

**ABACOA
MANAGEMENT PLAN**

SECTION C: GOPHER TORTOISE

CONTENTS

| | | |
|------------|---------------------------------------|----|
| 1.0 | INTRODUCTION | 3 |
| | 1.1 MANAGEMENT AREAS | 4 |
| | 1.2 DISTRIBUTION | 4 |
| | 1.3 RANGES | 5 |
| | 1.4 RELOCATION CONFIGURATION | 5 |
| 2.0 | OBJECTIVES | 7 |
| | 2.1 FACTORS AND CONSIDERATIONS | 7 |
| 3.0 | MANAGEMENT | 8 |
| | 3.1 MANAGEMENT INITIATIVES | 8 |
| | 3.2 IMPLEMENTATION | 9 |
| | 3.2.1. Preparation of Recipient Sites | |
| | 3.2.2. Relocation from Donor Sites | |
| | 3.3 MAINTENANCE/MONITORING | 13 |
| 4.0 | SUMMARY | 16 |
| 5.0 | EXHIBITS | 19 |

1.0 INTRODUCTION

The overall configuration of the Upland Preserve is contained within the larger Abacoa matrix. It includes, within its confines, a diverse assemblage of ecotypes described as variants of pine flatwood associations which consist of various floristic phases translated over the subtle microtopographical gradients and soils. Some of these associations represent artifacts of dry prairies, which have been altered extensively by a variety of water drainage and extractive well field draw-down influences over less than three decades. Coupled with the hydrologic alterations, there are other agents of physical disturbances (agricultural, clearing, and decades of fire exclusion) which have collectively influenced the population biology of individual species, as well as, ecosystem structure and function.

Fire exclusion has altered the density of understory features, mainly in the form of producing dominant growth patterns of saw palmetto (*Serenoa repens*) throughout all areas of the Upland Preserve, creating dense thickets that displace much of the open herbaceous layer. Pine tree canopy features have become greater in all areas with second and third generation growth characteristics of denser stands altering long-term successional trends.

The existing alignment of the Upland Preserve includes a cross-section of representative ecotype distributions that express unique habitat characteristics to the agents of disturbance, durational effects, and long-term ramifications. Plant community composition is linear, with exception of the nodding Pinweed (*Lechea cernua*) and a few isolated sand pines (*Pinus clausa*) which have established themselves in the northwest quadrant and toward the center of the site. The former being effected by proximity to the existing well-field depressional zone effect and the latter, with higher gradients, linked to drier site conditions induced from surface drainage in the localized habitat structure. Saw palmetto (*Serenoa repens*) and slash pine (*Pinus elliottii* var. *densa*) are ubiquitous to the overall Upland Preserve, varying in coverage and density in accordance with hydrologic depressional effects and long-term fire exclusion regimes.

A significant resident population of gopher tortoise exist within Abacoa as a discontinuous and dispersed population due to the exclusionary successional trends which are narrowing suitable sites by virtue of vegetative coverage and altered habitat features. Gopher tortoise population dynamics and burrow formation rates and distribution are affected by onsite factors such as fire exclusion, canopy development, hydrology, patch dynamics (succession and distribution of habitat patches in space and time) within habitat fragments, vegetative biomass accumulation, and forage quality (herbaceous groundstory ratios) linked to crude protein and roughage availability in relation to distance from burrows. Aggregate (colonies) populations are the exception onsite, while isolated individuals appear to be the norm, the individual populations are spatially and temporally distributed by virtue of natural openings within the flatwood feature, and among openings generated from anthropogenic disturbances in the form of overburden berms, right-of-ways, maintenance easements, and past "lighter pine" stumping excavations.

Onsite gopher tortoise population expresses an adaptive "opportunistic" propensity to utilize marginally suitable sites (man-made/induced) with regularity as more suitable open (natural) microsites disappear from vegetative closure at the understory level. Functional and spatial characteristics needed to sustain viable long-term populations of gopher tortoise onsite are configured within 181 acres of the overall Upland Preserve System and shall be maintained as suitable gopher tortoise habitat in perpetuity.

1.1 MANAGEMENT AREAS

The geometry of the Gopher Tortoise Management Area creates two distinct and disconnected Management Areas within portions of the Upland Preserve, they are as follows:

1. **Western Management Area "A"** (west of Military Trail): combined are of 110 +/- acres, contained within Habitat Ranges IV, VIa, VIb, IX and X. Combined ranges will accommodate an estimated population of:
 - 231 +/- tortoises @ 2.1 ac. low range stocking rate
 - 264 +/- tortoises @ 2.4 ac. mid range stocking rate
 - 297 +/- tortoises @ 2.7 ac. high range stocking rate

2. **Eastern Management Area "B"** (east of Military Trail): combined area of 71 +/- acres, contained within Habitat Ranges I & II. Combined ranges will accommodate an estimated population of:
 - 149 +/- tortoises @ 2.1 ac. low range stocking rate
 - 170 +/- tortoises @ 2.4 ac. mid range stocking rate
 - 198 +/- tortoises @ 2.7 ac. high range stocking rate

* Minimum home range estimates are taken from: Nongame Wildlife Program Technical Report No. 4 (FGFWFC) Ecology and Habitat Protection Needs of Gopher Tortoise Populations Found on Lands Stated for Large Scale Development in Florida (p. 31). References mean value for all studies conducted on density estimates between 1979 to 1989 (five studies) were calculated at 2.7 +/- to 2.1 gopher tortoise/individuals per acre.

1.2 DISTRIBUTION

Overall acreage devoted to the support of the insitu gopher tortoise population is 70% of the Upland Preserve. The Gopher Tortoise Management Area contains multiple corridors and network structures that establish continuous linkages, within which alternate movement corridors, from redundant links, combine into a network of habitat nodes and migration intervals.

Current distribution of onsite gopher tortoises within the Upland Preserve implies that the Gopher Tortoise Management Area, in its present spatial geometry, captures 49.5% of the estimated 321 tortoises within its boundaries. This implied figure estimates that the remaining dispersed individuals, approximately 50.5%, will be relocated within the referenced Ranges during the life-time of the development of Abacoa.

1.3 RANGES

Ranges within the Gopher Tortoise Management Area will be maintained in optimal open habitat condition conducive to foraging and burrow structuring by active management strategies (see Exhibit A). Ranges, after management ploys (initial) collectively hold home range size of 0.56 acres (density/acre) per individual tortoise with implied 50% overlap for home range distribution. This figure comes very close to agreement with relations between habitat type (slash pine/palmetto) and densities of gopher tortoises per acre estimates of [Auffenberg & Iverson (1979), Auffenberg & Franz (1982), Landers & Speake (1980), MacDonald (1986), and Breininger (1988)]. The mean value for all these referenced studies (across all habitat types) was 2.7 to 2.1 gopher tortoise per acre.

In the case of the Gopher Tortoise Management Area at Abacoa, specific ranges reflect quality and diversity of habitat on the entire site and encompasses 18.5% of the entire 980 mixed upland habitat found onsite. The configuration of the Management Area takes into account dispersed distribution of gopher tortoises onsite, and the projected intensity of the proposed long-term habitat management activities.

1.4 RELOCATION CONFIGURATIONS

Each development sequence will occur within a five year period and will overlap and dovetail with the preceding phase sequence somewhere within the fifth year. Within these phase, the following Ranges will be utilized as recipient sites (onsite) and are estimated to contain at any given time (post-initial management sequence) the following stocking thresholds:

A. Phase I (Years 1-5)

| | | | |
|---------------|--------------------------------|------------|--------------|
| Range I | (60.4 +/- ac.) - 127 tortoises | @ 2.1/ac., | 163 @ 2.7/ac |
| Range II | (11.0 +/- ac.) - 23 tortoises | @ 2.1/ac., | 30 @ 2.7/ac |
| Ranges IV & V | (37.0 +/- ac.) - 78 tortoises | @ 2.1/ac., | 100 @ 2.7/ac |
| Range VIa | (23.0 +/- ac.) - 48 tortoises | @ 2.1/ac., | 62 @ 2.7/ac |

Subtotal: 276 @ 2.1/ac., 355 @ 2.7/ac.

B. Phase II (Years 5-10)

| | | | |
|-----------------|-------------------------------|------------|-------------|
| Ranges VIb & IX | (16.0 +/- ac.) - 34 tortoises | @ 2.1/ac., | 43 @ 2.7/ac |
|-----------------|-------------------------------|------------|-------------|

C. Phase III (Years 10-15)

Ranges X (33.6 +/- ac.) - 71 tortoises @ 2.1/ac., 91 @ 2.7/ac

Total Acres: 181

D. Total Stocking Threshold for 181 acre Management Area:

380 tortoises @ 2.1/ac. low range stocking rate
434 tortoises @ 2.4/ac. mid range stocking rate
488 tortoises @ 2.7/ac. high range stocking rate

*Connectivity of ranges in context to respective Management Areas (A and B) is implied as a standard requirement and design feature. Physical severances within each of these areas will be tempered and nullified by incorporating tunnels to facilitate sufficient delivery of the target species to on-line habitat patches within the corridor. Military Trail has acted as a physical barrier and severance for more than three decades for migration and implies distinct populations within the two Management Areas (A & B) formulated over this time span.

2.0 OBJECTIVES

Explicit conservation objectives directed toward the long-term management of insitu gopher tortoise populations implies maintenance, and where necessary enhancement, of the pine flatwood associations and ecotypes operable within the boundaries of the Gopher Tortoise Management Area. Also implied is the preservation and protection of both rarer and more sensitive habitat assemblages and species populations that interact at the ecosystem process level within this system.

Conservation and management practices within the Gopher Tortoise Management Area will complement the larger Upland Preserve by interfacing and integrating management principles and methods which simulate or preserve vital ecological processes (fire regimes, micro-climate, herbivory, predation) that are essential to maintaining not only supportive elements at a species-specific level (Gopher Tortoise) but sustain the entire ecological component of the landscape.

Models were developed from actual regional sites (Kitchen Creek, J.D. State Park) as a reference for replicating successful approaches with local 'onsite' adaptations applied to insitu habitat systems.

Many of the key components of the original system still exist within the Upland Preserve, composition has remained relatively the same, distribution and specific abundance has been altered because of disturbance agents (hydrologic depression and fire exclusion), which from a process level will be entwined back into the operational system by creating the surface water retention system interior of the Upland Preserve matrix (overlaid over relic wetland features of the landscape) and reintroducing prescriptive fire regimes within the Gopher Tortoise Management Area.

Many of the conservation goals will be accomplished through a few relatively broad-based management ploys because of their complementary actions of protecting species level processes with maintaining community structure processes within the pine flatwood system. Conservation goals from a community level are aimed at maintaining the system's natural nutrient cycling, its high diversity, and to allow reproduction of the many component species. Conservation goals from a species population level target retaining necessary distribution, dispersal, connectivity, genetic viability, functional interactions of the species, variability of environmental parameters, and the variability of the population's vital rates (fecundity, mortality rates).

2.1 FACTORS AND CONSIDERATIONS

Most conservation goals reduce to the concerns of temporal and spatial processes: the population dynamics of a species and the dynamics of its demographic (topographic and physiographic conditions of site) ranges within the Upland Preserve. Extinction (local or macroscale) consists of either the population size or suitable habitat (ranges) going to zero. Many other factors, intermediately, come into play (inbreeding depression, heterozygosity, genetic distance, and outcrossing depression) in this downward spiral of extinction but the outcome remains constant.

Specific to these interrelated concerns of temporal and spatial processes are included factors that are extrinsic to threatened or listed species, such as environmental uncertainty (variability) and natural catastrophes (droughts, hurricanes, wild fires, greenhouse effects), as well as intrinsic factors, such as demographic (population) and genetic uncertainty. These factors interact within the temporal and spatial context and become requisite considerations for all future management strategies within the Gopher Tortoise Management Area. Of the four factors, only one (natural catastrophes) is beyond direct influence of the management process. Even this factor will be inadvertently addressed under proposed management strategies, in the form of minimizing risk of wild fires associated with present fuel loads onsite, through prescriptive fire management to reduce fuel and duff biomass, and alterations to drought potentials and durations by routing the proposed Constructed Water Management System through the interior of the Upland Preserve substantially increasing groundwater recharge potentials to presently hyper-drained habitat systems. The other three factors (environmental uncertainty, demographics, and genetic uncertainty) are specifically addressed collectively within the development of the long-term management plan for the gopher tortoise/listed species at Abacoa.

The Management Plan considers short-term actions that invariably carry over to long-term management considerations with long-range benefits derived over the life-time of Abacoa. Thus the following outlined strategies are reciprocal to both short and long-term considerations and are given separate treatment titles only as arbitrary function, which in reality are indistinguishable within the context of whole system management.

At current levels of habitat/vegetative succession, insitu populations of tortoises will continue dispersed characteristics due to vegetative coverage aspects and eventually lead to tendencies toward random genetic drift. The Gopher Tortoise Management Area offers in many ways, through management of its component processes, assurances of long-term survival of the species within an area of predictable continuums of suitable provisioned habitat.

3.0 MANAGEMENT

The following detailed description of management provisions and strategies will be adopted for creating and maintaining suitable gopher tortoise habitat for the long-term survival of insitu populations within the Gopher Tortoise Management Area at Abacoa. Interrelated spatial and temporal factors (extrinsic and intrinsic) are sequentially considered as part of the formulative process, because of their affect on survival over the long-term.

3.1 MANAGEMENT INITIATIVES

Without the guarantees of protection, delineation, and management/maintenance to optimize habitat suitability with attached assurances of its long-term protection, variability within habitat structures and overall suitability of vegetative site features can pose limits to long-term survival of the gopher tortoise. The main management strategy will be the establishment of multiple sites with built-in continuity which are unlikely to be affected adversely by the same perturbations at any given time.

This strategy will be conveyed by the following initiatives:

- A. Boundaries of Upland Preserve will be delineated and posted with signage. (see Section A: Upland Preserve Management Plan for Methodology)
- B. All exotic plant vector species will be eradicated. (see Section A: Upland Preserve Management Plan for Methodology)
- C. Dedication of Upland Preserve Site(s) within the present phase of development. (see Section A: Upland Preserve Management Plan for Methodology)
- D. Delineate Gopher Tortoise Management boundaries (Ranges/Sites) prior to construction commencement, in relation to phase of development.
- E. Barrier fence erected around Gopher Tortoise Management Areas provisioned under current phase of development. Protection from nuisance/predators such as raccoons, opossums, armadillos, dogs, and cats will be provided by the establishment of the referenced barrier fence 4.5 feet high above ground with .5 feet buried underground composed of 2" x 2" mesh wire to act as containment for gopher tortoise and insulator to outside disruptive agents and predators such as dogs and cats (see Exhibit B). Native species such as opossums, fox, and raccoons will be monitored for movement, population, and actual destruction patterns of burrows and apron areas or impacts specific to the gopher tortoise prior to management recommendations specific to species and situation. Fenced Gopher Tortoise Management Area(s) will maintain several points of entry to facilitate maintenance, education, research, observation, and monitoring, in the form of a self-closing gate feature. Monitoring for disruptive elements and agents will be an ongoing process integral to management and maintenance within the Upland Preserve by all participants.
- F. Active management of site by enacting initial ecological/prescriptive fire regimes, followed by staggered intervals (2-3, 5-7 years) in accordance with physiographic/vegetative conditions conducive to open understory/herbaceous groundstory 'flatwood' habitat to insure food resource availability and quality, thus optimizing average rate of energy gain per unit of foraging time and reducing necessary forage radii of local gopher tortoise populations within Ranges. (See Section D: Prescriptive Fire Management Plan)

3.2 IMPLEMENTATION

- 3.2.1 Recipient Sites.** Recipient sites are those designated ranges within the Upland Preserve Management Area which will be maintained specifically for the Gopher Tortoise. Preparation and management of the recipient gopher tortoise areas entails a certain amount of habitat manipulation measures including: exotic eradication, mowing and prescriptive fires, to increase habitat quality. This results in tortoise populations with greater local densities and forage radii and maintains different habitat patches which

benefit many other onsite wildlife species, thus increasing present carrying-capacities. Preparation of the Gopher Tortoise Management Areas shall include the following sequences:

- A. Sites will undergo preparatory measures that will align with phases enacted during development sequences over the build-out of Abacoa. Exactitudes in timing of such events and sequences become less hard as development goes beyond the immediate phase, but will in all events follow similar sequencing and priorities, to include the following:
 1. File for gopher tortoise/relocation/release Permit (FGFWFC 39-27.002 of the Wildlife Code of the State of Fla. (Title 39, F.A.C.)
 2. Site(s) boundaries delineated and a date established for the completion of the boundary survey and legal description.
 3. Site(s) surveyed for insitu gopher tortoise population (mapped, field staked)
 4. Site(s) surveyed for other listed species or sensitive structures, features or anomalies that command cognizant recognition for feature management (mapped, plotted, field staked).
 5. Fire breaks established - vegetative "modification" approval from Town of Jupiter.
 6. Removal of exotic, nuisance and "edited" species. Reintroduction monitoring is begun to ascertain further maintenance to eradicate recruited exotics.
 7. Diminutize saw palmetto thickets, lower fuel ladders and establish lower biomass vegetative fuel brakes/trails in preparation for Prescriptive Fire sequence. (see Section D: Prescriptive Fire Management Plan)
 8. Barrier fence erected around site provisioned under current phase of development. Protection from nuisance/predators such as raccoons, opossums, armadillos, dogs, and cats will be provided by the establishment of the referenced barrier fence 4.5 feet high above ground with .5 feet buried underground composed of 2" x 2" mesh wire to act as containment for gopher tortoise and insulator to outside disruptive agents and predators such as dogs and cats (see Exhibit B). Native species such as opossums, fox, and raccoons will be monitored for movement, population, and actual destruction patterns of burrows and apron areas or impacts specific to the gopher tortoise prior to management recommendations specific to species and situation. Fenced Gopher Tortoise Management Area will maintain several points of entry to facilitate maintenance,

education, research, observation, and monitoring, in the form of a self-closing gate feature. Monitoring for disruptive elements and agents will be an ongoing process integral to management and maintenance within the Upland Preserve by all participants.

9. Prescriptive Fire initiation as required and provided for in Section D: Prescriptive Fire Management Plan (pre-ignition/ignition/ suppression/analysis).
 10. Complete the boundary survey & legal description, and record deed & deed restrictions.
- B. Post Burn Analysis of insitu gopher tortoise population and supportive vegetative resprouting and recruitment of foraging radii. Begin monitoring of site, for the following elements:
1. Insitu population post-burn from burrow counts and estimates.
 2. Movement of local populations foraging radii, migration corridors within the Range and Burn Unit.
 3. Evaluate reactions (qualitative) to post-burn, fencing, and development activities.
 4. File report of burn and post-burn analysis with Florida. Game & Freshwater Fish Commission (FGFWFL) and Town of Jupiter and TCRPC.

3.2.2. Relocation From Donor Sites. Donor sites are those areas which fall outside of the Upland Preserve Management Area. Posturing and preparation for the relocation sequence on donor site(s) will be completed in conjunction with the preparation of the recipient sites or once recipient sites have been completed.

- A. This posturing and preparation includes the following sequences:
1. Biological survey and assessment of gopher tortoise burrows (active/inactive) and other sensitive or listed species and or habitat structures (snags) within the future altered sites (mapped, logged, plotted and field staked).
 2. Ascertain relocation quantities relative to recipient site carrying capacity.
 3. File for Gopher Tortoise capture/relocation/release Permit (FGFWFC) 39-27.002 of the Wildlife Code of the State of Florida (Title 39, F.A.C.).
 4. Obtain permit for relocation in conjunction with recorded deed restrictions of recipient site.

5. Initiate relocation sequence by the following capture methodologies and conducted in the following manner:
 - a. Excavated from burrows (e.g. with backhoe)
 - b. Trapped or otherwise captured by non-harmful means (e.g. pitfall traps).
 - c. Open capture of foraging tortoises outside of preserve areas.

*Capture methods are to follow Guidelines for Gopher Tortoise Relocations recommendations (FGFWFC, 1988)

B. Transport and Release methodologies will maintain the following criteria:

1. Captured tortoises will be transported without undue delay and under shaded and sanitary conditions. Care will be taken to avoid prolonged stressors to the individual gopher tortoise, or physical damage (e.g. abrasions) to intransit tortoises. Physical monitoring and representative (population) testing of relocated stock for exposure to the URTD mycoplasma will be conducted in random sampling prior to relocation into recipient site. In the event detection of URTD is verified in any individual or population they should be quarantined in an appointed holding site (pen) and evaluated for either later discharge or relocation in later phases or elimination from stock. The physical monitoring of local-natural populations within the Gopher Tortoise Management Areas will be an ongoing evaluation process, mandatory from the aspects of:
 - a. Ensuring survival and reproduction of individuals maintained in the managed areas.
 - b. Avoid infectious agents transmission to other stocks.
 - c. Eliminate the possibility of creating native populations epizootics after release of donor individuals.
2. Prior to release, each relocated tortoise will be sexed (adults only), measured, weighed and permanently or uniquely marked by scute-notching (Cagle, 1939), or other accepted means, and logged under number for later baseline information to be followed under future monitoring at recipient site.
3. Distribution of relocated tortoise should be according to physiographic features, location or existing burrows, and vicinity to shade and forage resources (per the criteria of Auffenberg & Franz, 1982).
4. Reporting all mortalities or debilitating injuries occurring during the capture,

relocation, release within five (5) days of incident to FGFWFC.

C. Post Relocation considerations and monitoring:

1. One year after release/relocation of onsite gopher tortoises (within 10 days of previous years release date) recipient sites will be re-evaluated to assess success of relocation process and ascertain possible amendments to the on-going management program. Evaluation will consist of:
 - a. Thorough recording of all encountered individuals, burrows (active, inactive, old categories) and plotted on acceptable scaled maps. (monitoring for 5 years)
 - b. Interim assessments will catalog:
 - colonies or aggregate populations establishment
 - migration - forage trails and corridors
 - health post-movement/relocation by random sampling and observation
 - social behavior of local populations
 - disruptive agents (predators, weather, etc.)
 - observations pertinent to long-range management strategies at Range scales
2. A post-relocation report will be compiled and submitted to Florida Game and Freshwater Fish Commission, TCRPC, and Town of Jupiter as an initial evaluation assessment process to the accuracy of the initial proposed management strategies and facilitate modifications and amendments, if deemed necessary, to give added assurances of the management strategies ability to anticipate, and maintain the extant population of gopher tortoise over the short and long-term future. (Five year monitoring of each Phase of development from time of relocation process.)

3.3 MAINTENANCE/MONITORING

Long-term survival parameters are closely attuned to population dispersal rates, density, growth rates, genetic effects, and overall carry-capacities of specific Gopher Tortoise Management Areas. Variability in environmental parameters and the variability of birth and death rates in natural populations are closely associated over the long-term. Assurances to the long-term survival of the Gopher Tortoise will be conveyed by the following management strategies:

- A. Determine the Minimum Viable Population size (MVP) to avoid local or macroscale extinction of tortoise due to chance factors affecting its population dynamics within the

Management Area. (see Exhibit C: MVP Determination)

- B. Establish multiple breeding populations within the Gopher Tortoise Management Area in order to maintain increased genetic fitness and prevent possible effects generated by local inbreeding (inbreeding depression) over long associations without introduced 'novel' gene exchanges from variant populations along migration corridors (see Exhibit D: Gene Dispersal Corridors). Fixation of detrimental alleles in a finite population can persist without such exchanges. Population bottlenecks are to be avoided.
- C. Maintenance of genetic diversity within the Gopher Tortoise Management Area will be administered to by several methodologies:
 - 1. Initial translocation of gopher tortoise from non-preserved areas into designated Management Sites to increase heterogeneity of local populations.
 - 2. Passive cross-over migration mixing and chance encounters (emigration) along corridor and patch exchanges.
 - 3. Transplanting of individuals from distinct insitu populations once every 10-20 years if necessary to sustain dwindling populations or alleviate genetic stagnation/depression trends.
- D. In order that referenced migration corridors are maintained indefinitely, certain provisions for the establishment of exchange routes will be enacted within the two distinct Management Areas, west of Military Trail and east of Military Trail.
 - 1. Within each Management Area (A & B) long-term connectivity and linkage corridors will be established at designated roadway crossings (see Exhibit E) by incorporating tunnels or underpasses (see Exhibit F) for animal movement between habitat nodes.
 - 2. A maintenance ingress and egress trail (6-8' width) at the interface of the Constructed Surface Water Management System and the edge of the Upland Preserve will provide additional forage and travel corridor aspects.
 - *Gopher Tortoise typically forage and excavate burrows along such ecotones between open areas and denser scrub habitats.
 - 3. Vegetative fuelbreaks and spur trails (4-6' width) off main ingress/egress maintenance trail (6-8' width) will be established within herbaceous confine features of Upland Preserve to facilitate fire management lines and offer additional forage and migration travel corridors.
 - 4. The overall Gopher Tortoise Management Areas A & B will be maintained separately,

within the respective Management Areas A & B East of Military Trail and West of Military Trail.

- E. Multiple functional aspects of maintenance/firebreak spur trails will be utilized as interpretive trails for "educational enhancement" of local resident population at Abacoa establishing effective focal points for observation, education and research as part of long-term management goals for Gopher Tortoise Management Areas.
- F. Long-term maintenance of habitat areas will rely on Prescriptive Fire Regimes as primary management technology and tool. Initial maintenance of exotic or nuisance species will be addressed during the construction of the Surface Water Management System, wherein exists the greatest preponderance of Brazilian pepper/Melaleuca. These areas will be mechanically harvested and spot treated with appropriate herbicides to curtail re-establishment within habitat areas. Fire management sequencing throughout the life-time of the Management Area will effectively address additional concerns of reintroduction of exotic, nuisance, or prohibited species within the specific elements of the Gopher Tortoise Management Area. Spot herbicide treatments will be augmented with fire management and monitored over the long-term for reintroduction patterns and dispersal vectors.
- G. Monitoring of insitu (existing and translocated) gopher tortoise populations will proceed along the following lines prior to relocation/translocation efforts:
 - 1. Recipient sites will be "ground-truthed" for movement of adult and juvenile tortoises, surveyed for burrows (active and inactive designation) and recorded on base maps indicating the location and status of use category. Burrows will be staked in field (verified) and maintained for baseline data collection and are protected during pre-burn preparation of Ranges. Present carrying capacity shall be figured from field analysis and submitted to FGFWFC prior to relocation.
 - 2. Donor sites slated for alteration within the Active 'Phase' of development shall be thoroughly and systematically surveyed (no more than four weeks prior to relocation/translocation) using appropriate, biologically sound methodology as outlined in FGFWFC (Non Game Technical Report No. 4; Dec. 1987) in conjunction with ground-truthing for movement of adults and juvenile tortoises within site area. Location of burrows will be mapped and quantified and staked and flagged in field for protection and later investigation/extraction.

From the combined ascertained baseline data collected from both the recipient site and the donor site an accurate accounting of stocking/relocation ratios can be derived, so as to not overstock at present levels on site of the Management Areas A & B.

4.0 SUMMARY

The Gopher Tortoise Management Area at Abacoa is an extensive assemblage of representative upland flatwood associations which at present conditions are supportive of a significant, but widely dispersed gopher tortoise population of an estimated +/- 320 individuals.

Long-term habitat and vegetative successional trends suggest that this dispersed density population ratio active at an overall ecosystem level is pervasive in its long-term patterns and likely ramification as a continuum with eventual tendencies toward random genetic drift within the local population, due to exclusionary affect of vegetative closure. Onsite population, regardless of future posturing, is significant from the standpoint of a regionally "significant" biological feature within the Upland Preserve system at Abacoa.

For this and other subtle reasons, the insitu tortoise population will be managed onsite within the designed Upland Preserve Area, specific to the long-term maintenance and survival of the species by way of design and management strategies. Specific to these two strategies, the design of the habitat configuration for the insitu tortoise population is one of a wide linear corridor that is separated within context to the overall Abacoa matrix into two distinct Management Areas (A & B) by Military Trail which recognizes historical severance (25-40 years) and in many aspects represents two distinct onsite tortoise populations. Collectively the two Management Areas represent 181 acres of set aside within the greater Upland Preserve for the specific purpose of maintenance of the insitu gopher tortoise population and more broadly to its supportive habitat system dynamics. Conversely, the other habitat elements and listed species which may persist by virtue of facultative or obligate commensals or other unique species will be managed for in consort to the gopher tortoise.

The Ranges which make up the Gopher Tortoise Management Area will be developed sequentially within the context of Phases in relation to development over a period of +/- 15 years. Management is therefor sequential, but follows a standard form of strategies, methods, and provisional references including:

1. Standard management and preservation criteria developed from the definitive text on "Ecology and Habitat Protection Needs of Gopher Tortoise (*Gopherus polyphemus*) Populations Found on Lands Slated for Large-Scale Development in Florida" (Nongame Wildlife Program Technical Report No. 4, 1987, FGFWFC).
2. In abbreviated form the Abacoa Gopher Tortoise Management Area is considered both suitable and adequate from the standpoint of long-term survival of the extant population by the following rationale:
 - a. The Management Area configuration occupies 18.5% of overall upland areas estimate to contain suitable habitat. (derived from original 980 acre assessment figure)
 - b. The Management Area makes up 70% of overall Upland Preserve which was configured as the required 25% Upland Preserve by Town of Jupiter Upland. Set-aside Ordinance.
 - c. The combined Ranges will accommodate all estimates of gopher tortoise populations found onsite, with the ability to provisionally maintain an additional tortoises population in the event additional tortoises are found during any Phase of development. In the unlikelyhood that these figures are exceeded, provisions for offsite relocation will be formulated as an additional management consideration or Provisions will be made to bring under management additional acreage within the Upland Preserve Area. These additional Upland Preserve acreages would then fall under the before referenced sequencing and provisions of Gopher Tortoise Management.
 - d. Active management will, in the final analysis, elevate present functional habitat values and create rationale for the referenced assumptions.
 - e. Additional to the gopher tortoise, other listed species specific to the overall upland flatwood system complex, primarily: Pine Pinweed, Pine Pink, Catesby Lily, Golden Polypoly*, Shoestring Fern*, Butterfly Orchid*, will be provided protection, either insitu if they are found within the Upland Preserve Areas, or provisionally relocated in suitable habitat sites.

*Represent wetland relic/isolated species found within remnant cypress which are slated to be preserved will be protected insitu, or found within upland areas slated to be altered and will be relocated to suitable habitat either, by hand-transplanting or tree-spade.
 - f. Provisions will be made as specific instances arise when additional listed species are found onsite in areas slated to be altered.

- g. Specific Keystone structural elements such as snags (lighter pine) will be maintained insitu or relocated into Upland Preserve margins whenever possible to accommodate raptor species nesting and platform structural elements. Essential to long-term management of the Upland Preserve and isolated Preserved Wetlands will be provided protection, either insitu if they are found within Preserve Areas, or provisionally relocated in suitable habitat sites. Within the preserved flatwood habitats is the inclusion of active construction of avian perches, nesting and roosting platforms and nest boxes. These items, although part of the concerns of Upland Management, are expressed here but will be examined in more detail under specific habitat features in which they persist. (see Section A: Upland Preserve Management Plan)

5.0 **EXHIBITS**

- A. Upland Preserve Range Designations
- B. Fencing Detail
- C. MVP Determination
- D. Gene Dispersal Corridors
- E. Designated Roadway Crossings
- F. Roadway Crossing

ABACO
JUPITER, FLORIDA



FIVE MINUTE WALK
0' 400' 800' 1200'
SCALE: 1" = 400'

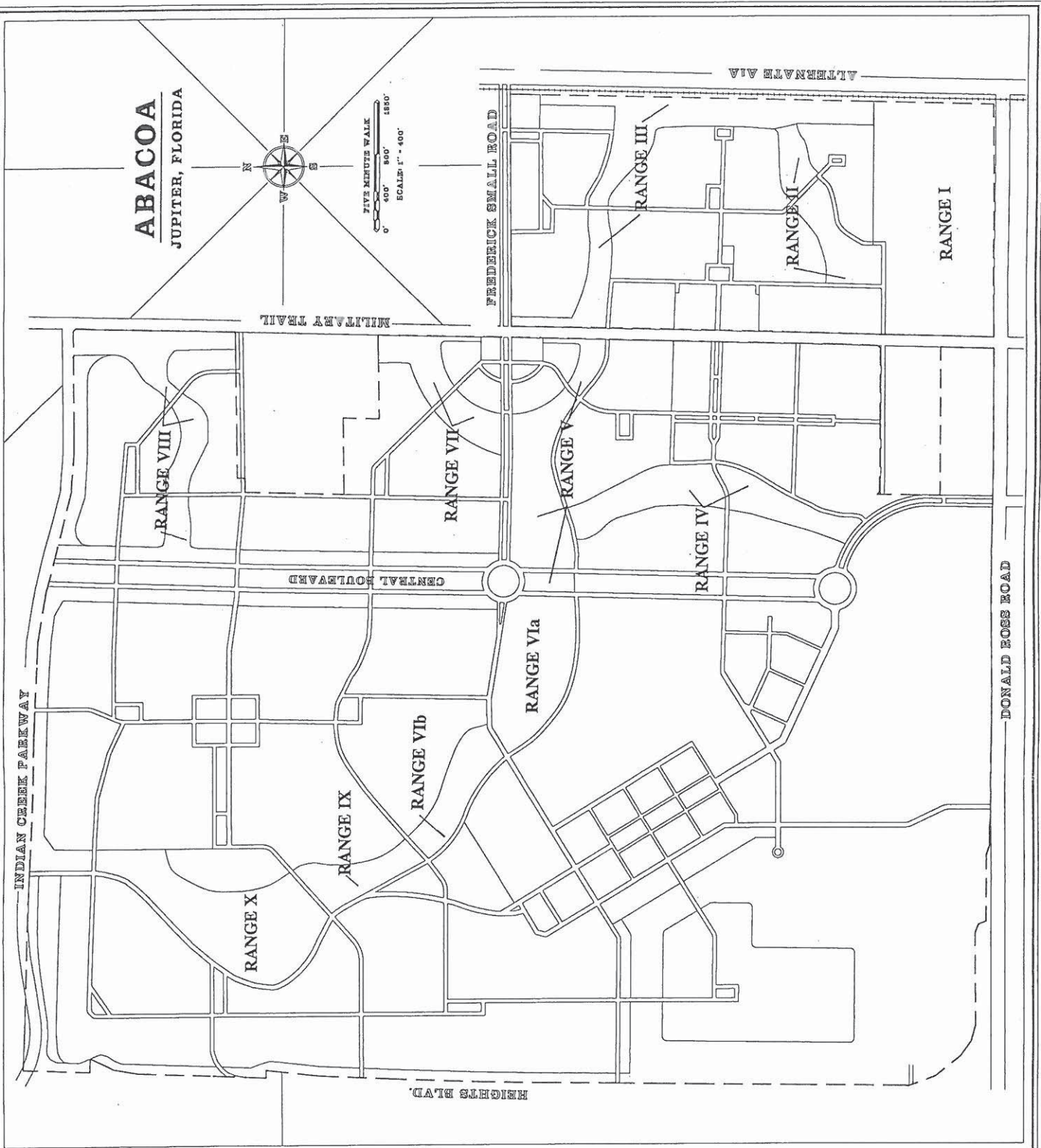
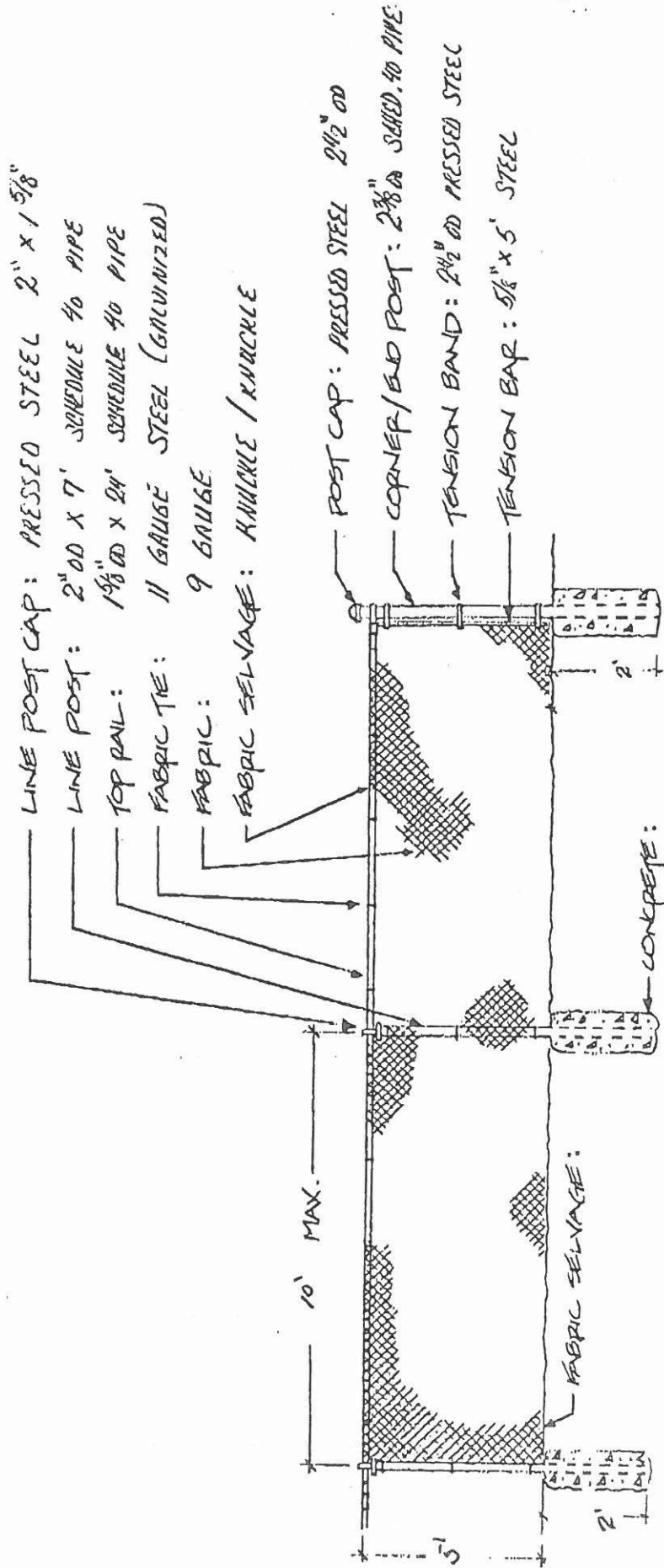


EXHIBIT A
UPLAND PRESERVE
RANGE DESIGNATIONS

EXHIBIT B
FENCING DETAIL



NOTE! FOR TORTOISE BARRIER,
FENCE IS TRENCHED INTO
EARTH SIX INCHES, HEIGHT
ABOVE GROUND IS 4 1/2'.

5' CHAIN LINK FENCING DETAIL

STYLE: TOP RAIL

NTS

EXHIBIT C MVP DETERMINATION

Minimum Viable Population (MVP) of onsite species Gopherus polyphemum necessary to avoid extinction due to various chance factors (extrinsic: environmental uncertainty and natural catastrophes, and intrinsic: demographic and genetic uncertainty) affecting its population dynamics. More precisely, the MVP is the population size which provides a given probability of persistence of the population for a given amount of time (e.g. a 50% expectation of persistence without loss of fitness for 200 years). Linear regression analysis was performed to extrapolate to the estimated population size need to meet the 200 year management goal. Extrapolating at this manner provides an estimate of the population size needed to have approximately a 50% chance of persisting for 200 years.

Assumptions made in this analysis/evaluation model was that management activities can influence many demographic (stochastic variations in sex ratios, birth and death rates, age-class distribution) parameters in gopher tortoise populations. The beneficial effects of certain management activities (fire regimes) on gopher tortoise persistence have been well documented (Auffenberg & Iverson 1979, Landers and Speake 1980, Landers & Breininger 1989). The values for fecundity and survival across all age classes were slightly altered in an arbitrary sensitivity analysis where "moderate" and "favorable" conditions mimic instances where attention is given to management to differing degrees. The parameters for "favorable" conditions best mirror demographic parameters observed in many well managed, natural gopher tortoise populations, either could be applied respectfully to Abacoa. Under those management conditions the following apply for estimating MVP of necessary gopher tortoise population for long-term survival:

- A. Moderate conditions: Populations as large as 130-150 individual appear to be needed to attain reasonable levels of persistence.
- B. Favorable conditions: Populations of approximately 40-50 individuals appear to have very good chance (>90%) of persisting for 200 years.

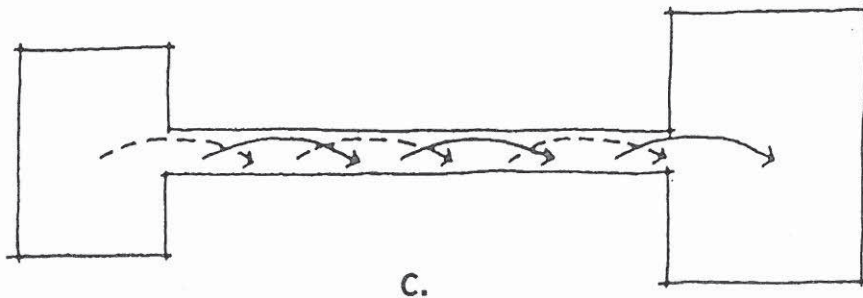
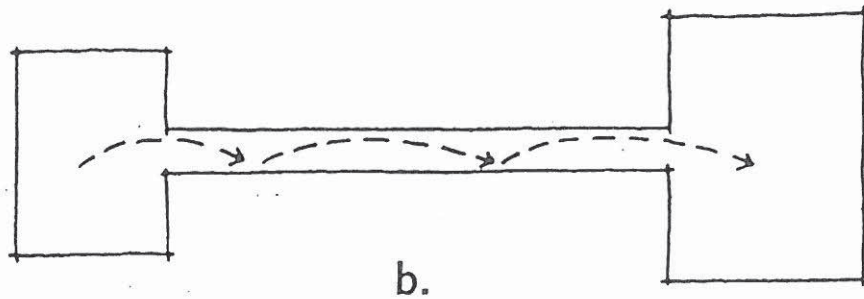
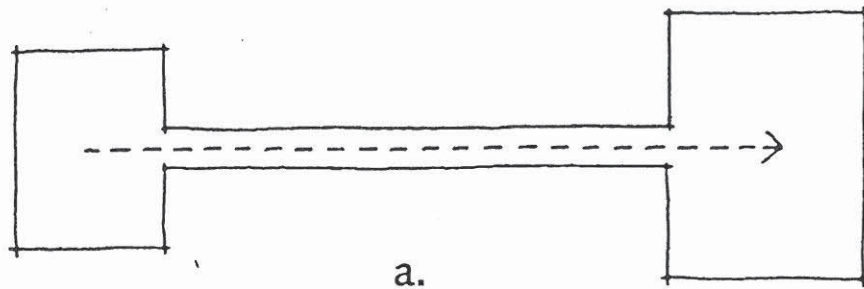
Specific to onsite relocation factoring, the following quantification breakdown applies to the overall Gopher Tortoise Management Area (GTMA):

- A. Of the original 980 acres of upland habitat within Abacoa, 25% (245 acres) was set aside as the Upland Preserve, satisfying the requirements of the Town of Jupiter. The GTMA (181 acres) within the Upland Preserve Area, equates to 18.5% of the original 980 acres of upland habitat.
- B. The 181 acre GTMA makes up 74% of the Upland Preserve Area.
- C. The 181 acre GTMA will have a density rate of 0.56 acres/gopher tortoise or 1.12 tortoises/acre. (*This is well within the parameter set forth by five studies conducted on density estimates between 1979 and 1989 which were calculated at 2.7 +/- to 2.1 gopher tortoise/individuals per acre)

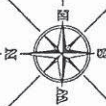
EXHIBIT D
GENE DISPERSAL CORRIDORS

The following sketches represent three ways in which corridors may facilitate dispersal of individual tortoises and genes between habitat nodes and/or patches:

- A. Direct, long-distance movement by single individual tortoise(s).
- B. Periodic movement by a single tortoise(s), punctuated by chance encounters with other individuals.
- C. Gene flow through a reproducing population resident within the corridor.



ABACOA
JUPITER, FLORIDA



FIVE MINUTE WALK
0" 400' 800' 1200'
SCALE 1" = 400'

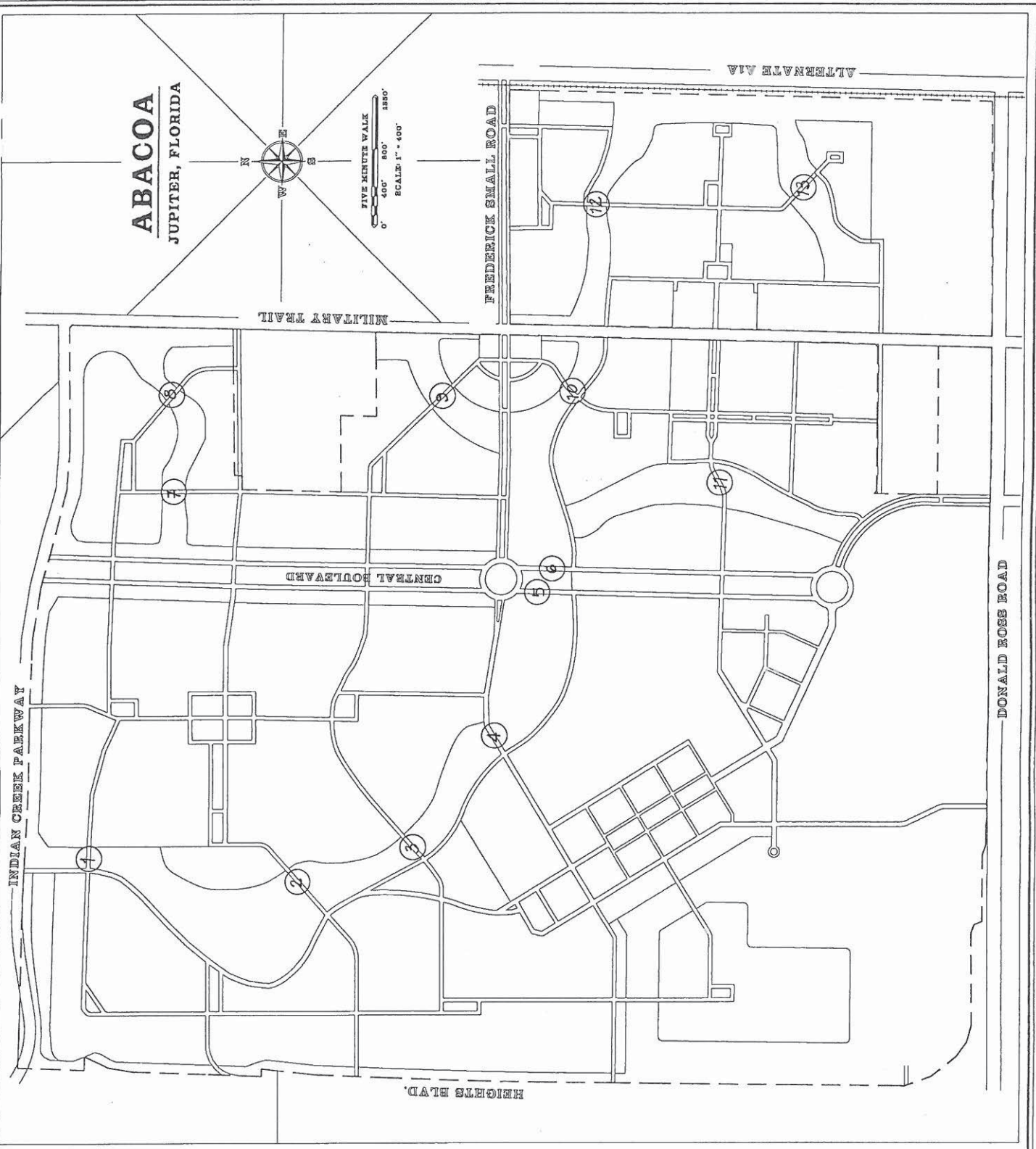


EXHIBIT E
DESIGNATED
ROADWAY CROSSINGS

EXHIBIT F ROADWAY CROSSING

Representative cross-section of passageway linkage under designated roadway crossings.

