criterion 2). Alternative C would require closures of some areas of the park during reduction activities during the life of the plan, which would limit their use by visitors. However, these closures would occur at times and places that were not high visitation periods and primarily at night when the park is closed. This alternative also would avoid undesirable consequences (e.g., behavioral changes from reproductive controls) and maximize forest regeneration by immediately reducing deer browsing (criterion 3). The closures within the park would limit individual choice, but only for limited periods of time. These closures would allow for the reduction of the deer population, which would protect the park's natural and cultural resources and provide greater choices in the future (criterion 4). This alternative would help to achieve a balance between population and the surrounding park resources by allowing for regeneration to occur at a higher rate than is currently occurring (criterion 5). Finally, by immediately reducing the deer browsing pressure and promoting forest regeneration, this alternative would enhance the quality of renewable resources (criterion 6).

2.11.4 Alternative D: Combined Lethal and Nonlethal Actions

Alternative D is similar to Alternative C in the extent to which it would meet the intent of NEPA. The evaluation of these alternatives by the planning team showed that both would fulfill the responsibilities of each generation as a trustee of the environment for succeeding generations (criterion 1) to a large degree, because both would immediately reduce deer numbers and sustain that reduction through maintenance actions. As with Alternative C, Alternative D also would result in safer conditions on local roads and more aesthetically pleasing conditions throughout the park (criterion 2). As with Alternative B, Alternative D involves some concern about unintended consequences (criterion 3), because an acceptable reproductive control agent is not currently available and it would rely on technology that has not been proven in large, free-ranging deer populations as a long-term management tool. Although the planning team recognized the uncertainties associated with reproductive control agents, it was recognized that the science associated with this technology is developing rapidly and would provide additional information in the near future. Any safety concerns would be reduced through proper safety controls. As with Alternative C, Alternative D would also preserve important historic, cultural, and natural aspects of our national heritage in the long term (criterion 4). Alternative D would help to achieve a balance between population and the surrounding park resources by allowing for regeneration to occur at a higher rate than is currently occurring. Finally, although through a different manner than Alternative C, Alternative D would approach the maximum attainable regeneration of depletable resources (i.e., forest vegetation) by reducing and maintaining the deer population density (criterion 6).

2.12 Environmentally Preferred Alternative

The NPS is required to identify the environmentally preferred alternative in its NEPA documents for public review and comment. Guidance from the CEQ states that the environmentally preferred alternative means it is “the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources” (CEQ 1981). Alternative C has been selected as the environmentally preferred alternative because it is the alternative that would best protect the biological and physical environment by ensuring an immediate reduction in deer population numbers that could be sustained with proven methods over the 15-year life of the plan. Alternatives C and D would best protect, preserve, and enhance the historic, cultural, and natural processes that support the park’s cultural landscape and forest through various management options to maintain low deer numbers. Although Alternatives C and D are very close in meeting the goal that identifies the environmentally preferred alternative, Alternative C was selected primarily because it provides the park with the ability to select the least environmentally damaging option. Alternative A was not considered environmentally preferred because of its lack of effect on deer population numbers, which would result in potential adverse impacts on the biological and physical resources of the park over the life of the plan. Alternative B was not considered as the environmentally preferred because of the length of time required before deer numbers would be reduced, thus continuing the adverse impact of deer browse on vegetation within the park. Also, Alternatives B and D include the introduction of a chemical agent within the white-tailed deer population to reduce population size.

Although this would be beneficial to the vegetation and other resources currently impacted by the deer population, the introduction of a chemical agent into the herd could have adverse impacts.

2.13 NPS Preferred Alternative

2.13.1 How Alternatives Meet Objectives

As stated in Chapter 1: Purpose of and Need for Action, all action alternatives selected for analysis must meet all objectives to a large degree. The action alternatives must also address the stated purpose of taking action and resolve the need for action; therefore, the alternatives were individually assessed in light of how well they would meet the objectives for this plan/EIS, which are stated on page 1-3 of this document. Alternatives that did not meet the objectives were not analyzed further (see Section 2.10: Options Considered but Rejected).

Table 6 compares the alternatives by summarizing the elements being considered, while Table 7 compares how each of the alternatives described in this chapter would meet the plan objectives. Chapter 4: Environmental Consequences describes the effects of each alternative on each impact topic, including the impact on recreational values and visitor experience. These impacts are summarized in Table 8.

2.13.2 NPS Preferred Alternative

To identify the NPS preferred alternative, the planning team ranked each alternative based on the ability to meet the individual plan objectives and the potential impacts on the environment (Chapter 4: Environmental Consequences). The rankings were added up to determine which alternative best met the objectives. Alternatives C and D were closely ranked in their ability to meet all of the objectives. The NPS also considered the safety of implementing each alternative in selecting the preferred alternative. Under Alternative D, the time that shooting would occur in the park would be limited to population reduction actions, followed by use of reproductive control to maintain the population at the desired density. By maintaining the efficiency of Alternative C in meeting the plan objectives and improving safety by reducing the time that sharpshooting activities would occur in the park, Alternative D proved to be the NPS preferred alternative. Although concerns were expressed over the potential length of time needed for reproductive control to take effect, these concerns were alleviated by the fact that sharpshooting would continue to be used to maintain the population until the target level of infertility had been achieved.

Alternative B only partially meets each of the objectives because of the lack of immediate reduction in deer numbers and the uncertainty that the deer density goal would be achieved even over an extended period of time.

Alternative A fails to meet the objectives of the plan/EIS, since no action would be taken to reduce deer numbers or effect a change in conditions that are the basis of the purpose of and need for this plan.

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Table 6 Summary of Alternatives

	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Management Actions	<ul style="list-style-type: none"> <input type="checkbox"/> Continue vegetation and deer population monitoring <input type="checkbox"/> Small-scale protective fencing <input type="checkbox"/> Roadkill removal <input type="checkbox"/> Public education <input type="checkbox"/> Coordination with the PGC <input type="checkbox"/> Continue opportunistic, targeted, and enhanced targeted CWD surveillance based on proximity of a confirmed case of CWD to the park boundary; Coordination with the PGC and PDA on CWD surveillance and response. <p>[= Elements Common to the Action Alternatives]</p>	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Construct 9-15 exclosures to protect vegetation from deer browsing over a total of 140-210 forested acres of the park (10-15% of forested area of park) and rotate when adequate tree regeneration has been achieved (approximately every 15 years). <input type="checkbox"/> Implement reproductive control of does when an acceptable reproductive control agent becomes available, based on criteria for use established by the park. <input type="checkbox"/> If CWD is confirmed within 5 miles of the park boundary or the park falls within a state-established CWD containment zone and reproductive control is being implemented, then live testing for CWD and removal of CWD-positive deer. <input type="checkbox"/> If CWD is confirmed within 5 miles of the park boundary or the park falls within a state-established CWD containment zone and reproductive control is not being implemented, continue as described under Alternative A. Test all deer for CWD and pool samples with state. <input type="checkbox"/> Work cooperatively with the Commonwealth of Pennsylvania on CWD surveillance and response actions. <input type="checkbox"/> Implement monitoring of deer productivity and vegetation within rotational fencing. 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Use lethal actions (sharpshooting and capture and euthanasia) to reduce deer population. <input type="checkbox"/> Use lethal actions to maintain deer population at target density. <input type="checkbox"/> If CWD is confirmed within 5 miles of the park boundary or the park falls within a state-established CWD containment zone, conduct active lethal CWD surveillance to rapidly reduce the deer population to the target deer density and/or to a level consistent with the state's actions to reduce deer density in surrounding communities (but not less than 10 deer per square mile). <input type="checkbox"/> Work cooperatively with the Commonwealth of Pennsylvania on CWD surveillance and response actions. <input type="checkbox"/> Test all deer for CWD and pool samples with state. It is assumed that an adequate number of samples would be available when samples collected within the park are combined with state samples to reach the desired detection/ prevalence level without having a significant impact on park deer population. <input type="checkbox"/> Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents and continue use of lethal actions to maintain population. 	<p>Same as Alternative A, plus a combination of actions from Alternatives B and C:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Use lethal actions (sharpshooting and capture and euthanasia) to achieve target deer density. <input type="checkbox"/> Use reproductive control to maintain the deer population at the target density, when an acceptable reproductive control agent becomes available; if an acceptable reproductive control agent is not available or is ineffective, continue lethal actions, to maintain deer population. <input type="checkbox"/> Implement monitoring of deer productivity when reproductive control is implemented. <input type="checkbox"/> If CWD is confirmed within 5 miles of the park boundary or the park falls within a state-established CWD containment zone, conduct active lethal CWD surveillance to rapidly reduce the deer population to the target deer density and/or to a level consistent with the state's actions to reduce deer density in surrounding communities (but not less than 10 deer per square mile). <input type="checkbox"/> Work cooperatively with the Commonwealth of Pennsylvania on CWD surveillance and response actions. <input type="checkbox"/> Test all deer for CWD and pool samples with state. It is assumed that an adequate number of samples would be available when samples collected within the park are combined with state samples to reach the desired detection/ prevalence level without having a significant impact on park deer population. <input type="checkbox"/> Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents. If there are no additional CWD-positive cases, return to reproductive control or lethal actions (as appropriate) to maintain population.

Table 6 Summary of Alternatives

	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions								
<p>CWD Response</p> <p>Based on recommendations of the CWD Science Team the CWD Response Plan for Valley Forge makes the following assumptions related to CWD:</p> <ol style="list-style-type: none"> All response actions, across implementation zones, will be closely coordinated with the PGC and PDA due to the scale of management identified as necessary to address CWD (minimum 79 mi²) relative to park size (5.3 mi²). The park will become part of the state's actions once a containment area has been established regardless of proximity of the confirmed case to the park boundary. CWD is likely present within the park if the zone 1 threshold is reached. 	<p>Initiate opportunistic, targeted, and enhanced targeted CWD surveillance based on proximity of a confirmed case of CWD to the park boundary; Enhanced targeted surveillance includes dedicated staff/volunteer time to monitoring for deer exhibiting clinical signs of CWD; Initiate coordination with the PGC and PDA.</p> <table border="0"> <thead> <tr> <th><u>Response Thresholds*</u></th> <th><u>Action</u></th> </tr> </thead> <tbody> <tr> <td>More than 60 miles from park boundary <i>(Implementation Zone 3)</i></td> <td>Opportunistic Surveillance; Cooperation with State</td> </tr> <tr> <td>Less than 60 miles but greater than 5 miles from park boundary AND park does not fall within a state established CWD containment zone <i>(Implementation Zone 2)</i></td> <td>Opportunistic, Targeted, and Enhanced Targeted Surveillance; Cooperation with State</td> </tr> <tr> <td>Within 5 miles of the park boundary OR park falls within a state established CWD containment zone <i>(Implementation Zone 1)</i></td> <td>All of the above plus other actions described under Alternatives B, C, and D (Test and Cull, Active Lethal Surveillance)</td> </tr> </tbody> </table> <p>* Based on distance to a confirmed case of CWD</p>	<u>Response Thresholds*</u>	<u>Action</u>	More than 60 miles from park boundary <i>(Implementation Zone 3)</i>	Opportunistic Surveillance; Cooperation with State	Less than 60 miles but greater than 5 miles from park boundary AND park does not fall within a state established CWD containment zone <i>(Implementation Zone 2)</i>	Opportunistic, Targeted, and Enhanced Targeted Surveillance; Cooperation with State	Within 5 miles of the park boundary OR park falls within a state established CWD containment zone <i>(Implementation Zone 1)</i>	All of the above plus other actions described under Alternatives B, C, and D (Test and Cull, Active Lethal Surveillance)	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ If reproductive control is NOT being implemented and CWD is confirmed within 5 miles of the park boundary or the park falls within a state-established CWD containment zone, continue as described under Alternative A. □ If reproductive control IS being implemented and CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone, conduct live testing for CWD and culling of CWD-positive deer. □ Test all deer for CWD and pool samples with state. □ Dispose of CWD-negative carcasses via landfilling; Dispose of CWD-positive carcasses via landfilling, incineration, or digestion. □ Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents. 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone, implement active lethal CWD surveillance. Active lethal surveillance involves the use of lethal methods (sharpshooting and euthanasia), to rapidly reduce the deer population, to the target deer density of 31-35 deer per square mile (within 2 years) and/or implement a one-time reduction in the deer population to less than 31-35 deer per square mile consistent with the state's actions to reduce deer density in areas surrounding the park. A one-time reduction action would not reduce deer density below 10 deer per square mile. □ Test all deer for CWD and pool samples with state. It is assumed that an adequate number of samples would be available when samples collected within the park are combined with state samples to reach the desired detection/ prevalence level without having a significant impact on park deer population. □ Dispose of CWD-negative carcasses via landfilling; Dispose of CWD-positive carcasses via landfilling, incineration, or digestion. □ Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents and continue use of lethal actions to maintain population. 	<p>Same as Alternative C, plus:</p> <ul style="list-style-type: none"> □ If reproductive control is being implemented and CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone, immediately return to lethal methods to successfully implement active lethal CWD surveillance as described under Alternative C. □ When CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents indicates no additional CWD-positive cases AND an acceptable reproductive control agent is available, implement reproductive control to maintain population. □ If an acceptable reproductive control agent is not available or is ineffective, continue to implement lethal actions (sharpshooting and euthanasia) to maintain population. □ If additional CWD-positive deer are detected continue to implement lethal actions (sharpshooting and euthanasia) to maintain population.
<u>Response Thresholds*</u>	<u>Action</u>											
More than 60 miles from park boundary <i>(Implementation Zone 3)</i>	Opportunistic Surveillance; Cooperation with State											
Less than 60 miles but greater than 5 miles from park boundary AND park does not fall within a state established CWD containment zone <i>(Implementation Zone 2)</i>	Opportunistic, Targeted, and Enhanced Targeted Surveillance; Cooperation with State											
Within 5 miles of the park boundary OR park falls within a state established CWD containment zone <i>(Implementation Zone 1)</i>	All of the above plus other actions described under Alternatives B, C, and D (Test and Cull, Active Lethal Surveillance)											

Table 6 Summary of Alternatives

	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Reduction in Deer Population	None, other than natural sources of mortality and deer-vehicle collisions and potentially disease.	Would not achieve target deer density within life of plan (15 years). When an acceptable reproductive control agent becomes available and is successfully implemented a small reduction (5%) is expected after the first several years of treatment or until natural mortality exceeded reproduction and reduced the population. Assumes an acceptable reproductive control agent will become available in the next 15 years.	<ul style="list-style-type: none"> □ Remove approximately 500 deer in each of the first two years and then 300 deer for the next two years. During year three or four, the target deer density should be achieved (31-35 deer per square mile). Once this density is achieved, deer would be removed as necessary to maintain this population. □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone, remove 650 deer in year one and 650 deer in year two to achieve the target deer density (31-35 deer per square mile) rapidly (assumes initial population size of 1,277). In subsequent years remove 35-50 deer annually to maintain population. □ If actions taken by the state to address CWD result in successful reduction in deer density to a level below 31-35 deer per square mile within areas surrounding the park, then conduct a one-time reduction action to reduce deer density within the park to a level consistent with that in the surrounding environment. This action would NOT reduce deer density below 10 deer per square mile. 	<ul style="list-style-type: none"> □ Remove approximately 500 deer in each of the first two years and then 300 deer for the next two years. During year three or four, the target deer density should be achieved (31-35 deer per square mile). Once this density is achieved, and if an acceptable reproductive control agent is available the population would be maintained by reproductive control. Should an acceptable reproductive control agent not be available or ineffective then lethal methods (sharpshooting and euthanasia) will be used to maintain population. □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone, remove 650 deer in year one and 650 deer in year two to achieve the target deer density (31-35 deer per square mile) rapidly (assumes initial population size of 1,277). In subsequent years remove 35-50 deer annually to maintain population. □ If actions taken by the state to address CWD result in successful reduction in deer density to a level below 31-35 deer per square mile within areas surrounding the park, then conduct a one-time reduction action to reduce deer density within the park to a level consistent with that in the surrounding environment. This action would NOT reduce deer density below 10 deer per square mile. □ Lethal actions will be used to maintain the deer population until CWD surveillance, conducted for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents, indicates no additional CWD-positive cases. If an acceptable reproductive control agent is available and effective then implement reproductive control to maintain population.

Table 6 Summary of Alternatives

	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
<p>Carcass Handling, Storage, and Disposal</p> <p>Disposal of deer carcasses once CWD is confirmed within 60 miles of the park boundary would follow guidelines provided by the PA CWD Response Plan (2007). It is acknowledged that these guidelines are considered preliminary and are expected to be more fully developed over time. Developing science is expected to dictate the disposal of CWD positive deer in Pennsylvania. Park staff will remain in close contact with appropriate state agencies regarding disposal of CWD-positive deer and integration of the park and state approach to carcass disposal.</p>	<ul style="list-style-type: none"> □ As long as CWD was not confirmed within 60 miles of the park boundary a contractor would continue to pick-up carcasses resulting from deer-vehicle collisions. The primary means of disposal would be via landfilling. In limited situations, surface disposal would also be acceptable. As many of these deer as possible would be tested for CWD. □ If CWD was confirmed within 60 miles of the park boundary or the park falls within a state-established CWD containment zone then NPS staff would assume full responsibility for removal of deer struck by vehicles and appropriate testing and disposal of carcasses. All deer would be tested for CWD. □ CWD-negative deer would be disposed of via landfilling. □ CWD-positive deer would be disposed of via landfilling or incineration. □ To minimize the potential for environmental contamination deer would be removed from the landscape as soon as possible, temporarily stored in an area with an impervious surface, and collection of tissue samples would occur on a plastic tarp or other impervious surface to minimize transfer of body fluids to the ground. 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ If CWD was confirmed within 60 miles of the park boundary or the park falls within a state-established CWD containment zone then NPS staff would assume full responsibility for appropriate handling, testing, and disposal of carcasses resulting from deer management actions. All deer would be tested for CWD. □ To minimize the potential for environmental contamination surface disposal would be eliminated as a disposal method and baiting as a tool for facilitating delivery of reproductive control agents under Alternative B would be eliminated (reducing fecal concentration on the landscape). 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ As long as CWD was not confirmed within 60 miles of park boundary, carcasses resulting from lethal removal actions would be donated to food pantries or similar facility for the purposes of human consumption. In limited situations where carcasses are unsuitable for donation then disposal will occur as described under Alternative A. □ If CWD was confirmed within 60 miles of the park boundary or the park falls within a state-established CWD containment zone then NPS staff would assume full responsibility for appropriate handling, testing, and disposal of carcasses resulting from deer management actions. All deer would be tested for CWD. □ Deer carcasses resulting from lethal management actions would be temporarily stored in a refrigerated boxcar until CWD test results are received and appropriate disposal method can be determined. □ Carcasses would be individually marked to facilitate tracking of test results. □ To minimize the potential for environmental contamination surface disposal and meat donation for the purposes of human consumption would be eliminated as disposal methods. Baiting as a tool for facilitating lethal actions under Alternative C would be eliminated (reducing fecal concentration on the landscape). Carcasses would be removed from the landscape immediately and remain ungutted. 	<p>Same as Alternative C, plus:</p> <ul style="list-style-type: none"> □ To minimize the potential for environmental contamination baiting as a tool for facilitating delivery of reproductive control agents or lethal removal actions under Alternative D would be eliminated (reducing fecal concentration on the landscape).

Table 6 Summary of Alternatives		Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Time Required to Achieve Desired Forest Regeneration	Forest regeneration cannot be achieved within life of plan (15 years).	<ul style="list-style-type: none"> □ Ten to 15% of the park’s forested area would be protected at one time by the rotational fencing. Within the fenced area it is expected the desired level of forest regeneration would be achieved across at least 30% of monitoring plots inside fenced areas within 10 years. This is estimated to be the minimum time fencing would be required prior to rotation. An additional 5-10 years may be required for tree seedlings to reach height of ≥ 60 inches (above browse level). Therefore, fence rotation would be expected to occur approximately every 15 years. □ Reproductive control, if implemented immediately, would not achieve the target deer density within the life of the plan. Therefore, the remaining 85-90% of unfenced park forests would not be expected to achieve the desired level of regeneration within the life of this plan (15 years). 	<ul style="list-style-type: none"> □ Would achieve the target deer density (31-35 deer per square mile) within three to four years. □ Expect to achieve the desired level of forest regeneration across at least 30% of monitoring plots, park-wide, within 10 years of reaching the target deer density or within 13 to 14 years. 	<ul style="list-style-type: none"> □ Same as Alternative C. 	
Handling of Live Deer	No handling of live animals required.	<ul style="list-style-type: none"> □ No handling of live deer would be required to drive them out of fenced areas. □ Initial treatment with a reproductive control agent would involve anesthesia and marking of individuals via collar and/or ear tags to prevent re-treatment of the same deer. Handling expected to require up to 30 minutes. Subsequent treatments may be able to be delivered remotely. □ If CWD was confirmed within 60 miles of the park boundary or the park falls within a state-established CWD containment zone, live testing for CWD will be conducted via tonsillar biopsy on deer receiving initial reproductive control treatments. Biopsy procedure may require 20 minutes of extra handling. Deer would be individually marked to allow relocation of CWD-positive deer. □ To minimize the potential for environmental contamination collection of tissue samples would occur on a plastic tarp or other impervious surface to minimize transfer of body fluids to the ground. □ CWD-positive deer would be removed from the population using lethal actions. 	<ul style="list-style-type: none"> □ No capture or live handling activities are required for sharpshooting activities. □ For capture and euthanasia, method of capture would be selected based on the specific circumstances (location, number of deer, accessibility, and reasons why sharpshooting was not advised) for each deer to be removed. Methods include box traps and immobilization. □ Confinement within a box trap and chemical immobilization may result in increased stress levels in deer prior to euthanasia. Stress will be minimized through development of capture protocols that incorporate animal welfare considerations (length of time between checking traps, proper chemical dosage, etc.). 	<ul style="list-style-type: none"> □ For sharpshooting activities, no capture or live handling are required. □ For capture and euthanasia, method of capture would be selected based on the specific circumstances (location, number of deer, accessibility, and reasons why sharpshooting was not advised) for each deer to be removed. Methods include box traps and immobilization. □ Confinement within a box trap and chemical immobilization may result in increased stress levels in deer prior to euthanasia. Stress will be minimized through development of capture protocols that incorporate animal welfare considerations (length of time between checking traps, proper chemical dosage, etc.). □ Initial treatment with a reproductive control agent would involve anesthesia and marking of individuals via collar and/or ear tags to prevent re-treatment of the same deer. Handling expected to require up to 30 minutes. Subsequent treatments may be able to be delivered remotely. 	

Table 6 Summary of Alternatives

	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Monitoring	<ul style="list-style-type: none"> □ Continued monitoring of forest vegetation in fenced and unfenced plots and through the NPS Inventory and Monitoring Program to evaluate changes in forest health every 5 years. □ Continued deer population monitoring to evaluate trends in deer population size on an annual basis. □ Conduct opportunistic, targeted, and enhanced targeted CWD surveillance based on proximity of a confirmed case of CWD to the park boundary and inclusion of the park in a state-established CWD containment zone. 	<ul style="list-style-type: none"> □ Continued vegetation and deer population monitoring and CWD surveillance actions as described under Alternative A. □ Forest monitoring data collected from outside fenced areas will be evaluated every 5 years to assess progress toward desired level of regeneration prior to and after implementation of reproductive control. □ Establish additional monitoring plots within fenced areas to evaluate progress toward achieving desired level of forest regeneration within fenced areas every 5 years and evaluate timing for fence rotation. □ Conduct monitoring of fence condition on a quarterly basis. □ When reproductive control actions are implemented, initiate monitoring of female deer productivity (e.g. number of fetuses present) based on female road-killed deer to determine reproductive control effectiveness. □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone AND reproductive control is being implemented, conduct enhanced targeted CWD surveillance in the form of testing and culling of CWD-positive deer. □ Conduct CWD-testing on all deer obtained through deer-vehicle collisions and associated with deer management actions. 	<ul style="list-style-type: none"> □ Continued vegetation and deer population monitoring and CWD surveillance activities as described under Alternative A. □ Forest monitoring data will be evaluated every 5 years to assess progress toward desired level of regeneration. □ Deer population size data will be evaluated annually to evaluate progress towards target deer density and determine the number of deer to be removed in subsequent years. □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone conduct active lethal CWD surveillance. □ Conduct CWD testing on all deer obtained through lethal removal actions (associated with both deer and disease management) and other causes of mortality. □ Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents to determine effectiveness of removals in controlling disease. 	<ul style="list-style-type: none"> □ Continued vegetation and deer population monitoring and CWD surveillance activities as described under Alternative A. □ Forest monitoring data will be evaluated every 5 years to assess progress toward desired level of regeneration. □ Deer population size data will be evaluated annually to evaluate progress towards target deer density and determine the number of deer to be removed or treated with a reproductive control agent in subsequent years. □ When reproductive control actions are implemented, initiate monitoring of female deer productivity (e.g., number of fetuses present) based on female road-killed deer to determine reproductive control effectiveness. □ If CWD is confirmed within five miles of the park boundary or the park falls within a state-established CWD containment zone conduct active lethal CWD surveillance. □ Conduct CWD testing on all deer obtained through lethal removal actions (associated with both deer and disease management) and other causes of mortality. □ Continue CWD surveillance for a period of time consistent with current knowledge of the environmental persistence of CWD infectious agents to determine effectiveness of removals in controlling disease.
Regulatory Considerations, Permits, and Approvals Required	<ul style="list-style-type: none"> □ Follow state/local regulatory requirements for landfill disposal of CWD-negative deer. □ Follow state/local regulatory requirements for disposal of CWD-positive deer; Obtain any appropriate permits and/or approvals (TBD). 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ Veterinarian prescription required pursuant to the <i>Animal Drug Use and Clarification Act</i> for off-label use in deer. □ Additional requirements could be prescribed by a veterinarian (e.g. meat withdrawal period, marking). □ Follow state/local regulatory requirements for any landfill disposal of CWD-negative deer. □ Follow state/local regulatory requirements for disposal of CWD-positive deer; Obtain any appropriate permits and/or approvals (TBD). 	<p>Same as Alternative A, plus:</p> <ul style="list-style-type: none"> □ Any necessary ATF permits would be obtained. □ Coordination with state/local/nonprofit/private entities might be needed to donate meat. □ Follow state/local regulatory requirements for any landfill disposal of CWD-negative deer. □ Follow state/local regulatory requirements for disposal of CWD-positive deer; Obtain any appropriate permits and/or approvals (TBD). 	<p>Same as Alternatives B and C.</p>

Table 6 Summary of Alternatives		Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Park Closure or Restricted Access	None		<p>Long-term (approximately 15 years) closure or restricted access within rotational fencing (10-15% of forested area of park).</p> <p>Temporary closures or restricted access in areas associated with active reproductive control activities.</p>	<p>Areas closed or access restricted during sharpshooting or capture and euthanasia activities.</p> <p>Areas closed or access restricted in during lethal removal activities for the purposes of conducting active lethal CWD surveillance.</p>	<p>Areas temporarily closed or access restricted during sharpshooting or capture and euthanasia activities.</p> <p>Temporary closures or restricted access in areas associated with active reproductive control activities.</p> <p>Areas closed or access restricted in during lethal removal activities for the purposes of conducting active lethal CWD surveillance.</p>
Adaptive Management	CWD Response		Relocation of fencing, changes in the number of fences, the amount of forest enclosed in the fencing, action thresholds or deer density goals, possible change in reproductive control agent used and its application procedures, CWD response.	Changes in action thresholds or deer density goals, as well as number of removal actions needed, CWD response.	Same as Alternative B and C.
Estimated Cost (Recurring Annual)	\$14,828 - \$32,567	\$246,103 - \$1,163,907	\$56,113 - \$176,817	Lethal Actions (Years 1-4): \$112,363 - \$176,817 Nonlethal Actions (Year 5+): \$108,363 - \$194,517	
Estimated Cost (15-year planning period)	\$253,482 - \$403,257	\$8,056,657 - \$14,025,682	\$1,461,332 - \$1,528,832	\$2,036,082 - \$2,925,282	

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Table 7 How Alternatives Meet the Objectives

Objective	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Vegetation				
Protect and promote the restoration of the natural abundance, distribution, structure, and composition of native plant communities by reducing deer browsing.	Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native plant communities.	Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of native plant communities in these areas. Reproductive controls would not reduce deer browsing pressure within the life of the plan.	Meets the objective: Combined lethal actions directly reduce browsing pressure, allowing for regeneration of native plant communities.	Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, allowing for regeneration of native plant communities.
Reduce deer browsing pressure enough to promote tree and shrub regeneration that results in a diverse forest structure dominated by native species.	Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native tree and shrub species.	Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of a diverse community of native trees and shrubs in these areas. Reproductive controls would not reduce deer browsing pressure within the life of the plan.	Meets the objective: Combined lethal actions directly reduce browsing pressure, allowing for a diverse forest structure to develop.	Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, allowing for a diverse forest structure to develop.
Promote a mix of native herbaceous plant species and reduce the competitive advantage of invasive, nonnative plant species.	Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native tree and shrub species. Nonnative plant species continue to dominate forest floor.	Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of a mix of native herbaceous plant species in these areas. Nonnative plant species continue to dominate most of the forest floor.	Meets the objective: Combined lethal actions directly reduce browsing pressure, reducing competitive advantage of nonnative species.	Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, reducing competitive advantage of nonnative species.

Table 7 How Alternatives Meet the Objectives

Objective	Alternative A: No-action	Alternative B: Combined Nonlethal Actions	Alternative C: Combined Lethal Actions	Alternative D: Combined Lethal and Nonlethal Actions
Wildlife & Wildlife Habitat				
Maintain a white-tailed deer population within the park that allows for protection and restoration of native plant communities.	Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native plant communities.	Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of native plant communities in these areas. Reproductive controls would not reduce deer browsing pressure throughout the park within the life of the plan.	Meets the objective: Combined lethal actions directly reduce browsing pressure, allowing for the protection and restoration of native plant communities.	Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, allowing for the protection and restoration of native plant communities.
Protect and preserve other native wildlife species by promoting the restoration of native plant communities.	Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native plant communities.	Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of native plant communities in these areas. Reproductive controls would not reduce deer browsing pressure throughout the park within the life of the plan.	Meets the objective: Combined lethal actions directly reduce browsing pressure, allowing for the protection and restoration of native plant communities.	Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, allowing for the protection and restoration of native plant communities.
Reduce the probability of occurrence, promote early detection, and reduce probability of spread of CWD	Partially meets the objective: CWD surveillance would be continued, contributing to early detection. No other action would be taken.	Partially meets the objective: CWD surveillance would be continued, contributing to early detection. No other action would be taken.	Meets the objective: The park would implement its complete CWD Response Plan and coordinate with the PGC on future management efforts.	Meets the objective: The park would implement its complete CWD Response Plan and coordinate with the PGC on future management efforts.

Table 7 How Alternatives Meet the Objectives

Threatened, Endangered & Special Status Species

<p>Protect and promote special status plant and animal species and their habitat.</p>	<p>Partially meets the objective: Small-scale fencing used to protect some species; No reduction in deer browsing pressure, resulting in insufficient regeneration of special status plant communities.</p>	<p>Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for protection of special status plant species in fenced areas and restoration of habitat for some special status animal species. Plant species outside fencing would experience continued heavy browsing and possible extirpation from the park. Reproductive controls would not reduce deer browsing pressure throughout the park within the life of the plan.</p>	<p>Meets the objective: Combined lethal actions directly reduce browsing pressure, allowing for the protection and restoration of special status plant communities.</p>	<p>Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, allowing for the protection and restoration of special status plant communities.</p>
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Cultural Resources

<p>Protect the integrity of the cultural landscape, including the patterns of open versus wooded land, commemorative plantings, and vegetative screenings.</p>	<p>Does not meet objective: No reduction in deer browsing pressure, resulting in degradation of the wooded land, commemorative plantings, and vegetative screenings.</p>	<p>Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for the protection of elements of the cultural landscape within these areas. Reproductive controls would not reduce deer browsing pressure throughout the park within the life of the plan.</p>	<p>Meets the objective: Combined lethal actions directly reduce browsing pressure, protecting the integrity of the cultural landscape.</p>	<p>Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, protecting the integrity of the cultural landscape.</p>
<p>Protect archeological resources by promoting growth and maintenance of native vegetative cover and reducing trampling and soil erosion.</p>	<p>Does not meet objective: No reduction in deer browsing pressure, resulting in insufficient regeneration of native plant communities and continued trampling and soil erosion.</p>	<p>Partially meets the objective: Rotational fencing would protect 10-15% of the park's forest from deer browsing. This would allow for regeneration of native vegetative cover in these areas. Reproductive controls would not reduce trampling and soil erosion throughout the park within the life of the plan.</p>	<p>Meets the objective: Combined lethal actions directly reduce browsing pressure, promoting growth of native vegetative cover and reducing trampling and soil erosion.</p>	<p>Meets the objective: Combined lethal and nonlethal actions directly reduce browsing pressure, promoting growth of native vegetative cover and reducing trampling and soil erosion.</p>

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Table 8 Summary of Environmental Consequences			
Alternative A	Alternative B	Alternative C	Alternative D
Action/Impact	Action/Impact	Action/Impact	Action/Impact
Vegetation and Special Status Plant Species			
Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources
Continued/future monitoring	Continued/future monitoring	Continued/future monitoring	Continued/future monitoring
Area would be dominated by non-native plants with no tree seedlings above 50 cm	Fencing would protect 10-15% of park's forested area (20-30% over the life of the plan)	Achieving target deer density in the 3-4 years via direct reduction	Achieving target deer density in the 3-4 years via direct reduction
	Trampling/loss of vegetation during the construction of the fencing	Trampling of vegetation through the installation use of sharpshooting equipment, etc	Trampling of vegetation through the installation use of sharpshooting and reproductive control equipment, etc
	Trampling of vegetation during monitoring	Full implementation of CWD Response Plan	Full implementation of CWD Response Plan
	Test and cull deer for CWD		
Overall Impact: long-term, major, adverse; may result in impairment	Overall Impact: long-term, major, adverse; may result in impairment	Overall Impact: long-term, beneficial	Overall Impact: long-term, beneficial
White-tailed Deer Population			
Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources	Continued/future fencing of sensitive resources
Continued/future monitoring	Continued/future monitoring	Continued/future monitoring	Continued/future monitoring
Continued/future coordination with the PGC	Continued/future coordination with the PGC	Continued/future coordination with the PGC	Continued/future coordination with the PGC
Continued population growth or stabilization at a very high density	Excluding deer from 10-15% of the park's forested area, increases density in other locations	Achieving target deer density in the 3-4 years via direct reduction	Achieving target deer density in the 3-4 years via direct reduction
	Reproductive controls would not achieve target deer density within the life of the plan	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
	Test and cull deer for CWD		
Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, beneficial	Overall Impact: long-term, beneficial
Other Wildlife, Wildlife Habitat, and Special Status Animal Species			
Continued monitoring and fencing of sensitive species	Continued monitoring and fencing of sensitive species	Continued monitoring and fencing of sensitive species	Continued monitoring and fencing of sensitive species
Continued reduction of diversity that could lead to the loss of several species	Increased competition results in increased reduction in diversity and loss of species	Deer density would be achieved within 3-4 years and maintained via lethal reduction	Deer density would be achieved within 3-4 years and maintained via reproductive controls/lethal reduction
Limited competition for species that do not share habitat with deer	Limited competition for species that do not share habitat with deer	Human presence associated lethal reduction activities	Human presence associated lethal reduction and reproductive control activities
	Reproductive controls would not reduce deer population within the life of the plan	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
	Human presence associated with fence construction/monitoring		
	Test and cull deer for CWD		
Overall Impact: long-term, major, adverse; may result in impairment	Overall Impact: long-term, major, adverse; may result in impairment	Overall Impact: long-term, beneficial	Overall Impact: long-term, beneficial
Cultural Landscapes			
Loss of character defining feature of the cultural landscape	Concentrated deer browse on areas outside the fence	Achieving target deer density in 3-4 years	Achieving target deer density in 3-4 years
Small-scale fencing	New structural elements that would be inconsistent with other buildings and structures	Actions related to deer reduction	Actions related to deer reduction and reproductive control
	Reproductive controls would not limit deer browsing within the life of the plan	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
	Test and cull deer for CWD		
Overall Impact: long-term, major, adverse; may result in impairment	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, beneficial	Overall Impact: long-term, beneficial
Section 106 Summary: Adverse effect on cultural landscapes	Section 106 Summary: Adverse effect on cultural landscapes	Section 106 Summary: No adverse effect on cultural landscapes	Section 106 Summary: No adverse effect on cultural landscapes

Table 8 Summary of Environmental Consequences (continued)			
Alternative A	Alternative B	Alternative C	Alternative D
Action/Impact	Action/Impact	Action/Impact	Action/Impact
Historic Structures			
Continued erosion of earthworks/structures due to lack of supporting vegetation	Concentrated deer browse on areas outside the fence	Achieving target deer density in 3 to 4 years	Achieving target deer density in 3 to 4 years
	Test and cull deer for CWD	Actions related to deer reduction	Actions related to deer reduction
		Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
Overall Impact: long-term, major, adverse; may result in impairment Section 106 Summary: Adverse effect on historic structures	Overall Impact: long-term, moderate to major, adverse; may result in impairment Section 106 Summary: Adverse effect on historic structures	Overall Impact: long-term, beneficial Section 106 Summary: No adverse effect on historic structures	Overall Impact: long-term, beneficial Section 106 Summary: No adverse effect on historic structures
Archeological Resources			
Small-scale fencing	Small-scale fencing	Small-scale fencing	Small-scale fencing
	Concentrated deer browse on areas outside the fence	Actions related to deer reduction	Actions related to deer reduction and reproductive control
	Installation of rotational fencing	Achieving target deer density in 3 to 4 years	Achieving target deer density in 3 to 4 years
	Test and cull deer for CWD	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
Overall Impact: long-term, major, adverse; may result in impairment Section 106 Summary: Adverse effect on archeological resources	Overall Impact: long-term, major, adverse; may result in impairment Section 106 Summary: Adverse effect on archeological resources	Overall Impact: long-term, beneficial Section 106 Summary: No adverse effect on archeological resources	Overall Impact: long-term, beneficial Section 106 Summary: No adverse effect on archeological resources
Visitor Use and Experience			
Continued small-scale fencing and roadkill removal	Continued small-scale fencing and roadkill removal	Continued small-scale fencing and roadkill removal	Continued small-scale fencing and roadkill removal
Increased opportunities to view deer offset by decreasing deer health and the opportunity to see other wildlife	Visual intrusions and limited access as a result of rotational fencing	Lethal reduction activities	Lethal reduction and reproductive control activities
Continued trampling of natural, cultural, recreational resources	Construction of rotational fencing	Achieving target deer density in 3 to 4 years	Achieving target deer density in 3 to 4 years
Continued buffering of noise to surrounding properties	Implementing reproductive controls	Noise from lethal reduction activities	Noise from lethal reduction activities
	Test and cull deer for CWD	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
Overall Impact: long-term, negligible, adverse	Overall Impact: long-term, negligible, adverse	Overall Impact: long-term, negligible, adverse	Overall Impact: long-term, negligible, adverse
Socioeconomic Resources and Adjacent Lands			
Continued small-scale fencing and monitoring	Continued small-scale fencing and monitoring	Continued small-scale fencing and monitoring	Continued small-scale fencing and monitoring
Continued population growth and expanded browsing	Benefits from reproductive control not met during life of plan	Achieving target deer density in 3 to 4 years	Achieving target deer density in 3 to 4 years
No reduction in deer-vehicle collisions	Fencing forces deer across roads and into other areas	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
	Test and cull deer for CWD		
Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, beneficial	Overall Impact: long-term, beneficial
Public Safety			
Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing
	Construction of rotational fencing	Sharpshooting activities in the park	Sharpshooting and reproductive control activities in the park
	Reproductive control activities in the park	Use of qualified federal employee or contractor to conduct lethal reduction	Use of qualified federal employee or contractor to conduct lethal reduction and reproductive controls
	Use of qualified federal employee or contractor to implement reproductive controls	Full implementation of the CWD Response Plan	Full implementation of the CWD Response Plan
	Test and cull deer for CWD		
Overall Impact: long-term, major, adverse	Overall Impact: long-term, major, adverse	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, moderate, adverse

Table 8 Summary of Environmental Consequences (continued)

Alternative A	Alternative B	Alternative C	Alternative D
Action/Impact	Action/Impact	Action/Impact	Action/Impact
Park Operations			
Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing	Continued monitoring and small-scale fencing
Increasing need for deer management with limited staffing	Use of contractor to construct and maintain rotational fencing	Staff support for lethal reduction	Staff support for lethal reduction
Reallocation of funds to cover increasing need for deer management	Cost for fencing	Cost for implementing sharpshooting	Cost for implementing sharpshooting
	Maintaining and monitoring fencing	Cost for implementing euthanasia	Cost for implementing euthanasia
	Cost for personnel and implementation of reproductive controls	Immediate reduction of the deer population	Cost for personnel and implementation of reproductive controls
	Test and cull deer for CWD	Full implementation of the CWD Response Plan	Immediate reduction of the deer population
			Full implementation of the CWD Response Plan
Overall Impact: long-term, minor, adverse	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, moderate, adverse	Overall Impact: long-term, moderate, adverse

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