Natural History Along the Department of Energy Glenn Seaborg Trail, Germantown, Maryland

Ferns along the Trail

Photo by Larry Waslh

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Introduction

Before the U.S. Atomic Energy Commission (AEC, now the U.S. Department of Energy) headquarters was built in Germantown, MD, (during 1956 - 1958), the land the site is built on belonged to Mr. William O. Dosh, a farmer living in Gaithersburg, MD. Mr. Dosh farmed most of the land, but apparently left a healthy portion of the natural terrain wooded and uninterrupted around the periphery of the farm site. An aerial photograph of the Dosh farm was taken in 1955 by the AEC when it was searching for a remote site on which to relocate and build the AEC headquarters. That photograph (Figure 1), from the archives of the Montgomery County Historical Society, shows that the 7-8 acre wooded area, that now contains the Seaborg Trail on DOE's property, was intact in 1955. Today, that natural terrain and wooded area remain near the southeastern border of the Germantown site. The wooded area has remained relatively undisturbed due to restricted access and by hands-off management over time by the AEC and the Department of Energy (DOE) Germantown site caretakers.

A number of DOE's sites nationwide have preserved forests and other significant ecological resources by virtue of their security needs and fenced property lines, areas that would not have been preserved otherwise. Security and fences at some DOE sites for 40-50 years have resulted in restricting human access and have allowed the natural habitat to naturally regenerate and self-renew. The preserved quality habitat that has resulted at some sites has been an unintended, yet beneficial, consequence of the need for long-term security. The Department of Energy headquarters site at Germantown, Maryland, also has achieved this by virtue of site security, which includes a peripheral fence line that has restricted access since the site was purchased in 1955. The Germantown site thus has preserved the small 7-8 acre stand of woods, which contains a small headwater creek running through it.

Dr. Glenn Seaborg, was a world-renowned chemist, Nobel laureate, and Chairman of the AEC at its Germantown headquarters from 1961 to 1971. He had a great appreciation for nature and hiking. He would frequently take hikes through this stand of woods during or after his lunch hour. Dr. Seaborg had a small trail cleared trough the forest, where he then began bringing his colleagues and business partners along during his daily hikes; they would walk, talk business, and enjoy nature's beauty, all at once. AEC and DOE employees have referred to the Trail ever since, as the "Glenn Seaborg Trail." This is not the only trail Seaborg is known for blazing. He and his wife, Helen would hike ten to fifteen miles in their leisure time. In 1979, the couple laid out an inter-connected network of 12-mile trails in the East Bay hills near San Francisco that extended from Contra Costa Country to the California-Nevada border. It has been reported that the Seaborgs actually hiked across the entire network that is now a link in a cross-country trek put together by the American Hiking Society.

Forest Survey During the Summer of 2000

AEC and DOE employees have been walking on the Seaborg Trail through the wooded area for more than 30 years. It provides a nice, quiet and restful natural atmosphere in which to take a break from the routine of government activity in the headquarters building on the Germantown site. Some years ago, a few trees along the Trail were marked with aluminum tags noting their common names. In the summer of 2000, just three trees still bore their tags whole and in place. There are several species of trees along the Trail that could be re-marked for information of the employees, so that enjoyment of the Trail and woods could be more informative, as must have been the intent of those who originally marked the trees some years ago.

This study was conducted, in part, under the auspices of the Office of Science Intern Program that funded the availability of author Powell, during the summer of 2000. The forest survey was conducted between May 16 and August 25, 2000, to describe this wooded area and its main tree species, to establish a relative time frame and age for the woods, and to better understand the human history of this piece of forest. One outcome of the study was to be a report on the findings that could be made available to employees of the Germantown site, for their information. This report is that outcome. It also was intended that the common and Latin names of the main tree species along the Trail would be offered to the Germantown facility site manager, so that new name markers could be made for those trees. Eight botanical markers were placed in the forest during October 2000.

Discussions with the DOE History Division in Germantown generated a collaborative project to contribute a segment on natural history of the Germantown site to a display on the institutional AEC/DOE history that was being designed and produced by the History Division. Companion brochures to the display also were to be prepared, one on the institutional history, and a second on the natural history, based on the results of this forest survey and other information. A display entitled "Why Germantown?" was completed and was opened to DOE employees and the public on September 6, 2000. Two companion brochures also were produced by DOE and made available publicly on September 6, 2000. A brochure entitled "Germantown Site History" discusses the selection of the Dosh family farm in Germantown for the AEC headquarters site, along with its related Cold War history. It also discusses the creation of the walking path through the woods on the Germantown site, by AEC Chairman Glenn Seaborg in the 1960's that became known as the "Seaborg Trail". DOE Historian Dr. Marie Hallion and Office of Science intern Marc Goodwin wrote this site history brochure. A second brochure entitled "Germantown Facility: A Natural History" discusses the natural history over time, from the Dosh farm in 1955 through a reforestation project in the year 2000. Authors Hickey and Powell wrote it. The brochure also relates the natural history along the Seaborg Trail, which is summarized in large part from earlier drafts of this report. Some prelim-

inary findings from the forest survey also were reported by author Powell in the August 2000 issue (Vol. 23, No. 6, p. 5) of the Department of Energy's corporate newsletter, *DOE This Month*, in an article entitled "Germantown site preserves natural history".

We recommend that the brochure on site and institutional history and the brochure on natural history be read together as companion pieces, in order to fully understand and appreciate the interplay of human history and natural history on the land and the Germantown site over time. People and the environment have been, and continue to be, intrinsically and irreversibly linked together, each affecting the other. When read together, the two brochures portray this linkage. They also portray the similarities between the HQ Germantown site and many of DOE's field sites across the country. These similarities include their Cold War histories, their remote siting for safety and security, the encroachment of the local community right up to the fence lines, and the unintended consequences of preserving natural habitat due to the security measures that restricted access to the sites and their resources. We hope, therefore, that the brochures and display will assist DOE employees in enhancing their awareness of the histories of the Germantown site and, thereby, enhancing their "DOE sense of place", by linking this HQ site with its counterparts nationwide. Both brochures are included as attachments to this report.

During the drafting of this survey report, we found a few very minor mistakes in the natural history brochure regarding the time frames for some of the trees noted on the site map in the brochure. For example, in the natural history brochure, the "White Oak ca. 1810's" near the north bridge actually should be "ca. 1800's", since our estimated age for that white oak is 192 years. These age estimates, however, are not precise and represent general time frames, as discussed in the methods section below. These have been corrected on Figure 4 of this survey report.

Methods

The forested area along the eastern boundary of the Germantown site was surveyed to describe, in general, the diversity and distribution of the main trees in the forest. Also, of interest were those tree species that appear to dominate in number and size, and thus probably are the oldest trees. These species would define the canopy and provide a means for understanding and interpreting the forest, its relative age, and history. The forest also was surveyed in order to map its main natural features, plus its accommodations for human use - the Seaborg Trail, its bridges and benches, the creek, and the remnants of old farm fence lines.

Establishment of Survey Reference Points and Mapping of the Forest.

We obtained a 1992 soils map of the DOE Germantown site to use as a starting point. It was provided by the Germantown Team of the DOE Facilities Management Group. The map shows the location of the forested area at the eastern side of the site, along the fence line that denotes the site boundary. The map contains contours of the land and its elevations (in feet) above sea level. From that map we copied the portion containing the forested area, on which we could plot the locations of the main features of the forest area during our survey. Figure 3 is a copy of the portion of the soils map containing the forest, to which have been added our reference points. The features we were interested in included: the main individual trees to be used for aging; the location of the creek and feeder stream; the path of the Seaborg Trail; the location of the two benches along the Trail; the locations of the three bridges that span the creek along the Trail; the locations of understory plants of interest; and the locations of the remnants of old farm fencing.

We used a meter wheel to measure distances and place survey markers within the forest. We measured the length of the Trail from its north entrance to its south entrance, a distance of 1273 feet, or about one quarter mile. We measured the fence line beginning at the elbow in the fence, on the eastern hillside, near I-270 (see Figure 3). We marked the fence every 100 feet heading in a southerly direction until we reached the southern edge of the forest, a distance of 861 feet. Each 100-foot increment was labeled, beginning with "F-0" at the elbow and running to "F-800", with "F-861" as the ending point. We also marked the fence every 100 feet in a northerly direction beginning at "F-0" and running to the edge of the forest parallel to I-270, a distance of 300 feet. We used these fence line markings as reference points from which we could use the meter wheel to measure the locations of items of interest. We walked perpendicular from the fence line reference points until we reached the Trail, the south entrance of the Trail, the creek, the benches, the old farm fence, and several trees to be aged. Some tree locations were plotted by triangulating them from two or three established reference points, that

could be a combination of fence line reference points and/or other well defined tree locations (such as the large white oak dating to the 1840's that is just upslope from the creek in the southern edge of the forest, see Figure 4).

We used surveyor's stakes to set up two transects ("A" and "B") across the forest to use as reference points, along with the pump house and the north bridge at the extreme northeastern end of the forest. From these points, we used the meter wheel to plot the location of the northern entrance of the Seaborg Trail, as well as the locations of several trees that we measured for their circumference, to be used in estimating their ages, as described below.

Aging of Trees and the Forest.

Using the methods described below, we collected girth measurements to estimate the ages of tulip poplar and white oak throughout the forest. We started on the eastern hillside, since that is where we began with the assistance of a forester from the Maryland Department of Natural Resources, with the coring and aging of two white oak. We also surveyed what appeared to be the largest trees along the Seaborg Trail, as well as trees off the Trail in various places in the forest. We surveyed trees at random in the northern edge and along the terraced area of the western hillside, both upslope and downslope of it. We wanted to compare ages of the trees along the terrace in order to test our observation that the terrace seemed to be at the edge of the farmland and the forest in the 1955 farm site photo (Figure 1). That area now appears to be newly regenerated forest.

On May 16, 2000, Maryland Department of Natural Resources (MDNR) forester David Plummer assisted us in aging a few key tree species that would be used as reference for aging other trees and for estimating the relative age of the forest in general. Mr. Plummer used an increment borer to remove cores from four trees - two white oaks, one tulip poplar, and one Virginia pine. We chose intermediate size trees to bore, and purposefully avoided boring the largest or "premier" trees" in the forest. The annual rings on each core of the trees were counted by several people and then averaged to obtain the empirical age of each tree. The girths (or circumference) of the two white oaks and the tulip poplar were measured at a height of 4.5 feet above the ground level to obtain the diameter of the trees at breast height (d.b.h.). Mr. Plummer measured the girths using a forestry tape rule that is calibrated in inches of diameter, rather than in inches of circumference. The d.b.h. measurement in inches then was used to calculate an estimated age for two of the tree species, using a standard growth factor for each species. As suggested by the MDNR, we applied a growth factor of 5 for the slower growing white oak and a factor of 3 for the faster growing tulip poplar. This forestry technique of estimating age then was applied by multiplying the d.b.h. (in inches) times the growth factor to arrive at an estimated age for the trees (in years). These estimated ages then were compared with the empirical ages (from the core samples) to test whether it would be reasonable to obtain estimated ages for many other white oak and tulip poplar by recording d.b.h. data for these two species throughout the forest. These two species were focused on since they appeared to be dominant species in the forest in terms of numbers and size (thus suspecting that they might be among the oldest trees in the forest), and in distribution within the forest. These data are presented in Table 1.

There was reasonable agreement of the ages obtained for the two species of trees using the core boring method and the d.b.h. estimation method. MDNR forester Plummer indicated that for the larger and older white oaks, an estimated age within 30 years of the empirical age would be reasonable for arriving at a relative age of oaks in the forest. Our data for these two white oaks yielded estimated ages within 13 years of the empirical ages. For both white oaks, the d.b.h. method underestimated the ages obtained by counting the annual rings on the cores. It is possible, also, that the white oaks actually might be older than indicated by the number of rings. *The North American Tree Guide* web site (http://www.treeguide.com) indicated for white oak that: "Shoots are usually browsed by deer and other mammals, and a new stem repeatedly sprouts. This may go on for many years before a shoot finally escapes predation, so that the root system is often 10 or more years older than the shoot system." For the one tulip poplar from which a core was obtained, the d.b.h method overestimated the age by about 6 years compared with the count of annual rings (Table 1).

It seems probable to us that our d.b.h. method of age estimation is not precise for individual trees. It may be more accurate, in a relative sense, for groups of trees or for a stand or forest, by using the range of ages of the trees surveyed, or by using an average value if the trees are all of similar size. This method probably is not precise, also, for trees of the same species that are located in different areas of the forest with differing soil or water availability conditions. We thus accepted an imprecision in the ages we estimated for the trees we surveyed, but believe that we were able to define a relative and reasonable overall time era for the forest, with which we could compare and discuss known or suspected human history. So, we estimated the ages of many trees, portions of the forest, and the entire forest with these understandings and limitations in mind, as we set out to provide a general understanding of the forest and Trail that could be communicated for the benefit of DOE HQ employees.

We wanted to be able to estimate the ages of many other individual white oak and tulip poplar trees in order to describe the forest in relative terms and to estimate its age or time era. We also wanted to be able to estimate the ages of portions of the forest, as the forest appeared to contain groups of trees or stands of different sizes, and probably ages. We wanted to be able to use the d.b.h method, since it is easy to perform. The increment coring method provides a more accurate age for individual trees, but it wounds the trees being surveyed and has the potential to open the way for infection or insect pests to get into the cored trees. Core boring, therefore, might be potentially harmful if it were used on many trees in the small forest we wished to survey. We did not want to risk damaging the forest we set out to survey for conservation purposes. The only precise way to age the trees with confidence would be to either obtain cores from a reasonable and statistically valid sample of trees, or by counting the annual rings on a similar sample of felled trees. Unwilling to do either, we chose the d.b.h. method, as a non-destructive technique, while understanding its limitations in precision and accuracy.

We obtained a standard carpenter's tape rule for use in measuring the circumference of the trees. We used it to re-measure the trees that had been measured for d.b.h by Mr. Plummer. We converted the circumference measurements (in inches) to a calculated diameter (or calculated d.b.h.) by dividing the circumference of the tree by 3.14. We then compared our calculated d.b.h. measurements with the d.b.h.'s measured by Mr. Plummer. These comparisons were extremely close, as were the comparisons of estimated ages using our calculated d.b.h. measurements and those of the forester. See Table 1.

Tree and Plant Identification.

The main species of trees in the forest were identified using various field guides, including those by Harlow (1959), Little (1988), Petrides and Wehr (1998), and Wernert (1982). We also used Wernert (1982) to identify some of the understory plants. In the fall of 2000, we collected some fallen leaves, twigs, and acorns to confirm the identity of some species. We consulted with botanist Diane Lewis at Brookside Gardens, in Wheaton, Maryland, to confirm the identification of two species of ground ferns that occur along the central portion of the Trail on the eastern hillside, and two fern species from the northern edge of the forest.

Results and Discussion

Overview

The results of this survey suggest to us that the forest on the DOE Germantown site is a relatively undisturbed natural area with many wild-like qualities. It contains many trees probably more than 100 years old, plus several others that we estimate date approximately to the early and middle 1800's (see Tables 1-4). Overall, this 7-8 acre forest appears to date approximately to the middle or latter 1800's or so, and it contains a few trees probably old enough to suggest that it goes back to the early 1800's. One white oak appears to date to the middle 1700's. It probably is the oldest tree in this forest, and certainly appears to be the most massive tree in the forest. The oldest and largest trees appear to be in close proximity to the creek. The forest appears to be predominantly a mix of hardwood tree species of many ages. Tulip poplar and white oak appear to be the dominant species in terms of number and distribution. They also appear to be the oldest tree species, although there are several large individual red maple and chestnut oak that we did not age. The predominance of the pioneer species tulip poplar, especially younger individuals on the western hillside, suggests that the forest is regenerating and self-renewing. The land on which the forest is located probably has served for both farm land and timber production over time. This is discussed in more detail in the sections below.

Interpreting the Aging Data.

We have a very small sample of empirical data on core-generated annual rings and measured d.b.h.'s with which to estimate and compare ages. No statistical analyses are possible. More actual annual ring data would have been needed to provide a robust sample for a statistically valid baseline. We chose to use a non-destructive qualitative approach for estimating the ages of white oak and tulip poplar by the d.b.h. method. Our calculated data for diameters and estimated ages were so close to those obtained by the MDNR forester (Table 1) that we feel comfortable with the method we used in collecting these data for many other trees. The difficulty comes with the precision in establishing the ages of the individual trees and in placing an age to the 7-8 acre forest itself, or to portions of the forest, since the d.b.h. method is less precise than the use of annual ring counts.

We used the calculated ages to represent more of a time era than exact dates for individual trees or for portions of the forest, in order to acknowledge the imprecision. For example, a random sample of five tulip poplar located on the upward slope of the western hillside had estimated ages ranging from about 27-36 years (average about 32 years) using our d.b.h. method. So, rather than stating that these trees are 27-36 years old (which seems more precise than we were comfortable with), we have stated that the tulip poplar in that region of the forest are "circa

1960's-1970's" or that they are "trees dating to the mid-1960's-early 1970s". This allows for the imprecision, yet places a relative time era on the stand of trees. In comparison with these trees on the upward slope, a sample of tulip poplar on the downslope of the western hillside had estimated ages ranging from about 60-102 years using our d.b.h. method. A white oak in that same area was estimated to be 120 years old. So, that area of the forest would be "circa 1890's-1940's" or "trees dating from the late 1890's to about the 1940's" (considering the tulip poplar), while the presence of the older white oak dates the area to "circa 1880's". The upslope and downslope of this portion of the forest are separated by a flat "terraced area" without trees, such that looks like it had been a path or old dirt roadway. See the schematic diagram of Figure 4 for the location of the terraced area. In fact, on the 1955 aerial photo of the pre-AEC farm site (Figure 1), this terraced area was at the edge of the western hillside of the forest and was open farmland. It seems apparent from this comparison (using our estimated relative age data and the old photo) that the upslope area is a newer growth area of trees, while the downslope area is an older growth area. Also, the upslope area is predominantly tulip poplar, while the downslope area is a mix of tulip, oak and maple. So, we were able to discern the differences in the areas and surmise that the upslope area is recently regenerated forest, since the AEC acquired the site and built the Germantown facility in the late 1950's. The fact that we estimated the ages of the trees on the upslope of the terraced area to be more recent than 1955, and those on the downslope to be older than 1955, gave us some confidence that our methods could be used to provide a relative age description of the forest. These are examples of the methods we used to estimate the ages of trees that were used to help "read the landscape" and to qualitatively discern and describe the relative age and history of this forested area.

We used this same method and interpretation for placing the largest and oldest white oaks and tulip poplar trees into relative time eras. Using our d.b.h. method, for example, we estimated that the oldest white oak we found in the forest dates to about the year 1756, or "circa 1750's". Similarly, the oldest tulip poplar we found dates to about the year 1870, or "circa 1870's" (see Figure 4 for the locations of these trees). While these are not exact ages or dates, we feel comfortable using the time eras as relative and comparative descriptors of these large older trees, and thus for interpreting their relative age within the forest, and their relation to human history.

General Description of the Forested Area

The forested area through which the Glenn Seaborg Trail runs is approximately 7-8 acres in size. It can be divided roughly into four general regions for descriptive purposes, based on slope and geography and based on the relative ages of the key tree species used for aging the forest (tulip poplar, white oak). These are discussed below. The forested area is roughly crescent shaped and approximately 1200 feet long. It is divided by the headwaters of an unnamed creek flowing out of the pond to the north. The pond is spring fed and also receives drainage from the eastern portion of the DOE site. Overflow from the pond feeds the creek, which is a tributary to Gunner's Branch and thus part of the Seneca Creek watershed. The creek enters the forest at an elevation of approximately 455 feet above sea level and leaves the forest at the site boundary fence line at an elevation of less than approximately 430 feet. See Figures 3 and 4.

The main species of trees in forest are the following:

Acer rubrum	Red maple
Carya spp.	Hickories (probably pignut and mockernut)
Liriodendron tulipifera	Tulip poplar (yellow poplar)
Nyssa sylvatica	Sourgum (black tupelo)
Pinus virginiana	Virginia pine
Quercus alba	White oak
Quercus montana	Chestnut oak
Quercus rubra	Northern red oak
Quercus velutina	Eastern black oak
Sassafras albidum	Sassafras

The hickory species appeared to be pignut and probably mockernut. We saw no obvious shagbark species in the forest. Hickories are scattered throughout the forest and appear to be most prevalent on the upslope of the southern edge. The Virginia pines are very few, occurring primarily on the upslope of the southern edge and near the forest edge of the western hillside. Red maple are scattered along the creek and in the northern edge. Tulip poplar are scattered throughout the entire forest, as are white oak. Chestnut oak are most prevalent on the eastern hillside. Northern red oak also are on the eastern hillside, along with sassafras and sourgum. Just one mountain laurel *(Kalmia latifolia)* was found in the forest, along the trail between the two benches. In the winter of 2000-2001, two small American holly *(Ilex opaca)* were found. One is an 18-inch high specimen found on the western hillside very near the large tulip poplar circa the 1870s. The other is about three feet high and located on the southern edge about ten paces off the Trail to the north near where the Trail curves on the upslope. The distribution of trees is discussed in more detail in the discussion below on regions of the forest.

The Four General Regions of the Forest

In order to understand and describe the 7-8 acre forest, it was broken into four general regions or sections based on its geography, on the trees and vegetation that occur there, and based on our qualitative interpretation of the old 1955 farm site photo (Figure 1). This helped in understanding the forest's current landscape and in understanding and describing it's likely past history. The four regions of the forest are shown on Figure 3.

The "Eastern Hillside". This portion of the forest is east of the creek and south of the intermittent drainage that comes from beneath I-270 near the northern end of the forest. This hillside area extends to about the southern bridge where the creek leaves the site. See Figure 4 for a schematic diagram of the forest. This hillside slopes from the elevation of the creek (about 455 feet where the creek enters the forest) up to approximately 480 feet at the F-0 elbow in the fence line. The creek leaves the site at about the 430-foot elevation. The upland portion of this hillside is somewhat rocky, with sparse undergrowth of plants. The hillside contains some white oaks that are estimated to be in the 119 - 133 year old range (Table 1), thus dating to about the 1860's - 1880's or so. Some tulip poplars very close to the southern bridge are estimated to date to about the 1920's. This hillside area contains many trees with a wide range in size, and thus probably in age as well. The 1955 aerial photo of the Dosh farm site shows the presence of

these woods and suggests that the eastern hillside was densely packed with apparently younger looking trees than in surrounding areas of the forest. There are many large tulip poplar and chestnut oaks in this area that we did not measure, as well as red oak, sourgum (black tupelo), sassafras, and one mountain laurel. The forest floor in this area has many very small (~ 6" high) young chestnut oaks and tulip poplar, as well as what appear to be many scattered low growing single blueberry (or huckleberry) plants, with only a few plants actually containing berries (on June 16). The Seaborg Trail runs through this area along the eastern rim of the creek.

The lower elevation of this area, near the creek and through which the Seaborg Trail runs, contains a lush bed of ground ferns. We took some fronds from four fern species to Brookside Gardens, of the Maryland-National Capital Park and Planning Commission, Wheaton, MD, for positive identification. Botanist Diane Lewis helped us to identify and confirm the four species, two of which are from the lower areas of the eastern hillside. The most predominant species in number and aerial extent borders both sides of the Trail along its low point near the creek. It is the seasonal New York fern *(Thelypteris noveboracensis)*. Scattered within this bed of New York ferns are individuals of the evergreen Christmas fern (Polystichum acrostichoides), and another less common form of it *(P. acrostichoides* forma *incisum)*. As well as being scattered among the dense bed of New York fern, the Christmas fern also grows on the steep eroded banks of the creek and along some of the rocky ledges at the beginnings of the steep upland areas. The low-lying area of the forest with its dense ferns has a very green appearance and provides a feeling of tranquility (see figure 4 for the locations of these ferns). This extensive bed of ferns has a depression running through it, between the Trail and the creek, that has the appearance of a drainage area or former creek bed. This bed of ferns is shown in a color photograph on the back of the natural history brochure, and on the cover of this report.

The "Western Hillside". This portion of the forest is west of the creek from about the location of the largest tulip poplar (which dates from about the 1870's) to about the "southern edge" of the forest where the "terraced area" meets the Seaborg Trail. This tulip poplar, at the north end of this hillside, is the largest and apparently oldest of its species that we found in the forest. This hillside slopes from the creek to approximately 465 feet at the western edge of the woods. There is a relatively flat "terraced" area running parallel to the contour of the land, approximately along the 450 foot contour, that seems to divide the larger and older tulip poplar on the downslope side to the east (nearest the creek) from the apparently younger tulip poplar on the upslope side to the west. This terraced area is visible on the 1955 aerial photo of the Dosh farm site as a relatively flat area running between the steep open farm field and the western edge of the woods. The western edge of the woods now extends up the slope of the hillside, such that the terraced area now is well within the forest. This western hillside area now contains a mix of age groups of tulip poplar, which seem to indicate relative ages of the area. Those tulip poplar downgradient (i.e., east) of the terraced area are estimated to be in the 60-102 year-old range, thus dating from about the 1880's to the 1940's or so. Those tulip poplar upgradient of the terrace are estimated to be 27-36 years old, thus dating from about the 1960's to the 1970's or so. (See Tables 2 and 4). Jack-in-the-pulpit can be found on the terrace and along its east side in the interior of this area. (see Figure 4). The New York fern and Christmas fern occur in the lower areas of the western hillside.

The "Southern Edge". This portion of the forest is on the extreme southern end of the forest, from the creek and southern bridge, along the upslope of the Seaborg Trail through the terraced area at elevation 450 feet, to the southern edge of the woods at about elevation 490 feet. This area is somewhat rocky and steeply sloped, with a 15%-25% grade. This area is visible on the 1955 aerial photo of the Dosh farm site (Figure 1) as an apparently relatively lightly forested area with trees that appear to be smaller and much less dense than the woods to the north (i.e., downslope toward the creek). This area contains a large white oak just upslope for the southern bridge that is estimated to be approximately 159 years old, thus dating to about the 1840's. This southern edge area contains tulip poplar and Virginia pine from which core borings were taken, that estimated their ages at approximately 41-47 years old, thus dating to about 1953-1959 ("circa 1950's"). Virginia pine is a pioneer species that establishes early in open areas, but is shade intolerant. Once it is overtaken and is within the understory, it does not do well. The few Virginia pine appear to be in poor condition, with leaves only at the very top of the trees. The much taller tulip poplars vastly overshadow them. Also, there are a few dead Virginia pine on the forest floor that presumably succumbed to their shade intolerance. This southern edge area also contains a mix of chestnut oak and hickory trees, probably pignut and mockernut hickory. There are only a few Christmas ferns on the hillside of this upland area.

The "Northern Edge". This portion of the forest is at the extreme northern end from where the creek enters the forest to about where the intermittent drainage slough from beneath I-270 runs and joins with the creek near the large tulip poplar dating to about the 1870's. The northern edge, on both sides of the creek, is the densest part of the forest in terms of understory shrubs and vegetation. This may be due to breaks in the canopy from fallen trees. There is a small wetland area between the creek and the west edge of the forest in this area.

We took some fronds from two additional fern species to Brookside Gardens, for positive identification. Botanist Diane Lewis helped us to identify the two species. Both ferns were found close to the Trail just north of the middle bridge. One species is the lady fern *(Athyrium filix-femina)* that we found only occasionally in a few places. It has fronds exceeding 2 feet in length and is the tallest of the ferns we have found in the forest. The second species is the sensitive fern or bead fern *(Onoclea sensibilis)*. We have seen only two individuals of this fern, about six feet apart, each with only one frond. The New York fern and Christmas fern also occur in the northern edge.

The northern edge appears on the 1955 aerial photo of the Dosh farm site (Figure 1) and appears to be relatively thickly wooded. There also is a relatively thick understory of young trees there now. Several trees in this area have either poison ivy or woodbine vines as epiphytes. Some of the vines are relatively thick, being 1"-2" in diameter. Also, there are patches of thick raspberry brambles scattered about. The predominant trees in the northern edge are tulip poplar, white oak, and maple. There are several trees (white oak and tulip poplar) in this area that we estimate are near or greater than 100 years old. A few trees appear to date back to about the 1860's and earlier. This area contains the large white oak, near the Trail's northern entrance, that is estimated to be approximately 244 years old, or dating to about the year 1756 ("circa 1750's"). We estimate that this is the oldest tree in the forest.

Glenn Seaborg Trail

The Seaborg Trail occurs on the site today in two main locations. One small portion runs through the laurel gardens in the southwestern portion of the site. Another portion runs through the forested area we surveyed. The Trail through the forest is 1273 feet long (or about one quarter mile) from its northern entrance near the newly reforested area to its southern entrance near the Child Development Center (see Figure 4). At its northern entrance, the Trail begins at an elevation of about 465 feet, descends to about 430 feet where it crosses the creek via the southern bridge near the eastern fence line, and then rises to about 490 feet at the southern entrance. This latter rise of 60 feet is about a 20% grade. The Trail crosses two bridges, one (the "middle bridge") near the northern entrance that spans the intermittent drainage slough from beneath I-270, and a second (the "southern bridge") that spans the creek very near where the creek leaves the site at the eastern fence line.

The Trail enters the northern edge and runs past the large white oak circa 1750's, then courses through a stand of tulip poplar with ages estimated to be approximately 96-97 years (circa early 1900's). As it winds southerly, the Trail crosses the middle bridge through a patch of raspberries and then along the rim of the creek which runs at least five feet or so beneath. As it continues to the south, the Trail passes by a large sourgum tree (black tupelo) near the creek and then dips into an area that is very open, and seems very spacious, beneath the canopy. This is the area that is carpeted by a broad blanket of New York ferns and Christmas ferns that gives the area a very green appearance and tranquil feel. There are two public benches along the eastern side of the Trail in this area. The Trail then continues southerly to where it crosses the southern bridge and then begins its ascent up the steep 20% slope of the southern edge of the forest. Just up the slope from the creek, is the large white oak circa 1840's. Across the Trail from this large white oak is the terraced area that runs parallel to the slope of the land, that was at the edge of the forest when this DOE Site was the Dosh family's farm land, (i.e., prior to 1955 or so). Proceeding up the slope, the Trail winds beneath the mix of hickories, chestnut oak and then near the tulip poplar and Virginia pine dating to the mid-1950s. The Trail then leaves the forest at its southern entrance.

Aspects of the Human History of the Forested Area

Local Montgomery County history suggests that about two-thirds of the County had been cleared for farming by about the year 1800. The remaining one-third of the County was either too hilly or rocky or unusable for farming for other reasons. The farmland became depleted and worn out by the early decades of the 1800s and then began to be revived by about 1850 due to the use of new fertilizers, crop rotation techniques and other measures. Based on the ages of the trees in the forested area of the Germantown site, it appears that some of it may have been part of the old land clearing for farming, while part of it may have been left forested for other uses.

Most of the trees in this forested area are estimated to be younger than about 130 years, thus they probably are more recent than about 1870. As discussed above, a few of the white oaks are estimated to date back to about the 1840's or earlier. It seems reasonable to suspect that much of this forested area, especially the western hillside, might have been farmland at one time, at least

back into the mid-1800s or so. Examination of the cores and annual rings from the 119 and 133 year-old white oaks on the eastern hillside suggests that area may not have been farmed, at least as far back as about the 1870's or so. MDNR forester David Plummer examined the tree growth from rings on the cores taken from those two white oaks. The cores showed an area of greatly increased growth (i.e., wide spaces between the annual rings) about 80 years ago. This suggested to Mr. Plummer that the hillside may have been harvested about 80 years ago (i.e., circa the 1920's or so), and that the larger trees then may have been removed for lumber or fuel, leaving behind the smaller oaks that now are about 120-130 years old. When the canopy was opened then, it would have allowed the smaller oaks to increase their growth rate, as seen on the core samples. If the trees that may have been harvested in the 1920's were oaks of the size and age of the existing 120-130 years old ones on the hillside today, they would have dated back to about the late 1700's or early 1800's. This suggests that the Eastern Hillside area may not have been cleared or used for farming at least back to about 1800 or so (i.e., to about the estimated dates of the two largest white oaks we found: circa 1750's to early 1800's). Perhaps this hillside area was allowed to reforest, as it may have been more useful as a source of wood than it was for farmland.

It also is interesting to note that the largest and oldest trees found in this forested area of the Germantown site all are located near the creek. This apparently is the norm for other areas of Montgomery County as well. The very oldest trees to be found in the County today often are located along stream courses, as these areas generally have not been cleared for farming or for development in recent years. This seems to be the situation for this forested area of the Germantown site as well. An apparent "hands-off" management of this forested area going back into the middle of the 19th century or so has resulted in the existence today of a few trees near the creek that are estimated to date back to the 1840's or earlier. There are also many others estimated to be in the age range of 100-130 years or so throughout the area.

Some Observations and Conclusions

The forest appears to be one that is regenerating or self-renewing and probably has been since the middle-latter 1800s or so. This is suggested by the predominance of tulip poplar, a species that is a pioneer on previously farmed areas, and by the many trees estimated to be more than 100 years old that are scattered throughout the forest. The presence of a few live and a few dead Virginia pine, also an early pioneer species, in the southern edge of the forest also suggests that this part of the forest is regenerating. The predominance of tulip poplar on the western hillside, with much of it dating to the 1960's and 1970's, also suggests the forest has expanded a bit in that area.

Our discussions with the Germantown Team of the Facilities Management Services Group indicated that the forest is not actively managed by the federal government owners, except to keep the Trail free of fallen branches and obstacles for the safety of those who hike the Trail during work hours. This hands-off approach has contributed to the regeneration and self-renewal of the forest and allowed it to remain relatively natural and undisturbed. This forest has many wild-like qualities and appears to support a diversity of wildlife, including mammals, birds and reptiles. The creek contains fishes, amphibians, and insect life.

The natural history of the forested area is intertwined with the local human history of Montgomery County, MD, in terms of farming and the human use of forests. The natural history also is connected to the human use of the Germantown site by the AEC and DOE, in terms of allowing the forested area to self-renew. This has been done by: (1) not disturbing the forest during AEC site construction in 1956-1957; (2) placement of security fences around the AEC site that kept people away from the area and thus isolated the forest; (3) managing the forest by hands-off techniques allowing it to naturally self-renew; and (4) allowing some of the farmland on the western hillside and in the southern edge to regenerate naturally with trees, thus expanding the forested area.

The outcome of contributing to or sustaining the self-renewal of this forested area over the last 45 years may be an unintended consequence of developing the site and providing security that isolated the forested area from public use. This same phenomenon of natural vegetative regeneration and habitat improvement has occurred at several of DOE's much larger field sites and facilities that were isolated for security and safety during World War II and during the Cold War. Notable among these are the Oak Ridge Reservation, Tennessee (Mann, et al., 1996), the Hanford Reservation, Washington (Gray, et al., 1989), the Idaho National Engineering and Environmental Laboratory, Idaho (Reynolds, et al., 1986), and the Savannah River Site, South Carolina (Cohn, 1994; Shearer and Frazer, 1997). The similar unintended consequences of habitat protection and improvement, nevertheless, have been beneficial to the quality of the

Germantown forested area and have contributed to the esthetics of it, and thus to the use of the Seaborg Trail through the forest by AEC and DOE employees over time. The forest and the Trail system now is a scenic, restful, and historic environment for employees and provides quality habitat for wildlife. This adds some tangible diversity to the DOE Germantown site.

Continued Conservation of the Forest and Trail

In the spring of 2000, approximately two acres of the Germantown site were planted with a mix of young hardwood trees in an effort to begin to reforest some of the land that was open lawn. This area is adjacent to the northern edge of the forest we surveyed, and is within about 100 feet of the creek at the closest point (see Figure 2). The length of the reforested area along its outer perimeter near the northern edge of the current forest is 625 feet. This reforestation will reduce the amount of fertilizer and pesticide use on the open lawn as it converts to forest, and eventually will reduce the need for mowing. The reforestation, therefore, may have some positive benefits for reduced runoff and improved water quality of the adjacent creek running through the forest. In time, it will add some new forest habitat that will benefit wildlife and provide an enlarged forested area of natural beauty for human enjoyment. This seems important, since development around the Germantown site has encroached right up the fence line on the eastern, western, and southern boundaries. Offsite and contiguous forested areas, seen on several old photographs of the site and surrounding areas from the 1950's, now are reduced or gone.

An aerial photo, circa 1956, of the Germantown site under construction shows the excavation and leveling of the site for the building, and seems to indicate that construction, grading, and leveling did not disturb those wooded areas around the periphery of the site. The AEC HQ building and associated facilities appear to have been constructed primarily on the existing open land of the old farm site. The relatively natural and undisturbed condition of the on-site forested area today seems to substantiate this. The Trail through the forest today also seems to be in good condition, suggesting that hikers stay on the trail and do not wander off into the surrounding woods. This is evidenced by the fact that the Trail is a narrow path for most of its length, and the areas along the Trail appear to be undisturbed and not trampled upon, even considering that AEC and DOE employees have been hiking the trail for 30-35 years. So, while the farmland area around the Germantown site has changed dramatically since the site was constructed in 1956-1957, some of the undeveloped portions of the Germantown site do not seem to have changed appreciably.

In 1999, Montgomery County, Maryland, chartered a Forest Preservation Task Force to develop a Countywide forest preservation strategy to assist in balancing community growth and the demand for forest and tree preservation (Montgomery County, MD, 2000). In part, the forest preservation strategy includes a vision for the County "…to increase the quantity and quality of forests and trees, and to restore and protect the natural forest ecosystems in Montgomery County. This strategy provides the first steps toward fulfilling our mission - to manage the forest and tree resources that already exist, to restore unforested and marginal forest areas to natural forest ecosystems, and to assess the need for additional preservation initiatives." The long-term stewardship of the 7-8 acre forest on the DOE Germantown site over the years,

plus the reforestation of two additional acres during early 2000, seem to be supportive of Montgomery County's forest preservation vision, even though the site is federal land and not County land.

During latter 1999 and early 2000, a portion of the contiguous forested area to the east of the site boundary was cleared for development. This was approximately between reference points "F-0" and "F-400" (see Figure 3), and southward along Interstate 270, apparently between I-270 and the creek beyond the fence line. This has opened a substantial portion of the eastern hillside of the forest to full sunlight and potential edge effects. The young trees in this area and the understory might be expected to show increased growth over the next several years, similar to that which Mr. Plummer surmised may have occurred in the 1920's due to tree harvesting on the eastern hillside. This edge effect may have both beneficial and undesirable effects. The reduction in contiguous forest may change some of the interior-like habitat quality that may exist in the forest on the DOE site.

One of our concerns in conducting this survey and then publishing the results in this report, and especially in the brochure and display on natural history, relates to continued conservation of the forest and Trail. In his 1948 classic book on conservation, entitled *A Sand County Almanac*, Aldo Leopold wrote of his concerns for the conservation of wilderness by people. He wrote:

"…all conservation of wildness is self-defeating, for to cherish we must see and fondle, and when enough have seen and fondled, there is no wilderness left to cherish."

One of the ultimate values of the forest and Trail system is its relatively undisturbed and wild-like character. We hope that the brochure, display, and this report will contribute to some new awareness and knowledge of the forest and Trail on the part of DOE employees. We also hope that any increased usage of the forest and Trail for enjoyment and relaxation will not result in a reduction in their natural quality due to either too much use or some accidental misuse by employees. For this reason, we added an admonishment to the natural history brochure suggesting to hikers: "While enjoying the forest, please stay on the Trail".

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Mr. Ken Grossnickle, Germantown Facility Manager, and Doug Knowles and Tommy Ingram of his site maintenance team (MA-211.2), supported us throughout the study and provided us with the site soils map that got us started. Mr. Grossnickle also assisted in providing the botanical signs for marking several of the trees and the ground ferns along the Seaborg Trail, as one outcome of our study.

Mr. David Plummer, forester with the Forest Service of the Maryland Department of Natural Resources, Woodbine, MD, came to the Germantown site in May of 2000 and assisted us in conducting increment core borings on several trees in the forest. He than assisted in getting us started with measuring the diameter of the trees so that we could estimate their ages. This helped us to set a baseline on aging of the trees and got us started on the forest survey. Mr. Plummer also helped us "read the landscape" and understand some of the environmental conditions that helped us to interpret the natural history and human history of the forest. Finally, Mr. Plummer reviewed a draft of this report and provided comment.

Ms. Diane Lewis, a botanist with Brookside Gardens of the Maryland-National Capital Park and Planning Commission, in Wheaton, Maryland, assisted us with the identification of the ferns along the Seaborg Trail. By coincidence, Ms. Lewis was preparing for a September, 2000, seminar at Brookside Gardens entitled "Ferns for Maryland Gardens", when we first consulted with her.

Early during the summer of 2000, author Hickey had an informal discussion on the forest survey with Office of Science colleague Dr. David Sutter of the SC High Energy Physics Division (SC-22). Dr. Sutter asked whether we were planning to prepare a brochure on the natural history of the Germantown site, which he remarked would be very useful for DOE employees. Hickey carried that message to the team working on the site and natural histories. The idea was accepted immediately.

Dr. Marie Hallion, Historian with the DOE History Division (MA-74), provided invaluable assistance in understanding the AEC and DOE institutional history with respect to the Germantown site. Dr. Hallion served as organizer and editor of the projects to prepare the display and brochures on site history and natural history. Office of Science Intern Marc Goodwin (a history major at Case Western Reserve University) worked with Dr. Hallion in compiling the site history and in producing the display on site history, to which we contributed a segment on the natural history of the site, as one outcome of our study. Lakia Powell was the principal author of the natural history segment of the display. Both Dr. Hallion and Mr. Goodwin assisted us greatly in understanding the human history of the site, the forest, and the Seaborg Trail.

The DOE Visual Media and Library Services Group (MA-224) provided invaluable assistance in producing the display and the brochure of the natural history of the site, as one outcome of our study. Graphic Artist Frank Porcheddu took our information and hand drawn charts of the forest and Seaborg Trail and turned them into computer generated art in the form of a visual map that was used in the display, the brochure, and in this report, which he also designed and produced. Photographer Larry Walsh accompanied us in the forest on two occasions to photograph aspects of its natural and human history. The photos are used in the display and the brochure. Helen Criares along with Jason Kaletra produced the hard copy color photographs for use in these communications and for use in presentations we have done on the forest study. Sam Baughman, manager of the DOE Germantown Graphics Branch, supported all of these activities all along the way. The late Bob Kleppner, of the DOE Print Media and Mail Services Group (MA-221), assisted us with the commercial contracting for printing of the brochures.

The DOE Office of Science provided support throughout this effort. Mr. Bill Nay (SC-80) directed the SC Intern Program and provided continual advice and council, and supported author Powell's efforts in leading people on educational hikes in the forest and in presenting the results of the study to various groups within SC. Mr. John Clark, Associate Director and manager of the SC Office of Resource Management (SC-60), and Ms. Myrna Vallette, Director of the SC Administrative and Information Management Division (SC-62), provided the funding for both of the brochures on site history and natural history produced by the SC Intern Program during the summer of 2000. The natural history brochure was not part of the original plan for this Intern Program forest study, but was a welcome outcome that we hope will assist DOE employees in understanding and appreciating the forest and Seaborg Trail for years to come.

Appendix

Figure 1. Aerial photograph of the Germantown farm site, owned by William O. Dosh, that was selected by the Atomic Energy Commission for its new headquarters location in 1955. This 109-acre site was located at the junction of Maryland State Route 118 (the road running horizontally in the upper third of the photo) and the Washington National Pike, Route 240 (the road running vertically along the right side of the photo), near Germantown, Maryland. Route 240 is aligned approximately southeast (at the bottom) to northwest (at the top), and now is Interstate 270. The wooded area at the bottom of the photo, along the left side of Route 240, is the forest through which the Glenn Seaborg Trail now runs, that was the subject of the survey of this report. Photo courtesy of the Montgomery County Historical Society, Rockville, Maryland.

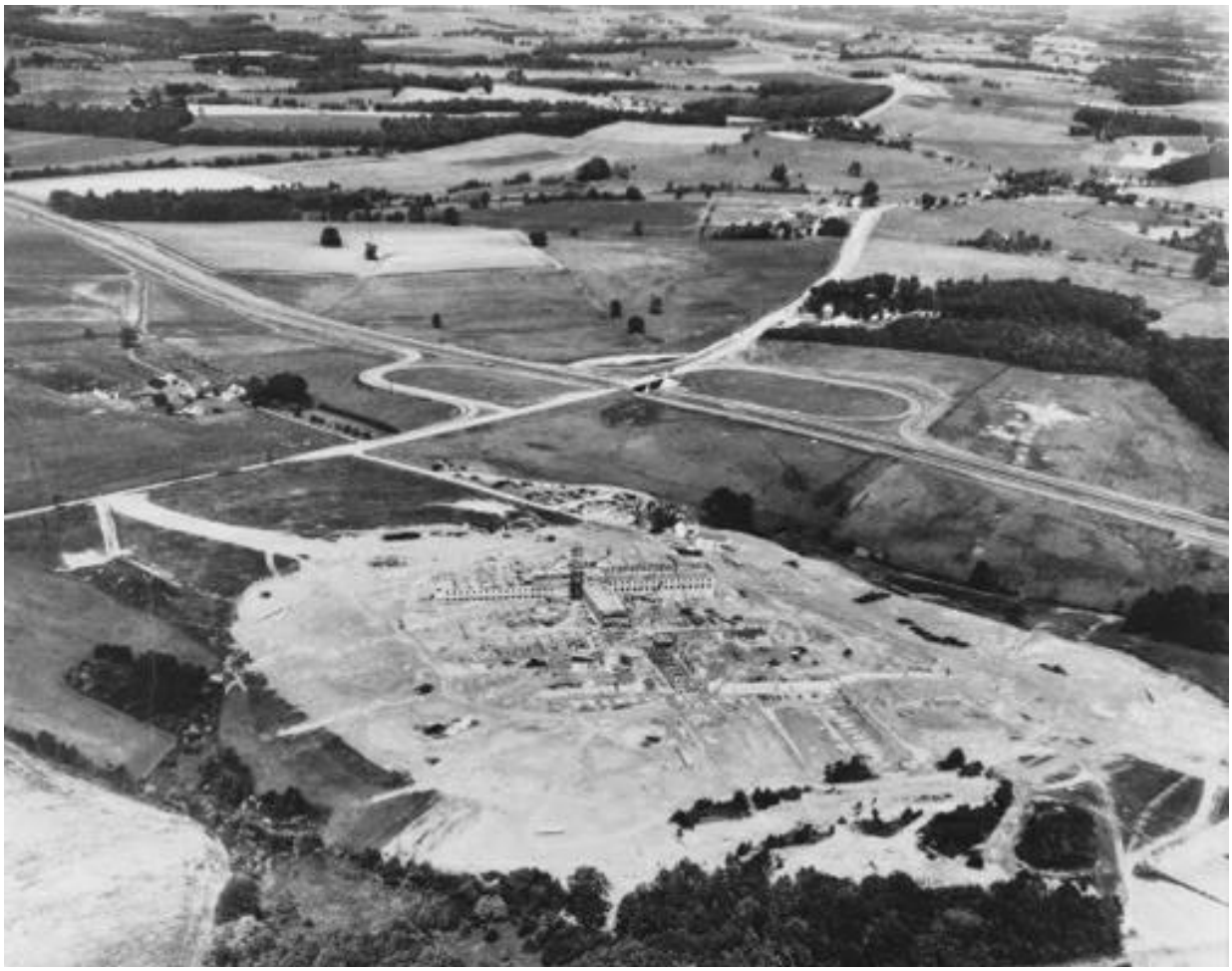

Figure 2. The AEC Germantown headquarters site under construction in 1956-1957. The view is to the north toward the intersection of Routes 118 and 240. The farmland was built up and leveled during excavation to an elevation of approximately 500 feet above sea level. The wooded area at the extreme right margin of the photo, just below Route 240, is the forest through which the Glenn Seaborg Trail now runs, that was the subject of the survey of this report. The portion of the forest seen here is the tip of the northern edge (see Figure 3 and the text for explanation).

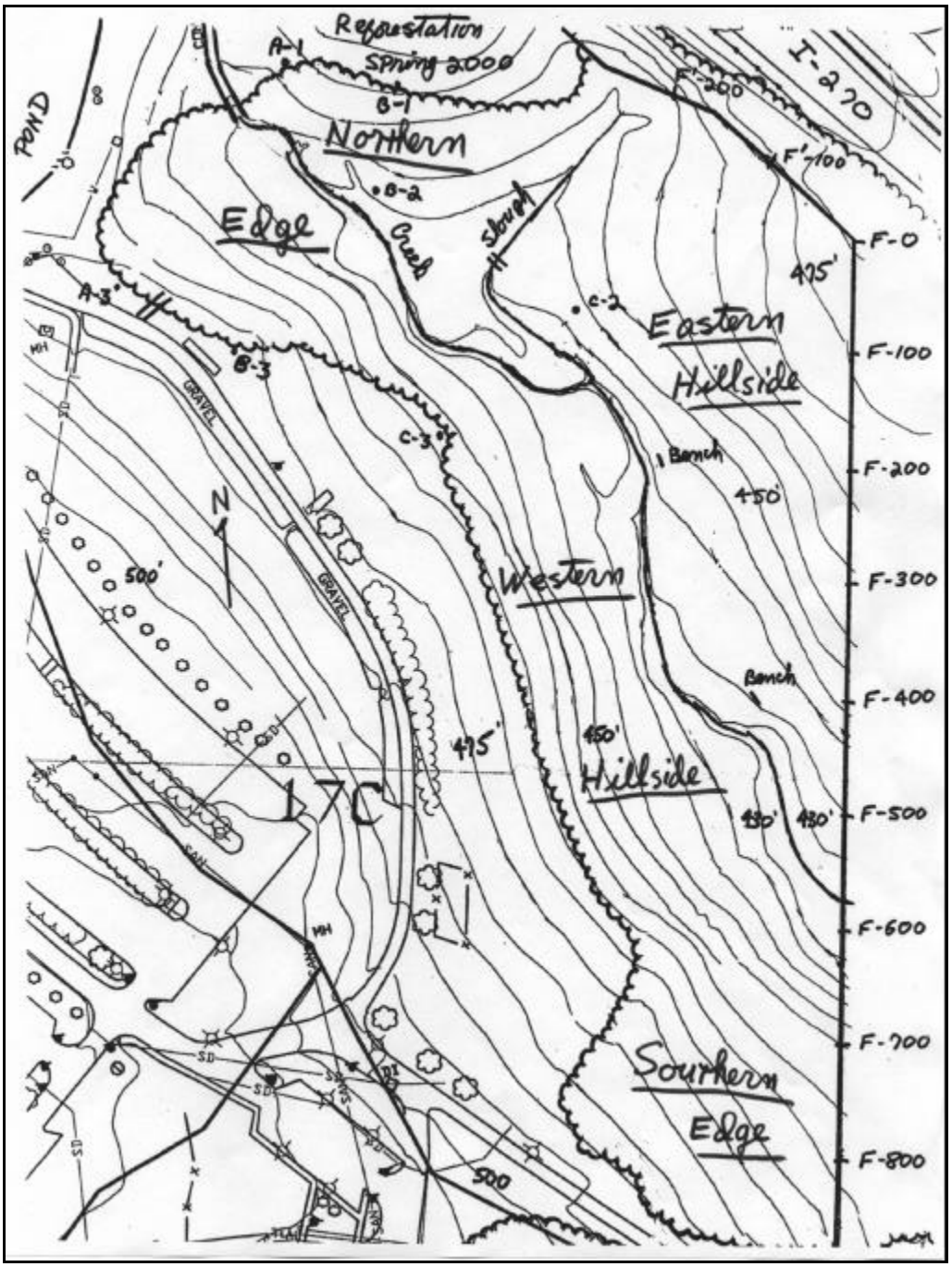

Figure 3. Portion of the soils map that shows the 7-8 acre forest on the DOE HQ Germantown, Maryland, site. The map shows the site elevation and contours in feet above sea level in relation to the forest and site boundaries, and in relation to the creek. This rough site map was used for the plotting of the main features of the landscape and the trees, and assisted in the preparation of the schematic map of the forest that is shown in Figure 4, as well as the map that was used in the natural history brochure (see text for explanation). Reference points that were established along the eastern fence line, at 100-foot intervals, are shown. The four regions of the forest are noted (see text for explanation). During latter 1999 and early 2000, much of the contiguous forested area to the east of the site boundary was cleared for development. This was approximately between reference points "F-0" and "F-400" and southward along Interstate 270.

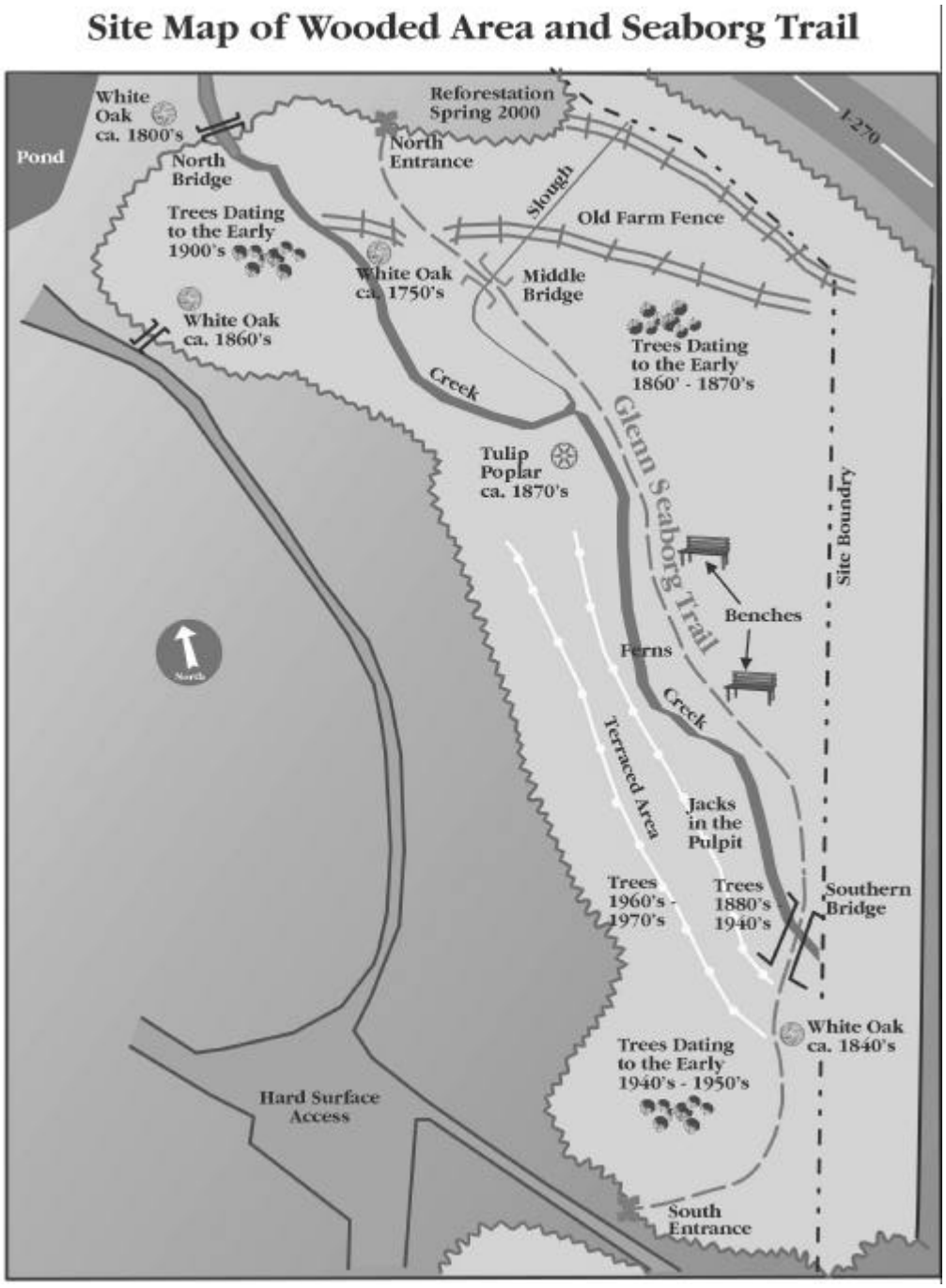

Figure 4. Schematic map of the 7-8 acre forest on the DOE HQ Germantown, Maryland, site. The map shows the forest in relation to the site boundary to the east, the pond to the north, and Interstate 270 to the northeast. Also shown are the relative locations of the creek and the Glenn Seaborg Trail that course through the forest. The largest and oldest white oaks and tulip poplar trees found during the survey are indicated, as are the estimated relative time eras for various stands of trees throughout the forest. The area that was planted for reforestation in the spring of 2000 is shown at the top center of the figure.

Table 1. Comparison of methods for estimating the ages of trees in the Germantown forest. The counts of annual rings, d.b.h. in inches, and the estimated ages (in the middle column) were those obtained by MDNR forester David Plummer on May 16, 2000. The circumference in inches, calculated d.b.h., and corresponding estimated ages were those obtained by us for comparison. See text for full explanation. "White Oak 3" in this table is located along the Seaborg Trail opposite the terraced area in the southern edge. It is denoted with the superscript * as a tree that we recommended be newly marked with a botanical sign along the Seaborg Trail.

Tree of Interest	Annual Rings	d.b.h. in Inches	Estimated Age in Yrs.	Circumference in Inches	Calculated d.b.h. in Inches	Est. Age in Yrs.
White Oak 1 on East. Hill.	119 (ca. 1880's)	21.1	105.5 (ca. 1890's)	66.50	21.2	106.0 (ca. 1890's)
White Oak 2 on East. Hill.	133 (ca. 1860's)	23.9	119.5 (ca. 1880's)	75.75	24.1	120.5 (ca. 1870's)
Tulip Poplar – South. Edge	47 (ca. 1950's)	17.8	53.4 (ca. 1940's)	56.5	18.0	54.0 (ca. 1940's)
Virginia Pine – South. Edge	41 (ca. 1950's)	-	-	41.00	13.1	-
Largest Tulip Poplar; West. Hill. at Creek	-	43.5	130.5 (ca. 1860's)	136.00	43.3	129.9 (ca. 1870's)
White Oak 3 South. Edge; at Terrace *	-	31.7	158.5 (ca. 1840's)	100.00	31.8	159.0 (ca. 1840's)

Table 2. Estimated ages of trees in several areas of the Germantown forest based on circumferences measured on June 23, 2000, and calculated diameters at breast height (d.b.h.). The last five tulip poplar listed in this table were sampled at random from among many similar trees on the upslope of the western hillside (i.e., west of the terraced area). The two trees denoted with the superscript * are two that were recommended to be newly marked with botanical signs along the Seaborg Trail.

Tree of Interest	Location	Circumference in Inches	Calculated d.b.h. in Inches	Estimated Age in Yrs.
White Oak	At Spillway & North Bridge	120.50	38.4	191.9 (ca. 1800's)
White Oak *	At North Entrance	153.00	48.7	243.6 (ca. 1750's)
White Oak	Near North Entrance	79.25	25.2	126.2 (ca. 1870's)
White Oak	Near Middle Bridge	114.50	36.5	182.3 (ca. 1810's)
Tulip Poplar	Near North Entrance & Creek	67.25	21.4	64.3 (ca. 1930's)
Tulip Poplar	Near Middle Bridge	71.75	22.9	68.6 (ca. 1930's)
Tulip Poplar *	Near Middle Bridge	100.50	32.00	96.0 (ca. 1900's)
Tulip Poplar	Near South Bridge	80.50	25.6	76.8 (ca. 1920's)
Tulip Poplar	Near South Bridge	79.75	25.4	76.2 (ca. 1920's)
Tulip Poplar	West. Hillside; W. of Terrace	37.50	11.9	35.7 (ca. 1960's)
Tulip Poplar	West. Hillside; W. of Terrace	31.00	9.9	29.7 (ca. 1970's)
Tulip Poplar	West. Hillside; W. of Terrace	36.25	11.5	34.5 (ca. 1960's)
Tulip Poplar	West. Hillside; W. of Terrace	33.50	10.7	32.1 (ca. 1960's)
Tulip Poplar	West. Hillside; W. of Terrace	28.25	9.0	27.0 (ca. 1970's)

Table 3. Estimated ages of some trees in the northern edge of the Germantown forest based on circumferences measured on June 30, 2000, and calculated diameters at breast height (d.b.h.). Each tree was given a reference number for the date of sampling (i.e., "6/30-1"). The "service path" runs from the hardtop roadway down into the northern edge of the forest. On Figure 4 of this report, the "White Oak ca. 1860's" in the northern edge is tree 6/30-3 in this table.

Tree of Interest	Location	Circumference in Inches	Calculated d.b.h. in Inches	Estimated Age in Yrs.
Tulip Poplar 6/30-1	North. Edge at Service path	102.00	32.5	97.5 (ca. 1900's)
White Oak 6/30-3	North. Edge	84.00	26.8	133.8 (ca. 1860's)
Tulip Poplar 6/60-6	North. Edge	109.00	34.7	104.1 (ca. 1890's)
Tulip Poplar 6/30-8	North. Edge	78.5	25.0	75.0 (ca. 1920's)

Table 4. Estimated ages of some trees along the terraced area of the Germantown forest based on circumferences measured on July 15, 2000, and calculated diameters at breast height (d.b.h.). These trees are located along the terraced area near the Seaborg Trail. The reference to "T-2" was tree No. 2 (a hickory) that was marked on 7/15/00 and used as a reference point. T-2 is located along the terrace at a distance of 96 feet from the large white oak at the junction of the terrace and the Trail. The "Jacks" are Jack-in the-Pulpit plants that are located on the terraced area about 165 feet from the large white oak. The trees in this table, therefore, are located along the edges of the terrace between T-2 and the "jacks".

Tree of Interest	Location	Circumference in Inches	Calculated d.b.h. in Inches	Estimated Age in Yrs.
Tulip Poplar	E. of Terr., bet. Jacks & T-2	63.00	20.1	60.2 (ca. 1940's)
Tulip Poplar	E. of Terr., bet. Jacks & T-2	107.00	34.1	102.2 (ca. 1890's)
Tulip Poplar	E. of Terr. , bet. Jacks & T-2	80.00	25.5	76.4 (ca. 1920's)
White Oak	E. of Terr., bet. Jacks & T-2	76.00	24.2	121.0 (ca. 1870's)
White Oak	W. of Terr.; Opposite Jacks	62.00	19.7	98.7 (ca. 1900's)