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Cox Arboretum

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Nature Trail Design:

Considerations for Accessibility and Education

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Landscape Architecture**

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ABSTRACT

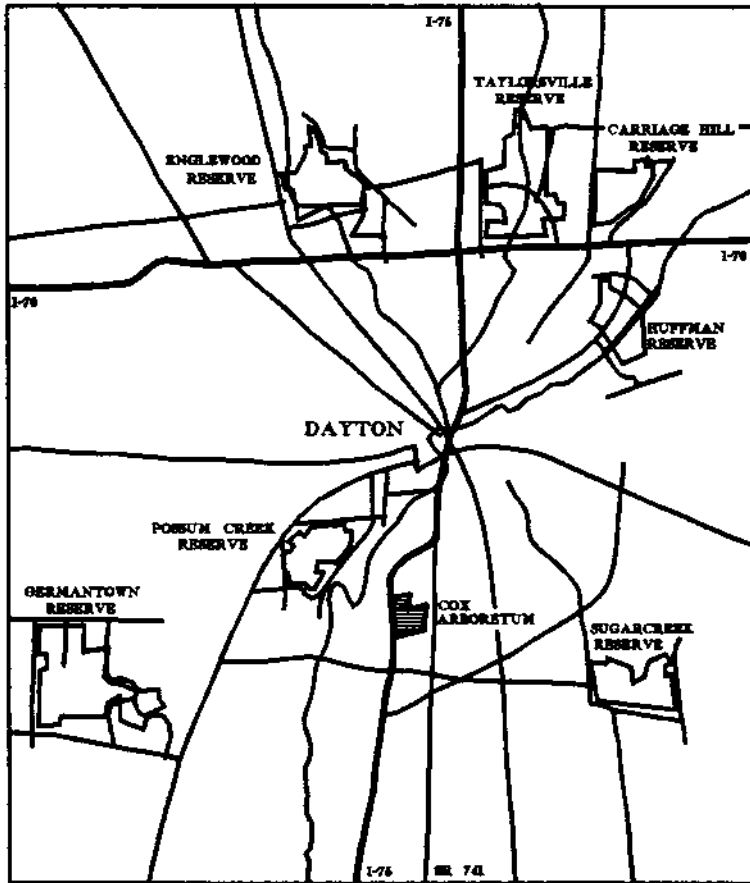
The purpose of this site study and project is to redesign, revitalize and expand the existing trail system of Cox Arboretum in such a way that it blends with the future use and educational objectives of the administration, staff and volunteers. One of the stated goals of the arboretum is to provide visitors access to at least a part of the nature reserve and/or wooded areas. Currently, this goal is not being fulfilled. Visitors should be exposed to both the biological and geological sciences found throughout these portions of the arboretum. Visitors should be educated about native plant materials in the local region and gain an understanding of natural forest succession from a meadow environment to advancing woods stages. Visitors should also acquire a basic understanding of the geologic elements found on the site.

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I would like to thank the faculty and staff of Ball State University College of Architecture and Planning for all their instruction and time. I would also like to thank the Cox Arboretum for giving me the opportunity to work with their master planning process. I hopfully have given them a worthwhile product which will benefit the arboretum. And finally a thanks to the Design team at Johnson Johnson and Roy for working with me and making this project more educational and realistic.



SITE LOCATION

CHAPTER 1 BACKGROUND

In 1962, the realization that the City of Dayton was growing quickly, made it necessary to set public green space aside for future park space. James M. Cox Jr. shared in this realization. Cox set aside his 162 acre family farm, and developed a foundation, that would provide a location for a botanical showplace for the city. On December 3, 1962, the farm was incorporated and opened as the James M. Cox Jr. Arboretum. As the Arboretum grew, another entity was developing in the area— The Dayton-Montgomery County Park District. Both organizations shared a common goal to set aside and preserve natural areas as public green space. In 1973, the Cox Arboretum became a member of the Park District. Both financial and maintenance responsibilities would be shared by the Park District and the Cox Foundation.

Throughout the history of the Cox Arboretum, several master plans have been developed. These plans were based on current goals and physical capabilities in place at the Arboretum at the time. In 1990, the Cox Arboretum had outgrown its most recent master plan, so the Park District and the Cox Foundation set aside the funds to hire a Landscape Architecture Firm to develop a new master plan. After many meetings and interviews, the Arboretum selected Johnson, Johnson and Roy in Ann Arbor, Michigan to undertake the task. Johnson, Johnson and Roy began the task of gathering site information and clarifying the goals and needs of both the administration and the some 220 active volunteers at the Cox Arboretum. Currently, the master plan is expected to be completed by May or June of 1991.

In the process of beginning the master plan, the Arboretum decided to assign a detailed design project of the wooded section of the site to the author as his Terminal Project. The current deteriorated condition of the arboretum's nature trail system requires a more in depth study to successfully bring it to a level which meets the future physical and educational goals set by the Cox Arboretum. The part of the site through which these trails currently run, offers a unique opportunity to give the general public access to natural and native features already on the site. These features

offer an educational potential which needs to be actively exploited in order to match the goals set by the educational staff at the Cox Arboretum.

The basic goal and direction of the Cox Arboretum can be found in the History of the Arboretum, written by the Director of the Arboretum, Dr. George Rogers. The statement reads:

“...It involves a commitment to make the grounds and facilities inviting and accessible to all, including persons with disabilities. Strengthening and diversifying our educational efforts is high on the list, as is reaching a broader clientele. Related ambitions are adding more outreach, generating more publications, and initiating a modest research program. Overall the arboretum strives to give more to Dayton (Ohio) and to become a more interactive participator with our colleagues in the national community of public gardens. They have much to teach us, and we might have a few ideas for them.”

This basic feeling of turning outwards in scope towards the community and to other similar institutions is becoming a common feeling within both the staff and the administration at the Cox Arboretum. This viewpoint offers many possibilities both for the future of Cox Arboretum and for the future development of the trail system being developed in this project.

CHAPTER 2 PROGRAMATIC STATEMENT

Accessible Nature Trail design and Interpretation

Background

Site: The Cox Arboretum

Location: Dayton, Ohio

Site Size: 162 Acres

Project Site: West half of the Cox Arboretum

Project Goal: To redesign, revitalize and expand the existing trail system in such a way that it blends with the future design and educational objectives of the various interested parties at the Cox Arboretum.

Physical Design Goal: To provide access for all visitors to at least a part of the nature reserve or wooded area of Cox Arboretum. Visitors should be exposed to the natural environment by hands on experiences with native plant materials and interpretation of natural forest succession occurring on the site.

Educational Design Goal: To teach visitors about plant materials native to the region. Visitors should gain an understanding of natural forest succession from the meadow environment to advancing woods stages. Visitors should also acquire a basic understanding of the geologic elements found on the site.

Programatic Statement:

Design Considerations: Physical trail layout and design.
Various trail classifications.
Interpretative system to be implemented on
the trail system.

Detailed Information:

I. Trail design

- Provide connections to the existing pathway system of the formal arboretum.
- Provide trails with widths varying from 3-6 feet.
- Provide trail surfaces such as: asphalt, compacted crushed rock, gravel, wood chips or a natural surface.
- Provide shoulder widths of .5 to 1.5 feet with surfaces of mown grass or cut underbrush.
- Provide trails with different degrees of difficulty by varying slope or (not) providing stairs.

- Provide rest stops and/or interpretation points at varying intervals depending on the difficulty of the trail.

- Provide bridges or stairs at trail and ravine intersections.
(See attachment)

II. Trail classifications (Time Saver Standards for Landscape Architects, 1990)

- Class I- fully accessible including:

- Length up to 1/4 mile.

- Rest stops or interpretation points every 100-150 feet.

- 6 foot trail width.

- 1.5 foot mown grass shoulder

- 1:50 or 2% maximum slopes

- Asphalt trail surface.

- Class II- easy including:

- Length of 1/4 to 1 mile

- Rest stops or interpretation points every 200-300 feet.

- 4-5 foot trail width.

- 1 foot cut underbrush shoulder.

- 1:20 or 5% maximum slope.

- Asphalt or compacted crushed rock surface.

- Class III- Moderate difficulty including:

- Length of 1-2 miles

- Rest stops or interpretation points every 500- 600 feet.

- 3-4 foot trail width

- 1 foot cut underbrush shoulder.

- 1:10 or 10% maximum slope.

- Wood chips or gravel surface.

- Class IV- Difficult including:

- Length of 2+ miles.

- Rest stops or interpretation points every half mile.

- 1/2 foot cut underbrush shoulder.

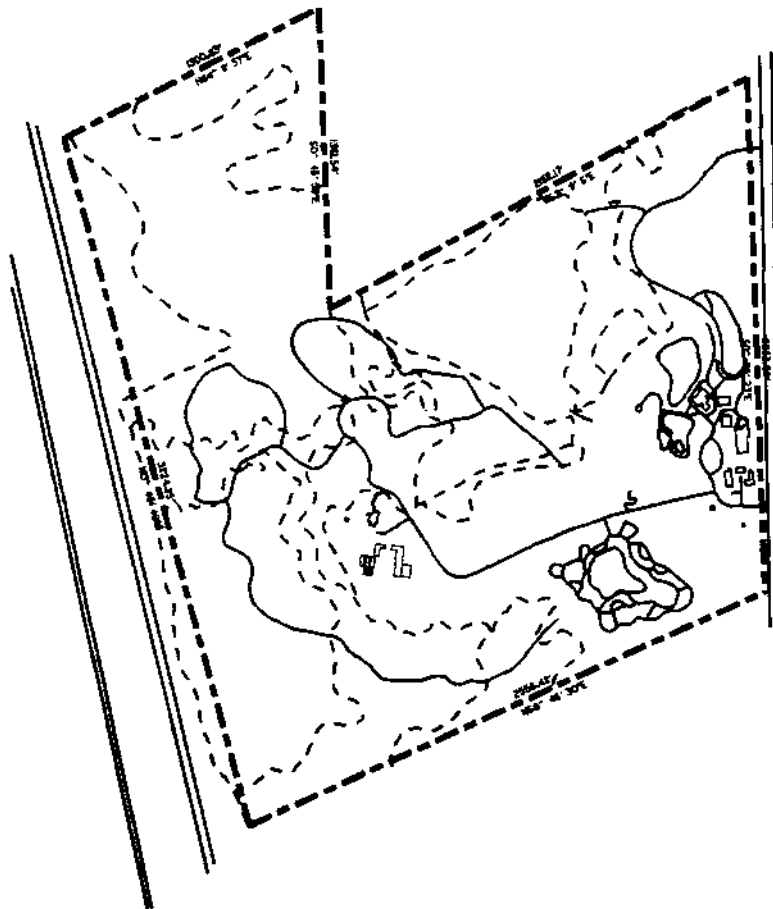
- No maximum slope limit including steps.
- Wood chips or natural surface.

III. Provide an interpretative system.

- Use treated 4 by 4's as bollard type sign posts at a height of 2 1/2 feet above ground level with routed numbers on a sloped top to locate various interpretative points on the trail system.
- Provide a format for a printed document that corresponds to the numbers found on the trail system. The document should include trail type information and a map showing rest and interpretation points. (See Attachment)
- Provide interpretative points which identify various native plant material, natural succession areas, and geologic or other points of interest, including a potential a document for the visually impaired.
- Provide interpretative stations which allow at least some direct contact with plant materials, or geologic elements.
- Provide a form of visual or textural clue regarding interpretative point location.
- Examine the potential of developing an outdoor instructional area or amphitheater for the education of school groups.

CHAPTER 3 SITE ANALYSIS

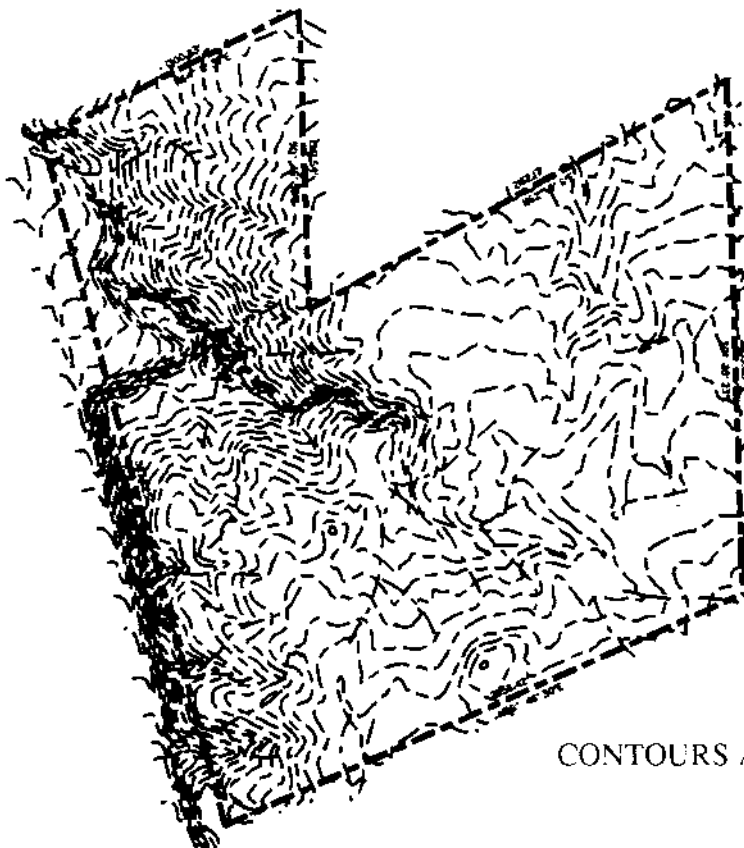
In order to fully utilize the natural education potential of the site, and provide the majority of the population access to these features, a detailed site inventory of what features are actually present on the site was necessary. This inventory began with the collection of physical site data including: site boundaries, soils, contour data, vegetation types and location, native specimen tree locations, drainage, views, existing man-made site features as well as locations of potential interpretive points. These interpretive points were chosen for a number of reasons, but mainly as potential educational areas of interest and to make accessible good views both within and out of the site. This data was obtained from existing data bases, and site visits.



EXISTING SITE FEATURES

Once the data was collected, the materials were put into an Intergraph mainframe computer system for further analysis. The computer system was used in an overlay method to show pertinent comparisons between various types of site information. The analysis was then taken into a GIS mode to allow the computer to perform such tasks as defining slope percentage and slope aspect based on a ten foot square grid system. The information was then used with other site information to develop conceptual models appropriate to the site. These concepts were reinforced by the use of three dimensional terrain modeling. This allowed for an aerial type view of the site from any location the author desired. The use of these three software packages offered a more detailed and accurate look at the site. Backed with this information, along with the author's familiarity of the site, several conclusive concepts were developed.

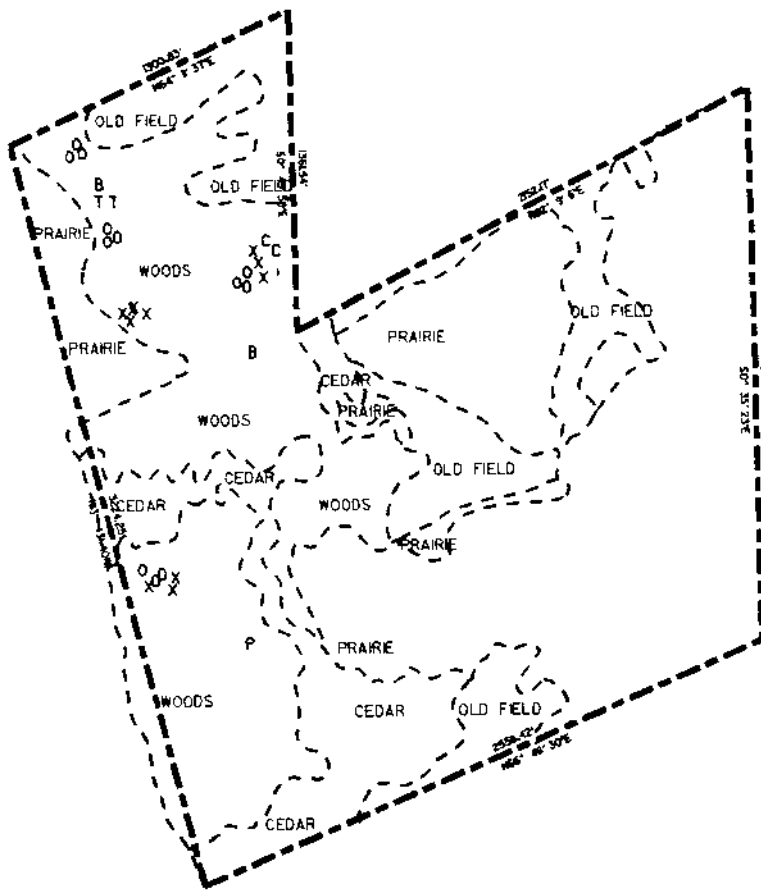
The site has slopes ranging from 0 to 73 percent. Severe slopes are the result of a major drainage ravine that runs through the majority of the site.



CONTOURS AND DRAINAGE

The site contains a wide variety of vegetation types ranging from prairie, old field successional, cedar woods and mature woods. Without the in depth analysis of the site, one would assume that this area is in a series of stages found in a normal forest succession process. However, upon close inspection, these areas contain species that are not normal to this form of succession. Throughout the history of the site, the prairie areas have been aided in their development by the planting of native plants that are normally found in a natural site. The cedar woods are the result of the removal of top soil prior to the establishment of the arboretum. The soils found in the cedar woods allow for the growth of the red cedar. The old field successional areas are the only result of true forest succession. These areas contain such characteristic plants as ash and hawthorne along with other sun loving native plants. The mature woods contain many large native species. However, the woods do not contain the correct type of sapling age trees to support a normal forest succession in its late stages. The history of grazing on the site shows that a few trees lived through the grazing period to become the now mature trees in these areas. However, the trees which should be growing at this stage of succession are not found. The main character which is missing is the american beech (*Fagus grandifolium*). The woods are currently trying to reach a point of maturity. This can be seen with the profuse growth of sugar maples, oaks and hickories. To the casual visitor, these woods will give the feeling of a natural mature forest due to the characteristic of the high tree canopy and sparse undergrowth in some areas. The native species found in these woods worth identifying to the public include: blue ash, three types of hickory, five types of oaks, one single american beech tree, tulip, buckeye, black cherry, ironwood and sugar maples.

Another site feature was the location of several views within the site. The rolling, steep topography provides many long and spectacular views for the visitor. The drainage ravine is both a positive and negative influence on the site. First, the ravine exposes many geologic features not normally seen in the area. Due to erosion, layers of rock have been exposed, forming waterfalls and exposing fossils. Each offers another educational opportunity to the visitor. The ravine also provides a major obstacle to both the visitor as well as to service equipment. The ravine severely limits choices for the placement of trails accessible to disabled persons. Yet this severity does offer a



- B BUCKEYE
- C BLACK CHERRY
- I IRONWOOD
- O OAK
- P PIGNUT HICKORY
- T TULIP
- X SHAGBARK HICKORY

VEGETATION TYPES

physical challenge to the remainder of the visitors. As was noted earlier, the existing trail system is in very poor condition and is in need of being brought up to standards set by the arboretum. Three sections of trail will need to be closed to the public, one of which will need to remain due to maintenance considerations. These trails need to be closed due to the poor quality, steep slopes, erosion and proximity to sharp drop-offs which are a liability potential to both the Park District and Cox Arboretum. These trails will not be difficult to eliminate. Their closing will require small plantings to block their entrances.

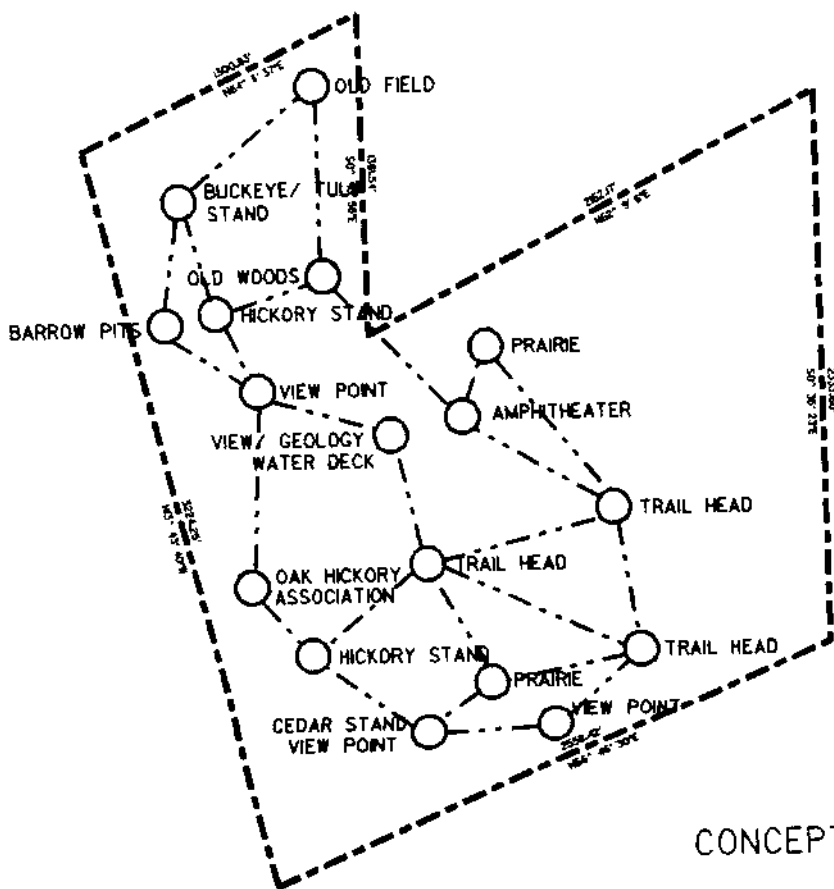
Overall, this site offers many exciting possibilities in terms of future development and education potential. The Park District and the Arboretum have recognized the problems and potentials of this site and nature trail system. This recognition allows for successful implementation of a new trail system. Overall, this project presents a unique educational opportunity for the surrounding community.

CHAPTER 4 CONCEPT DEVELOPMENT

In order to successfully develop a solution to this problem, one needs to look at the wide range of interested parties and site consumers. By selecting a wide range of interpretive topics and trail difficulty levels, an environment can be created to satisfy most of these user groups. The range of interests found at Cox Arboretum include: disabled accessibility which is to be arboretum wide, the introduction and preservation of native plant material into the wooded areas, use of the trail system as a source of exercise, and the education of the public about the natural features and plant material found in the region. Interests are also present at the detail level which will affect the final outcome of the project but not at the conceptual level. These interests were weighed based on the political influence of the involved parties, but the over-riding factor for the development of the area will be dictated by the site itself and the educational possibilities which it offers. The other interests which have been expressed, will be introduced on top of the above stated strategy in order to meet the goals and objectives of the arboretum.

By taking the final data from the site analysis, 17 points were identified as points of interest. These points were selected based on the availability of a plant association type, the location of native trees, a geological feature of the site and an amphitheater. These points will be used as major interpretive points and rest stops. Many of these points are located where there is already a bench in place, and there is the potential for education. Each point will offer the visitor either some form of educational information or a view point as well as a place to sit and rest. The next part of the concept was based on the connections that join the various interpretative points. The existing linking system is confusing due to the existence of three trail heads. Currently the visitor may start at one point of the arboretum and end up at another, causing confusion and disorientation. The conceptual links were created to form a looping system so that the visitor can end at the same beginning point. The loops were developed with the disabled in mind, but the drainage ravine was a major limiting factor to the extent of the possibilities. The drainage ravine also caused some

restraints for connections on either side. However, by working around the ravine, a series of loops can be developed. The looping system provides the visitor with a series of pathway choices to provide for different experiences on subsequent visits to Cox Arboretum. The new layout basically includes the entire existing trail system with a few minor adjustments, but adds a few major loops to the system. These new loops will take visitors into areas not previously accessible. These new areas include trips through old field associations, cedar woods and mature wooded areas. The new loops will also take the hardy visitor down into the barrow pits, which offer another point of education. A new feature that will reduce confusion is the physical connection of the three trail heads. By physically leading the visitor back to the starting point, other points of the arboretum can then be explored without having to re-orient oneself. A new feature which is being proposed is an outdoor amphitheater. This will be located in the prairie which adjoins the back forty section of the arboretum. The natural bowl form of the topography makes it ideal for this purpose. The location is on the edge of the wooded area which is ideal for possible contact with wildlife. The site is also away from bright lights, which provides the opportunity for star gazing.



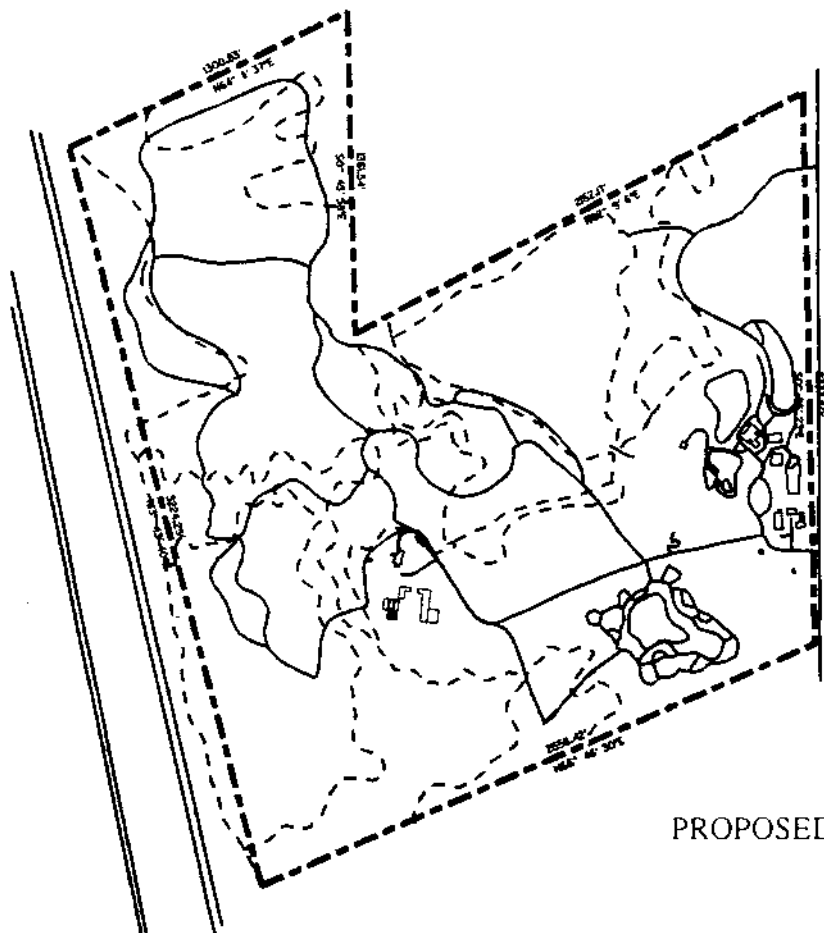
CONCEPT 2

By developing the trail system in this manner, a more efficient and enjoyable visit for the visitors will result. This system should make a more logical and functional educational system possible. By creating loops through various types of terrain, the different trail types can be introduced and coincide with the existing trail system.

CHAPTER 5 FINAL DESIGN

The final layout of the trails reflects both the needs of the user in terms of interpretive opportunities as well as the needs of the site itself. The trails were laid out in such a way that they followed contours where possible and avoided severe erosional areas. In order to maintain the site in its naturalistic state, the trails must be as site sensitive as possible while maintaining and utilizing the educational opportunities that the site offers.

The new trail system will utilize a majority of the existing trail system. Two sections of the trail had to be removed to prevent either injury to the visitors or to the site itself. One of the sections was simply rerouted, while the other had to be completely removed. Along with the existing trail system, a series of new trail loops will be added. These new sections of trail will offer the visitor a wider range of choices as to which route to take. These new loops will give visitors access to areas of the arboretum not previously available.



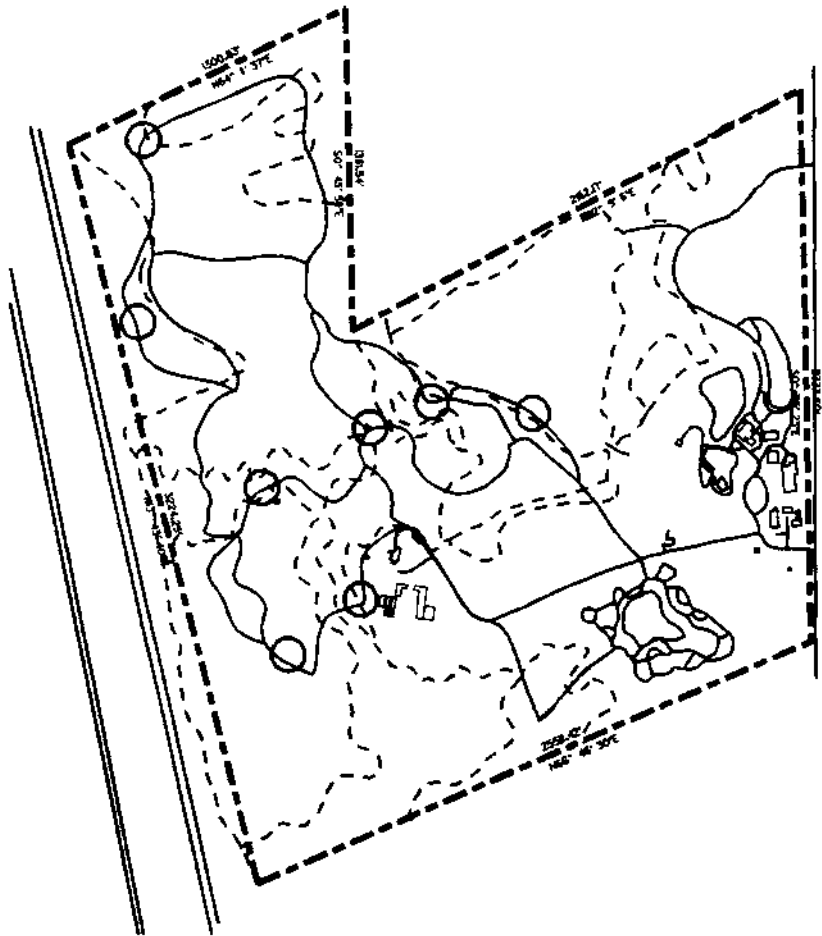
PROPOSED TRAILS

The trails will be identified by structures located at the points of beginning. These structures will provide the visitor with a map for orientation, upcoming events, benches, and trail information. Interpretative brochures will be available for the trail users. This brochure will indicate the locations and types of trails that he will be experiencing. The map on the brochure will allow for easier circulation through the trails as well as show the visitor where the rest and interpretive stops are located. The trail head structure will match the style of the newly implemented interpretive signs in place elsewhere in the arboretum, helping to add a consistency to the signage. These structures will replace the existing ones which give a state park look to the arboretum.

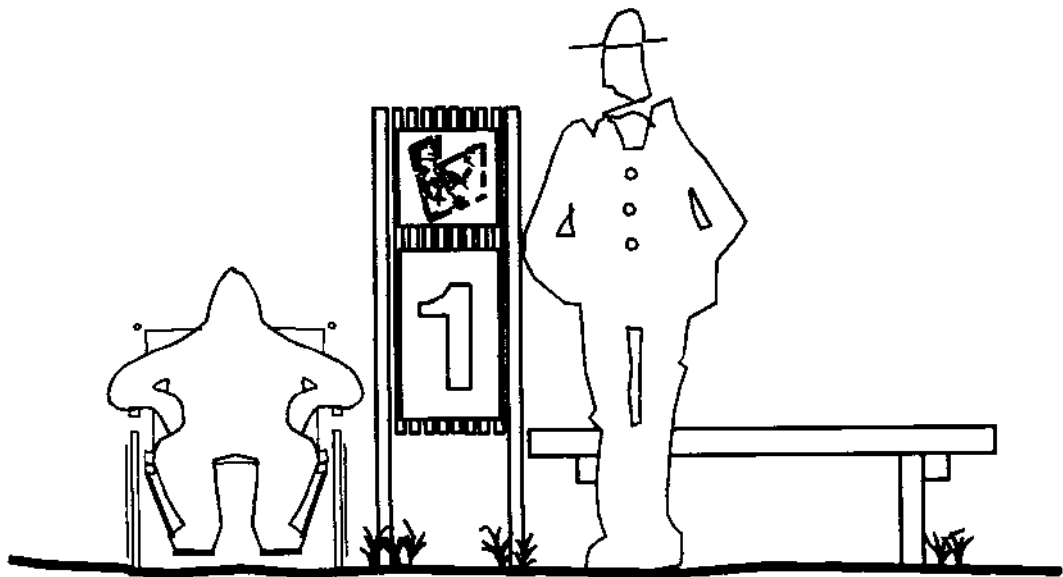


TRAIL HEAD

Along the trails at the interpretive points, another sign and bench will be erected. The bench will remain the same style as the existing ones found throughout the existing trail system. The interpretive signs, as with the trail head structures, will match the new grey sign in place in the front zones of the arboretum. Each sign will display a map with the visitor current location as well as a number which corresponds to the numbers in the trail brochure. Each stop will educate the visitor to the natural systems in which they are walking. This can be a specific element such as a native tree along with its importance to both the native environment and its economic uses or a broad subject such as forest succession.



INTERPRETIVE POINTS



INTERPRETIVE STATION

In order to accommodate the wide range of visitors, a series of trail types was developed. Each trail type gives the visitor a choice as to how far he wishes to go and how difficult that section of trail is to complete. The visitor will have a choice from the following:

Trail classifications (Time Saver Standards for Landscape Architects, 1990)

-Class I- fully accessible including:

- Length up to 1/4 mile.
- Rest stops or interpretation points every 100-150 feet.
- 6 foot trail width.
- 1.5 foot mown grass shoulder
- 1:50 or 2% maximum slopes
- Asphalt trail surface.

-Class II- easy including:

- Length of 1/4 to 1 mile
- Rest stops or interpretation points every 200-300 feet.
- 4-5 foot trail width.
- 1 foot cut underbrush shoulder.
- 1:20 or 5% maximum slope.
- Asphalt or compacted crushed rock surface.

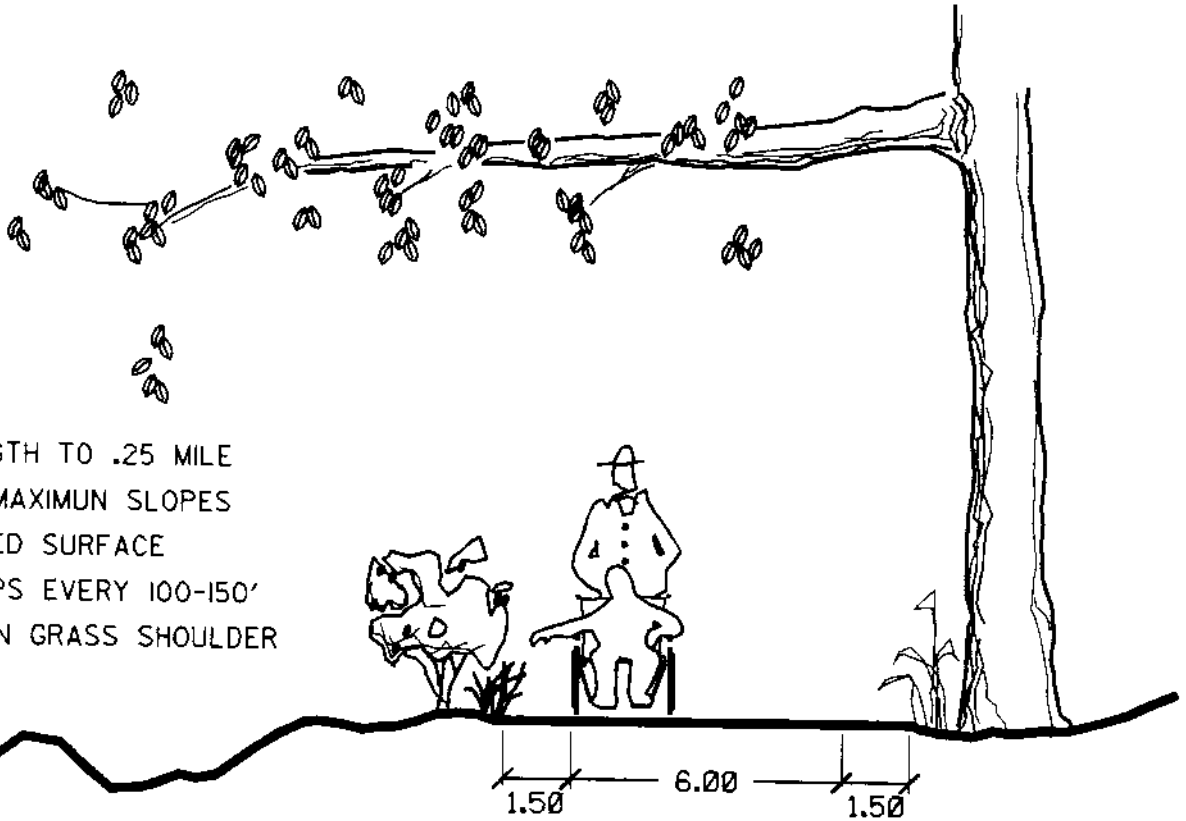
-Class III- Moderate difficulty including:

- Length of 1-2 miles
- Rest stops or interpretation points every 500- 600 feet.
- 3-4 foot trail width
- 1 foot cut underbrush shoulder.
- 1:10 or 10% maximum slope.
- Wood chips or gravel surface.

-Class IV- Difficult including:

- Length of 2+ miles.
- Rest stops or interpretation points every half mile.
- 1/2 foot cut underbrush shoulder.
- No maximum slope limit including steps.
- Wood chips or natural surface.

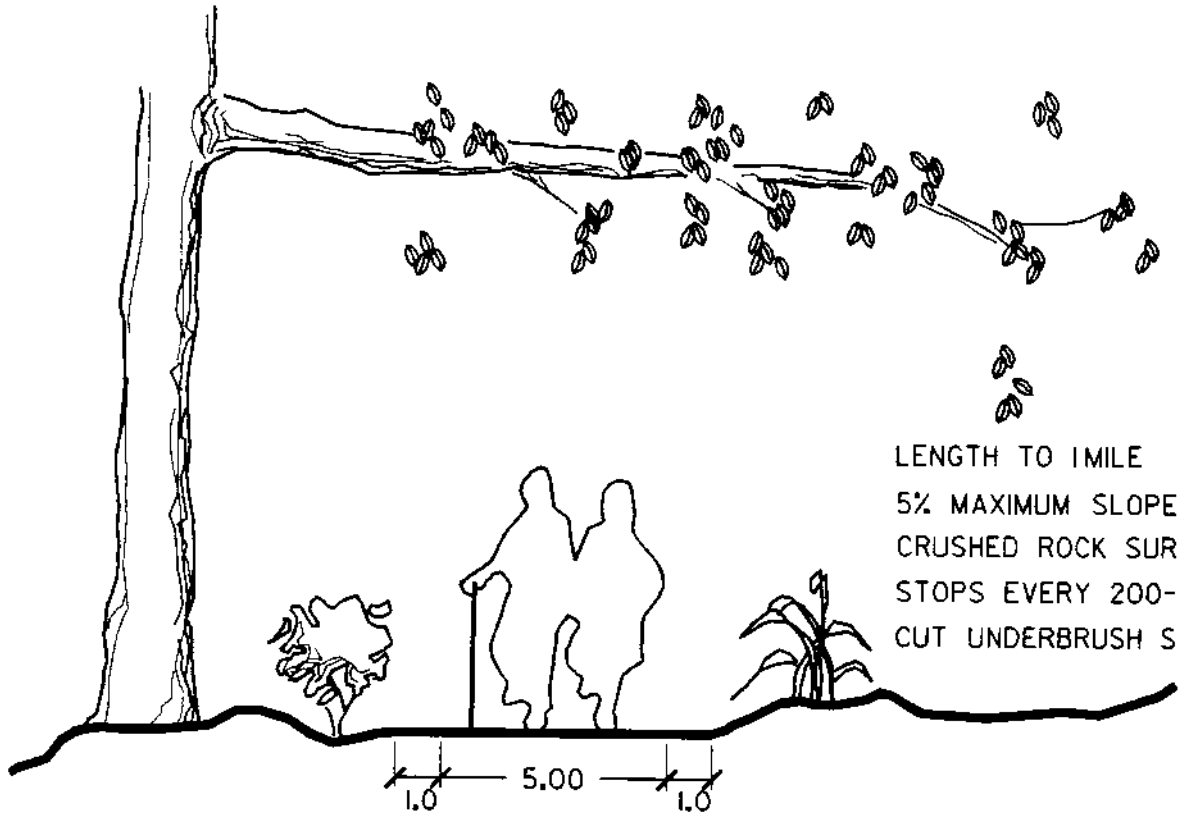
These various trail classifications will allow both the visitor to determine how difficult the trail will be as well as allow for trails to traverse any type of terrain found at the Cox Arboretum. This system will also require that a loop system be maintained in order to aid in visitor orientation. By providing loops, the visitor has the option of finishing the trail at the same point he started from and to continue on with his tour of the arboretum.



LENGTH TO .25 MILE
 2% MAXIMUM SLOPES
 PAVED SURFACE
 STOPS EVERY 100-150'
 MOWN GRASS SHOULDER

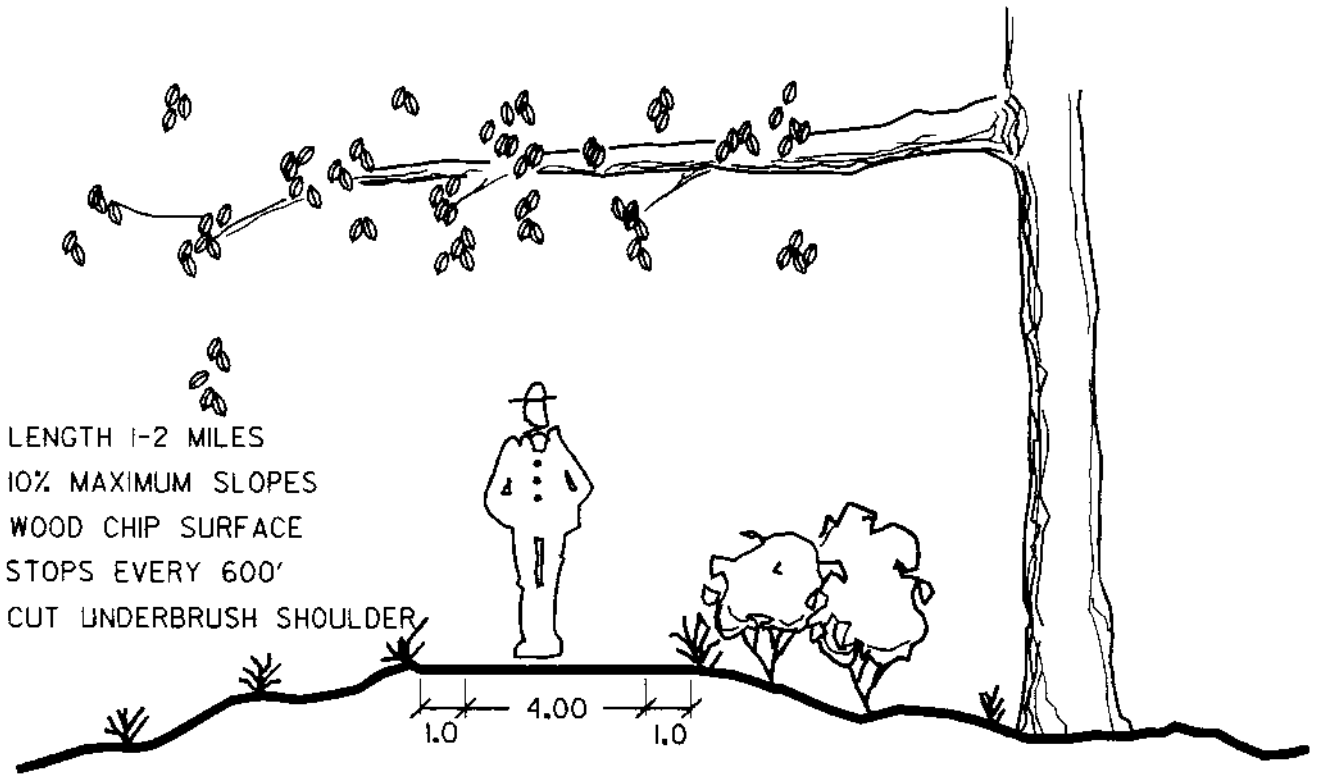
CLASS 1 TRAIL

FULLY ACCESSIBLE



CLASS 2 TRAIL

EASY

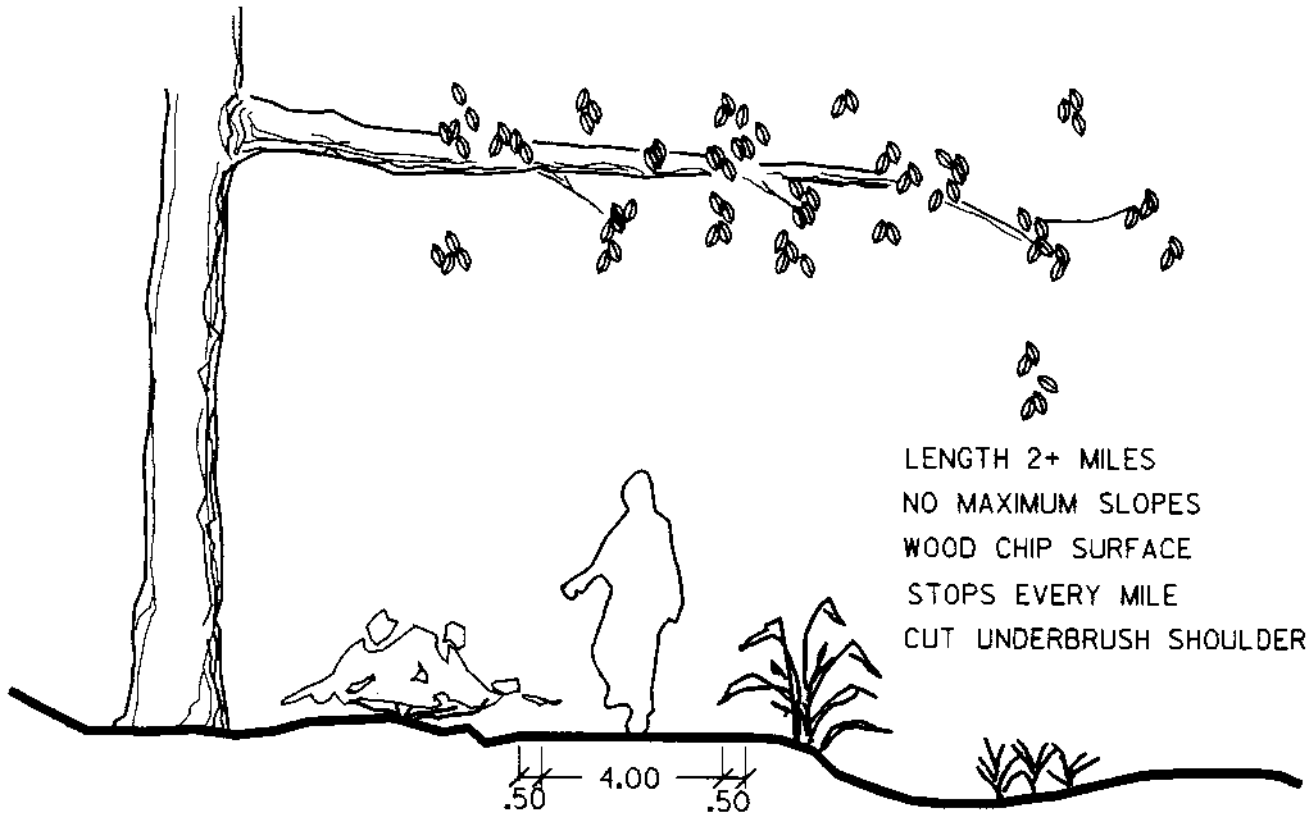


LENGTH 1-2 MILES
 10% MAXIMUM SLOPES
 WOOD CHIP SURFACE
 STOPS EVERY 600'
 CUT UNDERBRUSH SHOULDER

1.0 4.00 1.0

CLASS 3 TRAIL

MODERATE DIFFICULTY



CLASS 4 TRAIL

DIFFICULT

CONCLUSION

In conclusion, the proposed trail system is both sensitive to the site as well as to the visitors who will be using the trail system. The intergraph computer system and its GIS software system allowed for the detailed analysis of the site in terms of slope, a major factor in the layout of the various trails. By gaining a detailed knowledge of the site, these proposed trails will be both functional and useful for educating the public in subjects about the natural systems occurring on the site.

The new system of trails incorporates a series of loops which will give the visitors a series of choices as to which path to follow. This will provide the visitor with a number of different experiences each time he visits. The looping system provides the visitor the opportunity to end his trail tour at the same point he began in order to continue his tour of the arboretum. This will eliminate the current problem of disorientation of the visitor. The visitor will also have the opportunity to end up at various points in the arboretum, but the disorientation will be eliminated due to the well marked trails and frequent locations of trail maps.

To begin the trail, a visitor must pass the trail head structure. As described before, these structures will display a map of the trail system which indicate the various levels of difficulty and the locations of rest and interpretative points. Trail brochures will be distributed at these points to aid the visitor in following the various trail loops. These structures will provide visitors some protection from the sudden rains which can occur.

Along the trail, the visitors will be introduced to elements of the natural systems found on the site. The visitor will be exposed to things such as native plant material, geology, and the issues of natural forest succession. The interpretative points will display a map of the site including present location and a large number. This number will correspond to the brochure which the visitor is carrying. The brochure can be developed with several people in mind. For example, large print could be incorporated for the visually impaired. The proposed system of interpretative points is a beginning system. The series of points can easily be expanded for future needs.

Finally, the designer feels that this solution is the best solution at this

time. This solution takes into account the current needs of the arboretum both of its staff and visitors. The proposed solution is also sensitive to the site itself. The trails avoid areas of erosion and take visitors to areas of interest. By utilizing a majority of the existing trails complemented by some additions, the proposed trail system will give the visitors an understanding of the natural and native environment in which they live.

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