7.0 Tree Preservation During Construction

Introduction

All trees are valuable and should be considered an asset. Trees provide aesthetic, environmental and monetary benefits to a project. Designer's should be flexible and work with the existing vegetation. It takes a lifetime to replace the benefits of a mature tree.

The intent of this section is to provide an aid for Base to make informed decisions regarding existing vegetation on a site. It contains basic information and techniques that can be used to preserve trees during development process. Landscape architects and/or arborist should be involved to ensure that appropriate decisions regarding tree preservation are being made.

Table 1 illustrates how to determine the optimal tree protection zone and Table 2 illustrates how much space is required to achieve the optimal tree protection zone. Table 3 is a checklist to use while monitoring trees during the construction process.

Many factors influence whether a particular tree or group of trees can be or should be saved in a project. However, the main influencing factor is a commitment that tree preservation is a priority by all parties connected with the project. Everyone from the client, the designers, the local governments, the contractors and the maintenance personnel need to be on board with the tree preservation goal. If not, it will be a very difficult task.

Tree preservation techniques need to occur in all four phases of site development; Planning, Design, Construction and Maintenance to have a successful outcome. It is important to start the tree preservation as early in the project as possible. If the contractor has already started digging, it may be too late. Construction injury to trees may take years to manifest and provide recognizable signs that the tree is deteriorating and will die. The best protection is to be proactive and prevent injury to trees. Arborists are limited on what can be done to help a tree after it has been damaged.

Planning Phase

In the Planning phase of a project the primary goal with regard to tree preservation is to identify the tree resources. A certified arborist or landscape architect should do this. These consultants can prepare a tree survey or stand delineation that describes the nature of the resource and the opportunities for optimizing preservation. Various methods of tree resource identification exist. At the lowest level of detail the tree resource identification it only involves examining the amount and pattern of tree cover, including gaps, land use, adjacent properties and topography. The most detailed resolution is a total tree survey. The total tree survey typically includes the following steps for each tree:

- tagging the tree with a numerically coded metal tag
- locating its position on a topographic map
- identifying the drip line on the site plan
- identifying the species of tree
- measuring the trunk diameter (and height if appropriate)
- rating the condition on a scale (1 = poor; 5 = excellent)
- identifying any specific defects in structure, presence of pests, etc.
- assessing the tree's suitability for preservation
- noting other significant site or tree features

The level of detail that is most appropriate for the tree resource evaluation for your project will depend on the site and the intended development. Once the information is gathered, a table summarizing the tree resources is then developed and becomes a useful tool for the designers in the next phase of the project.

Design Phase

The following tree preservation guidelines and standards should be followed for optimum results in the design phase of the project:

1. Plot accurate trunk locations and drip lines of all trees and/or tree stands to be preserved with in development areas on all plans of the project. Include tree preservation notes on all plans for the project.

2. Identify a tree protection zone (refer to Table 1) for each tree in which no soil disturbance, including stripping, is permitted. Specify that the natural grade shall be maintained within the tree protection zone. Specify that no storage, dumping of materials, parking, construction trailers, underground utilities, fires, etc. be allowed within the tree protection zone with out the approval of the consultant.

3. Require that any plans affecting trees be reviewed by the consultant. This requirement should include (but not limited to) plans for demolition, erosion control, improvement, utility and drainage, grading plans, landscape, and irrigation.

4. Specify that special foundation, footing and pavement designs be employed to minimize root interference when structures must be placed within the tree protection zone.

5. Require utilities (electric, gas, cable TV, telephone, water, drains, sewer) to be routed outside the tree protection zone.

6. Indicate that landscapes be designed to exclude trenching for irrigation lines within the tree protection zone and that no irrigation be applied within five feet of the trunks of protected trees. (Note: The irrigation limits will vary from project to project)

7. State that any new plantings within the tree protection zone must be designed to be compatible with the cultural requirements of the retained tree(s), especially with regard to irrigation and nitrogen application.

8. If excavation must occur within the tree protection zone, specify that the consulting arborist will determine where tunneling, handwork, and root pruning are required. Require that root pruning be completed before grading begins. (Note: This is included to forewarn the design team and owners that non-routine construction methods may be required to successfully retain the tree.)

9. Stipulate that surface drainage not be altered so as to direct water into or out of the tree protection zone unless specified by the consultant as necessary to improve conditions for the tree.

10. Require that site drainage improvements be designed to maintain the natural water table levels within the tree retention areas. If water must be diverted, permanent irrigation systems should be provided to replace natural water sources for the trees.

11. This approach is intended to be a guide for planning adequate space around trees, not an absolute rule. There will certainly be times when it is not possible to retain the optimum tree protection zone around each tree to be preserved. The consultant must evaluate the minimum tree protection zone that would prevent the death, decline, or instability of the specific tree.

Table 1
Calculating the Optimal Tree Protection Zone

1. Evaluate the construction impact tolerance for the species of tree: good, moderate, or poor.
2. Identify tree age: young, mature, or overmature.
3. Using Table 2 on the next page, find the distance from the trunk that should be protected per inch of trunk diameter.
4. Multiply the distance by the trunk diameter to calculate the optimum radius (in feet) for the tree protection zone.

Examples:

- A healthy 60-year-old, 30" diameter Pin Oak (moderate-good tolerance, mature age):

  1.0' x 30" = **30' Radius Tree Protection Zone Required**

- A 10-year-old, healthy 12" diameter Honey locust tree (good tolerance, young age):

  0.5' x 12" = **6' Radius Tree Protection Zone Required**

Table 2

Guidelines for Optimal Tree Preservation Zones

Species tolerance	Tree Age	Distance from trunk Feet (per inch trunk diameter)
Good	**Young** (<20% life expectancy)	0.5'
	Mature (20-80% life expectancy)	0.75'
	Overmature (>80% life expectancy)	1.0'
Moderate	**Young**	0.75’
	Mature	1.0'
	Overmature	1.25’
Poor	**Young**	1.0’
	Mature	1.25'
	Overmature	1.50’

Projects that consider trees early in the design process and during construction rarely cause short-term tree death. The exception to this occurs when significant mistakes are made in the design (e.g., grades on plans were incorrect) or when construction activities are careless or negligent. Rather than dying quickly, trees may decline gradually and eventually reach the point that removal is required. This scenario is typical when the construction impact is indirect, such as changes in the hydrology of site, changes in soil quality, increased exposure to sun and/or wind, which causes chronic stress to which the tree never adapts. The tree ultimately may be killed by insects or diseases that successfully attack it.

Before site construction begins the designers can evaluate the potential impacts to the trees and take the prudent steps necessary to reduce or avoid the adverse impact during construction. The evaluation that occurs needs to consider the impact tolerance of the tree, the type of disturbance that will occur in the root zone and the disturbance to the overall site that could affect the tree.

How much impact a tree can tolerate depends on many factors including:

- **The specific tree**
  - Age
  - Health
  - Structure
  - Species tolerance (refer to Appendix A)
  - Previous exposure to wind, sun
  - Vigor

- **Changes that will occur**
  - Amount of root injury
  - Degree of restriction of root area
  - Amount of reduction of leaf area
  - Degree of change is soil structure, moisture and drainage
  - New exposure to sun, wind
  - Change in microclimate
  - Exposure to toxic chemicals
  - Competition with other plants
  - Number and depth of mechanical wounds

- **Ability to ameliorate impacts**
  - Possibility for irrigation
  - Potential for reducing compaction
  - Potential for increasing soil aeration
  - Potential to protect from stress-related insects and diseases
  - Potential for improving drainage

When evaluating the impact of the design and potential impact of construction the following **Tree Impact Evaluation Checklist** should be reviewed:

- **Tree characteristics**
  - Species tolerance to impacts
  - Tree age/longevity
  - Tree health and vigor
  - Root depth and extent
  - Conformation of canopy
  - Structural stability

- **Site Development**

Disturbance that will occur within the rooting area

- Distance from trunk and depth of excavations (e.g., grade changes, underground utilities, pavement section, footings, foundations)
- Root area exposed to compaction
- Root area covered by pavements
- Pruning requirements (e.g., clearance, overhead utilities)
- Irrigated landscape (compatibility with tree, trenching for system)
- Removal of adjacent vegetation (root damage, changing microclimate, exposure)

Disturbance to overall site that could affect the tree

- Diversion of runoff (to of from tree)
- Installation of subdrains or drainage swales (lowering water table)
- Altered drainage patterns that increase erosion
- Altered drainage patterns or vegetation removal that increases siltation
- Walls or foundations damming underground water flow
- Road fill over streams and check dams that alter water flow and sedimentation
- Change in capacity for soil water recharge

If the impacts are determined to be too severe, the plans must either be redesigned to reduce injury, or the tree removed.

After the designer evaluates the impacts that may occur to the trees, the design is re-evaluated to determine how impacts could be reduced. Some design options are:

- Using retaining walls for grade transformations
- Adjusting paving sections, finish grades and paving materials to minimize root interference
- Modifying footing and foundation design to reduce excavation in the root zone
- Considering canopy conformations when locating fireplaces, windows and structures
- Locating utilities and services away from trees and consolidating lines into joint trenches

A number of construction work procedures can help protect trees from unnecessary damage. Such procedures include planning the clearing, grubbing and demolition with tree protection in mind, root pruning before excavating near trees, tunneling under roots rather than trenching through them, and protecting the soil from surface compaction from equipment.

Construction Phase

In the construction phase of the project the trees must be monitored. The monitoring ensures that all regulations and requirements imposed on the project are being met, it leads to the identification of existing or developing tree-related problems that require treatment and it allows for the opportunity to discuss any new design or work procedures with the contractor. Refer to Table 3 for information on what to look for during a site visit for tree monitoring.

Maintenance Phase

When the construction activity ends the project moves into the post-construction period for tree management. Typically, tree care programs focus on correcting physical damage that occurred during development. However, arboricultural treatments have limited ability to cure mechanical injury and other impacts from construction; therefore, the goal of a tree protection program is to prevent injury to trees.
An essential step in this phase is to evaluate the condition of the trees. If a predevelopment tree report is available, this information can be compared to the post development condition of the trees. At this time, trees that have declined in health may be targeted for remedial treatments such as pruning and irrigation. Typical symptoms of tree stress from construction injury include the following:

- Small, yellow leaves
- Thin foliage
- Leaf scorch
- Wilting
- Early fall coloration and defoliation
- Heavy seeding
- Twig dieback
- Branch dieback
- Irregular wounds from equipment damage on trunks and lower branches
- Attack by borers and other stress related pests
- Death
- Destruction of the general root system, particularly loss of rooting area
- Damage to the root collar and structural roots
- Mechanical injury and damage to the stem
- Changes in soil structure such as compaction, fills, erosion, and loss of organic matter

The most common remedial actions recommended for trees impacted by construction include the treatments below:

- Irrigation - should wet the entire root zone and be allowed to dry before another application.
- Pruning
- Mulch - 4 - 6 inch layer of organic mulch beneath the tree canopy
- Fertilization
- Pest management
- Tree removal
- Removing fill soil to original grade. If the entire drip line cannot be cleared of fill, a minimum 5 foot radius around the trunk should be returned to natural grade. Removal of fill should be done by hand, especially within 10 feet of the trunk.
- Remediation of soils damaged during construction

Table 3
What to look for during Monitoring

1. Ensure the integrity of tree protection zones:

- ☐ Tree protection fences intact
- ☐ No storage of materials No parking
- ☐ No dumping
- ☐ No evidence of soil or understory disturbance in protected area

2. Note any tree injury that occurred:

- ☐ Damaged branches from equipment
- ☐ Cut, injured, or exposed roots

3. Look for unusual changes in tree appearance:

- ☐ Leaf color, density
- ☐ Wilting
- ☐ Checking, bleeding on bark
- ☐ Pest activity
- ☐ Consult with arborist on recommended treatments

4. Confirm that previously recommended treatments have been applied:

- ☐ Irrigation
- ☐ Pruning
- ☐ Mulching
- ☐ Fencing
- ☐ Root pruning

5. Address new questions and problems

- ☐ Unapproved activity near trees
- ☐ Additional pruning for clearance
- ☐ Design changes
- ☐ Work procedure or design changes

6. List new action items

- ☐ Tree treatments
- ☐ Fence repair

8.0 Future Project Landscape Requirements

Purpose and Intent

The purpose of this section is to establish protective requirements for trees and landscaped areas within the boundaries of the base. Such areas preserve the ecological balance of the environment, control erosion, sedimentation, and storm water runoff; provide shade and reduce heat and glare; abate noise pollution; and buffer incompatible land uses. The intent of this section is to encourage the preservation of existing trees and to require the planting of new trees on newly developed sites. It is critical that a balance be maintained between new and existing vegetation and developed and undeveloped areas.

Applicability

The provisions of this document shall be applicable within the following land use districts: Residential, Commercial, Office and Industrial Areas.

Other Areas - The provisions of this section shall also be used as guidelines in reviewing site plans in other areas within the boundaries of the base, airport transition zones, and in applications for special planned developments.

Exemptions - The designated clear zone areas around the airfield, and any other area identified by the Base Civil Engineer as critical to aircraft operations, shall be exempt from this requirements in this section.

Landscape Area Requirements

The minimum percentage of the total developable site that shall be devoted to landscaping, unless otherwise specified in this instruction, shall be as follows:

Land Use District Percent	
Land Use District	Percent
Residential	20
Commercial and Office	15
Industrial	10

Off-Street Parking and Vehicle Use Areas

Off-street parking facilities and other vehicular use areas shall meet the following requirements:

Perimeter Requirements - A 15-foot-wide strip of land abutting the road edge of pavement located along the front and side property line(s) of the site to be developed shall be landscaped. In no case shall this strip be less than 15 feet wide. Widths of sidewalks shall not be included within the 15-foot wide perimeter landscape area. Sidewalks shall be located on the street side of the development site boundary.

The perimeter landscape requirement shall be credited toward the percentage required for the total developable site in "Landscape Area Requirements" above. Material requirements in perimeter areas are as follows:

- One tree for each 40 feet of linear foot of frontage as measured along the street shall be required. Trees planted to meet this requirement shall measure a minimum of 3 inches in diameter at 4

feet above grade and may be clustered. The remaining area within the perimeter strip shall be landscaped as appropriate to minimize maintenance and screen views of parking.

- All trees and other landscaping required in the perimeter strip shall be maintained to assure unobstructed visibility between 3 and 9 feet above the average grade of the adjacent street and the driveway intersections through the perimeter strip.

Interior Planting Areas - Interior planting areas within parking lots shall be determined by subtracting the area set aside in the 15-foot perimeter strip from the total minimum area required to be landscaped in "Landscape Area Requirements" above. This remaining percentage shall be allocated throughout the parking lot or in areas adjacent to the parking lot other than in the perimeter strip. Interior planting areas shall be located to most effectively accommodate storm water runoff and provide shade in large expanses of paving and contribute to orderly circulation of vehicular and pedestrian traffic. Minimum sizes of interior planting areas are as follows:

- A minimum of 100 square feet of planting area shall be required for each new species of tree identified.

- A minimum planting area of 50 percent of the dripline area of the tree shall be required for all existing trees. If conditions warrant that an area greater than 50 percent is need to preserve the tree, additional areas may be negotiated between the applicant and the Base Civil Engineer.

Vehicle Overhang

Trees and shrubs shall not be located within two feet from the back of curb or edge of pavement in interior planting islands to accommodate for the vehicle overhang. This vehicle overhang area shall be developed to include mulch or turf grass.

Curbs - Protection and Vegetation

Where landscaping is installed in interior or perimeter strip planting areas, a continuous curb shall be provided to prevent injury to the vegetation. Such a curb shall be designed to allow percolation of the water to the root system of the landscape material. Where existing trees are preserved, tree wells, tree islands, or a continuous curb shall be utilized to protect the trunk and root system from alterations to surrounding grade elevations and damage from automobiles. A drainage system sufficient enough to allow percolation into permeable soil shall be provided in the area defined by the drip-line of the tree(s).

8.1 Utility Screening

To reduce the visibility of generally unattractive utility equipment, landscape screening shall be incorporated. For the purpose of these standards and guidelines, utility structures are any appurtenances that are above ground and have been installed in conjunction with new construction or are existing and part of a newly renovated project (i.e. electric meters, transformers, irrigation equipment, air conditioning units, etc.). The landscape plans shall identify all utility structures on site and provide appropriate screening.

General Design Requirements

- All utility structures shall be screened from view with appropriate landscaping.
- Utility structures shall utilize camouflage, disguising the facility as a natural or more aesthetically pleasing man-made object to soften its visual impact on its surroundings.
- Access to utility structures shall be maintained, while at least seventy-five (75%) of the utility shall be screened from view.
- Bollards shall not be installed with any new utility equipment unless required by governing agency.
- All utility equipment shall be located at the rear of the property.
- All utility equipment shall be located in shrub areas with a minimum of three feet (3') clear distance around all sides for appropriate landscape screening.
- Screening shall take into consideration traffic sight distance requirements established by the Base Civil Engineer.

8.2 Buffer Yards between Incompatible Land Use Districts and Uses

The Base Civil Engineer may require the construction of buffer yards between incompatible land use districts, or areas with aesthetic incompatibilities. Buffer yards shall be a minimum of 20 feet in width and continuous along a common line between the incompatible land uses.

20' landscape buffer strips shall have 2 tree (deciduous or evergreen) and 30 shrubs (deciduous or evergreen) per 30 lineal feet of buffered distance area. Shrubs are to be at least 3' in height and planted no farther than 6' apart. Plantings shall not be placed in a straight line unless they continue the overall theme of the site. Distinguished Visitor Routes are to be used as planting examples. See Section 4.0 for recommended plant material.

The buffer yard is in addition to any other required landscape percentage requirements. This requirement may not always be feasible to mitigate current land use or aesthetic incompatibilities; however, when needed, landscape buffers should be incorporated into all Area Development Plans for new construction or redevelopment areas. Initial considerations for strategic landscape buffers are at the following locations, which are illustrated in **Figure 8-1**. Composition rates are shown below:

Composition of Screens & Buffers		
Plants	**Spacing**	**Ratio**
Evergreen Trees	15' o.c. (max.)	3 ev : 1 dec
Deciduous Trees	30' o.c. (max.)	1 dec : 3 ev
Evergreen Shrubs	6' o.c. (max.)	2 ev : 1 dec
Deciduous Shrubs	6' o.c. (max.)	1 dec : 2 ev

(Refer to Section 4.0 Plant Material, for species)

Housing along U.S. 98

Accompanied housing along U.S. 98 should be buffered from the negative impacts from traffic on the highway. Heavy landscape treatment along U.S. 98 would mitigate the visual and noise impacts from the roadway. Heavy tree canopy and understory landscape treatment would also provide some degree of visual security from vehicles.

Southside Industrial Area

The industrial area on the south side of the main cantonment area is primarily associated with civil engineering operations. This site also has some degree of incompatibility with the administrative area south of Independence Road, and the fact that Independence Road is a DVR. The landscape plantings on the north side of Independence Road should be based on DVR recommendations. The plantings at the entrance road to the administrative area to the south should be based on DVR recommendations; however there could be a slightly different plant palette to highlight a separate "neighborhood".

East Side Dormitories

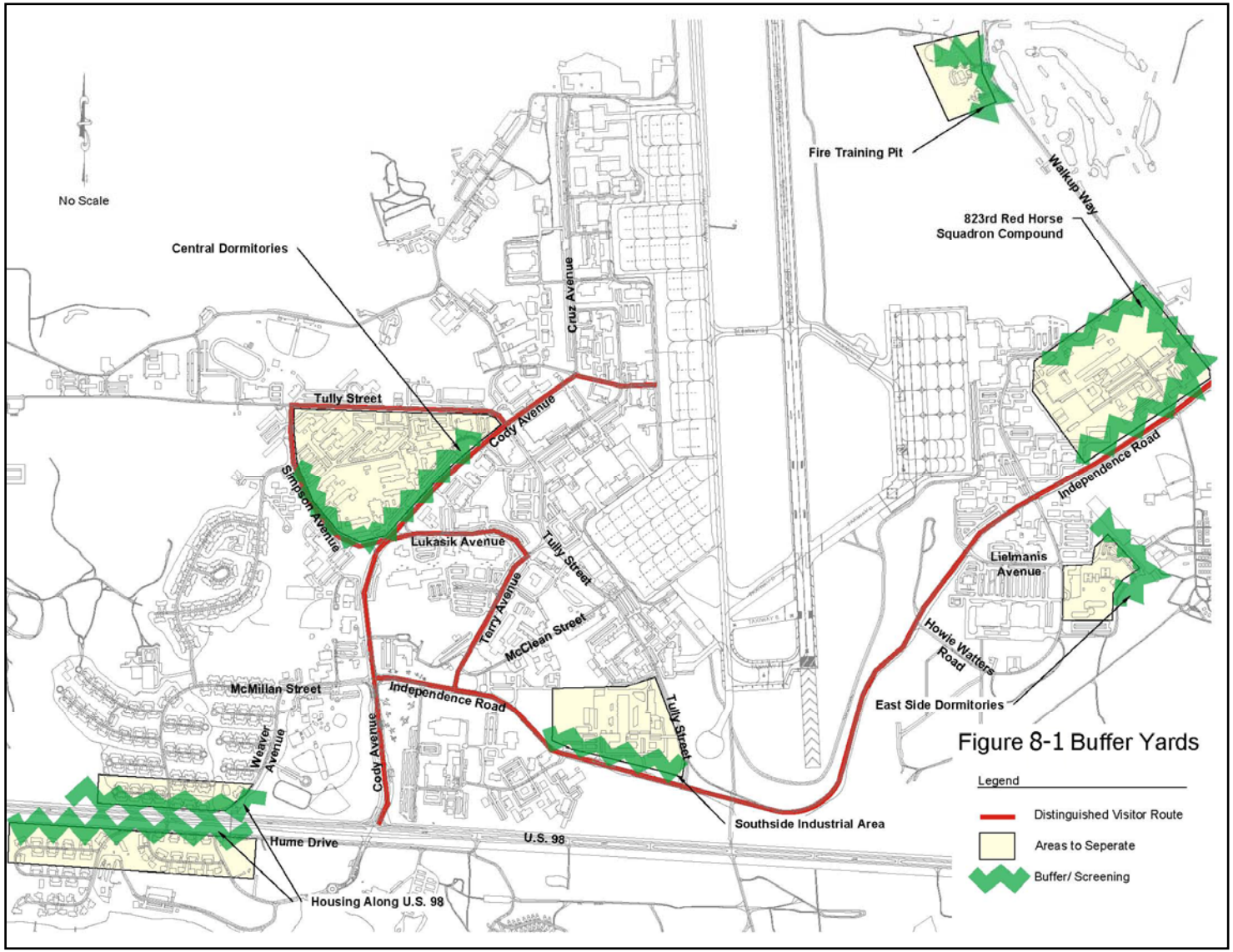
East side dormitories are adjacent to the Permanent Exercise Area, which includes an 823rd Red Horse training area. This land use is not compatible with unaccompanied housing and the views to the east should be mitigated with trees and shrubs.

823rd Red Horse Squadron Compound

The 823rd Red Horse Squadron compound is exposed to the Independence Road DVR route, vehicles traveling on Freedom Way and to the Eastside Flight line. This industrial compound is exposed to the DVR route and is one of the first areas a visitor sees coming from the east. The planting recommendations for the DVR route should be implemented to buffer the view from Independence Road. Because visitors along the DVR route can easily view Freedom Way, landscape material should be planted along the east side of the compound. The plant palette used for the DVR route should extend along the east of the compound. Although some industrial land uses are compatible with airfield uses, these functions are not associated, so some buffering should occur on the west side of the compound. It is unlikely that a complete visual buffer can be planted; however strategic plantings of shrubs and trees can "soften" the view of the industrial compound.

Fire Training Pit

The Fire Training Pit is located on the west side of Freedom Way. The Hurlburt golf course is on the east side of the road. Although outdoor recreation and industrial operations are not necessarily incompatible land uses, there is an aesthetic incompatibility between the Fire Training Pit and the golf course. Some vegetative buffering exists along Freedom Way; however additional tree plantings and use of similar plant material as the golf course is warranted.


No Scale
Central Dormitories
Fire Training Pit
Walkup Way
823rd Red Horse Squadron Compound
Cruz Avenue
Tully Street
Cody Avenue
Simpson Avenue
Lukasik Avenue
Tully Street
Terry Avenue
McClean Street
Independence Road
Lielmanis Avenue
Howie Watters Road
East Side Dormitories
McMillan Street
Independence Road
Weaver Avenue
Cody Avenue
Tully Street
Southside Industrial Area
Hume Drive
U.S. 98
Housing Along U.S. 98
Figure 8-1 Buffer Yards
Legend
Distinguished Visitor Route
Areas to Seperate
Buffer/ Screening

8.3 Landscape Plan

A landscape plan shall be required as a condition prior to construction of residential, commercial, and industrial development as specified in "Landscaping Requirements" above. The plan shall be submitted to the Base Civil Engineer for review.

No construction of the planned improvement shall commence until the landscape plan has been submitted, approved, and receipt of a tree removal permit has been issued (if required). Beneficial occupancy of any building shall not occur until the Base Civil Engineer or his/her designated representative has determined after final inspection that the required site improvements have been installed according to the approved application and landscape plan. In lieu of the immediate installation of the landscaping material and trees, the government may require a performance bond or other security in an amount equal to the cost of the required improvements in lieu of withholding beneficial occupancy, and may further require that improvements be satisfactorily installed within a specified length of time.

Contents of Landscape Plan

The landscape plan shall include the following information:

- The location by species and size of all trees, shrubs, and landscape material to be retained or placed on the site.
- Location of proposed structures, driveways, parking areas, and other improvements to be constructed or installed.
- Location of irrigation system to be provided, if any, or manual outlet for watering.
- Landscape and tree protection techniques proposed to prevent damage to vegetation during construction and after construction has been completed.
- Information, written and graphic, submitted to the Base Civil Engineer and any tree removal permit if issued.

Installation Period

All landscape materials and trees depicted on the approved landscape plan shall be installed prior to the final inspection or within one year of the date of approval of the landscape plan unless deemed inappropriate by the Base Civil Engineer.

8.4 Maintenance

The contractor shall be responsible for the maintenance of all landscape areas, which shall be maintained so as to present a healthy, neat, and orderly appearance at all times and shall be kept free from refuse and debris for the period determined by the Base Civil Engineer or his/her representative but not less than 60 days after the installation. Maintenance shall include the replacement of all dead plant material within the period of one complete growing cycle. Dead plant material shall be replaced within a time appropriate to the growing season of the species in question, not to exceed one year.

8.5 Protected Trees

Protected trees are defined as any tree over 6 inches in diameter identified as a native species in the 'Recommended Plant List" found in Section 4.0 - Plant Material. Where protected trees are identified on a

site proposed for clearing within the development site, the number of trees to be preserved shall be based on a ratio of one tree for 3,600 square feet of impervious surface area or fraction thereof. The required amount of greenspace identified in "Perimeter Requirements" and "Interior Planting Areas" (Refer to pages 8 – 1 & 8 – 2) shall be provided in the development and can be used for the preservation of protected trees.

Tree Credits

Any existing protected tree located on the development site with a crown extending over planned paved parking area, within the perimeter or interior landscaped areas, shall be eligible for credit against the number of trees required to be planted. The following credit schedule may be applied for preserving existing trees on site:

Diameter of Tree Trunk of Preserved Tree	Credit towards Requirement
24" or Greater	3 Trees
12" to 24"	2 Trees
6" to 12"	1 Tree

Such credits shall be subject to approval of the Base Civil Engineer or his/her representative. Tree trunk diameter measurement shall be rounded off to the nearest whole inch. Diameter of a tree shall be measured at a height of four feet above the natural grade.

A reduction of required parking spaces may be allowed by the Base Civil Engineer when the reduction would result in the preservation of a protected tree with a trunk of at least 12 inches in diameter. This credit is per tree and not a total site credit. The following reduction schedule shall apply:

Number of Required Parking Spaces	Allowable Reduction of Required Parking Spaces
1 to 4	0
5 to 9	1
10 to 19	2
20 or Above	10 Percent of Total Number of Spaces

Relocation, Removal, and Replacement of Protected Trees

Where a proposed site plan cannot be designed to accommodate existing protected trees on the site, a permit shall be obtained from the Base Civil Engineer to remove any such protected tree as specified in Section 8.5.1 - Tree Removal Permit. Where practical, when proposed improvements necessitate removal of protected trees, said trees shall be relocated on the site in the required perimeter or interior landscaped areas. If the relocation of said trees is impractical, the protected tree may be removed and replaced with a native tree species identified in the Recommended Plant List in Section 4.0 – Plant Material. The replacement tree shall measure a minimum of 3 inches in diameter, 4 feet above grade in order to comply with "Tree Credits."

A replacement ratio of 3:1, three new trees for every one protected species removed, shall be applied. In cases where forested areas require clearing of protected trees, the replacement ratio shall be 1:1, one new

tree for every existing tree removed. Trees identified as diseased or dead shall not be required to be replaced.

New Planting of Protected Trees

On sites proposed for development where no existing protected trees are identified, the contractor shall be required to plant one new tree species identified in the protected tree list or the tree replant list. Trees shall be a minimum of 3 inches in diameter measured 4 feet above grade for each 3,600 square feet of impervious surface area. New trees or replacement trees shall be planted within a time appropriate to the growing season of the species in question, not to exceed one year.

New Residential

In new residential developments, a minimum of one tree planted in the front yard no closer than 20 feet to the edge of paving shall be required, provided there is no existing acceptable tree in the front yard. Acceptability of existing trees(s) will be determined by the Base Civil Engineer or his representative. Where a protected or replanted tree species is required to be replanted, such tree shall be a minimum of 3 inches in diameter, measured 4 feet above grade. The location of an existing protected tree on the site or the proposed location of a new protected or replanted species, where required in this section, shall be identified on the landscape plan submitted to the Base Civil Engineer.

Road Tree Protection Zone

The road tree protection zone is the strip of land lying parallel to the road, 10 feet behind the edge of paving to 30 feet behind the pavement edge. No person, organization, or agency shall cut, remove, trim, or in any way damage any protected tree in any road tree protection zone or create any condition injurious to any such tree without first obtaining a permit to do so from the Base Civil Engineer. The location of all existing trees adjacent to the road and/or within the tree protection zone must be evaluated to determine if there is a conflict with a driver's field of vision.

The Base Civil Engineer may issue an annual permit to public utility companies exempting them from the provisions of this section concerning tree preservation. In the event of flagrant or repeated disregard for the intent and purpose of the tree protection zone, the Base Civil Engineer may revoke said permit. The reasons for revoking such a permit shall be provided in writing to the offender. In no case shall the utility company be permitted to prune more than 30 percent of the existing tree canopy.

8.5.1 Tree Removal Permit

Unless otherwise exempt from the provisions of this section, no person shall cut, remove, trim, or in any way damage any protected tree without first obtaining a permit from the Base Civil Engineer as provided below.

Permit Application Information

The following information shall be submitted to the Base Civil Engineer before a tree removal permit shall be issued:

- **Residential, Office, Commercial, and Industrial Development** - Prior to commencing any development activity, including removal of vegetation for site preparation, in any residential, office, commercial, or industrial area identified herein, an accurately scaled

drawing prepared by a land survey, architect, engineer, or landscape architect which includes the following information:

- Location of all protected trees noting species, size, and general condition.
- Location of proposed structures, driveways, parking areas, required perimeter and interior landscaped areas, and other improvements to be constructed or installed.
- Identification of trees to be preserved, trees to be removed, including dead trees, and trees to be replanted.
- Proposed grade changes that might adversely affect or endanger trees with written instructions on how to maintain the trees.
- In addition to this graphic information, a written statement shall be included noting the reasons why tree removal is requested.

On-Site Inspection

Trees scheduled for removal shall be tagged by the requestor with colored plastic tape to help the Base Civil Engineer with the identification of the subject trees. Prior to issuance of a tree removal permit, the Base Civil Engineer or his/her representative shall conduct an on-site inspection.

Conditions of Approval

The Base Civil Engineer may approve the permit if one or more of the following conditions are present:

- **Safety Hazard -** Necessity to remove trees that pose a safety hazard to pedestrians or vehicle traffic or threaten to cause disruption of public services, or that pose a safety hazard to persons or buildings.
- **Diseased or Weakened Trees -** Necessity to remove diseased trees or trees weakened by age, storm, fire, or other injury.
- **Good Forestry Practices -** Necessity to observe good forestry practices.
- **Construction of Improvements -** Necessity to remove trees in order to construct proposed improvements such as:
  - Need for access around the proposed structure for construction equipment.
  - Need for access to the building site for construction equipment.
  - Essential grade changes.
  - Surface water drainage and utility installations.
  - Location of driveways, buildings, or other permanent improvements.
- **Compliance with Other Instructions—**Necessity for compliance with other Air Force Instructions, health provisions, or other environmental instructions/statutes.

Review

The Base Civil Engineer shall have 30 working days after receipt of a completed application filed pursuant to this instruction in which to approve or deny the requested permit. In the event an application is denied, the Base Civil Engineer shall specify to the applicant in writing the reason for said action.

8.6 Enforcement

Stop Work Order

Whenever the Base Civil Engineer determines that a violation of this instruction has occurred, the following actions shall be initiated:

- **Written Notice -** Immediately issue written notice by personal delivery or certified mail to the contractor or organization violating this instruction of the nature and location of the violation, specifying what remedial steps are necessary to bring the project into compliance. Such person or organization shall immediately, conditions permitting, commence the remedial action and shall have 10 working days after receipt of said notice, or such longer time as may be allowed by the Base Civil Engineer, to complete the remedial actions set forth in said notice.

- **Remedial Work and Stop Work Orders -** If a subsequent violation occurs during the 10 working days referred to in "Written Notice" above, or if remedial work specified in the notice of violation is not completed within the time allowed, or if clearing and development of land is occurring without a permit, then the Base Civil Engineer shall issue a stop work order immediately. Said stop work order shall contain the ground for its issuance, and shall set forth the nature of the violation. The stop work orders shall be directed to the person or organization whose land is being improved and to the person(s) or firm actually performing the physical labors of the development activity or the person responsible for the development activity, directing him forthwith to cease and desist all or any portion of the work upon all or any geographical portion of the project, except such remedial work as is deemed necessary to bring the project into compliance. If such person fails to complete the recommended remedial action within the time allowed, or fails to take the required action after the issuance of such stop work order, then the Base Civil Engineer may issue a stop work order on all or any portion of the entire project.

- **Notification by Responsible Person or Organization -** Upon completion of the remedial work, the responsible person or organization shall notify, in writing, the Base Civil Engineer that such remedial work has been completed. The Base Civil Engineer shall inspect the work to verify remedial compliance.

- **Notice of Compliance -** After inspection by the Base Civil Engineer and upon completion of remedial steps required by notice, the Base Civil Engineer shall issue a notice of compliance and cancellation of said notice or stop work order.

- **Penalty -** The fine for violating this section shall be based on the size of the tree removed without a permit. Each day a violation of a stop work order continues shall constitute a separate offense. Each protected tree removed without a permit, or in violation of a permit, shall constitute a separate offense. The fine shall be based on the diameter of the removed tree. The minimum fine shall be $300.00 per inch of diameter per offense per day until cancellation

of said stop work order, but the fine may be increased by the Base Civil Engineer due to the type of tree removed.

Appeal

Any person adversely affected by a decision of the Base Civil Engineer in the interpretation or enforcement of the provisions of this Appendix may appeal such decision to the Base Commander. Such appeal shall be submitted in writing within 30 days of the rendering of the subject order, requirement, decision, or determination.

8.7 Low Impact Development Checklist

Low Impact Development (LID) is a type of smart growth to manage stormwater, conserve greenspace and irrigate smarter. These items should be considered for future projects.

Permeable Pavement – This can be permeable pavers or pavement. The permeability of these surfaces will reduce runoff replenishing the water table below. Reducing road surfaces increases the amount of permeable areas.

Conserved Green Space – Natural terrain protects soils from disturbance and compaction. "Wild" areas allow for naturalization and encourages interaction with wildlife.

Rain Gardens – Small vegetated depressions in the landscape collect and filter stormwater into the soil. These can be accomplished as vegetative swales, an alternative to the curb and gutter systems. Vegetative swales can be installed along streets, parking and runways. These gardens are a vegetated way to slow runoff and promote infiltration.

Green Roof Systems – Green roofs can significantly reduce the rate and quantity of runoff from the roof and provide buildings with improved insulation, improved aesthetics and promote the quality of air.

Stormwater Reuse – Surface ponds, underground catchments, cisterns and rain barrels can be used to store water. With these systems, water can be reused for irrigation.

Enhanced Storm Basins – Stormwater ponds can be improved through use of wetland plants. Vegetation enhances the quality of water stored and attracts wildlife.

8.8 Rain Gardens

Rain gardens are landscaped areas designed to collect and utilize rainwater. They are a great way to reclaim rainwater from a roof downspout or driveway. Rain gardens allow more water from rain to soak into the ground to water plants and create a beautiful, low-maintenance landscaped bed. Typically about 30 percent more water from a rain soaks into the ground in a rain garden than in an equivalent area of lawn. Rain gardens reduce stormwater runoff that carries pollutants from fertilizers and pesticides and debris washing from lawns and driveways into nearby rivers, lakes or streams. They also prevent damage to stream banks and reduce the risk of local flooding. In addition to being beautiful, they can provide valuable habitat to many birds and butterflies.

A rain garden collects stormwater, filters it through soils and plants and allows it to soak into the ground. A rain garden receives runoff water from lawns as well as rooftops or other hard surfaces such as driveways. The garden's shape holds the water on the landscape so that it can soak into the ground instead of flowing down storm drains, taking away water that can be used. The plants, mulch and soil in a rain garden combine natural physical, biological and chemical processes to remove pollutants from runoff. Many pollutants will be filtered out and break down in the soil over time.

Rain gardens are best located in low areas if the yard where runoff tends to flow. While they should not be built next to a building's foundations, rain gardens located near to impervious surface such as driveways, patios and sidewalks can easily capture the runoff from these areas. A rain garden should be located at least 10 feet from the foundation of a building. Sites with more than a 12 percent slope may not be suitable for rain gardens. Also, if there are septic systems, avoid planting a rain garden over top of the system.

- Locate a rain garden in natural depressions in the landscape near a downspout of the home.
- Lay out the boundary of the rain garden with the longest length perpendicular to the slope of the land.
- Design rain garden to hold about 6" of water above the ground surface.
- Rain garden should be located in such a way that a low berm on the downhill side of the rain garden will hold back the appropriate amount of water.
- The bottom of the rain garden should be as level as possible, minor grading may be necessary. Try to avoid compaction of soils.
- A shallow swale or corrugated drain pipe (buried or above ground) will channel runoff from the roof downspout or paved surface to the rain garden.
- The soil in the rain garden should be a loose, sandy organic soil that allows water to quickly soak into the ground to nourish plant roots and recharge the groundwater. A general rule-of-thumb is to have a soil that soaks in about one inch of water per hour. The following steps will help to achieve this:
    - Mix organic matter into the soil within the rain garden by spreading 2 to 4 inches of compost over the area and mixing the organic matter in with the existing soil.

- If the soil is acidic (has a low pH), lime should also be added to neutralize the pH of the soil.

- For soils with high clay content, it may be beneficial to remove about 1-2 feet of the soil and replace it with a more porous "rain garden soil." A soil mix suitable for rain gardens is a mix of 50-60 percent sand, 20-30 percent topsoil, and 20-30 percent compost. The clay content in the rain garden soil replacement mix should be no more than 10 percent.

- Establish a grass or groundcover border along the upper edge of the rain garden to slow down the runoff water as it enters the rain garden. Do the same over the berm to stabilize it as a border of the rain garden.

- Plant drought tolerant, wet tolerant, hardy plants. A mix of ornamental grasses, shrubs and self-seeding perennials are good choices.

- Once plants are in place, cover the rain garden with a 3" layer of inorganic mulch.

- Remove weeds on a regular basis and replenish mulch as needed.

- Plan on providing an "overflow" path for water to take if it keeps raining after the rain garden fills up. This path should be stabilized with a hardy grass or groundcover.

A rain garden can be a more natural landscape, combining beauty with less maintenance and less need for chemicals.

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