Crescent Park, Sea Girt Borough
Forest Stewardship Plan

321 Baltimore Boulevard
PO Box 296
Sea Girt, NJ 08750

Borough Contact: Mayor Ken Farrell
732-449-9433

Property Location:
The Crescent
Sea Girt, Monmouth County, New Jersey
Plan Acreage: Approximately 17 acres
Plan Timeframe: 2015 - 2025

Prepared by:
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(908) 366-7903
Prepared Date: October 2015

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Signature NJ Approved Forester

Stewardship Pledge:
As a forest landowner I believe the right to own land also carries the responsibility for stewardship of the natural resources in my care. I have read the attached ten-year Forest Stewardship Plan and agree to implement the plan to the best of my ability.

_____
Signature Landowner / Authorized Representative

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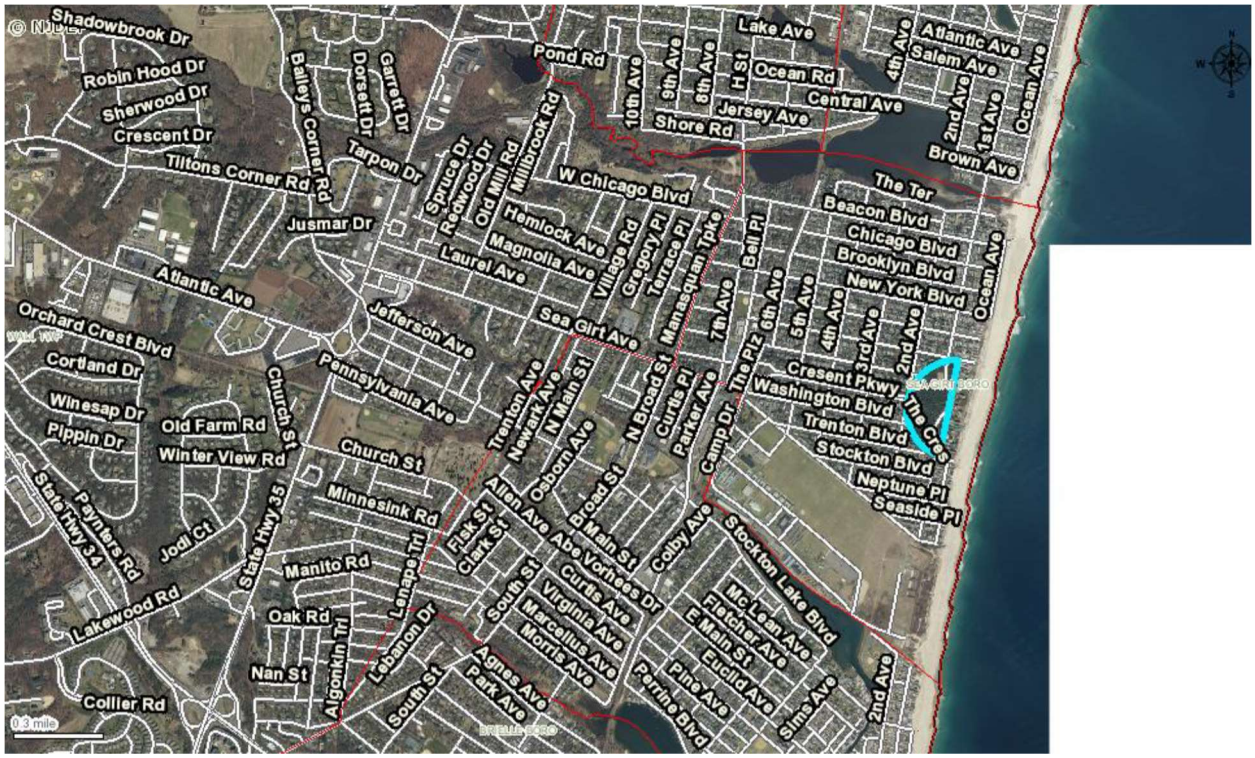
PROPERTY LOCATION & DIRECTIONS

The subject property is located one block in from the ocean, approximately midway between the northern and southern extents of Sea Girt Borough as shown in blue on the map below. The parcel is bound to the west by a road called *The Crescent*, and is bound in the east by private residences that lie between the park and the oceanfront. Crescent park is most easily accessed from 1st Avenue, which cuts through the eastern half of the park and includes a number of pull-offs for parking. The adjacent beachfront residences are also accessed via 1st Avenue, with driveways extending through the east side of the park.



PROPERTY BACKGROUD AND HISTORY

Historical accounts indicate that the area known as Sea Girt consisted primarily of cultivated farmland throughout much of the 1800's. However, the harsh conditions and nutrient poor soils directly adjacent to the ocean are typically poorly suited to row cropping, and were undoubtedly left as maritime forest cover. Forests were also maintained along the coast to provide a buffer from the direct effects of high winds and sea surges during storm events. The town's motto "Where the Cedars Meet the Sea" suggest at least anecdotal evidence of the significance of forests to the area. The borough of Sea Girt was established from Wall Township in 1917, and its origins can be traced to the *Sea Girt Improvement Corporation,* which had purchased the land to develop a speculative resort community. Aerial imagery from the 1930's confirms that although a network of roads had been established in the borough, much of the uplands along the beachfront was still undeveloped and remained largely in forest cover at the time.

The design for Crescent Park was built into the original plans for the resort community as an undeveloped center for recreation. Today, the park remains an integral piece of open space for passive recreation, and it is one of the few remaining patches of maritime forest that are of significant size to provide stop-over habitat for migrating birds.

There is no evidence of any sort of vegetation management occurring within the park. The existing vegetative structure suggests that the forest has undergone a typical pattern of maritime forest succession, with very little disturbance having affected that dynamic over the years. Current forest conditions will be discussed in greater detail later in this plan.

LANDOWNER MANAGEMENT GOALS

- To maintain forest cover for the enjoyment and passive recreational use of local residents.
- To improve forest health and ecosystem services, and to specifically begin addressing the proliferation of non-native vegetation becoming established in the understory.
- To maintain the unique wildlife values associated with the maritime forest type, which has become an increasingly rare component of the coastal landscape throughout the region.

PROPERTY BOUNDARIES

Property boundaries are normally addressed as part of the overall management of a parcel to ensure that activities are not occurring on neighboring tracts, or so that neighboring properties can be adequately buffered from such activities. In the case of Crescent Park, the public road network provides a functional boundary for most of the park. The exception to this is the eastern boundary that is shared with residences along the beachfront. This boundary is not currently delineated, and in the absence of getting the boundary established via a licensed surveyor, 1st Avenue could be used temporarily as a default boundary. However, recognizing that natural processes and plant germination do not abide by human devised tax lot lines or roads, it would behoove the town administration to establish a working relationship with the residential property owners along 1st Avenue to collectively manage the forest under some unified principals - regardless of the actual boundary position. An example of the importance of such collective management includes the control of non-native plant populations, which can quickly become re-established from nearby populations that are left untreated.

RECREATION & AESTHETICS

On numerous occasions during the field reconnaissance for this plan, NJA staff encountered individuals who were walking through the park, and who expressed satisfaction with ability to recreate in the park because of its forest cover and uniqueness. Due to our limited time at the park, we are unable to fully account for all of the attributes that residents find valuable. It is assumed that the ability to leave the adjacent residential development and enjoy the trees, may be the greatest value that the park serves in terms of ecosystem services to the community. Many of the users did confer an interest in ensuring that the forest remained healthy, but did not express concern for any specific issues related to forest health.

High winds, salt spray and poor soil nutrients, are all components of the harsh environment for

plants found at the coastal interface. These factors limit tree growth and give the maritime forest its characteristic appearance that differs from most other forests. Furthermore, Crescent Park contains a significant amount of relatively mature American holly growing in groups of co-dominant stems, which of-itself is somewhat rare. The sections of the park that are dominated by mature American holly present a special appearance that needs to be considered appropriately when undertaking future management activities.

CULTURAL & HISTORIC RESOURCES

A search was conducted online through the NJDEP GeoWeb portal to see if Crescent Park has any historic significance that might be impacted by management activities. There were no listings for this property, as illustrated on the attached *Historic Resources* map.

There were also no items encountered during the field inventory that would have been thought to have cultural significance to the history of the site.

SOILS

A custom soil report has been completed for this plan using the Natural Resources Conservation Service (NRCS) online *Web Soil Survey*. The soil report includes soil mapping and comprehensive information on soil capability classification, vegetative productivity, and relevant soil limitations.

The soil type found here is the Downer Complex, 0%-5% slopes. Downer soils are not considered prime farmland, nor are they highly productive for forestland uses. They support a tree productivity rate of about 52 cubic feet / acre / year for most of the hardwood species that commonly occur on them.

The general limitations for site activities in Downer soils include a risk of erosion when exposed (due to loose soil structure), and low water availability / drought susceptibility. Soil rutting and compaction are not problems for these soils.

The proposed activities that are recommended in this plan are relatively small in scale, and do not employ the use of heavy equipment that would cause significant soil disturbance. Therefore, they should not cause any measurable erosion issues.

WATER, RIPARIAN RESOURCES & WETLANDS

Upon visual inspection of the park, there were no streams or bodies of water found, nor were any obvious freshwater wetlands noted. This assessment is seemingly confirmed by the data available on the NJDEP GeoWeb program; whereas the attached *Wetland & Streams* map confirms the absence of mapped wetlands or steams within the park. The map does show a narrow band of wetlands approximately 300 feet offsite from the boundary, paralleling the ocean. The offsite wetlands are adequately buffered from any forest stewardship activities that might occur within Crescent Park, and no further measures are required to protect them.

THREATENED & ENDANGERED SPECIES

A US Fish & Wildlife Service (USFWS) *Trust Resources* list was generated for the property via their online portal, and is attached in the appendices for reference.

According to the report, there are no critical habitats for federally listed species on the property.

The report lists two federally Threatened species, Piping Plover *Charadrius melodus* and Seabeach Amaranth *Amaranthus pumilus*, that are thought to occur in the area of Crescent Park. Both species are associated with sand dune habitat containing sparse vegetation. Crescent Park does not contain sand dunes and is heavily vegetated, and therefore does not hold suitable habitat for either species. Piping Plover and Seabeach Amaranth should not be affected by forest stewardship activities. Fact sheets for both species are included as attachments to this plan.

The USFWS report also lists numerous birds that are subject to the Migratory Bird Treaty Act. These birds should be considered during management so that the appropriate conservation measures can be employed to avoid harming them. Since there is very little tree cutting proposed in this plan, the birds noted in the report are unlikely to be impacted in any way. The primary mechanism to avoid negatively impacting most bird species is to conduct tree felling operations during the dormant season, when most are no longer breeding. Activities proposed in this plan will likely be undertaken during the winter months. Additionally, prior to commencing work, a careful review of the site should occur in order to determine if nesting birds are present, and would be harmed by the actions.

A NJDEP Natural Heritage Database report for the property was requested from the Office of Natural Lands Management. A copy of that report is included in the attachments also. The report indicates that there are no records of rare species occurring on the site, but there are several records of rare species occurring in the general vicinity. The subject species are all associated with the ocean, and would not be impacted by forest stewardship work occurring in Crescent Park.

WILDLIFE

Crescent Park is an isolated patch of forest lacking connectivity to other blocks of forest or any other habitat type (i.e. it is surrounded by residential developed property), it provides value for wildlife species that are more generalists in nature. Examples of these generalist species include gray squirrel, raccoon, red fox, and other mammals found in urban and suburban setting (e.g., striped skunk). However, the park offers much more value to avian species, both seasonal residents and transients that depend upon these coastal woodlands as temporary stopovers during migration or to complete a portion of their life cycle.

For breeding birds, the Park currently lends itself more for generalist avian species, such as resident Red-bellied Woodpecker, Downy Woodpecker, Carolina Chickadee, Carolina Wren, Northern Cardinal, and Blue Jay, among others. Because of the relatively small size of the park (within a forest context) and competing habitat requirements among many of the neo-tropical migrant passerine species (e.g. Wood Thrush, Prairie Warbler, Fox Sparrow, Black-billed

Cuckoo, Rusty Blackbird, etc), there is little opportunity to create optimal breeding habitat for most birds listed as a *Bird of Conservation Concern* in the USFWS Crescent Park IPaC Trust Resource Report (a copy can be found in the Attachments). However, because the park is one of the few remaining significant blocks of maritime forest along the coast in this area, it is more valuable to wildlife as critical stopover habitat for *migrating* birds (the passerine birds listed in the IPaC report). A mixture of trees and shrubs in maritime forests produce highly nutritious mast and seeds, as well as provide habitat for invertebrates, that sustain migrants as they travel between summer and winter ranges. Additionally, the forest patch provides resting cover where birds can stop during their journey and recuperate without the exposure that is found in residential landscapes or nearby shoreline, providing cover from predators.

Rather than focusing on any particular vegetation species for enhancement or single bird species of conservation concern, one strategy is to broadly increase plant vigor and diversity within the forest, thereby increasing seed production and cover to the benefit of a wide range of birds. This type of general approach is the most appropriate for a property of this size, which is relatively small and surrounded by residential development, and therefore has limitations regarding targeted wildlife management. Recommendations on how to improve the vegetation value is discussed within the Forest Resources section below.

Any discussion of wildlife in New Jersey would be incomplete without considering deer and their impacts on native vegetation. Sea Girt is not thought to have a significant deer population, and there was not much evidence found at Crescent Park suggesting significant deer use. Discussions with some residents revealed deer occurrences tend to be rare and of a transient nature, rather than any persistent population. The naturalization of non-native plants here is seemingly a function of site conditions that favor the plants, instead of preferential or excessive browsing by deer.

FOREST RESOURCES

In the absence of natural disturbances (e.g. storms, fire, insects, etc.) or anthropogenic disturbances (clearing and harvesting), forest plant communities evolve through a continuum of predictable successional stages. In most instances, site parameters change (primarily the amount of available sunlight or shade for germination) as succession progresses, often creating unsuitable conditions for the predominant species to perpetuate themselves. This allows a different suite of species to take advantage of the altered conditions, until ultimately a climax stage is achieved. Within a climax forest, plant communities are stabilized as site conditions remain favorable for a select number of species to perpetuate themselves indefinitely, or at least until a disturbance creates different conditions that allow the process to start over again. Accordingly, climax forests are achieved at the expense of diversity, because fewer species can persist this way. Crescent Park is reaching a climax condition - characterized by the position of American holly in the overstory. American holly is quite shade tolerant, meaning that it can germinate and persist under the canopy of other trees. It then maintains a slow and steady growth pattern, eventually replacing other trees as they die. At Crescent Park, remnants of an earlier community of oak, cherry, sassafras and red cedar remain in pockets, but are mostly decreasing because of their inability to reproduce under the dense shade. Many of the largest stems in this forest are oaks that have recently died, or are in severe decline. Many cherries and sassafras can

also be found in decline or already dead. Over time, American holly continues to gradually occupy more and more of the stand's growing space, converting the forest from an assemblage of mixed upland species to what is essentially a monoculture of holly.

As part of the reconnaissance for this report, tree cores were extracted from a number of co-dominant stems to ascertain the stand age. The oldest trees were found to be between 90 - 120 years old. The average tree height for this stand was approximately 60' - 65', which is below the stand's projected site index of 70'. Considering the site conditions, stand age and the species involved, it is not unexpected that we are witnessing a transition between successional stages at this time.

The primary tree species found occurring at Crescent Park include; **American holly** *Ilex opaca*, **sassafras** *Sassafras albidum*, **black oak** *Quercus velutina*, **white oak** *Quercus alba*, **red maple** *Acer rubrum*, **black cherry** *Prunus serotina*, **scrub oak** *Quercus marilandica* and **black gum** *Nyssa sylvatica*. Additional species that were noted, but were not common enough to be captured as part of the sampling, include; **black locust** *Robinia pseudoacacia*, **bigtooth aspen** *Populus grandidentata*, **Japanese maple** *Acer palmatum*, Little-leaf linden *Tilia cordata* and **crab-apple** *Malus spp.*

The following table provides a breakdown of the predominant species basal area and stem count per acre.

Composition

	All species	American holly	sassafras	black oak	white oak	red maple	black cherry	scrub oak	blackgum
Basal Area (square feet)	181.4	114.3	25.7	18.6	7.1	7.1	5.7	1.4	1.4
Percentage of stand basal area	100.0	63.0	14.2	10.2	3.9	3.9	3.1	0.8	0.8
Stems Per Unit Area (stems per acre)	321.2	243.7	44.0	9.7	9.5	4.9	6.8	1.3	1.2

(Dead observations were omitted when calculating values in this report)

The table below provides a breakdown of the amount of basal area for each species within different diameter classes (DBH). This report includes dead trees.

species	< 2.00	>=2.00 and <=6.00	>6.00 and <=10.00	>10.00 and <=14.00	>14.00 and <=18.00	>18.00 and <=22.00	>22.00 and <=26.00	>26.00 and <=30.00	> 30.00
American holly	0.0	14.3	28.6	48.6	20.0	2.9	0.0	0.0	0.0
sassafras	0.0	2.9	7.1	10.0	8.6	10.0	0.0	0.0	0.0
black oak	0.0	0.0	0.0	1.4	11.4	5.7	2.9	1.4	1.4
black cherry	0.0	0.0	2.9	4.3	1.4	0.0	0.0	0.0	0.0
white oak	0.0	0.0	2.9	1.4	2.9	0.0	0.0	0.0	0.0

red maple	0.0	0.0	0.0	1.4	1.4	2.9	0.0	1.4	0.0
scrub oak	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
blackgum	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0

In order to best reflect the average tree diameter in a stand (based on the predominant size classes) forestry applications often employ the quadratic mean diameter (QDM), which is the "average tree diameter of the average basal area". Since QDM gives a better approximation of the central tendency rather than a straight mean, it minimizes skewed representation by individual stems occurring at either end of the range. The table below provides the average tree diameters by species.

Diameters

	All species	**American holly**	**sassafras**	**black oak**	**white oak**	**red maple**	**black cherry**	**scrub oak**	**blackgum**
Quadratic Mean DBH (inches)	10.2	9.3	10.3	18.7	11.7	16.3	12.4	14.0	15.0
Average DBH (inches)	9.3	8.6	9.1	18.4	11.2	15.6	12.2	14.0	15.0

Stem densities are integral factor in understanding forest stand dynamics, and various densities dictate how a forest develops. There are several stocking index's to evaluate the relationship between the number of stems of any given size and overall basal area. *Relative* density incorporates the difference in growth among *species* into the relationship, and is therefore a good index in mixed species stands. As the following table indicates, the stand-wide relative density at Crescent park is 120% of the optimum (maximum optimum being 100%). At 120% of the optimum, there is an elevated amount of competition between trees for limited growing space. This reduces individual tree vigor, and usually leads to increased mortality among smaller stems. Overall, a stand's resilience to stress is significantly compromised when relative density is high, making it more susceptible to drought, extreme weather, diseases and insect outbreaks.

Relative density

	All species	**American holly**	**sassafras**	**black oak**	**white oak**	**red maple**	**black cherry**	**scrub oak**	**blackgum**
Relative Density (percent)	120.42	76.28	15.83	14.22	5.94	3.80	2.40	1.15	0.80
percentage of stand	100.00	63.34	13.14	11.81	4.93	3.15	1.99	0.96	.67
Stems Per Unit Area (stems per acre)	321.2	243.7	44.0	9.7	9.5	4.9	6.8	1.3	1.2

Although growing and harvesting forest products is not currently a management objective for the Borough of Sea Girt, it is often helpful as a descriptive tool, to quantify the volume of vegetation on a site in terms of cordwood and board feet. The following table provides those volumes based on a per acre basis.

Volumes

	All species	American holly	sassafras	black oak	white oak	red maple	black cherry	scrub oak	blackgum
Sawtimber net total (board feet/acre)	7,590	3,221	1,455	1,618	290	503	306	103	94
Pulpwood net total (cords/acre)	27	19	3	2	1	1	1	0	0
Gross total (cords/acre)	52	31	7	6	2	2	2	0	0

Because trees are long lived, their mere existence is not always a very good indicator of forest health, function, or ecological value. In many instances, the understory vegetation can be a better metric for this, and a diverse understory containing native plants is usually the desired condition to best exemplify good forest health.

At Crescent Park, fourteen evenly spaced inventory locations were established to collect ground cover data within fixed radius plots. This sampling revealed only ten understory plants other than tree seedlings, and of these, four are non-native plants (English ivy, multiflora rose, Japanese honeysuckle and double-file viburnum). Although many non-native plants have become endemic and widespread in New Jersey, they are considered invasive to native ecosystems because they displace native vegetation and disrupt ecological processes. Furthermore, they tend to be less palatable and nutritious to local wildlife.

Understory (*i.e. large shrub & sapling*) data was also collected on fixed radius plots, and the resulting data shows the park to be very limited in terms of diversity and density. Only four different tree or tall shrub species were sampled as part of the fixed radius plot inventory, and one of those is the non-native invasive known as Norway maple.

Several other ground cover and understory plants are found in the park (particularly within the forest edge along First Avenue), but were not common enough to be picked up as part of the sampling. They are; pokeweed, winterberry, European privet, mugwort, Japanese knotweed, winged euonymus, clematis and Asiatic bittersweet. Of these, only pokeweed and winterberry are native plants to New Jersey. The others have been known to completely take over native systems and become quite problematic after becoming established.

The core flora are those species common to every ground cover plot. For Crescent Park, the core flora is represented by one species, English ivy *Hedera helix*, which accounts for 77% of the stand's ground cover.

Ground Cover Species	Frequency	Rel Frequency	Percent cover	Rel Percent cover	Importance Value
English ivy	100.00	32.56	68.57	77.17	41.34
sassafras	71.43	23.26	5.43	6.11	31.90
greenbrier	35.71	11.63	5.14	5.79	7.51
multiflora rose	21.43	6.98	2.57	2.89	4.31
Japanese honeysuckle	21.43	6.98	0.86	0.96	3.67
Virginia creeper	21.43	6.98	0.21	0.24	3.43
eastern poison ivy	14.29	4.65	2.86	3.22	3.30
fox grape	7.14	2.33	1.43	1.61	1.65
Viburnum (combined double-file and arrow-wood)	7.14	2.33	1.07	1.21	1.52
Allegheny blackberry	7.14	2.33	0.71	0.80	1.38

Description of Ground Cover Table Items

- **Frequency** = The percentage of plots where this species was observed, based on the number of plots where species occurred divided by total number of plots.
- **Rel Frequency** = Relative frequency of occurrence, based on individual species frequency divided by the total of all species frequencies.
- **Percent cover** = Mean percent coverage. The mean proportion of area that is covered by a vertical projection of the foliage onto the ground surface for all stems or individuals of a given species.
- **Rel Percent cover** = Mean relative percent coverage, based on the individual species percent coverage or basal area divided by the total percent coverage or basal area for all species.
- **Importance Value** = Importance Value, a value computed by arbitrarily adding together the values for relative abundance, relative frequency, and relative dominance and dividing by three.

Understory Species	Stems per acre
sassafras	207
American holly	21
black cherry	14
Norway maple	7

Compiled list of species recorded within the forest sampling

Species	Latin	Overstory	Understory	Ground
black cherry	***Prunus serotina***	X	X	
American holly	***Ilex opaca***	X	X	
sassafras	***Sassafras albidum***	X	X	X
red maple	***Acer rubrum***	X		
English ivy	***Hedera helix***			X
Virginia creeper	***Parthenocissus quinquefolia***			X
black oak	***Quercus velutina***	X		
white oak	***Quercus alba***	X		
Norway maple	***Acer platanoides***		X	
scrub oak	***Quercus marilandica***	X		
blackgum	***Nyssa sylvatica***	X		
greenbrier	***Smilax***			X
multiflora rose	***Rosa multiflora***			X
fox grape	***Vitis labrusca***			X
Japanese honeysuckle	***Lonicera japonica***			X
Allegheny blackberry	***Rubus allegheniensis***			X
double-file viburnum	***Viburnum plicatum***			X
arrowwood viburnum	***Viburnum dentatum***			X
eastern poison ivy	***Toxicodendron radicans***			X

CRESCENT PARK CARBON STORAGE

The quantification of long term carbon storage in forests is dependent on a number of factors that vary according to the site, and the ultimate fate of the trees. One of the best ways to maximize carbon sequestration is to process harvested trees into durable goods that will be maintained for long durations, and then have those trees quickly replaced by new vigorously growing trees. However, this will not be strong option for this property because of the constraints surrounding the management objectives and the public use of the property.

We can assume that given the current tree stocking, age, and site fertility, carbon storage is at, or near maximum for this stand. One strategy to maintain stable carbon levels is to avoid catastrophic dieback (in this case, particularly to holly) and the subsequent spike of released carbon that would be emitted during the time that new trees become established.

The following tables show the current estimated carbon storage at Crescent Park

Total Live Carbon (total tons)

	Stand Area (ac)	Foliage	Stem Wood	Stem Bark	Aboveground	Coarse Root	Total
Crescent Park	18	20	619	126	998	189	1,186
TOTALS	18	20	619	126	998	189	1,186

Total Dead Carbon (total tons)

	Stand Area (ac)	Foliage	Stem Wood	Stem Bark	Aboveground	Coarse Root	Total
Crescent Park	18	3	83	17	131	25	156
TOTALS	18	3	83	17	131	25	156

Total Live and Dead Carbon (total tons)

	Stand Area (ac)	Foliage	Stem Wood	Stem Bark	Aboveground	Coarse Root	Total
Crescent Park	18	23	703	143	1,129	213	1,342
TOTALS	18	23	703	143	1,129	213	1,342

MANAGEMENT RECOMENDATIONS

The key stand dynamics associated with this forest are:

- The relative decline in those tree species that are common to earlier successional stages of maritime forest types, many of which are important forage producers for migratory birds.
- The continual progression towards a climax overstory of American holly as the dominating overstory species, and the reduced complexity that comes with a "single species" forest. Single species stands are also less resilient to environmental stressors.
- Dwindling diversity at the shrub and ground cover layers, which provides the basis for many important ecosystem services including water conservation, carbon storage and wildlife habitat.
- Relatively high tree stocking, which compromises individual tree vigor due to the stress of competition for resources such as water, sunlight and nutrients.
- The high proportion of non-native invasive species in the park, which further compromises all of the above issues.

The first course of action recommended to begin mitigating these issues is to reduce, or eliminate, the non-native plants to allow for the eventual establishment of preferential native vegetation. Of particular focus should be the English ivy. Despite that some people may find the ivy to be aesthetically pleasing, it is currently the largest disruption to native plant regeneration at the park. It has become so dense that it even seems to be preventing the otherwise shade tolerant American holly from regenerating in the understory. If left unchecked, it may become

the only plant persisting in the understory, and as the hollies eventually die (as all trees do), the site would be converted from a forest, to a barren of English ivy.

English ivy can be controlled via mechanical and chemical methods, or potentially a combination of both. Each control method has pros and cons, and the preferred method rests with the landowner's resources and commitment to completing the task a certain way. Generally speaking for invasive plants, long term successful control warrants at least some chemical applications to be effective (and cost effective). Author Jonathan Soll of The Nature Conservancy, prepared a comprehensive summary for controlling English Ivy in the Pacific Northwest, and those experiences should apply equally to Crescent Park. The 12 page document is attached to this plan for reference, and while it reviews the methods they found successful, there are undoubtedly other treatments - including different herbicides - that could provide comparable results. It is beyond the scope of this plan to fully comprehend the resources of the Borough to control the ivy, but consultation with a licensed pesticide applicator who has experience with English ivy would be warranted prior to undertaking the work. It could be feasible to assemble a workforce to first conduct a hand pulling operation to reduce the amount on the forest floor and to sever vines climbing into the trees. Then, conduct herbicide applications to treat the residual materials and new sprouts that occur. This would require less chemicals, but will be much more labor intensive. Undoubtedly, complete control will be a multi-year task, requiring follow-up treatments.

Since English ivy is an evergreen species, it has the unusual characteristic of being susceptible to foliar chemical treatments during the dormant season, when other plants aren't. This allows for a very selective treatment, eliminating the possibility of affecting non-target species. It also allows for applications to occur from very late fall through early spring, when human visitor use is presumably lowest, and wildlife exposure is lowest.

Given the size of the park and available resources, eradication efforts may need to occur as phases over successive years, covering a certain amount of land each year. Some cost per unit estimated are outlined in the attached English ivy control document. Additionally, the adjoining landowners along First Avenue who also have English ivy should be encouraged to co-operate, otherwise a re-infestation is almost certain.

The populations of mugwort, Japanese knotweed, privet and clematis cannot easily be controlled via mechanical treatments, and should therefore be treated using herbicides. Each plant has a preferred chemical control and treatment process, depending on its location and growing conditions. At Crescent Park, these plants tend to occur in smaller pockets, and can be effectively treated during the growing season while providing very little disruption to visitors and wildlife usage. A licensed pesticide applicator can determine the best treatment methods for each population.

Once sufficient control has been exerted in a given area, the management focus can shift to altering the light regime to allow for more diverse plant growth to occur. This can be accomplished via a Forest Stand Improvement (FSI) treatment with the assistance of a professional forester. Sections of the forest can be selected where a variety of overstory species remain, and where the target trees exhibit sufficient vigor to expect adequate seed development.

Once the ideal candidate trees are selected, the adjacent stems can be culled in order to open the canopy to allow better light penetration to the forest floor. In general, the gaps created would be on the order of 50'- 100' wide, and ideally they would be scattered widely throughout the park to stagger the regeneration. If there are no hiking trails within 75' of the gaps, the trees (which are a maximum of 65' tall) should be girdled and retained as snags for wildlife. Where trails are in close proximity, trees can be felled and left on the ground to serve as coarse woody debris for wildlife use, and to recycle nutrients.

To balance the varied interests for this forest and the unique aesthetic values that it provides to visitors, it is suggested that at least one third of the stand where holly dominates is retained as a climax holly forest, and perhaps the other two thirds are managed for a continuum of various ages and species. However, even where holly is the dominant species, tree stocking is well above the optimum for tree growth, and those sections would be well served by a thinning operation to reduce inter-tree stress and improve residual tree vigor. It is suggested that 30 - 40 sq. feet of basal area per acre can be culled in these sections, which will concentrate growth on the residual stems. This effort should target intermediate and co-dominant stems for removal that already exhibit symptoms of decline. Common signs of decline might include structural defects, decay or compacted bark plates. A secondary benefit of thinning is that the small canopy openings will allow some filtered light to reach lower canopy strata, fostering better understory plant development.

It is suggested that FSI progress slowly through the stand, rather than in a few intense treatments. Completing patches that are smaller than an acre per year (perhaps spread across several spots), will help to minimize the visual impacts and preserve visitor use for most of the park at any given time.

MANAGEMENT SCHEDULE

The management schedule is simply a prioritization of management recommendations based on the current conditions, the landowner goals, the landowner's financial constraints, and ability to implement the prescribed activities. It is not intended to be definitive, and should be adjusted to change as situational conditions change. Therefore, the option of where to work and when, is purely a landowner decision based on their preferences or ability to accomplish the work using the guidance contained herein. The proposed management schedule is not meant to be rigidly interpreted, but rather, to provide a framework that establishes a generally acceptable rate of progress towards management of the property. In conjunction with advice form a consultant forester, activities proposed for a given year should be switched with those from a different year if site conditions dictate that the shift is the most appropriate choice for management. This could include accommodating unforeseen circumstances such as disease and insect outbreaks, or storm damage. If adaptive management monitoring reveals that *significant* changes are required, the schedule should be modified as a plan amendment. The management schedule can also be accelerated if resources are available to do so. All of the recommended activities are extremely labor intensive and can be quite costly.

2015 - 2018

Initial English ivy control- suggested to commence immediately on five acres per year to complete a rotation through the entire park in three years.

2016 - 2024

Conduct follow-up herbicide treatments in English ivy control areas - attempt to complete at least two to five acres per year as needed. Treat other non-native plants using growing season herbicide applications as described in plan.

2018 - 2024

As English ivy control is deemed successful, initiate FSI treatments annually in those areas as described herein.

2025

Re-evaluate stand conditions and update the Forest Stewardship Plan.

ATTACHMENTS

- Glossary of Terms
- Maps - Stand, Infrared, Wetlands & Streams, Topo, Historic Resources, 1930's Photo
- English Ivy Control Methods for the Pacific Northwest
- USFWS – Trust Resources List
  (Federal Threatened & Endangered Species List)
- Federal Species Fact Sheets
- NJ DEP Natural heritage Database Report
  (State Threatened & Endangered Species List)
- NRCS Custom Soil Report

GLOSSARY OF TERMS

Acre – An area of land measuring 43,560 square feet. A 1-acre plot measures about 209' x 209'. A circular acre has a radius of 117.75'.

AGS – Acceptable Growing Stock. Trees that are of good form and vigor that are likely to live for at least 15 years. They should be capable of yielding at least one 8' sawlog, or if they are sapling or pole size trees they can be expected to yield a sawlog in the future.

Age – Mean age of the dominant and co-dominant trees in a forest.

All-aged or Uneven Aged Stand – A forest compromised of trees of different ages and sizes.

Aspect – Compass direction to which a slope faces.

Basal Area – The cross sectional area of all trees in a stand, usually expressed as a square feet per acre value. It is normally measured at DBH.

BAF – Basal Area Factor. Number of units of basal area per acre represented by each tree.

Board Foot – A unit of wood measuring 144 cubic inches. A board foot measures 1 inch thick by 12 inches wide by 12 inches long. Board foot volume is determined by:
length (feet) x width(inches) x thickness (inches) / divided by 12.

Bole – The main trunk of a tree.

Butt Rot – Decay or rot confined to the base or lower bole of a tree.

Crown – Upper portion of the tree where most of the leaves are found.

DBH – Diameter at Breast Height. Defined as a tree diameter measurement taken 4.5 feet above the forest floor on the uphill side of a tree.

Dominant Trees – Trees with crowns receiving full light from above and at least partly from the sides; usually larger than the average trees in the stand. The crown extends above the others in the vicinity.

Even Aged – Stand of trees where there are only small differences in age among the individual trees.

FSI – Forest Stand Improvement. Improving the forest quality by removing or deadening undesirable trees to achieve desired stocking and species composition.

Forest Type – Groups of tree species commonly growing in the same stand because their environmental requirements are similar.

Girdling – A physical cutting or disruption of the cambial sap flow around the entire circumference of a tree.

Group Selection – The removal of small groups of trees to regenerate shade intolerant trees in relatively small openings (usually at least ¼ acre).

High Grading – A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality shade tolerant trees tend to dominate in continually high-graded sites.

Improvement Cut – An intermediate cut made to improve the form, quality or health of the remaining stand.

Intermediate Trees – Trees receiving little direct light from above and none from the sides. Usually with small crowns that extend into the canopy of co-dominant trees.

Intolerant Species – Tree relatively incapable of developing and growing normally in the shade of other trees.

Mast – Fruits or nuts used as a food sources by wildlife. Soft mast includes fruits with fleshy coverings, such as dogwood or cherries. Hard mast refers to nuts such as acorn, beech and hickory nuts.

Sawlog or Sawtimber – A log or tree that is at least 12 inches diameter and 8 foot long that can be sawn into lumber.

Silviculture – The art, science, and practice of establishing, tending, and reproducing forest stands of desired characteristics. It is based on knowledge of species characteristics and environmental requirements.

Site Index – A relative measure of forest quality based on the height of co-dominant trees at base age of 50 years old. Helps estimate future productivity.

Slash – Tree tops, branches, bark or other woody residue left on the ground after logging operations.

Stocking – A description of the number of trees, basal area, or volume compared with a desired level for balanced health and growth.

Suppressed Trees – Trees with crowns receiving no direct light from above or the sides. Usually with small crowns that are entirely below the canopy of co-dominant trees.

Thinning – A tree removal practice that reduces tree density and competition between trees in a stand. Thinning concentrates growth on fewer, high quality trees.

Tolerant Species – A tree species that has the ability to grow normally in the shade of other trees.