Draft

Environmental Assessment

Bird/Wildlife Aircraft Strike Hazard

Risk Mitigation through Habitat Management,

JBSA-Randolph, TX

May 2021

Letters or other written comments provided may be published in the Final EA. As required by law, comments will be addressed in the Final EA and made available to the public. Any personal information provided will be kept confidential. Private addresses will be compiled to develop a mailing list for those requesting copies of the Final EA. However, only the names of the individuals making comments and their specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the Final EA.

DRAFT FINDING OF NO SIGNIFICANT IMPACT (FONSI)

for an

Environmental Assessment of

Bird/Wildlife Aircraft Strike Hazard Risk Mitigation through

Habitat Management, JBSA-Randolph, TX

Pursuant to provisions of the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4321 et seq.), the President's Council on Environmental Quality (CEQ) *Regulations Implementing the Procedural Provisions of NEPA* (40 Code of Federal Regulations [CFR] §§ 1500–1508), the United States Air Force (USAF) Environmental Impact Analysis Process (EIAP) (32 CFR § 989), Protection of Historic Properties (36 CFR § 800), and the National Preservation Programs (54 USC Subtitle III DIVISION A) to evaluate the potential environmental consequences associated with implementing a habitat management project to mitigate the bird/wildlife aircraft strike hazard (BASH) risk at JBSA-Randolph, TX.

The purpose of the Proposed Action is to mitigate existing Bird/Wildlife Aircraft Strike Hazard (BASH) threats and risks posed by the various species of birds living and roosting in the National Historic Landmark District's (NHLD) 175-acre urban forest between the two runways at JBSA-Randolph.

The need for the Proposed Action is to reduce the high BASH risk caused by the large population of birds roosting, breeding, and rearing young in the trees and shrubs between the two runways on JBSA-Randolph. The large bird population sharply elevates the risk of midair collisions with birds during take-offs and landings. These collisions can cause aircraft failure resulting in civilian and aircrew fatalities and property damage on JBSA-Randolph and in the local communities surrounding the airfield. By expanding its habitat management efforts, JBSA-Randolph seeks to minimize the attractiveness of the base to white winged doves and other species of birds and obtain a commensurate reduction in the BASH risk. The project's vegetation management goals also include guidelines designed to make positive changes that help restore the original historic landscape design, views, and viewsheds within the installation's Randolph Field NHLD.

PREFERRED ALTERNATIVE

The Preferred Alternative includes the following actions within the Randolph Field NHLD: removal of bird attracting shrubs and trees, reduction in tree density, removal of trees in North–South and East–West Parks, reduction of individual tree canopy density, removal of dead diseased and dying vegetation, and removal of shrubs with high-density foliage. Up to 40 percent of the healthy trees would be removed from the NHLD. The Preferred Alternative also would provide a sustainable vegetation management plan that would make positive changes that help restore the original landscape design.

TWO-PHASE IMPLEMENTATION HABITAT MANAGEMENT ALTERNATIVE

Like the Preferred Alternative, the Two-Phase Implementation Habitat Management Alternative includes the following actions within the Randolph Field NHLD: removal of bird attracting shrubs and trees, reduction in tree density, removal of trees in North–South and East–West Parks, reduction of individual tree canopy density, removal of dead, diseased and dying vegetation, and removal of shrubs with high-density foliage. However, this alternative employs an approach that would be implemented in two phases separated by the time necessary for JBSA to evaluate the efficacy of the first phase's actions. The amount of time between phases would be two years or more, as determined by JBSA. Up to 40 percent of the healthy trees would be removed from the NHLD if both phases of this alternative were to be implemented—20 percent in each phase. The Two-Phase Implementation Habitat Management Alternative also would provide a sustainable vegetation management plan that would make positive changes that help restore the original landscape design.

NO ACTION ALTERNATIVE

The No Action Alternative is carried forward for further analysis in the EA to provide a baseline against which the effects of the Proposed Action can be assessed. The No Action Alternative would be "no change" from current practices or continuing with the present course of action until that action is changed.

Under the No Action Alternative, JBSA-Randolph would be unable to mitigate the BASH risk to the desired level. The risk caused by the large number of birds on JBSA-Randolph would not be sufficiently reduced using current mitigation practices. The No Action Alternative also would not provide a sustainable vegetation management plan that would make positive changes that help restore the original landscape design.

SUMMARY OF THE ENVIRONMENTAL EFFECTS

The Preferred Alternative and the Two-Phase Implementation Habitat Management Alternative, i.e., the action alternatives, have been reviewed in compliance with the National Environmental Policy Act as implemented by the Council on Environmental Quality and USAF regulations. The analysis focused on the following resource areas: air quality, greenhouse gases, noise and acoustic vibration, heating and cooling energy needs, cultural resources, biological resources, and airfield safety. The EA concluded that neither action alternative would significantly nor adversely affect any resource area. The EA also concluded that no significant adverse cumulative impacts would result from activities associated with the action alternative when considered with past, present, or reasonably foreseeable future projects.

STAKEHOLDER INVOLVEMENT

Based on the description of the Proposed Action as set forth in the EA, all activities have been found to comply with the criteria or standards of environmental quality. Coordination and consultation with appropriate federal, state, and local agencies regarding this EA is being completed. The attached EA and this FONSI are being made available to the public for a 30-day review period. Agencies are receiving coordination throughout the EA development process, and their comments will be addressed as part of the analysis of potential environmental impacts performed in the EA.

FINDING OF NO SIGNIFICANT IMPACT.

Based on the information and analysis presented in the EA and on review of the public and agency comments submitted during the 30-day public comment period, I conclude that the environmental impacts of implementing the habitat management project to mitigate BASH risk at JBSA-Randolph are not significant, that preparation of an Environmental Impact Statement is unnecessary, and that a FONSI is appropriate.

CAROLINE M. MILLER, Brig Gen, USAF Commander, 502 ABW and JBSA	Date

Attachment: Environmental Assessment of Bird/Wildlife Aircraft Strike Hazard Risk Mitigation through Habitat Management, JBSA-Randolph, TX

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Table of Contents

Appendices

List of Figures

List of Tables

Abbreviations and Acronyms

ABW	Air Base Wing
ACHP	Advisory Council on Historic Preservation
ACAM	Air Conformity Applicability Model
ADP	Area Development Plan
AETC	Air Education and Training Command
AFB	Air Force Base
AFI	Air Force Instruction
AFSC	Air Force Safety Center
AICUZ	Air Installation Compatible Use Zones
AIRFA	American Indian Religious Freedom Act of 1978
ANSI	American National Standards Institute
APE	Area of Potential Effect
APZ	Accident Potential Zone
AQCR	Air Quality Control Region
ATC	Air Traffic Control
BASH	Bird/Wildlife Aircraft Strike Hazard
BHWG	BASH Hazard Working Group
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CAAA	Clean Air Act, as amended in 1990
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon monoxide equivalent
CWA	Clean Water Act
CZ	clear zone
dB	decibels
dBA	A-weighted decibels
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOPAA	Description of Proposed Action and Alternatives
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact

FSH	Fort Sam Houston
FTS	Flying Training Squadron
FTW	Flying Training Wing
ft	feet or foot
ft^2	square feet
FTW	Flying Training Wing
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
HQ	Headquarters
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resource Management Plan
JBSA	Joint Base San Antonio
JBSA-RND	Joint Base San Antonio-Randolph
KWh	kilowatt hour
L_{eq}	equivalent sound level
Lmax	maximum sound level
Lmin	minimum sound level
Ldn	day-night average sound level
MBTA	Migratory Bird Treaty Act
MMT	million metric ton
MOA	Memorandum of Agreement
MSDS	Material Safety Data Sheet
MW	megawatt
MWh	megawatt hour
NAAQS	National Ambient Air Quality Standard
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Protection Act
NHL	National Historic Landmark
NHLD	National Historic Landmark District
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NPDES	National Pollution Discharge System
O^3	ozone
OSHA	Occupational Safety and Health Administration
Pb	lead
$PM_{2.5}$	particulate matter measuring less than 2.5 microns in diameter
PM_{10}	particulate matter measuring less than 10 microns in diameter
ROI	region of influence
SDS	Safety Data Sheet

SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_x	oxides of sulfur
SOF	Supervisor of Flying
TCEQ	Texas Commission on Environmental Quality
TPWD	Texas Parks and Wildlife Division
tpy	tons per year
TSHPO	Texas State Historical Preservation Office
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USHUD	United States Department of Housing and Urban Development
VMP	Vegetation Management Plan
VOC	Volatile organic compound
WS	Wildlife Services
WWDO	White Winged Dove

1. Purpose of and Need for the Action

1.1 Introduction

Joint Base San Antonio-Randolph (JBSA-RND), Texas has long considered implementing a habitat management solution to mitigate existing Bird/Wildlife Aircraft Strike Hazard (BASH) threats and risks present at the installation. This section provides a brief project background; a statement of the purpose and need for the Proposed Action; and an overview of the scope of the environmental analysis, regulatory framework, public involvement activities and other analyses relevant to the action.

This EA was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4321 et seq.), the President's Council on Environmental Quality (CEQ) *Regulations Implementing the Procedural Provisions of NEPA* (40 Code of Federal Regulations [CFR] §§ 1500–1508)[1], the United States Air Force (USAF) Environmental Impact Analysis Process (EIAP) (32 CFR § 989), Protection of Historic Properties (36 CFR § 800), and the National Preservation Programs (54 USC Subtitle III DIVISION A) to evaluate the potential environmental impacts associated with implementation of the proposed project.

The EA provides sufficient evidence and analysis for determining whether an action would cause significant environmental impacts (requiring an Environmental Impact Statement) or if the agency can issue a Finding of No Significant Impact (FONSI) (40 CFR § 1508.9). A FONSI is a decision document that briefly presents the reasons why an action would not have a significant effect on the human environment (40 CFR § 1508.13). As required by NEPA and the implementing regulations from CEQ and USAF, the alternative of taking no action is evaluated, providing a baseline for comparison of potential impacts from the action alternatives.

[1] The Council on Environmental Quality (CEQ) issued a final rule on July 16, 2020 (85 FR 43304) to update the regulations implementing the procedural provisions of the National Environmental Policy Act (NEPA). The new rule retains much of the existing rule's language but there have been changes in effects terminology and definition of major federal actions. CEQ's final rule took effect September 14, 2020, and agencies were given 12 months to propose revisions to their implementing procedures. Due to the timing of this EA, it is prepared in accordance with the existing USAF Environmental Impact Analysis Process as amended (66 FR 16868, March 28, 2001).

1.2 Project Background

JBSA-RND occupies approximately 2,900 acres of land outside of the city limits of San Antonio, Texas, about 17 miles to the northeast of the downtown area (Figure 1-1). The airfield is equipped with two parallel runways running northwest/southeast on opposing sides of the base perimeter.

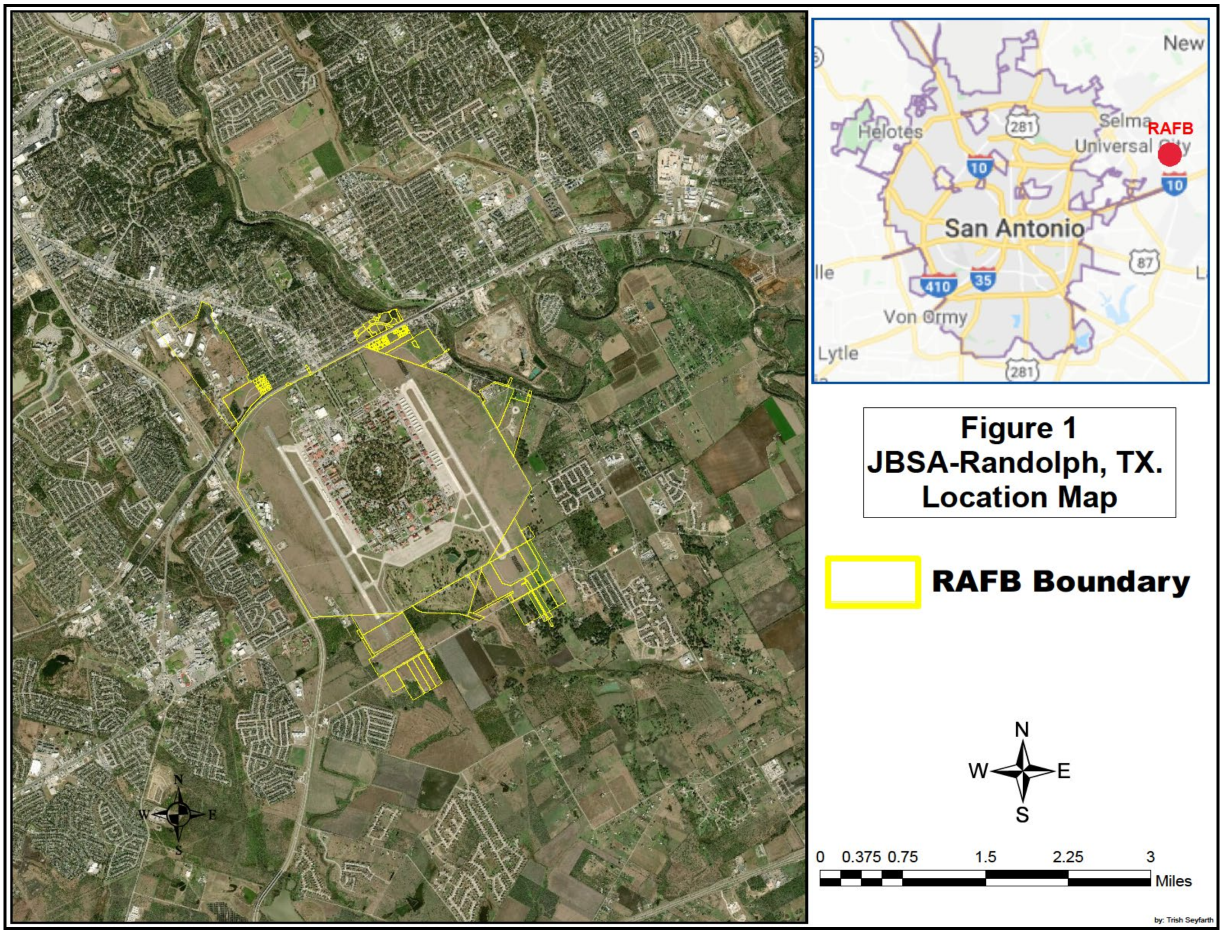

Figure 1-1. JBSA-RND, TX location map.

JBSA-RND is in a region that is historically recognized as Blackland Prairie Grassland and through the years has been disturbed by agriculture and now urban encroachment. Today, JBSA-RND is surrounded by developed areas, including Universal City and Converse to the north and west, and Schertz to the northeast, east, and south. Developed, residential areas are located to the north and west of JBSA-RND, with sparser residential developments giving way to agricultural areas to the east and south.

The San Antonio Airport Company donated the land on which JBSA-RND is situated to the Army Air Corps in 1927. Lt. H. Clark developed the plan and layout of Randolph Field upon an innovative design in 1928 (Brown, 2019), a time when the up-and-coming Army Air Corps flew biplane training aircraft. His design of the perfect "Air City" included the building area centered on the field, streets laid out concentrically, and the aircraft ramps and parallel runways situated on the eastern and western sides of the base perimeter. The design includes the base's 210-acre residential neighborhood in the center of JBSA-RND. Because of the base's unique architecture and history, the National Park Service designated the Randolph Field Historic District in central JBSA-RND a National Historic Landmark District (NHLD) in 2001 with a period of significance from 1928 to 1950 (Cook & Sprinkle, 2001).

Randolph Field (now JBSA-Randolph) opened in 1931 and has served as a premier flying training facility for the United States Army Air Corps, the United States Army Air Forces, and the United States Air Force. Historically, the primary mission at Randolph Air Force Base (AFB) was undergraduate pilot training from 1931 until 1948. In August 1950, Randolph AFB shifted emphasis to combat crew training in B-29s, B-57s, and C-119s in preparation for combat in Korea. Primary basic training was dispersed to numerous locations during this period to accommodate the rapid increase in pilot training requirements. In January 1960, Randolph AFB again reverted to a primary training mission with the establishment of the Air Training Command (now the Air Education and Training Command [AETC]). As part of this effort, schools were established for the advanced training of pilots in instructor skills. Randolph AFB was transferred to the 502nd Air Base Wing (ABW) on 31 January 2010 and became JBSA-Randolph (JBSA, 2019).

JBSA operates under the 502nd ABW and has over 200 mission partners that include diverse training, flying, medical, cyber intelligence, and installation missions. JBSA was established in accordance with congressional legislation and through the implementation of the 2005 Base Realignment and Closure (BRAC) recommendations. Under the BRAC recommendations, the installation support functions at Randolph AFB were combined with those at Lackland AFB, Fort Sam Houston, and Camp Bullis under a single organization, with the USAF identified as the lead agency.

Today, JBSA-RND supports many military mission partners including AETC headquarters, USAF Personnel Center headquarters, USAF Recruiting Service, Air Force Office of Special Investigation, and the 12th Flying Training Wing (FTW). JBSA-RND provides training in aircraft fighter fundamentals, weapons systems, remotely piloted aircraft, and laser sensor operations. The 12th FTW provides Pilot Instructor Training and Instructor Combat System Operator Training, formerly known as navigator training, in T-1As, T-6As, and T-38Cs. JBSA-RND operates approximately 28,500 flights for more than 38,000 flight hours annually to meet mission requirements. JBSA-RND may be the first base to receive the new, single engine T-7A Advanced Pilot Trainer aircraft[2]. The T-7A will replace the T-38C as the Air Force's next generation trainer.

BASH flying safety risks are inherent to most airfield operations; especially those having a training mission with a high sortie[3] rate such as JBSA-RND. Because of the high sortie rate and JBSA-RND's location within the Central Flyway[4] migratory bird route, the BASH risk is greater at JBSA-RND than at any other USAF base with a similar training mission. JBSA-RND experiences approximately twice as many bird strikes as other base with a similar mission based upon the bird strike rate per 1,000 sorties at Undergraduate Pilot Training bases[5]. Over the last 5 years (2015-2019), JBSA-RND had 314 bird strikes, resulting in approximately $4.4M in damage (12th FTW, 2019).

In addition to the physical damage to aircraft, each bird strike requires early termination of the sortie resulting in lost pilot training time; pilot training is the mission of the 12th FTW. JBSA-RND also lost approximately 294 student sorties in five years due to bird strikes[6]. Additionally, pilot training time (an equivalent of 333 sorties annually) is lost because operations are altered to avoid flocks of white winged doves (WWDO) during their daily feeding flight across the runway to or from JBSA-RND's 175-acre urban forest in the central residential area of the base. Base Flight Safety at times has implemented operation avoidance measures in response to heightened BASH threat conditions. Operational avoidance measures adversely impact training schedules and are not sustainable long term. Headquarters Air Force Safety Center (AFSC) BASH Staff Assistance Visits identified the WWDOs nesting and roosting in JBSA-RND's residential area as a risk to flight safety as early as 2004 and as recently as 2015 (USAF, 2015). For the period 2008-2019, approximately 62 percent of the bird strikes occurred during takeoff/landing or initial climb/approach operations at JBSA-RND (12th FTW/SEF)[7]. JBSA-RND seeks to mitigate the BASH risk to JBSA-RND and surrounding communities that is caused by the large population of birds on base.

There are four basic BASH management control strategies available to mitigate BASH risks on airports: habitat modification and exclusion; aircraft flight schedule modification; repellent and

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[2] The USAF is preparing an Environmental Impact Statemen to evaluate the impacts associated with basing the T-7A Red Hawk, the next generation advanced fighter training system, at JBSA-RND.
[3] A sortie, an air operations term, is an operational flight by one aircraft. (Joint Chiefs of Staff, Joint Publication 3-30, Joint Air Operations, 25 July 2019).
[4] The Central Flyway is a primary bird migration route in North America that generally follows the Great Plains in the United States and Canada.
[5] Bird strike rate per 1,000 sorties at bases with a similar training mission: JBSA-RND, TX, 2.1; Columbus AFB, MS, 1.1; Laughlin AFB, TX, 0.95; Vance AFB, OK, 1.1; Sheppard AFB TX, 0.75 (12th FTW, 2019).
[6] Five-year average for 2015-2019 (12th FTW/SE). 12th FTW/SE is the office symbol for the 12th FTW Chief of Flying Safety. The 12th FTW/SE has overall responsibility for the BASH program on JBSA-RND.
[7] 12th FTW/SEF is the office symbol of the 12th FTW BASH Program Manager. The 12th FTW/SEF is responsible for coordinating and implementing the JBSA BASH Plan on JBSA-RND. Cited data was provided by 12th FTW/SE.

harassment techniques; and wildlife removal (Cleary & Dolbeer, 2005; Airport Cooperative Research Program, 2015). The strategies range from passive management (e.g., habitat management) to active control (removal) and include several mitigation techniques.

All four BASH management control strategies are implemented at JBSA-RND (JBSA, 2018):

- Habitat modification and exclusion: JBSA-RND's trees are trimmed to reduce internal growth and dead/diseased/dying trees are removed. Between 2014 to present date there have been 1,245 trees removed from JBSA-RND. Most trees that have been removed were not from within the NHLD. Only dead, diseased, or dying trees were removed from within the NHLD. Herbicides and pesticides were applied to the airfield in 2021. The efficacy of herbicide and pesticide application is under evaluation
- Flight schedule modification—operational avoidance: JBSA-RND schedules operations to avoid windows when birds typically leave from and return to the on-base habitat. A Merlin DeTect ™ Aircraft Birdstrike Avoidance Radar system recently has been installed at JBSA-RND. This bird strike avoidance system provides real-time data collection of bird numbers and flight paths.
- Repellent and harassment techniques: JBSA-RND dispersal techniques include the use of non-lethal propane concussion cannons and audible generators as well as a variety of handheld pyrotechnics creating sounds and, in some cases, momentary flashes of light. Additionally, non-lethal, biodegradable paintball guns are systematically employed as harassment to move birds, especially WWDO, from critical areas to reduce flight safety risk.
- Wildlife removal by depredation: JBSA manages migratory birds such as the WWDO, in accordance with conditions of its US Fish and Wildlife Service Migratory Bird Treaty Act (MBTA) Depredation at Airports Permit (MB09077B-0, 2020). Depredation is used as a last resort when non-lethal methods are deemed ineffective.

The USDA Wildlife Services (WS)[8] biologist assigned to JBSA-RND has assisted the 12th FTW/SEF in investigating other BASH mitigation techniques that might be used on JBSA-RND. Many have been determined infeasible due to the magnitude of the problem and their restricted use in residential areas of the base. Techniques considered include avicides (substances to kill birds), methyl anthranilate (bird repellant), falconry, long-range acoustic device (LRAD), unmanned aerial vehicles, tree nets, airsoft guns, and water cannons, among others (12th FTW, 2019).

Despite current BASH mitigation efforts at JBSA-RND, BASH risks continue to be unacceptably high. A study conducted by Texas A&M Natural Resources Institute (NRI), *Feasibility of Avian Management Techniques Aimed to Reduce Risk of Bird-aircraft Collisions on Joint Base San*

[8] The U.S. Department of Agriculture's (USDA) Wildlife Services (WS) program partners with the Department of Defense to provide scientific expertise and operational assistance to reduce the safety hazards and economic impacts to aviation caused by birds, mammals, and other wildlife.

Antonio-Randolph, identified habitat modification, a passive technique, to mitigate the airfield's high BASH risk (Colón, Thompson, & Long, 2017a). Based upon the recommendations from Headquarters AFSC, USDA WS biologist, AETC, and the Texas A&M NRI study, JBSA-RND has decided to prepare this EA to determine the impacts of the Proposed Action. In this EA, JBSA-RND identifies, analyzes, and documents the potential physical, environmental, cultural, and socioeconomic impacts associated with implementing a BASH habitat management solution.

1.3 Purpose of the Proposed Action

The **purpose** of the Proposed Action is to reduce the BASH risk posed by the various species of birds living and roosting in the Randolph Field NHLD's 175-acre urban forest between the two runways.

1.4 Need for the Proposed Action

The **need** for the Proposed Action is to reduce the high BASH risk caused by the large population of birds roosting, breeding, and rearing their young in the trees and shrubs between the two runways on JBSA-RND. The large bird population sharply elevates the risk of bird strike events during take-offs and landings. These collisions can cause aircraft failure resulting in civilian and aircrew fatalities and property damage on JBSA-RND and in the local communities surrounding the airfield. Although there are several bird species on JBSA-RND, the Air Force has determined that the greatest threat is from WWDO (USAF, 2015). By expanding its habitat management efforts, JBSA-RND seeks to minimize the attractiveness of the base to WWDOs and other species of birds and obtain a commensurate reduction in the BASH risk.

1.5 Interagency/Intergovernmental Coordination and Consultation

1.5.1 Interagency Coordination and Consultations

Scoping is an early and open process for developing the breadth of issues to be addressed in the EA and for identifying significant concerns related to a proposed action. Per the requirements of Intergovernmental Cooperation Act of 1968 (42 USC § 4231(a)) and EO 12372, *Intergovernmental Review of Federal Programs*, federal, state, and local agencies with jurisdiction that could be affected by the Proposed Action were notified during the development of this EA.

Appendix A contains the list of agencies consulted during this analysis and copies of correspondence with those agencies.

1.5.2 Intergovernmental Consultations

EO 13175, *Consultation and Coordination with Indian Tribal Governments* directs Federal agencies to coordinate and consult with Native American tribal governments whose interests might be directly and substantially affected by activities on federally administered lands. Consistent with that executive order (EO), Department of Defense Instruction (DoDI) 4710.02, *DoD Interactions with Federally-Recognized Tribes*, and Air Force Instruction (AFI) 90-2002, *Air Force Interaction with Federally-Recognized Tribes*, federally-recognized tribes that are historically affiliated with the JBSA's geographic region are invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations. The JBSA-RND point-of-contact for Native American tribes is the Installation Tribal Liaison Officer[9].

The Native American tribal governments that will be coordinated with or consulted, regarding these actions, are listed in Appendix A.

1.5.3 Other Agency Consultations

Per the requirements of Section 106 of the National Historic Preservation Act and implementing regulations (36 CFR § 800), a request for concurrence was transmitted to the Texas State Historical Preservation Office (TSHPO). Initial consultation with TSHPO has been accomplished previously for tree maintenance that currently is in progress in the NHLD. A finding of "No Historic Properties Affected Project May Proceed" was received from TSHPO on September 20, 2016, for the work in progress. This EA is being prepared to analyze the effects of further decreasing woody plant (henceforth referred to as shrub) and tree density in the NHLD. Both SHPO and the National Park Service are being consulted for this proposed undertaking.

There are no Threatened and Endangered (T&E) species or habitat at JBSA-RND therefore the Proposed Action has been determined to have "no effect" and consultation with the United States Fish and Wildlife Service (USFWS) in accordance with Section 7 of the Endangered Species Act is not required.

Correspondence regarding the findings and concurrence and resolution of any adverse effect is included in Appendix A - Interagency/Intergovernmental Coordination and Public Participation.

1.6 Public and Agency Review of EA

The 12th FTW and 502nd ABW hosted a Randolph AFB BASH Town Hall meeting at the Base Theatre (Building 100) on 27 February 2018. JBSA-RND's flying mission, BASH program, BASH threat, and possible courses of action (including targeted tree removal) to reduce the BASH threat were presented (12th FTW, 2018).

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[9] The Installation Tribal Liaison Officer is the Deputy Director of the 502nd Force Support Group Joint Base San Antonio.

A Notice of Availability (NOA) of the Draft EA and FONSI was published in the San Antonio Express-News and the Universal City Herald, announcing the availability of the EA for review on 26 June 2021. The NOA invited the public to review and comment on the Draft EA. The public and agency review period ended on 31 July 2021. The NOA and public and agency comments are provided in Appendix A.

Copies of the Draft EA and FONSI are available for review at the following locations:

San Antonio Central Library
600 Soledad St.
San Antonio, TX 78205

Universal City Library
100 Northview Dr.
Universal City, TX 78148

The document is available online at https://www.jbsa.mil/Resources/Environmental/

1.7 Decision to be Made

This EA evaluates whether the Proposed Action would result in significant impacts on the human environment. If significant impacts were identified, JBSA-RND would undertake mitigation to reduce impacts to below the level of significance, undertake the preparation of an EIS addressing the Proposed Action, or abandon the Proposed Action. This EA is a planning and decision-making tool that will be used to guide JBSA-RND in implementing the Proposed Action in a manner consistent with USAF standards for environmental stewardship.

This EA has been prepared to identify, analyze, and document the potential physical, environmental, cultural, and socioeconomic effects associated with the proposed habitat management solutions to mitigate BASH risks at JBSA-RND. The USAF, as a federal agency, is required to incorporate environmental considerations into its decision-making process for the actions it proposes to undertake. This is done in accordance with the regulations and guidance identified in Section 1.1.

This EA:

- Informs the public of the possible environmental impacts of the Proposed Action and its considered alternatives, as well as methods to reduce their effects;
- Provides for public, state, interagency, and concerned Native American groups' input into USAF's planning and evaluation; and
- Documents the NEPA process, supporting informed decision-making by the federal government.

The decision document for this proposed federal undertaking also identifies the actions to which USAF would commit to minimize environmental effects, as required under NEPA, its implementing regulations from CEQ (40 CFR § 1500–1508) and the USAF EIAP (32 CFR § 989).

The decision to be made is whether—having considered the potential physical, environmental, cultural, and socioeconomic effects—JBSA-RND should implement the Proposed Action including, as appropriate, measures to reduce adverse effects.

2. Description of the Proposed Action and Alternatives

2.1 Proposed Action

The Proposed Action is to reduce the BASH risk posed by the various species of birds living and roosting in the NHLD between the two runways. The Proposed Action would reduce the tree, tree canopy, and shrub density in the NHLD located in central JBSA-RND and thereby decrease the habitat and thus the population of WWDO and other avian species on base. The proposed action is a peer supported wildlife management recommendation for airports nationwide (FAA, 2020). The vegetation resources have historical significance and would be protected and enhanced to the extent possible considering flying safety and fiscal constraints. A vegetation management plan is part of the Proposed Action. The plan would guide JBSA in the management of vegetation resources in the NHLD. Central to the plan is that it be sustainable and can be managed with less maintenance effort (DoD, 2019a) and cost than currently is required while placing an increased emphasis on restoring period of significance views and viewsheds to the extent flying safety allows. The VMP only would be implemented if the proposed action were selected.

A large population of WWDO (*Zenaida asiatica*), along with a variety of other avian species, utilize habitat in central JBSA-RND to nest, loaf, roost, and rear their young. The WWDOs present a serious BASH risk when they fly across the airfield on their daily feeding flights, see Figure 2-1. It is estimated that approximately 15,000 doves transit the corridor between the urban forest in the housing area and areas beyond the east runway daily during the spring and summer months, BASH SAV (USAF, 2015). Although a high percentage of the doves migrate south during the fall and winter months, some remain in the housing area and pose a BASH risk year-round.

JBSA-RND recorded 51 bird strikes in fiscal year 2020. The 5-year average is 63 bird strikes per year. Approximately 50 percent of the strikes at JBSA-RND occurred on approach to the east runway, Runway 32R.[10] The number of bird strikes peaks during the doves' morning and afternoon feeding flights.

JBSA-RND completed two important studies that provide critical information that the decision maker will use to guide selection of the Proposed Action. The Texas A&M Natural Resources Institute (NRI) completed both studies in 2017. The first is *Feasibility of Avian Management Techniques Aimed to Reduce the Risk of Bird-aircraft Collisions on Joint Base San Antonio-*

[10] Information cited here includes the most current published Air Force Safety Automated System (AFSAS) data and fiscal year 2020 data from the 12FTW BASH Program Manager (12FTW/SEF). AFSAS is a safety reporting system used to collect and maintain safety related data.

Randolph (Colón et al., 2017a) and the second is *Urban Tree Inventory at JBSA-Randolph* (Colón, Thompson, Miller, & Long, 2017b).

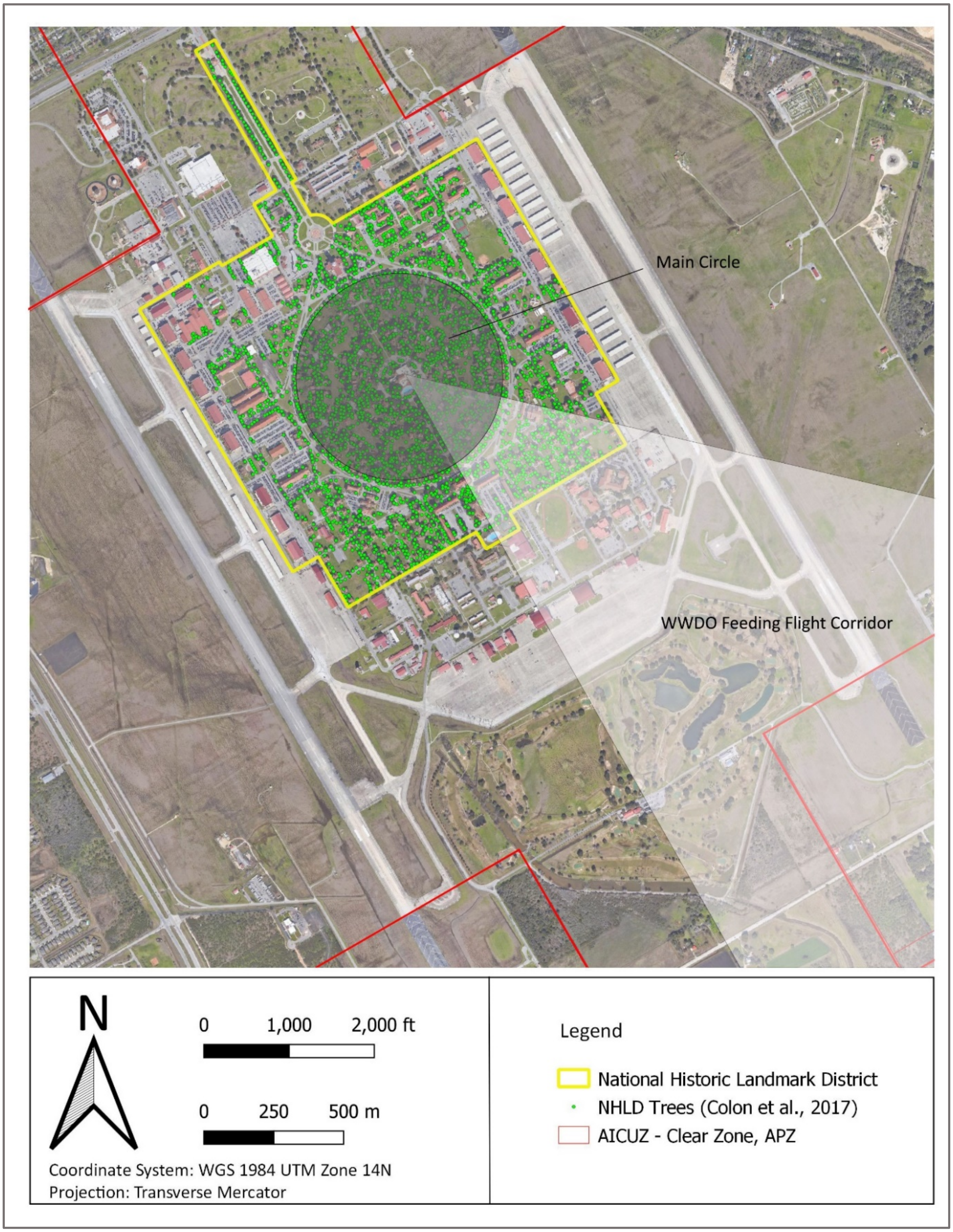

Figure 2-1. NHLD urban forest and WWDO feeding flight corridor.

In 2017, JBSA-RND evaluated the feasibility of various avian management techniques to reduce BASH risk (Colón et al., 2017a). This avian study examined the abundance, distribution, and movement patterns of bird species on the base, quantified landscape and vegetation metrics, analyzed trends in bird strikes, and evaluated proposed options to reduce BASH risk. Removal of selected trees within the central residential area at JBSA-RND to reduce the available habitat for WWDO and other avian species was recommended.

Also in 2017, JBSA-RND completed an urban tree inventory (Colón et al., 2017b). This study collected information on 7,515 trees and shrubs on JBSA-RND. Canopies of the 4,404 trees were classified by their condition, i.e., excellent, good, fair, poor, critical, or dead. The inventory also includes tree species; height; trunk diameter breast height (dbh); and condition other than dead, diseased, or dying (e.g., hazards, conflict with roads, sidewalks, etc.). The location of the trees catalogued during the study is depicted by green circles in Figure 2-1. On-site beautification projects over the last 50 years have resulted in a large (71 ha [175 ac]) urban forest in the residential area that is dominated by mature southern live oak trees (*Quercus virginiana*) and inhabited by thousands of birds (Colón et al., 2017b). The number of trees exceeds the historical landscape design. Many of the trees in JBSA-RND's NHLD were planted after the NHLD's POS, i.e., after 1950, and are inconsistent with the historic landscape design.

The full tree canopies of the mature trees in the NHLD afford birds protection from natural predators and provide a source of food (TPWD, 2021). Approximately 68 percent of the trees have overlapping canopies (Colón et al., 2017b). The overlapping canopies are a major attractant to WWDO and other avian species. Studies have found that southern live oak and Arizona ash are the WWDO's preferred nesting habitat in the San Antonio area (West, 1993). The Texas A&M NRI study catalogued more than 2,800 oaks–88 percent of them were southern live oaks. Population modeling suggests that there is a 9–20 percent increase in dove density for every 10 percent increase in tree density (Colón et al., 2017a). Results of the Texas A&M NRI study estimate that approximately 15,000 doves transit the corridor between the urban forest habitat in the housing area and areas beyond the east runway daily during the spring and summer months. The highest risk is between 07:00 am and 10:00 am daily. Historically, WWDO activity on JBSA-RND is greatest from March 1st through November 30th.

The two action alternatives evaluated in the EA both seek to reduce the BASH risk through habitat management, i.e., by reducing the tree and shrub density within the NHLD of JBSA-RND. However, they differ significantly in their approach. The Proposed Action (Alternative 2) is a single-phased approach that reduces tree density by 40 percent in a single phase. The second (Alternative 3) is a two-phased approach. The two-phased approach would reduce tree density 40 percent but in two phases each of 20 percent. The 40 percent tree density reduction would occur only if both phases were implemented, i.e., 20 percent in each phase. Phase II of the two-phase approach would not be implemented if the Phase I were determined to be ineffective, i.e., regarding WWDO population decrease, or if the BASH risk reduction goal was met. Alternative 3 incorporates the management approach of "PLAN-DO-CHECK-ACT", i.e., have current actions produced the expected results. However, the time between implementation of both phases, if both were necessary, would increase the length of exposure to a high BASH risk. If only Phase I of Alternative 3 were required to meet the project's safety goal, Alternative 3 could be implemented at a lower short-term cost than Alternative 2 although Alternative 3's long-term tree maintenance costs would be greater. The short- and long-term costs of the alternatives are discussed further in Section 2.3. Both alternatives incorporate recommendations and management actions included in the VMP for the NHLD. The VMP would allow for sustainable management of JBSA-RND's urban forest and the BASH risk by providing long term, detailed vegetation management objectives for the NHLD.

2.2 Alternative Development

Various BASH mitigation techniques were considered and eliminated from inclusion in an existing alternative or combined with other techniques to form additional alternatives. Table 2-1 lists the mitigation techniques considered and eliminated from further consideration. The reasons for deciding not to propose these techniques are listed in the table and include restrictions for use in residential areas, safety of residents and non-targeted animals, prohibitively labor intensive, short persistence, unacceptably high adverse impacts to NHLD, and MBTA take concerns.

Table 2-1. BASH Mitigations Considered

BASH Mitigation Technique	Rationale for Eliminating from Further Consideration
Chemical capture	Immobilizing agent to capture birds (e.g., alpha-chloralose)—restricted use in residential areas
Chemical repellants—perching structures (polybutenes)	Chemical repellant applied to surfaces; surfaces would have to be treated and retreated—costly and labor intensive due to large number of trees and perching surfaces
Contact Toxicants	Hollow metal perches treated with toxicant (e.g., fenthion)—use of toxicants in residential area is problematic, poses high risk to residents/pets/non-target species and "takings" under MBTA
Habitat Modification – Exclusion	Physical barriers to exclude habitat (e.g., tree nets, spikes)—costly and impractical due to large number of trees and other perching surfaces
Laser	Hand-held laser devices that project a beam to disperse birds— limited use in daylight and poses safety risks in an airfield environment; lasers are ineffective against *Columbidae* dove species such as the WWDO
Live trapping	Traps—currently used on a limited basis but prohibitively labor intensive and disposal of trapped nuisance birds problematic on a large scale
Net launchers	Blank rifle cartridge used to launch net—limited use in residential area (firearms)
Nest destruction	Physical destruction of nests—not viable due to the large number of nesting WWDOs; the WWDO is a federally protected species, nest

	destruction is a "taking" and must be reported under JBSA's Depredation at Airports Permit
Oral toxicants	Toxicants added to bait birds—use of toxicants in residential area problematic, high risk to residents/pets/non-target species and "takings" under MBTA
Falconry	Birds of prey (e.g., falcons) to control WWDO population—labor intensive, limited use during daylight hours, cannot be used when molting; Falconry would be ineffective due to the size of area, number and types of hawks/falcons needed, and cost and time constraints
Radio controlled devices (e.g., drones, vehicles)	Use of radio-controlled devices—limited use on airfield, and requires coordination with other agencies on base prior to use
Ultrasonic devices	High-frequency sound generating device—not proven to be effective bird repellent
Visual repellants	Hawk effigies, flags, Mylar tape, etc.—short term effect only

2.2.1 Selection Standards

Alternatives were developed to be responsive to the project's purpose and need. Per the requirements of 32 CFR § 989, the Air Force EIAP regulations, selection standards are used to identify required and preferred or influencing factors for meeting the purpose of and need for the Proposed Action. JBSA-RND established the following selection standards as goals used to develop a reasonable range of alternatives for this project.

Selection Standard 1 SAFETY. Reduces the BASH risk by 50 percent[11], or more, of fiscal year 2018 levels thereby increasing the safety of the surrounding communities, JBSA-RND airfield, and aircrews.

Selection Standard 2 CULTURAL. Minimizes the impacts to, or best restores, the NHLD's character defining features to include historical landscape design, views, and viewsheds.

Selection Standard 3 SUSTAINABILITY. Provides a sustainable plan to manage JBSA-RND's urban forest such that the BASH risk from WWDOs and other avian populations roosting, perching, nesting, and rearing their young in the JBSA-RND community is reduced to 50 percent, or less, of fiscal year 2018 levels.

Selection Standard 4. ECONOMIC. Considers the long-term economic impact of urban forest management on the Air Force flying mission, grounds maintenance, and to JBSA-RND base housing residents.

Selection Standard 5 PREDATION. Adheres to the MBTA Depredation at Airports Permit.

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[11] BASH risk will be evaluated using the bird activity level as measured by the DeTect™ MERLIN Aircraft Birdstrike Avoidance Radar system. The assumption is that the bird activity level measured by the bird strike avoidance radar is directly related to the bird-aircraft strike probability and risk. The DeTect™ MERLIN system is discussed further in Section 2.3.1.

2.3 Description and Screening of the Alternatives

2.3.1 Alternative 1: No Action

CEQ and USAF NEPA regulations require consideration of the No Action Alternative to assess any environmental consequences that may occur if the Proposed Action is not implemented. The No Action Alternative serves as a benchmark against which the effects of the action alternatives can be evaluated. For this project, the No Action Alternative is defined as being no change in management direction.

Under the No Action Alternative, the 12th FTW would continue to implement a combination of mitigation techniques that it employs to reduce the BASH risk caused by the large population of WWDOs and other avian species living and rearing their young in the base's residential area. The 502nd ABW BASH Plan (JBSA, 2018) for JBSA includes: bird trapping, visual/acoustic repellents, elimination/reduction of roosting/nesting sites, bird/bat proofing structures, vegetation maintenance, tree/shrub maintenance, radio-controlled vehicles, employing Bird Watch Conditions, bird depredation (including Migratory Bird Treaty permitted takings), and other pest management techniques as described in AFI 91-212 (USAF, 2018).

Current JBSA-RND BASH mitigation activities would continue and include:

- Habitat modification—trees in JBSA-RND's urban forest are trimmed to reduce internal growth, and dead trees are removed. Diseased and dying trees also are removed.
- Operational avoidance—JBSA-RND mitigates BASH risks in response to seasonal changes in the base's WWDO population. The base launches T-38 morning sorties from runway 15R in July and resumes use of runway 15L for morning launches in October to avoid the morning WWDO feeding flight from base housing across the east runway (15L).
- Propane cannons—JBSA recently installed a new 36-cannon bird deterrence system that allows for Air Traffic Control (ATC), Supervisors of Flying (SOF), Airfield Management, USDA wildlife biologist, and 12th FTW/SE direct control and utilization.
- Bird tracking radar—JBSA-RND is one of only twelve military/commercial air facilities that currently utilizes a commercial bird tracking radar system, the Merlin DeTect™ Aircraft Birdstrike Avoidance Radar system. 12th FTW/SE, ATC Tower, and SOF use the bird tracking data to update pilots on bird threats, trends, and to modify flight operations when necessary. Based upon the bird activity level, the SOF establishes and ensures dissemination of local Bird Watch Conditions in accordance with AFI 91-202 (USAF, 2020)[12].

[12] Historical Horizontal Surveillance Radar (HSR or "Bird Radar") utilizes bird activity data collected with the Merlin DeTect™ system to estimate the bird strike risk level and guide the selection of flying safety risk target levels at JBSA-RND. The target levels are used in determining Bird Watch Conditions. The assumption is that the bird activity level measured by the MERLIN bird system is directly related to bird strike probability. The target bird activity/risk

- Anti-perching bird devices—JBSA-RND has installed anti-perching devices on signage, taxiway lights, propane canons, etc. adjacent to the runways and aircraft movement areas.
- Bird harassment—JBSA-RND expended 16,800 man-hours during the past 5 years to disperse birds using non-lethal bangers/screamers and paintball guns (12th FTW/SE).
- Bird trapping – JBSA-RND places wire traps in areas where WWDO and other targeted avian species congregate.
- Bird depredation—JBSA's MBTA Depredation at Airports Permit (USFWS, 2018) allows the taking of migratory birds (with restrictions) to relieve or prevent injurious situations affecting public safety.
- USDA Biologist—JBSA-RND employs a certified USDA wildlife biologist to assist in managing the wildlife hazards that affect the flying mission.

The No Action Alternative, utilizing just the current BASH mitigation techniques, would not allow JBSA-RND to achieve its goal of significantly reducing BASH risks and providing a safer flying environment for the 12th FTW pilots and for the safety of the installation and surrounding community. The rapid increase in WWDO population during the summer months would continue. Additionally, modification of flight operations as described in bullet two, above, is unsustainable. The lost sortie hours and additional fuel usage/costs adversely impact the training mission. Therefore, the No Action Alternative would not meet the purpose of and need for the action. The 12th FTW pilots, the installation, and local communities would continue to be exposed to the current high BASH risk level. The probability of a catastrophic event due to aircraft failure would not be lessened.

Results of screening for Alternative 1, the No Action Alternative, evaluated against the selection standards are summarized as follows:

Selection Standard 1—SAFETY. Would not meet. The BASH risk to surrounding communities, JBSA-RND, and aircrews would continue at current levels.

Selection Standard 2 CULTURAL. Would not meet. Dead, diseased, and dying trees and vegetation would be removed and not replaced. There would be no NHLD VMP that would provide management guidance to restore the views and viewsheds more consistent with the historic landscape design (see Figure 2-2). Without a VMP, the original landscape design of the NHLD would not be a principal grounds maintenance goal. Significant parts of views, viewsheds, and historical architectural resources would continue to be concealed by the large number of post-period of significance trees and shrubs.

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levels are reviewed and updated periodically. Safety threshold levels currently are set at 1,000 HSR targets (birds) in a 30-second interval for high risk and 600 HSR targets for moderate risk.

Figure 2-2. View looking south from the Commanding General's quarters toward the Officers Club illustrating the historic planting designs of North Park in the 1930s, (Tooker, Hartman, & Smith, 2013).

Selection Standard 3 SUSTAINABILITY. Would not meet. Current management practices do not provide a sustainable plan to control the BASH risk posed by WWDOs and other avian species. Although dead, diseased, and dying trees would continue to be removed and not replaced, there is no NHLD VMP that would afford sustainability that balances safety and cultural heritage stewardship.

Selection Standard 4 ECONOMIC. Would not meet. The high cost of aircraft damage due to aircraft-bird strikes, or cost of a potential aircraft accident in the communities surrounding JBSA-RND, would continue at the current high level. Aircraft damage costs would be expected to continue at their current levels, $3.4M over the past 5 years. The long-term costs of tree trimming and removal would continue at existing levels, approximately $930,000 for JBSA in 2019 (502nd CONS, JBSA Contracting). There would be no to negligible change in energy required for heating and cooling buildings.

Selection Standard 5 DEPREDATION. MBTA Depredation at Airports Permit. Would meet. Present management practices would continue to adhere to JBSA's MBTA depredation permit.

2.3.2 Alternative 2: Single-Phase Implementation Habitat Management (Preferred Alternative)

Alternative 2 includes removal of bird attracting shrubs and trees in the NHLD, reduction of tree density, removal of trees in North–South and East–West Parks; reduction of individual tree canopy density, removal of dead diseased and dying vegetation, removal of bird attractant shrubs and trees, and removal of shrubs with dense foliage. Up to 40 percent of the healthy trees would be removed from the NHLD in this alternative. This alternative would be implemented in a single phase.

Inclusion of a NHLD VMP that provides detailed vegetation management objectives for the Proposed Action and the sustained management of landscapes in the NHLD is a fundamental component of this alternative. The NHLD VMP includes overall management guidelines, specific tree trimming guidance, and tree removal and documentation requirements. Tree trimming and removal would be accomplished outside of migratory bird nesting season (1 March – 15 August)[13]. The NHLD VMP also includes large format panorama photographs that document key viewsheds and view corridors (Tooker, Hartman, & Smith, 2013) as they currently exist and renderings that depict key viewsheds and view corridors after implementation (Figures 2-3 and 2-4). The NHLD VMP includes positive changes that help restore the historic landscape design.

BASH mitigation techniques currently implemented by the 12th FTW, including operational avoidance, wildlife dispersal, and wildlife depredation, would continue in accordance with the 502ndABW BASH Plan (JBSA, 2018).

Results of evaluating Alternative 2, the Single-Phase Implementation Habitat Management Alternative, against the selection standards are summarized as follows:

Selection Standard 1 SAFETY. Would meet. The level of habitat modification proposed in this alternative would be expected to reduce the number of WWDO's and other avian species living and rearing their young in JBSA-RND's urban forest with an expected reduction in bird-aircraft strikes by 50 percent, or more, of fiscal year 2018 levels-JBSA-RND's safety goal. This alternative offers the greatest possibility of meeting the safety goal most quickly.

Selection Standard 2 CULTURAL. Would meet. This alternative would include a sustainable vegetation management plan for the NHLD. Vegetation treatments would be in accordance with the NHLD VMP management objectives. The views, viewsheds, and historical architectural

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[13] Physical destruction of nests and "take" due to habitat modification is allowed under JBSA's Depredation Permit (USFWS, 2018).

Figure 2-3. South Park viewshed currently, Building 900.

Figure 2-4. Rendering of South Park viewshed following implementation – included in both action alternatives. Building 900 depicted.

resources now hidden by the large number of post-period of significance trees would be more closely restored to the historical landscape design (see Figures 2-3 and 2-4). As part of this alternative, dead, diseased, and dying trees and shrubs would be removed and not replaced.

Selection Standard 3 SUSTAINABILITY. Would meet. This alternative would provide a sustainable method to control the BASH risk posed by WWDOs and other avian species. It would include a sustainable vegetation management plan to manage JBSA-RND's urban forest in the NHLD consistent with both safety goals and cultural resource requirements.

Selection Standard 4. ECONOMIC. Would meet. The risk of the high cost of aircraft damage due to aircraft-bird strikes, or of a potential aircraft accident in the communities surrounding JBSA-RND, would be decreased. There would be a decreased need for operational avoidance thereby saving fuel and reducing lost training time and manhours. The long-term costs of tree trimming and removal would be reduced by an estimated 30-40 percent following full implementation[14]. Costs were approximately $930,000 in 2019 (502nd CONS, JBSA Contracting). Energy needs and costs would be expected to increase primarily because of more direct insolation from the loss of shade trees.

Selection Standard 5 DEPREDATION. MBTA Depredation at Airports Permit. Would meet. Management practices would continue to meet conditions in JBSA's MBTA Depredation at Airports Permit.

2.3.3 Alternative 3: Two-Phase Implementation Habitat Management

Alternative 3 includes removal of bird attracting shrubs and trees in the NHLD, reduction of tree density, removal of all trees in North–South and East–West Park medians, reduction of individual tree canopy density, removal of dead diseased and dying vegetation, removal of bird attractant shrubs and trees, and removal of shrubs with dense foliage. Up to 40 percent of the healthy trees would be removed from the NHLD in this alternative if both phases were to be implemented—20 percent in each phase. Phase II of the two-phase approach would not be implemented if Phase I were determined to be ineffective, i.e., regarding WWDO population decrease, or if the BASH risk reduction safety goal was not met. This alternative is a multi-year approach that would be implemented in two phases separated by the time necessary for JBSA to evaluate the efficacy of the first phase's actions. The amount of time between phases would be two years or more, as determined by JBSA.

[14] Estimate is based upon a 40 percent reduction in costs associated with tree trimming and tree and trunk removal. Contracting costs for tree trimming and tree and stump removal were approximately $500 and $950, respectively, per tree as of the most recent (2019) contract (502nd CONS). Tree trimming costs are continuing costs while tree and stump removal are one-time costs. Therefore, additional tree maintenance costs would be incurred between implementation of Phase I and Phase II of Alternative 3.

Inclusion of a NHLD VMP that would provide detailed vegetation management objectives for the Proposed Action and the sustained management of landscapes in the NHLD is a fundamental component of this alternative. The NHLD VMP includes overall management guidelines, specific tree trimming guidance, and tree removal and documentation requirements. Tree trimming and removal would be accomplished outside of migratory bird nesting season (1 March – 15 August). The NHLD VMP also includes large format panorama photographs that document key viewsheds and view corridors (Tooker et al., 2013) as they currently exist and renderings that depict key viewsheds and view corridors after implementation (Figures 2-3 and 2-4). The NHLD VMP includes positive changes that help restore the historic landscape design.

BASH mitigation techniques currently implemented by the 12th FTW, including operational avoidance, wildlife dispersal, and wildlife depredation would continue in accordance with the 502nd ABW BASH Plan (JBSA, 2018).

Results of evaluating Alternative 3, the Two-Phase Implementation Habitat Management Alternative, against the selection standards are summarized as follows:

Selection Standard 1 SAFETY. Would potentially meet. The level of habitat modification, i.e., tree and shrub removal, proposed in this alternative would be expected to reduce the number of WWDO's and other avian species living and rearing their young in JBSA-RND's urban forest with an associated reduction in bird-aircraft strikes 50 percent, or more, below fiscal year 2018 levels. However, if implementation of both phases were required to meet the safety goal, there would be additional exposure of the base and surrounding communities to a substantially higher BASH risk for the additional time required to monitor results and determine Phase I's efficacy before deciding whether to implement Phase II. Additionally, the rapid increase in WWDO population during the summer months likely would continue.

Selection Standard 2 CULTURAL. Would partially meet. The views and viewsheds now hidden by the large number of post-period of significance trees would be partially restored after Phase I implementation and more fully restored following Phase II implementation. By implementing healthy tree removal in two stages, this alternative would modify the existing views and viewsheds in the NHLD to only the amount required to meet the BASH reduction goals, i.e., if the removal of 20 percent of the healthy trees in the NHLD met the safety goals, no further healthy tree removal would be required. Vegetation treatments would be in accordance with NHLD VMP management objectives. As part of this alternative, dead, diseased, and dying trees and shrubs would be removed and not replaced.

Selection Standard 3 SUSTAINABILITY. Would meet. This alternative would provide a sustainable method to control the BASH risk posed by avian species. It would include a sustainable vegetation management plan to manage JBSA-RND's urban forest in the NHLD consistent with safety goals and cultural resource requirements.

Selection Standard 4. ECONOMIC. Would partially meet. The risk of the high cost of aircraft damage due to aircraft-bird strikes and the potential for an aircraft accident in the communities surrounding JBSA-RND would be decreased. The magnitude of the decrease would depend upon implementation, i.e., one or two phases. There would be a decreased need for operational avoidance thereby saving fuel and reducing lost training time and manhours. The decrease would be expected to be less if only Phase I were to be implemented. The long-term costs of tree trimming and removal would be reduced by an estimated 30-40 percent if both phases of this alternative were implemented but substantially less if only Phase I were implemented. Costs were approximately $930,000 in 2019 (502nd CONS, JBSA Contracting). Energy needs and costs are expected to increase primarily because of more direct insolation from the loss of shade trees. The magnitude of the effects would depend upon implementation, i.e., one or two phases.

Selection Standard 5 DEPREDATION. MBTA Depredation at Airports Permit. Would meet. Management practices would continue to meet conditions in JBSA's MBTA Depredation at Airports Permit.

2.4 Screening Summary

Alternative 2 would meet the BASH safety goal most quickly, reducing the time that JBSA-RND and surrounding communities would be exposed to the substantial BASH flight safety risk. Cultural and economic goals also would be best met by this alternative. Alternative 2 would make positive changes that help restore the original landscape design and restore the views and viewsheds to the POS. This alternative also would most rapidly reduce exposure to potential danger and costs of an aircraft accident by reducing the risk of a potential bird-aircraft strike mishap in a single phase.

Based on the application of these Selection Standards, Alternative 2 is the alternative that best meets all the selection standards and will therefore be carried forward as the Preferred Alternative. Table 2-2 summarizes the screening results. Alternative 3's Phase I and II have been awarded separate screening ratings. Phase II's rating includes implementation of both phases. Alternative 3 also substantially meets the five selection standards. However, more time may be needed to meet the BASH safety goals and potentially lengthen the time JBSA-RND personnel and surrounding communities are exposed to a substantially high BASH flight safety risk. Both Alternative 2 and Alternative 3 will be carried forward for analysis. The No-Action Alternative also will be evaluated in this EA. Evaluation of the No-Action Alternative will analyze the consequences of not undertaking the Proposed Action, not simply conclude no impact, and will serve to establish a comparative baseline for analysis.

2.5 Alternatives Eliminated from Further Consideration

JBSA-RND has considered a full range of alternatives and has decided that Alternative 2, the Single-Phase Implementation Habitat Management alternative is the best option to meet the BASH safety goals most expeditiously. Alternative 3, Two-Phase Implementation Habitat Management substantially meets the purpose and need and will be carried forward for analysis. Alternatives using BASH mitigation techniques discussed in Section 2.2 were considered but failed to meet the purpose and need, and therefore will not be carried forward for analysis. The baseline, No Action, and the action alternatives are discussed in more detail in Section 2.6.

Table 2-2. Alternative Screening Summary

Selection Standard	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3	
			Phase 1	Phase 2
Safety	✕	✓	◆	✓
Culture	✕	✓	●	✓
Sustainability	✕	✓	◆	✓
Economic	✕	✓	◆	✓
MBTA	✓	✓	✓	✓

Symbols: (✓) meets (◆) potentially meets (●) partly meets (✕) does not meet

2.6 Alternatives to be Evaluated in this EA

2.6.1 Alternative 1: No Action Alternative

The No-Action Alternative fails to address the purpose of and need for the action as described in Sections 1.3 and 1.4. The BASH risk caused by the large number of birds on JBSA-RND would not be reduced to an acceptable level. The No Action Alternative also would not provide a sustainable vegetation management plan that would make positive changes that help restore the original landscape design. The No-Action Alternative will be carried forward for further analysis consistent with CEQ regulations and provide a baseline against which the impacts of the Alternative 2 and Alternative 3 can be assessed.

2.6.2 Alternative 2: Single-Phase Implementation Habitat Management (Preferred Alternative)

Alternative 2 includes reducing the tree density in the NHLD by 40 percent in a single phase of implementation. Alternative 2 incorporates recommendations and management actions from the VMP for the NHLD. The NHLD VMP is Appendix B to the EA and is described in Section 2.7.

Actions that are part of the Alternative 2:

- Remove bird-attracting fruiting woody plants and trees (Odenwald & Turner, 1985) in the NHLD (Figure 2-5);
- Increase Street Tree Spacing and Remove Trees in Park Medians (Figure 2-6) as envisioned in the historic landscape design (Tooker et al., 2013);
- Reduce tree density by 40 percent in the NHLD, approximately 1250 trees (Figure 2-7);
- Reduce individual tree canopy density (see Appendix 2 in NHLD VMP);
- Remove selected hazard trees (Figure 2-8);
- Remove dead, diseased, or dying trees (Figure 2-9); and
- Remove shrubs with high-density foliage.

2.6.3 Alternative 3: Two-Phase Implementation Habitat Management

Alternative 3 would include all the actions listed in Alternative 2, above. However, this alternative would be implemented in two phases. Like Alternative 2, this alternative incorporates recommendations and management actions from the VMP for the NHLD. The NHLD VMP is an Appendix B to this EA and is described in Section 2.7.

Actions that are part of this Alternative are identified below. Figures 2-5 through 2-8 are the same figures as used to describe Alternative 2.

Phase I

- Remove bird-attracting fruiting woody plants and trees (Odenwald & Turner, 1985) in the NHLD (Figure 2-5);
- Increase Street Tree Spacing and Remove Trees in Park Medians (Figure 2-6); as envisioned in the historic landscape design (Tooker et al., 2013);
- Reduce tree density by 20 percent in the NHLD, approximately 625 trees;
- Reduce individual tree canopy density (see Appendix 2 in the NHLD VMP);
- Remove selected hazard trees (Figure 2-8);
- Remove dead, diseased, or dying trees (Figure 2-9); and
- Remove shrubs with high density foliage.

There would be a monitoring period between phases to determine Phase I efficacy and determine whether to implement Phase II. The amount of time would be two years, or as determined by JBSA.

Phase II

- Remove bird-attracting fruiting woody plants and trees (Odenwald & Turner, 1985) in the NHLD (Figure 2-6);
- Reduce tree density by an additional 20 percent in the NHLD, approximately 625 trees;

- Reduce individual tree canopy density (see Appendix 2 in the NHLD VMP);
- Remove selected hazard trees (Figure 2-8);
- Remove dead, diseased, or dying trees (Figure 2-9); and
- Remove shrubs with high density foliage.

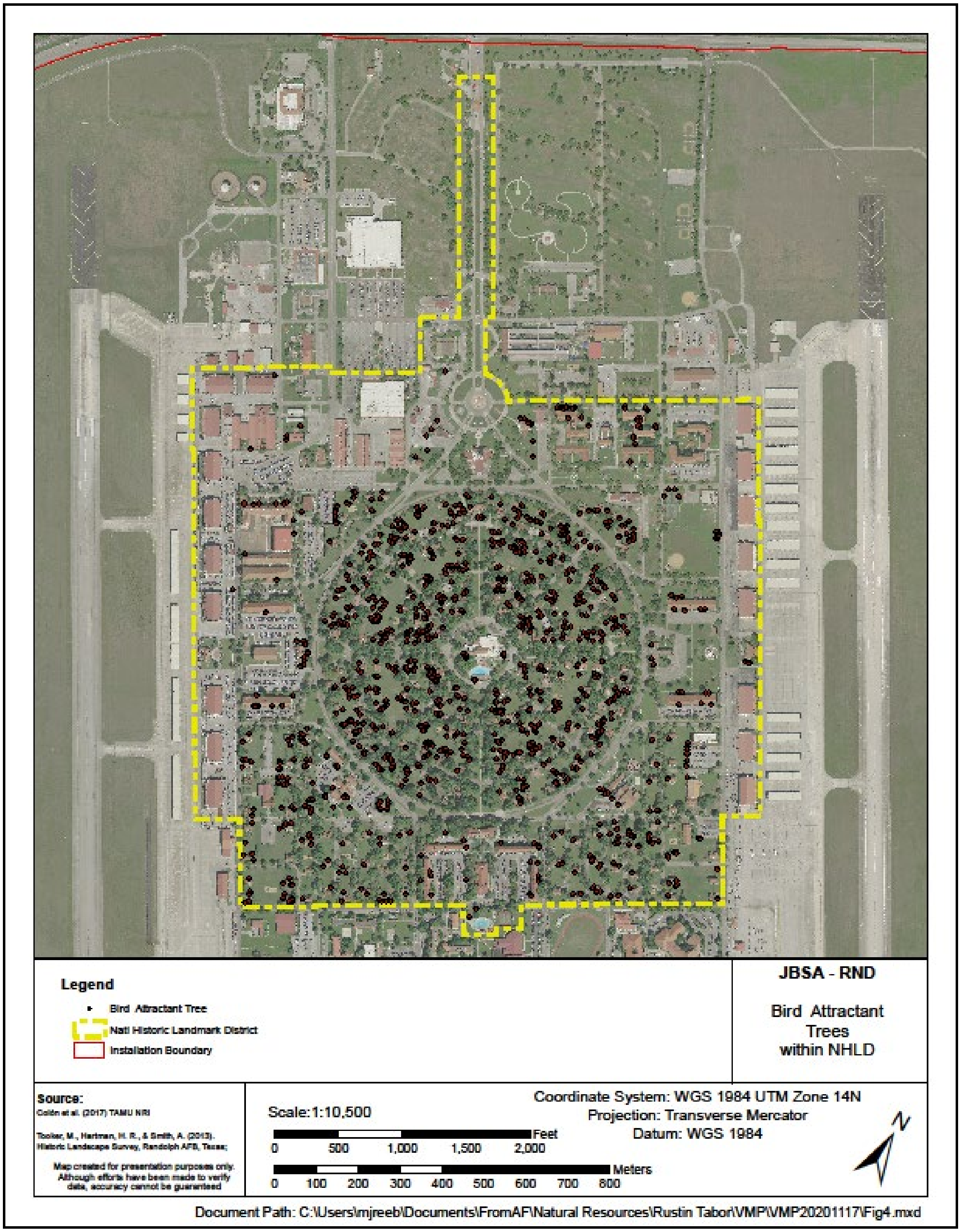

Figure 2-5. Bird-attracting fruiting woody plants and trees in the National Historic Landmark District that would be removed—removal included in both action alternatives.

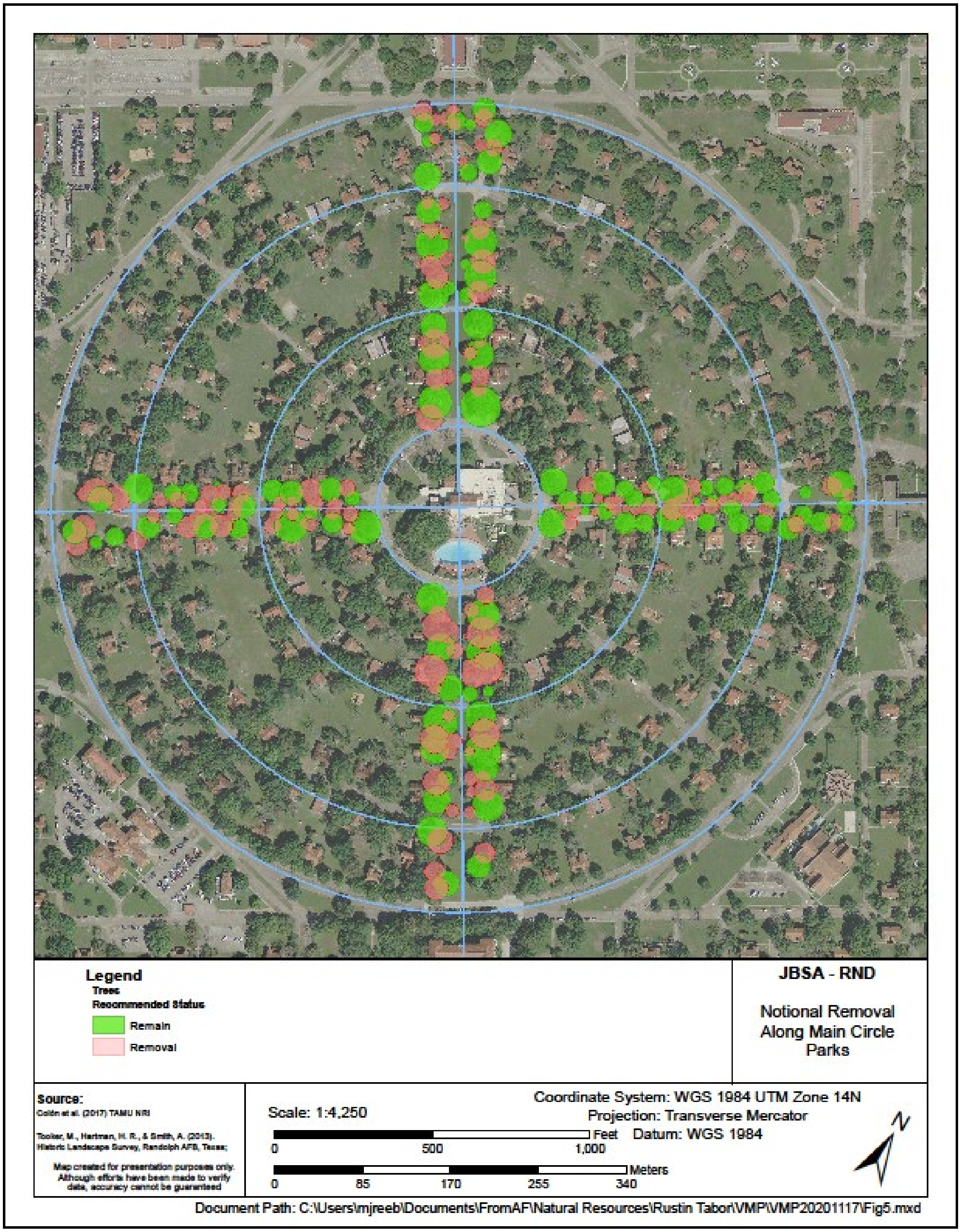

Figure 2-6. Main Circle Parks with increased tree spacing. This diagram is notional. Specific trees to be removed would be selected based upon species health, hazard, form, etc.

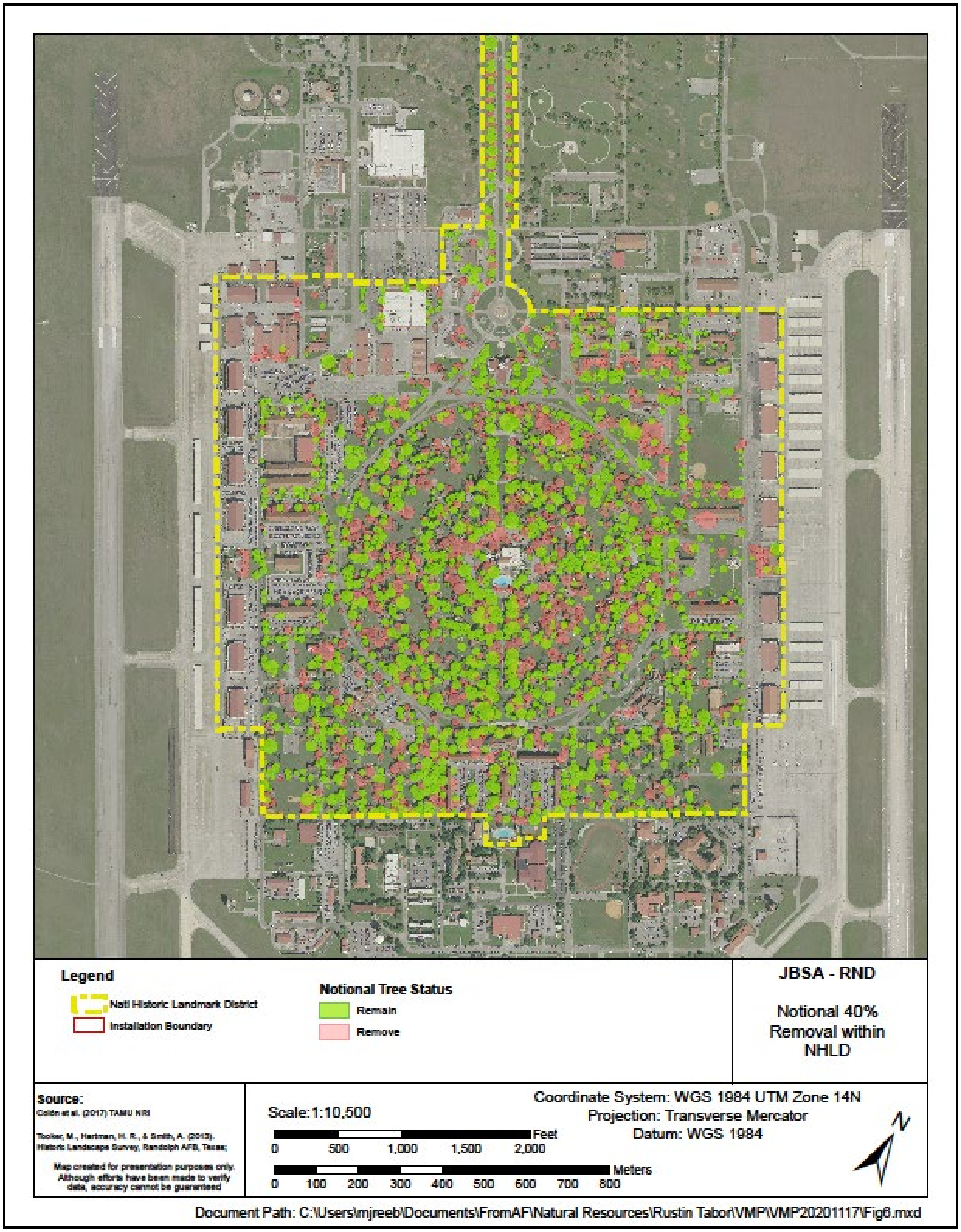

Figure 2-7. NHLD 40 percent tree removal. This diagram is notional. Green (retained) and red (removed) circles are 30-foot buffers around each tree for scale. Specific trees to be removed would be selected based upon health, hazard, attraction to birds, species, etc.

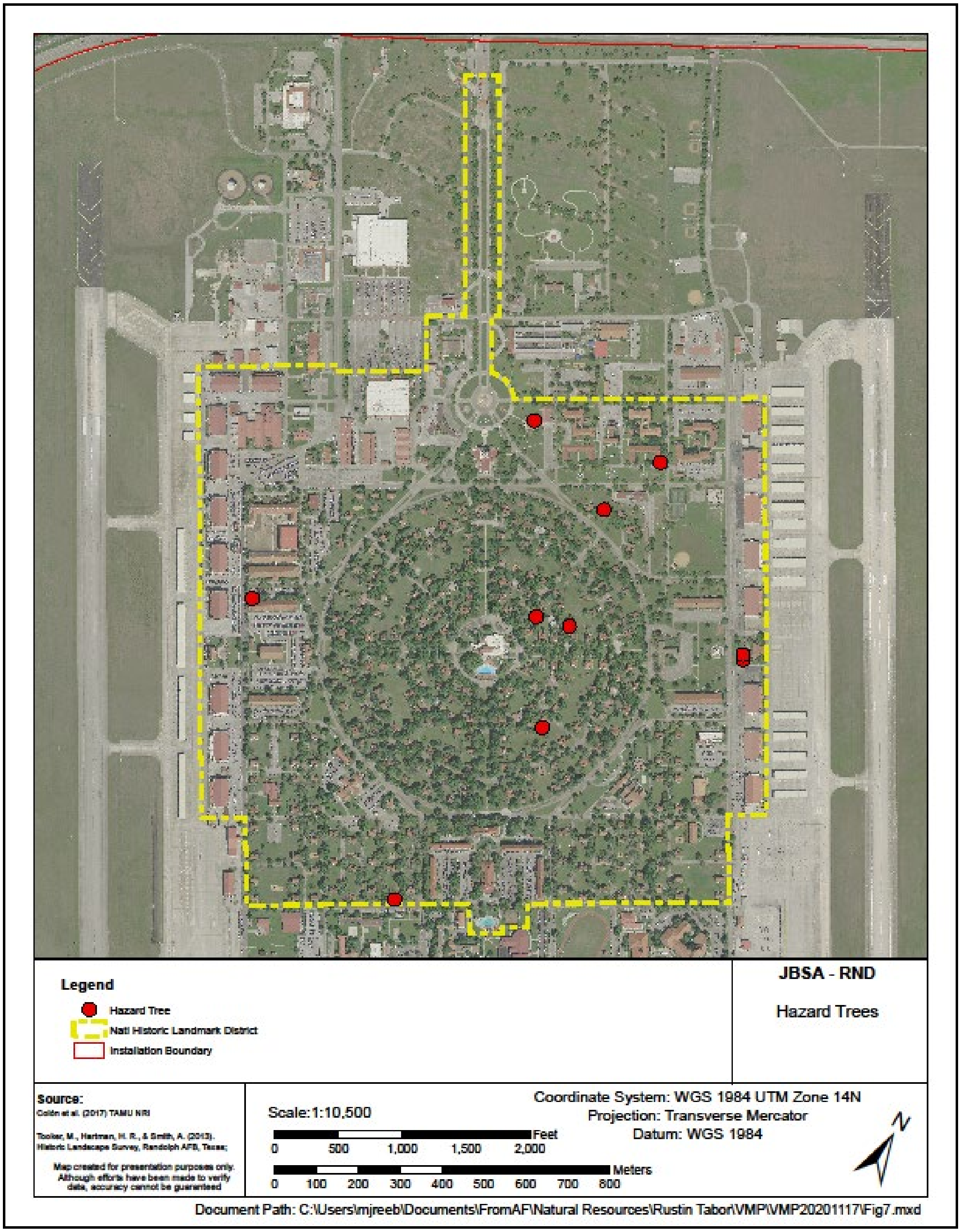

Figure 2-8. Hazard trees (Colón et al., 2017). Hazard tree removal is part of both action alternatives.

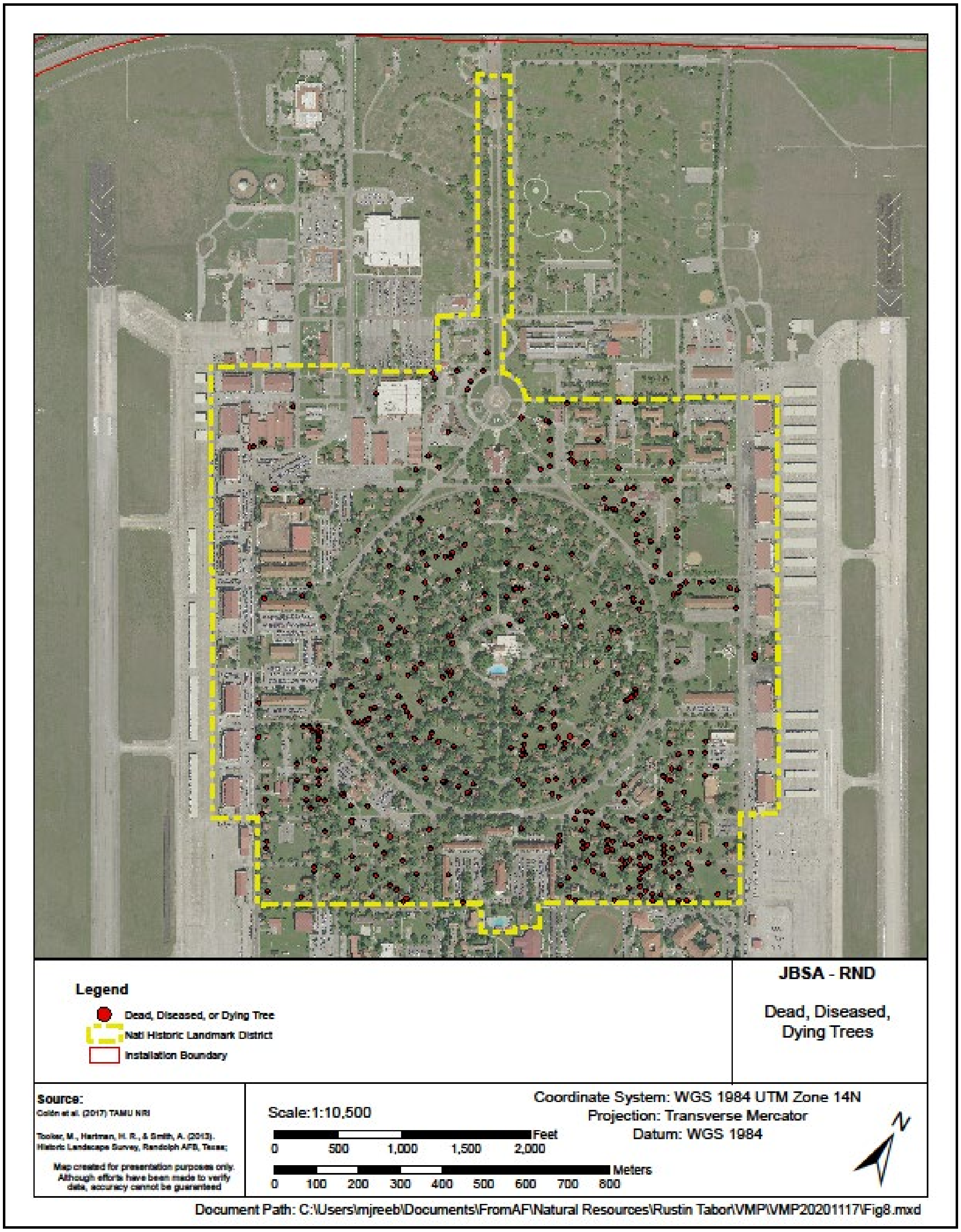

Figure 2-9. Dead, diseased, or dying (DDD) trees (Colón et al., 2017). Removal of DDD trees is part of both action alternatives.

2.7 National Historic Landmark District Vegetation Management Plan

The National Historic Landmark District Vegetation Management Plan (NHLD VMP) is part of both action alternatives and is a stand-alone appendix to the EA. It serves as a guide for on-the-ground management. The VMP (Appendix B) is designed to meet mission requirements, help ensure a safe flying environment, and protect the aesthetic and cultural aspects of the NHLD. While flying safety takes precedence, vegetation treatment objectives in the VMP are designed to preserve the integrity of the NHLD. The VMP details vegetation management objectives for the Proposed Action and the sustained management of landscapes in the NHLD.

The landscapes of Randolph Field (now part of JBSA-RND) are integral to the character of the district (Tooker et al., 2013). Views around Randolph Field were emphasized through the geometrical layout of the base. Through spatial organization, important features of the base were visually reinforced by axial alignments, open spaces, and vertically defined by street trees. The base plan is augmented by rows of oak trees, green boulevards, extensive plantings, gardens, and fountains (Tooker et al., 2013). The vegetation in Randolph's NHLD is closely related to land use patterns. Differences in vegetation patterns delineate boundaries and land use areas in the NHLD (Figure 2-12). The NHLD VMP's general arboreal management guidelines are consistent with the period of significance arboreal plans to the extent practicable.

The NHLD VMP consists of four sections: Introduction, Randolph Field NHLD BASH Risk Management and Viewshed Restoration Actions, Randolph Field NHLD Vegetation Management Guidelines, and Vegetation Treatment Guidance.

1. The **Introduction** section includes a management summary and scope; historical overview; vegetation as related to land use, spatial organization, and views; and existing conditions summarized from the EA.
2. The **Randolph Field NHLD BASH Risk Management and Viewshed Restoration Actions** section describes the Proposed Action, and desired future conditions, i.e., conditions following implementation of the Preferred Alternative in the *Bird/Wildlife Aircraft Strike Hazard Risk Mitigation through Habitat Management, JBSA-Randolph, TX*, Environmental Assessment.
3. The **Randolph Field NHLD Vegetation Management Guidelines** section provides the overall management guidelines, component guidelines for views and viewsheds, and the preservation strategy for the long-term management of the landscape in the NHLD. The original intent and character of the planting strategies from the period of significance, as available from plan-to-scale drawings and period photographs from the 1930's and 1940's, are the basis for treatment decisions within the NHLD. If alterations and substitutions were to be required to meet operational needs or for mitigation purposes, they would be made with an effort to preserve the integrity of the landscape. All treatment decisions in the NHLD VMP also would be made with consideration and

understanding of maintenance issues to ensure that the proposed treatment is accomplished and maintained over time. Preservation of the overall integrity of the historic landscape would be the goal.

4. The **General Vegetation Treatment Guidance** section would provide general vegetative treatment guidance to include pruning, trimming and tree/stump removal, tree risk management, site cleanup, tree removal documentation requirements, and MBTA responsibilities.

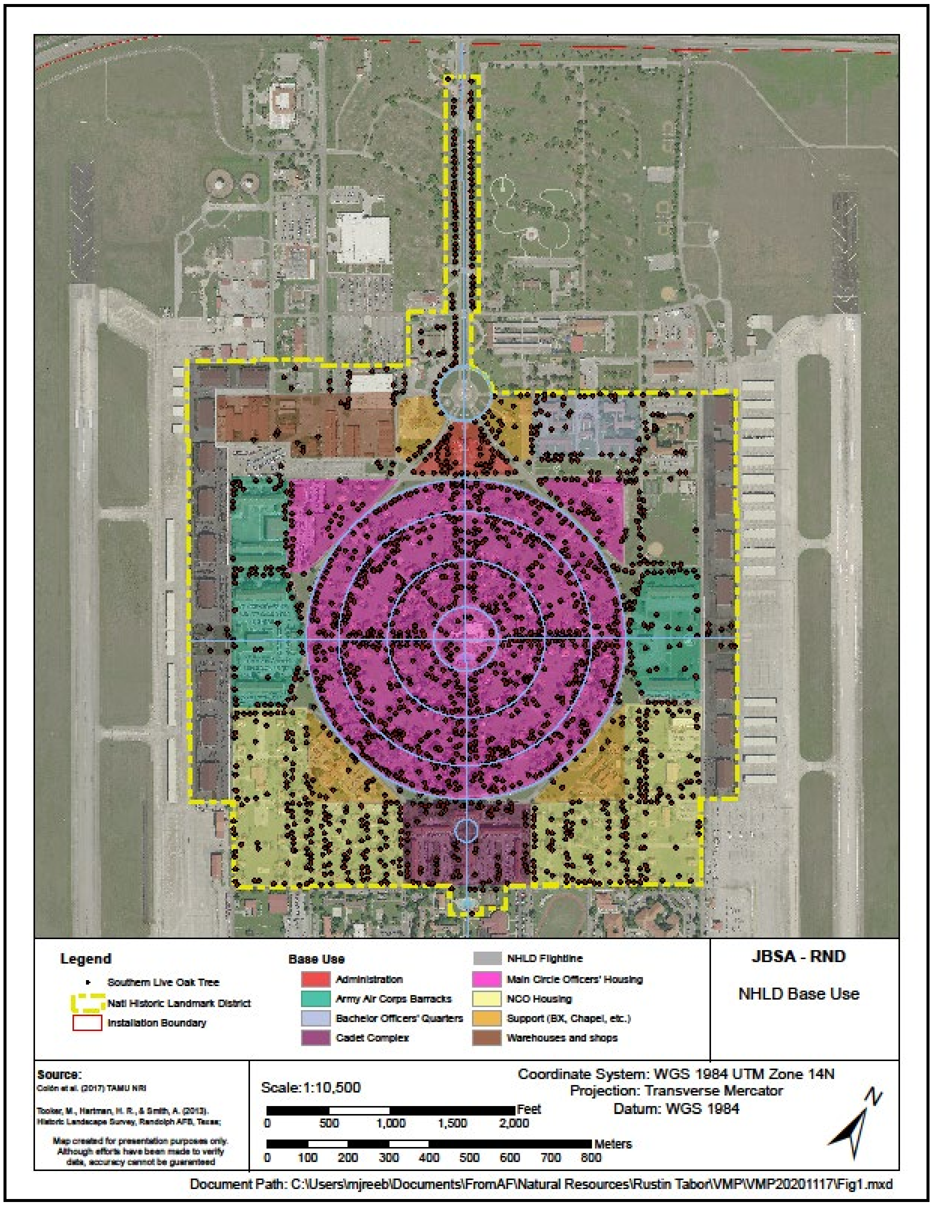

Figure 2-10. Base Plan, land use, geometric axes, 1930's.

3. Affected Environment

This section describes the environmental resources and current conditions that may be affected by the Proposed Action and provides information to serve as a baseline from which to identify and evaluate potential environmental and socioeconomic impacts that could result from implementation of the Proposed Action. Baseline conditions are represented by current conditions.

The criteria for evaluating potential environmental effects are measured in terms of context and intensity (40 CFR § 1508.27).[15] Context is the potentially affected environment while intensity is the degree of the effects. Context and intensity of the potential effects consider duration, direct or indirect impacts, magnitude of the impact, and whether they are adverse or beneficial.

3.1 Scope of the Analysis

Per CEQ regulations (40 CFR § 1501.7(s) (3)), federal agencies may focus their NEPA analysis on those resource areas that could be affected and omit discussions of resource areas that would not be affected by a Proposed Action. Based upon the scope of the Proposed Action, resource areas with minimal or no impacts were identified through an interdisciplinary screening process. The following resource areas have been reviewed and determined not to warrant further consideration because there would be no or negligible potential for effects from implementing the Proposed Action:

- Airspace Management;
- Land Use;
- Water Resources (ground water, surface water, wetlands, floodplains);
- Earth Resources;
- Hazardous Materials and Waste;
- Safety and Occupational Health; and
- Socioeconomics and Environmental Justice.

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[15] The Council on Environmental Quality's (CEQ) updated the regulations implementing the procedural provisions of the NEPA in 2020. While the new rule retains much of the existing rule's language, there have been changes in impacts terminology. "effects" now are defined as "changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives." There also are changes to the concept of cumulative impacts. CEQ's final rule took effect September 14, 2020. Agencies have 12 months to propose revisions to their implementing procedures. Due to the timing of this EA, it has been prepared in accordance with the USAF Environmental Impact Analysis Process as amended (66 FR 16868, March 28, 2001).

A description of each resource area and the rational for a determination of negligible or no effect is provided below. Unless otherwise noted, the region of influence (ROI) is the Randolph Field National Historic Landmark District.

3.1.1 Airspace Management

The Proposed Action would have no impact on airspace management. No new airspace would be designated and no changes in use of the existing airspace would occur. Although the alternatives described herein address safety concerns with respect to the JBSA-RND flying mission, the alternatives would not affect JBSA-RND or other airspace management. Consequently, the USAF anticipates no short- or long-term impacts on airspace management at JBSA-RND.

This resource area has not been carried forward for detailed analysis.

3.1.2 Land Use

The Proposed Action would have no impact on land use. The alternatives described herein would not involve any changes in land use designations, and lands would be used consistent with current uses following implementation of the Proposed Action. There would be a change in land cover types. Implementation of the action alternatives would result in an estimated increase in open, grassy areas of approximately 34 acres and a corresponding decrease tree covered acreage in the NHLD based upon a land cover assessment (i-Tree Canopy[16] Cover Assessment and Tree Benefits Report, Appendix C). The change would not affect land use.

This resource area has not been carried forward for detailed analysis.

3.1.3 Water Resources

The Proposed Action would have minimal or no impact on water resources on JBSA-RND or potentially affected contiguous areas. Water resources include groundwater, surface water, wetlands, and floodplains. Evaluation of the impacts includes the effect that implementation of Proposed Action would have on the quality and quantity of the resource.

Groundwater. Groundwater is water beneath the earth's surface that fills the spaces between soil particles and the fractures in rocks. Groundwater originates as and is replenished by precipitation. A body of rock or sediment that holds groundwater is called an aquifer.

The USEPA designated the Edwards Aquifer[17]as a Sole Source Aquifer in 1975 under the Sole Source Aquifer Protection Program of the Safe Drinking Water Act. A Sole Source Aquifer supplies 50 percent or more of the drinking water used by the area overlying the aquifer

[16] i-Tree Canopy is one of a suite of software from the USDA Forest Service that provides an estimate of urban and rural forestry analysis and benefits assessments.
[17] The Edwards Aquifer is the only sole source aquifer in Texas.

(USEPA, 1994). The aquifer extends through parts of ten counties including Bexar and covers an area approximately 180 miles long and 5 to 40 miles wide (Edwards Aquifer Authority, 2021). The aquifer is divided into two segments, the San Antonio segment to the south and the smaller, northern Barton Springs segment. The San Antonio segment is where most withdrawal for human use occurs. The Edwards Aquifer is the primary source of drinking water for the San Antonio Metropolitan Area. The Edwards Aquifer underlies JBSA-RND at a depth of 500 feet or more and no portion of the installation is within the Edwards Aquifer contributing zone or the recharge zone (Edwards Aquifer Authority, 2021). The northwest corner of JBSA-RND is within the artesian[18] zone of the Edwards Aquifer. JBSA-RND has eight groundwater supply wells, all are completed in the Edwards Aquifer but only three currently are in service (JBSA, 2020a). Concerns over the impact of water levels within the aquifer on local economies and the welfare of endangered species have led to an increase in regulation on aquifer users. The Edwards Aquifer is under artesian conditions and is sealed from the surface by substantial sequences of clay, marl, and sandstone. This project would not be expected to affect groundwater.

This resource area has not been carried forward for detailed analysis.

Surface Water. Surface water resources consist of rivers, streams, and natural and artificial impoundments (lakes, ponds, etc.). They include natural, modified, and constructed water confinement and conveyance features above groundwater that may, or may not, have a confined channel and discernable water flows. Surface water is important for its contributions to the economic, ecological, recreational, and human health of a community. Stormwater is an important component of surface water systems because of its potential to introduce sediments and other contaminants that could degrade lakes, rivers, and streams. Proper management of stormwater flows, which can be exacerbated by high proportions of impervious surfaces associated with buildings, roads, and parking lots, is important to the management of surface water quality and natural flow characteristics.

JBSA-RND lies within the Cibolo Watershed, which is part of the San Antonio River Drainage. Cibolo Creek and its tributaries drain the area surrounding JBSA-RND and are part of the Central Texas Coastal Subregion, flowing into the Gulf of Mexico. The project area is located adjacent to mid Cibolo Creek, which flows south and east along the northeastern boundary of JBSA-RND. Most of JBSA-RND drains to the southeast through the on-base detention ponds to Woman Hollering Creek (sometimes known as Women Hollow Creek). Woman Hollering Creek begins at the southwest of the apron area of JBSA-RND. The creek is historically an intermittent stream receiving and conveying water only during rainfall events and from groundwater seepage through its course. There also exists a shallow water table beneath JBSA-RND that may be in communication with the local surface waters such as Woman Hollering Creek.

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[18] An artesian aquifer is a confined aquifer containing groundwater under positive pressure. Water flows under natural pressure without pumping from wells that tap artesian aquifers.

There would be no increase in impervious cover that would affect runoff (see i-Tree Canopy Appendix C). Tree canopy and vegetation removal resulting from implementation of the Proposed Action would reduce intercepted rainfall and dynamic storage. Implementation of the Proposed Action is expected to result in and estimated 58,800 cf/yr increase in runoff (see i-Tree Eco Hydrology Effects in Appendix C). However, because of the large number of trees, shrubs, and extensive groundcover remaining following implementation and because of JBSA-RND's storm sewers, the Proposed Action would be expected to have a negligible effect on surface water runoff.

This resource area has not been carried forward for detailed analysis.

Wetlands. Wetlands are one type of Water of the United States (WoUS). Typically, for a wetland to be considered a Water of the United States (WoUS), it must satisfy three criteria: (1) greater than 50 percent of the plant species in the community must be hydrophytic (water loving) species, (2) the soils must be hydric, and wetland hydrology (i.e., standing water), and (3) evidence of standing or flowing water must be present. If one or more of these criterion is absent, the wetland is not considered a WoUS. The Clean Water Act defines wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs, and similar watery environments. The United States Army Corps of Engineers (USACE) regulates the discharge of dredged material or fill material into waters and wetlands of the United States pursuant to Section 404 of the CWA. Section 401 of the CWA requires that an application for a federal license or permit to conduct an activity that could result in a discharge into the waters of the United States provide the permitting agency a certification from the state in which the discharge originates that certifies that the license or permit complies with the CWA requirements, including applicable state water quality standards.

The Integrated Natural Resources Management Plan (INRMP) identifies 18 wetlands on JBSA-RND with a total acreage of 25.5 acres (JBSA, 2020a). All "wetlands" on JBSA-RND are man-made and are identified by the USFWS as either diked/impounded or excavated[19] (USFWS, 2021a). There are no wetlands in the project area or that would be affected by implementation of the Proposed Action.

This resource area has not been carried forward for detailed analysis.

[19] The USFWS classifies the retention ponds in the southeastern part of JBSA-RND as "PUBHh"-palustrine (P), unconsolidated bottom (UB), permanently flooded (H), diked/impounded water bodies (h). A palustrine system includes nontidal wetlands dominated by trees, shrubs, etc. Unconsolidated bottom refers to the small particle size of sediments of bottom of the waterbody and the waterbody having a vegetative cover less than 30 percent.

Floodplains. Floodplains are areas of low-level ground present along rivers, stream channels, or coastal waters. Such lands might be subject to periodic or infrequent inundation due to a flood created by rain or melting snow. Risk of flooding typically hinges on local topography, the frequency of precipitation events, the size of the watershed above the floodplain, and upstream development. Flood potential is evaluated by the Federal Emergency Management Agency (FEMA), which defines the 100-year floodplain as an area within which there is a 1 percent chance of inundation by a flood event each year. Certain facilities such as hospitals, schools, or storage buildings for irreplaceable records inherently pose too great a risk from flooding to be within a 100- or 500-year floodplain. Federal, state, and local regulations often limit floodplain development to passive uses, such as recreational and preservation activities, to reduce the risks to human health and safety.

EO 11988, Floodplain Management, requires Federal agencies to determine whether a Proposed Action would occur within a floodplain. This determination typically involves consultation of appropriate FEMA Flood Insurance Rate Maps, which contain enough general information to determine the relationship of the project area to nearby floodplains.

Approximately 54 acres of JBSA-RND fall within a 100-year floodplain (USAF 2020) and approximately 9.7 acres fall within a 500-year floodplain. Areas within floodplains are typically adjacent to creeks or their tributaries that transect JBSA-RND (e.g., Woman Hollering Creek). Implementation of the Proposed Action would result in an estimated 60,000 cf/yr increase in runoff (see i-Tree Eco Hydrology Effects in Appendix C). The increase is within JBSA-RND's stormwater sewer system design value. The project area is not in a floodplain and the estimated increase in stormwater discharge due to implementing the Proposed Action is minimal.

This resource area has not been carried forward for detailed analysis.

3.1.4 Earth Resources

The Proposed Action would have no impact on earth resources on JBSA-RND. The alternatives described herein would not involve major excavation or drilling that would affect subsurface geological structures. Under the Proposed Action, trees to be removed would be cut below ground level, the hole filled with a soil and woodchip mix and, to the extent possible considering obstructions, an area within a 10-foot radius surrounding the tree stump would be graded to match the grade of the adjacent ground. The bare ground promptly would be seeded with a drought-tolerant grass species. Geology, topography, and soils would remain unchanged from their current conditions.

This resource area has not been carried forward for detailed analysis.

3.1.5 Hazardous Materials and Solid Waste

The Proposed Action would have no impact on the generation or handling of hazardous materials or solid waste on JBSA-RND.

Hazardous Materials. Hazardous materials are hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions in 49 CFR 173. Hazardous wastes are defined by the Resources Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments of 1984 as "solid waste, or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." (42 USC 82 § 6903).

Hazardous materials, such as pesticides, are stored and used at JBSA-RND for everyday operations. Pesticide and herbicide use would be managed in accordance with the JBSA INRMP (JBSA, 2020a), AFI 32-1053 (Integrated Pest Management Program), DoD Installation Integrated Pest Management Program Guide (2013, as amended), and JBSA 91-212 Bird/Wildlife Aircraft Strike Hazard Plan. Pesticides and herbicides would be applied in accordance with manufacturer recommendations as provided on Safety Data Sheets[20] and product labels. All pesticide and herbicide applications to vegetation on Randolph would be accomplished by certified DoD pesticide applicators under the direct supervision of a currently certified person, or by contractors who are State of Texas licensed pesticide applicators. There would be no change in the storage, usage and disposal of hazardous materials and products. Usage would be in accordance with AFI 32-7086, Hazardous Materials Management (USAF, 2004).

This resource area has not been carried forward for detailed analysis.

Solid waste. All municipal solid waste from JBSA-RND is collected and disposed of off-installation by private contract disposal services (JBSA, 2018). Solid waste is disposed of at the Covel Gardens Landfill, a Type I Municipal Solid Waste Landfill located about 34 miles by road southwest of the installation. The landfill has a permitted capacity of 124.1 million cubic yards with a remaining capacity of 110.5 million cubic yards (approximately 89 percent) and is authorized under TCEQ Permit No 2093B (Waste Management, 2021). Landscaping solid wastes include those wastes that are generated by vegetation maintenance activities associated with

[20] An SDS (formerly known as Material Safety Data Sheet (MSDS)) includes information such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.

the removal of dead, diseased, and dying trees, and other vegetation. There would be no change in solid waste management, but more waste temporarily would be generated while implementing the tree density reduction measures of the Proposed Action. The increase would be a negligible increase to the volume of waste received by Covel Gardens Landfill.

This resource area has not been carried forward for detailed analysis.

3.1.6 Safety and Occupational Health

The Proposed Action would have no impact on safety or occupational health on JBSA-RND. A safe environment is one in which there is no or reduced potential for death, serious bodily injury, or property damage. Human public safety includes the well-being, safety, and health of members of the public, contractors, and USAF personnel. USAF safety program ensures the safety of personnel and the public on the installation by regulating mission activities. AFI 91-202, The USAF Mishap Prevention Program, implements Air Force Policy Directive 91-2, Safety Programs, and provides guidance for implementing the safety program on all activities that occur on USAF installations. No unique or disproportionate risks to workers or the public or expose these populations to inherently unsafe or unhealthful environments is expected. Tree removal and waste handling would be consistent with current practices and would not be expected to result in an increased safety risk.

This resource area has not been carried forward for detailed analysis.

3.1.7 Socioeconomics

The Proposed Action would have insignificant impact on socioeconomics in local communities surrounding JBSA-RND or in the Greater San Antonio-New Braunfels Metropolitan Area. The term socioeconomics describes demographics associated with the human environment, such as employment, industry, income, population, housing, and schools. The alternatives described herein are predicted to have a negligible impact on employment levels or economic indicators in the region, including employment, industry, income, population, housing, and schools. None of the alternatives would result in a noticeable change in area employment or related community services. Consequently, the USAF anticipates no short- or long-term socioeconomic impact due to implementing either action alternative.

This resource area has not been carried forward for detailed analysis.

3.1.8 Environmental Justice

The Proposed Action would have no impact on environmental justice. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires Federal agencies to consider disproportionately high adverse effects on the human or environmental health to minority and low-income populations. The EO is intended to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The *Memorandum on Environmental Justice* (February 11, 1994) accompanying this EO was issued to "underscore certain provision of existing law that can help ensure that all communities and persons across this Nation live in a safe and healthful environment." The memorandum directs Federal agencies to "analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321 et seq."

The Proposed Action would not significantly alter public-use areas and would not introduce unique impacts not currently present. The USAF anticipates that no significant or disproportionate short- or long-term impacts would be expected on environmental justice populations.

This resource area has not been carried forward for detailed analysis.

The Proposed Action would have no impact to children from environmental health and safety risks. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, states that each Federal agency "(a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks."

No adverse health or safety risks would be introduced to public-use areas resulting within the ROI from implementation of the Proposed Action. Therefore, no impacts would be expected to children's health and safety.

This resource area has not been carried forward for detailed analysis.

3.2 Air Quality and Climate Change/Greenhouse Gasses

3.2.1 Definition of the Resource

The Clean Air Act as amened (CAAA), directed the EPA to establish a list of National Ambient Air Quality (NAAQ) standards to protect the public from the adverse impacts of potentially harmful pollutants. Under the Clean Air Act, the six pollutants defining air quality, called "criteria pollutants" are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3)[21], particulate matter (measured less than or equal to 10 microns in diameter [PM_{10}] and measured less than or equal to 2.5 microns in diameter [$PM_{2.5}$]), and lead (Pb). CO, SO_2, NO_2, and some particulates are emitted directly into the atmosphere from emissions sources. NO_2,

[21] Ozone commonly is referred as "smog". Ground level ozone is not emitted directly by any base source but is created by chemical reaction between nitrogen oxides (NO_x) and volatile organic compounds (VOC).

O_3, and some particulates are formed through atmospheric chemical reactions that are influenced by weather, ultraviolet light, and other atmospheric processes. Volatile organic compounds (VOCs) and nitrogen oxides[22] (NO_x) emissions are precursors[23] of O_3 and are used to represent O_3 generation. Air quality is measured by the concentration of these pollutants and precursors in the atmosphere at a given location.

Under the Air Force Air Quality EIAP (32 CFR § 989), the air pollutants of concern (USAF, 2019) include all criteria pollutants, greenhouse gases, and total hazardous air pollutants (HAPs). Under General Conformity the air pollutants of concern include only those criteria pollutants and their precursors for which the area is designated nonattainment or maintenance. Air quality documents must address the CAA General Conformity Rules requirements[24] as applicable.

The air emission sources used to implement any action alternative would produce negligible emissions of lead; therefore, lead does not warrant further discussion in this EA.

Air Quality Standards. The US Environmental Protection Agency (USEPA) has established National Ambient Air Quality Standards (NAAQS) (40 CFR § 50) for criteria pollutants. NAAQS are classified as either primary or secondary. Primary standards protect against adverse health impacts while secondary standards protect against welfare impacts, such as damage to farm crops, vegetation, and buildings. Some pollutants have short- and long-term standards. Short-term standards are designed to protect against acute, or short-term, health impacts, while long-term standards were established to protect against chronic health problems. While each state has the authority to adopt stricter standards than those established under the federal program, the State of Texas has accepted the federal standards. NAAQS are shown in Table 3-1.

Areas that are and have historically been in compliance with the NAAQS or have not been evaluated for NAAQS compliance are designated as attainment areas. Areas that violate a federal air quality standard are designated as nonattainment areas. Areas that have transitioned from nonattainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment.

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[22] NO_x is one of a group of nitrogen oxides. NO_2 and NO_x interact with water, oxygen, and other chemicals in the atmosphere to form particulate matter and ozone. NO_2 is used as the indicator for the group of nitrogen oxides.
[23] A "precursor" is a chemical compound that leads to the formation of a pollutant.
[24] AFMAN 32-7002 States that, "for local projects or projects not related to aircraft, only use an approved Air Quality database/tool, along with best available local information and estimating techniques, if available" (USAF, 2020). Permission to use the *Air Emissions Guide for Mobile Sources* and *Air Emissions Guide for USAF Transitory Source*s to perform the air impacts analysis for this project has been granted because the ACAM model does not include emission factors for the off-road equipment (stump grinders, chainsaws, etc.) that would be used to implement the action alternatives (F. Castaneda, personal communication, October 5, 2020).

Table 3-1. National Ambient Air Quality Standards

Pollutant		Primary/Secondary	Averaging Time	Concentration[25]	Remarks
CO		Primary	8 hr	9 ppm	Not to be exceeded more than once per yr
			1 hr	35 ppm	
Pb		Primary and Secondary	Rolling 3 mo average	0.15 μg/m³	Not to be exceeded
NO_2		Primary	1 hr	100 ppb	98th percentile of 1-hr daily max concentration, averaged over 3 yrs
		Primary and Secondary	Annual	53 ppb	Annual mean
O_3		Primary and Secondary	8 hr	0.070 ppm	Annual 4th highest daily max 8-hr concentration, averaged over 3 yrs
Particulate Matter	$PM_{2.5}$	Primary	Annual	12.0 μg/m³	Annual mean, averaged over 3 yrs
		Secondary	Annual	15.0 μg/m³	Annual mean averaged over 3 yrs
		Primary and Secondary	24 hr	35 μg/m³	98th percentile, averaged over 3 yrs
	PM_{10}	Primary and Secondary	24 hr	150 μg/m³	Not to be exceeded more than once per yr on average over 3 yrs
SO_2		Primary	1 hr	75 ppb	99th percentile of 1-hr daily max. concentration, averaged over 3 yrs
		Secondary	3 hr	0.5 ppm	Not to be exceeded more than once per yr

3.2.2 Affected Environment

The region of influence (ROI) for the evaluation of air quality impacts in this EA is Bexar County, the San Antonio Texas Nonattainment Area, and the Metropolitan San Antonio Intrastate (MSAI) Air Quality Control Region (AQCR) 217 (40 CFR § 81.40). As defined in 40 CFR § 81.344, Bexar County is designated as marginal nonattainment for ozone pollutants. The CAAA

[25] "ppm" is parts per million. "ppb" is parts per billion. "μg/m³" is micrograms per cubic meter.

mandates that state agencies adopt State Implementation Plans (SIPs) that are designed to eliminate or reduce the severity and number of exceedances of the NAAQS.[26]

The USEPA General Conformity Rule (GCR) applies to federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specific thresholds. The emissions thresholds that trigger requirements for a conformity analysis are called *de minimis* levels. *De minimis* emissions levels (in tons per year [tpy]) vary by pollutant and depend on the severity of the nonattainment status for the air quality management area in question. The *de minimis* emissions level for ozone (volatile organic compounds or NO_x) is 100 tpy in a marginal nonattainment area (40 CFR § 93.153) such as Bexar County. Emissions exceeding this level would require a conformity determination.

JBSA-RND operates under a single air operating permit. Permit requirements include periodic reporting, monitoring, and record keeping of emissions of criteria pollutants of concern from base operations, e.g., paint spray booths, aircraft engine test stands, etc. JBSA-RND's facility-wide emissions are listed in Table 3-2.

Table 3-2. Emissions of Significant Stationary Sources at JBSA-RND (2018)

Pollutant	Emissions[27] (tpy)
CO	8.7
NO_x	7.2
VOCs	3.8
$PM_{2.5}$	1.0
PM_{10}	0.8
SO_2	0.2

Source: USAF 2019

Climate Change and Greenhouse Gases. JBSA-RND experiences a modified subtropical climate due to its location on the northwest edge of the Gulf Coastal Plain. January is the coolest month with the average high of 62 degrees Fahrenheit and the average low 40 degrees Fahrenheit. August is the warmest month averaging a high of 97 degrees Fahrenheit and a low of 75 degrees Fahrenheit[28] (US Climate Data, 2021). The average annual precipitation is 32.91 inches with the least precipitation occurring during the winter months and greatest in the spring.

[26] The Texas Commission on Environmental Quality proposed SIP revision that would include a technical analysis and weight of evidence analysis to demonstrate that the Bexar County marginal ozone nonattainment area would attain the 2015 eight-hour ozone NAAQS by its attainment date "but for" anthropogenic emissions emanating from outside the United States in accordance with CAA, §179B.)

[27] "tpy" is tons per year.

[28] The monthly normals cited here are for the period 1981-2010.

Global climate change refers to any significant, long-term fluctuations in temperature, precipitation, wind, sea level, and other elements of Earth's climate system brought about because of changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological, and geographic factors within the Earth system. Ways in which the Earth's climate system may be influenced by changes in the concentration of various gases in the atmosphere have been discussed worldwide. Of particular interest, greenhouse gases (GHGs) are gases[29] (e.g., CO_2) that trap heat or longwave radiation in the atmosphere and are therefore important temperature regulators of our atmosphere. GHG emissions occur from natural processes and human activities. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Ning, Chambers, & Abdollahi, 2015). Scientific evidence indicates a trend of increasing global temperature over the past century because of an increase in GHG emissions from human activities. Climate projections for JBSA were completed by Colorado State University's Center for Environmental Management Military Lands (CEMML, 2019). Model results forecast minimum and maximum temperatures and precipitation to increase because of global warming (JBSA, 2020a)

EO 13990[30], *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,* tasks agencies to capture the costs of GHG emissions to include the "social cost of carbon", social cost of nitrous oxide", and the "social cost of methane" associated with increases in GHG emissions and their impact on climate pollution. The climate change associated with global warming is predicted to produce negative economic and social consequences in many parts of the globe.

[29] The principal GHGs are water vapor, carbon dioxide, methane, nitrous oxide, and fluorinated gases. Although water vapor is the largest contributor to the Earth's greenhouse effect, it does not control the Earth's temperature because it is condensable, i.e., the maximum amount of water vapor is regulated by the atmosphere's temperature through evaporation and condensation. Without an increase in the remaining non-condensable GHGs, the amount of water vapor would remain constant, i.e., barring other changed conditions. Importantly, atmospheric water vapor generally cannot be attributed to human activities. In contrast, carbon dioxide largely is emitted through human activities. It is the most important GHG and accounts for about 80 percent of US GHG emissions. Carbon dioxide enters the atmosphere through the burning of fossil fuels, solid waste, trees and wood products, and certain chemical reactions. It is removed from the atmosphere naturally by plants as part of the biological carbon cycle.

[30] EO 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis* (86 FR 7073, January 20, 2021) directed CEQ to update its *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* (81 FR 51866, August 5, 2016). CEQ's final guidance on GHG and climate change had been revoked by EO 13783 *Promoting Energy Independence and Economic Growth* (82 FR 16093, March 28, 2017) and CEQ prepared new guidance, *Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions* (84 FR 30097, June 26, 2019) which subsequently has been rescinded by EO 13990.

EO 14008, *Tackling the Climate Crisis at Home and Abroad* (86 FR 7619, February 1, 2021) outlines policies to reduce GHG emissions and to bolster resilience to the impacts of climate change. The EO directs CEQ to review, revise, and update its 2016 final guidance entitled “Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews.” The CEQ guidance requires agencies within the DoD to quantify GHG emissions in NEPA assessments and review federal actions in the context of future climate scenarios and resiliency.

3.3 Noise and Acoustic Vibration

3.3.1 Definition of the Resource

Noise. Noise is defined as any sound that is undesired by the recipient and typically includes sounds not present in the natural environment, such as sounds emanating from aircraft; highways; and industrial, commercial, and residential sources. Noise generally interferes with normal activities or otherwise diminishes the quality of the natural environment. Noise may be intermittent or continuous, steady, or impulsive, stationary, or transient.

The standard measurement unit of sound is the decibel (dB), which represents the relationship between a measured sound pressure level and the minimum sound level a person with good hearing can detect reported on a logarithmic scale. A doubling of the energy of a noise source, such as doubling of traffic volume, would increase the noise level by three decibels, and a halving of the energy would result in a three-decibel decrease, both of which are barely perceptible to the human ear (California Department of Transportation, 2013a).

The human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, sound can be characterized by several methods. The most common method is the “A-weighted” sound level (dBA), which gives greater weight to the frequencies audible to the human ear by filtering out noise frequencies not audible to the human ear. Human judgments of the relative loudness or annoyance of a sound correlate well with the dBA levels of those sounds. Therefore, the dBA scale is used for measurements and standards involving the human perception of noise. The range of human hearing is approximately 3 to 140 dBA, with 110 dBA being considered intolerable or painful.

Noise levels vary continuously with time, and various descriptions of noise are used to account for this variance with time, including Leq, defined as the equivalent continuous sound level, Lmin and Lmax, defined as the minimum and maximum noise levels recorded during a monitoring period, and Ldn, defined as the day-night average sound level. The degree of annoyance depends on several other factors including frequency, pitch, background noise, duration, repetitiveness, and time of day.

In outdoor environments, sound generally is attenuated with distance from the source. For stationary off-road equipment such as a stump grinder or chainsaw that would be used to implement the Proposed Action, the rate of sound attenuation would be expected to be about 6 dB per doubling of distance, e.g., going from 10 feet to 20 feet would result in a 6 dB attenuation, from the noise site in an urban setting with highly acoustically reflective surfaces such as asphalt or concrete (California Department of Transportation, 2013a). Grounds maintenance equipment can cause an increase in sound well above ambient levels.

The federal government established noise guidelines and regulations to protect citizens from potential hearing damage and various other adverse physiological, psychological, and social effects caused by noise. According to the US Department of Housing and Urban Development criteria, residential units and other noise-sensitive land uses are “unacceptable” in areas where the 24-hour average noise exposure (Ldn) exceeds 75 dBA and “acceptable” in areas exposed to noise of 65 dBA or less (USHUD, 2021). For outdoor activities, USEPA recommends an average of 55 dBA[31] Ldn over 24-hours as the sound level below which there is no reason to suspect that the general population would be at risk from any of the effects of noise (USEPA, 1971; USEPA, 1974). The USEPA has determined that limiting exposure to noise levels more than 70 dBA $Leq_{(24)}$ for 24 hours or exposure to noise levels of 75 dBA for 8 hours ($Leq_{(8)}$) provides adequate hearing protection (USEPA, 1974). The ROI for noise impact assessment is the project site within the NHLD.

Table 3-3 lists the sound levels of common grounds maintenance equipment in the NHLD, predicted sound levels at distances of 50 feet and 500 feet, and the distance at which sound level is calculated to be 75 dBA (TRS Audio, 2021).

The Air Installation Compatible Use Zone (AICUZ) day-night average sound level (Ldn) for JBSA-RND gradients shown in Figure 3-1 depicts the cumulative noise exposure resulting from all aircraft operations at JBSA-RND (AFCEC, 2017). Because military flight operations vary daily, the modeled Ldn shown in the figure is an annual average. The noise contours align with the runways with the highest levels along the runways. The contour pattern is longer and wider on the east runway (Runway 32R) than on the west runway because T-38 flight operations dominate the east runway while the T-6 flight operations dominate the west runway. The T-38 is a twin jet engine fighter trainer aircraft that generates more noise than does the T-6 single-engine turboprop.

Acoustic Vibration. Acoustic vibration is energy transmitted as waves through the ground or man-made structures, which generally dissipates with distance from the vibration sources. In contrast to airborne noise, ground-borne vibration is not a common environmental problem

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[31] Equivalent noise levels for a duration less than 24 hours are higher, e.g., the USEPA calculates that exposure to a noise level of 75 dB over 8-hours would be equivalent to 70 dB over 24 hours (USEPA, 1974).

(John A. Volpe National Transportation Systems Center, 2018). It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major construction. Building damage due to vibration is rare. However, damage can occur in projects that include blasting or pile driving.

Table 3-3. Grounds Maintenance Equipment and Common Sound Reference Levels

Outside Noise Source	Sound Level (dBA)[32]	Predicted Sound Level at 50 ft (dBA)[33]	Predicted Sound Level at 500 ft (dBA)	Distance from Source Sound Level 75 dBA (ft)
Loader	112	78	58	71
Chainsaw	110	76	56	56
Stump Grinder	114	80	60	89
Hedge Trimmer	103	69	49	25
Weed Eater	96	62	42	11
Shredder and Riding Lawn Mower	90	56	36	6

There are several methods used to quantify vibration. The peak particle velocity (PPV) is most frequently used to describe vibration impacts to buildings. PPV is defined as the maximum peak of the vibration signal in inches per second (in/sec). Frequency and duration also are factors. Impact to buildings has been found to be greater at lower frequencies and with longer duration (Konan & Schuring, 1983). Generally, in residential areas such as those in the NHLD, the background vibration velocity is usually around 0.0013 in/sec PPV which is well below the vibration velocity level threshold of perception for humans, which is 0.035 in/sec PPV (California Department of Transportation, 2013a). A conservative vibration limit of 0.12 in/sec (Hanson, Towers, & Maister, 2006) for transient and 0.08 for continuous threshold criteria has been established for historic structures (California Department of Transportation, 2013b), see Table 3-4.

[32] Sources: (USEPA, 1971), (Predator, 2007) (University of Florida, 2021)
[33] Source: (Linuxfocus.org, 2021).

Figure 3-1. JBSA-RND AICUZ noise contours in the NHLD *(AFCEC, 2017)*.

Table 3-4. Acoustic Vibration Damage Potential

Acoustic Vibration Damage Potential/Annoyance Potential	Maximum PPV [in/sec]	
	Transient Source	Continuous/Frequent Intermittent Source
Barely perceptible	0.04-0.2	0.01
Large bulldozer		0.089
Extremely fragile historic building	0.12	0.08
Fragile building	0.2	0.10
Distinctly perceptible	0.2-0.8	0.035
Jackhammer (at 25 feet)		0.035
Historic/Old building	0.5	0.25
Older residential structures	0.5	0.30
Strongly perceptible	0.8-2.0	0.10
Newer residential structures	1.0	0.50
Modern commercial buildings	2.0	0.50
Severe	2.0	0.40

Source: Acoustic vibration damage potential (California Department of Transportation, 2013); vibration annoyance potential guidelines (Carman, 2012).

3.3.2 Affected Environment

Noise. Universal City's noise ordinance (Code of Ordinances of Universal City, Texas Part III, Sec. 3-121) prohibits, "Any unreasonably loud, disturbing, unnecessary noise which causes material distress, discomfort or injury to persons of ordinary sensibilities in the immediate vicinity thereof is hereby declared to be a nuisance and is hereafter prohibited." Nuisances include "any excessive noise on any street adjacent to any school or institution of learning while the same is in session or adjacent to any hospital which unreasonably interferes with the workings of such institutions, providing conspicuous signs are displayed in such manner indicating that the same is a school or hospital street."

Sensitive receptors such as schools or hospitals are not located in the vicinity of the project area. All grounds maintenance activities currently occur routinely. Actions would occur in residential and office areas of the NHLD which currently experience the same grounds maintenance activities, including tree trimming and removal.

Acoustic Vibration. Randolph Field NHLD includes 350 historical buildings and structures. Building construction began in November 1928 and most of the historic buildings were built between 1929 and 1932 (Cook & Sprinkle, 2001). The dominant architectural styles of the NHLD are Mission Revival, Spanish Colonial, and Art Moderne (Clow, Knight, Peter, & Allday, 1998). Construction materials include concrete foundation, stucco walls, red clay tile and metal rooves (Cook & Sprinkle, 2001). Infrastructure

3.4 Infrastructure

3.4.1 Definition of the Resource

Infrastructure includes the facilities and systems that support the sustainable functionality of a population in a specified area. Infrastructure includes transportation, electrical system, stormwater system communications systems, water supply, wastewater system, liquid fuel, natural gas, and solid waste management. The alternatives described herein would not be expected to require or result in any facility construction or modification, utility infrastructure upgrades, demolition, or any other impacts to infrastructure at JBSA-RND. No new utility connections expected for any of the alternatives.

3.4.2 Affected Environment

Transportation and Parking. Transportation refers to major and minor roadways that feed into an installation and the roadways, traffic patterns, and parking areas on an installation. Randolph Field is within a well-developed roadway system composed of all levels of roads. The primary roads moving traffic on and off the installation are Harmon Drive, West 3rd Street and East 5th Street, which connect with Main Circle, C Street, F Street, and H Street. Other roads on the installation are connected to these primary roads. A condition of good, fair, or poor has been assigned to all pavement within JBSA-RND and is based on a street's condition and presence of curbs/gutters, trees, pedestrians' buffers, planting strips, and sidewalks. However, most pavement on the installation, is in good or fair condition (JBSA, 2019). Parking at JBSA-RND is provided by 12,231 street and parking lot spaces. JBSA-RND has a total population of 15,492 which includes 5,291 dependents (DoD, 2021). The installation is considered to have excessive street parking (JBSA, 2019). Traffic only would be temporarily delayed, and parking suspended until vehicles could safely enter and exit a work zones where ground maintenance activities, e.g., street tree removal, were occurring.

This resource area of infrastructure has not been carried forward for detailed analysis.

Pedestrian Facilities. The pedestrian network at JBSA-RND consists of intermittent concrete sidewalks and crosswalks along primary roadways. Pedestrian facilities along residential streets and minor roadways are uncommon. The JBSA-RND Support Services Area Development Plans outline a district planning vision that includes promoting walkable neighborhoods and campuses, and providing modern, multi-use transportation networks (JBSA, 2019). Pedestrian traffic may be affected locally for short periods during tree trimming and tree removal.

This resource area of infrastructure has not been carried forward for detailed analysis.

Electrical System. Electrical power at JBSA-RND is provided by San Antonio City Public Service Energy through one primary on-installation substation, four 13.3-kilovolt feeder lines, and two secondary substations. San Antonio City Public Service Energy sources power from a variety of sources including coal plants, natural gas plants, and wind power facilities. The existing capacity of the substation is 21 megawatts (MW), which is sufficient to meet JBSA-RND average electrical demand of 16 MW (JBSA, 2018). The electrical distribution system is completely underground, and all new electrical infrastructure is required to be placed underground. Residential buildings are individually metered.

This resource area of infrastructure has not been carried forward for detailed analysis.

Heating and Cooling Systems. Facilities at JBSA-RND are cooled using four on-installation chilled-water plants. Three chilled-water plants on the east side of the installation have a combined estimated capacity of 6,000 tons and one chilled-water plant on the west side of the installation has an estimated capacity of 1,000 tons. Together the four plants provide cooling to approximately 80 percent of the buildings on the installation. Additionally, Building 991 houses three 500-ton chillers and a thermal energy storage system with a 1,000,000-gallon capacity. Facilities on the installation are heated with boilers as there is no central heating system. There are 318 housing units on JBSA-RND. They are heated by natural gas (802 CES/CENPE, energy and utilities). Heating and cooling systems would be adequate for additional demand that may be caused by implementation of the Proposed Action. However, there would be additional fuel costs with additional energy demand.

This resource area within infrastructure has been carried forward for detailed analysis related to energy costs.

Natural Gas System. Natural Gas at JBSA-RND is supplied by Kinder Morgan and CenterPoint Energy and approximately 80 percent of installation buildings are metered for natural gas use. Natural gas pipeline distribution capacity is 4 billion cubic feet per day, while the average demand is approximately 43.2 million cubic feet per day. Underground natural gas lines are primarily located along roadways and in residential areas (JBSA, 2018).

This resource area of infrastructure has not been carried forward for detailed analysis.

Stormwater System. In accordance with the Clean Water Act (33 USC §§ 1251-1387) and implementing regulation, JBSA-RND is a regulated small municipal separate storm sewer system (MS4) and is required to have coverage under the National Pollutant Discharge Elimination System (NPDES) for stormwater discharges. JBSA-RND has been issued a Texas Pollutant Discharge Elimination System (TPDES) minor general industrial stormwater permit (TX05D855). JBSA-RND has developed and implements a stormwater management program designed to reduce the discharge of pollutants. Stormwater at JBSA-RND is managed by runoff, a series of detention basins, and underground storm sewer piping with outfalls to Cibolo Creek and Woman Hollering Creek. There are three stormwater outfalls that flow into Cibolo Creek at the northeast installation perimeter and Woman Hollering Creek at the southern installation perimeter. The stormwater infrastructure was initially installed between the 1930s and 1950s and has required minimal maintenance. The system is comprised of mostly concrete piping (approximately 75 percent) and some clay materials (approximately 25 percent). During heavy rainfall periods, smaller facilities with limited underground infrastructure capacity tend to flood, which causes surface weathering over time. Additionally, there is insufficient drainage on the west runway causing frequent flooding and progressive surface degradation (JBSA, 2018)[34]. The stormwater infrastructure within the perimeter of JBSA-RND is owned and operated by installation.

During precipitation events, a portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi, 2013). Urban trees and shrubs are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. On average, San Antonio has 82 days with 0.01 in. of precipitation or more and only 9 days annually with precipitation of 1 in. or greater. Avoided runoff due to the NHLD urban forest was estimated using the USFS's tree benefits model, i-Tree Eco. Modeled input included local

[34] JBSA-RND has the long-range plan to convert the existing retention ponds into detention ponds that normally are dry. JBSA would drain the ponds within 48 hours of a storm event to keep the basin mowable. JBSA civil engineering (AETC 802 CES) has undertaken studies to determine the best course of action.

weather from JBSA-RND (total annual precipitation in 2015 was 42.0 inches) and the JBSA-RND tree inventory prepared by TAM NRI. Using JBSA-RND weather observations, i-Tree Eco (USFS, 2021) estimated that there would be an annual increase of approximately 58,800 cf in surface runoff resulting from implementation of the Proposed Action. The i-Tree Eco results and method are discussed in Appendix C-3.

Most of the urban forest would be intact following implementation of the Proposed Action and would serve to intercept precipitation and aide in infiltration. The Proposed Action would be expected to have a minor long-term adverse effect by increasing stormwater runoff but JBSA-RND's stormwater system is considered adequate to handle the expected increase (Pfeiffer, 2021).

This resource area of infrastructure has not been carried forward for detailed analysis.

3.5 Cultural Resources

3.5.1 Definition of the Resource.

"Cultural resources" is an umbrella term inclusive of several heritage-related resources defined in Federal laws and executive orders. These include the National Historic Preservation Act of 1966 (NHPA), the Archaeological and Historic Preservation Act of 1974 (AHPA), the American Indian Religious Freedom Act of 1978 (AIRFA), the Archaeological Resources Protection Act of 1979 (ARPA), and the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). As defined by 36 CFR § 800, cultural resources include prehistoric resources, historic resources, and traditional and cultural places (or properties). Prehistoric resources are physical properties resulting from human activities that predate written records and are generally identified as archaeological sites. Traditional and cultural places are tangible places that are important in maintaining the cultural identity of a community or group. Historic resources include resources that postdate the advent of written records in a region.

The NHPA focuses on cultural resources such as prehistoric and historic sites, buildings and structures, districts, or any other physical evidence of human activity considered important to a culture, a subculture, or a community for scientific, traditional, religious, or other reason. Such resources might provide insight into the cultural practices of previous civilizations or they might retain cultural and religious significance to modern groups. Resources that are judged to be important under the NHPA are determined eligible for, or listed in, the National Register of Historic Places (NRHP). They are termed "historic properties" and are provided some level of protection under the NHPA. The AHPA built upon the national policy, set out in the Historic Sites Act of 1935, "...to provide for the preservation of historic American sites, buildings, objects, and antiquities of national significance...".

Cultural resources include architectural resources--buildings or other structures or groups of structures and designed landscapes that are of historic or aesthetic significance. To be eligible for the NRHP, properties must be at least 50 years old and have national, state, or local significance in American history, architecture, archaeology, engineering, or culture. Important contributing resources to the Randolph Field NHLD include its designed landscape elements of mature tree rows, accent plantings, and park-like open spaces.

Section 106 of the NHPA mandates that all federal agencies consider the effects of their undertakings (actions) on historic/prehistoric resources in the area of potential effect (APE), and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to review and comment on any action that may affect properties that are listed, or are eligible for listing, in the NRHP.

3.5.2 Affected Environment

Prehistoric Resources. JBSA-RND lies within the southern portion of the Central Texas archeological region (Prewitt, 1981). The region's prehistory is divided into three broad temporal periods: the Paleo-Indian period (11,500–8,800 B.P.); the Archaic period (8,800–1,200 B.P.), and the Late Prehistoric period (1,200–300 B.P.) (JBSA, 2020b). As there are no prehistoric archaeological resources at JBSA-RND, the history of the installation itself is the focus of this EA.

One archaeological study, *Archaeological Reconnaissance Survey of Randolph Air Force Base,* was conducted in 1991 by the National Park Service Interagency Archaeological Services (DeVore, S.L. , 1991). This study surveyed areas considered to have a high potential for intact sites; however, no archeological resources were identified and there was no further work recommended (JBSA, 2020b). Currently, no mitigation measures are recommended for archaeological resources as there are no such resources to preserve. Although NAGPRA, is not an issue in this EA, JBSA-RND continues consultation with Native American tribes known to maintain an association with the area in accordance with NHPA, AIRFA, and NAGPRA law. There are no NRHP eligible or ineligible archaeological sites on JBSA-RND.

Historic Resources. The historic cultural history of Central Texas can be divided into seven distinct periods between the sixteenth through the twentieth centuries that reflect the overall common political/economic activity of the period from 1519-1991 (JBSA, 2020b). Those periods include Early Spanish exploration and missionization, Spanish colonial settlement, Mexican statehood, The Republic of Texas, Early US Statehood, Post Civil War/Closing the Frontier, and Twentieth Century Military Events. Throughout the remainder of the twentieth century, San Antonio has continued to grow and diversify, as Fort Sam Houston, Lackland AFB, Kelly AFB, Brooks AFB, Randolph AFB, and Camp Bullis further contributed to regional military prominence, adding to the area's historic context and landscape (JBSA, 2020b).

JBSA-Randolph History. Military aviation in San Antonio began at Fort Sam Houston Military Reservation (FSH). The fort received the Army's first airplane, a Wright Brothers model-A biplane (Clow et al., 1998). FSH intermittently served as the focus of the Army's aviation program until 1916 when the Army's Aviation Section, which had been part of the Army Signal Corps, was made into a separate branch of the Army—the Air Service. Funding for new aviation training facilities allowed the Army to take advantage of San Antonio's mild climate and construct a new aviation training facility in mid-1917, Kelly Field. America's involvement in WWI soon necessitated construction of a second air training facility in San Antonio, Brooks Field.

The Army's aviation grew to 27 flying fields by the end of WWI. However, post-war demobilization left pilot training dormant at Kelly and Brooks fields until passage of the Air Corps Act in 1926. Flying training at the existing aviation schools in San Antonio was assigned to the newly formed Air Corps training center. The headquarters for the Army's training center was established at Duncan Field, which became part of Kelly Field. The Air Corps Act also provided for development of two new airfields, one to house a new attack wing for combat forces and a second for flying training. Following the Chief of the Air Corps' visit to San Antonio in 1926, he recommended "establishment of the largest flying field in the world", a field large enough to accommodate 500 planes-a minimum 2,000-acre site (Tooker et al., 2013). A board of Army officers was appointed to submit plans and specifications for a model Air Corps training center flying field. The selected plan was that of Lt. Harold Clark, a dispatch officer at the Kelly Field motor pool and a trained architect. Lt. Clark had designed the perfect "Air City". The layout was symmetrical along a dominant north-south axis and a secondary east-west axis (Figure 3-1). An interior circle was bounded by a large square that was defined on the east and west sides by the flight lines. The intention was to divide the circle into four quadrants, where each would be dedicated to a distinct function. Three quadrants would accommodate the training areas, with the fourth quadrant defining the shop and service area (Tooker et al., 2013). The circular road system and airfield design and layout was the first and only American military airfield to be arranged with such a layout (NPS 2001). The result was an operational Air Corps training center that combined the training mission needs with advanced city planning principles of the time (Tooker et al., 2013). However, a large tract of land was needed to construct the new field.

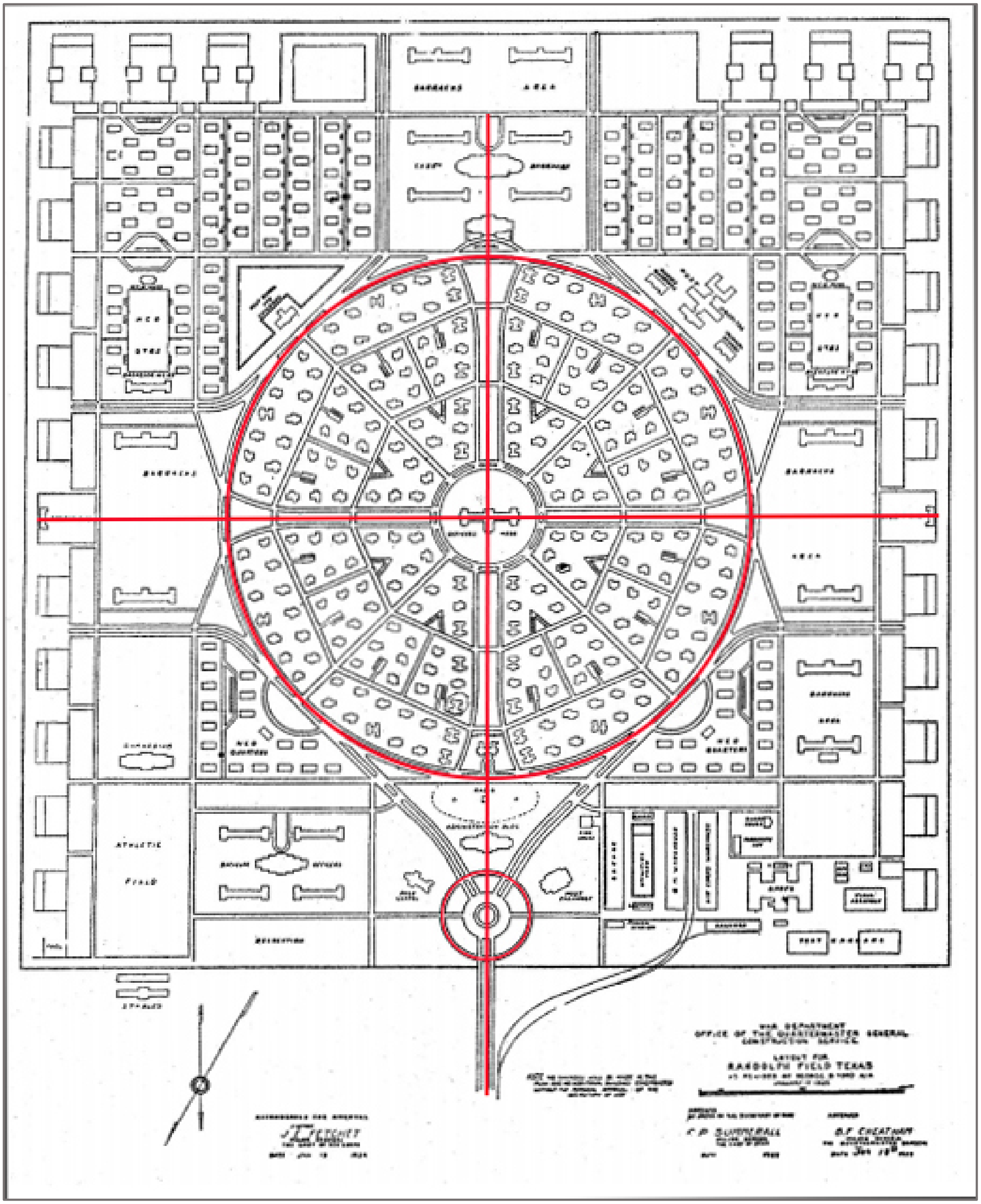

Figure 3-2. Final layout for Randolph Field circa 1929 illustrating Lt. Clark's four quadrant approach. Hangars, support, and service buildings defined the outside of the square. Living quarters were inside the main circle. (Clow et al., 1998).

Competition for the new training facility from other cities was intense. Other cities, including Dallas and Houston, offered the Army incentives of land and facilities as an inducement to relocate. During 1927, the San Antonio Chamber of Commerce pursued locating and purchasing a suitable site (Clow et al., 1998). A 2,300-acre tract of land near Schertz was identified. The land was acquired by the City of San Antonio and gifted to the Secretary of War in August 1928. A modified version of Lt. Clark's plan was approved for the new airfield in January 1928. Although interiors, paving and landscaping remained to be completed, almost all structural elements of the buildings were ready by November 1931 in time for arrival of the first cadets (Tooker, 2013). From the initial site search for the new field in 1927 to the construction of the housing area in 1931, Randolph Field developed from a concept to a completed "Air City" in just four years (Clow et al., 1998).

Architectural Resources at Randolph Field NHLD*.* Randolph Field Historic District[35] is approximately 405 acres located between the east and west runways in central JBSA-RND. The District has 342 buildings, 1 historic landscape, and 7 structures that were constructed between 1931 and 1950 that are contributing elements[36] to the NHLD, including the previously listed Building No. 100[37] (Huber, 1987). The Historic District includes Spanish Colonial Revival[38] and

NHRP and NHL Program

The terms National Register of Historic Places (NRHP) and National Historic Landmark (NHL) identify different levels of significance.

NRHP — the official list of the nation's historic properties considered worthy of preservation

NHLs — a select group of NHRP listed properties that are of exceptional value in illustrating or interpreting American heritage. Only three percent of the properties on the NHRP are NHLs.

The Randolph Field Historic District was listed on the NHRP in 1996 and was declared a NHL in 2001.

[35] An "historic district" is important to American history at the national level and is listed on the National Register.
[36] A "contributing property" or "contributing resource" is any building, object, or structure which adds to the historical integrity or architectural qualities that make the historic district significant.
[37] The Randolph Field Administration Building ("Taj Mahal"), Building 100, is the only historic resource on JBSA-RND to be added to the NRHP individually. The building was added to the NRHP in 1987 and now is a contributing element to the more recent Randolph Field NHLD.
[38] Spanish Revival architectural influence period was from 1915 to 1940. Military architecture adapted the Spanish Revival style which sometimes is referred to as Mission Revival, Spanish Eclectic, or Spanish Colonial Revival especially on WWI Army camps. The Randolph Field base chapel, completed in 1934, is an example of Spanish revival architecture and is featured as an example of this style in the DoD publication, *The Architecture of the Department of Defense; A Military Style Guide* (Michael, Smith, & Sin, 2011). Art Moderne architectural influence period was from 1920-1945. Randolph Field's hangars, constructed in 1931, are examples of this architectural style.

Art Moderne [39] style buildings, and the related styles of Spanish Renaissance Revival and Spanish Mediterranean, the majority of which were constructed between 1931 and 1935. The NHLD's period of significance is 1928-1950.

Architectural designs for the buildings were created by the Army's Quartermaster Corps and San Antonio architects and architectural firms. Most buildings were designed in the Spanish Colonial Revival style as characterized by hollow core tile construction, with stucco exterior wall treatments, and clay tile roofs. Hangars, however, were constructed in the Art Moderne style (NPS 2001). Most of the contributing buildings are single and multiple family dwellings in the central section of the base, with the remaining contributing buildings comprising aircraft hangars and towers, administrative and operations buildings, automobile garages, service buildings and structures, industrial and infrastructure buildings and structures, and recreational buildings and structures. The NHD's buildings and structures are in good to excellent condition with the majority retaining their architectural integrity with few alterations to the original plan, layout, buildings, and structures since 1950 (Thomason and Associates, 1994).

In 1994, Thomason and Associates prepared a draft National Register nomination, titled *Historic and Architectural Resources of Randolph Air Force Base, Bexar County, Texas*, for a proposed historic district that was officially listed on the NRHP in 1996, with 348 contributing resources to the district. In 2001, the NPS's Southeast Regional Office in Atlanta, Georgia prepared a National Historic Landmark nomination titled *Randolph Field Historic District* (Cook & Sprinkle, 2001). The nomination was to elevate the status of the Randolph Field Historic District to a National Historic Landmark District (NHLD) (JBSA 2014).

Historical Landscape at Randolph Field NHLD*.* Prior to development of Randolph Field, the site was undeveloped land vegetated with scrub oak and mesquite trees. Vegetation was cleared for the new airfield using a cable attached between a large tree and a tractor (Thomason and Associates, 1994). The planning and layout of Randolph Field was complemented by extensive landscaping planned and developed by Lt. Norfleet Bone. Lt. Bone, a trained landscape architect, was assigned as the supervising landscape architect for the new field. The landscape plants and plantings, like Randolph's architecture, were based on regional themes that highlighted the environment of the Southwest. Differences in vegetation patterns delineated functional boundaries and land use areas. The landscape was designed to beautify the campus by creating open spaces and vistas—influenced by the popular Garden City movement of the period, which promoted extensive landscaping and communal parks.

Extensive landscaping first took place during the 1930s when a base nursery was established that included indigenous plants, as well as those that would survive the dry San Antonio climate. Lt. Bone developed plans for rows of Spanish oaks and live oaks, wide park-like boulevards, and rock gardens with fountains. In 1932, oak trees were planted as a gift from the San Antonio de Bexar Chapter of the Daughters of the American Revolution and were the first trees to be planted on the base. These trees lined the main base roadways, which together form a scenic view corridor running through the center of the residential area. Nearly every building on the base was accented with ornamental shrubs and shade trees. The planting design also specified clusters of plants at the arced ends of street medians (Figure 3-2). These plant groups helped define the interior open spaces of the medians; the medians created by the road system provided Randolph Field with distinct open areas, as well as a park-like atmosphere (Tooker et al., 2013).

Figure 3-3. Arcuate plantings used to define open spaces of medians. Commanding Generals quarters and North Park shown.

The viewsheds of Randolph Field are integral to the character of the historic district; the NHL nomination listed elements that contribute to the cohesive architectural character of the historic landscape design. One element was an historic landscape. The NHLD is distinguished by its lush foliage and wide variety of landscaping and is significant for the large live oak and Spanish oak shade trees, and native desert plants. The NHLD survey prepared by the USACE noted the importance of Randolph's historic landscape as being unique in its design and implementation. Many small-scale features at

Randolph Field have been added over the years such as different species of trees and woody plants, benches, planters, and trashcans. This wide variety of non-period of significance elements detracts from the overall landscape integrity since they were not added according to a specific plan or designed to be compatible to the overall feeling and character of the historic district. Little of the historic vegetation at Randolph Field remains other than street trees. The loss of grassy, open space with the addition of sidewalks and trees between the roadways and the hangers is notable. The USACE's report finds that are the character-defining features of Randolph Field still maintain a high level of integrity which is prominent today in its cohesive architectural styles and materials (Tooker et al., 2013).

Table 3-5. Chapel entrance—Spanish Colonial Revival style, completed 1934 (left). Administration Building (Taj Mahal)—Spanish Mediterranean and Spanish Colonial Revival styles, completed 1931 (top right). Hangars—Art Moderne style, completed 1931 (bottom right).

Traditional and Cultural Places. Four federally recognized tribes have an expressed or potential interest in JBSA cultural resources: the Comanche Nation, the Mescalero Apache Tribe of the Mescalero Reservation, the Tonkawa Tribe of Indians of Oklahoma, and the Wichita and Affiliated Tribes. USAF consults with these tribes on issues related to cultural resource management, the unanticipated discovery of human remains and cultural items under the Native American Graves Protection and Repatriation Act, and on project-specific effects under Section 106 of the NHPA. To date, these tribes have not identified any sacred sites or traditional cultural properties. USAF has invited these tribes to consult on the Proposed Action. Although no traditional cultural properties or sacred sites have been identified at JBSA-RND, these types of sites could be identified in the future. Currently, no mitigation measures are recommended. NAGPRA treatment procedures for traditional cultural properties or sacred sites are not necessary for this EA, but JBSA-RND continues consultation with tribes known to maintain an association with the area following NHPA, AIRFA, and NAGPRA law.

3.6 Biological Resources

3.6.1 Definition of the Resource

Biological resources include native or naturalized plants and animals and their habitats (e.g., grasslands, forests, wetlands). Habitat can be defined as the resources and conditions present in an area that support a plant or animal. Plant associations are generally referred to as vegetation and animal species are generally referred to as wildlife. Protected and sensitive biological resources include Endangered Species Act (ESA) listed species (threatened or endangered), those proposed for ESA-listing as designated by USFWS (terrestrial and freshwater organisms), and migratory birds. Sensitive habitats include those areas designated or proposed by USFWS as critical habitat protected by the ESA and as sensitive ecological areas designated by state or other federal rulings. Sensitive habitats also include wetlands, plant communities that are unusual or limited in distribution, and important seasonal use areas for wildlife (e.g., migration routes, breeding areas, crucial summer and winter habitats). Migratory birds are protected species under the Migratory Bird Treaty Act (MBTA). Texas Parks and Wildlife Code (TPWC § 64.002) also should be considered. It affords limited protection to some year-round, seasonal, and migratory nongame birds and their nests and eggs that may be in the project area (TPWC § 64.003).

Endangered Species Act. The ESA (16 USC § 1531 et seq.) established a federal program to protect and recover imperiled species and the ecosystems upon which they depend. The ESA requires federal agencies, in consultation with USFWS, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. Under the ESA, “jeopardy” occurs when an action is reasonably expected, directly or indirectly, to diminish numbers, reproduction, or distribution of a species so that the likelihood of survival and recovery in the wild is appreciably reduced. The ESA also prohibits any action that causes a "take" of any listed animal. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct."

An "endangered species" is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined by the ESA as any species likely to become an endangered species in the foreseeable future. Listed plants are not protected from take, although it is illegal to collect or maliciously harm them on federal land. Critical habitat is designated by the USFWS if it determines that the habitat is essential to the conservation of a threatened or endangered species. Federal agencies must ensure that their activities do not adversely modify designated critical habitat to the point that it will no longer aid in the species' recovery.

Migratory Bird Treaty Act (MBTA). The MBTA of 1918 (16 USC §§ 703–712), as amended, and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds,* require federal agencies to minimize or avoid impacts on migratory birds. Unless otherwise permitted by regulations, the MBTA makes it unlawful to (or attempt to) pursue, hunt, take, capture, or kill any migratory bird, nest, or egg. Federal agencies with activities that could have measurable negative impacts on migratory birds are directed by EO 13186 to develop and implement a Memorandum of Understanding (MOU) with USFWS to promote the conservation of migratory bird populations.

Bald and Golden Eagle Protection Act. Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the *Bald and Golden Eagle Protection Act* (BGEPA), which prohibits the "take" of bald or golden eagles in the United States without a permit. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." For purposes of these guidelines, "disturb" means "to agitate or bother a bald or golden eagle to a degree that causes or is likely to cause: (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

For this EA, the biological resources focus on species or vegetation types that are important to the function of the surrounding ecosystem, are of societal importance, or are protected under federal or state laws or statutes. These resources are divided into three categories: vegetation, wildlife, and special-status species; the latter includes state and federally listed threatened or endangered species (TES), and other sensitive species not present on JBSA-RND.

3.6.2 Affected Environment

The description of existing conditions applies to the project site, (i.e., areas that would be directly or indirectly affected by alternatives 2 or 3). The ROI for biological resources is the NHLD and those areas that may be affected by implementation of one of the action alternatives.

Vegetation. Randolph Field NHLD is developed and intensely managed through mowing and herbicide application. Vegetation in the NHLD includes landscaping around residences, administrative buildings and hangars and non-native turf grass infield areas near the runway. Landscaped areas have various native and non-native trees and woody plants (shrubs). A recent urban tree and woody plant study conducted by Texas A&M Natural Resources Institute (TAM NRI) catalogued 3,202 trees and 46 species in the NHLD (Colón et al., 2017). Southern live oak (*Quercus virginiana*) is the most common tree species and is the predominant street tree in the NHLD. The ten most common species are listed in Table 3-8. There are over 2,000 oaks of 10 different species in the NHLD.

Table 3-6. Most Common Tree Species in NHLD

Common Name	Scientific Name	Count
Southern live oak	*Quercus virginiana*	1788
Pecan	*Carya illinoinensis*	307
Japanese privet	*Ligustrum japonicum*	217
Texas oak	*Quercus buckleyi*	163
Hackberry	*Celtis occidentalis*	97
Cedar elm	*Ulmus crassifolia*	79
Crape myrtle	*Lagerstroemia indica*	62
Eastern red cedar	*Juniperus virginiana*	59
White ash	*Fraxinus texensis*	48
Bur oak	*Quercus macrocarpa*	27

Source: Colón et al., 2017)

Tree canopy condition, an indicator of tree health, was categorized from dead to excellent in the TAM NRI inventory. The inventory identified 220 dead trees that were removed or were being removed by grounds maintenance crews. Condition of the NHLD trees is in Figure 3-3.

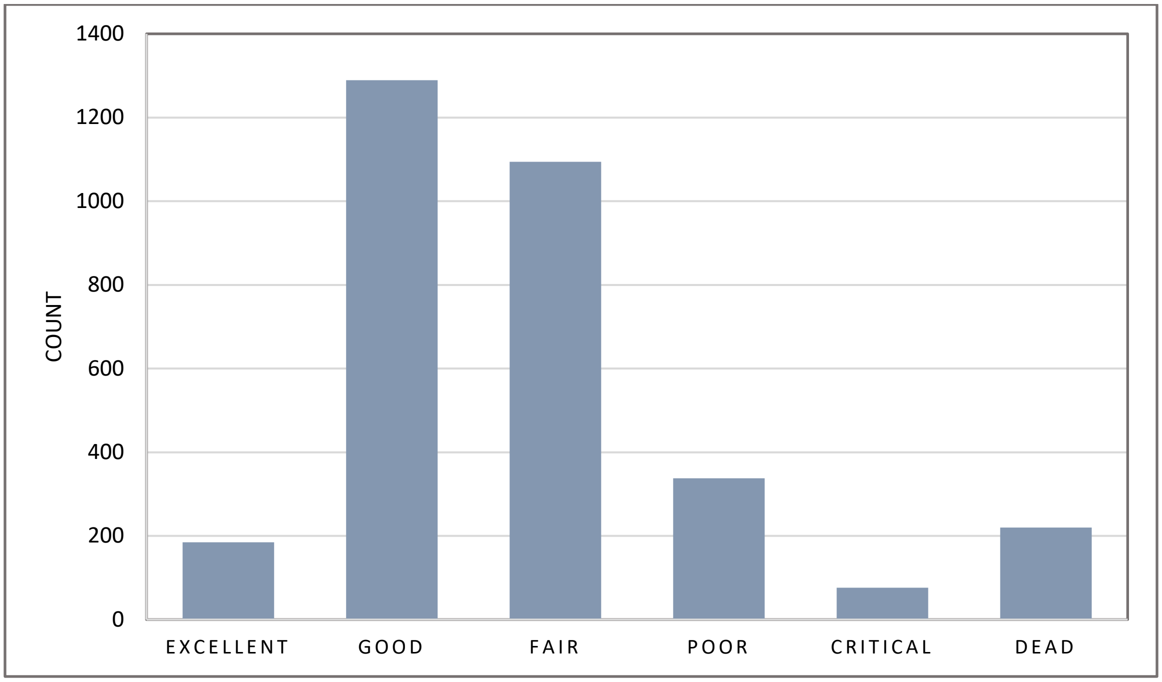

Figure 3-4. NHLD tree canopy condition (Colon et al., 2017).

The TAM NRI also identified 55 species of shrubs in the NHLD. There were 2,426 shrubs in the NHLD and the most common shrub species[40] were crape myrtle (616), Japanese privet (435), red-tipped photinia (372), yaupon holly (191), pittosporum (103) and mountain laurel (91).

Nineteen (19) of the species of trees and shrubs identified in the TAM NRI inventory attract birds. Vegetation such as *Ligustrum* (490), hackberry (93), and loquat (9) provide an attractive food source for the bird population. Many of the NHLD's trees and shrubs, including those that attract birds, are post-period of significance and are not part of Lt. Bone's original landscape strategy.

Invasive Species. Species can be categorized as invasive, exotic, or native. Invasive species are alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health (EO 13112). In natural areas, the definition of invasive species is expanded to include aggressive plants that produce a significant change in terms of composition, structure, or ecosystem functions. An exotic species is defined as a non-indigenous or non-native species that was either purposefully or accidentally introduced into an area outside its natural range. The Texas Forestry Association provides a list of the most common invasive species most likely to occur within the region. The invasive species that have

[40] Several inventoried species can grow in a tree or shrub form (e.g., crape myrtle). In addition to the shrub count, there also were 62 crape myrtle (*Lagerstroemia indica*), 217 Japanese privet (*Ligustrum japonicum*), 1 red-tipped photinia (*Photinia fraseri*), 11 yaupon holly (*Ilex vomitoria*), 1 pittosporum (*Pittosporum spp.)*, and 12 mountain laurel (*Sophora secundiflora*) specimens catalogued as trees.

the potential to be found within the ROI include Bastard cabbage (*Rapistrum rugosum*), giant reed (*Arundo donax*), Johnson grass *(Sorghum halepense),* Chinese tallow tree *(Triadica sebifera*), King Ranch bluestem *(Bothriochloa ischaemum),* field bindweed *(Convolvulus arvensis)*, Bermuda grass *(Cynodon dactylon),* chinaberry tree *(Melia azedarach),* red-tipped photinia *(*Photinia × fraseri*)*, heavenly bamboo *(Nandina domestica)*, and Chinese privet *(Ligustrum sinense)* (TexasInvasives.org, 2021).

Wildlife. Due to the development and management of the airfield environment, wildlife species on JBSA-RND are mainly limited to those native species that persist and thrive in human made environments. Many of the bird species are migratory. JBSA-RND is within the Central Flyway migratory route. The Central Flyway extends from northern Alaska, south through Canada, through the central U.S., and through Texas into northern Mexico. Bird species present on JBSA-RND can vary greatly depending on the time of year and which species are migrating through the area. Migratory threatened and endangered bird species may use JBSA-RND for rest or forage.

Seventy-seven (77) bird species have been observed at JBSA-RND (JBSA, 2020a). Bird species data for JBSA-RND is the most comprehensive of the any of the JBSA installations as birds represent the most formidable threat to pilot safety, i.e., BASH risk. The TAM NRI survey conducted on JBSA-RND from December 2-June 16, 2017, recorded 49 species of birds. The species with the highest density in the survey area were white-winged dove *(Zenaida asiatica),* Great-tailed grackle *(Quiscalus mexicanus),* and European starling *(Sturnus vulgaris)* (Colón et al., 2017). Both the WWDO and great-tailed grackle are protected by the MBTA (USFWS, 2021b). Other common bird species that have been observed on JBSA-RND and are protected by the MBTA include the cattle egret (*Bubulcus ibis*), loggerhead shrike (*Lanius ludovicianus*), great-tailed grackle (*Quiscalus mexicanus*), Bewick’s wren (*Thryomanes bewickii*), scissor-tailed flycatcher (*Tyrannus forficatus*), western kingbird (*Tyrannus verticalis*), and mourning dove (*Zenaida macroura*) (USFWS, 2021b). Common bird of prey species also protected by the MBTA that have been observed at JBSA-RND include the Cooper’s hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), red shouldered hawk (*Buteo lineatus*), Swainson’s hawk (*Buteo swainsoni*), turkey vulture (*Cathartes aura*), and black vulture (*Coragyps atratus*) (JBSA, 2020a).

Twenty-nine (29) mammal species have been observed on JBSA-RND (JBSA, 2020a). Urban-adapted species commonly observed include northern raccoon *(Procyon lotor),* fox squirrel (*Sciurus niger*), cottontail rabbit (*Sylvilagus floridanus*), black-tailed jackrabbit (*Lepus californicus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and common gray fox (*Urocyon cinereoargenteus*). Coyote (*Canis latrans*) and white-tailed deer (*Odocoileus virginianus*) also are known to visit urban areas but are not considered to be primary species due to the absence of preferred habitat.

Special Status Species. A current list of federal TES for Bexar County (dated June 9, 2021) was obtained from the USFWS Information for Planning and Consultation (IPaC) website (USFWS, 2021a). The IPaC resource list for Bexar County, identified 21 federally listed species: four birds, two amphibians, one fish, five insects, six spiders, one crustacean, and two plants. Most TES in Bexar County are known as karst[41] species. Karst species are biological obligates, meaning they occupy and can survive only in a specific type of habitat. Most of the federally listed endangered species occurring in Bexar County are karst dwelling invertebrates (insects and spiders). These species rely on nutrients in the form of organic matter (i.e., leaf litter, decomposed plant matter, animal droppings, etc.) that infiltrate the karst zone through openings at the surface. Openings to the subsurface karst zones are necessary for these species to receive organic material and other surface resources; the absence of these surface openings significantly reduces the possibility that karst species occupy a site. The entirety of JBSA-RND is in Karst Zone 5, which is defined as "areas which do not contain listed invertebrate karst species" (Veni, 2002).

In general, JBSA-RND is managed and does not support habitat conducive to federally listed T&E species. The project area is managed and does not include habitat needed to support the two listed bird species, i.e., golden-cheeked warbler *(Dendroica chrysoparia)* or the whooping crane *(Grus americana).* Federally listed bird species and their habitats are listed in Appendix D. Although many of the species listed in the iPaC report have designated critical habitat, none of the designations occur within or near JBSA-RND; therefore, critical habitat is not analyzed further.

TPWD manages state-listed threatened and endangered and sensitive species in Texas. A report of state-listed TES for Bexar County (dated March 24, 2021) was obtained from the Texas Parks and Wildlife (TPWD) website (TPWD, 2021). There are 118 state sensitive species in Bexar County. Of these species, one avian and seven mammal Species of Greatest Conservation Need[42] (SGCN) have been reported to occur on JBSA-RND— bald eagle (*Haliaeetus leucocephalus*), big brown bat (*Eptesicus fuscus),* big free-tail bat (*Nyctinomops macrotis*), cave myotis bat (*Myotis velifer*), eastern spotted skunk (Spilogale putorius), tricolored bat (Perimyotis subflavus), western spotted skunk (Spilogale gracilis), and long-tailed weasel (Mustela frenata) (JBSA, 2020a). Texas' conservation plan's bird species of greatest concern in Bexar County are listed in Appendix D.

Bald eagles, protected under the BGEPA, have the potential to occur on JBSA-RND. However, they primarily are a wintering population in Central Texas. No bald eagles have been observed

[41] "Karst" is a term that refers to the subsurface voids and caves which are created when limestone is dissolved into solution through its encounter with groundwater. Limestone dissolved at the earth's surface opens passages (i.e., caves, sinkholes, or faults) that lead to the subsurface karst environment.

[42] In addition to species that have been afforded legal protection (Federal and State Listed Species) due to risk of extinction, TPWD identifies species that are considered to be Species of Greatest Conservation Need (SGCN). Texas native animals or plants designated as a SGCN are generally those that are declining or rare and need additional attention to prevent listing under state or federal regulation.

during any of the bird surveys on JBSA-RND. No state listed endangered or threatened species have been documented on JBSA-RND (JBSA, 2020a).

3.7 Airfield Flying Safety

3.7.1 Definition of the Resource

Airfield flying safety addresses safety concerns of flights, i.e., the potential for aircraft mishaps (i.e., crashes or crash landings), including those caused by adverse weather events and bird-aircraft strikes. DoD classifies aviation mishaps/accidents as Class A, B, C, or D mishaps[43] (DoD, 2011). Class A mishaps are the most severe with total property damage of $2.5 million or more, or a fatality or permanent total disability. Bird and wildlife strikes are a flight safety concern due to the potential damage that a strike might have on the aircraft or injury to aircrews. Flight safety risks exist in all aviation operations. The goal is to identify and mitigate the risks and continue to improve operational safety. AFI 91-202 (USAF, 2020) establishes mishap prevention program requirements (including those for BASH), assigns responsibilities for program elements, and contains program management information while AFI 91-212 provides policy and guidance for implementing the BASH program.

Airports, due to the nature of their operations, typically have large, open, grassy areas where various wildlife congregate. Additionally, some land uses, like golf courses, are often situated near airports because they can easily meet the height and density restrictions imposed by aircraft activity. Unfortunately, golf courses also have large, open, grassy areas and oftentimes also feature water – another wildlife attractant. Given the fatal ramifications that can occur because of a bird and/or wildlife strike, the FAA set forth recommendations for managing these types and other types of bird and wildlife attractants near airports (FAA, 2020). JBSA-RND's Randolph Oaks Golf Course[44] is an 18-hole course on the east end of the installation.

The Air Installation Compatible Use Zone (AICUZ) program is used to protect public and USAF personnel health and safety, as it relates to aircraft noise, accident potential, and the intersection with land use. The AICUZ Program is an extensive analysis of the effects of military operational noise, aircraft accident potential, and land use development upon present and future neighbors of USAF installations with an active flying mission. Each USAF installation's AICUZ study identifies clear zones (CZs) and accident potential zones (APZs) to protect the public from aircraft mishaps and noise zones to protect from aircraft noise.

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[43] Currently, Class A mishaps occur when there is more than $2.5 million in damage to the aircraft, the aircraft is destroyed, or its pilot or crew is killed or permanently, totally disabled. Class B mishaps are recorded when aircraft damage ranges from $600,000 to $2.5 million, a crew member faces permanent partial disability, or three or more persons are sent to the hospital due to the accident. Class C incidents, the least serious of the top three categories, occurs when damage is between $60,000 and $600,000 or an injury results in loss of time from work.

[44] Randolph Oaks Golf Course is managed by the US Air Forces Service Agency. The course opened in 1948.

3.7.2 Affected Environment

The ROI for the evaluation of airfield flying safety is JBSA-RND and adjacent communities. Aircraft mishaps are uncommon. The USAF reported a total of 34 BASH Class A mishaps, four related fatalities, and 11 destroyed aircraft for the 20-year period 2000-2019 (USAF, 2020). During that period, JBSA-RND had a single Class A mishap with one fatality when a T-38 left the runway due to tire failure in March 2003. That was the first aircraft mishap involving a fatality since an earlier crash of a T-38 in 1977 (Flight Safety Foundation, 2021). BASH was identified as the cause of the 1977 mishap.

The bird-strike rate per 1,000 sorties at JBSA-RND is greater at any other USAF airfield with a similar training mission, see Figure 3-4. JBSA-RND recorded 51 bird strikes in fiscal year 2020. The 5-year average is 63 bird strikes per year. Most of the strikes at JBSA-RND occurred on approach to the east runway, Runway 32R[45] (12 FTW/SE). JBSA-RND employs several mitigation techniques to reduce the BASH hazard in accordance with the JBSA BASH Plan (12th FTW, 2018). In accordance with the plan, JBSA-RND has an active BASH program, BASH Management Plan, and Bird Hazard Working Group. This group is tasked with collecting, compiling, and reviewing data on bird strikes; identifying and recommending actions to reduce hazards; recommending changes in operational procedures; preparing informational programs for aircrews; and serving as a point of contact for BASH issues. In particular, the JBSA BASH Plan notes several issues that are related to areas off installation; the plan notes raptors and white-winged doves associated with Cibolo Creek present a conflict to operations on the east, 14L/32R, runway. The plan also notes that a greater number of BASH incidents, i.e., bird strikes, are associated with operations occurring on the east runway in comparison to the west runway, 14R/32L.

JBSA-RND's AICUZ (Figure 3-5) is an extensive analysis of the effects of aircraft noise, aircraft accident potential, and land use development upon present and future neighbors of JBSA-RND. One aspect of the AICUZ program discussed in the Land Use section is designed to mitigate the aircraft accident potential to public around JBSA-RND by working with local governments to ensure zoning ordinances and subdivision regulations support compatible land use around the airfield. The CZs and APZs are based on statistical analyses of Air Force aircraft accidents throughout the United States. The CZ, the area closest to the runway end, is the most hazardous[46]. Statistically, 68 percent of Air Force accidents occur along the runway or within

[45] Information cited here includes the most current published Air Force Safety Automated System (AFSAS) data and fiscal year 2020 data from the 12FTW BASH Program Manager (12FTW/SEF). AFSAS is a safety reporting system used to collect and maintain safety related data.

[46] The CZ is defined as the square area beyond the end of the runway and centered on the runway centerline, extending outward 3,000 ft. The Air Force generally acquires the land in the CZ through purchase or easement to prevent development. APZ I is an area beyond the CZ that possesses a significant potential for accidents. APZ II is

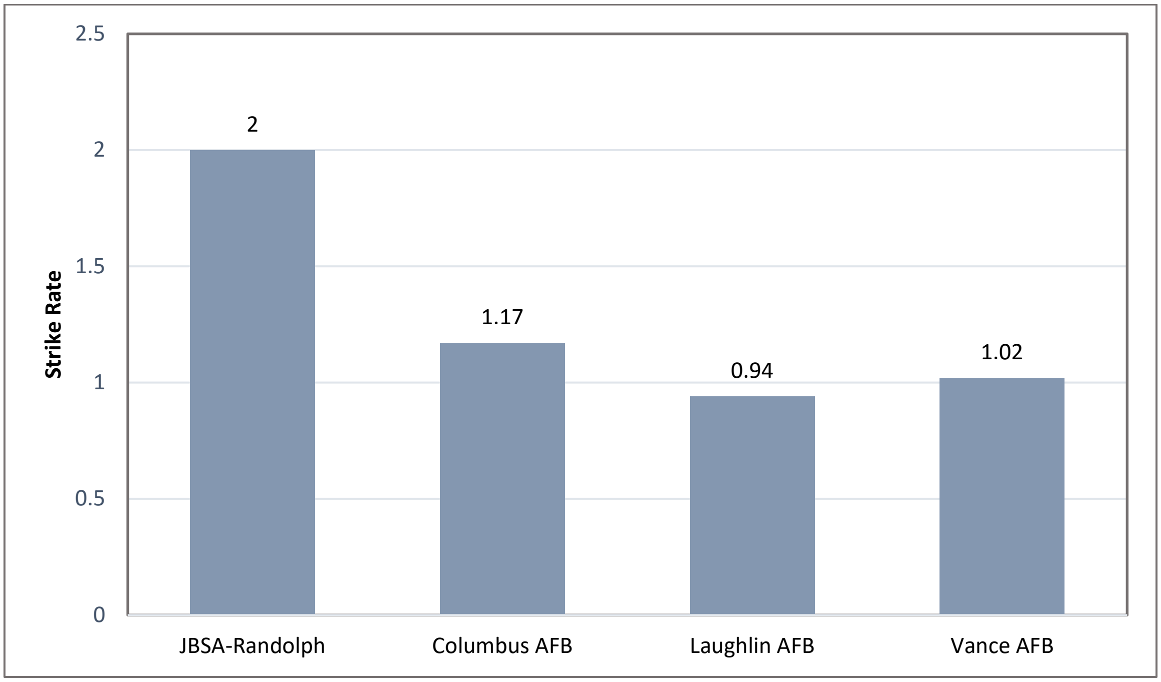

Figure 3-5. Bird strike comparison at USAF undergraduate pilot training installation—five-year average bird strike comparison per 1,000 sorties, 2016-2020 (12 FTW/SE).

the CZ. APZ I and II are areas beyond the CZ that possesses a significant potential for accidents. The USAF has acquired properties in the Clear Zones around JBSA-RND through purchase or easements to prevent development in these areas and mitigate the flight safety hazard. JBSA-RND's AICUZ study would be updated if there were a change the aircraft fleet mix, flight operations, flight track, etc. Currently, JBSA-RND based aircraft include the T-1 Jayhawk (twin-engine medium range jet), the T-6A Texan II (single-engine turboprop trainer), and the T-38C Talon (twin-engine supersonic jet trainer). Predominant runway usage at JBSA-RND occurs on Runway 15L for T-1 and T-38 training and on Runway 15R for the T-6. Approximately 65 percent of the bird strikes are with T-38 and T-1 airframes.

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an area beyond APZ I having a lower, but still significant, potential for accidents. APZ I is defined as the rectangular area beyond the clear zone. APZ I is 3,000 ft in width and 5,000 ft in length along the extended runway centerline. APZ II is defined as the rectangular area beyond APZ I. APZ II is 3,000 ft in width and 7,000 ft in length along the extended runway centerline.

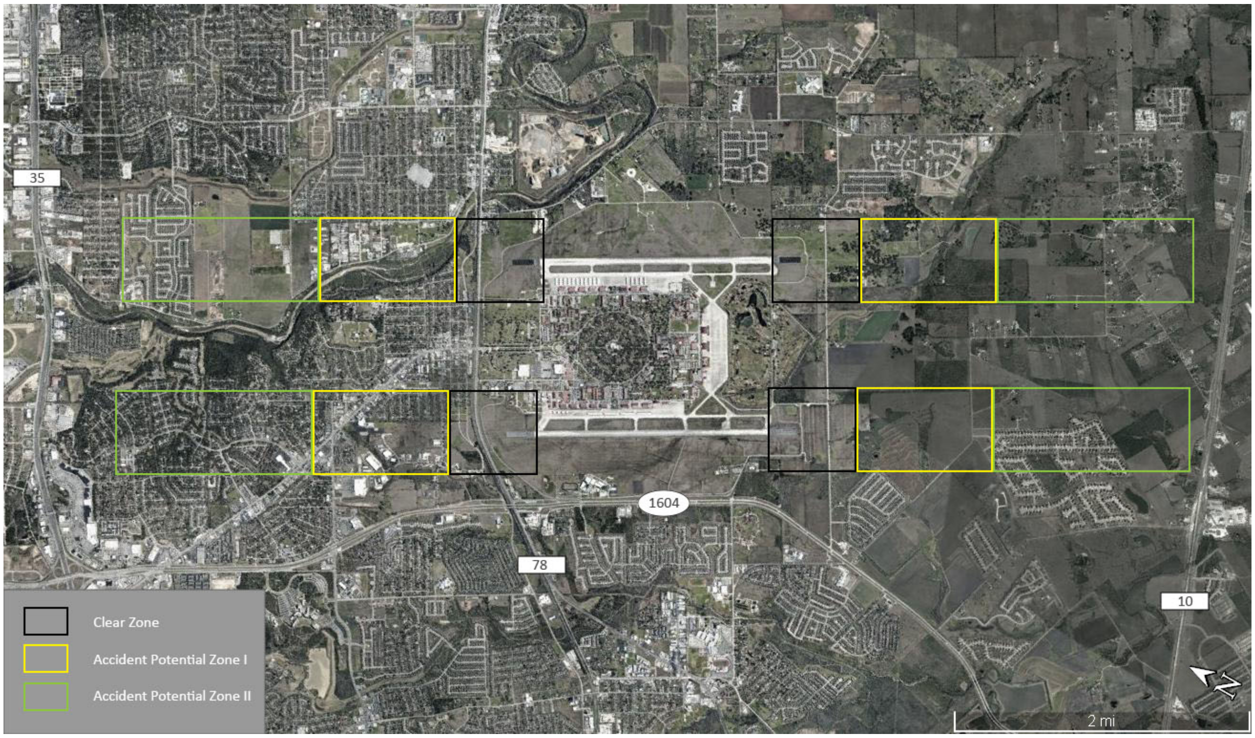

Figure 3-6. JBSA-RND Clear Zones and Accident Potential Zones. Runway 15L top and runway 15R bottom.

Bird strikes have resulted in millions of dollars in aircraft damage in addition to being a serious flight safety hazard at JBSA-RND, see Figure 3-6. Pigeons and doves (27 percent) and songbirds (40 percent) have been involved in the greatest number of strikes on JBSA-RND (Colón, 2017). An estimated 15,000 doves transit across the flightline daily on feeding flights in the spring and summer months (HQ Air Force Safety Center, 2015). JBSA-RND flightlines are very active. JBSA-RND logged 32,252 flight hours and flew 24,688 sorties in 2020[47]. Aircraft damage has been costly. The 2020 bird strike damage costs currently are $337,226 as of March 31, 2021 but may reach $1M when all repairs are completed.

[47] JBSA-RND flight hours and sorties were lower than average in 2020 due to COVID-19 impacts.

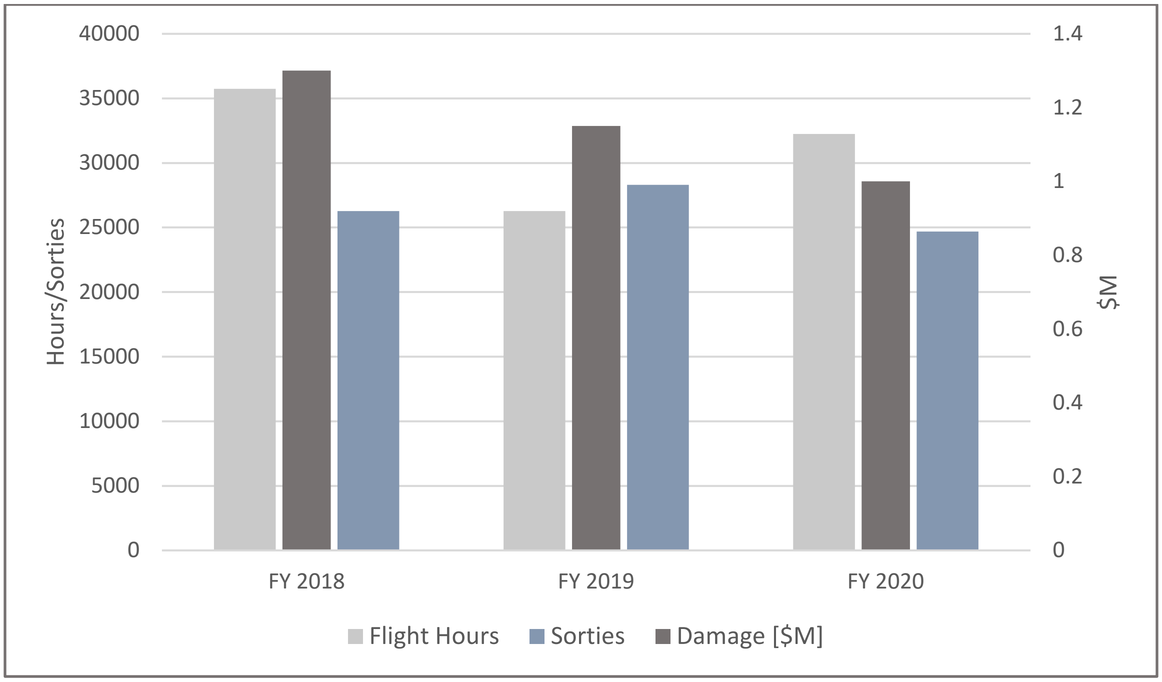

Figure 3-7. JBSA-RND flight hours and sortie rates (left axis), and bird-strike damage (right axis). Damage costs for FY 2020 are estimated; repairs are incomplete.

Figure 3-7 depicts a bird strike on one of JBSA-RND's T-38s that occurred in November 2019. The strike resulted in injury to the pilots and damage to the aircraft. The damage was a small portion of total bird strike damage at JBSA-RND; bird strike damage reached $1.9M in 2019. The image emphasizes the safety risk bird strikes pose to flight crews and the local communities.

Figure 3-8. Bird strike damage on one of JBSA-RND's T-38s.

4. Environmental Consequences

4.1 Introduction

This chapter describes the expected impacts for resource areas that may be affected by implementation of alternatives described in Chapter 2. Potential impacts are evaluated in terms of type (beneficial or adverse), context (setting or location), intensity (severity), and duration (short-term/temporary or long-term/permanent). Impacts may be a direct result of an action which occurs at the same time and place; or an indirect result of an action which occurs later in time or in a different place and is reasonably foreseeable; or the cumulative results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.8). Cumulative effects also can result from individually minor but collectively significant actions taking place over a period (40 CFR § 1508.7). Cumulative effects are discussed in Chapter 5.1.

The specific criteria for evaluating the potential environmental effects of each alternative are explained under each resource area. Unless otherwise noted, short-term impacts are those that would result from the alternative's actions and would end upon completion of that action. Long-term impacts extend well beyond the action and result from implementation of the Proposed Action. The definitions for impact thresholds used in this analysis are none, negligible, minor, moderate, or major.

Those resource areas determined to have no or negligible effect if an alternative were implemented have not been carried forward for detailed analysis (see Section 3.1).

Environmental Effects Impact Thresholds

The definition for impact thresholds used in this document include:

None — no impact

Negligible — barely noticeable, impacts may be perceptible but are at the lower level of detectable

Minor — slight, impacts are very small but detectable

Moderate — readily apparent, impacts are easily noticeable but localized or short-term

Major—easily noticeable, impacts are widespread, and long-term

Major, or significant, impacts that due to their context and intensity (severity) have the potential to meet thresholds for significance set forth in CEQ regulations (q.v., 40 CFR §1508.27).

4.2 Air Quality and Climate Change/Greenhouse Gasses

4.2.1 Air Quality

Potential impacts to air quality would be considered significant if the Proposed Action were to exceed the applicable General Conformity Rule (GCR) *de minimis* thresholds.

Based on compliance with the NAAQS, the General Conformity Rule is applicable to Bexar County for emissions of the ozone precursors NO_x and VOC due to its designation as being in marginal nonattainment for ozone pollutants (40 CFR § 81.344). The *de minimis* level for these pollutants is 100 tpy. If the emissions of an attainment pollutant exceed 100 tpy for either pollutant, further investigation would be performed to ensure the new emissions would not interfere with Bexar County's ability to maintain attainment for those criteria pollutants. Significant impacts also would occur if implementation of the Proposed Action meaningfully contributed to the potential effects of global climate change.

Air Emissions from Grounds Maintenance Activities. Short-term, minor, adverse impacts on air quality would occur during grounds maintenance activities associated with the Proposed Action. Short-term emissions of criteria pollutants would be produced from on-road (e.g., trucks) and off-road vehicles or equipment (e.g., chainsaws, chippers/shredders, etc.) associated with the Proposed Action's grounds maintenance activities, e.g., tree trimming, tree removal, stump grinding, etc. Such emissions would be temporary and only would occur when the grounds maintenance activities were in progress.

Sources of air emissions would include the operation of vehicles, heavy duty diesel vehicles hauling debris from project areas, tree maintenance and removal, and ground disturbance activities (e.g., stump grinding). Stump grinding and localized site grading following tree removal also would generate particulates such as fugitive dust from ground-disturbing activities and from the combustion of fuels in equipment. Fugitive emissions would be greatest during tree removal and stump grinding activities and would vary from day to day depending on the level of activity and prevailing weather conditions. Environmental control measures (e.g., wetting the ground surface during localized site grading and reseeding) would be incorporated into the plan of work to minimize fugitive dust emissions. Additionally, work vehicles and equipment would be well-maintained and, where appropriate, use diesel particulate filters to reduce emissions of criteria pollutants.

The emission factors in the USAF's Air Emissions Guide for Air Force Mobile Sources (AFCEC, 2020) were used to estimate emissions from grounds maintenance activities associated with the alternatives. Assumptions and method used to obtain the emission estimates are discussed in Appendix E[48]. Table 4-1 summarizes the estimated criteria pollutant air emissions resulting from implementation.

Table 4-1. Criteria Pollutant Air Emissions (tpy) - Tree Maintenance and Removal by Alternative

	CO	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$	CO_2e[49]
Alternative 1 (No Action)							
	10.818	1.967	0.592	0.001	0.295	0.277	139.279
Alternative 2 (Preferred Alternative)							
Year 1	*23.127*	4.197	1.279	0.002	0.629	0.582	302.210
Year 2	*23.127*	4.197	1.279	0.002	0.629	0.582	302.210
Alternative 3 (Two-Phase Implementation)							
Phase I	*23.127*	4.197	1.279	0.002	0.629	0.582	302.210
Phase II	*23.127*	4.197	1.279	0.002	0.629	0.582	302.210
Significance Criteria		100	100				

Notes: (1) Emissions are in tpy. (2) CO_2e is carbon dioxide equivalent emissions. (3) Alternative 2's actions would occur in consecutive years while Alternative 3's phases would not occur in consecutive years. (4) Annual air emissions would be somewhat less than those of Alternative 1, the No Action Alternative, following full implementation of both action alternatives and between phases of Alternative 3.

Air Pollutant Removal by NHLD Urban Forest. Long-term adverse effects include an increase in air pollution resulting from removal of NHLD trees. Trees directly remove air pollutants. Once the trees are removed, that benefit is lost. i-Tree Eco (USFS, 2021) was used to estimate pollution removal using the TAM NRI NHLD tree inventory, weather data for JBSA-RND, and climate data for San Antonio. Pollution removal was greatest for ozone. It is estimated that the NHLD's urban forest annually removes approximately 2.1 tpy of ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matter less than 2.5 microns

[48] The Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide (AFCEC, 2019) requires a quantitative assessment of the annual net total direct and indirect emission of pollutants of concern to be calculated using the Air Force's Air Conformity Assessment Model (ACAM). ACAM is an emissions modeling tool used by the Air Force to determine GC applicability for typical Air Force projects. The majority of the emission sources that would be used to implement the proposed action are from off-road equipment. The ACAM has limited built-in off-road emission factors. Due to the unique emission sources of the proposed action, authorization to manually calculate emissions using emission factors listed in the Guide (AFCEC, 2020) was obtained from AFCEC (F. Castaneda, personal communication, October 5, 2020)

[49] CO_2e, carbon equivalent emissions, is a measure used to the emissions from various greenhouse gases based upon their global warming potential.

($PM_{2.5}$)[50]. Pollutant removal effects for all alternatives is compared in Table 4-2. Implementation of the Proposed Action would reduce the amount of ozone removed by an estimated 1959 lbs (0.650 tpy). Removal before, Alternative 1, and following implementation of Alternative 2 or 3.

Table 4-2. NHLD Urban Forest Pollutant Removal by Alternative

Pollutant	Estimated Removal (lbs)			
	Alternative 1 No Action	Alternative 2 (Preferred Alternative)	Alternative 3 Phase I Two-Phase	Alternative 3 Phase I and II Two-Phase
Carbon Monoxide (CO)	89.1	53.5	71.3	53.5
Ozone (O_3)	3,264.8	1958.9	2611.8	1958.9
Nitrogen Dioxide (NO_2)	602.6	361.6	482.1	361.6
Sulfur Dioxide (SO2)	115.8	69.48	92.64	69.48
Particulate Matter $PM_{2.5}$	163.5	50.8	130.8	50.8

VOC Production by NHLD Urban Forest. A long-term, minor beneficial effect of tree removal would be a reduction in biogenic volatile organic compounds[51] (BVOC). Integrative studies (Nowak and Dwyer, 2000) have shown that an increase in tree cover also can lead to ozone formation. Using the TAM NRI tree inventory and JBSA-RND weather data, i-Tree Eco estimated that the NHLD trees annually emit 19.49 tons of BVOCs. Emissions vary among species based upon species characteristics (e.g., genera such as oaks are high emitters) and amount of leaf biomass. Ninety-five percent of the NHLD urban forest's VOC emissions were from live oak and Japanese privet. Implementation of either Alternative 2 or 3 would be expected to have the long-term beneficial effect of reducing the urban forest's BVOC emissions by an estimated 7.8 tpy.

Oxygen Production by NHLD Urban Forest. A long-term, negligible adverse effect of tree removal would include a loss in oxygen production. Oxygen production is a commonly cited benefit of urban forests. The annual oxygen production of a tree is related to the amount of

[50] I-Tree eco analyzes particulate matter less than 2.5 microns ($PM_{2.5}$) which is a subset of PM_{10} and considered more relevant in discussing air pollution effects on human health. Trees can remove $PM_{2.5}$ when particulate matter is deposited on leaf surfaces. The deposited $PM_{2.5}$ can be resuspended or removed during rain events with beneficial or adverse effects.
[51] The bulk of VOCs are produced from natural sources such as plants. Isoprene and monoterpenes are the main components of biogenic volatile organic compound emissions (BVOC). BVOCs have an important impact on the atmospheric composition of methane and of ozone, aerosols, etc. (Hantson, Knorr, Schurgers, Pugh, & Arneth, 2017)

carbon sequestered by the tree and is related to its biomass. i-Tree Eco estimated that the NHLD produces 270 tpy of oxygen.

The summary report of the i-Tree Eco analysis for Randolph Field NHLD Trees is in Appendix C-3. Additional reports generated as part of the i-Tree Eco analysis include carbon storage and sequestration and avoided runoff. A brief discussion of the model precedes the results summary in the appendix.

Alternative 1 (No Action)

The No Action Alternative would not result in impacts on air quality. Neither Alternative 2 nor Alternative 3 would be implemented, and air quality would remain the same as described in Section 3.2. No new air emissions would be generated and air emissions from grounds maintenance activities, including tree removal, would remain the same and no additional impacts to air quality would occur.

Alternative 2 (Preferred Alternative)

Grounds maintenance activities would have short- and long-term minor, adverse effects on air quality. Short-term effects would be from an increase in particulate matter (fugitive dust) from localized site activities related to stump grinding, site grading/re-seeding, and debris removal activities. Short-term effects would include an increase in criteria pollutants and ozone precursors from mobile sources including vehicles (e.g., dump truck), non-road engines and equipment (loader, chainsaw, stump grinder, etc.). There would be a temporary increase in air pollution emissions from non-road equipment during tree maintenance and removal activities

Tree removal would have no short- and negligible long-term adverse effect on air pollutant removal. The amount of air pollutants removed by the NHLD urban forest is extremely small when considering the ROI as described in Section 3.2.1. Similarly, there would be no short- and negligible long-term adverse effect due to a loss in oxygen production; the amount of oxygen in the atmosphere is large and stable. There also would be negligible beneficial effect due to less BVOC production. The amount of BVOCs produced by the NHLD urban forest is extremely small when considering the ROI.

Alternative 2 would not produce pollutants exceeding significance levels; Ozone precursor (VOC and NO_x) emissions would not exceed the General Conformity *de minimis* threshold. Therefore, no significant impact would occur to air quality under Alternative 2.

Alternative 3 (Two-Phase Implementation)

Like Alternative 2, Alternative 3 would have short- and long-term minor adverse effects on air quality. Short-term adverse effects would be from an increase in particulate matter (fugitive dust) from localized site activities related to stump grinding, site grading/re-seeding, and debris removal activities. Short-term effects also would be from an increase in criteria pollutants and ozone precursors, from mobile sources including vehicles (e.g., dump truck), non-road engines and equipment (loader, chainsaw, stump grinder, etc.) during tree maintenance and removal activities.

Tree removal would have no short- and negligible long-term adverse effect on air pollutant removal. The amount of air pollutants removed by the NHLD urban forest is extremely small when considering the ROI as described in Section 3.2.1. Similarly, there would be no short- and negligible long-term adverse effect due to a loss in oxygen production; the amount of oxygen in the atmosphere is large and stable. There also would be no to negligible beneficial effect due to less BVOC production. The amount of BVOCs produced by the NHLD urban forest is extremely small when considering the ROI.

There would be an estimated 2-3 years between Alternative 3's two phases to determine if Phase I's actions had met the BASH flying safety goals. If those goals were met, Phase II would not be implemented at that time. Conditions would be periodically re-evaluated to determine if implementation of Phase II would be necessary to continue meeting the BASH flying safety goals. If only Phase I were to be implemented, the air emissions would be half Alternative 2's air emissions.

The Two-Phase Implementation alternative would not produce pollutants exceeding significance levels if Phase I and Phase II both were implemented; Ozone precursor (VOC and NO_x) emissions would not exceed the General Conformity *de minimis* threshold. Therefore, no significant impact would occur to air quality under Alternative 3.

4.2.2 Greenhouse Gases/Climate Change

Greenhouse Gases. CEQ guidance requires agencies within the DoD to quantify GHG emissions in NEPA assessments and review federal actions in the context of future climate scenarios and resiliency. There is a lack of consensus on how to measure incremental impacts on GHG emissions. Global and regional climate models lack the ability to model the small, incremental impacts such as those of the Proposed Action. Additionally, there are no monetized values of GHG emissions considered to be significant in a NEPA assessment.

The emission factors in the USAF's Air Emissions Guide for Air Force Mobile Sources (AFCEC, 2020) were used to estimate CO_2e emissions from grounds maintenance activities associated with the Proposed Action.

For this assessment, i-Tree Eco (USFS, 2021) was used to quantify carbon storage and sequestration impacts that would result from a decrease in urban forest density following implementation of either Alternative 2 or 3. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from CO_2) and indirectly by affecting energy use in buildings and lessening the need of energy from fossil fuel burning power plants. Trees store carbon within their tissue. As a tree grows, it accumulates carbon, acting as a carbon sink. If a tree dies and decays, that carbon largely is released back into the atmosphere. i-Tree Eco estimates that trees in the NHLD sequester about 101.3 tons of carbon per year in new growth with an associated value of $17,300 and store 5,070 tons of carbon with an associated value of $864,000[52]. Carbon stored in the tissue of trees would remain stored until the tree dies, and the carbon released. Carbon sequestration is the annual amount of carbon sequestered in NHLD trees. Estimated GHG emissions, CO_2e storage, and CO_2e sequestration following implementation are compared in the table below.

Table 4-3 Estimated GHG Emissions – Grounds Maintenance and Tree Removal

	CO_2e Equipment Emissions (tpy)	CO_2e Tree Carbon Storage (tons)	CO_2e Tree Carbon Sequestration (tpy)
Alternative 1 (No Action)	131.415	18,573.8	371.3
Alternative 2 (Preferred Alternative)			
Year 1	284.618	14,859.0	297.0
Year 2	284.618	11,144.3	222.8
Alternative 3 (Two Phase)			
Phase I	284.618	14,859.0	297.0
Phase II	284.618	11,144.3	222.8

For this assessment, i-Tree Design (USFS, 2021) was used to quantify carbon storage and sequestration impacts that would result from a decrease in urban forest density following implementation of the Proposed Action. i-Tree Design was used to estimate storage and sequestration of those TAM NRI inventoried trees surrounding representative buildings. Implementation of Alternative 2 or 3 would have the long-term, minor adverse impact of decreasing stored carbon by approximately 7,430 tons and reducing carbon sequestration by about 148.5 tpy. There also would be an expected increase in CO_2 emissions due an increase in energy needs for heating and cooling if alternative 2 or 3 were implemented. Fifteen representative structures in the NHLD were modeled. The specific tree location, species, canopy health, size (dbh) from the TAM NRI tree inventory was used to model the beneficial impact of each tree surrounding the 15 representative structures (building footprint and vintage). San Antonio climate data was input to localize results. Table 4-4 summarizes results. The projected

[52] -Tree Eco bases carbon storage and carbon sequestration values on estimated or customized local carbon values. For international reports that do not have local values, estimates are based on the carbon value for the United States (U.S. Environmental Protection Agency 2015, Interagency Working Group on Social Cost of Carbon 2015) and converted to local currency with user-defined exchange rates. Additional information on i-Tree Canopy air pollutant removal and monetary value model descriptions, carbon storage and sequestration rates, and carbon dioxide sequestration rates can be found at *i-Tree Methods Documentation, Model Notes, & Technical Papers*, (USFS, 2021).

amount of CO_2 lost would depend on the tree species, size, location, and canopy health. The i-Tree Design reports for each building, including individual tree benefits, is in Appendix C-2. A brief discussion of the model precedes the results summary.

Table 4-4. Estimated CO_2 Sequestration Benefits

Building Number	Building Type	Number of Contributing Trees	Two-Year Projection CO_2 (lbs)	Annual Projection[1] CO_2 (tpy)
B100 (Taj Mahal)	Offices	8	10,597	2.65
B120	Dormitory	21	9,628	2.41
B323	Residential	7	5,625	1.41
B336	Residential	5	8,242	2.06
B414	Residential	4	3,710	0.93
B432	Residential	4	5,302	1.33
B443	Residential	6	5,029	1.26
B449	Residential	22	14,489	3.62
B523	Residential	5	7,501	1.88
B542	Residential	7	6,854	1.71
B560	Residential	7	13,614	3.40
B613	Residential	8	11,403	2.85
B642	Residential	12	12,391	3.10
B663	Offices	11	8,237	2.06
B822	Residential	8	11,309	2.83
900 (HQ AETC)	Offices	12	15054	4.70

Note: Annual projection is approximated using two-year average.

For comparison, US GHG emissions were 6,577 MMT[53] (about 7,250 million US tons) and GHG emissions from large facilities in Bexar County totaled approximately 11.7 MMT (about 12.9 million US tons) in 2019 (USEPA, 2021a).

Alternative 1 (No Action)

The No Action Alternative would not result in additional impacts to air quality. Neither Alternative 2 or Alternative 3 would be implemented, and GHG emissions would remain the same as described in Section 3.2. No new GHG emissions would be generated and emissions from grounds maintenance activities, including tree removal, would remain at the same level.

[53] 2019 GHG emissions (USEPA, 2021b). Annual GHG emissions in 2019 were 5,788 MMT after accounting for sequestered carbon. MMT is million metric tons. One US ton (short ton) is approximately 0.091 metric tons.

Alternative 2 (Preferred Alternative)

Grounds maintenance activities would have short-term, and no to negligible long-term, adverse effects on GHG emissions. Short-term adverse effects would be from an increase in GHG emissions from localized site activities related to stump grinding, site grading/re-seeding, and debris removal activities. Short-term effects include an increase in GHG emissions from mobile sources including vehicles (e.g., dump truck), non-road engines and equipment (loader, chainsaw, stump grinder, etc.). There would be a temporary increase in GHG emissions from non-road equipment during tree maintenance and removal activities.

Tree removal would have no short- and negligible long-term adverse effect on GHG emissions. Implementing Alternative 2 and reducing the urban forest density would have the negligible, long-term, adverse effect of less carbon sequestration and less carbon stored in plant tissue. The long-term reduction in carbon sequestration also would be due to the indirect impact of increased energy needs resulting in an increase in GHG emissions from additional fossil fuel combustion. The long-term indirect effect of the increased need of energy from fossil fuel burning power plants to cool and heat buildings is discussed in the Heating and Cooling Systems section of the Infrastructure environmental consequences section. Although quantifiable, the effective increase in GHG emissions and long-term loss in tree benefits is trivial considering the global environment.

Therefore, Alternative 2 would not meaningfully contribute to the potential effects of global climate change. Therefore, no significant impact due to GHG emissions would occur under Alternative 2.

Alternative 3 (Two-Phase Implementation)

As in Alternative 2, grounds maintenance activities would have short-term and no to negligible long-term adverse effects on GHG emissions. Short-term adverse effects would be from an increase in GHG emissions from localized site activities related to stump grinding, site grading/re-seeding, and debris removal activities. Short-term effects include an increase in GHG emissions from mobile sources including vehicles (e.g., dump truck), non-road engines and equipment (loader, chainsaw, stump grinder, etc.). There would be a temporary increase in GHG emissions from non-road equipment during tree maintenance and removal activities.

Tree removal would have no short- and negligible long-term adverse effect on GHG emissions. Implementing Alternative 3 would reduce the urban forest density and would have the adverse effect of less carbon sequestration and less carbon stored in plant tissue. The long-term reduction in carbon sequestration also would be due to the indirect impact of increased energy needs resulting in an increase in GHG emissions from additional fossil fuel combustion. The long-term indirect effect of the increased need of energy from fossil fuel burning power plants to cool and heat buildings is discussed in the Heating and Cooling Systems section of the Infrastructure environmental consequences section. Although quantifiable, the effective increase in GHG emissions and long-term loss in tree benefits is trivial considering the global environment.

Therefore, these GHG emissions would not meaningfully contribute to the potential effects of global climate change. Therefore, no significant impact to GHG emissions would occur under Alternative 3.

Climate Change. Climate projections for JBSA completed by Colorado State University's Center for Environmental Management Military Lands (CEMML, 2019) forecast minimum and maximum temperatures and precipitation to increase at JBSA-RND. Maximum temperatures are forecast to increase by 3.1 to 4.3 degrees Fahrenheit and the number of days exceeding 90^{o}F (hot days) is forecast to increase by 40 to 48 percent for the decade centered around 2050. The growing degree days[54]are forecast to increase from 10 to 13 percent and precipitation to increase between 9 to 13 percent during the same period. Table 4-5 outlines the potential climate stressors and their effects on the Proposed Action. The DoD listed JBSA as one of the top at-risk bases due to recurring flooding, recurring drought conditions, and potential wildfires (DoD, 2019b). Climate change could increase the frequency and intensity of major storm events such as hurricanes and tornadoes in the region. None of the forecast potential climate stressors would have an appreciable effect on JBSA-RND's ability to implement the Proposed Action. Therefore, no significant impact would occur if either action alternative were to be implemented.

Table 4-5. Effects of Potential Climate Stressors

Potential Climate Stressor	Stressor Caused Impact	Effects on Alternatives 2 and 3
Increased precipitation	Increased stormwater runoff	Negligible
Increased maximum temperature	Increased energy demand for air conditioning Decreased energy demand for heating Increased stress on less heat tolerant species and species with higher water demand	Negligible
Increased minimum temperature	Increased energy demand for air conditioning Decreased energy demand for heating Increased stress on less heat tolerant species and species with higher water demand	Negligible
Increased number of hot days	Increased energy demand for air conditioning Decreased energy demand for heating Increased stress on less heat tolerant species and species with higher water demand	Negligible
Longer dry spells	Increased stress on less heat tolerant species and species with higher water demand	Negligible

[54] Growing degree days is the number of days with a base temperature of 50^{o}F or above.

Increased number of growing degree days	Benefit offset by surface water loss and heat stress Potential increase in the number of pests and invasive weeds	Negligible

Sources: JBSA (2020), CEMML (2019), USEPA (2021)

4.3 Noise and Acoustic Vibration

Noise. Potential impacts from noise would be considered significant if the action were to exceed the noise exposure level that has been determined by USEPA to provide adequate hearing protection for the public.

The noise from grounds maintenance activities associated with Alternative 2 and Alternative 3 would be from the same activities and noise sources as currently occurring on JBSA-RND, i.e., noises of the No Action Alternative. The difference would be the increased intensity of those actions during implementation. Currently, dead, diseased, or dying trees are removed from JBSA-RND annually. Under Alternative 2 and Alternative 3, that would increase to approximately 600-700 trees annually for about two years. The rate of tree removal then would be expected to fall to a rate lower than that of pre-implementation since overall forest health would be improved by selectively removal those trees in critical or poor health. Noise generation only would occur during normal workdays and during normal work hours.

The table below lists noise levels associated with grounds maintenance activities. As discussed in Section 3.3, the USEPA has determined that exposure to noise levels more than 70 dBA for 24 hours or exposure to noise levels of 75 dBA for 8 hours provides adequate hearing protection (USEPA, 1974). Exposure of receptors to noise levels in excess of USEPA standards would be an adverse impact. The predicted distance from the noise source where the sound level is calculated to be at acceptable levels from noise sources that would be associated with grounds maintenance and tree removal, 75 dBA, is given in Table 4-6.

The duration of the noise associated with tree removal varies by alternative. Table 4.7 shows an estimate of the duration of short-term noises. Tree removal would be suspended during avian species' breeding season, March 1—August 15.

Table 4-6. Noise Levels Associated with Grounds Maintenance Equipment

Noise Source[55]	Sound Level (dBA)	Predicted Sound Level at 100 ft (dBA)	Distance from Source Sound Level 75 dBA (ft)
Loader	112	72	71
Chainsaw	110	70	56
Stump Grinder	103	63	25
Hedge Trimmer	103	63	25
Weed Eater	96	56	11
Shredder and Riding Lawn Mower	90	50	6

Table 4-7. Duration of Tree Removal Activities and Associated Noise

	Number of Trees Removed	Activity Duration (excluding breeding season)
Alternative 1		
Annual	300	Continuous
Alternative 2 (Preferred Alternative)		
Year 1	600-700	1 year
Year 2	600-700	1 year
Following Implementation	50 (est.)	Continuous
Alternative 3 (Two Phase)		
Phase I	600-700	1 year
Between Phases	100 (est.)	2-a3 years (est.) - if Phase II implemented); Continuous - if Phase II not implemented
Phase II	600-700	1 year
Following Implementation of Phases I and II	50 (est.)	Continuous

[55] Source: University of Florida, Noise level for Common Equipment, NoiseID (ufl.edu), accessed March 9. 2021.

Alternative 1 (No Action)

Under the No Action Alternative, short-term minor adverse effects on the noise environment in the NHLD from grounds maintenance activities would continue with the same noise sources and at the same intensity level. Hedge trimmers, weed eaters, riding lawn mowers, leaf blowers chainsaws, shredders, loaders, and light duty trucks would continue to be used almost daily weekdays to maintain the grounds in the NHLD. Typically, two to three crews work outside of breeding season to remove dead, diseased, or dying trees. Three crewmembers are employed to remove an average of one to two trees daily. A typical crew would include 2 to 3 trimmers using chainsaws in the tree and one crew member using a leaf blower on the ground (Brooker Tree Service, personal communication, September 29, 2020).

Alternative 2 (Preferred Alternative)

Alternative 2 would have short-term minor adverse effects on the noise environment in the NHLD. Temporary noise generated by hedge trimmers, weed eaters, riding lawn mowers and other equipment associated with grounds maintenance activities would continue at the same intensity level. The noise levels would not exceed the USEPA's 75 dBA noise exposure limit during grounds maintenance or tree removal activities. Tree removal activities (felling, bucking, shredding, stump grinding, grading, seeding, and debris clean-up) would increase an estimated two-fold during implementation of the Alternative 2, i.e., for an estimated two years. It is expected that the number of crews would be increased proportionately, i.e., doubled, during implementation and the area affected by heightened noise levels also would increase during this time. Dead, diseased, and dying (DDD) trees would be culled from the urban forest as part of the Alternative 2. A long-term minor indirect beneficial effect is expected due to the decreased need to cull DDD trees in the post-implementation, healthier forest. Therefore, no significant impact from noise would occur under Alternative 2.

Alternative 3 (Two Phase)

Alternative 3 would have short-term minor direct adverse effects on the noise environment in the NHLD. Temporary noise generated by hedge trimmers, weed eaters, riding lawn mowers and other equipment associated with grounds maintenance activities would continue at the same intensity level. The noise levels would not exceed the USEPA's 75 dBA noise exposure limit during grounds maintenance or tree removal activities. Tree removal activities (felling, bucking, shredding, stump grinding, grading, seeding, and debris clean-up activities would increase an estimated two-fold during implementation, i.e., for two non-consecutive years if both phases are implemented. It is expected that the number of crews would be increased proportionately, i.e., doubled, during implementation and the area affected by heightened noise levels also increased during this time. Dead, diseased, and dying (DDD) trees would be culled from the urban forest as part of Alternative 3. A long-term minor beneficial indirect effect is expected due to the decreased need to cull DDD trees in the post-implementation, healthier forest. Therefore, no significant impact from noise would occur under Alternative 3.

Acoustic Vibration. Potential impacts from acoustic vibration would be considered significant if the action were to exceed the vibration limit of 0.12 in/sec PPV for transient noise (Hanson, Towers, & Maister, 2006) or 0.08 in/sec PPV for continuous noise (California Department of Transportation, 2013b).

The US Bureau of Mines has performed extensive testing of structural damage to buildings caused by ground vibration and has identified threshold damage level to residential structures to be 0.5 to 2.0 in/sec PPV (Siskind, Stagg, Kopp, & Dowding, 1980). A conservative vibration limit of 0.12 in/sec PPV for transient (Hanson, Towers, & Maister, 2006) and 0.08 in/sec PPV for continuous (California Department of Transportation, 2013b) threshold criteria has been established for historic structures.

Caltrans suggests the formula $PPV = PPV_{ref} (25/D)^{1.1}$ to calculate source level vibrations (in/sec) from equipment where PPV is the vibration at distance "D" and PPV_{ref} is the vibration source amplitude for the equipment, in this formula, 25 feet. As an example, a small dozer having a source amplitude at 25 feet of 0.003 in/sec would generate vibration amplitude of approximately 0.00065 in/sec at 100 feet and would be below the human perception level. A small dozer would be the largest piece of equipment that would be used to implement the proposed action.

Vibrations are readily perceptible at 0.08 in/sec PPV and levels of 0.4-0.6 in/sec PPV are considered unpleasant (Lane & Pelham, 2012). Ground vibrations associated with tree removal may briefly be noticeable to humans if they exceed the perception threshold level of 0.0016 to 0.019 in/sec PPV (Lane & Pelham, 2012). Ground vibrations vary with source and environmental conditions (e.g., soil compaction) but generally dissipate quickly away from the source[56] (California Department of Transportation, 2013).

Alternative 1 (No Action)

Under the No Action Alternative, there would be no change to current grounds maintenance and tree removal activities, i.e., there would continue in the NHLD and at the same intensity. No change in impacts from acoustic vibration to historic properties and negligible impact on the human environment would occur. Grounds maintenance activities and tree removal would have no short-term or long-term direct or indirect adverse impact due to acoustic vibration on the NHLD's historic architectural properties and negligible short-term and no long-term direct adverse impact on the human environment.

Alternative 2 (Preferred Alternative)

Under Alternative 2, grounds maintenance activities and tree removal would have no short-term or long-term direct or indirect adverse impact due to acoustic vibration on the NHLD's historic architectural properties and negligible short-term and no long-term direct adverse impact on the human environment. No grounds maintenance or tree removal activities would generate ground vibrations exceeding the conservative threshold level of 0.12 in/sec PPV established to protect historic properties. Ground vibrations associated with tree removal may briefly be noticeable to humans if they exceed the perception threshold level of 0.0016 to 0.019 in/sec PPV (Lane & Pelham, 2012). Therefore, no significant impact from acoustic vibration would occur under Alternative 2.

Alternative 3 (Two Phase)

Under Alternative 3, grounds maintenance activities and tree removal would have no short-term or long-term direct or indirect adverse impact due to acoustic vibration on the NHLD's historic architectural properties and negligible short-term and no long-term direct adverse impact on the human environment. No grounds maintenance or tree removal activities would generate ground vibrations exceeding the conservative threshold level of 0.12 in/sec PPV established to protect historic properties. Ground vibrations associated with tree removal may briefly be noticeable to humans if they exceed the perception threshold level of 0.0016 to 0.019 in/sec PPV (Lane & Pelham, 2012). Therefore, no significant impact from acoustic vibration would occur under Alternative 3.

4.4 Infrastructure – Heating and Cooling Systems

Heating and Cooling Systems. Potential impacts would be considered significant if the action were to exceed the capacity of the utility or cause an unacceptable increase in heating or cooling costs.

Facilities on the installation are heated with natural gas fired boilers; there is no central heating system. There are 318 residential housing units on JBSA-RND. They are heated by natural gas (802 CES/CENPE, energy and utilities). Heating and cooling systems would be adequate for the expected additional demand that would be caused by implementation of alternatives 2 or 3.

Trees around buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with production of electric power. Tree shade reduces summer air conditioning demand but can increase heating energy use by intercepting winter sunshine

(Heisler 1986[57]; Simpson and McPherson 1996[58]). The amount of energy required to heat and cool buildings depends on their thermophysical properties, occupant behavior and local climate. Older structures such as those in the NHLD often are less energy efficient than are more modern structures.

USDA's i-Tree Design[59] was used to provide a gross estimate of trees' value in reducing energy costs rather than a precise value. Fifteen (15) representative buildings and the 233 inventoried trees surrounding those buildings (tree location, species, canopy condition, and dbh) along with climatological information for San Antonio, Texas were modeled to assess the effects of implementing Alternative 2 or Alternative 3 on energy usage and costs. The structures represent a range in size, location, and orientation within the NHLD. Table 4-8 shows the average beneficial annual energy impact of all trees affecting the representative buildings — four large buildings (dormitories and administration buildings) and eleven residential buildings. Individual building results and method used are given in Appendix C, i-Tree Design. An illustrative example of the method used also is provided for B100, Taj Mahal, in Appendix C-2. Additional energy demand due to tree removal would vary based upon the number, location, and species of the trees removed.

The American Council for an Energy-Efficient Economy (Drehobl, Ross, & Ayala, 2020) determined the median energy burden for San Antonio metro area households to be approximately $1,800 annually, about 3 percent of median annual income ($55,000) households (Drehobl, Ross, & Ayala, 2020)[60].

Alternative 1 (No Action)

Under the No Action Alternative, there would not be any additional energy demand on the heating and cooling systems and no additional costs. Trees surrounding office buildings/dormitories were estimated to save approximately 507 kWh of energy for cooling annually. Trees surrounding residential buildings were estimated to save approximately 285

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[57] Heisler, G.M. (1986) *Energy Savings with Trees*, Journal of Arboriculture, 12, pp. 113-125.
[58] Simpson, J.R. and McPherson, E.G. (1996) *Potential of Tree Shade for Reducing Residential Energy Use in California*, Journal of Arboriculture, 22, pp.10-18.
[59] i-Tree Design uses quantities that directly influence building energy use: Heating Degree Days (HDD), Cooling Degree Days (CDD), Latent Enthalpy Hours[59] (LEH), atmospheric clearness index[59] (KT), and average windspeed. San Antonio, TX values of HDD (base 65 ºF); CDD, Cooling Degree Days (base 65 ºF); LEH, KT, along with average annual wind speed (WND) were used to model Randolph NHLD tree benefits. Detailed discussion of these parameters and how they affect cooling and heating loads can be found in Heisler (1986), Simpson and McPherson (1996) among others. A brief discussion can be found in Appendix C.

[60] Monthly Basic Allowance for Housing (BAH) rates (without dependents) for San Antonio (2021) ranged from $1239 for an E1 to $1806 for an O6.

kWh of energy for cooling annually (see Table4-8)[61]. For heating, the energy saved is estimated to be approximately 13 therms[62] for offices/dormitories and 6 therms for residential buildings. Under the No Action alternative, dead, diseased, and dying trees would continue to be removed but no healthy trees would be removed, and the heating and cooling benefits essentially would remain as they are currently.

Alternative 2 (Preferred Alternative)

Under Alternative 2, grounds maintenance activities and tree removal would have no direct short-term adverse effects on heating or cooling systems. The loss of the beneficial effect from removed trees would have minor indirect long-term adverse effect on the heating and cooling system due to increased energy demand and commensurate increase in energy costs. The additional energy demand is forecast to range from approximately 113.8 kWh for residential buildings to 202.7 kWh for office buildings/dormitories for cooling and 2.4 therms to 5.3 therms for heating residential and administration/dormitory buildings, respectively. Therefore, no significant impact to heating and cooling systems would occur under Alternative 2.

Alternative 3 (Two Phase)

Under Alternative 3, grounds maintenance activities and tree removal would have no direct short-term adverse effects on heating or cooling systems. The loss of the beneficial effect from removed trees would have minor indirect long-term adverse effect on the heating and cooling system due to increased energy demand and commensurate increase in energy costs. If both phases were to be implemented, the additional energy demand is forecast to range from approximately 113.8 kWh for residential buildings to 202.7 kWh for office buildings/dormitories for cooling and 2.4 therms to 5.3 therms for heating residential and administration/dormitory buildings, respectively. Therefore, no significant impact to heating and cooling systems would occur under Alternative 3.

[61] The tree benefits are gross estimates for comparison only. The

[62] One therm is equal to burning approximately 99.98 cf of natural gas.

Table 4-8. Average of Annual Beneficial Energy Impact from Trees Affecting Buildings - Representative Sampling

		Cooling			Heating		
Building Type	Average Number of Trees	kWh	Residential Rate[1] ($)	Commercial Rate[2] ($)	Therms	Residential Rate[3] ($)	Commercial Rate[4] ($)
Office/Dormitory Buildings (Average of 4)	13	506.9	46.83	38.88	13.3	13.83	15.96
Residential Buildings (Average of 11)	7	284.6	26.61	22.65	5.9	6.15	1.84

Notes: (1) Average residential electricity rate in San Antonio is $0.0924/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021).

(2) Average commercial electricity rate in San Antonio is $0.0767/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021)
(3) The average residential natural gas prices in San Antonio averaged approximately $1.04 per therm. ($10.41 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to burning approximately 99.98 cf of natural gas.
(4) The average industrial natural gas prices in San Antonio averaged approximately $0.30 per therm. ($3.00 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to approximately 99.98 cf of natural gas.

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4.5 Cultural Resources

Potential impacts would be considered significant if they were to impact the integrity of the historic architectural resources in the NHLD (APE) that make the structure(s) eligible for the National Register.

Potential impacts also would be considered significant if they were to impact the integrity of the NHLD's original landscape design[63] of the period of significance, i.e., the time in which the property achieved the qualities that make it eligible for the National Register (Keller & Keller, 1994). These impacts can be adverse or beneficial.

Adverse impacts on cultural resources can include physically damaging all or part of a resources or altering the characteristics of the environment that contribute to the resource's significance. Impacts on cultural resources can be short- or long-term, and direct or indirect. Actions also can have beneficial impacts if they improve the preservation of the cultural resource or their historic setting.

JBSA will coordinate the proposed undertaking with TSHPO's and the National Park Service's review under Section 106 of the NHPA which requires federal agencies to assess the effects of their undertakings on historic properties. If an undertaking is determined to have an adverse effect, JBSA must implement measures to avoid, minimize, or mitigate the effect. JBSA's Section 106 determinations are presented in this section along with the analysis of impacts under NEPA.

Assessment of Adverse Effects

"An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." (36 CFR § 800.5)

Possible Section 106 Determinations

Finding of ***no effect***

Finding of ***no adverse effect***

Finding of ***adverse effect*** on historic properties

[63] The National Park Service's National Register Bulletin 18, "How to Evaluate and Nominate Designed Historic Landscapes" lists the basic criteria of a designed historic landscape. Lt. Bone's design principles followed the Garden City movement of the early 20th century (Thomason and Associates, 1994)— open spaces and vistas that provided a park-like atmosphere. His landscape design also emphasized important functional buildings (e.g., Administration Building, Cadet Complex, etc.) and acknowledged military rank structure (e.g., enhanced landscaping around the Commanding General's quarters, Officers Club, etc.).

Alternative 1 (No Action)

Under the No Action Alternative, there would be no effect to the National Historic Landmark District that would occur from the removal of dead, dying, or unsalvageable trees. This is an exempt undertaking in the PA[64], i.e., considered to have “no effect” (Patrick, L.A.; Wolfe, M., 2011).

Alternative 2 (Preferred Alternative)

Under Alternative 2, there would be a positive long-term, minor indirect beneficial impact on the National Historic Landmark District—removal of trees in North and South Parks and East and West Parks would restore the spatial emphasis of important buildings (e.g., B900 HQ AETC, B500 Officers Club, B661 HQ 19th Air Force, etc.). There also would be long-term, direct beneficial impact to the landscape design. Component guidelines in the NHLD Vegetation Management Plan (Appendix B) were designed to make positive changes that help recreate the original landscape design of Lt. Bone—e.g., trees would be removed from medians restoring viewsheds and view corridors, and post period of significance trees and shrubs inconsistent with the original design preferentially would be removed as part of Alternative 2. As necessary, vegetation species that are dead, diseased, or dying could be replaced with vegetation that would not diminish the integrity of the landscape design (Keller & Keller, 1994), e.g., replacement with the same or similar, but more drought or heat tolerant species.

Alternative 3 (Two Phase)

Under Alternative 3, there would be positive long-term, minor indirect beneficial impact on the National Historic Landmark District—removal of trees in North and South Parks and East and West Parks would restore the spatial emphasis of important buildings (e.g., B900 HQ AETC, B500 Officers Club, B661 HQ 19th Air Force, etc.). There also would be long-term, direct beneficial impact to the landscape design. Component guidelines in the NHLD Vegetation Management Plan (Appendix B) were designed to make positive changes that help recreate the original landscape design of Lt. Bone—e.g., trees would be removed from medians restoring viewsheds and view corridors, and post period of significance trees and shrubs inconsistent with the original design preferentially would be removed as part of the Alternative 3. As necessary, vegetation species that are dead, diseased, or dying could be replaced with vegetation that would not diminish the integrity of the landscape design (Keller & Keller, 1994), e.g., replacement with the same or similar, but more drought or heat tolerant species. The extent of beneficial impact would depend on whether one or both phases of Alternative 3were implemented, i.e., less if only Phase I were implemented.

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[64] The Programmatic Agreement among the USAF and TSHPO identifies routine activities that are found not to have an adverse effect on historic properties and therefore do not require TSHPO project review. Among these exempted activities is the maintenance and repair of existing landscape features.

4.6 Biological Resources

Potential impacts would be considered significant if a federally listed threatened or endangered species (TES) or designated critical habitats over a large area would be affected.

Potential impacts would be considered significant if conditions of JBSA's Migratory Bird Permit (Depredation at Airports Permit, MB09077B, 2020) would be violated.

Potential impacts would be considered significant if it resulted in an infusion of invasive species.

Vegetation. The NHLD urban forest is in a developed area. The remainder of JBSA-RND is either developed area or managed grasslands with exception of the runway clear zones and water in the detention ponds and golf course ponds at the south end of the installation (JBSA, 2020a).

Alternative 1 (No Action)

Under the No Action Alternative, there would be no change in impacts to NHLD vegetation. Grounds maintenance activities (tree trimming, mowing, etc.) and removal of dead, diseased and dying trees would continue. NHLD tree density would not be reduced as proposed in the action alternatives. The dense urban forest canopy would continue to foster a humid environment conducive to mold formation in buildings within the NHLD.

Alternative 2 (Preferred Alternative)

Under Alternative 2, there would be the negligible short-term, direct adverse impact of increasing the risk of spreading disease (e.g., oak wilt [*Ceratocystis fagacearum*]) and pests (e.g., gypsy moth [*Lymantria dispar*]) during tree maintenance and removal activities. There would be minor long-term, indirect beneficial impact of creating and maintaining a healthier urban forest. Trees that are dead or are in critical or poor health (20 percent) and non-native trees or invasive species, e.g., Chinese Tallow tree, (8 percent) would be removed, leaving a healthier, better structured forest.

The following actions would be taken during and after grounds maintenance/tree removal activities to mitigate the potential spread of disease and pests within the urban forest (see Appendix B, VMP).

- Chainsaws and equipment used for tree trimming oaks would be sterilized between used on each individual tree to avoid spread of oak wilt.
- Oaks would be painted with wound sealer within 30 minutes of trimming.
- Wood chips would not be discharged on the ground and would be removed from the hole following stump grinding to reduce spread of disease or insects.
- Stump and perimeter roots would be removed within the ground area of the tree canopy to avoid any spread of disease or insects.

- The area within a 10- foot radius of the tree stump would be graded and seeded with a drought-tolerant grass (e.g., Cynodon TIFF 419) within 2 days of tree removal. Soil disturbance from tree removal activities could provide opportunities for the spread of undesirable, non-native, and invasive plant species.

Additionally, implementation of proposed action would have the long-term, positive impact of lessening the humidity under the forest canopy and thereby reducing harmful mold formation in buildings within the NHLD. The health and safety of residents and persons utilizing NHLD buildings would be improved by implementing Alternative 2.

Therefore, no significant impact to vegetation would occur under Alternative 2.

Alternative 3 (Two Phase)

Alternative 3 would have the same impacts as Alternative 2. There would be the negligible short-term, direct adverse impact of increasing the risk of spreading disease (e.g., oak wilt [*Ceratocystis fagacearum*]) and pests (e.g., gypsy moth [*Lymantria dispar*]) during tree maintenance and removal activities. There would be minor long-term, indirect beneficial impact of creating and maintaining a healthier urban forest. Trees that are dead or are in critical or poor health (20 percent) and non-native trees or invasive species, e.g., Chinese Tallow tree, (8 percent) would be removed, leaving a healthier, better structured forest.

The following actions would be taken during and after grounds maintenance/tree removal activities to mitigate the potential spread of disease and pests within the urban forest (see Appendix B, VMP).

- Chainsaws and equipment used for tree trimming oaks would be sterilized between used on each individual tree to avoid spread of oak wilt.
- Oaks would be painted with wound sealer within 30 minutes of trimming.
- Wood chips would not be discharged on the ground and would be removed from the hole following stump grinding to reduce spread of disease or insects.
- Stump and perimeter roots would be removed within the ground area of the tree canopy to avoid any spread of disease or insects.
- The area within a 10- foot radius of the tree stump would be graded and seeded with a drought-tolerant grass (e.g., Cynodon TIFF 419) within 2 days of tree removal. Soil disturbance from tree removal activities could provide opportunities for the spread of undesirable, non-native, and invasive plant species.

Additionally, implementation of the Alternative 3 would have the long-term, positive impact of lessening the humidity under the forest canopy and thereby reducing harmful mold formation in buildings within the NHLD. The health and safety of residents and persons utilizing NHLD buildings would be improved by implementing Alternative 3. The positive impact would be less if only Phase One of Alternative 3 were to be implemented.

Therefore, no significant impact to vegetation would occur under Alternative 3.

Wildlife. JBSA-RND largely is developed/urban (1,073 acres) or managed grassland (1,747 acres) with only 52 acres, less than 2 percent, which are water or woodland. JBSA-RND has limited ability to support fish and wildlife species due to development and mission requirements for vegetation management (JBSA, 2020a).

Alternative 1 (No Action)

Under the No Action Alternative, there would be no change in impacts. Negligible short- and long-term adverse impacts would occur to wildlife, including birds protected under the MBTA. Short-term noise impacts on wildlife during grounds maintenance and tree removal activities would occur and would include an increase in stress, altered behavior, and disruption of foraging, mating, and nesting behavior. Long-term, minor, indirect impacts would occur from permanent loss of habitat following removal of dead, diseased, and dying trees and shrubs.

Alternative 2 (Preferred Alternative)

Under Alternative 2, negligible short- and long-term adverse impacts would occur to wildlife, including birds protected under the MBTA. Short-term noise impacts on wildlife during grounds maintenance and tree removal activities would occur and would include an increase in stress, altered behavior, and disruption of foraging, mating, and nesting behavior. Long-term, minor, indirect impacts would occur from permanent loss of habitat following implementation, i.e., up to 40 percent tree removal from the NHLD. However, avian species could relocate to nearby suitable habitat; between 13 percent and 29 percent of the current landscape within 5 km and 40 km of JBSA-RND offers suitable habitat for WWDO and other avian species (Colón, Thompson, & Long, 2017a). There is the possibility of a long-term indirect impact of a new species, e.g., non-native granivores, that may increase with conversion of habitat, more grass cover, following implementation[65]. JBSA would continue to monitor the bird population in the NHLD urban forest to evaluate changes in BASH threat.

Implementation of Alternative 2 would have no effect on TES or their critical habitat; no TES are known to occur near JBSA-RND.

JBSA's Migratory Permit would not be violated. JBSA would follow INRMP (JBSA, 2020a; JBSA, 2018) and the USFWS' Guidance on the destruction and relocation of migratory bird nest contents (USFWS, 2021). Tree removal would be conducted outside breeding season, 1 March to 15 August to lessen the impact of implementing Alternative 2. Grounds maintenance/tree

[65] Currently, approximately 140 acres of the NHLD is grass and 84 acres tree/tree canopy (see i-Tree Canopy in Appendix **C**). Removal of 40 percent of the NHLD trees could result in conversion of 34 acres of tree/tree canopy into grass cover.

removal contractors would be advised on the potential to encounter migratory birds nesting or wintering in the NHLD and be instructed to avoid negatively impacting them.

Therefore, no significant impact to wildlife would occur under Alternative 2.

Alternative 3 (Two Phase)

Under Alternative 3, negligible short- and long-term adverse impacts would occur to wildlife, including birds protected under the MBTA. Short-term noise impacts on wildlife during grounds maintenance and tree removal activities would occur and would include an increase in stress, altered behavior, and disruption of foraging, mating, and nesting behavior. Long-term, minor, indirect impacts would occur from permanent loss of habitat following implementation, i.e., up to 40 percent tree removal from the NHLD if both Alternate 3 phases are implemented. However, avian species could relocate to nearby suitable habitat; between 13 percent and 29 percent of the current landscape within 5 km and 40 km of JBSA-RND offers suitable habitat for WWDO and other avian species (Colón, Thompson, & Long, 2017a). There is the possibility of a long-term indirect impact of a new species, e.g., a non-native granivore, that may increase with conversion of habitat, more grass cover, following implementation. JBSA would continue to monitor the bird population in the NHLD urban forest to evaluate BASH threat.

Alternative 3 would have no effect on TES or their critical habitat; no TES are known to occur near JBSA-RND.

JBSA's Migratory Permit would not be violated. JBSA would follow INRMP (JBSA, 2020a) (JBSA, 2018) and the USFWS' Guidance on the destruction and relocation of migratory bird nest contents (USFWS, 2021). Tree removal would be conducted outside breeding season, 1 March to 15 August to lessen the impact of implementing Alternative 3. Grounds maintenance/tree removal contractors would be advised on the potential to encounter migratory birds nesting or wintering in the NHLD and be instructed to avoid negatively impacting them.

Therefore, no significant impact to wildlife would occur under Alternative 2.

4.7 Airfield Flying Safety

Potential impacts would be significant if there was an increase in the BASH risk at JBSA-RND airfield.

Potential risk would be significant if the USAF did not have a management plan in place to respond to changes in BASH risk.

JBSA-RND has an active BASH program, BASH Management Plan, and Bird Hazard Working Group (BHWG) to manage BASH risk. The BHWG is tasked with collecting, compiling, and reviewing data on bird strikes; identifying and recommending actions to reduce hazards;

recommending changes in operational procedures; preparing informational programs for aircrews; and serving as a point of contact for BASH issues.

Alternative 1 (No Action)

Under the No Action Alternative, there would be no change in impacts to Airfield Flying Safety and the BASH risk would remain at the current high level compared with other bases with a similar mission. JBSA-RND would continue to implement its BASH Management Plan.

Alternative 2 (Preferred Alternative)

Under Alternative 2, there would be direct, long-term beneficial impact due to a reduction in the population of WWDOs and other avian species foraging, roosting, nesting, and rearing their young in the NHLD's urban forest and an attendant reduction in BASH risk. The forest would be less dense, overlapping canopies would be reduced or eliminated, and fruiting trees and shrubs would be removed. The BHWG would continue to monitor BASH risk and respond to changes in threats, e.g., introduction of a new avian species (DeGraff & Wentworth, 1986).

Therefore, no significant adverse impact to airfield safety would occur under Alternative 2.

Alternative 3 (Two Phase)

Alternative 3, like Alternative 2, would provide a direct, long-term beneficial impact of a reduced BASH risk due to a reduction in the population of WWDOs and other avian species foraging, roosting, nesting, and rearing their young in the NHLD's urban forest. The forest would be less dense, overlapping canopies would be reduced or eliminated, and fruiting trees and shrubs would be removed. However, if only Phase I of Alternative 3 were implemented, the BHWG would continue to monitor BASH risk and respond to changes in threats, e.g., introduction of a new avian species.

Therefore, no significant adverse impact to airfield safety would occur under Alternative 2.

5. Other NEPA Considerations

5.1 Cumulative Impacts

Federal regulations implementing NEPA (40 CFR §§ 1500–1508) require that cumulative impacts of a Proposed Action be assessed. CEQ regulations stipulate that the cumulative impacts analysis in a NEPA document should consider the potential environmental consequences resulting from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR § 1508.7).

Cumulative impacts may occur when other actions are expected to occur in a similar location (i.e., overlapping geographic location) or during a similar time period (i.e., coincidental or sequential time of events). Scope must consider other projects that coincide with the location and timetable of a proposed action and other actions. The impacts may then be incremental and may result in cumulative impacts. Actions overlapping with or in close proximity to a proposed action can reasonably be expected to have more potential for cumulative impacts on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide in the same timeframe tend to offer a higher potential for cumulative impacts. Cumulative impacts analyses must evaluate the nature of interactions among these actions (CEQ 1997). Actions that have the potential to interact with the Proposed Action at JBSA-RND are included in this cumulative impacts analysis.

For the action alternatives to have a cumulatively significant impact on an environmental resource, two conditions must be met. First, the combined impacts of all identified past, present, and reasonably foreseeable projects, activities, and processes on a resource, including the impacts of a proposed action, must be significant. Second, a proposed action must make a substantial contribution to that significant cumulative impact. Proposed actions of limited scope such as the actions analyzed in this EA do not typically require as comprehensive an assessment of cumulative impacts as proposed actions that have significant environmental impacts over a large area (CEQ 2005).

5.1.1 Present and Reasonably Foreseeable Actions

For most resource areas, such as biological resources, geological resources, infrastructure and transportation, hazardous materials and wastes, and water resources, the impacts of past actions are now part of the existing environment and are incorporated in the description of the affected environment in Section 3. The following table summarizes present, and reasonably foreseeable projects considered within the geographic scope of the cumulative impacts. Most are within the NHLD. In addition, the Texas Department of Transportation roadway resurfacing projects are planned nearby JBSA-RND.

Table 5-1. Summary of Present and Reasonably Foreseeable Actions[1]

	Project/Action	Timeframe	Within NHLD	Description
1	Child Development Center[1]	2023	TBD	Construct Child Development Center within Flight Operations Planning District. Siting location currently undetermined. Demolish current Child Development Center (Building 152).
2	Stormwater system maintenance[3]	2030		Renovate retention ponds on south end of installation near golf course. Courses of action being developed. (Retention ponds drain into Woman Hollering Creek.)
3	Clear trees along perimeter fence[1]	2021		Clear trees and brush around base perimeter.
4	Replace west runway[3]			Replace west runway and upgrade drainage. Demolish existing runway.
5	Renovate HQ AFPC (B493)		✓	Renovate and construct addition to B493, Air Force Personnel Center building complex.
6	Consolidated Mission Support Complex[1]	2027	TBD	Construct Consolidated Mission Support Complex (CE/SFS/LRS)
	T-7A Related Projects in NHLD[66]			
	Construct MTS facility[3]		✓	T-7A project. Construct Mission Training Squadron facility at current site of non-historic buildings – B388, B389, B390, and B397.
	Renovate Hangar 7		✓	T-7A project. Construct addition to field level repair facility in Hangar .7
	Modify Hangar 63[3]		✓	T-7A project. Modify interior of Hangar 63 to meet mission requirements.
	Modify Hangar 13[3]		✓	T-7A project. Modify interior of Hangar 63 for training and to accommodate communications equipment.
	Fuel cell facility[3]			T-7A project. Construct fuel cell facility west of B38.
	Modify B220[3]		✓	T-7A project. Modify B220 (currently Public Affairs Office) and install utilities.

[66] An Environmental Impact Statement (EIS) is being prepared to assess the impacts of the USAF's new advanced trainer aircraft, the T-7A Red Hawk. The T-7A would be phased-in to replace the T-38C Talon trainers over a period of several years beginning as early as 2023. The associated increase in criteria pollutant and GHG emissions from air operations is being evaluated as part of that analysis.

	Modify Hangar 72[3]		✓	T-7A project. Modify interior and exterior to meet mission requirements.
	Modify Hangar 6[3]		✓	T-7A project. Modify interior and exterior to meet mission requirements.
	Modify Hangar 12[3]		✓	T-7A project. Modify interior to meet mission requirements.
	Reconfigure Hangar 5		✓	T-7A project. Reconfigure interior for use as repair facility.

Sources: (1) JBSA-Randolph Area Development Plan, (2) AETC 802 CES/CEOER, (3) AETC 802 CES/CEI
Note: Additional projects may be considered for historic housing (shade structures, window tint, etc.). JBSA will consult with TSHPO on proposed projects in the NHLD as required.

5.1.2 Cumulative Impacts Analysis

As discussed in Section 3, there is no or negligible potential for effects on airspace management, land use, water resources, earth resources, hazardous material use or waste, safety and occupation health to social and environmental justice from implementing Alternative 2 or Alternative 3. Therefore, when added to other past, present, and reasonably foreseeable future actions they would not add a cumulatively significant increase in impacts and are not discussed further.

Air Quality and GHG emissions. Projects 1-6 in Table 5-1 would be expected to have short-term, minor, adverse effects on criteria pollutant and GHG emissions while activities are occurring. These impacts would include an increase in criteria pollutant and GHG emissions due to construction or maintenance activities and increased vehicular traffic.

If implemented, the T-7A related projects would have short-term, minor, adverse effects on criteria pollutant and GHG emissions while construction activities are occurring. Long-term, minor, adverse, cumulative impacts on air quality also would be anticipated from heating and cooling new building space and operating new emergency generator. Aircraft operations associated with recapitalization[67] of T-7A aircraft at JBSA-RND would have long-term, adverse impact on air quality and GHG emissions.

If implemented, the incremental impact of Alternative 2 or Alternative 3 when added to other past, present, and reasonably foreseeable future actions is minor and would not add a cumulatively significant increase in criteria pollutants or GHG emissions.

Noise and Acoustic Vibration. Projects in Table 5-1 would be expected to have short-term, minor, adverse effects on the noise environment and negligible short-term, adverse acoustic vibration impacts while construction, demolition, or grounds maintenance activities are

[67] Recapitalization is the phased acquisition of the new generation T-7A aircraft and construction and upgrade of specific facilities

occurring. Aircraft operations associated with recapitalization of T-7A aircraft at JBSA-RND also would be expected to have long-term, adverse impact on the noise environment.

If implemented, the incremental impact of Alternative 2 or Alternative 3 when added to other past, present, and reasonably foreseeable future actions is minor and would not add a cumulatively significant increase in the noise environment or in acoustic vibrations.

Infrastructure – Heating and Cooling. Projects in Table 5-1 would be expected to have minor, long-term increase in heating and cooling requirements for new building space that would add to the minor long-term increase in heating and cooling requirements from implementing Alternative 2 or Alternative 3. If implemented, the incremental impact of the action alternatives evaluated in this EA when added to other past, present, and reasonably foreseeable future actions is minor and would not add a cumulatively significant increase that would exceed the capacity of the utility or cause an unacceptable increase in heating or cooling costs.

Cultural Resources. If implemented, the incremental impact of Alternative 2 or Alternative 3 when added to other past, present, and reasonably foreseeable future actions is negligible and would not add a cumulatively significant increase in impacts to cultural resources. Positive steps that restore the period of significance historic landscape design would be cumulatively beneficial.

Biological Resources. If implemented, the incremental impact of Alternative 2 or Alternative 3 when added to other past, present, and reasonably foreseeable future actions is minor and would not add a cumulatively significant increase in impacts to biological resources—vegetation or wildlife.

Airfield Flying Safety. Increased flight activities and thus an increase in BASH risk would occur if T-7A recapitalization were to occur at JBSA-RND. The expected reduction in BASH risk from implementing Alternative 2 or Alternative 3 would help mitigate the added risk. Thus, if implemented, either action alternative of this EA when added to other past, present, and reasonably foreseeable future actions would be beneficial and thus would not add a cumulatively significant increase in impacts.

5.2 Unavoidable Adverse Impacts

Unavoidable adverse effects would result from implementation of Alternative 2 or Alternative 3. As discussed in detail in Section 4, implementation of either alternative would result in short- and long-term, adverse impacts associated with grounds maintenance and tree removal activities, including a minor increases in air emissions (criteria pollutants and GHGs), noise and acoustic vibration, interruptions to traffic flow, habitat loss, and expected increase in building heating and cooling costs. None of these effects would be significant.

5.3 Relationship of Short-Term Uses of the Environment and Long-Term Productivity

NEPA requires that Federal agencies disclose "…the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity…" (40 CFR 1502.16). Short-term uses of the human environment generally refer to the more immediate period of time during which the proposed project would be implemented, whereas "long term" refers to an indefinite period beyond this timeframe, e.g., more than 5 years or permanent resource loss. Short-term uses of the environment associated with the action alternatives are generally the same as the short-term impacts described in Chapter 4. There would be a permanent loss of tree benefits described in the affects section. Beneficial long-term productivity would be gained with reduction in JBSA-RND's BASH risk. A reduced BASH risk would support ongoing and future training missions on JBSA-RND. There also would be a long-term, beneficial impact of restored historic landscape design within the NHLD and improved sustainability where fewer trees could be more easily maintained and cared for at less cost.

5.4 Irreversible and Irretrievable Commitment of Resources

NEPA requires that that Federal agencies disclose "Any irreversible or irretrievable commitments of resources that would be involved in the proposal should it be implemented." (40 CFR § 1502.16). An irreversible commitment of resources occurs when a nonrenewable resource such as petroleum-based fuels is used to implement a project or when a species becomes extinct. Because nonrenewable resources are "used up," or consumed, this use cannot be reversed except possibly over an extremely long period of time (e.g., hundreds of thousands or millions of years), and thus are considered irreversible. Irreversible environmental changes that would result from implementation of Alternative 2 or Alternative 3 would include the consumption of energy resources (petroleum products) by grounds maintenance equipment, vehicles, etc.; and the carbon that had been stored in removed vegetation. An irretrievable commitment of resources involves the loss of productive use or value of renewable resources (e.g., timber) for a period of time. There would be an irretrievable loss of habitat favorable to WWDOs and other avian species due to thinning the NHLD urban forest—an estimated 34 acres of forest would be converted to grass cover. There also would be an irretrievable loss due to carbon that would not be sequestered by the removed vegetation. Irreversible and irretrievable commitments of resources would not be significant if either Alternative 2 or Alternative 3 were implemented.

6. List of Preparers

This DEA has been prepared by Cherokee Federal under the direction of the General Services Administration Assisted Acquisition Services and the 802nd Civil Engineering Squadron JBSA-San Antonio. Individuals who contributed to the preparation of this document are listed below.

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7. References

12th FTW. (2018, February 27). Randolph AFB Bird/Wildlife Aircraft Strike Hazard (BASH) Townhall. *Randolph AFB Bird/Wildlife Aircraft Strike Hazard (BASH) Townhall*. JBSA-Randolph, TX: USAF.

12th FTW. (2019, October). Bird Hazard Working Group (BHWG) Semiannual Meeting Presentation. JBSA-Randolph, TX: USAF.

AFCEC. (2017). *Joint Base San Antonio-Randolph and Seguin Auxiliary Airfield, Texas Air Installations Compatible Use Zones Study.* San Antonio: Air Force Civil Engineer Center.

AFCEC. (2019). *Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide.* San Antonio: USAF.

AFCEC. (2020). *Air Emissions Guide for Air Force Mobile Sources.* San Antonio: USAF.

Airport Cooperative Research Program. (2015). *ACRP Report 145 Applying an SMS Approach to Wildlife Hazard Management.* Washington, D.C.: Transportation Research Board.

Brasseur, G., & Chatfield, R. (1991). The fate of biogenic trace gases in the atmosphere. In T. Sharkey, E. Holland, & H. Mooney, *Trace Gas Emissions by Plants* (pp. 1-27). New York: Academic Press.

Brown, T. (2019, November 25). *Randolph Air Force Base*. Retrieved from Texas State Historical Association: https://tshaonline.org/handbook/online/articles/qbr01

California Department of Transportation. (2013a). *Technical Noise Supplement to the Caltrans Traffic noise Analysis Protocol.* Sacramento: California Department of Transportation Division of Environmental Analysis.

California Department of Transportation. (2013b). *Transportation and Construction Vibration Guidance Manual.* Sacramento: California Department of Transportation Division of Environmental Analysis.

Carman, R. (2012). *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects; National Highway Cooperative Research Program Project 25-25 (Task 72).* National Highway Cooperative Research Program (unofficial publication). Retrieved from file:///E:/BASH/BASH%202019%20das/References/Miscellaneous/NCHRP25-25(72)_FR.pdf

CEMML. (2019). *Climate Change Summaries for Incorporation into Installation INRMPS, Joint Base San Antonio.* San Antonio: JBSA.

Cleary, E., & Dolbeer, R. (2005). *Wildlife Hazard Management at Airports: A Manual for Airport Personnel; Staff Publication 133.* Washington D.C.: USDA National Wildlife Research Center.

Clow, V., Knight, L., Peter, D., & Allday, S. (1998). *The Architecture of Randolph Field, 1928-1931.* Fort Worth: U.S. Army Corps of Engineers.

Colón, M., Thompson, C., & Long, A. (2017a). *Feasibility of Avian Management Techniques Aimed to Reduce Risk of Bird-aircraft Collisions on Joint Base San Antonio-Randolph.* Texas A&M University, Natural Resource Institute. College Station: Texas A&M Natural Resource Institute.

Colón, M., Thompson, C., Miller, S., & Long, A. (2017b). *Urban Tree Inventory at JBSA-Randolph.* College Station: Texas A&M Natural Resources Institute.

Cook, J., & Sprinkle, J. (2001). *National Historic Landmark Nomination: Randolph Field Historic District.* US Department of the Interior, National Park Service.

DeGraff, R., & Wentworth, J. (1986). Avian guild structure and habitat associations in suburban bird communities. *Urban Ecology*, 399-412.

DeVore, S.L. . (1991). *Archaeological Survey of Randolph AFB. Bexar County, Texas.* Denver: Rocky Mountain Regional Office, National Park Service.

DoD. (2011). *Mishap Notification, Investigation, Reporting, and Recordkeeping, DoD Instruction 6055.07 (June 6, 2011 as changed August 31, 2018).* Washington, DC: Department of Defense.

DoD. (2019a). *Department of Defence Improving Water Security and Efficiency on Installations Report to Congress.* Washington D.C.: Department of Defence.

DoD. (2019b). *Report on the Effects of Changing Climate to the Department of Defense.* Washington DC: Department of Defense Office of the Under Secretary of Defense for Acquisition and Sustainment.

DoD. (2021, March 17). *Joint Base San Antonio (Lackland, Randolph, Sam Houston) In-depth Overview*. Retrieved from Military Installations: https://installations.militaryonesource.mil/in-depth-overview/joint-base-san-antonio-lackland-randolph-sam-houston

Drehobl, A., Ross, L., & Ayala, R. (2020). *How High are Household Energy Budgets.* Washington DC: American Council for an Energy-Efficient Economy.

Edwards Aquifer Authority. (2021, March 17). *About the Edwards Aquifer*. Retrieved from Edwards Aquifer Organization: https://www.edwardsaquifer.org/science-maps/about-the-edwards-aquifer/

Edwards Aquifer Authority. (2021, March 18). *EAA Subchapter 713 Reguated Zones*. Retrieved from Edwards Aquifer Authority Organization: https://www.arcgis.com/home/webmap/viewer.html?webmap=aed0e4eddc794ec49d740a267d42560a&extent=-101.1491,28.3085,-96.6364,30.6845

FAA. (2020). *Hazardous Wildlife Attractants on or Near Airports, AC 150/5200-33C.* Washington D.C.: Federal Aviation Administration.

Flight Safety Foundation. (2021, March 19). *ASN Wikibase Occurrence #64711*. Retrieved from Aviation Safety Network: https://www.aviation-safety.net/wikibase/64711

Guenther, A., Karl, T., Harley, P., Wiedinmyer, C., Palmer, P., & Geron, C. (2006). Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature). *Atmospheric Chemistry and Physics*, 3181-3110.

Hanson, C., Towers, D., & Maister, L. (2006). *Transit Noise and Vibration Impact Assessment, FTA-VA-1003-06.* Washington DC: Department of Transportation, Federal Transit Administration.

Hantson, S., Knorr, W., Schurgers, G., Pugh, T., & Arneth, A. (2017). Global Isoprene and Monoterpene Emissions under Changing Cimate, Vegetation, CO2 and land use. *Atmospheric Environment*, 33-45.

Hirabayashi, S. (2013). *i-Tree Eco Precipitation Interception Model Descriptions.* New York: The Davey Tree Expert Company.

HQ Air Force Safety Center. (2015). *Bird/Wildlife Aircraft Strike hazard (BASH) Staff Assistance Visit.* Kirkland AFB: USAF.

Huber, H. (1987). *National Register Nomination of Base Administration Building, Building 100, "The Taj Mahal".* Denver: US National Park Service.

JBSA. (2018). *Bird/Wildlife Aircraft Strike Hazard (BASH) Plan, 502d ABW Command Instruction 91-212.* San Antonio: United States Air Force.

JBSA. (2018). *Installation Development Plan Joint Base San Antonio, Texas.* San Antonio: JBSA.

JBSA. (2019). *JBSA Randolph Support Services Area Development Plan.* San Antonio: JBSA.

JBSA. (2019, November 25). *Joint Base San Antonio History*. Retrieved from Joint Base San Antonio: https://www.jbsa.mil/Information/History/

JBSA. (2020a). *Integrated Natural Resources Management Plan Joint Base San Antonio.* San Antonio: JBSA.

JBSA. (2020b). *Integrated Cultural Resources Management Plan Joint Base San Antonio, Texas.* San Antonio: USAF.

John A. Volpe National Transportation Systems Center. (2018). *Transit Noise and Vibration Impact Assessment Manual.* Washington DC: Federal Transit Administration.

Keller, T., & Keller, G. (1994). How to Evaluate and Nominate Designed Historic Landscapes. *National Register Bulletin 18*, 1-14.

Konan, W., & Schuring, J. (1983). Vibration Criteria for Historic and Sensitive Older Buildings. *Preprint 83-501.* Houston: American Society of Civil Engineers.

Lane, K., & Pelham, R. (2012). *Ground Vibrations Emanating from Construction Equipment, FHWA-NH-RD-12323W.* Concord: New hampshire Department of Transporattion.

Linuxfocus.org. (2021, June 7). *Decibel calculator for sound*. Retrieved from Linus Focus: http://main.linuxfocus.org/~guido/javascript/decibel-calculator.html

Michael, M., Smith, A., & Sin, J. (2011). *The Architecture of the Department of Defense: A Military Style Guide.* Washington DC: DoD Legacy Resource Management Program.

Ning, Z., Chambers, R., & Abdollahi, K. (2015). Modeling Air Pollutant Removal, Carbon Storage, and CO2 Sequestration . In E. Paoletti, & P. Sicard, *Global Challenges of Air Pollution and Climate Change to Forests* (pp. 860-867). Nice (France): i-Forest .

Nowak, D. (1994). Understanding the Structure of Urban Forests. *Journal of Forestry*, 42-46.

Odenwald, N. G., & Turner, J. R. (1985). *Plants for the South.* Baton Rouge.

Patrick, L.A.;Wolfe, M. (2011). *Programmatic Agreement Among the U.S. Air Force and the Texas State historic Preservation Officer for the Operation, Maintenance and Development of Joint Bas San Antonio, Texas.* San Antonio: JBSA.

Predator. (2007). *Predator Stree Stump Grinder.* Oxon, England: Predator.

Prewitt, E. (1981). Cultural Chronology in Central Texas. *Bulletin of the Texas Archaeological Society*, 65-89.

Siskind, D., Stagg, M., Kopp, J., & Dowding, G. (1980). *Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting, RI8507.* Twin Cities: US Bureau of Mines.

Slowik, J., Stroud, C., Bottenheim, J., Brickell, P., Liggio, J. M., Moran, M., . . . Abbatt, J. (2010). Characterization of a Large Biogenic Secondary Organic Aerosol Event from Eastern Canadian Forests. *Atmospheric Chemistry and Physics*, 2825-2010.

TexasInvasives.org. (2021, March 16). *Resources*. Retrieved from TEXASINVASIVES.ORG: https://www.texasinvasives.org/resources/

Thomason and Associates. (1994). *National Register of Historic Places Registration Form, Randolph Field Historic District.* Denver: US National Park Service.

Tooker, M., Hartman, H. R., & Smith, A. (2013). *Historic Landscape Survey, Randolph AFB, Texas; ERDC/CERL TR-13-14.* Champaign: US Army Corps of Engineers, Engineer Research and Development Center.

TPWD. (2012a). *Texas Conservation Action Plan - Overview.* Austin: Texas Parks and Wildlife Department.

TPWD. (2012b). *Texas Conservation Action Plan- Texas Blackland Praries.* Austin: Texas Parks and Wildlife Department.

TPWD. (2012c). *Texas Conservation Action Plan - Edwards Plateau.* Austin: Texas Parks and Wildlife Department.

TPWD. (2021, March 24). *Rare, Threatened, and Endangerd Species of Texas by County*. Retrieved from Rare, Threatened, and Endangerd Species of Texas: https://tpwd.texas.gov/gis/rtest/

TPWD. (2021, June 10). *South Texas Wildlife Management, White-winged Doves*. Retrieved from Wildlife Management in South Texas: https://tpwd.texas.gov/landwater/land/habitats/southtx_plain/upland_birds/white_winged_dove.phtml

TRS Audio. (2021, April 13). *Tontechnik-Rechner-sengpielaudio*. Retrieved from Sengpielaudio: http://www.sengpielaudio.com/calculator-distance.htm

University of Florida. (2021, 06 07). *https://webfiles.ehs.ufl.edu/noiselvl.pdf*. Retrieved from Noise Levels for Common Equipment: https://webfiles.ehs.ufl.edu/noiselvl.pdf

US Climate Data. (2021, March 17). *Climate San Antonio - Texas*. Retrieved from U.S. Climate Data: https://www.usclimatedata.com/climate/san-antonio/texas/united-states/ustx1200

US National Research Council. (1983). *Changing Climate: Report of the Carbon Dioxide Assessment Committee.* Washington DC: Academic Press.

USAF. (2004). *AFI 32-7086 Civil Engineering-Hazardous Materials Management.* Washington D.C.: Department of the Air Force.

USAF. (2015). *Bird/Wildlife Aircraft Strike Hazard (BASH Staff Assistance Visit (SAV).* Washington: Headquarters Air Force Safety Center.

USAF. (2018). *Air Force Instruction 91-212; Bird/Wildlife Aircraft Strike Hazard (BASH) Management Program.* Washington: United States Air Force.

USAF. (2019). *Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide-Fundamentals, Volume 1.* San Antonio: USAF.

USAF. (2020, March 17). *Aviation Statistics*. Retrieved from Air Force Safety Center, Aviation Safety Division: https://www.safety.af.mil/Portals/71/documents/Aviation/BASH%20Statistics/FY19%20statistics/BASH_website_data_2020_class_A_B_C_D_Mishaps_by_FY.pdf?ver=QrNRhi5KfAkkuXDrYjacew%3d%3d

USAF. (2020). *Environmental Compliance and Pollution Prevention; AFMAN 32-7002.* Washington DC: USAF.

USAF. (2020). *The US Air Force Mishap Prevention Program; AFI 91-202.* Washington DC: United States Air Force.

USEPA. (1971). *Noise from Construction Equipent and Operations, Building Equipment, and Home Appliances, NTID300.1.* Washington DC: USEPA.

USEPA. (1974). *Information of Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Publication No. 550/9-74-004.* Washington DC: USEPA.

USEPA. (1994, March 17). *Designated Sole Source Aquifers Nationally.* Washington DC: US Emvironmental Agency. Retrieved from Designated Sole Source Aquifers Nationally Fact Sheet with Designated Aquifers and Pending Petitions Listed: https://nepis.epa.gov/Exe/ZyNET.exe/901E0R00.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=

USEPA. (2021a, April 12). *2019 Greenhouse Gas Emissions from Large Facilities*. Retrieved from EPA Facility Level Information on Greenhouse Gases Tool: https://ghgdata.epa.gov/ghgp/main.do

USEPA. (2021b, April 12). *Inventory of US Greenhouse Gas Emissions and Sinks*. Retrieved from Greenhouse Gas Emissions: https://www.epa.gov/ghgemissions/inventory-us-gas-emissions-and-sinks

USFS. (2020, December 18). *i-Tree Eco Methods, Model Descriptions, & Journal Articles*. Retrieved from i-Tree: https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files/i-tree-eco-resources

USFS. (2021, April 15). *i-Tree Design*. Retrieved from i-Tree: https://design.itreetools.org/

USFS. (2021, February 21). *i-Tree Eco*. Retrieved from i-Tree: https://www.itreetools.org/tools/i-tree-eco

USFS. (2021, March 4). *i-Tree Methods and Files*. Retrieved from i-Tree: https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files,

USFWS. (2018). Depredation Permit MB09077B-0.

USFWS. (2021, April 19). *Destruction and Relocation of Migratory Bird Nest Contents.* Retrieved from U.S. Fish and Wildlife Service Guidance Documents: https://www.fws.gov/guidance/?field_guidance_program_target_id=9&field_document_topic_target_id=All&combine=

USFWS. (2021a, March 24). *IPaC Information for Planning and Consultation*. Retrieved from US Fish & Wildlife Service IPaC Information for Planning and Consultation: https://ecos.fws.gov/ipac/

USFWS. (2021a, March 10). *National Wetlands Inventory Surface Waters and Wetlands*. Retrieved from National Wetlands Inventory: https://www.fws.gov/wetlands/Data/Mapper.html

USFWS. (2021b, March 24). *Migratory Bird Treaty Act Protected Species (10.13 List)*. Retrieved from U. S. Fish and Wildlife Service Migratory Bird ProgramConserving America's Birds: https://www.fws.gov/birds/management/managed-species/migratory-bird-treaty-act-protected-species.php

USHUD. (2021, April 14). *HUDnoise.com*. Retrieved from Housing and Urban Development; HUDnoise.com: http://hudnoise.com/

Veni, G. (2002). *Delineation of Hydrologic Areas and Zones for the Management and Recovery of Endangered Karst invertebrate Species in Bexar County, Texas.* Austin: US Fish and Wildlife Service.

Waste Management. (2021, March 17). *Facility Information*. Retrieved from Covel Gardens Landfill: https://covelgardenslandfill.wm.com/facility/index.jsp

West, L. (1993). *Ecology of Breeding White-Winged Doves in the San Antonio Metropolitan Area.* Lubbock: Texas Tech University.

Xiaoxi, J., Xiaoxiu, L., Chong, F., & Weifang, M. (2020). Emission Patterns of Biogenic Volatile Organic Compounds from Dominant Forest Species in Beijing, China. *Journal of Environmental Science*, 73-81.

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Appendix A

Interagency/Intergovernmental Coordination and Consultation

A

Native American Tribes

Comanche Nation
Mescalero Apache Tribe of the Mescalero Reservation
Wichita and Affiliated Tribes

Federal Agencies

US Fish and Wildlife Service, Southwest Region
U.S. Congressman District 28 Hon. Henry Cuellar
US Senator Hon. John Cornyn
US Senator Hon. Ted Cruz

State Agencies

Texas Historical Commission
Texas State Senator District 19 (Randolph)

Local Agencies and Stakeholders

Alamo Area Council of Governments
City of San Antonio
Conservation Society of San Antonio
City of Schertz
Hunt Military Communities (AETC Group II, Randolph)
San Antonio River Authority
Universal City

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Native American

Comanche Nation
Mescalero Apache Tribe
Wichita and Affiliated Tribes

A-1

Native American

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

May 21, 2021

Mr. Michael Waldrop
JBSA Tribal Liaison
AETC 502 ABW
502 MSG/CD (BLDG 122)
JBSA-Fort Sam Houston, TX 78234

Mr. William Nelson, Sr.
Chairman, Comanche Nation, Oklahoma
PO Box 908
Lawton, OK 73502

Dear Chairman Nelson:

The purpose of this letter is to give you an opportunity to review and comment on a proposed action at Joint Base San Antonio (JBSA)-Randolph, TX, pursuant to Section 106 of the National Historic Preservation Act (NHPA), in which the Comanche Nation, Oklahoma may have an interest.

JBSA has initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph. The large population of birds roosting and living on the base causes an unacceptably high risk of midair collisions with birds during take-offs and landings. These collisions can cause costly catastrophic aircraft failure resulting in civilian and aircrew fatalities as well as property damage in the local communities surrounding the airfield. Minimizing or eliminating the attractiveness to birds of the habitat will reduce the risk of bird aircraft strikes by reducing the number of birds living on base.

Pursuant to Section 106 of the NHPA, implementing regulations at 36 CFR Part 800, and Department of Defense (DoD) Instruction 4710.02, DoD Interactions with Federally Recognized Tribes, we request your review and input concerning this Proposed Action. In particular, we invite you, pursuant to 36 CFR Section 800.4(a)(4), to provide information on any properties of historic, religious, or cultural significance that may be affected by our proposed undertaking. Regardless of whether the Tribe chooses to comment on this project, the U.S. Air Force will comply with the Native American Graves Protection and Repatriation Act by informing you of any inadvertent discovery of archaeological or human remains and consulting on their disposition.

The Final Description of Proposed Action and Alternatives (DOPAA) and Vegetation Management Plan are available upon request. The U.S. Air Force anticipates publishing the Draft EA in early Summer 2021 and the Final EA in late Summer 2021. Please contact Ms. Maria Monroy Gonzalez by email at maria.monroy_gonzalez@us.af.mil, with any questions. Thank you in advance for your assistance in this effort.

Sincerely,

WALDROP.MICHAEL.DUANE.1160753451
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MICHAEL D. WALDROP

Mission ~ Wingman ~ Partners

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

May 21, 2021

Mr. Michael Waldrop
JBSA Tribal Liaison
AETC 502 ABW
502 MSG/CD (BLDG 122)
JBSA-Fort Sam Houston, TX 78234

Mr. Gabe Aguilar
President, Mescalero Apache Tribe of the Mescalero Reservation
PO Box 227
108 Central Avenue
Mescalero, NM 88340

Dear President Aguilar:

The purpose of this letter is to give you an opportunity to review and comment on a proposed action at Joint Base San Antonio (JBSA)-Randolph, TX, pursuant to Section 106 of the National Historic Preservation Act (NHPA), in which the Mescalero Apache Tribe, New Mexico may have an interest.

JBSA has initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph. The large population of birds roosting and living on the base causes an unacceptably high risk of midair collisions with birds during take-offs and landings. These collisions can cause costly catastrophic aircraft failure resulting in civilian and aircrew fatalities as well as property damage in the local communities surrounding the airfield. Minimizing or eliminating the attractiveness to birds of the habitat will reduce the risk of bird aircraft strikes by reducing the number of birds living on base.

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The Final Description of Proposed Action and Alternatives (DOPAA) and Vegetation Management Plan are available upon request. The U.S. Air Force anticipates publishing the Draft EA in early Summer 2021 and the Final EA in late Summer 2021. Please contact Ms. Maria Monroy Gonzalez by email at maria.monroy_gonzalez@us.af.mil, with any questions. Thank you in advance for your assistance in this effort.

Sincerely,

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MICHAEL D. WALDROP

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

May 21, 2021

Mr. Michael Waldrop
JBSA Tribal Liaison
AETC 502 ABW
502 MSG/CD (BLDG 122)
JBSA-Fort Sam Houston, TX 78234

Ms. Terri Parton
President, Wichita and Affiliated Tribes
PO Box 729
Anadarko, OK 73005

Dear President Parton:

The purpose of this letter is to give you an opportunity to review and comment on a proposed action at Joint Base San Antonio (JBSA)-Randolph, TX, pursuant to Section 106 of the National Historic Preservation Act (NHPA), in which the Wichita Tribes, Oklahoma may have an interest.

JBSA has initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph. The large population of birds roosting and living on the base causes an unacceptably high risk of midair collisions with birds during take-offs and landings. These collisions can cause costly catastrophic aircraft failure resulting in civilian and aircrew fatalities as well as property damage in the local communities surrounding the airfield. Minimizing or eliminating the attractiveness to birds of the habitat will reduce the risk of bird aircraft strikes by reducing the number of birds living on base.

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The Final Description of Proposed Action and Alternatives (DOPAA) and Vegetation Management Plan are available upon request. The U.S. Air Force anticipates publishing the Draft EA in early Summer 2021 and the Final EA in late Summer 2021. Please contact Ms. Maria Monroy Gonzalez by email at maria.monroy_gonzalez@us.af.mil, with any questions. Thank you in advance for your assistance in this effort.

Sincerely,

WALDROP.MICHAEL.DUANE.1160753451
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MICHAEL D. WALDROP

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Federal Agencies

Federal Emergency Management Agency
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service, Southwest Region
U.S. Congressman District 28 Hon. Henry Cuellar
U.S. Senator Hon. John Cornyn
U.S. Senator Hon. Ted Cruz

A-2

Federal Agencies

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Ross Richardson, Chief
Federal Emergency Management Agency
Floodplain Management and Insurance Branch
800 North Loop 288
Denton, TX 76209-3698

Dear Chief Richardson,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

The purpose of the Proposed Action is to reduce the tree, tree canopy, and woody plant density in the National Historic Landmark District (NHLD) located in central JBSA-RND and thereby decrease the habitat and thus the population of white winged doves and other avian species on base. The need of the Proposed Action is to reduce the high BASH risk caused by the large population of birds roosting and living in the trees and shrubs between the two runways on JBSA-RND. The large bird population sharply elevates the risk of midair collisions with birds during take-offs and landings. These collisions can cause aircraft failure resulting in civilian and aircrew fatalities and property damage on JBSA-RND and in the local communities surrounding the airfield. Although there are several bird species on JBSA-RND, the Air Force has determined that the greatest threat is from white winged doves (USAF, 2015). By expanding its habitat management efforts, JBSA-RND seeks to minimize the attractiveness of the base to white winged doves and other species of birds and obtain a commensurate reduction in the BASH risk.

The EA will consider the potential impacts resulting from this Proposed Action and assess a Single-Phase Implementation Habitat Management Alternative, based on restoring the trees in the NHLD to a condition consistent with the period of historic significance. This Alternative includes the removal of bird attracting woody plants and trees in the NHLD; reduction of tree density in the North, South, East, and West Park areas to create a 30-foot spacing between canopies with open areas; reduction of the tree canopy density of individual trees; and removal of dead diseased and dying vegetation in the NHLD without replacement. The No-Action Alternative will also be considered.

The EA will be prepared in compliance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code (U.S.C.), the Council of Environmental Quality NEPA Regulations, 40 Code of Federal Regulations (CFR) Parts 1500-1508, and the Air Force's Environmental Impact Analysis Process, 32 CFR 989.

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Stephen Brooks
U.S. Army Corps of Engineers, Fort Worth District
Regulatory Branch, Permit Section
819 Taylor Street, Room 3A37
Fort Worth, TX 76102

Dear Mr. Brooks,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

The purpose of the Proposed Action is to reduce the tree, tree canopy, and woody plant density in the National Historic Landmark District (NHLD) located in central JBSA-RND and thereby decrease the habitat and thus the population of white winged doves and other avian species on base. The need of the Proposed Action is to reduce the high BASH risk caused by the large population of birds roosting and living in the trees and shrubs between the two runways on JBSA-RND. The large bird population sharply elevates the risk of midair collisions with birds during take-offs and landings. These collisions can cause aircraft failure resulting in civilian and aircrew fatalities and property damage on JBSA-RND and in the local communities surrounding the airfield. Although there are several bird species on JBSA-RND, the Air Force has determined that the greatest threat is from white winged doves (USAF, 2015). By expanding its habitat management efforts, JBSA-RND seeks to minimize the attractiveness of the base to white winged doves and other species of birds and obtain a commensurate reduction in the BASH risk.

The EA will consider the potential impacts resulting from this Proposed Action and assess a Single-Phase Implementation Habitat Management Alternative, based on restoring the trees in the NHLD to a condition consistent with the period of historic significance. This Alternative includes the removal of bird attracting woody plants and trees in the NHLD; reduction of tree density in the North, South, East, and West Park areas to create a 30-foot spacing between canopies with open areas; reduction of the tree canopy density of individual trees; and removal of dead diseased and dying vegetation in the NHLD without replacement. The No-Action Alternative will also be considered.

The EA will be prepared in compliance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code (U.S.C.), the Council of Environmental Quality NEPA Regulations, 40 Code of Federal Regulations (CFR) Parts 1500-1508, and the Air Force's Environmental Impact Analysis Process, 32 CFR 989.

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

David W. Gray, Deputy Regional Administrator
U.S. Environmental Protection Agency Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202

Dear Mr. Gray,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Adam Zerrenner, Field Supervisor
U.S. Fish & Wildlife Service, Southwest Region
10711 Burnet Road, Suite 200
Austin, TX 78758

Dear Mr. Zerrenner,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Henry Cuellar
U.S. Congressman District 28
615 E. Houston Street, Suite 563
San Antonio, TX 78205

Dear Mr. Cuellar,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Sen. John Cornyn
517 Hart Senate Office Building
Washington, DC 20510

Dear Sen. Cornyn,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Sen. Ted Cruz
Russell Senate Office Building, 127A
Washington, DC 20510

Dear Sen. Cruz,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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A-3

State Agencies

State Agencies

Texas Commission on Environmental Quality
Texas Historical Commission
Texas Parks and Wildlife Commission
Texas State Representative District 118
Texas State Senator District 19

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

NEPA Coordinator
Texas Commission on Environmental Quality
MC119, P.O. Box 13087 Austin, TX
78711-3087

Dear NEPA Coordinator,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Deputy, 802d Civil Engineer Squadron
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Director Mark Wolfe
Texas Historical Commission
P.O. Box 12276, Capitol Station
Austin TX 78711-2276

Dear Director Wolfe,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight
502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Julie Wicker, Program Supervisor Chief
Texas Parks and Wildlife Department
Ecosystem/Habitat Assessment Branch
4200 Smith School Road
Austin, TX 78744-3291

Dear Chief Wicker,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Leo Pacheco
Texas State Representative District 118
660 SW Military Drive, Suite M
San Antonio, TX 78221

Dear Mr. Pacheco,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Roland Gutierrez
Texas State Senator District 19
P.O. Box 12068, Capitol Station
Austin, TX 78711

Dear Mr. Gutierrez,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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Local Agencies and Stakeholders

Alamo Area Council of Governments
City of San Antonio
City of Schertz
Conservation Society of San Antonio
Hunt Military Communities (AETC Group II, Randolph)
San Antonio River Authority
San Antonio River Authority (Averyt)
San Antonio River Authority (Teague)
Universal City

A-4

Local Agencies and Stakeholders

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Tiffany Harris, Communications Coordinator
Alamo Area Council of Governments
8700 Tesoro Drive #160
San Antonio, TX 78217

Dear Ms. Harris,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

John E. Cantu, Environmental Manager
City of San Antonio
Municipal Plaza Building
114 W. Commerce, 2nd Floor
P.O. Box 839966
San Antonio, TX 78283-3966

Dear Mr. Cantu,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

The purpose of the Proposed Action is to reduce the tree, tree canopy, and woody plant density in the National Historic Landmark District (NHLD) located in central JBSA-RND and thereby decrease the habitat and thus the population of white winged doves and other avian species on base. The need of the Proposed Action is to reduce the high BASH risk caused by the large population of birds roosting and living in the trees and shrubs between the two runways on JBSA-RND. The large bird population sharply elevates the risk of midair collisions with birds during take-offs and landings. These collisions can cause aircraft failure resulting in civilian and aircrew fatalities and property damage on JBSA-RND and in the local communities surrounding the airfield. Although there are several bird species on JBSA-RND, the Air Force has determined that the greatest threat is from white winged doves (USAF, 2015). By expanding its habitat management efforts, JBSA-RND seeks to minimize the attractiveness of the base to white winged doves and other species of birds and obtain a commensurate reduction in the BASH risk.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Mark Browne, City Manager
City of Schertz
1400 Schertz Parkway
Schertz, Texas 78154

Dear Mr. Browne,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Conservation Society of San Antonio
107 King William Street
San Antonio, TX 78204

To whom it may concern,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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The Final Description of Proposed Action and Alternatives (DOPAA) and Vegetation Management Plan are available upon request. The U.S. Air Force anticipates publishing the Draft EA in early Summer 2021 and the Final EA in late Summer 2021. Please contact Ms. Maria Monroy Gonzalez by email at maria.monroy_gonzalez@us.af.mil, with any questions. Thank you in advance for your assistance in this effort.

Sincerely,

ROBERSON.EDWARD.LEWIS.1124911636 Digitally signed by ROBERSON.EDWARD.LEWIS.1124911636 Date: 2021.05.26 13:43:36 -05'00'

EDWARD L. ROBERSON, P.E.

DEPARTMENT OF THE AIR FORCE
502D AIR BASE WING
JOINT BASE SAN ANTONIO

Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Lauren Herman, Community Director
Hunt Military Communities
Randolph Family Housing
205 New B St E,
Universal City, TX 78150

Dear Director Herman,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Kerry Averyt, PE
Engineering Design and Construction Manager,
Aarin Teague, PhD, PE
Ecological Engineering Manager
San Antonio River Authority
100 East Guenther Street
San Antonio, TX 78204

Dear Mr. Averyt and Dr. Teague,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Kerry Averyt, PE
Engineering Design and Construction Manager,
San Antonio River Authority
100 East Guenther Street
San Antonio, TX 78204

Dear Mr. Averyt

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Aarin Teague, PhD, PE
Ecological Engineering Manager
San Antonio River Authority
100 East Guenther Street
San Antonio, TX 78204

Dear Dr. Teague,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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Edward L. Roberson, P.E.
Chief, Installation Management Flight 502 CES/CEI
1555 Gott Street
JBSA-Lackland, Texas 78234-5645

June 1, 2021

Mayor John Williams
2150 Universal City Boulevard
Universal City, TX 78148

Dear Mayor Williams,

The United States (U.S.) Air Force (USAF) has prepared initiated the development of an Environmental Assessment (EA) to assess the environmental impacts associated with actions that may be taken to reduce the bird aircraft strike hazard risk posed by the various species of birds living and roosting in the urban forest between the two runways on JBSA-Randolph.

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Appendix B

B

Randolph Field National Historic District

Vegetation Management Plan

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Randolph Field

National Historic Landmark District

Vegetation Management Plan

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Contents

Figures

Table

Appendices

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1 Introduction

This vegetation management plan (VMP) has been developed to guide Joint Base San Antonio in the management of vegetation resources that contribute to the landscape of the Randolph Field National Historic Landmark District (NHLD) at Joint Base San Antonio-Randolph (JBSA-Randolph). The Randolph Field NHLD is significant for its historic buildings, urban design, and landscape architecture. The VMP places an emphasis on restoring period of significance, 1928-1950, views and viewsheds. This is a sustainable plan that can be managed with less maintenance effort and cost than currently is required.

This VMP would be implemented only if the proposed action in the *BASH Risk Mitigation through Habitat Management, JBSA-Randolph Environmental Assessment* were to be selected. The verbiage in this VMP is chosen such that it would be a stand-alone document if the proposed action were selected, e.g., statements that may contain "will" are contingent upon selection and implementation of the proposed action.

1.1 Scope and Organization of VMP

This VMP is an action plan for Randolph Field NHLD that is part of JBSA-Randolph (JBSA-RND). The JBSA-RND 502nd Civil Engineering Squadron (CES) will be responsible for preparing the performance work statement (PWS) that will execute the plan. 12th FTW/SE will preview the Draft PWS to ensure compliance with the JBSA Bird/Wildlife Aircraft Strike Hazard (BASH) Plan. Vegetation management actions in the NHLD can have a major impact to the airfield BASH conditions, thus BASH precautions and requirements must be considered and included in the PWS executing the VMP. A Contracting Officer's Representative (COR) from the 502nd CES will be appointed to oversee the contractor's execution of the PWS on behalf of the contracting office. The COR will coordinate execution of the PWS with the Hunt Military Communities (AETC Group II, Randolph) in base housing as required. Hunt Military Communities (AETC Group II, Randolph) has the responsibility for the management of military family housing on JBSA-RND pursuant to the Military Privatization Initiative (10 USC 169 Subchapter IV). In coordination with 502nd Civil Engineering Group, Hunt Military Communities is responsible for vegetation maintenance in the bases' housing areas to include lawns, shrubs, and trees.

Chapter 1 describes the scope of the VMP, history of the NHLD, and existing conditions in the NHLD. Chapter 2 describes management actions proposed to mitigate Bird/Wildlife Aircraft Strike Hazard (BASH) risk through habitat management and move the NHLD toward the desired future condition. Chapter 3 provides overall and component guidance for sustainable, long-term management of vegetation within the NHLD. Chapter 4 provides vegetation treatment directions to include pruning, trimming and tree/stump removal, tree removal documentation requirements, site cleanup, and Migratory Bird Treaty Act (MBTA) responsibilities. While flying safety takes precedence, vegetation treatment objectives in the VMP are designed to preserve the integrity of the District.

1.2 Randolph Field National Historic Landmark District

JBSA-RND's historic landscape was planned and designed in the late 1920's as an ideal "Air City" to meet flying training requirements while providing a pleasant environment for airmen and their families to live. The landscape reflects early twentieth-century planning ideas that grouped functional uses together in geometrically distinct patterns. Implementing these design principles at Randolph Field resulted in a main circle surrounded by a grid of streets, with two flight lines on the east and west sides of the main cantonment area (Figure 1). However, the historic design did not consider what effect advances in flight and the changing landscape would have on flight safety.

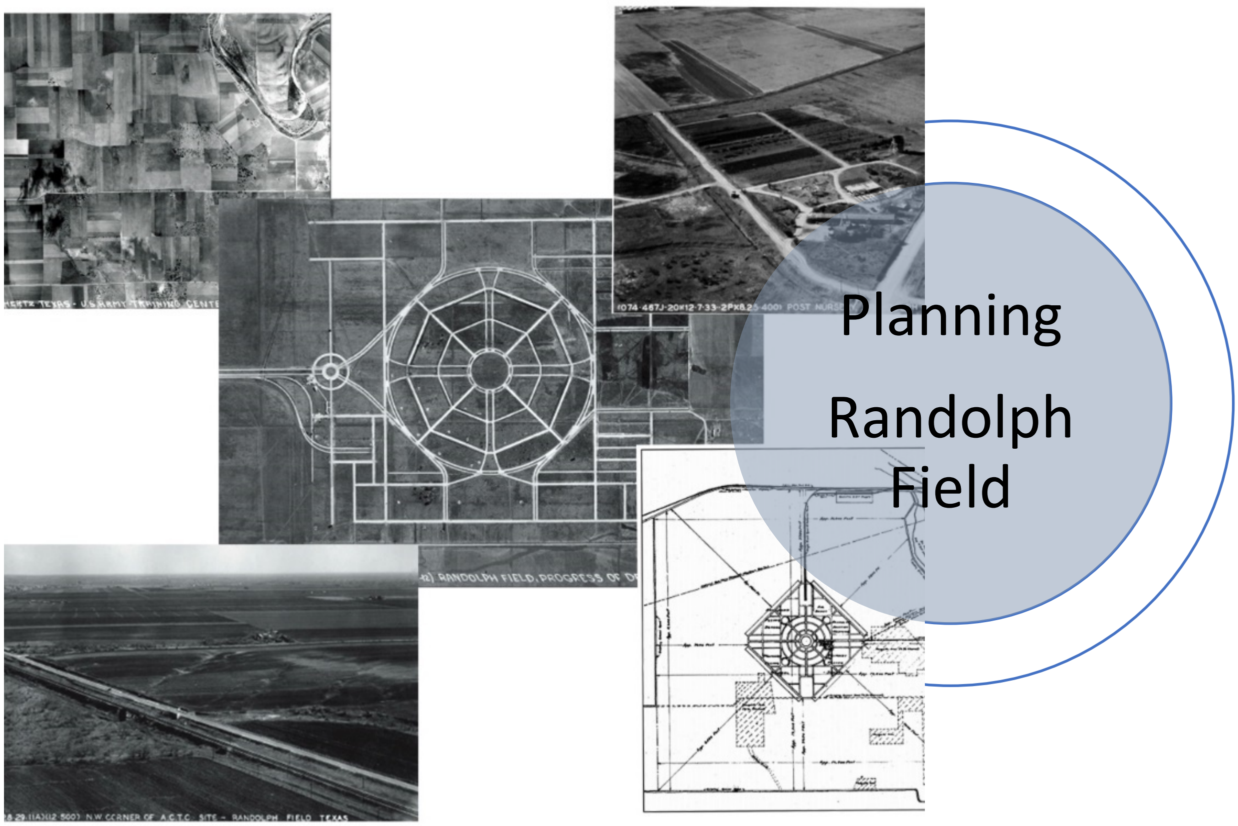
During initial construction, Lt. Norfleet Bone[68] was assigned to special duty as the field's landscape architect. Lt. Boone's landscape strategy for the base included 680 ornamental shade trees, 415 Spanish oaks, 3,500-4,000 plants, and 706 Japanese *Ligustrums* planted as hedges (Clow et al., 1998). Little of the historical vegetation remains with exception of the street trees (Tooker et al., 2013). Original trees and plantings have been removed or replaced with different species, and plants and trees have been added in areas inconsistent with the original landscape design. Many of the current trees and plantings post-date the NHLD's period of significance, compare figures 2 and 3.

Tooker, Hartman, & Smith (2013) prepared a comprehensive survey of the Randolph Field NHLD. Their survey documents the architectural and landscape elements of the NHLD. The NHLD's original landscaping was closely related to the base's land use plan. Through spatial organization, important features of the base were visually reinforced by axial alignments and open spaces that were vertically defined by street trees. Green boulevards, extensive plantings, gardens, and fountains augmented the original base plan. The road system planned in the 1930s consisted of a large circle with interior, concentric, octagonal roads. The main circle was divided by two major boulevards, North and South Park and East and West Park. Plantings were designed to accentuate key buildings in different functional areas of Randolph's NHLD. Southern live oak trees and to a lesser extent white ash were used to emphasize the geometric layout of the base.

Tooker et al, (2013) is the guide for the goals and specific recommendations in Chapter 3. Tooker et al. (2013) studied the planting designs shown in historic photographs and compared

[68] Although an aviator, Lt. Bone's qualifications for his assignment as the field's first landscape architect included two Bachelor of Science degrees, one from New Mexico A&M College in Civil Engineering (1915) and a second from Texas A&M in Landscape Architecture (1923).

them with the current landscaping conditions to determine a planting and landscaping strategy that best reflects the historic precedent of Lt. Bone as well as meets landscaping requirements for low-maintenance vegetation and water conservation. The original intent of the planting strategies from the period of significance, as available from plan-to-scale drawings and period photographs from the 1930's and 1940's, are the basis for treatment decisions within the NHLD.



Source of historical photographs: Tooker et al., 2013; Clow et al., 1998; and Hoffman, 2014.

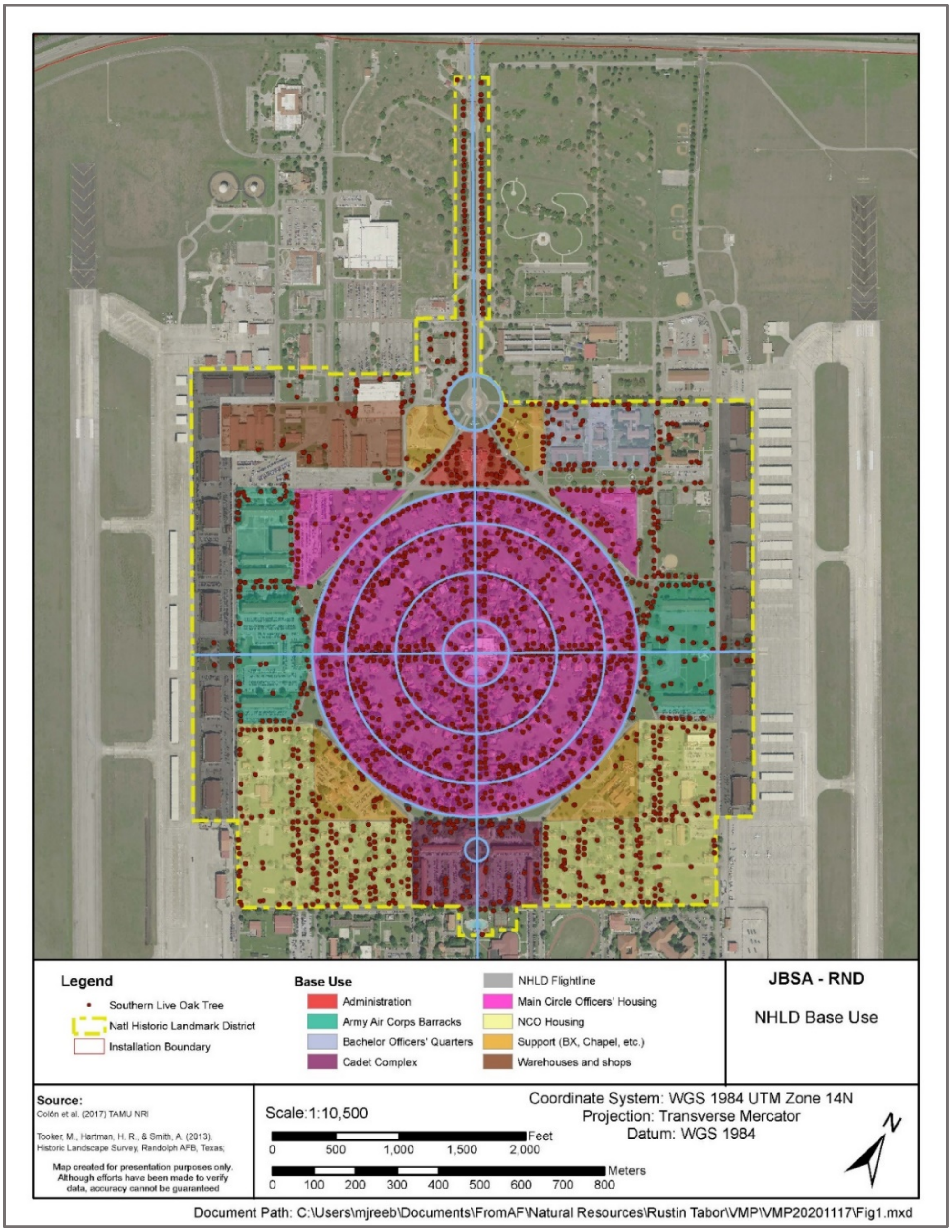


Figure 1-1. Randolph Field National Historic Landmark District--1930's base use plan. The blue lines and circles highlight the base's geometric pattern. Red dots depict existing southern live oaks.

Figure 1-2. Primary trainer aircraft [69] overflying Randolph Field's Main Circle, late 1930's. The photograph depicts trees planted along the Landmark District's streets during the period of significance.

[69] The aircraft in the photograph is a North American BT-9. The BT-9 was the United States Army Air Corps (USAAC) designation for a low-wing single engine monoplane primary trainer aircraft that served before and during World War II. Note the roundels on the aircraft's wings. They were used on US aircraft from 1919 to 1942.

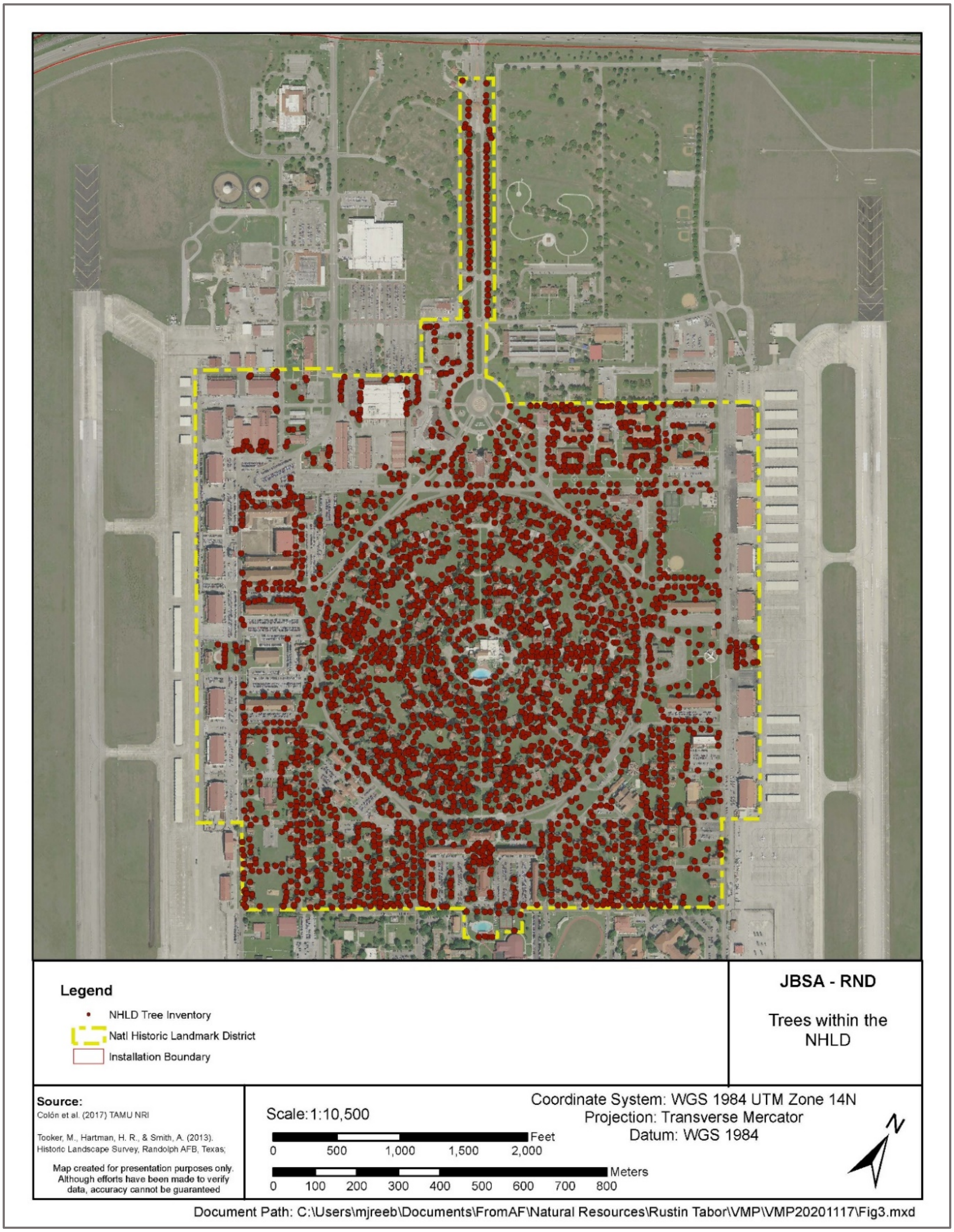


Figure 1-3. NHLD tree inventory (Colón et al., 2017). The inventory includes all trees and woody shrubs greater than 12 feet in height and with a diameter at breast height (dbh) of 5 inches or greater.

1.3 Existing Conditions-Vegetation

A recent tree survey conducted by Texas A&M Natural Resources Institute (TAM NRI) identified 3,202 trees and 48 species in the NHLD (Colon, et al., 2017b). The most common tree species are southern live oak *(Quercus virginiana)*, pecan *(Carya illinoinensis)*, Japanese privet (*Ligustrum japonicum*), Texas oak *(Quercus buckleyi)* and hackberry *(Celtis occidentalis),* see Figure 4. As part of the survey, each tree's condition was classified. One hundred and eighty-four (184) were classified as being in excellent condition, 1,290 in good condition, 1,093 in fair condition, 339 in poor condition, 76 in critical condition, and 193 dead.

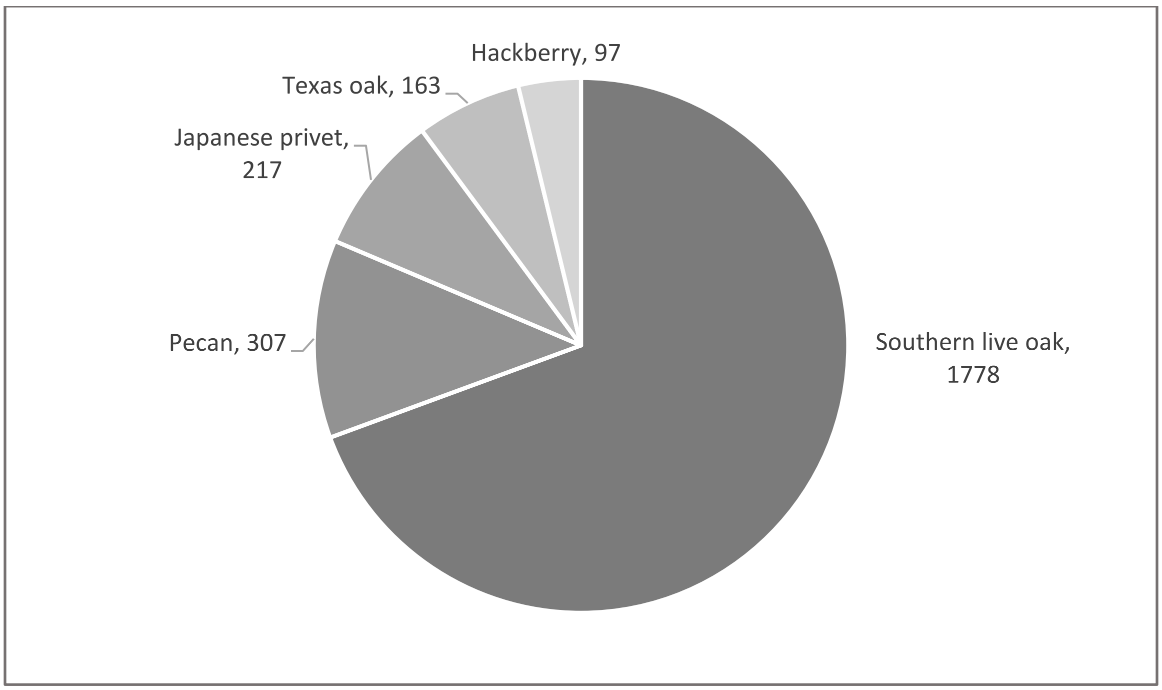


Figure 1-4. The five most common tree species on JBSA-RND (Colón, et al., 2017). The number of trees of each species is indicated.

The TAM NRI inventoried 2,426 woody shrubs in the NHLD. Fifty-five species were identified. Woody shrubs were identified as woody plants ≥ 3 feet in height that do not meet the definition of a tree. In some instances, shrubs recorded represent a row of individual plants of the same species. In those instances, the location was recorded at the center of the row. The most common shrub species[70] were crape myrtle (616), Japanese privet (435), red-tipped

[70] Several inventoried species can grow in a tree or shrub form (e.g., crape myrtle). In addition to their woody shrub count, crape myrtle (*Lagerstroemia indica*) species (Lagerstroemia indica) had 62 trees, Japanese privet (*Ligustrum japonicum*) 217 trees, red-tipped photinia (*Photinia fraseri*) 1 tree, yaupon holly (*Ilex vomitoria*) 11 trees, pittosporum (*Pittosporum spp.)* 1 tree, and mountain laurel (*Sophora secundiflora*) 12 trees.

photinia (372), yaupon holly (191), pittosporum (103) and mountain laurel (91). According to the inventory, there are 55 woody plant species in the NHLD.

Many of the trees and shrubs identified in the inventory attract birds and contribute to the airfield's BASH problem. Vegetation such as *Ligustrum* (490), hackberry (93), and loquat (9) provide an attractive food source for the bird population. Many of the NHLD's trees and shrubs, including those that attract birds, are post-period of significance and are not part of Lt. Bone's original landscape strategy.

Appendix A summarizes the tree and woody plant inventory (Table 1) of the TAM NRI report (Colón et al., 2017) and lists the characteristics of the tree species in the NHLD (Table 2).

Appendix B consists of maps of individual tree species and species statistics prepared using Colon et al. (2017b) inventory data. Only those inventoried trees located in the NHLD are included. Some of the dead trees in the NHLD have been removed as part of ongoing routine grounds maintenance. JBSA has consulted with TSHPO where required.

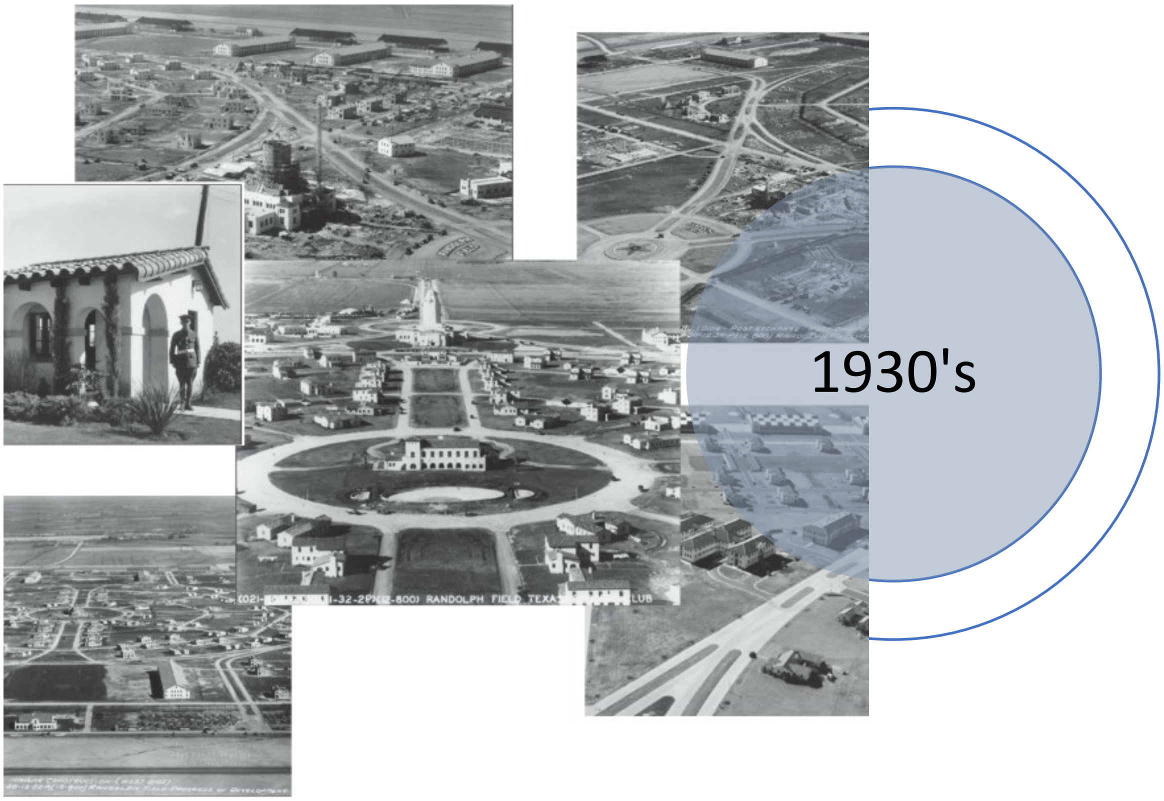
Appendix C consists of maps of individual plant species and species statistics prepared using Colón et al. (2017) inventory data. Only those inventoried plants in the NHLD are included.

The NHLD has significant grounds maintenance requirements due to the large number of trees and shrubs. Grounds maintenance within JBSA-RND consists of lawn cutting throughout the base property, trimming trees and shrubs, maintaining ground cover, and removing dead trees and shrubs. From 2014 to present, JBSA-RND has contracted for the trimming and removal of trees and shrubs. Contracted tree services consist of trimming, thinning, and raising of tree canopies as well as tree removal. Removal in the NHLD has been focused on the dead, diseased, and dying trees to create a healthier tree population (JBSA consulted with the Texas State Historical Preservation Office and the National Park Service in 2017). Trees also have been removed from the southeast clear zone[71] and along flight lines outside the NHLD to reduce the BASH risk and to meet Air Force airfield safety requirements.

Contracted grounds maintenance costs are significant. JBSA grounds maintenance records indicate that from 2014 to 2019 there have been 8,472 tree trimmings and 1,436 removals[72] at a total cost of $5,510,356. Maintenance costs in the NHLD are especially high due to the large

[71] The Clear Zone (CZ) is an obstruction-free surface on the ground symmetrically centered on the extended runway centerline beginning at the end of the runway and extending outward 3,000 feet. The CZ width is 3,000 feet, 1,500 feet to either side of the center of the runway. Trees and woody plants will be removed from the northeast, northwest, and southwest clear zones as funds become available.
[72] JBSA grounds maintenance service contracts include tree maintenance and removal on the entirety of JBSA-RND, to include areas beyond the Randolph Field NHLD.

number of trees and shrubs. To date, only dead, diseased, or dying trees have been removed in the NHLD. Trees that were removed have not been replaced due to JBSA-RND's high BASH risk.



Source of historical photographs: Tooker et al., 2013; Clow et al., 1998; and Hoffman, 2014.

2 NHLD BASH Risk Mitigation and Viewshed Restoration Actions

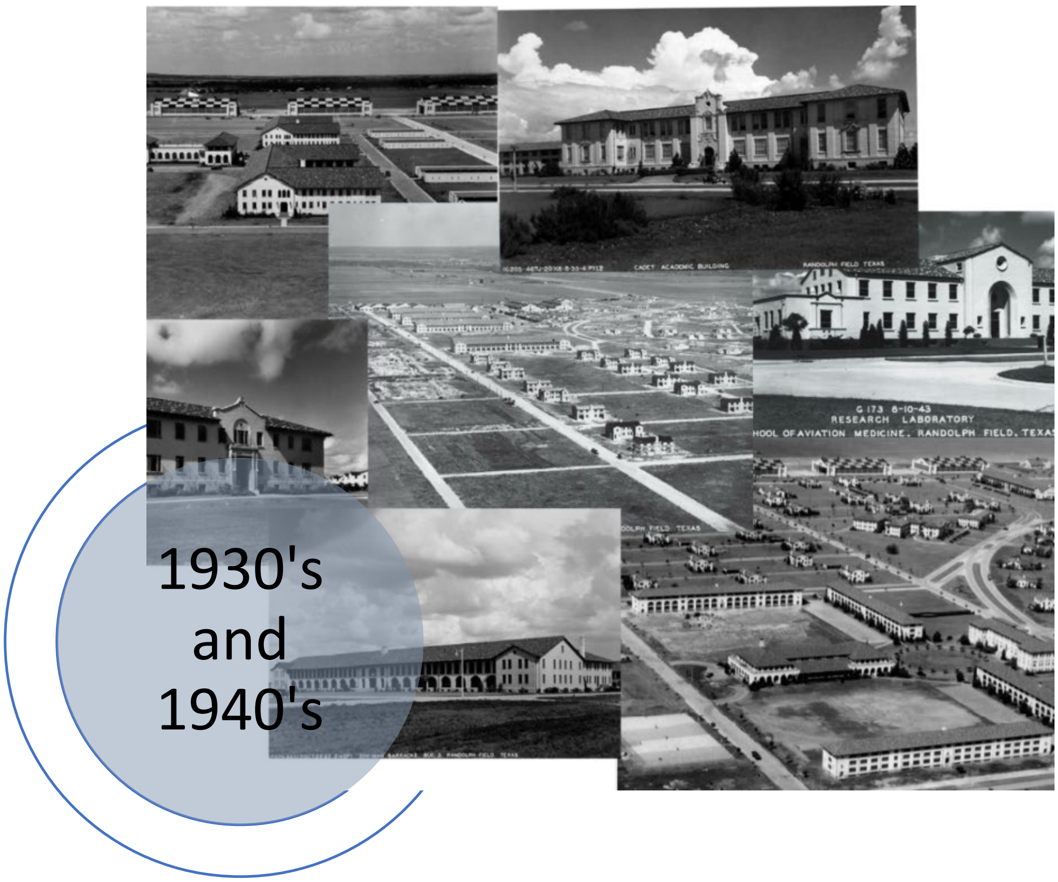
This chapter describes vegetation management actions that will mitigate the BASH risk and restore historical viewsheds. These actions move the NHLD toward the desired future conditions, preparing it for sustainable management following the guidelines and treatments described in the chapters that follow.

2.1 Remove Bird Attracting Fruiting Trees and Woody Plants in the NHLD

Nineteen (19) species of trees and woody plants that attract birds were identified in the TAM NRI inventory (Colón et al., 2017), see Table 1 below. The fruiting trees and woody plants (Odenwald & Turner, 1985) will be removed as funding is available. There are 450 trees and 858 plants that attract birds in the NHLD, approximately 15 percent of the trees and 35 percent of the shrubs within the NHLD (Figure 5). Removal of the fruiting vegetation is expected to reduce the number of birds roosting and foraging in the NHLD that contribute to JBSA-RND's BASH problem.

Table 1. Bird attracting trees and woody plants (shrubs)

Scientific Name	Common Name	Count
Ilex vomitoria ♁	Yaupon holly, female	202
Juniperus virginiana	Eastern red cedar	69
Ligustrum japonicum	Japanese privet	652
Melia azedarach	Chinaberry	23
Photinia serratifolia	Chinese photinia	14
Triadica sebifera	Chinese tallowtree	25
Celtis occidentalis	Hackberry	183
Juniperus ashei	Ashe Juniper	6
Pyrus calleryana	Callery pear	22
Punica granatum	Pomegranate	68
Ilex opaca	American Holly	7
Pyracantha spp.	Firethorn	12
Eriobotrya japonica	Loquat	14
Diospyros texana	Texas persimmon	3
Cornus drummondii	Roughleaf dogwood	2
Ficus spp.	Fig	2
Crataegus spp.	Hawthorn	1
Prunus persica	Peach	1
Vitex angus-castus	Vitex	2



Source of historical photographs: Tooker et al., 2013 and Hoffman, 2014.

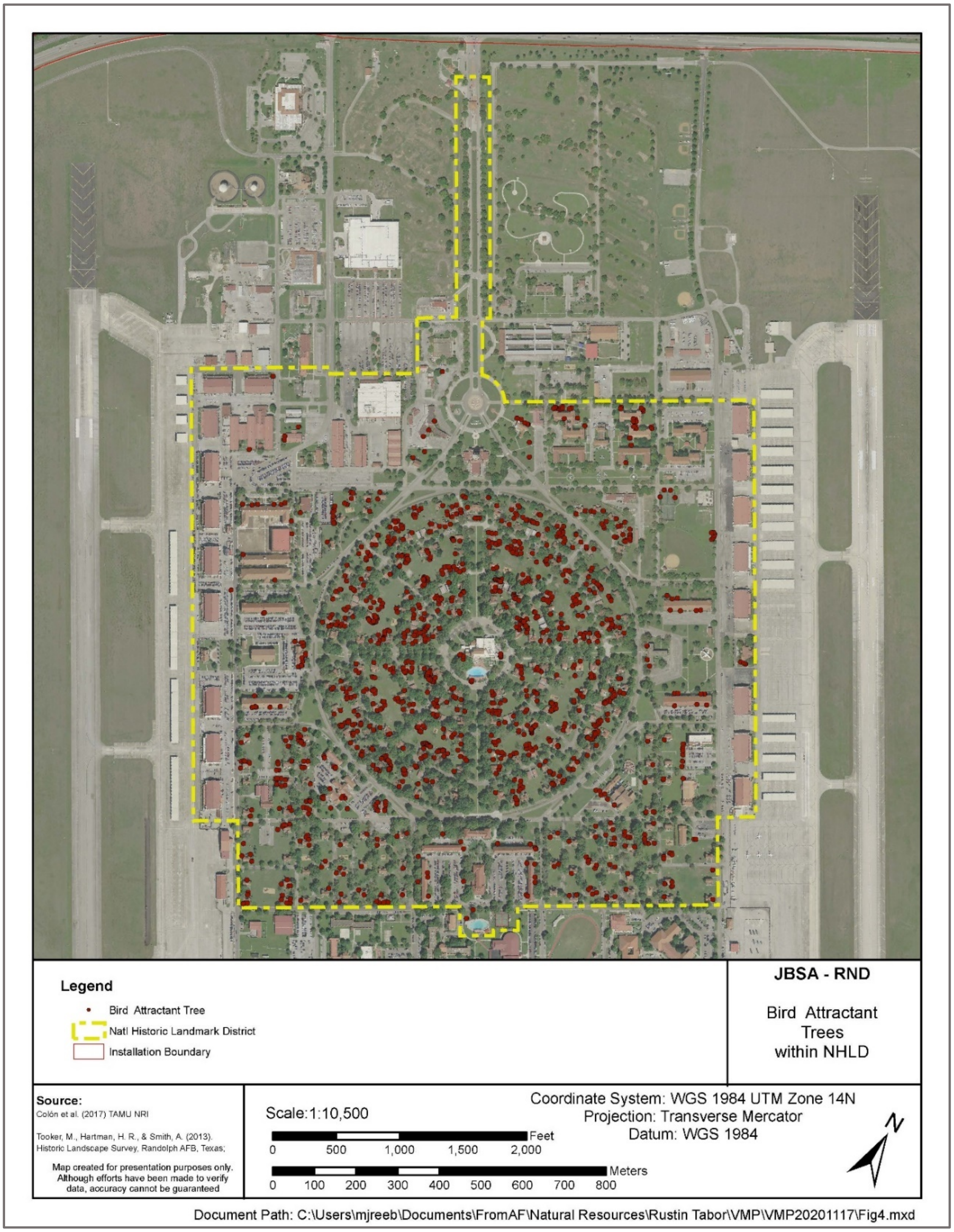


Figure 2-1. Bird attracting trees and woody plants.

2.2 Increase Street Tree Spacing and Remove Trees in Park Medians

Increasing street tree spacing along the park streets to reduce the overlapping canopies is expected to decrease the number of White Wing Doves (WWDO) and other avian species on

JBSA-RND and consequently reduce the BASH risk. The current overlapping canopies afford protection for WWDOs and other bird species. Increased street tree spacing is proposed to minimize the safety risk through habitat management. The parks' dense and interlocking canopies have been a favorable location for nesting. Also, removing trees within the medians also will move the park areas toward the original arboreal plan of open spaces, wide, tree-lined roads, and a park-like atmosphere. See Figure 6.

2.3 Reduce Tree Density by 40 Percent in the NHLD

Trees to be removed will be selected by an arborist based on several factors (e.g., dead/diseased/dying, hazard, species, attraction to birds, etc.) to attain the desired reduced tree density. The arborist will work closely with the COR, 12th FTW/SE, and the NRM to select trees for removal that will best reduce the BASH risk while meeting natural resource and heritage requirements. A reduction in tree density is expected to reduce the number of White Wing Doves (WWDO) and other avian species nesting, roosting, and rearing their young in JBSA-RND's urban forest. The current overlapping canopies that occur in many areas of the NHLD afford protection for WWDOs and have been a favorable location for nesting.

A reduction in tree density is expected to result in fewer bird-aircraft collisions. Colón & Long (2017) studied BASH mitigation techniques that could be used to reduce the BASH risk on JBSA-RND. They found a strong correlation between the number of WWDOs and tree density in the NHLD and suggested a reduction in tree density as a method to mitigate the BASH risk. Reducing tree density also will move the NHLD toward the original arboreal plan. Many of the trees in the NHLD are a result of post-period of significance beautification projects. See Figure 7.

2.4 Reduce Individual Tree Canopy Density

Reducing individual tree canopy density (see crown thinning, Section 4.3.1) will discourage nesting of WWDOs and other avian species and makes it easier for safety personnel to see and harass birds. Harassment is a regular BASH mitigation technique employed by the 12th FTW. Reducing the density of individual tree canopies has been an ongoing effort in the Randolph Field NHLD for years. See tree trimming prescriptions in Section 4.

2.5 Remove Selected Hazard Trees

Hazard trees will be prioritized for removal based upon the likelihood of impacting a target and likelihood of tree failure (see tree risk management guidelines, Section 4.3.5). Removal would be to address safety concerns and to prevent infrastructure or other damage (e.g., parked vehicles, power lines, etc.). See Figure 8.

2.6 Remove Dead, Diseased, or Dying Trees

Removing dead, diseased, or dying trees will continue. It has been an ongoing tree maintenance practice at JBSA-RND for many years. See Figure 9.

2.7 Remove Woody Plants with High-Density Foliage.

Woody plants with high-density foliage that can provide nest sites, shelter, and protection from predators for WWDO and other avian species will be subject to removal. Densely foliated woody shrubs are common shelter and nesting sites for WWDOs and other avian species. Reducing high-density foliage is expected to discourage nesting of WWDOs and make it easier for safety personnel to see and harass birds as part of regular operations.

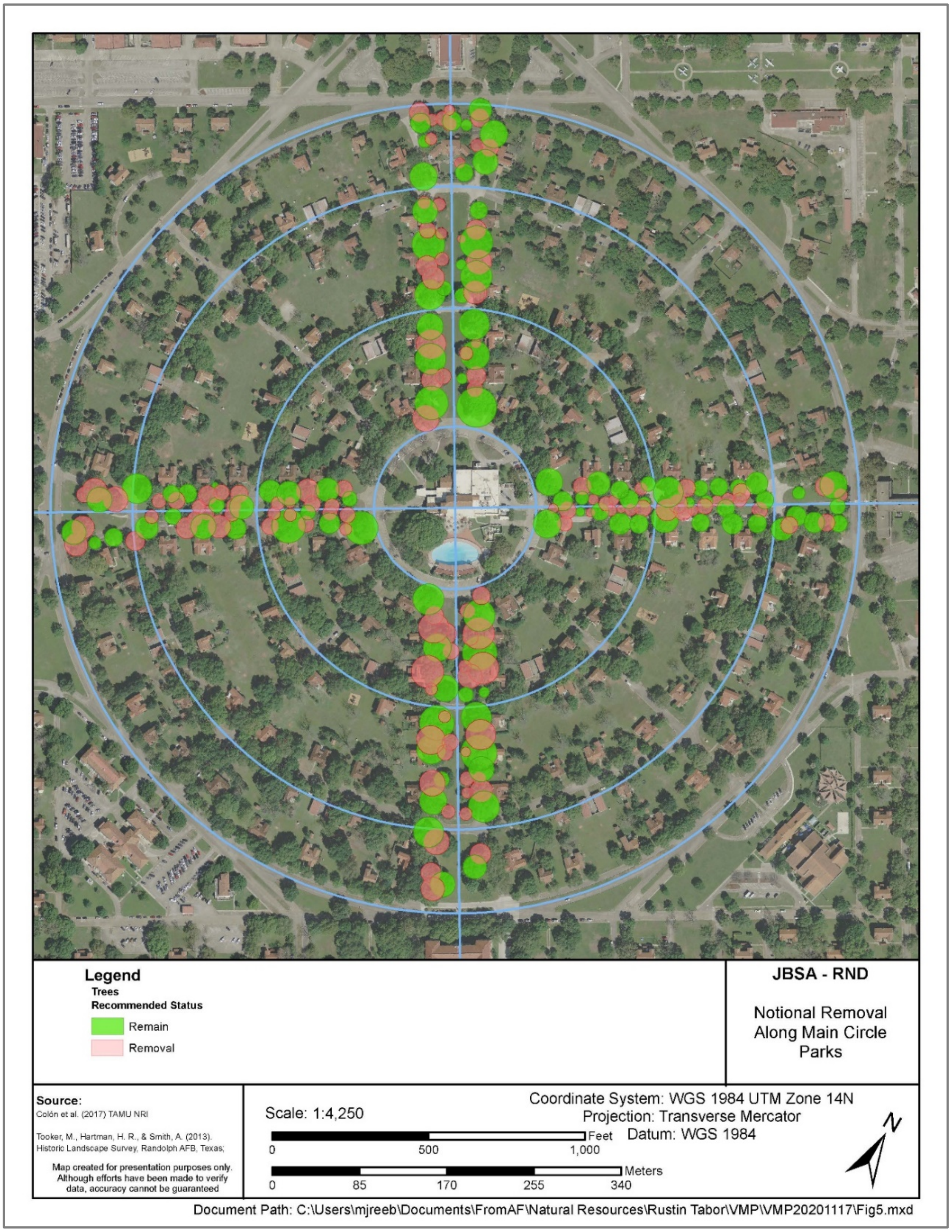


Figure 2-2. Main Circle Parks with increased tree spacing. This diagram is notional. Specific trees to be removed will be selected based upon health, hazard, form, etc.

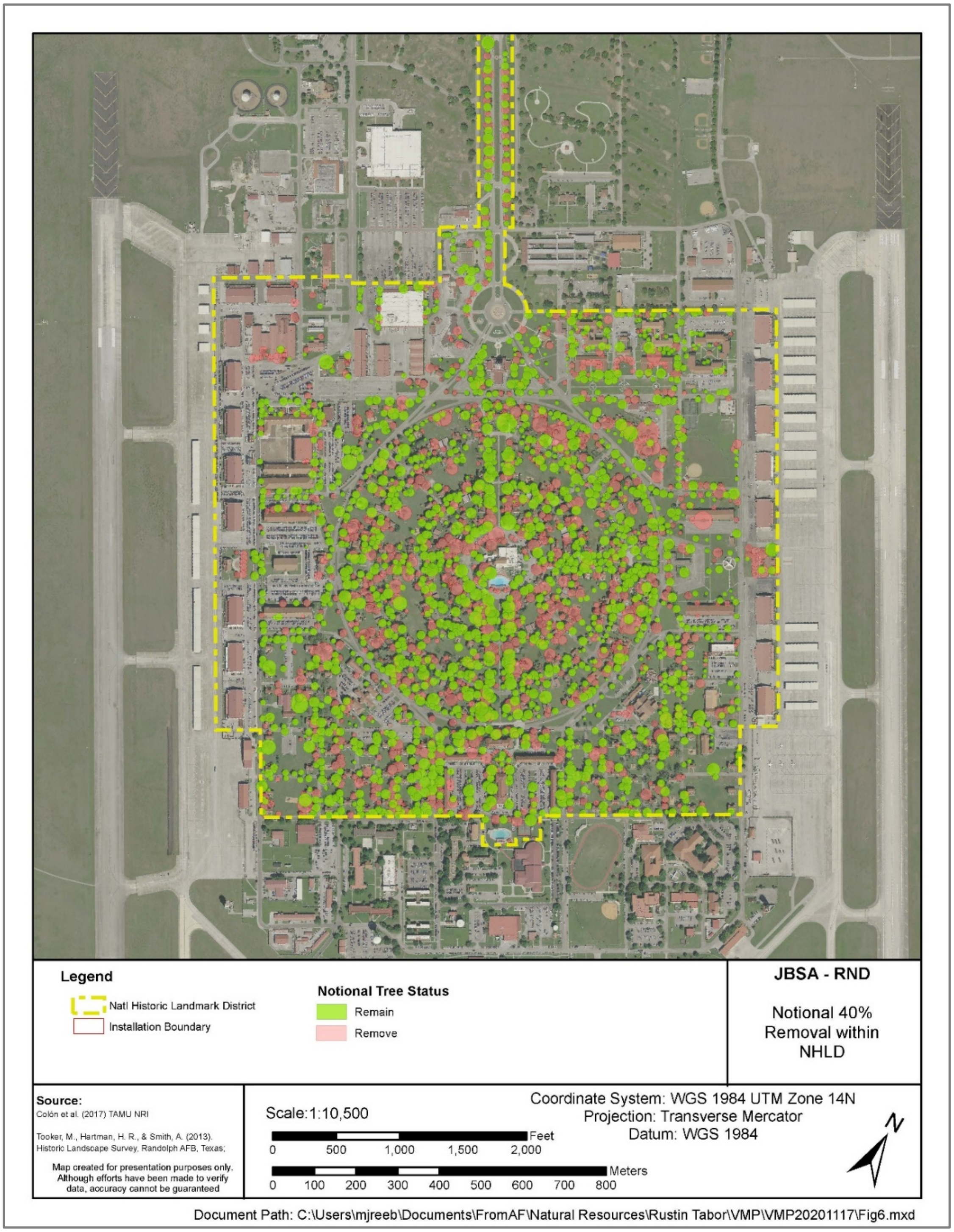


Figure 2-3. NHLD 40 percent tree removal. This diagram is notional. Green (retained) and red (removed) circles are 30-foot buffers around each tree for scale. Specific trees to be removed will be selected based upon health, hazard, attraction to birds, etc.

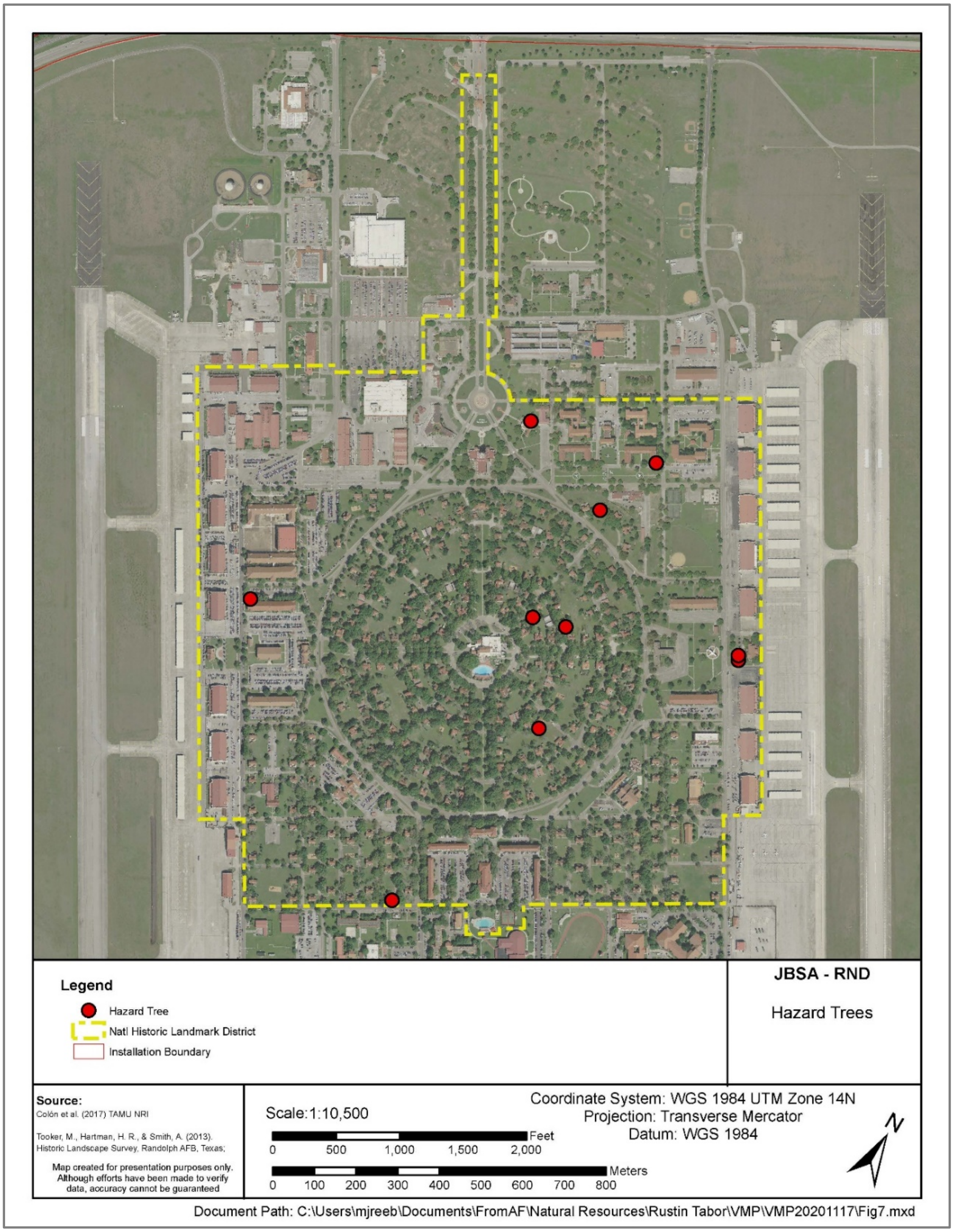


Figure 2-4. Hazard trees (Colón et al., 2017).

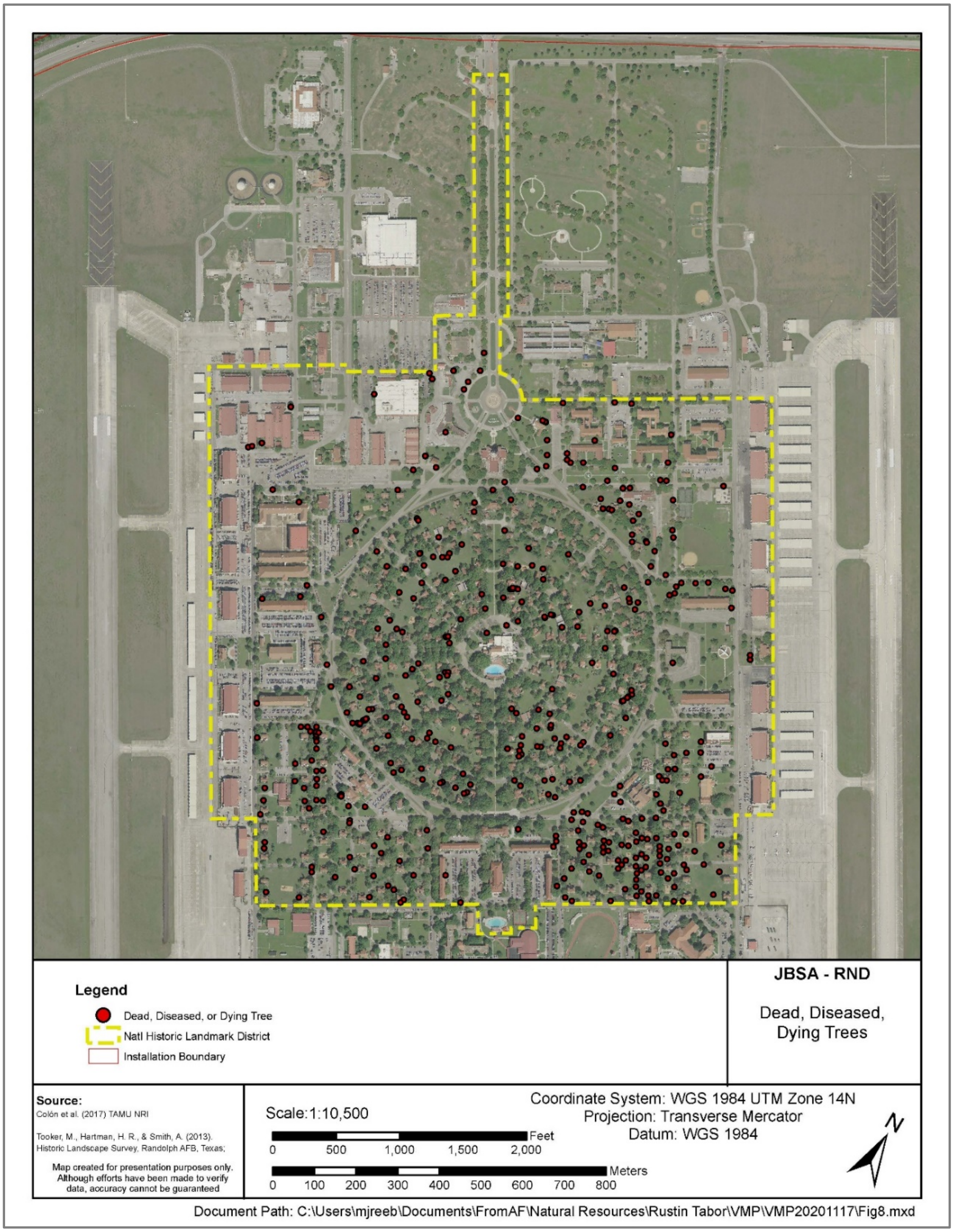


Figure 2-5. Dead, diseased, or dying trees (Colón et al., 2017).

3 Randolph Field NHLD Vegetation Management Guidelines

Guidelines are based upon the recommendations in the *Historic Landscape Survey, Randolph AFB, Texas*, (Tooker et al., 2013). Overall management guidelines apply to the NHLD as a whole; the component landscape design recommendations apply to specific views, viewsheds, and view corridors in the NHLD.

3.1 Overall Management Guidelines

Planting/Landscaping management guidelines listed below reflect the historic precedent of Lt. Bone (Tooker et al., 2013) and EO 13112, DoDI 4715.03 Enclosure 3(4)(b)(4)(c), AFMAN 32-7003 Sec. 2A, DoD guidance (DoD, 2019a), and JBSA's Integrated Natural Resources Management Plan Sect 7.7 (JBSA, 2020a).

- Open space, parks, and wide, tree-lined roads should be maintained to give the district a park-like feeling.
- Views, viewsheds, and view corridors (Tooker et al., 2013) will be maintained to the extent possible consistent with flight safety. These areas should remain unobstructed.
- Alterations and substitutions to VMP guidance that are required to meet operational needs or for mitigation purposes will be made with an effort to preserve the integrity of the landscape.
- Treatment decisions in the VMP will be made with consideration and understanding of maintenance issues to ensure that the proposed treatment is accomplished and maintained over time. Preservation of the overall integrity[73] of the landscape will be the goal.

3.2 Component NHLD Management Guidelines-Views, Viewsheds, and View Corridors

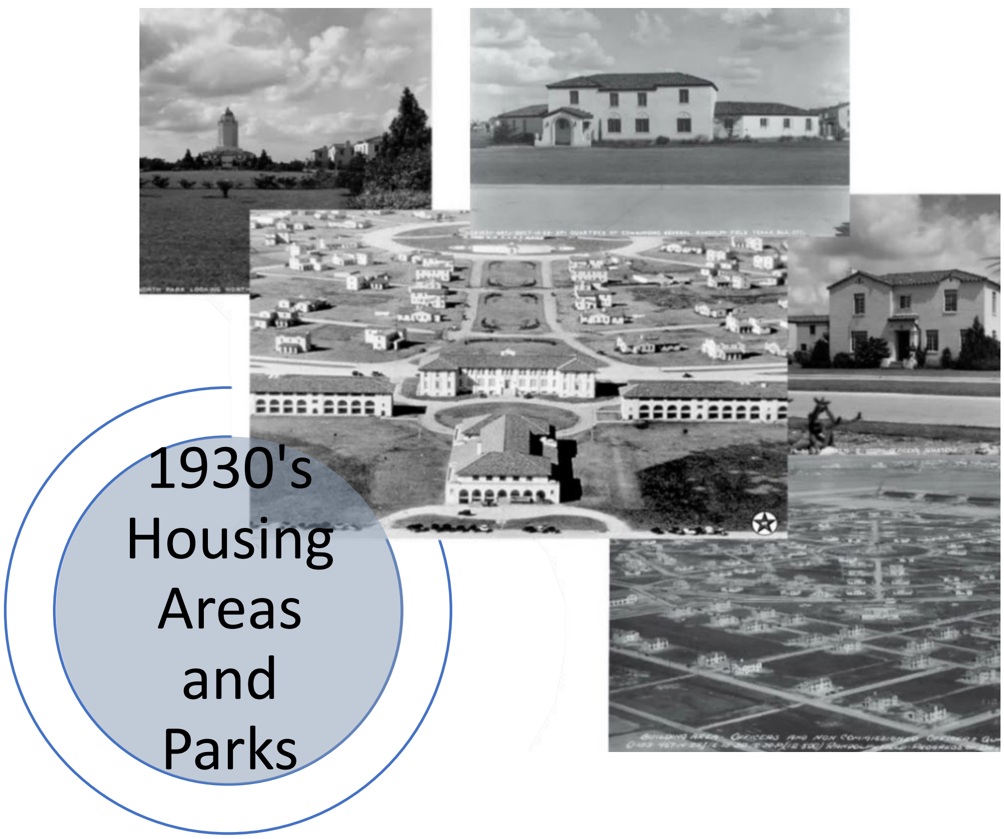
3.2.1 Views, Viewsheds, and View Corridors

There are many views and viewsheds in the NHLD that are integral to the original design of the base. The strong geometrical street network of the base provided ample views to significant features around the base. Views, viewsheds and view corridors are created by landscape-scale physical elements. A view is a scene or vista that can be seen when looking in one direction

[73] Integrity is the ability of the property to convey significance through physical features and context (National Register Bulletin No.36, Guidelines for Evaluating and Registering Archeological Properties"). Evaluation of a site's integrity is subjective. The landscape, to include the vegetation, adds to Randolph NHLD's integrity of setting -- imparting to the observer a feeling of the site's original design ("Air City") and the historic period of significance (1928-1950).

standing at a certain viewpoint. Viewshed refers to all visible elements that can be seen from a certain viewpoint. View corridors are corridors that spatially connect key physical elements. An example is Harmon Drive which is the primary view corridor of the base.

The Historic Landscape Survey prepared by Tooker et al. (2013) recommended preservation of the NHLD's historically important views, viewsheds, and view corridors. The views in the NHLD highlight important buildings and functional areas of the base (Tooker et al., 2013). Figure 10 depicts the viewpoints and their relationship to the functional areas of the base. This section (Section 3.2) provides management guidelines to preserve the landscape's views, viewsheds, and view corridors while meeting BASH flying safety requirements. Figure 11 depicts component viewsheds and view corridors discussed in the text.



Source of historical photographs: Tooker et al., 2013 and Hoffman, 2014.

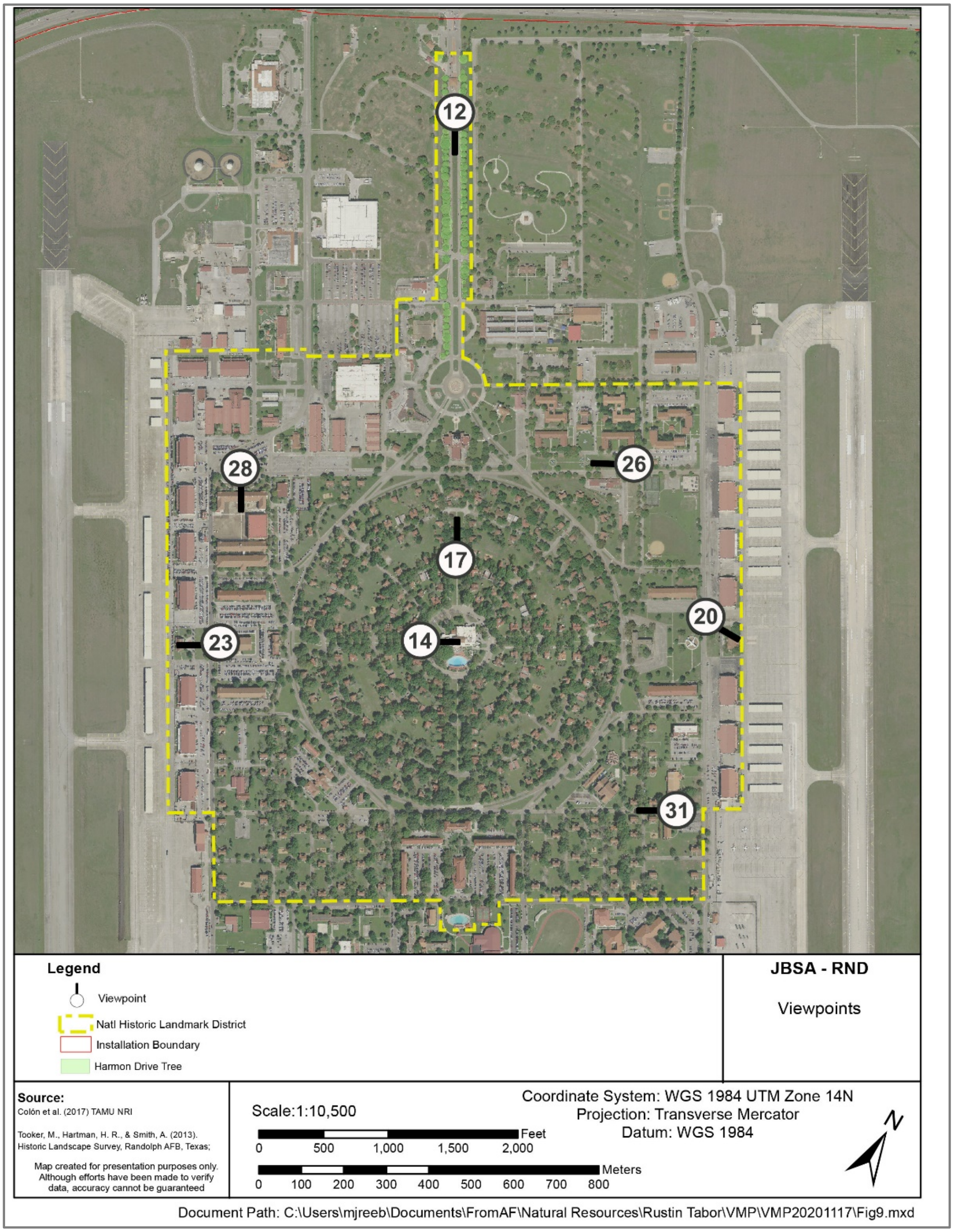


Figure 3-1. Viewpoints within the NHLD discussed in this section. Numbers within circles correspond to figures in text. Viewpoint barbs indicate view directions.

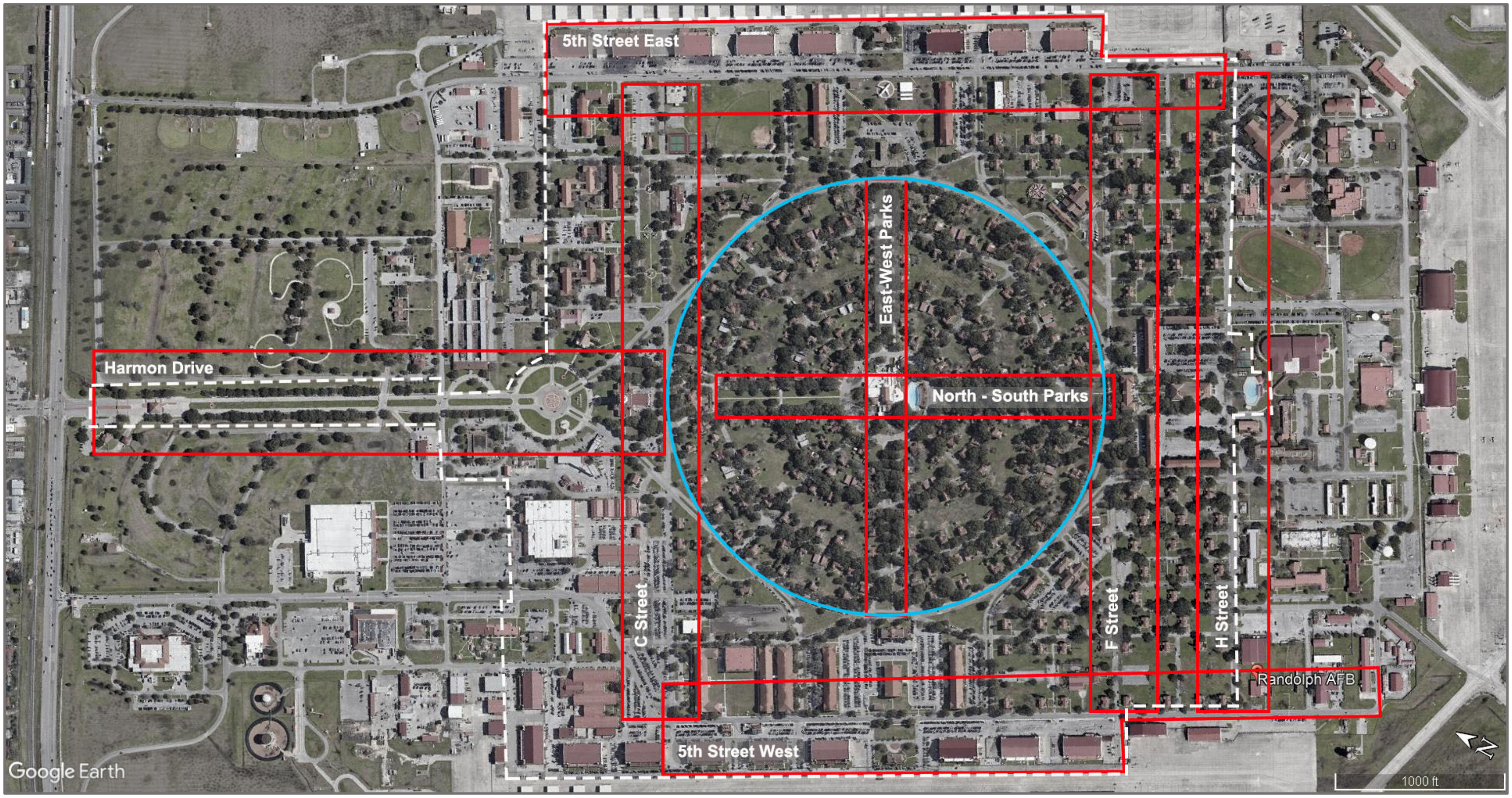


Figure 3-2. Component district management viewsheds and view corridors (red), Randolph Field NHLD (dashed white), and Main Circle (blue).

3.2.1.1 Harmon Drive and Washington Circle View Corridor

The entrance boulevard, Harmon Drive, begins at the main gate at the intersection of Farm to Market Road 78 (FM 78) and Pat Booker Road and terminates at the Administration Building (100) commonly known as the Taj Mahal. Just north of the Taj Mahal and within the view corridor is Washington Circle. This is the primary view of the base. The Harmon Drive and Washington Circle view corridor has changed significantly over the years with Airmen's Heritage Park to the east and an open green space to the west that once consisted of Capehart Wherry housing. The rows of southern live oaks (*Quercus virginiana*) donated by the Daughters of the American Revolution (DAR) in 1932 and 1933 have grown to full maturity. Placed fifty feet on center, the trees lining Harmon Drive emphasize the long axis toward the Administration Building. The center medians display the flags of all fifty states and the lawn areas are planted with *Zoysia* sod thus maintaining a clean appearance. Although enlarged in 2008, Washington Circle still consists of one outer road and one inner road maintaining the roundabout design. During the construction in 2008, several of the DAR southern live oaks were lost and the trees were not replaced. The center island that once displayed the Air Force Star consisting of boxwood also has been replaced. The Star was redesigned, and TSHPO consulted with, in 2015 to meet drought and water restrictions. See Figure 12.

Figure 3-3.Harmon Drive view corridor. Primary entry view to JBSA-RND (photo December 2019). Southern live oaks (Quercus virginiana) define the view corridor.

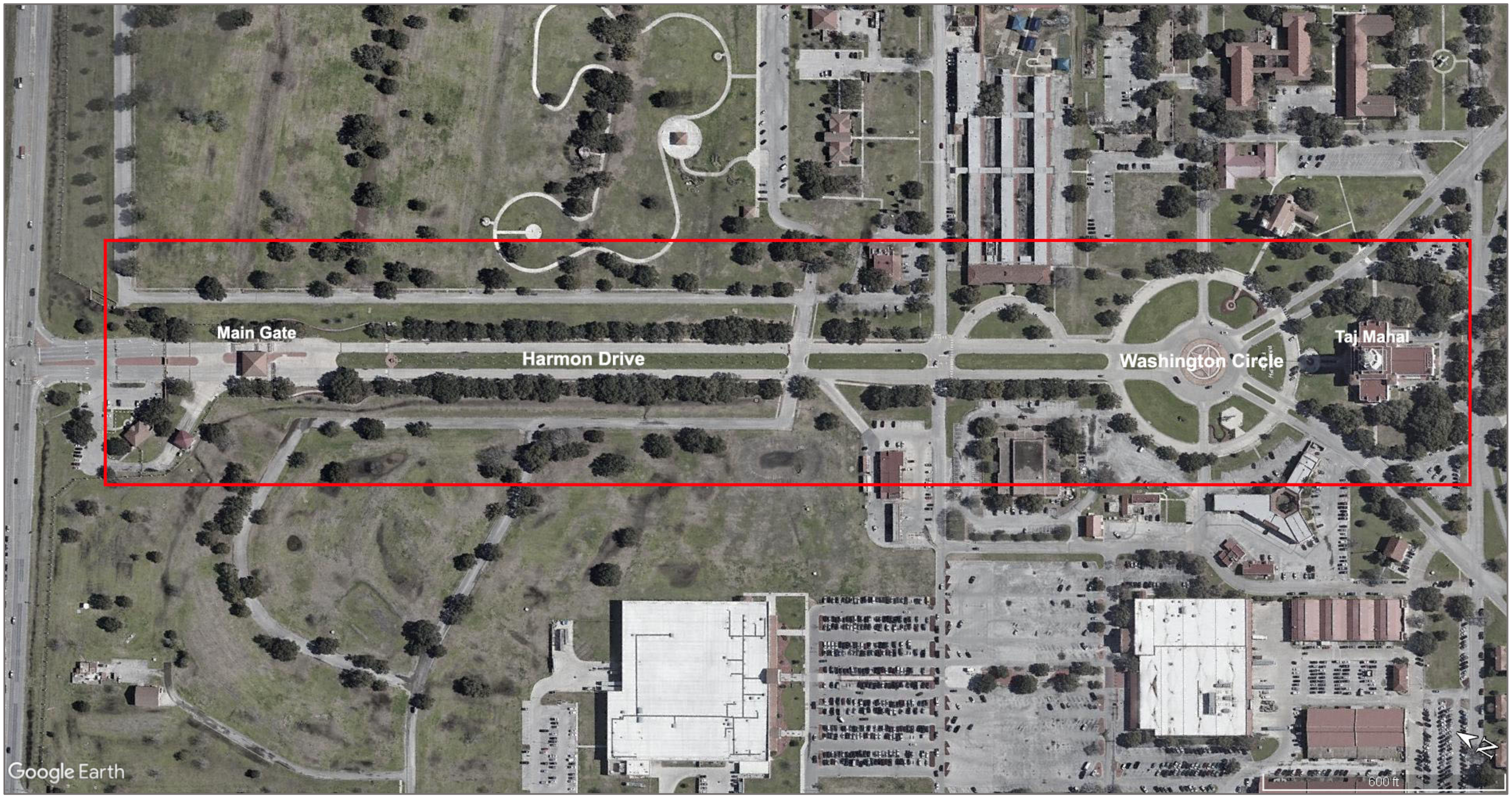


Figure 3-4. Harmon Drive and Washington Circle View Corridor.

Harmon Drive and Washington Circle View Corridor Component Guidelines (Figure 13)

- Street trees (southern live oaks) in the Harmon Drive view corridor should be maintained on either side of drive and around Washington Circle to preserve the integrity of the view corridor and history of the trees.

- Canopies of the street trees should be thinned and separated to reduce the attractiveness to roosting and nesting birds.

- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.

- The open spaces along the median and Washington Circle should remain open and planted with drought tolerant grass consistent with the historic design's intent.

3.2.1.2 East and West Parks View Corridors

Both East Park and West Park originate at Main Circle Road and terminate at the Officers Club, Building 500. The original planting scheme of the 1930's that included clusters of plants at the arced ends of the medians no longer exists, instead an urban forest of live oak trees has been establish throughout the years. The live oaks on the medians form a dense canopy that shades the lawn areas below. In conjunction with the live oaks growing in the medians, the live oaks that line both the East Park and West Park roads that parallel the medians form very dense canopies that cantilever over the streets. By thinning the canopies and removing selected live oaks along the streets and the oaks in the medians, the medians would receive enough light to sustain a lawn and re-establish the open vegetated areas within the housing area as Lt. Bone originally designed. The east-west views that terminate at the Officers Club were originally designed to extend through the enlisted men's barracks and terminate in the east and west stage houses[74]. VMP guidelines are designed to restore the historical feeling of the period of significance, i.e., roads divided by wide, grassed medians lined with trees. See figures 14 and 15

[74] Army flight training in the 1920's consisted of three different levels, or stages, of instruction. Basic and primary stages of instruction were provided at Randolph Field. Primary instruction was provided on the west flight line while basic instruction was provided on the east flight line. Stage houses located at the middle of each flight line served as the centers of flight training for each stage.

Figure 3-5. East Park looking northeast toward Officers Club (photo December 2019).

Figure 3-6. East Park looking northeast toward Officers Club-desired future condition.

Figure 3-7. West Park and East Park.

West Park and East Park View Corridor Component Guidelines (Figure 16)

- Street trees (southern live oaks) in the East Park and West Park view corridor should be maintained on the building side of the streets paralleling the Parks.
- Canopies of the street trees should be thinned and separated to reduce the attractiveness to roosting and nesting birds.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.
- Trees in the medians should be removed and the medians should remain open and planted with drought tolerant grass consistent with the historic design's intent.

3.2.1.3 North and South Parks View Corridors

North Park originates at Outer Octagon Road and terminates at Military Plaza across from the Officers Club while South Park originates at Main Circle Road across from Building 900 and terminates at Military Plaza. North Park and South Park medians are planted in a mixture of St Augustine *(Stenotaphrum secundatum)* and Bermuda *(Cynodon dactylon)* sod providing sustainable lawns with healthy live oak trees planted randomly. The original planting design that included shrubs and hedges to define the interior open spaces of the medians has been removed and sidewalks added along the centerlines of all medians. Trees also have been planted in the medians. Both North Park and South Park are lined with historical live oaks donated in 1932 and 1933 by the Daughters of the American Revolution. Most of these trees are on the housing side of the streets that parallel the Parks. Their branches intertwine and cantilever over the streets creating shaded corridors. By thinning tree canopies and removing selected oaks along the streets and the oaks in the medians, the WWDO population would be discouraged from nesting due to a lack of protection from predators. The housing area also would be moved closer to Randolph Field's original design of open vegetated areas. See figures 17 and 18.

Figure 3-8. North Park looking northwest (photo December 2019).

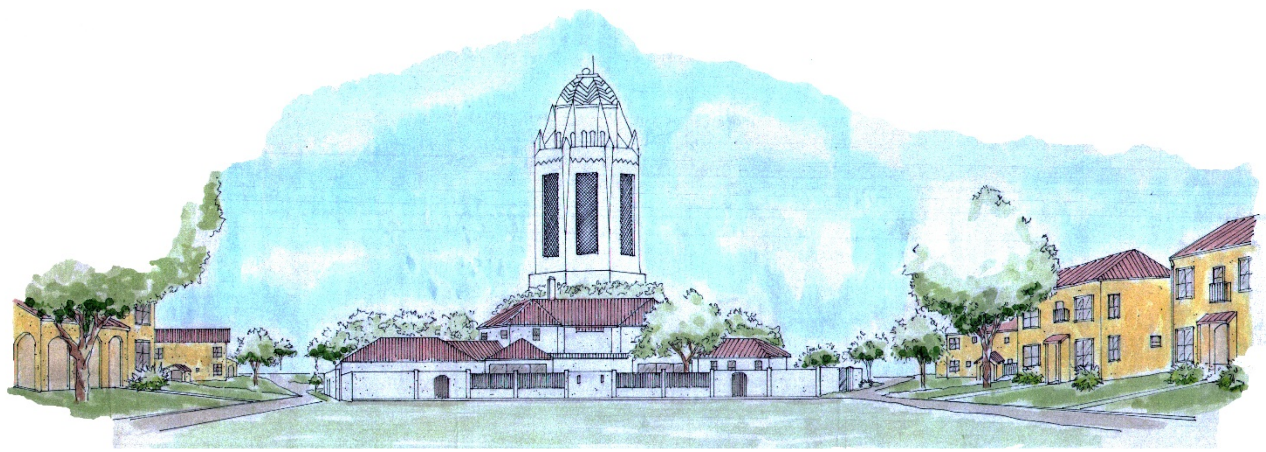


Figure 3-9. North Park looking northwest-desired future condition.

Figure 3-10. North Park and South Park Viewsheds.

North Park and South Park Viewshed Component Guidelines (Figure 19)

- Street trees (southern live oaks) in the North Park and South Park view corridor should be maintained on the building side of the streets paralleling the Parks.
- Canopies of the street trees should be thinned and separated to reduce the attractiveness to roosting and nesting birds.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.
- Trees in the medians should be removed and the medians should remain open and planted with drought tolerant grass consistent with the historic design's intent.

3.2.1.4 5th Street East and 5th Street West View Corridors

Flightlines and hangars line the east and west side of 5th Street East and 5th Street West, respectively. Historic photographs of these areas show little vegetation during the period of significance. 5th Street East extends a little over a mile along the east perimeter of the cantonment area. It begins at the East Gate and continues south to J Street East. Entering through the East Gate and prior to entering the NHLD, the Randolph baseball fields lie to the west and the east runway and clear zone to the east. The airfield is planted in coastal Bermuda *(Cynodon dactylon)* creating a pasture-like appearance and providing erosion control. Continuing south, the east side of the street is lined with hangars and parking lots while the west side of the street has several government buildings with military housing toward the south end. Southern live oaks are found in intermittent clusters along the street with some having interlocking canopies. Located in the western quadrant, 5th Street West begins at C Street West and extends to J Street West. Government buildings are located to the east along 5th Street West and warehouse type buildings are located to the west. A row of hangars is along the flightline with parking lots lining the adjacent street. The trees are predominantly live oaks with little landscaping. The views along 5th Street East and 5th Street West provide long views that emphasize the importance of the flight lines on the east and west sides of the field, respectively. 5th Street East and 5th Street West also compliment the spatial uniformity of the long line of hangars along the streets. The VMP guidelines to reduce trees in the vicinity of the flight line, e.g., around the stage houses, are consistent with the arboreal plan of the period of significance. Trimming tree canopies and removing selected trees on the interior of both streets and removing trees along the hangar side of both streets would help reduce the BASH risk while moving the viewshed closer to the original planting design. See figures 20 and 21 (5th Street East) and 23 and 24 (5th Street West).

Figure 3-11. Stage house looking east along 5th Street East (photo December 2019).

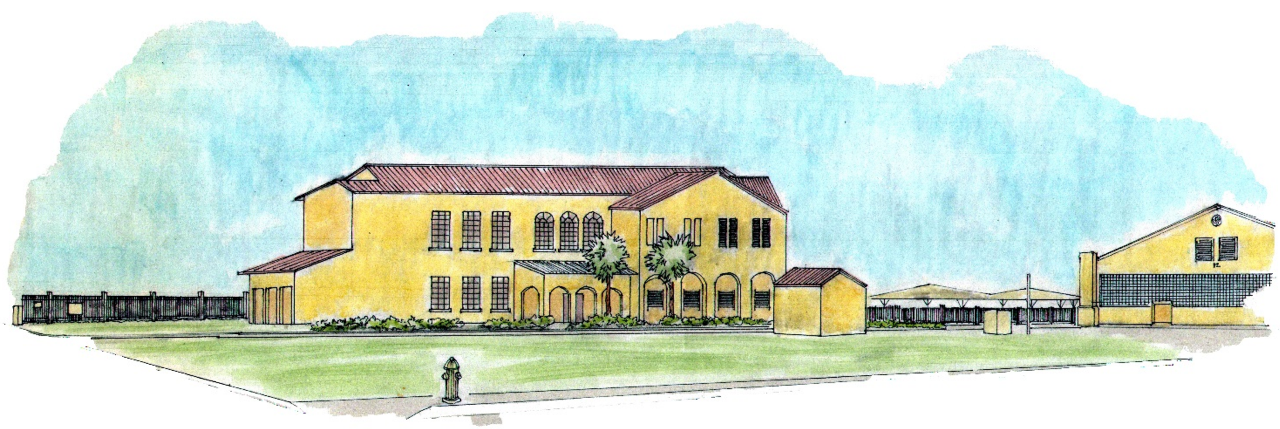


Figure 3-12. Stage house looking east along 5th Street East-desired future condition.

Figure 3-13. 5th Street East viewshed.

Figure 3-14. Stage house looking west along 5th Street West (photo December 2019).

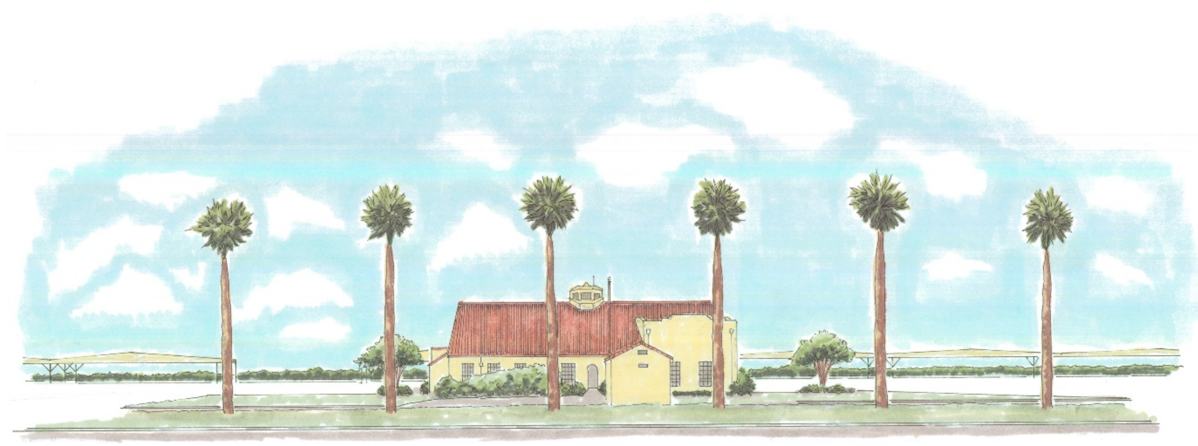


Figure 3-15. Stage house looking west along 5th Street West-desired future conditions.

Figure 3-16. 5th Street East viewshed.

5th Street East and 5th Street West Viewshed Component Guidelines (Figures 22 and 25)

- Street trees should line only the cantonment side of 5th Street East and 5th Street West. Individual tree canopies should be thinned.
- Canopies of adjacent trees should be thinned such that they do not overlap.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.
- Minimal vegetation should exist around the stage houses and hangars.

3.2.1.5 C Street / East to West View Corridor

Located north of Circle Housing, C Street runs from 5th Street East to 5th Street West connecting both east and west boundaries of the cantonment area. The Bachelor Officers Quarters (BOQ) and other buildings along the C Street were landscaped with small evergreens and shrubs around their foundations during the period of significance. C Street is a secondary view corridor that provides views across the width of the base from one flight line to the other. Following VMP guidelines by reducing tree density will help re-establish the east-west C Street corridor as originally designed.

Traveling from 5th Street East on C Street, Randolph's Aircraft Park is located on a grassy median. Historical trainer aircraft flown at Randolph are displayed in the median. The Park is in front of buildings 110, 112 (Randolph Lodging), and 120. The C Street view corridor is lined with southern live oaks and red oaks *(Quercus rubric)*. The sabal palms *(Sabal palmetto)* planted in front of buildings 110 and 120 add diversity in plant material. Continuing on C Street between Northeast Drive and Northwest Drive is an iconic historical NHLD view. The historic Randolph Theater is on the north side of the street. The theater is in the architectural design of the nearby Taj Mahal. Heritage live oaks flank the building. In the island located in front of Building 300 on the south side of the street is a clustering group of healthy southern live oak, pecan *(Carya illinoiensis)* with planting beds containing variegated *Liriope (Liriope muscari 'varigata')*, morea iris *(Dietes iridioides)* and mountain laurel *(Kalmia latifolia)*. Beyond Northwest Drive, the view corridor changes to a more hardscape appearance with parking lots on the north side of C Street and a small cluster of military housing on the south. The housing is landscaped with southern live oak and pecan trees. Historic photos taken during the period of significance show that the utilitarian warehouse and shop areas on the western part of C Street largely were limited to a few street trees and foundation plantings. Moving toward 5th Street West and to the south is Building 499, Air Force Personnel Center. In front of Building 499 are southern live oaks and other trees of various species. The enhanced landscaping around the building imparts a sense of place within the view corridor. Bird attractant trees and shrubs would be removed along C Street to reduce the BASH risk. Trimming tree canopies and reducing tree density on C Street also would reduce the BASH risk while moving the viewshed closer to the original planting design. See figures 26 through 29.

Figure 3-17. C Street East looking west (photo December 2019).

Figure 3-18. C Street East looking west-desired future condition.

Figure 3-19. C Street West looking south, Building 499 (photo December 2019).

Figure 3-20. C Street West looking south, Building 499-desired future condition.

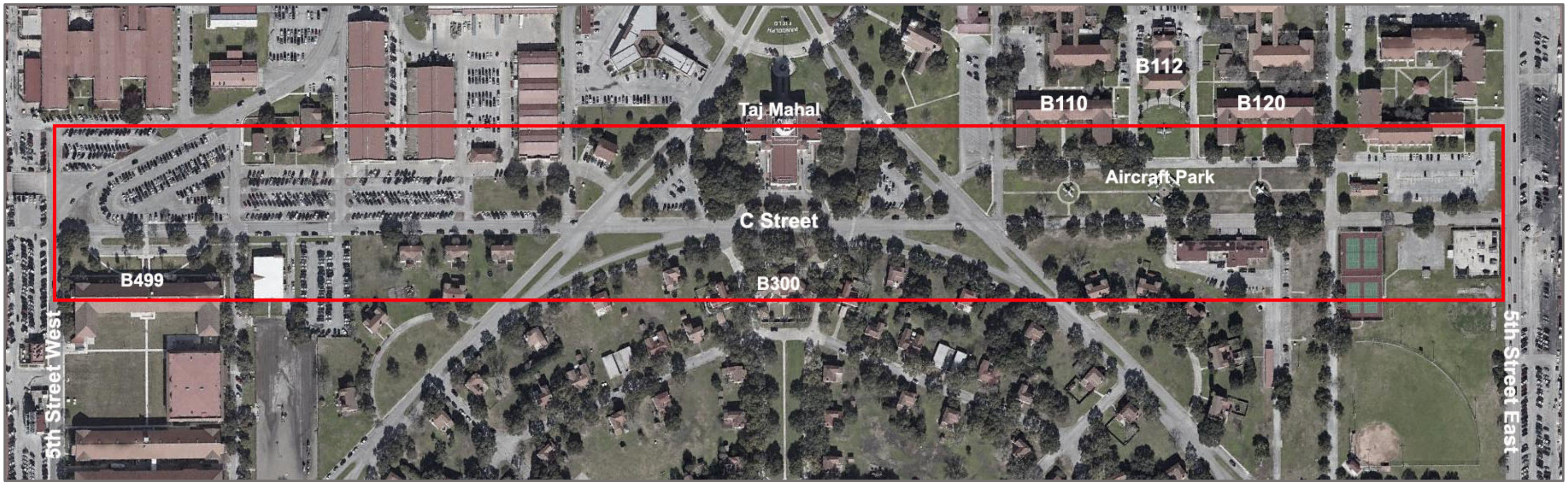


Figure 3-21. C Street East and C Street West view corridor.

C Street East and C Street West View Corridor Component Guidelines (Figure 30)

- Street trees should line C Street East and C Street West to define the C Street view corridor.
- Canopies of adjacent trees should be thinned such that they do not overlap.
- Individual tree canopies should be thinned.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.

3.2.1.6 F Street / East to West View Corridor

F Street touches the southern point of Circle Housing as it extends from 5^{th} Street East to 5^{th} Street West. The F Street view corridor includes numerous historical buildings and is lined with southern live oaks, red oaks, and pecan trees. Entering F Street from the east, the view corridor consists of historical government facilities on the north side of the street and military housing to the south. Located between 1^{st} Street East and 1^{st} Street West and oriented toward the south is Building 900, Air Education and Training Command headquarters. The front of the facility is shaded by heritage southern oaks accented with Sabal palms (*Sabal palmetto*) and sago palms (*Cycas revoluta)* with Asian jasmine *(Trachelospermum asiaticum)* carpeting the understory landscaping. To the north is the entrance to South Park with the Officers Club as the focal point. The view consists of southern live oaks and a grassy median. From 1^{st} Street West to 5^{th} Street West are live oaks cantilevered over the street creating a dense canopy. This view contains historical government buildings and military housing with live oaks and trees of miscellaneous species throughout the area. Bird attractant trees and shrubs would be removed to reduce the BASH risk along F Street. Trimming tree canopies and selected tree removal also would be accomplished to reduce the BASH risk. The overall feel of the NHLD along F Street would be maintained. See figures 31 and 32.

Figure 3-22. F Street East looking west (photo December 2019).

Figure 3-23. F Street East looking west-desired future condition.

Figure 3-24. F Street East and F Street West view corridor.

F Street East and F Street West View Corridor Component Guidelines (Figure 33)

- Street trees should line F Street East and F Street West to define the F Street view corridor.
- Canopies of adjacent trees should be thinned such that they do not overlap.
- Individual tree canopies should be thinned.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.

3.2.1.7 H Street / East to West View Corridor

H Street provides direct access through the southern portion of the base from 5th Street East to 5th Street West. Building 743, Pilot Training Campus, is located on the south side of H Street. The street at that point is lined with southern live oaks and miscellaneous landscape plantings. Across the street is military housing with sporadic plantings of trees and shrubs within the landscape. As the housing units become more numerous on the north side of the street, the live oak plantings become more closely spaced creating clusters of dense canopies. Located on the south side of the street is the Randolph Athletic Field. The field is covered in Bermuda grass *(Cynodon dactylon)* and has a running track. Between 1st Street East and 1st Street West is the historical 900 Building complex to the north and the Athletic Center to the south. Southern live oaks, Japanese black pine *(Pinus thunbergii)* and pecan trees soften the view corridor with miscellaneous landscape plantings. Beyond 1st Street West and before reaching 5th Street West the live oaks, red oaks and miscellaneous species of trees form a continuous canopy that ultimately promotes a sense of space but provides refuge for the WWDO and other avian species thus contributing to the BASH problem. Bird attractant trees and shrubs would be removed to reduce the BASH risk along H Street. Tree canopies would be trimmed, and selected trees removed to decrease tree density.

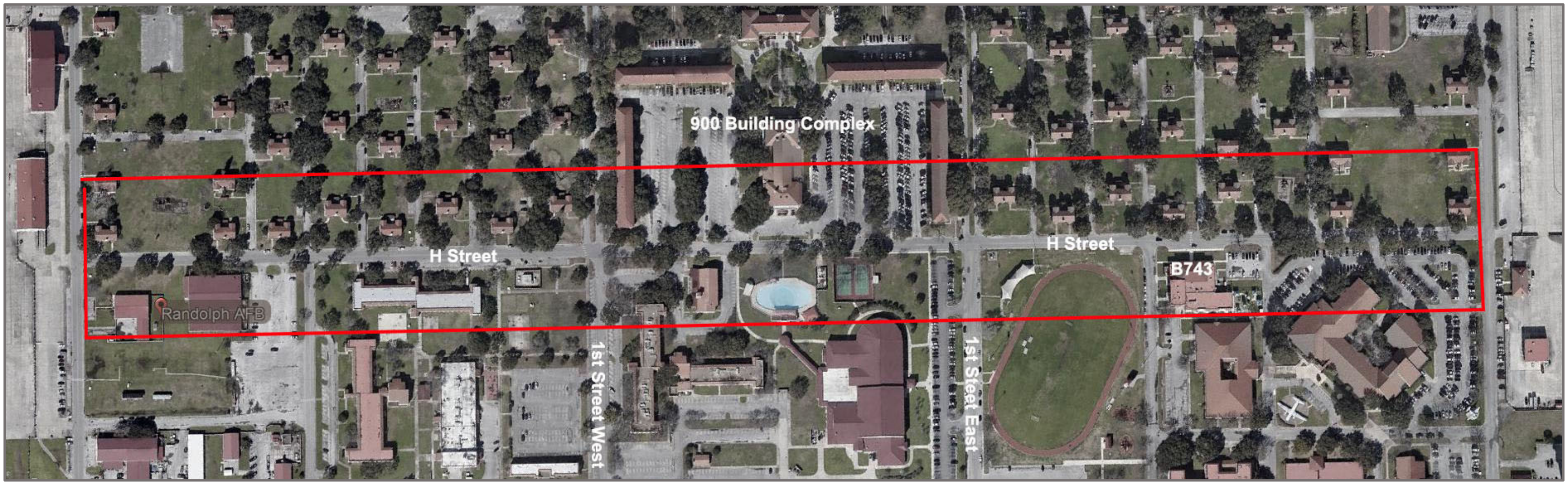


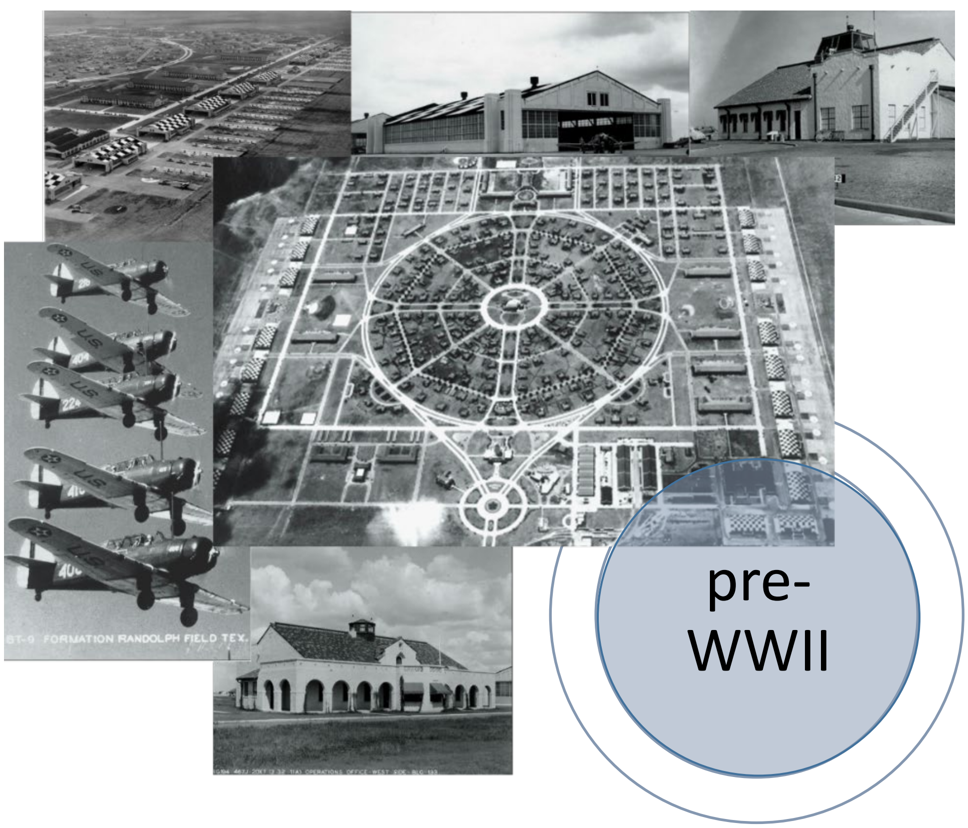
Figure 3-25. H Street East and H Street West view corridor.

H Street East and H Street West View Corridor Component Guidelines (Figure 34)

- Street trees should line H Street East and H Street West to define the H Street view corridor.
- Canopies of adjacent trees should be thinned such that they do not overlap.
- Individual tree canopies should be thinned.
- Tree branches over streets should be raised to provide a minimum 15-foot clearance from the street surface to the lower branches.

3.2.1.8 Main Circle Viewshed

Main Circle is a continuous roadway that encircles the main housing area and includes much of JBSA-RND's urban forest. The roadway is divided by intermittent grassy island medians. The trees on the housing side of the Circle soften the appearance of the Spanish Colonial Revival architecture and occasionally cantilever over the roadway to form shaded corridors with their dense canopy. Most structures within the viewshed are of a historical nature and create an overall ambiance and sense of place. Housing units observed from Main Circle include a variety of landscapes that serve to enhance and soften the street view of the structures. Viewsheds of North Park, South Park, East Park, and West Park are visible from Main Circle. The urban forest forms a dense canopy in the park areas. Most trees in these areas are southern live oaks that form a tunnel effect as they cantilever over the roads leading into Circle housing. Two large grassy islands at Main Circle's east and west ends. These islands are planted in Bermuda grass and provide soft lawn areas along the route. See Figure 35.



Source of historical photographs: Tooker et al., 2013; Clow et al., 1998; and Hoffman, 2014.

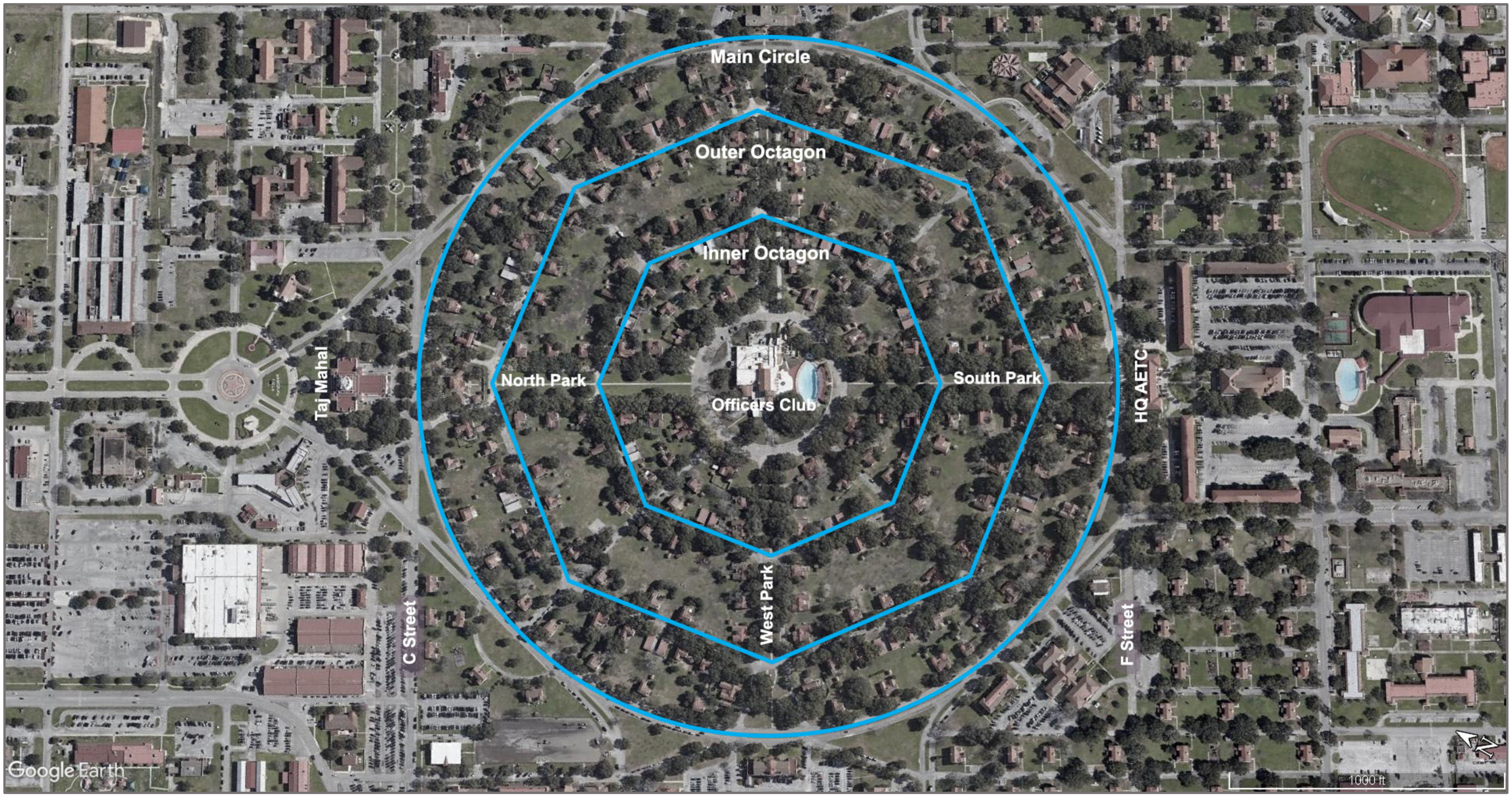


Figure 3-26.Main Circle view corridors.

4 Vegetation Treatment Guidance

4.1 Purpose

The purpose of this section is to provide treatment directions following attainment of the desired future conditions described in Chapter 2. Guidance described here includes street tree spacing, tree trimming, tree and stump removal, tree risk management, debris and site cleanup, construction site/utility maintenance, tree removal documentation, hazardous material use, and MBTA responsibilities.

Pruning, trimming and removal shall be consistent with the overall and component management guidance furnished in this NHLD VMP. Vegetation treatments are to be accomplished in accordance with the most current version of the American National Standards Institute (ANSI) A300 Pruning Standard - Part 1 **Invalid source specified.**. All work shall comply with applicable Federal and State Occupational Safety and Health standards; ANSI Z133.1 – Safety Requirements for Arboricultural Operations **Invalid source specified.**; Federal Insecticide, Fungicide, and Rodenticide Act; and the JBSA INRMP (JBSA, 2020a). Provision of AFI 90-801, Environmental, Safety and Occupational Health, shall be followed. All actions in this VMP will be implemented consistent with the “Programmatic Agreement Among the U.S. Air Force and the Texas State Historic Preservation Officer for the Operation, Maintenance and Development of Joint Base San Antonio, Texas”. Randolph NHLD’s vegetation resources have historical significance that will be protected and enhanced to the extent possible considering flying safety and fiscal constraints.

4.2 Street Tree Spacing

Street trees should be spaced to avoid intertwining branches when trimmed. Trees should be symmetrically spaced on opposite sides of a street where possible, with exception of the flightline sides of 5th Street East and 5th Street West where there should be no street trees. Street trees should be trimmed so that they do not obstruct a driver’s 50-foot cone of vision at intersections. The minimum clearance from the street surface to branches overhanging the street is to be 15 feet. Street trees should not be a species that bears fruits or nuts that might be a bird attractant.

4.3 Tree Trimming

The Contracting Officer's Representative (COR), 12th Flying Training Wing Safety Office (12 FTW/SE), Natural Resource Manager (NRM), and Cultural Resource Manager (CRM) will prioritize the schedule for tree trimming. The contractor will remove limbs of trees to reduce attractiveness to birds and create a hollow inner canopy. Cuts will be made as directed and coordinated by the Contractor's Certified Arborist (International Society of Arboriculture certification) to ensure canopy removal is safely performed and does not add risk to the injury or death of the tree. Applying wound sealer to cuts is not necessary except to prevent oak wilt. When used, all cuts must be painted with wound sealer within 30 minutes of trimming **Invalid source specified.**. All limbs larger than 2 inches in diameter, which are cut at a height greater than 6 feet, shall not be allowed to freefall when being removed/cut. All trees, limbs, and debris shall be removed from the site in a vehicle or container. Discharging wood chips onto the ground is prohibited.

4.3.1 Crown Thinning

The contractor shall perform scheduled tree crown thinning work as determined through coordination with the COR, 12th FTW/SE, NRM, and CRM. Branches should be selectively removed to increase light penetration and air movement throughout the crown of a tree. The intent is to maintain or develop a tree's structure and form and to reduce the attractiveness to nesting birds. To avoid unnecessary stress and prevent excessive production of epicormic sprouts, no more than one-quarter of the living crown should be removed at a time. When branch removal is necessary, avoid injury to the branch collar; cutting into the collar will destroy the tree's natural defenses against infection. The collar surrounds the branch and usually is indicated by a slight swelling near the trunk or main stem. The branch bark ridge is formed above the branch where it joins the trunk. All cuts shall be made outside both the branch collar and bark ridge. All cuts shall be made with sharp, clean tools. Tools used on a diseased tree must be cleaned and disinfected prior to use on another tree or woody shrub[75].

1.1.1.1. General crown thinning guidelines (Figure 36):

- Assess how a tree will be pruned from the top down;

[75] Before each branch is cut, sanitize pruning tools with either 70 percent denatured alcohol, or with liquid household bleach diluted 1 to 9 with water (1 part bleach, 9 parts water). Tools should be immersed in the solution, preferably for 1-2 minutes, and wood particles should be wiped from all cutting surfaces. Bleach is corrosive to metal surfaces, so tools should be thoroughly cleaned with soap and water after each use. See Texas A&M AgriLife Extension, Tree Care Kit, Pruning tools for sanitizing practices **Invalid source specified.**.

- Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark;
- Ideally, lateral branches should be evenly spaced on the main stem of young trees;
- Remove any branches that rub or cross another branch;
- Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the stem to discourage the development of co-dominant stems; and
- Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.

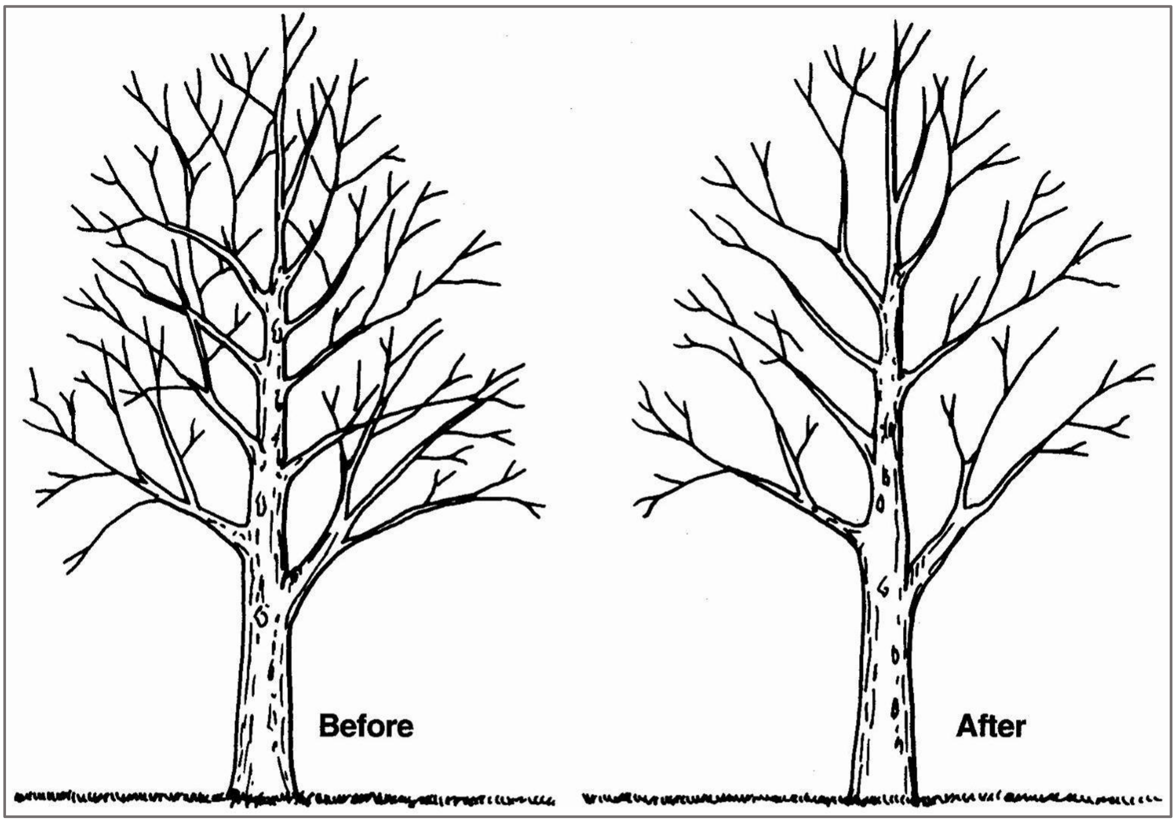


Figure 4-1. Crown thinning.

4.3.2 Crown Raising

The contractor shall perform scheduled tree crown raising work as determined through coordination with the COR, 12th FTW/SE, NRM, and CRM. Crown raising is the practice of removing branches from the bottom of the crown of a tree to provide clearance for pedestrians, vehicles, buildings, and lines of site. Branches that conflict with normal traffic or safety are to be removed or cutback. Minimum safety clearances are 15 feet over streets, 12 feet over driveways, 8 feet over walk areas, 4 feet over buildings, and 1 foot from buildings. Do not trim trees that touch or hang over energized utility poles or power lines. Notify COR if trees need to be trimmed from around power lines. COR will notify appropriate base agency. After pruning, the ratio of the living crown to total tree height should be at least two-thirds (e.g., a 30-foot tree should have living branches on at least the upper 20 feet).

1.1.1.2. General crown raising guidelines (Figure 37):

- Always maintain live branches on at least the upper two-thirds of a tree's total height. Removing too many lower branches will hinder the development of a strong stem; and
- Remove basal sprouts and vigorous epicormic sprouts.

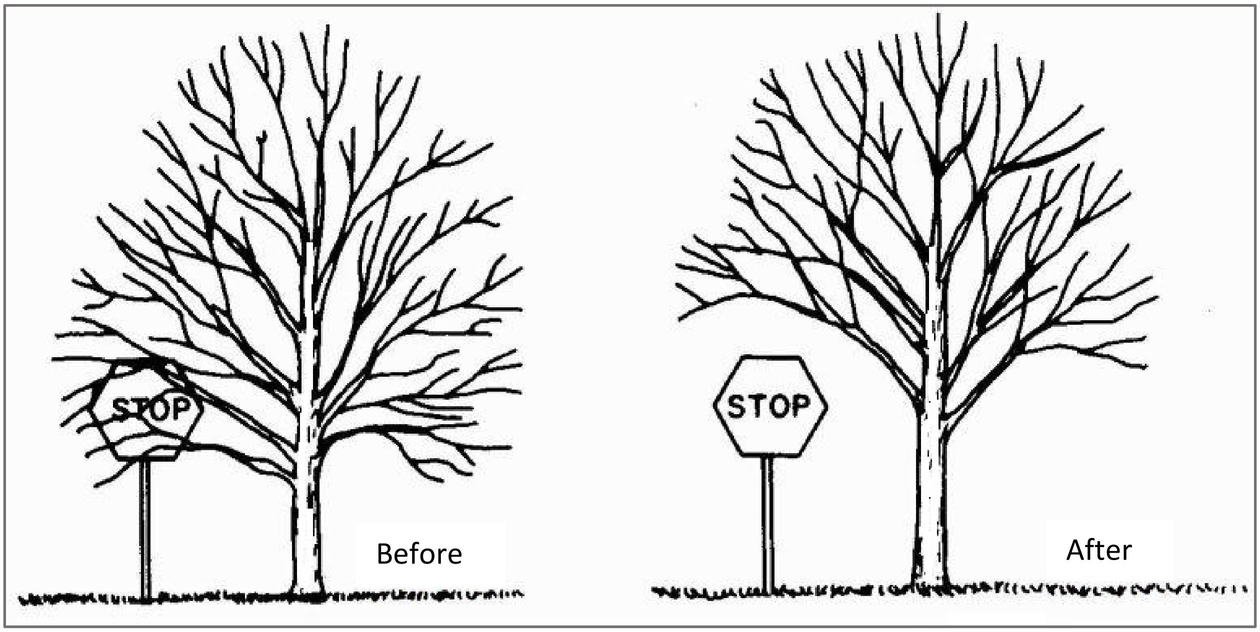


Figure 4-2. Crown raising.

4.3.3 Tree and Stump Removal

The contractor shall perform scheduled tree and stump removal work as determined through coordination with the COR, 12th FTW/SE, NRM, and CRM. The Contractor and the COR shall establish priorities, as necessary. The contractor shall remove all trees as indicated by marking with paint or tape. Woodchippers used shall discharge into a screened or covered vehicle/container. Discharging wood chips onto the ground is prohibited. Stumps shall be removed within two (2) days of performing tree removal. Following stump grinding operations, all excess wood chips shall be removed from the hole; reducing the soil/wood chip to a ratio of not more than 20 percent of the mineral soil content. The stump shall be completely removed along with all perimeter roots (within the ground area of the former tree canopy) to a depth below grade identified in the PWS. The area within a 10-foot radius surrounding the tree stump shall be graded level to match grade of adjacent ground. Bare ground should be seeded with a variety of grass, such as a Bermuda mix (e.g., *Cynodon* TIFF 419*)* that can withstand drought conditions and that requires minimal maintenance (see Appendix D). A Base Civil Engineer (BCE) Work Clearance Request, (Digging Permit) must be approved by BCE for any work that disturbs the ground surface (e.g., stump removal), or may disrupt vehicular traffic flow, base utility services, etc.

Trees may be selected for removal if any of the following conditions exist:

- Hazardous Trees (see tree risk management guidelines, section 4.3.5, below)
    - Large dead branches in the tree;
    - Cavities or rotten wood along the trunk or in major branches;
    - Mushrooms present at the base of the tree;
    - Cracks or splits in the trunk where branches are attached cracked or flaking bark on trunk or branches;
    - Strong lean at the trunk.
    - Many major branches arise from one point on the trunk;
    - Damaged, broken, or injured roots; and
    - Tree has been topped or otherwise heavily pruned.
- Dead Trees
    - Trees that are dead or have been determined by an International Society of Arboriculture (ISA) Certified Arborist to be in a state of severe decline shall be removed.
- Diseased/Infested Trees
    - Trees that are diseased and lost their productive capacity, and are not likely to recover despite the application of available remedies; and
    - Trees that acquire an infectious disease or are infested with an insect that is declared a serious pest threat to other nearby trees shall be removed, if removal is determined to be the best pest control solution.
- Problem Areas
    - Includes trees where there are high densities of birds and/or defecation, contiguous intermingling canopy, too close to buildings, entrances, sidewalks, roads, etc.
- Exotic, invasive, or trees beyond landscaping life.
- Public Safety
    - Healthy trees may be removed if a serious flying safety risk (BASH) exists, and the tree removal is determined to be the only option available.

4.3.4 Tree Removal Documentation

All trees removed shall be documented by the contractor’s arborist and reports of trees removed submitted to the JBSA grounds maintenance COR periodically as identified in the PWS. Two electronic copies of the documentation shall be provided to the COR not later than one week following tree removal. The COR shall furnish the JBSA NRM with one copy. Trees that are removed shall be uniquely identified by a tree inventory number in the report. Digital photograph files shall be identified by their corresponding tree inventory number. The NRM will maintain an updated vegetation management database. The NRM will coordinate with Air Force Civil Engineer Center (AFCEC) GIS support or others to update the vegetation management GIS layer for the NHLD.

Documentation shall include:

- GPS location;
- Tree species, size (dbh[76]), approximate height, tree condition, and approximate tree age;
- Minimum of two photographs of the tree prior to removal with a minimum of 120-degree difference in view angle;
    - Photograph captions should include appropriate directional information and any significant details;
- Photographs taken from the same pre-removal photograph locations following tree and stump removal;
- Reason for tree removal e.g., hazard, dead, diseased, dying, etc.;
- Tree risk management report (hazard trees); and
- Arborist's report is to be prepared by an arborist certified by the International Society of Arboriculture for all trees removed from the NHLD.

4.3.5 Tree Risk Management

The contractor's arborist will identify hazard trees in performance of scheduled tree crown raising work as directed by the COR. Tree risk assessments will be consistent with the ANSI Tree Risk Assessment Standard, Tree Failure Part 9**Invalid source specified.**. The TAM NRI Tree Inventory (Colón et al., 2017) identifies potentially hazardous trees in the NHLD.

Levels of tree risk assessment – look for factors that affect the likelihood and consequence of tree failure Dahle et al., 2020). Determine risk based upon the likelihood of failure and likelihood of impacting a target[77], etc. **Invalid source specified.**. Prepare a hazard tree evaluation, for unsafe trees to be removed. Trees will be identified for removal by an arborist based upon their likelihood of failure, likelihood of impacting a target, and consequences of failure. Use a hazard evaluation form (Appendix E).

[76] Diameter at breast height, or dbh, is a standard method of expressing the diameter of the trunk or bole of a standing tree.
[77] A target would include infrastructure, buildings, parked vehicles, walkways, etc.

Categorize likelihood of failure:

- Improbable – tree unlikely to fail even in severe weather conditions;
- Possible – failure could occur, but unlikely during normal weather;
- Likely – failure is expected under normal weather conditions; and
- Imminent – failure has started or is most likely to occur soon, even if there is no wind or increased load (e.g., icing).

Categorize likelihood of impacting a target:

- Very low – chance of impacting a target is remote; low-unlikely a target will be impacted;
- Medium – target may or may not be impacted; and
- High – target is likely to be impacted.

Consequences of tree failure:

- Negligible – low value property damage and personal injury unlikely;
- Minor – low to moderate value property damage and personal injury unlikely;
- Significant – moderate to high value property damage and people could be injured; and
- Severe – high value property damage and one or more people could be killed.

4.3.6 Debris and Site Cleanup

All debris and litter created from tree trimming, tree removal, and/or stump grinding must be immediately removed from each worksite after operations are completed. Debris disposal procedures shall comply with all local, state, and federal regulations for disposal.

4.3.7 Construction Sites/Utility Maintenance

4.3.7.1 Tree Removal/Protection

Prior to any clearing, earth movement, or construction, an accurate inventory should be made of all trees on the site. The GPS location, species, height, and general condition of the construction site's trees should be noted. This inventory will be used to prioritize tree removal or preservation. Final decisions regarding removal should be made after the final design and construction documents have been approved by the project COR and the JBSA NRM or another designated official. Documentation (see 4.3.4) will be required for all trees removed. Existing trees designated to remain on the site during and after construction shall be surrounded with protective barricades prior to the start of site preparation. Fencing shall protect the trunks and branches and prevent compaction of soil within the tree's drip line. Barricades shall be placed no closer than 6 feet to the tree trunk.

New construction adjacent to existing trees shall occur outside the dripline when possible but not closer than the distance from the drip line to the tree trunk. Prior to any earth movement, the roots should be pruned back within the area of new construction and the crown thinned accordingly.

A Base Civil Engineer (BCE) Work Clearance Request, (Digging Permit) must be approved by BCE for any work that disturbs the ground surface (e.g., stump removal), or may disrupt vehicular traffic flow, base utility services, etc.

4.3.7.2 Trenching

Open trenching for services and utilities shall not be dug within a tree or large shrub's dripline. To avoid root damage, a hole should be tunneled when passing through the root zone and open trenching continued outside the dripline.

4.4 Pesticides, Herbicides, and Hazardous Materials

Pesticides and herbicides will be used in accordance with the JBSA INRMP (JBSA, 2020), AFI 32-1053 (Integrated Pest Management Program), DoD Installation Integrated Pest Management Program Guide (2013, as amended), and JBSA 91-212 Bird/Wildlife Aircraft Strike Hazard Plan. Pesticides used on JBSA-RND must be registered with the Texas Department of Agriculture and/or the US Environmental Protection Agency. Pesticides and herbicides are to be applied in accordance with manufacturer recommendations as provided on Safety Data Sheets[78] and product labels. All pesticide/herbicide applications on JBSA properties must be accomplished by certified DoD pesticide applicators under the direct supervision of a currently certified person, or by contractors who are State of Texas licensed pesticide applicators. Pesticides applied must be reported in accordance with AFI 32-1053. Pesticide use on JBSA-RND will be monitored by the NRM. The NRM is required to review and approve all non-DoD personnel who apply pesticides or perform pest management operations on JBSA.

Selected herbicides will be used as needed to eliminate the undesired plant species when non-chemical methods will not produce the desired landscape effect. Herbicide selection will be based upon the "best" herbicide to achieve the desired effect with consideration given to formulation persistency, target plant specificity, and plant/site control. Weed control operations will be seasonal with application of the herbicide timed to occur when plant species or growth phase is most susceptible.

[78] An SDS (formerly known as Material Safety Data Sheet (MSDS)) includes information such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.

The Contractor shall obtain approval using the application requirements of the AF Form 3952, Chemical/Hazardous Material Request/Authorization. Once the process is implemented and contractor is trained, the contractor may submit the AF Form 3952 electronically. The government has the right to prohibit the use of hazardous materials deemed to be especially hazardous to human health and the environment. In the event the government does not approve a hazardous material for use, the government may provide the contractor a list of suitable substitutes; however, the contractor shall retain responsibility for finding an acceptable substitute. The contractor shall take appropriate actions to comply with waste minimization and pollution prevention practices and policies at JBSA-RND. The contractor shall maintain spill control material on hand at all times sufficient to contain a worse case spill, both volume and hazard level.

The contractor shall register with the base HAZMAT Office and comply with all the rules and regulations for the storage, usage and disposal of hazardous materials and products. The contractor shall not bring any hazardous materials on base until all registration and documentation has been accomplished with the HAZMAT Office. The contractor shall provide a copy of each Safety Data Sheet (SDS) on all hazardous materials to be used by the contractor in performance of work on this contract. The contractor shall forward the monthly usage reports to the HAZMAT Office and the COR by the 5th of each month, or as identified by the COR. All hazardous materials use shall be in accordance with AFI 32-7086, Hazardous Materials Management (USAF, 2004).

4.5 Migratory Bird Treaty Act

In accordance with the Migratory Bird Treaty Act of 1918 (Title 16 U.S.C. §§ 703-712) and Executive Order No. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001, JBSA is responsible for avoiding and/or minimizing the negative impact of AF actions on migratory birds. Intentional and incidental take of migratory birds is prohibited, unless otherwise exempted (depredation permits, military training activities). Management activities in this VMP are not considered military training activities and thus are subject to these constraints. Trimming and removal will be planned to occur outside of the breeding season unless the tree is an immediate safety threat to persons on the ground or is diseased.

During the migratory bird nesting season (1 March – 15 August), all removal and trimming schedules will be coordinated by the COR and approved by the JBSA Natural Resources Manager (502 CES/CEIEN). The contractor will be required to report the discovery of nests and/or eggs to the COR prior to trimming or removing trees scheduled for completion. The contractor shall not trim or remove any tree containing nests and/or eggs without approval of the Natural Resources Manager. Any dead birds must be reported to the NRM within twenty-four (24) hours of discovery.

5 References

Clow, V., Knight, L., Peter, D., & Allday, S. (1998). The Architecture of Randolph Field, 1928-1931. Fort Worth: U.S. Army Corps of Engineers.

Colón, M., Thompson, C., & Long, A. (2017a). Feasibility of Avian Management Techniques Aimed to Reduce Risk of Bird-aircraft Collisions on Joint Base San Antonio-Randolph. Texas A&M University, Natural Resource Institute. College Station: Texas A&M Natural Resource Institute.

Colón, M., Thompson, C., Miller, S., & Long, A. (2017b). Urban Tree Inventory at JBSA-Randolph. College Station: Texas A&M Natural Resources Institute.

DoD. (2019a). Department of Defence Improving Water Security and Efficiency on Installations Report to Congress. Washington D.C.: Department of Defence.

JBSA. (2018). Bird/Wildlife Aircraft Strike Hazard (BASH) Plan, 502d ABW Command Instruction 91-212. San Antonio: United States Air Force.

JBSA. (2020a). Integrated Natural Resources Management Plan Joint Base San Antonio. San Antonio: JBSA.

Odenwald, N. G., & Turner, J. R. (1985). Plants for the South. Baton Rouge.

Tooker, M., Hartman, H. R., & Smith, A. (2013). Historic Landscape Survey, Randolph AFB, Texas; ERDC/CERL TR-13-14. Champaign: US Army Corps of Engineers, Engineer Research and Development Center.

USAF. (2004). AFI 32-7086 Civil Engineering-Hazardous Materials Management. Washington D.C.: Department of the Air Force.

USFWS. (2018). Depredation Permit MB09077B-0.

West, L. (1993). Ecology of Breeding White-Winged Doves in the San Antonio Metropolitan Area. Lubbock: Texas Tech University.

Appendices

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Appendix A

NHLD Tree Inventory

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NHLD Tree Inventory

This appendix summarizes the tree inventory of the TAM NRI report (Colon et al., (2017b) and lists the characteristics of the tree species in the NHLD. To meet BASH safety goals the urban forest density will be reduced. Tree and woody plant (shrub) retention will be prioritized based upon several factors that include contribution to the NHLD character, tree species (native versus non-native, invasive species, etc.), tree condition, bird attraction, hardiness (water requirements, drought tolerance, heat tolerance), and shading capacity, among others. The TAM NRI inventory (Colón et al. (2017) includes trees and woody plants in the improved area of JBSA-RND, an area that extends beyond the Randolph Field NHLD which is beyond the scope of this VMP. The information presented in this section includes only trees and woody plants (shrubs) in the NHLD.

Forty-seven species of trees[1] and fifty-five species of shrubs were identified in the NHLD. A total of 3,202 trees and 2,426 woody shrubs were identified in the NHLD. The 10 most numerous tree species are southern live oak (1788), pecan (307), Japanese privet (217), Texas oak (163), hackberry (97), cedar elm (79), crape myrtle (62), and eastern red cedar (59). Table 1 lists the species, tree count, and tree condition in the NHLD.

The TAM NRI inventory includes tree canopy condition (E, G, F, P, C, D) corresponding to the estimated crown health based upon the amount of dieback within each tree's canopy. Standard i-Tree definitions for each condition are:

Excellent (E)

- 100% of crown exists
- No dieback of branches in the upper crown
- No damage to trunk
- No suckering (upright shoots growing out of roots or branches that appear out of place

- Good (G):
  - 90-99% of canopy exists

[1] The TAM NRI inventory defined trees as woody vegetation greater than 12 feet tall and having at least one stem greater than 5 inches in diameter. Shrubs were defined as woody plants having a t least one stem greater than 5 inches in diameter. Some woody plants have both a tree form and shrub form thus some tree species include individuals counted as trees and others counted as woody shrubs. I-Tree condition class definitions can be found at i-Tree Help, https:/help.itreetools.org/MyTree/tree-condition (accessed February 17, 2021). i-Tree is a suite of computer software tools developed through a collaborative public-private partnership. The tools are designed to assess and value the urban forest resource, understand forest risk, and develop sustainable forest management plans to improve environmental quality and human health. The TAM NRI inventory uses a modified version of i-Tree condition categories; TAM NRI combines i-Tree classifications of" critical" (25-49% canopy existing) and "dying" (1-24% of canopy existing) into the single classification of "critical".

  - Mostly full canopy
  - Little damage to trunk
  - No dieback in branches over 2 inches in diameter in the upper crown
  - Little or no suckering
- Fair (F):
  - 75-90% of canopy exists
  - Thinning canopy Significant damage o trunk caused by insects or disease
  - Premature fall coloring on foliage
- Poor (P)
  - 50-75% of canopy exists
  - Visible dead branches over 2 inches in diameter in canopy
  - Significant dieback of living branches with no leaves on tips
  - Severe damage to trunk, including decay
  - Bark may be peeling in dead or dying areas
- Critical (C):
  - 1-50% of canopy exists
  - Dead (D)
  - 0% of canopy exists.

VMP Appendix Table 1. Tree Species Count and Condition

Species	Condition						Count
	E	G	F	P	C	D	
Southern live oak	96	776	686	172	23	35	1788
Pecan	12	87	76	22	5	105	307
Japanese privet	1	83	90	40	2	1	217
Texas oak	8	39	49	27	16	24	163
Hackberry	4	32	35	17	4	5	97
Cedar elm	4	46	22	5	1	1	79
Crape myrtle	16	38	5	1	1	1	62
Eastern Red Cedar	4	14	18	9	5	9	59
White ash	0	5	16	11	4	12	48
Oriental arborvitae	1	3	16	13	2	2	37
Bur oak	1	18	4	3	1	0	27
Chinese pistache	1	11	11	1	3	0	27
Chinese tallow	0	8	6	6	1	3	24
Monterey oak	3	10	6	1	0	0	20
Chinaberry	0	8	2	1	1	2	14
Mountain laurel	2	7	1	0	2	0	12
Yaupon	0	5	4	1	1	0	11
Bald cypress	0	4	3	1	0	0	8

Slash pine	0	0	4	0	0	2	6
American elm	1	2	2	0	0	0	5
Ashe juniper	0	0	0	1	1	3	5
Escarpment live oak	0	3	2	0	0	0	5
Loquat	0	2	2	0	1	0	5
Mulberry	1	1	3	0	0	0	5
Chinese photinia	0	3	1	0	0	0	4
Chinese privet	0	3	1	0	0	0	4
Cottonwood	0	1	3	0	0	0	4
Post oak	0	2	2	0	0	0	4
Leyland cypress	1	2	0	0	0	0	3
Osage Orange	0	0	3	0	0	0	3
Shumard oak	0	0	1	1	1	0	3
Blackjack oak	0	1	0	0	0	1	2
Mexican sycamore	0	1	0	0	0	1	2
Chinese elm	0	0	1	0	0	0	1
Desert Willow	0	1	0	0	0	0	1
Eastern redbud	0	0	0	0	1	0	1
Fig	0	1	0	0	0	0	1
Firethorn	0	1	0	0	0	0	1
Honey mesquite	0	0	1	0	0	0	1
Lacey blue oak	0	1	0	0	0	0	1
Magnolia	0	1	0	0	0	0	1
Pittosporum	0	1	0	0	0	0	1
Red-tipped photinia	0	1	0	0	0	0	1
Vitex	0	0	1	0	0	0	1
Water oak	0	1	0	0	0	0	1
Total (excluding Palm *spp.*)	156	1223	1077	333	76	207	3072
Percent of total	5	40	35	11	2	7	
Palm *spp.*	28	62	14	1	0	2	107

Approximately 9 percent (283) of the trees were in critical (2 percent) or dead (7 percent) condition. The greatest number of dead trees were pecan trees (105 trees, about 34 percent of pecan trees), southern live oak (35 trees, about 2 percent southern live oaks), Texas oak (24 trees, about 15 percent of Texas oaks), white ash (12 trees, about 32 percent of the white ash) and eastern red cedar (9 trees, about 15 percent of the eastern red cedar). Many of the dead trees have been removed. JBSA has consulted with TSHPO where required.

Approximately 78 percent of the trees had canopy overlap. The five species having the greatest percentage of overlap and with more than 50 trees in the NHLD were Chinese privet (about 98 percent), hackberry (about 98 percent, southern live oak (about 80 percent), crape myrtle (about 85 percent), and pecan (about 74 percent).

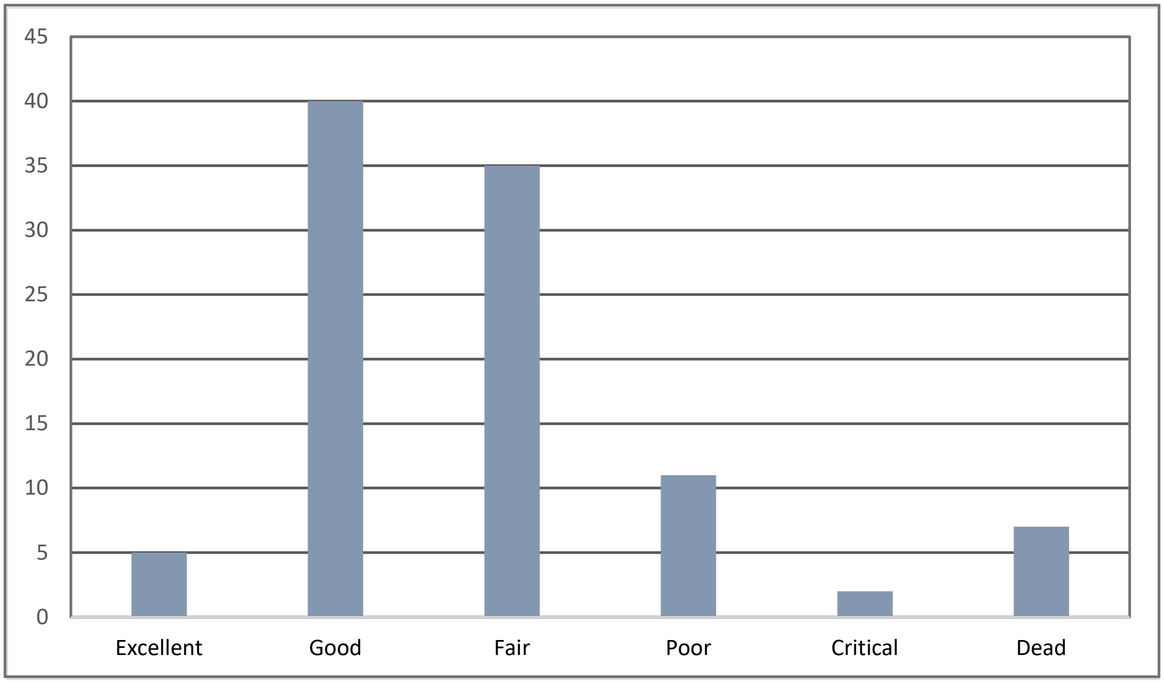

Figure 1. Tree condition percentages.

The tree species with the tallest individuals include pecan (2) and southern live oak (1) with individual trees between 60-65 feet and Mexican sycamore, hackberry, cottonwood, bald cypress, white ash, Leyland cypress, cedar elm and eastern red cedar with individual trees between 50-59 feet.

Tree canopy diameter varies with species. The average diameter for a single tree canopy of all species was estimated to be 24.6 feet[2]. Tree canopy radii were measured in the northwest quadrant of Main Circle as part of this study with similar results (24.2 feet). The canopies of 50 oaks lining Harmon Drive from the Main Gate to Washington Circle are estimated to average approximately 49 feet and range fr0m 25 to almost 80 feet in diameter with a standard deviation of 12 feet. Tree canopy diameters were estimated using Google Earth Pro satellite imagery.

Tree characteristics are listed in Table 2. The characteristics were obtained from multiple online sources including several Texas A&M websites and The University of Texas at Austin's Ladybird Johnson Wildflower Center website. Information in the table also was obtained from the

[2] *Air Quality Impact Assessment of Tree Removal at Randolph Air Force Base,* 2016, Air Force Civil Engineering Center.

National Resources Conservation Survey (NRCS) Plant Database and the California Polytechnical State University Select-a-Tree website. Sources are listed at the bottom of the table.

Characteristics include the Earth–Kind® Index and the Density Index. The Earth-Kind Index represents a best estimate of the adaptability of the plant to the average environmental conditions in the Hill Country and central coast region of Texas, including Bexar County. The Earth–Kind® Index considers the predicted water use, heat tolerance, plant adaptability to varied soil conditions, growth with little attention to applying fertilizer, and the overall freedom from insect and disease pests. The range is from 1 to 10, with plants having an Earth–Kind® Index of 10 being the best adapted plants for the region.

The Shading Capacity (density in/out of leaf) is the characteristic important in determining the amount of shade and shelter a tree may provide. Factors consider in this index include are a tree's leaf size and shape and branching pattern. The rating refers to the relative density when compared to other species in leaf. Density out of leaf is important for those interested in visual screening or shelter during the winter. Also, the more warming from the sun that is desired during the winter, the less dense the out of leaf condition should be. This category refers to the relative density when compared to other species out of leaf.

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VMP Appendix Table 2. NHLD Tree Characteristics

Common Name	Scientific Name	Native	H (ft)	W (ft)	Water Use	Heat Tolerance	Drought Tolerance	Shading Capacity	Earth-Kind	Count* Trees/ Woody Plants (Shrubs)	Notes
American Elm	*Ulmus americana* (ULAM)	Texas native (east)	60-80	80	High	Low	Medium	Moderate	4.2	5/0	Tree; deciduous; susceptible to Dutch elm disease; seeds attract granivorous birds
Arizona Cypress	*Hesperocypars arizonica (HEAR22);*	Texas native (west)	30-40	15-25	Low	High	Medium	Low-Moderately low	9	0/1	Tree; evergreen; fruit does not attract wildlife
Ashe Juniper	*Juniperus ashei* (JUAS)	Texas native (central)	15-20	15-20	Low	High	Yes	Low-Moderately Low	10	5/1	Shrub/Tree; evergreen; female plants produce fruit; fruit used by wildlife; mountain cedar, Texas cedar
Bald Cypress	*Taxodium distichum* (TADI2)	Texas native (east and central)	50-75	25-40	Medium-High	High	Yes	Moderately low-Moderate	7.2	8/2	Tree; deciduous; Gulf cypress, swamp cypress, southern cypress; seeds produced in female cone attract granivorous birds
Blackjack Oak	*Quercus marilandica* (QUMA3)	Texas native (east and central)	15-45		Low	High	High	-		2/0	Shrub/Tree; deciduous; susceptible to oak wilt
Bur Oak	*Quercus macrocarpa* (QUMA2)	Texas native (central and northeast)	50-80	50-70	Low	High	High	Moderately Dense (in), Moderate (out)	8	27/1)	Shrub/Tree; deciduous; produces a large nut; resists oak wilt
Callery Pear	*Pyrus calleryana* (PYCA80)	China and Korea	30-40	20-30	Medium	High	Low	Moderately dense	6	10/12	Tree; deciduous; fruit attracts birds; invasive species
Cedar Elm	*Ulmus crassifolia* (ULCR)	Texas native (south and east)	30-60	40-60	Low-Medium	High	Medium	Moderate-moderately-dense (in leaf)	9	79/96	Tree; deciduous; produces winged fruit

Chinaberry	*Melia azedarach* (MEAZ)	Persia/SE Asia	30-50	15-25	Medium-high	High	High	Dense (in), Moderate (out)	-	14/10	Shrub/tree; deciduous; fruit attracts some birds; Texas Department of Agriculture noxious weed list, invasive; umbrella-tree, white cedar, Chinaberrytree
Chinese Elm	*Ulmus parvifolia* (ULPA)	China, Japan, Korea	30-40	50	Low	Medium	Medium	Moderate (in), Moderate (out)	-	1/0	Tree; deciduous; produces winged fruit; fruit attracts birds; Lacebark Elm
Chinese photinia	*Photinia serratifolia* (PHSE17)	China, Japan, Philippines, Indonesia, India	15-20	10-15	Medium	High	High	Dense in leaf	7	4/10	Shrub/Tree; produces a small fruit that attracts birds
Chinese Pistache	*Pistacia chinensis* (PICH4)	China, Philippines	25-35	25-35	Medium	High	High	Moderately dense (in), Moderate (out)	8	27/8	Tree; deciduous; female produces fruit that attracts birds; invasive species
Chinese privet	*Ligustrum sinensis* (LISI)	China, Vietnam	8-12	6-10	Medium	High	Moderate		5.2	4/44	Shrub/Tree; females produce fruit that attracts birds; invasive; Chinese ligustrum, small leaf privet
Chinese tallowtree	*Triadica sebifera* (TRSE6)	Japan and China	35-40	25-30	Medium	Medium-High	Medium-High	Moderate to dense (in), Moderate (out)	-	24/1	Tree; deciduous; seeds attract birds; invasive; Texas Department of Agriculture noxious weed list; Chinese tallow, candleberry tree; chicken tree
Cottonwood	*Populus deltoides ssp.* (PODE3)	Texas native (east, central, west)	60-80	30-40	High	Heat	Medium	Dense (in), Moderate (out)	5.2	4/0	Tree; deciduous
Crape-myrtle	*Lagerstroemia indica* (LAIN)	India, China, Korea, Japan	12-20	8-12	Low-Medium	High	Medium	Moderately dense (in), moderate (out)	7	62/616	Shrub/Tree; deciduous; fruit attracts birds
Desert Willow	*Chilopsis linearis* (CHLI2)	Texas native (west)	15-25	15-20	Low	High	High	Low (in), Low (out)	10	1/6	Shrub/Tree; deciduous; open, airy; flowering willow, willow leaf catalpa, desert catalpa

Eastern Red Cedar	*Juniperus virginiana* (JUVI)	Texas native (east)	30-40	8-12	Low	High	High	Moderate (in)	9	59/10	Tree; evergreen; pyramidal; females produce fruit that attract birds
Eastern Redbud	*Cercis canadensis* (CECAC)	Texas native (east)	10-15	10-15	Low	High	Low	Moderately low (in), Moderately low (out)	7.2	1/5	Shrub/Tree; deciduous
Escarpment Live Oak	*Quercus fusiformis* (QUFU)	Texas native (central and south-central)	20-40	25-40	Low	Very High	High	Moderate (in)	9 (5)	5/2	Shrub/Tree; evergreen/semi-evergreen; susceptible to oak wilt
Fig	*Ficus carica* (FICA)	Mediterranean and western Asia	10-12	8-10	Medium	High	Medium	Dense (in) Moderately Low (out)	7	1/1	Shrub/Tree; invasive; produces fruit that attracts birds; listed in the Invasive Plant Atlas of the United States Chinese
Firethorn	*Pyracantha coccinea* (PYCO2)	Europe, southwestern Asia	6-10	4-8	Medium	High	Low	Moderately Dense (in)	7	1/11	Shrub; fruit that attract birds
Hackberry	*Celtis occidentalis* (CEOC)	Texas native (central and Panhandle)	40-60	30-50	Low-Medium	High	High	Dense (in) Moderate (out)	8	97/86	Shrub/Tree; deciduous; fruit attracts birds
Honey Mesquite	*Prosopis glandulosa* (PRGL2)	Texas native	25-30	20-30	Low	High	High	Low to Moderately Low (in) Low (out)	10	1/0	Shrub/Tree; deciduous; fruit attracts wildlife; thorns; invasive
Japanese privet	*Ligustrum japonicum* (LIJA)	Japan	20-25	7-10	Medium	High	Medium	Dense (in)	6	217/435	Shrub/Tree; evergreen
Lacey blue oak	*Quercus laceyi* (QULA)	Texas native (south-central)	30-35	30-35	Low	High	High	Moderate 9in) Moderate (out)	10	1/0	Shrub/Tree; deciduous; blue oak
Leyland cypress	*x Cuprocyparis leylandii* (HELE4)	Nonnative hybrid	30-50	8-15	Low	High	Moderate	Dense (in)	8	3/0	Tree; evergreen; listed as × *Hesperotropsis leylandii* by NRCS plan database

Loquat	*Eriobotrya japonica* (ERJA3)	China, Japan	10-15	10-15	Medium	High	Medium	Dense (in)	9	5/9	Tree; evergreen; produces fruit that attracts birds
Mexican sycamore	*Platanus mexicana*	Mexico (northeastern and central)	30-60	20-40	High	Medium-High	High	Dense (in leaf) Moderately Low (out of leaf)		2/3	Tree; deciduous
Monterrey oak	*Quercus polymorpha* (QUPO2)	Texas native (southwest)	35-45	25-40	Medium	High	High		9	20/8	Shrub/Tree; semi-evergreen; resistant to oak wilt and pests; Mexican white oak, netleaf white oak
Mountain Laurel	*Sophora secundiflora* (SOSE3)	Texas native (central and south)	8-12	4-8	Low-Medium	High	Medium-High	Moderate (in)	10	12/91	Shrub/Tree; evergreen, fragrant flowers; Texas mountain laurel
Mulberry	*Morus alba* (MOAL)	China, India	30-40	30-40	Medium	High	Medium	Dense (in) Moderate (out)	6	5/20	Tree; deciduous; fruit attracts birds; Texas invasives Organization lists native alternative as red mulberry; white mulberry, common mulberry
Oriental arborvitae	*Thuja orientalis* (THOR) *Platycladus orientalis*	China and Korea	15-20	10-15	Medium	High	Medium	Dense (in)	-	37/18	Shrub/Tree; evergreen
Osasge orange	*Maclura pomifera* (MAPO)	Texas native (east and central)	25-30	25-40	Medium	High	Medium	Dense (in) Moderate (out)	9	3/0	Shrub/Tree; deciduous; female produces fruit; Texas hedge-apple, horse apple; 3F
Peach	*Prunus persica* (PRPE3)	China	10-15	12-18	Medium	High	Medium (depends on rootstock)	Moderately Dense (in) Moderate (out)	4.4	1/0	Deciduous, produces fruit that attracts birds
Pecan	*Carya illinoinensis* (CAIL2)	Texas native (east and central)	80-95	50-60	High	High	Low	-Moderate (in) Moderately Low (out)	3.6	307/24	Tree; deciduous;

Pittosporum	*Pittosporum spp.* (PITTO)	Non-native; many species Australasia, Oceania, eastern Asia	8-10	8-10	Medium	High	High	Dense (in)	6	1/103	Shrub/Tree, evergreen
Post oak	*Quercus stellata* (QUST)	Texas native (east and central)	40-50	35-50	Low-Medium	High	High	Low to Moderately Low (in)	9	4/0	Tree, deciduous
Red-tipped photinia	*Photinia fraseri* (PHFR9)	Asia	10-15	7-10	Medium	High	Medium	Dense (in)	5.2	1/372	Shrub, evergreen; invasive species
Sabal palm	*Sabal mexicana* (SAME8)	Texas native (south)	30-50	15-18	Low-Medium	High	High	Moderately Low	6	119/66	Tree; evergreen; Texas sabal palm, Rio Grande palmetto
Shumard oak	*Quercus shumardii* (QUSH)	Texas native (central and east Texas)	50-90	40-50	Medium	High	High	Moderately Dense (in) Moderate (out)	6	3/1	Shrub/Tree; deciduous, susceptible to oak wilt
Slash pine	*Pinus elliottii* (PIEL)	Texas native (east) US	40-60	20-30	Medium	High	Low	Moderately Low (in)	5.2	6/0	Tree; evergreen
Southern live oak	*Quercus virginiana* (QUVI)	Texas native (southeast)	40-60	50	Low-Medium	High	Medium	Moderate (in)	8	1788/30	Tree; evergreen to partly deciduous; susceptible to oak wilt
Southern magnolia	*Magnolia grandiflora* (MAGR4)	Texas (southeast)	30-40	20-40	High	High	Low	Dense to Very Dense (in)	3.6	1/1	Tree; evergreen
Texas oak	*Quercus buckleyi* (QUBU2)	Texas (central and north central)	30-50	30-50	Low-Medium	High	Medium-High	Moderate to Moderately Dense (in)	6	163/3	Tree; deciduous; susceptible to oak wilt; Texas red oak
Vitex	*Vitex agnus-castus* (VIAG)	Europe and Asia	10-15	10-15	Low	High	High	Low to Moderately Dense (in) Low to Moderately Dense (out)	9	1/1	Shrub/Tree; deciduous; produces fruit that attracts birds; lilac chastetree, Texas lilac

Water oak	*Quercus nigra* (QUNI)	Texas native (east)	50-70	40-60	High	High	Low	Moderate to Moderately Dense (in) Low to Moderately Low (out)	6.2	1/0	Tree; deciduous; susceptible to oak wilt; pin oak
White ash	*Fraxinus americana* (FRAM2)	Texas native (east)	50-60	40-50	Medium	High	Low	Moderate (in) Moderately Low (out)	7	48/3	Tree; deciduous
Winged elm	*Ulmus alata* (ULAL)	Texas native (east)	30-60	25-45	Medium	High	Low	Moderate to Moderately Dense (in)	6	0/0	Tree; deciduous; susceptible to Dutch elm disease
Yaupon holly	*Ilex vomitoria* (ILVO)	Texas native (east)	10-20	8-12	Low-Medium	High	High	Dense (in)	9	11/191	Shrub/Tree; evergreen; female plants produce fruit that attracts birds

* The count is the number of trees and shrubs inventoried in the NHLD (Colón, M. et al., 2017). The count to the left of the virgule, or slash, is the number of trees while the count to the right of the slash is the number of shrubs.

Sources: (1) Texas A&M AgriLife Extension, Tree Selection and Planting Guide, WCMGA-Tree-Selection-and-Planting-Guide-FINAL.pdf (agrilife.org), accessed 27 January 2021.

(2) Texas A&M Forest Service, Trees of Texas, Texas A&M Forest Service - Trees of Texas - List of Trees (tamu.edu), accessed 27 January 2021

(3) Texas A&M Aggie Horticulture, Texas Native Trees (tamu.edu), accessed 28 January 2021

(4) Lady Bird Johnson Wildflower Center, Native Plants of North America - Lady Bird Johnson Wildflower Center, accessed 28 January 2021

(5) USDA Natural Resources Conservation Service, Welcome to the PLANTS Database | USDA PLANTS, accessed 28 January 2021

(6) California Polytechnic State University, Urban Forest Ecosystem Institute, SelecTree: A Tree Selection Guide UFEI - SelecTree: A Tree Selection Guide (calpoly.edu), accessed 28 January 2021

(7) Texas A&M University, Earth-Kind Landscaping, ekps.tamu.edu/details?id=193&region=zone_c, accessed 28 January 2021

Appendix B

NHLD Tree Species Maps

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TREE

American Elm

Ulmus americana
ULAM

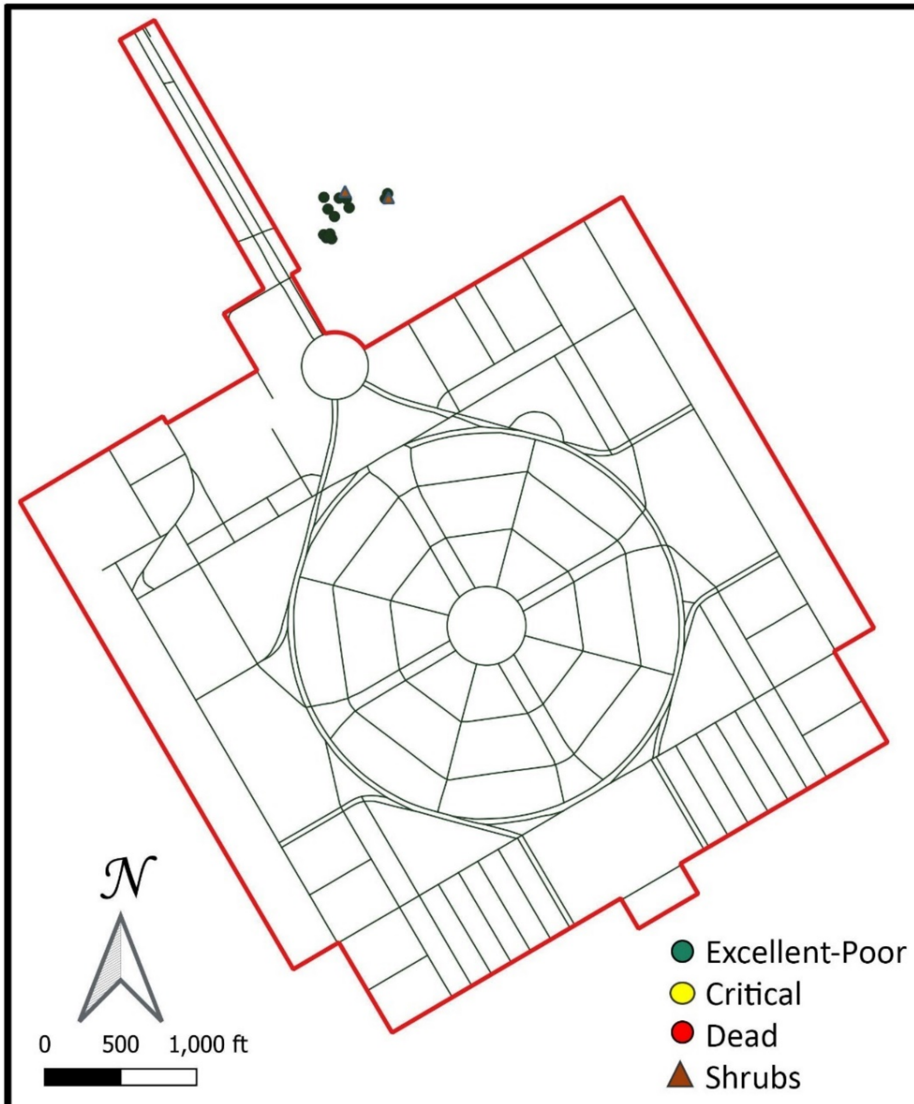
Texas Native
(east)

TAM NRI NHLD Inventory*

Total : 5 trees/0 shrubs
Average Height: 30 ft
Range of Heights: 22-37 ft

Condition
Excellent: 1
Good: 2
Fair: 2
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Arizona Cypress

Hesperocyparis arizonica
HEAR22

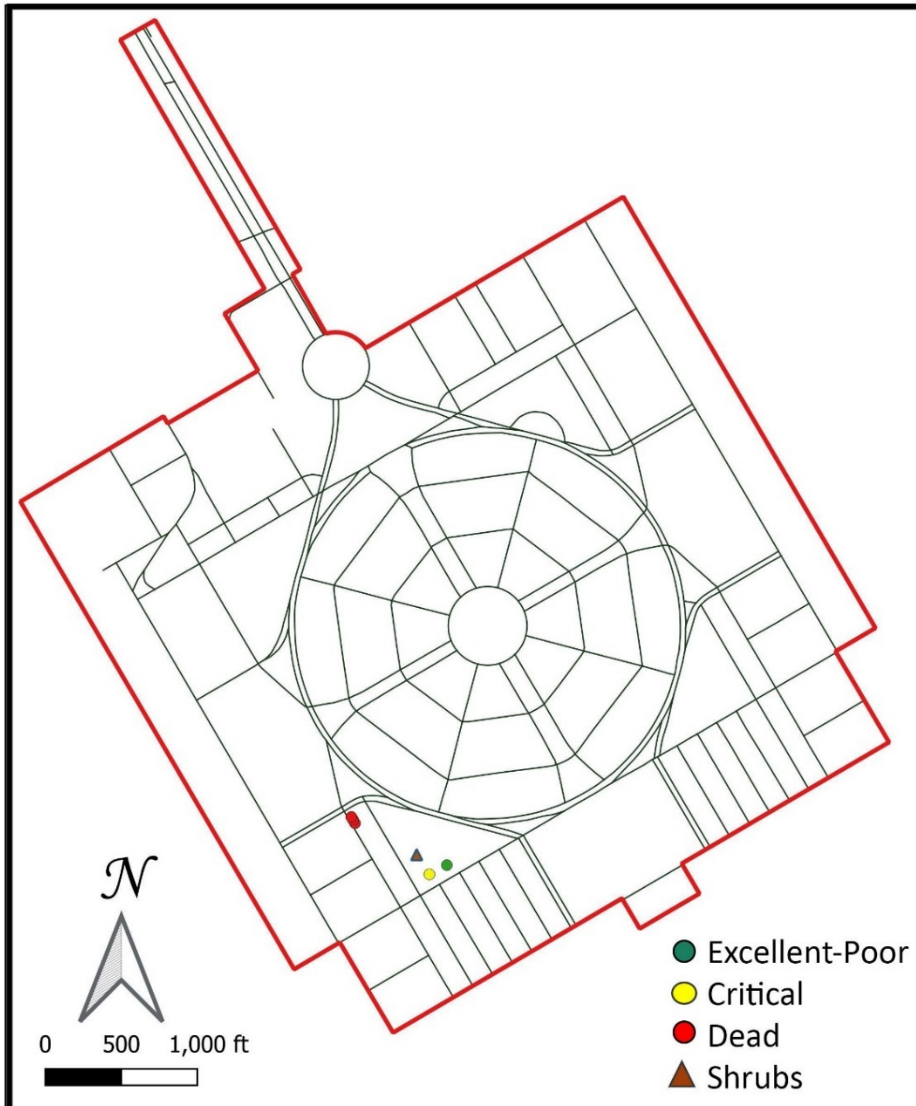
Texas Native
(west)

TAM NRI NHLD Inventory*

Total : 0 trees/0 shrubs
Average Height: na
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Ashe Juniper

Juniperus ashei
JUAS

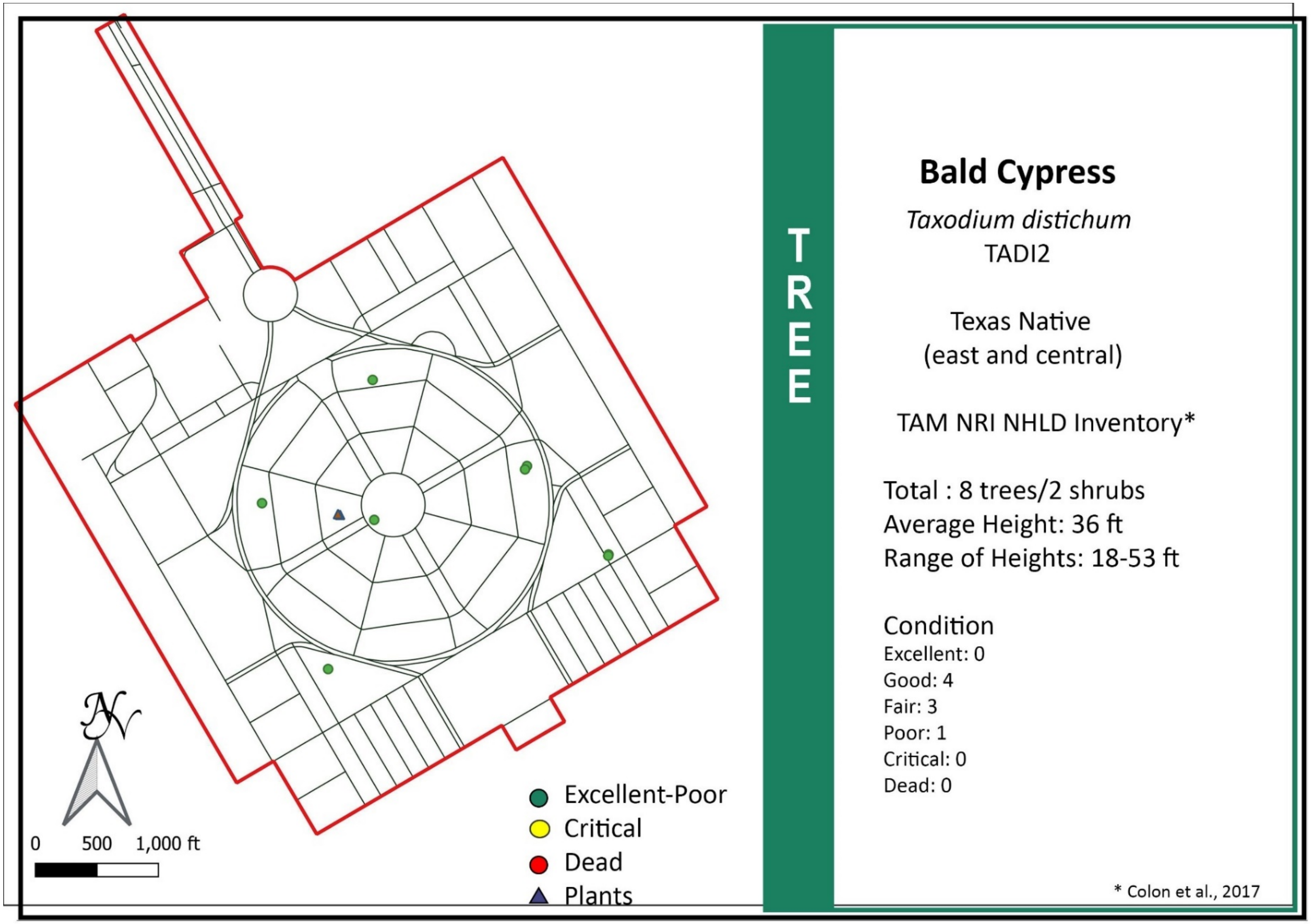
Texas Native
(central)

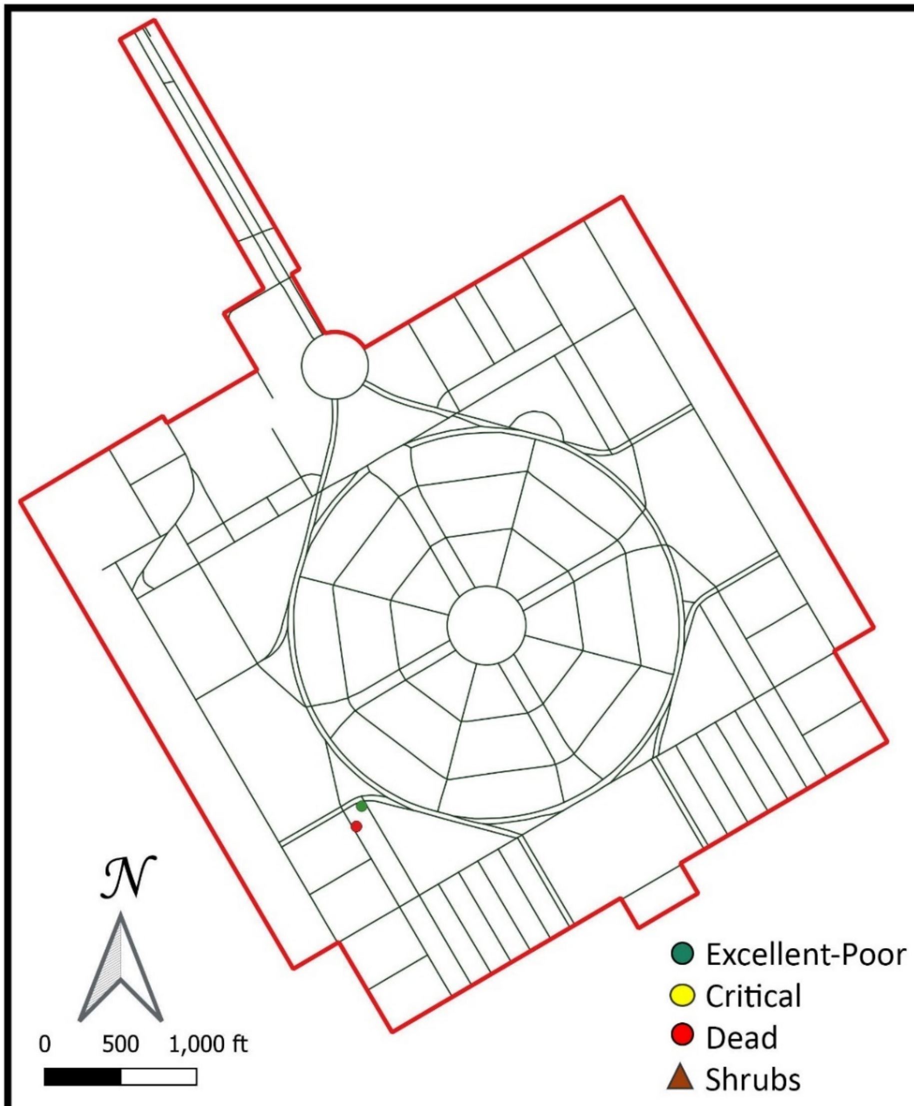
TAM NRI NHLD Inventory*

Total : 5 trees/1 shrub
Average Height: 24 ft
Range of Heights: 23-25

Condition
Excellent: 0
Good: 0
Fair: 0
Poor: 1
Critical: 1
Dead: 3

* Colon et al., 2017, NHLD only


TREE
Bald Cypress
Taxodium distichum
TADI2
Texas Native
(east and central)
TAM NRI NHLD Inventory*
Total : 8 trees/2 shrubs
Average Height: 36 ft
Range of Heights: 18-53 ft
Condition
Excellent: 0
Good: 4
Fair: 3
Poor: 1
Critical: 0
Dead: 0
* Colon et al., 2017
N
0
500
1,000 ft
Excellent-Poor
Critical
Dead
Plants



TREE

Blackjack Oak

Quercus marilandica
QUMA3

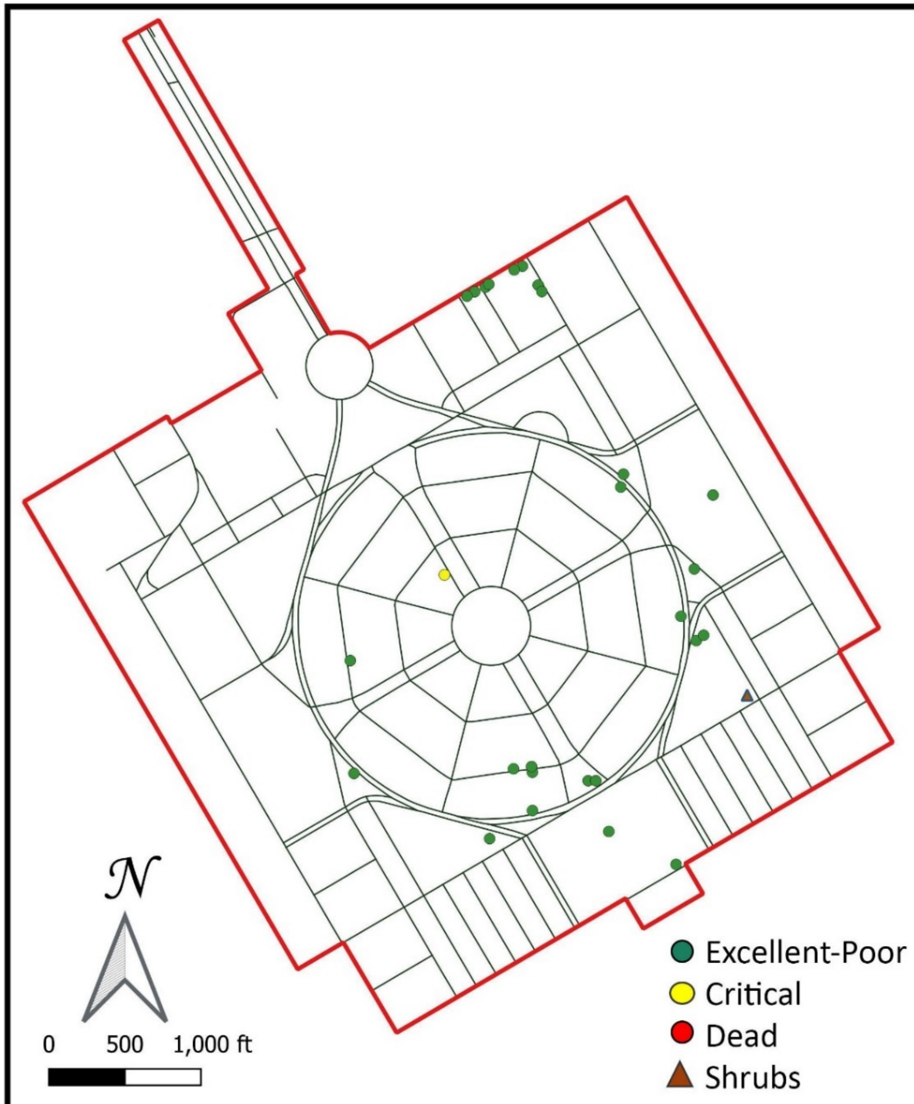
Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total : 2 trees/0 shrubs
Average Height: 29 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 1

* Colon et al., 2017, NHLD only



TREE

Bur Oak

Quercus macrocarpa
QUMA2

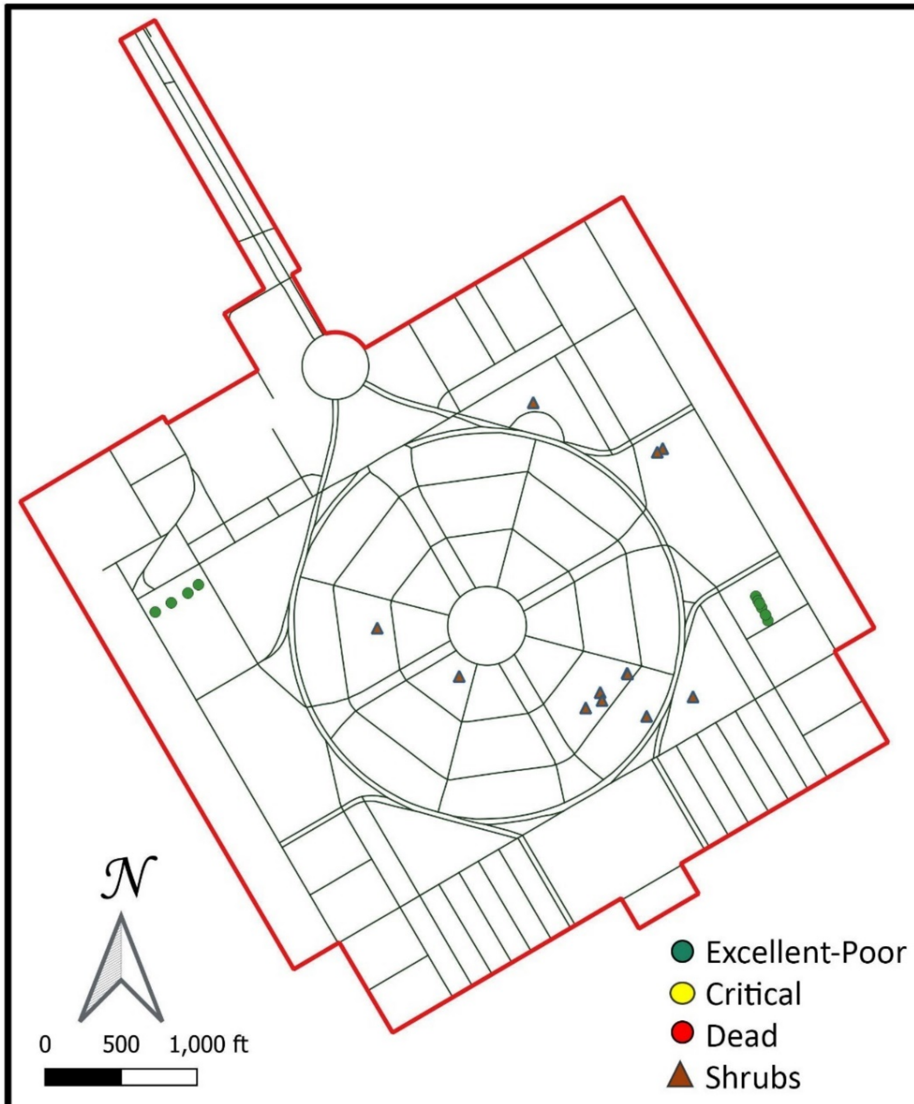
Texas Native
(central and northeast)

TAM NRI NHLD Inventory*

Total : 27 trees/1 shrub
Average Height: 30 ft
Range of Heights: 21-38 ft

Condition
Excellent: 1
Good: 18
Fair:4
Poor: 3
Critical: 1
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Callery Pear

Pyrus calleryana
PYCA80

Non-native
(China and Korea)

TAM NRI NHLD Inventory*

Total : 10 trees/12 shrubs
Average Height: 25 ft
Range of Heights: 18-33 ft

Condition
Excellent: 0
Good: 4
Fair: 4
Poor: 2
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Cedar Elm

Ulmus crassifolia
ULCR

Texas Native
(south and east)

TAM NRI NHLD Inventory*

Total : 79 trees/6 shrubs
Average Height: 30 ft
Range of Heights: 18-51 ft

Condition
Excellent: 5
Good: 46
Fair: 22
Poor: 4
Critical: 1
Dead: 1

* Colon et al., 2017, NHLD only

TREE

Chinaberry

Melia azedarach
MEAZ

Non-native
(Persia and southeast Asia)

TAM NRI NHLD Inventory*

Total : 14 trees/9 shrubs
Average Height: 33 ft
Range of Heights: 22-47 ft

Condition
Excellent: 0
Good: 8
Fair: 2
Poor: 1
Critical: 1
Dead: 2

* Colon et al., 2017, NHLD only

TREE

Chinese Elm

Ulmus parvifolia
ULPA

Non Native
(China, Japan, Korea)

TAM NRI NHLD Inventory*

Total: 1 tree/0 shrubs
Average Height: 26 ft
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Chinese Photinia

Photinia serratifolia
PHSE17

Non-native
(China, Japan, Philippines)

TAM NRI NHLD Inventory*

Total : 4 trees/10 shrubs
Average Height: 16 ft
Range of Heights: 14-18 ft

Condition
Excellent: 0
Good: 3
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Chinese Pistache

Pistacia chinensis
PICH4

Non-native
(China and Philippines)

TAM NRI NHLD Inventory*

Total : 27 trees/8 shrubs
Average Height: 24 ft
Range of Heights: 14-36

Condition
Excellent: 1
Good: 11
Fair: 11
Poor: 1
Critical: 3
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Chinese Privet

Ligustrum sinensis
LISI

Non-native
(China and Vietnam)

TAM NRI NHLD Inventory*

Total : 4 trees/45 shrubs
Average Height: 22 ft
Range of Heights: 20-25 ft

Condition
Excellent: 0
Good: 3
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Chinese Tallowtree

Triadica sebifera

TRSE6

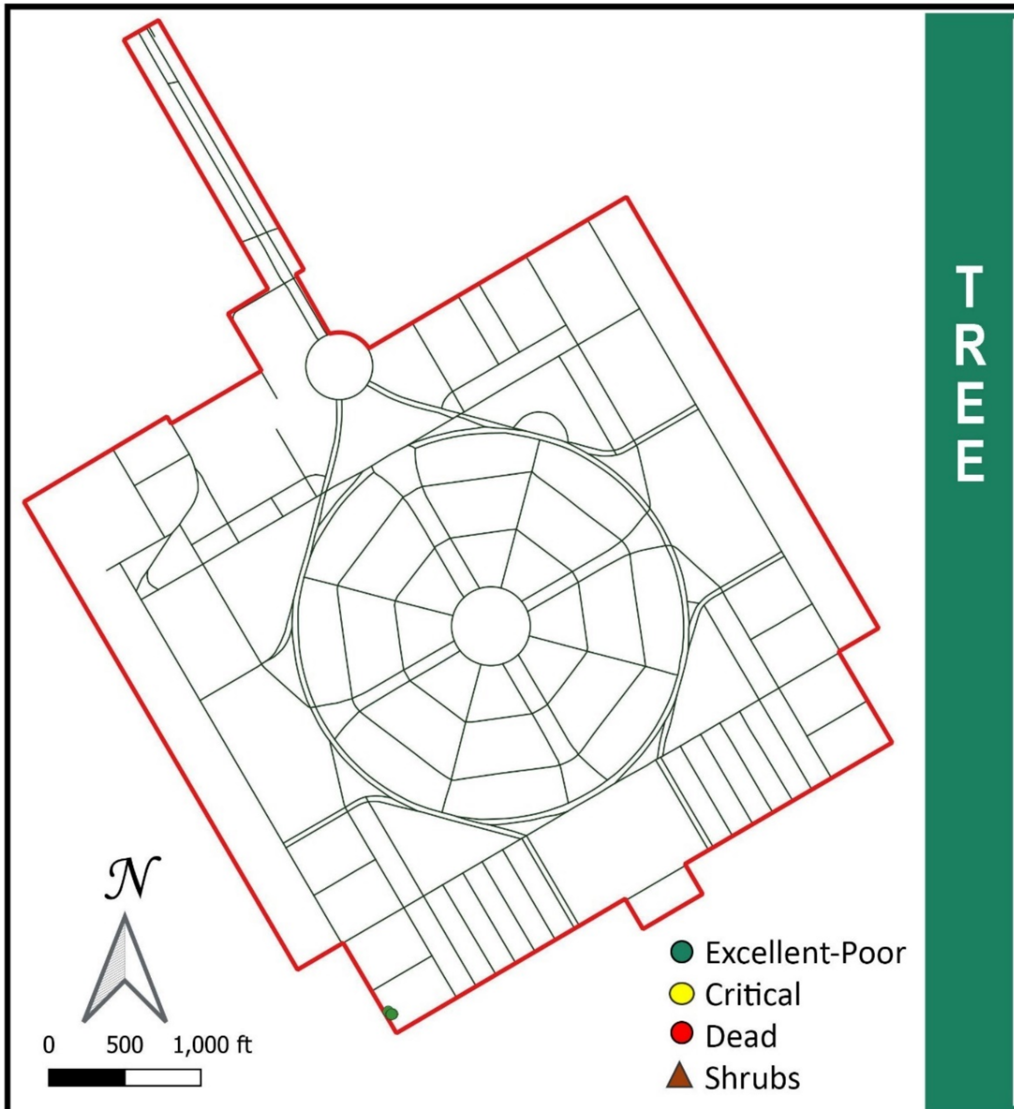
Non-native
(China and Japan)

TAM NRI NHLD Inventory*

Total: 24 trees/1 shrub
Average Height: 36 ft
Range of Heights: 29-47

Condition
Excellent: 0
Good: 8
Fair: 6
Poor: 6
Critical: 1
Dead: 3

* Colon et al., 2017, NHLD only



Cottonwood

Populus deltoides
PODE3

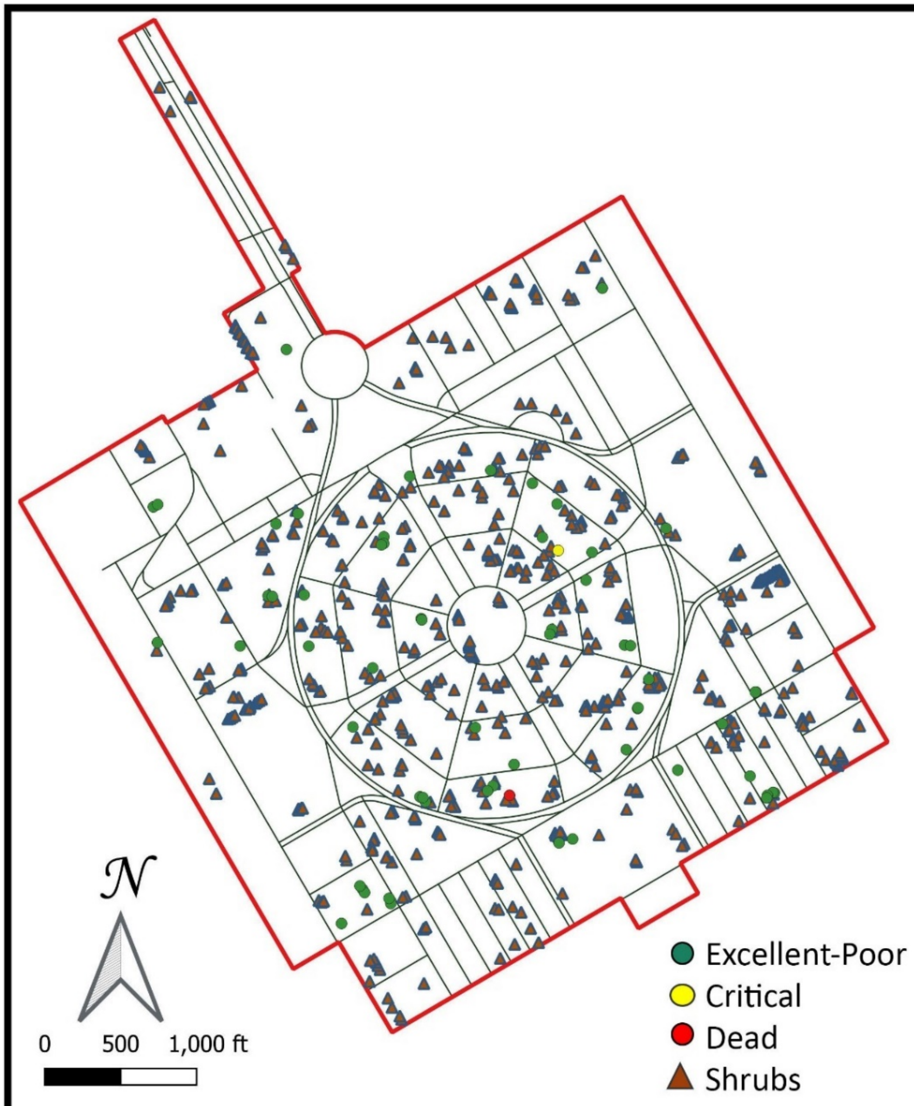
Texas Native
(east, central, west)

TAM NRI NHLD Inventory*

Total : 4 trees/0 shrubs
Average Height: 51 ft
Range of Heights: 45-54 ft

Condition
Excellent: 0
Good: 1
Fair: 3
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Crape Myrtle

Lagerstroemia indica
LAIN

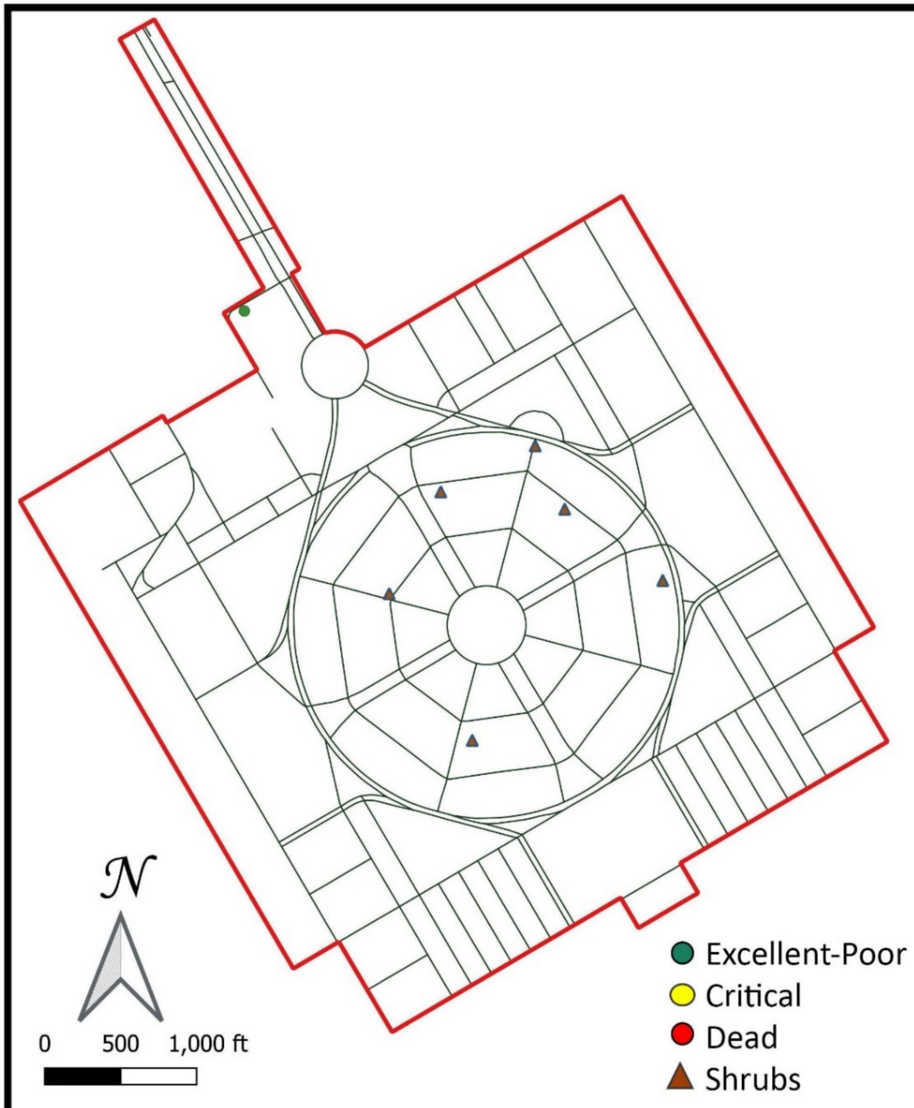
Non-native
(India, China, Korea, Japan)

TAM NRI NHLD Inventory*

Total : 62 trees/616 shrubs
Average Height: 25 ft
Range of Heights: 15-36 ft

Condition
Excellent: 16
Good: 38
Fair: 5
Poor: 1
Critical: 1
Dead: 1

* Colon et al., 2017, NHLD only



TREE

Desert Willow

Chilopsis linearis
CHLI2

Texas Native
(west)

TAM NRI NHLD Inventory*

Total : 1 tree/6 shrubs
Average Height: 17 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Eastern Red Cedar

Juniperus virginiana
JUVI

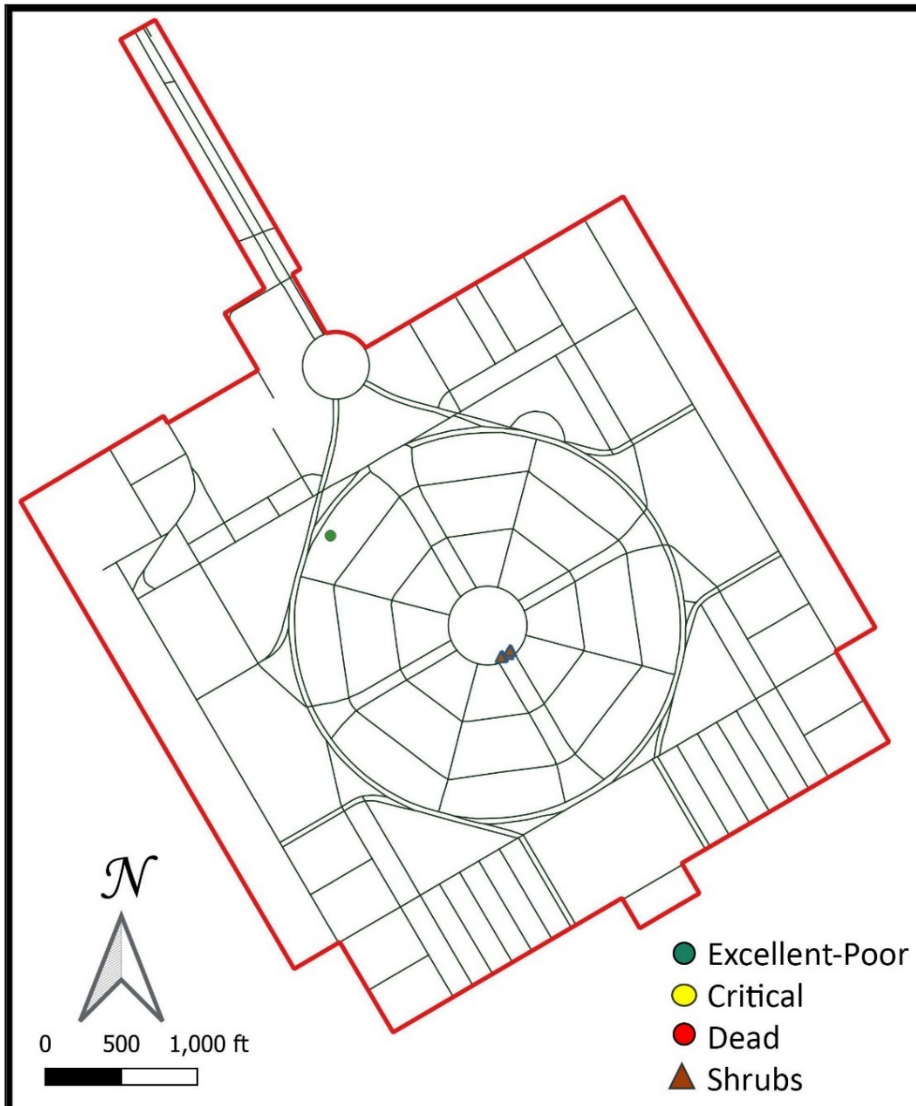
Texas Native
(east)

TAM NRI NHLD Inventory*

Total : 59 trees/10 shrubs
Average Height: 32 ft
Range of Heights: 12-50 ft

Condition
Excellent: 4
Good: 14
Fair: 18
Poor: 9
Critical: 5
Dead: 9

* Colon et al., 2017, NHLD only



TREE

Eastern Redbud

Cercis canadensis
CECAC

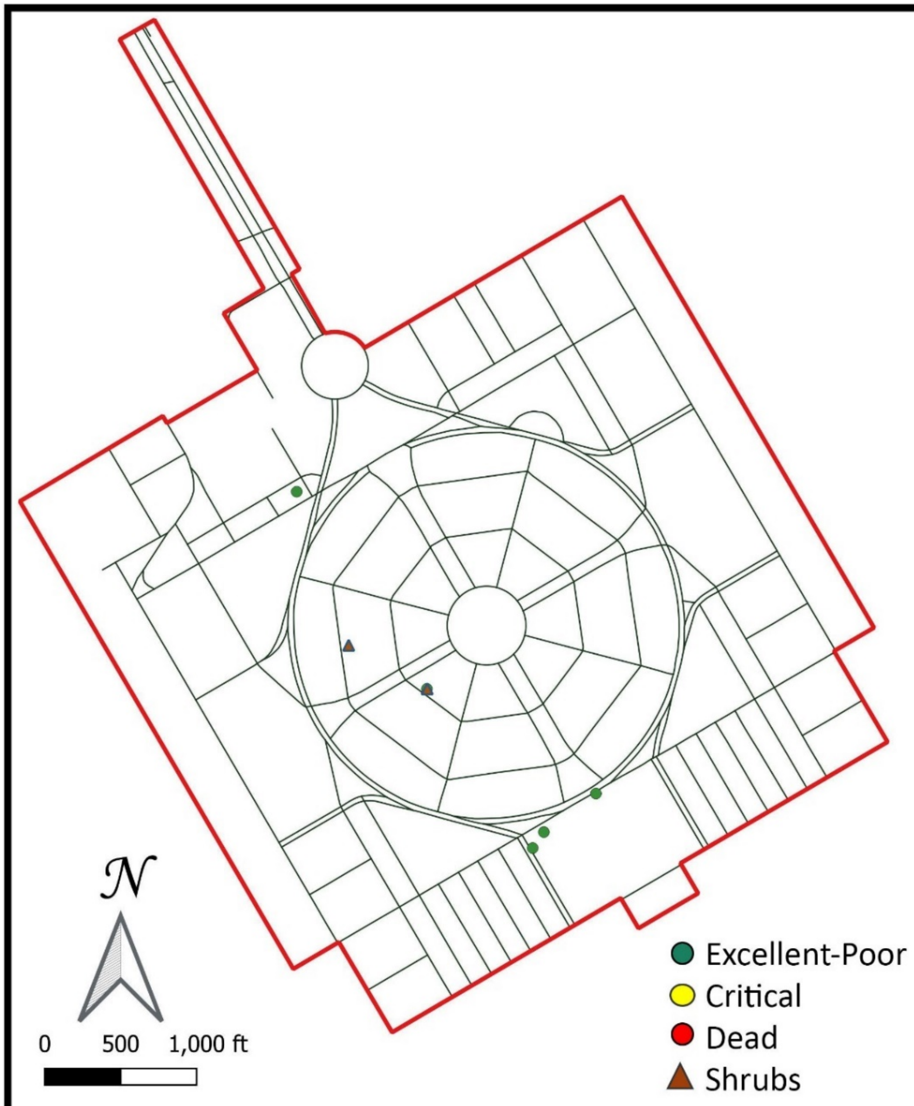
Texas Native
(east)

TAM NRI NHLD Inventory*

Total : 1 tree/5 shrubs
Average Height: 22 ft
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 0
Poor: 0
Critical: 1
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Escarpment Live Oak

Quercus fusiformis
QUFU

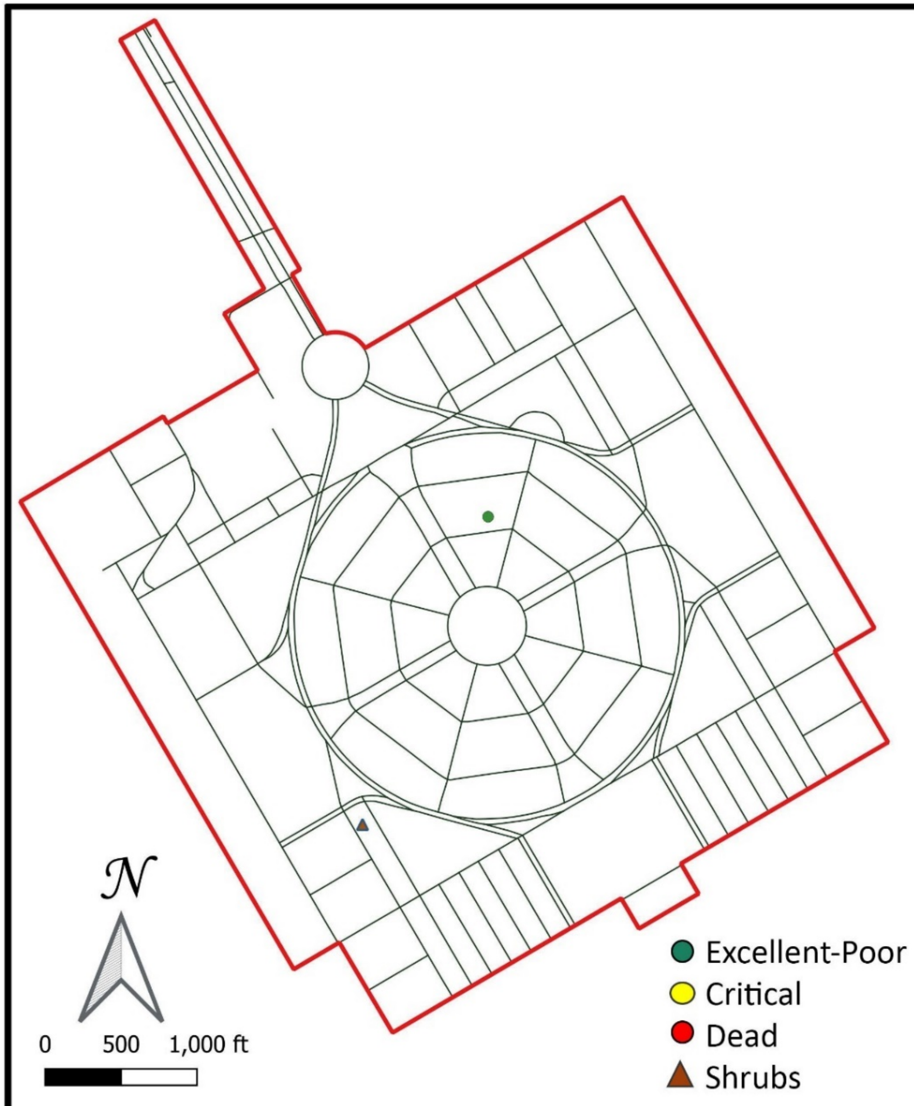
Texas Native
(central and south-central)

TAM NRI NHLD Inventory*

Total: 5 trees/2 shrubs
Average Height: 30 ft
Range of Heights: 20-40 ft

Condition
Excellent: 0
Good: 3
Fair: 2
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Fig

Ficus carica
FICA

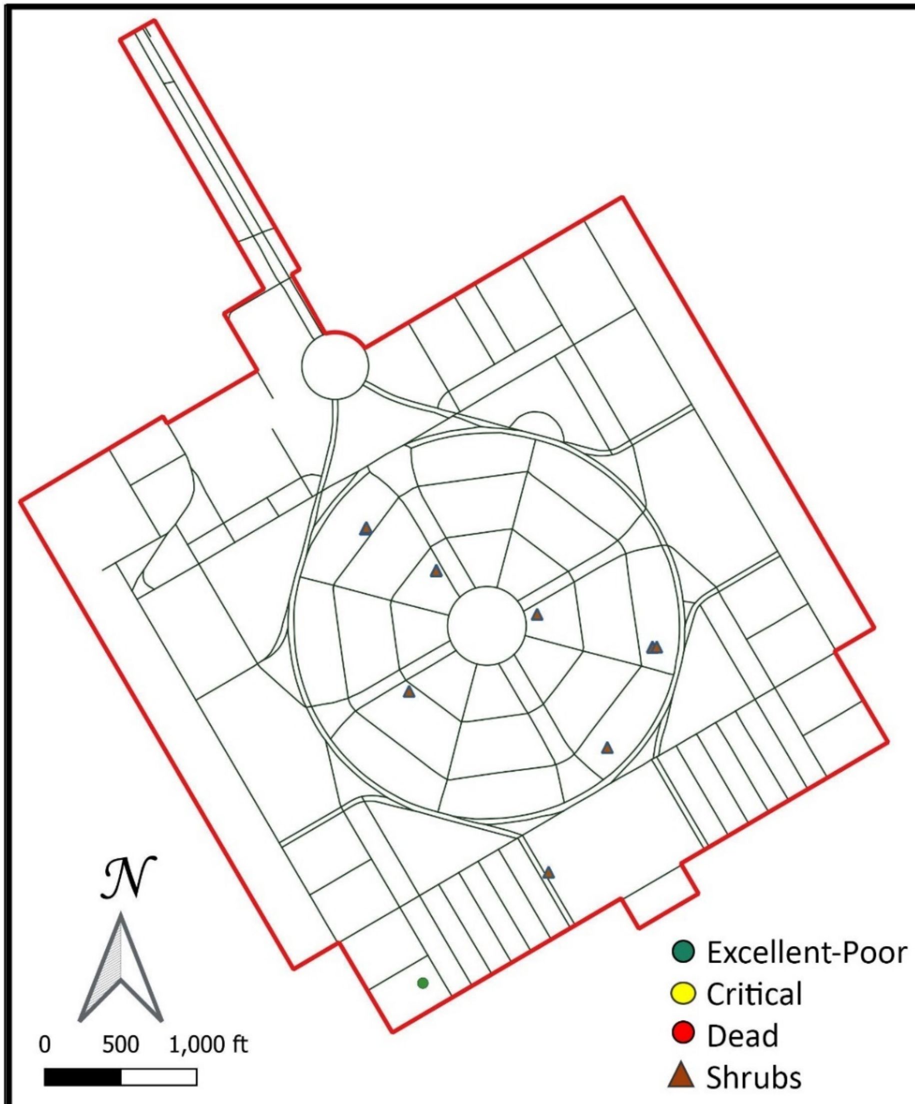
Non Native
(western Asia)

TAM NRI NHLD Inventory*

Total: 1 tree/1 shrub
Average Height: 17 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Firethorn

Pyracantha coccinea
PYCO2

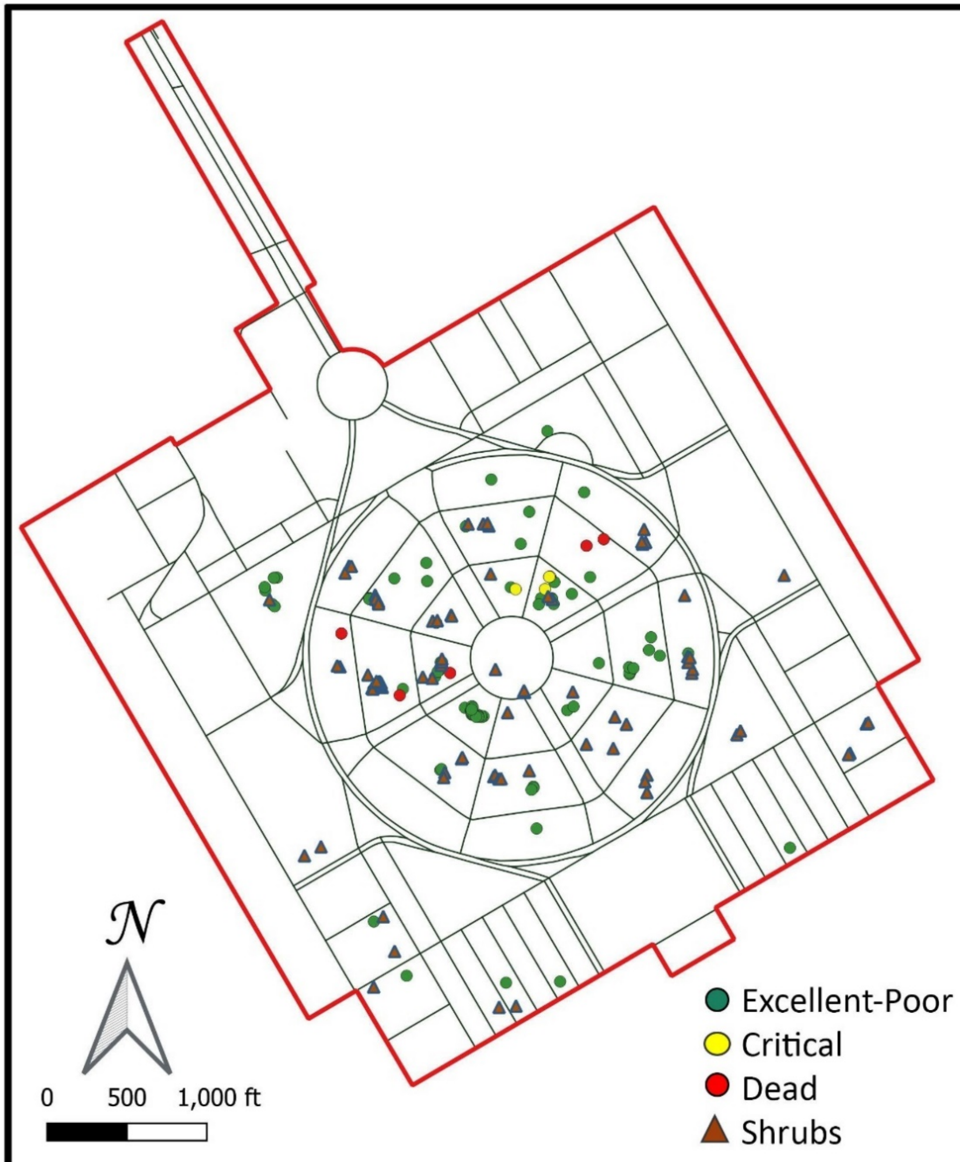
Non-native
(Eurasia)

TAM NRI NHLD Inventory*

Total: 1 tree/11 shrubs
Average Height: 17 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Hackberry

Celtis occidentalis
CEOC

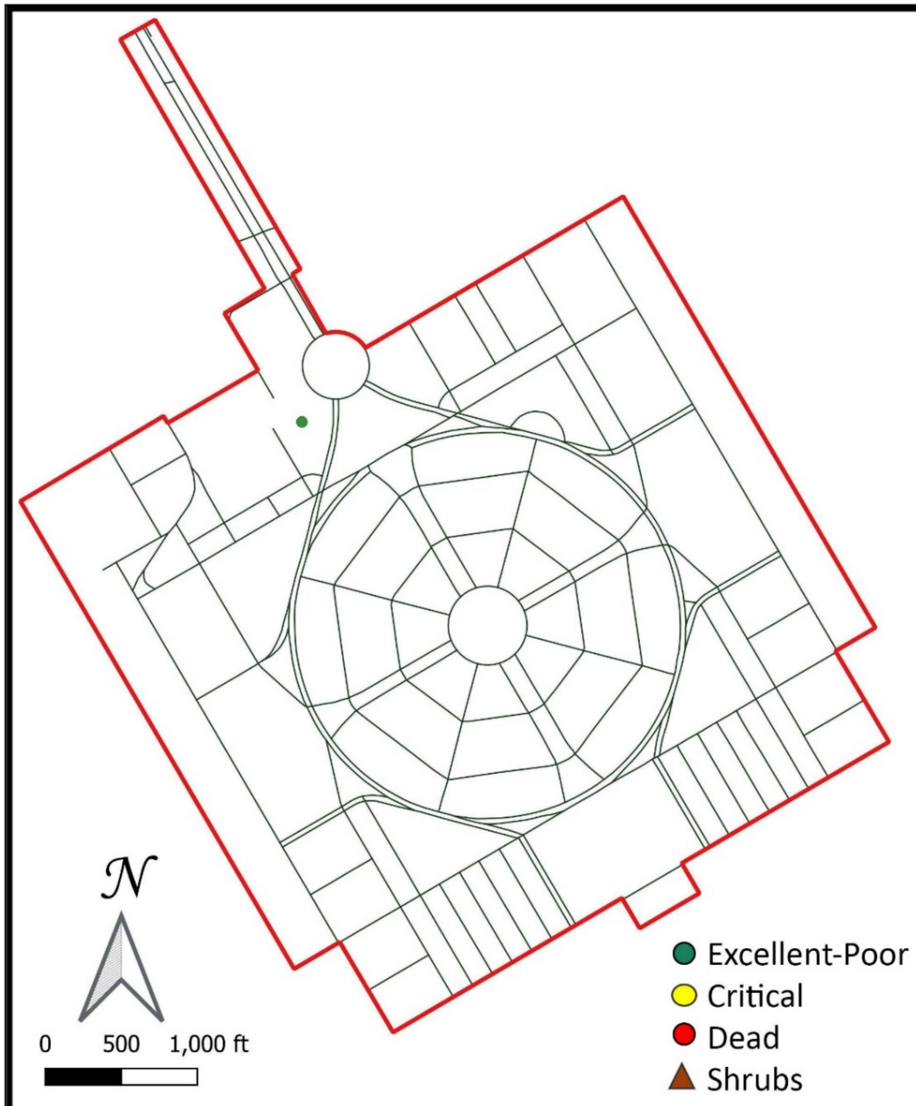
Texas Native
(central, Panhandle)

TAM NRI NHLD Inventory*

Total: 97 trees/86 shrubs
Average Height: 32 ft
Range of Heights: 17-55 ft

Condition
Excellent: 4
Good: 32
Fair: 35
Poor: 17
Critical: 4
Dead: 5

* Colon et al., 2017, NHLD only



TREE

Honey Mesquite

Prosopis glandulosa

PRGL2

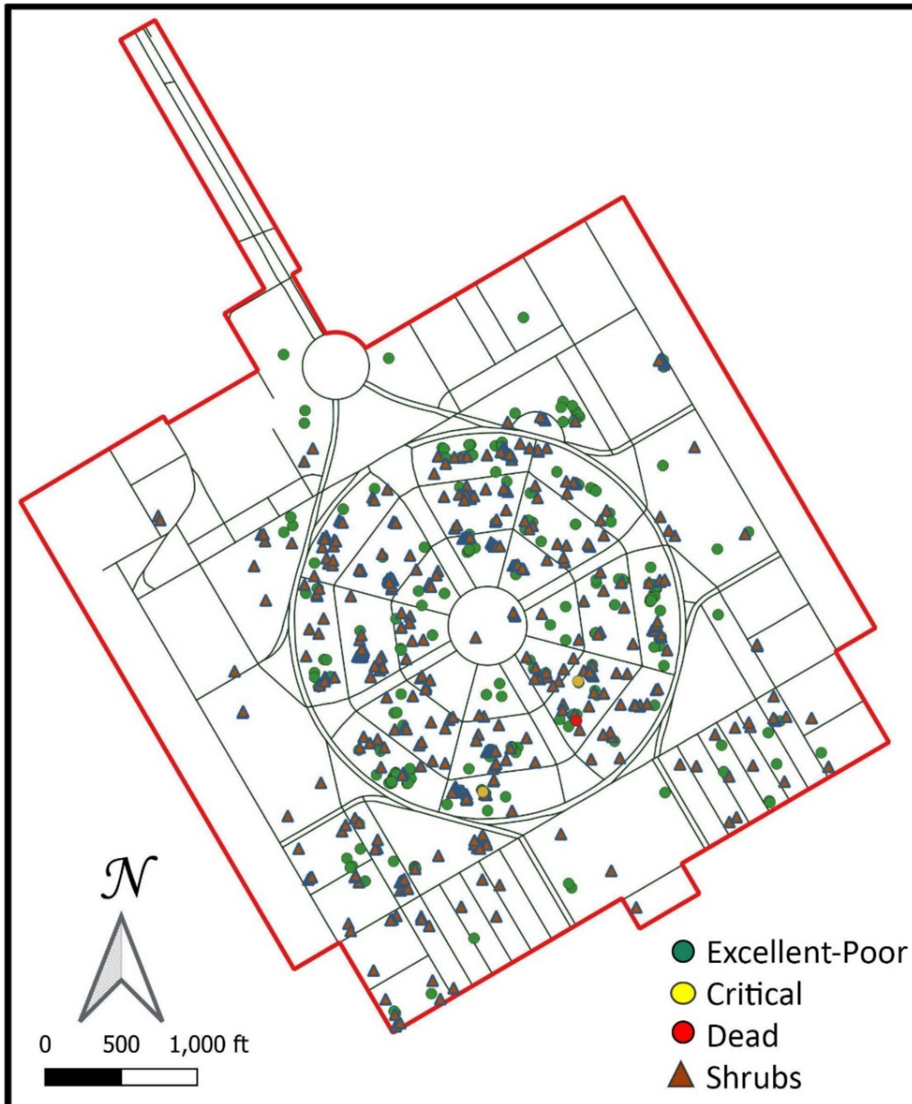
Texas Native

TAM NRI NHLD Inventory*

Total: 1 tree/0 shrubs
Average Height: 25 ft
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Japanese Privet

Ligustrum japonicum
LIJA

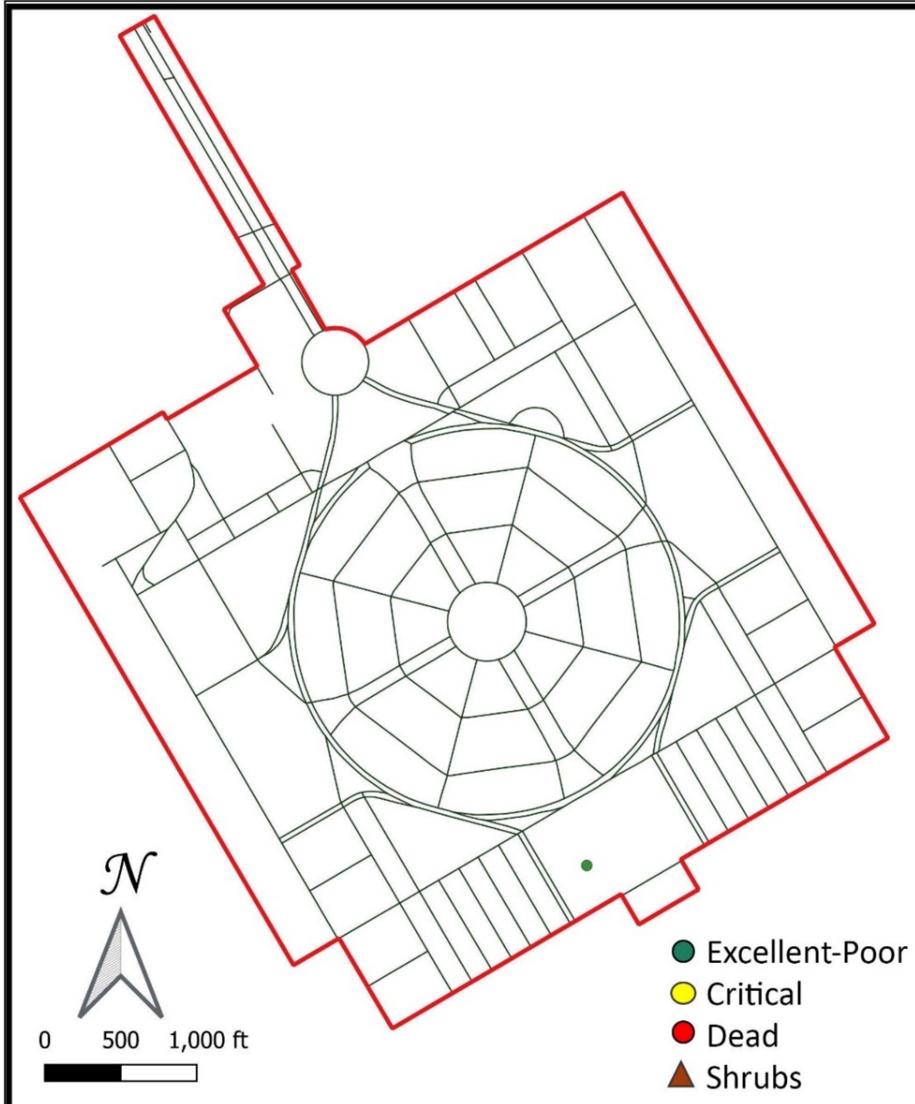
Non Native
(Japan)

TAM NRI NHLD Inventory*

Total: 217 trees/435 shrubs
Average Height: 26 ft
Range of Heights: 13-41 ft

Condition
Excellent: 1
Good: 83
Fair: 90
Poor: 40
Critical: 2
Dead: 1

* Colon et al., 2017 NHLD only



TREE

Lacey Blue Oak

Quercus laceyi
QULA

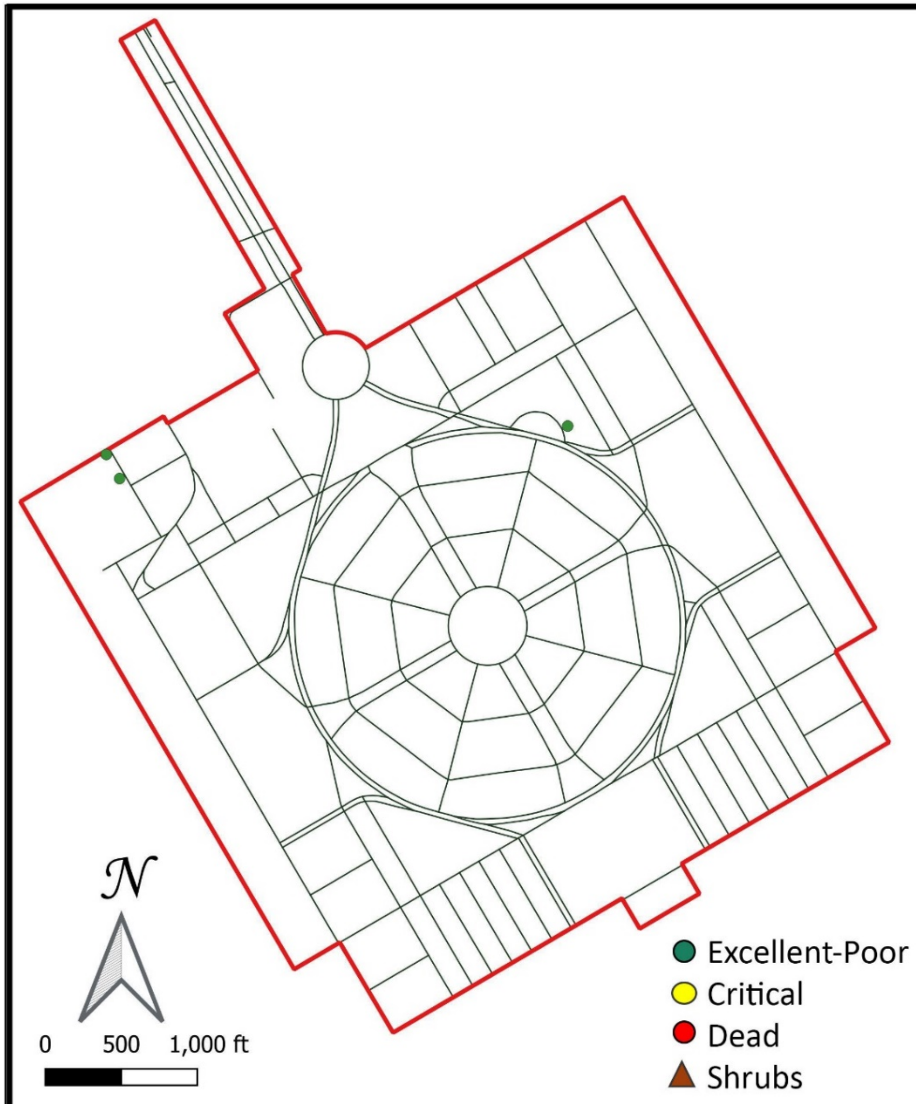
Texas Native
(south-central)

TAM NRI NHLD Inventory*

Total: 1 tree/0 shrubs
Average Height: 22 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al 2017, NHLD only



TREE

Leyland Cypress

x Cuprocyparis leyandii
HELE4

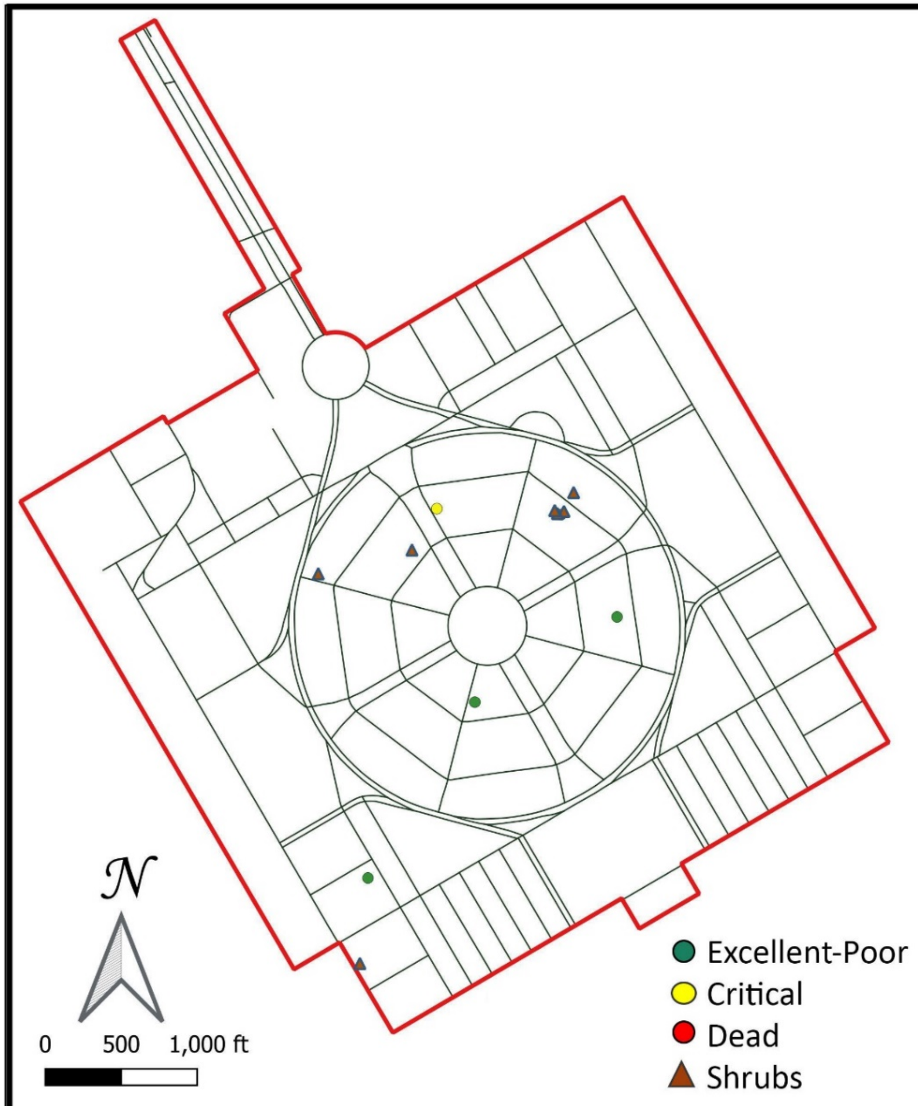
Non Native
(hybrid)

TAM NRI NHLD Inventory*

Total: 3 trees/0 shrubs
Average Height: 50 ft
Range of Heights: 48-51 ft

Condition
Excellent: 1
Good: 2
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Loquot

Eriobotrya japonica
ERJA3

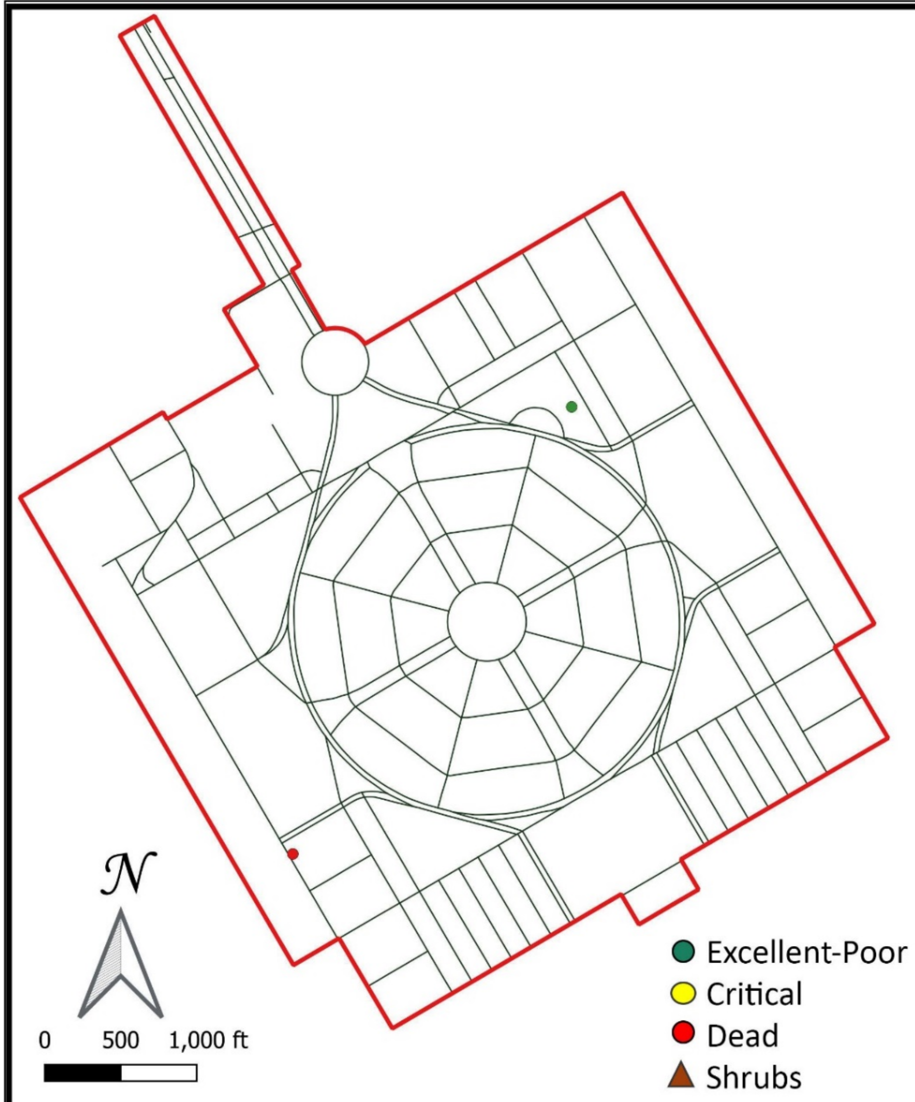
Non Native
(China, Japan)

TAM NRI NHLD Inventory*

Total: 5 trees/9 shrubs
Average Height: 20 ft
Range of Heights: 16-24 ft

Condition
Excellent: 0
Good: 2
Fair: 0
Poor: 2
Critical: 1
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Mexican Sycamore

Platanus mexicana

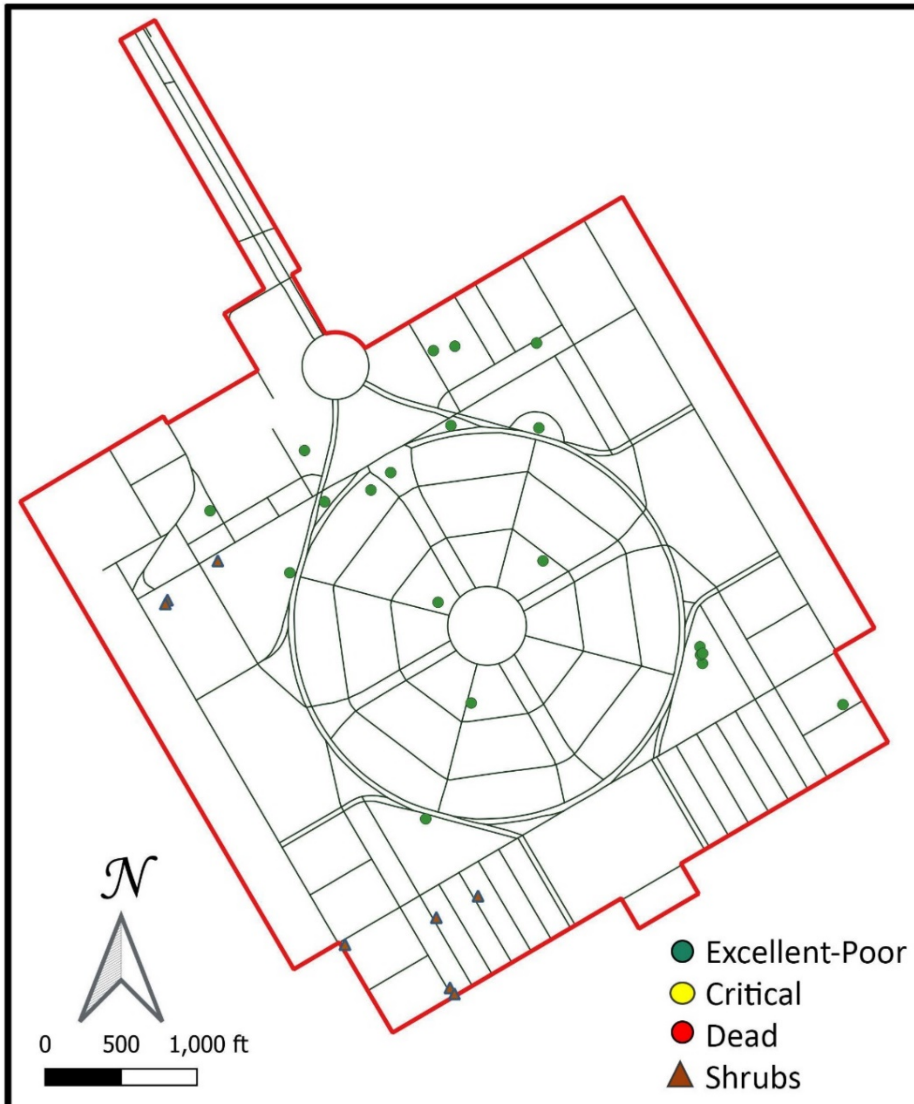
Non-native
(northeastern and central Mexico)

TAM NRI NHLD Inventory*

Total: 2 trees/0 shrubs
Average Height: 57 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 1

* Colon et al., 2017, NHLD only



TREE

Monterrey Oak

Quercus polymorpha
QUPO2

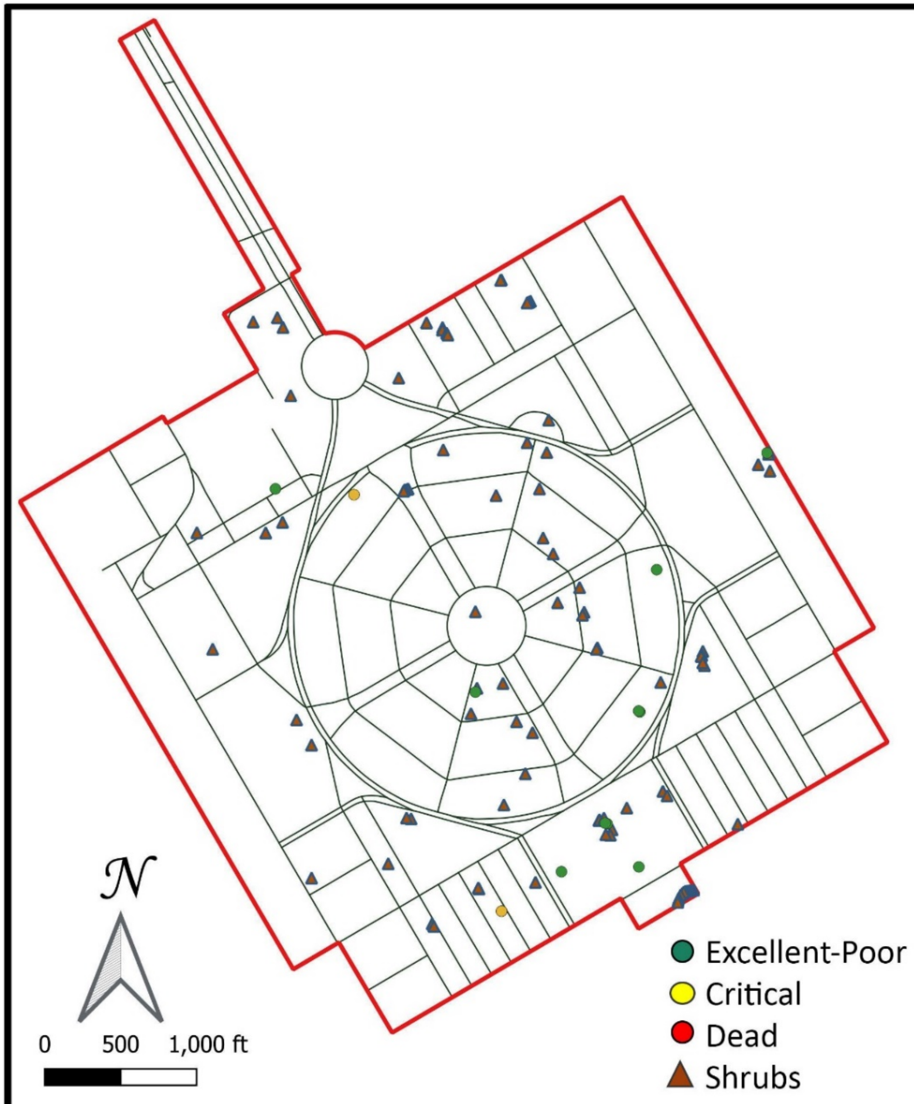
Texas Native
(southwest)

TAM NRI NHLD Inventory*

Total: 20 trees/8 shrubs
Average Height: 28 ft
Range of Heights: 19-40 ft

Condition
Excellent: 3
Good: 10
Fair: 6
Poor: 1
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Mountain Laurel

Sophora secundiflora
SOSE3

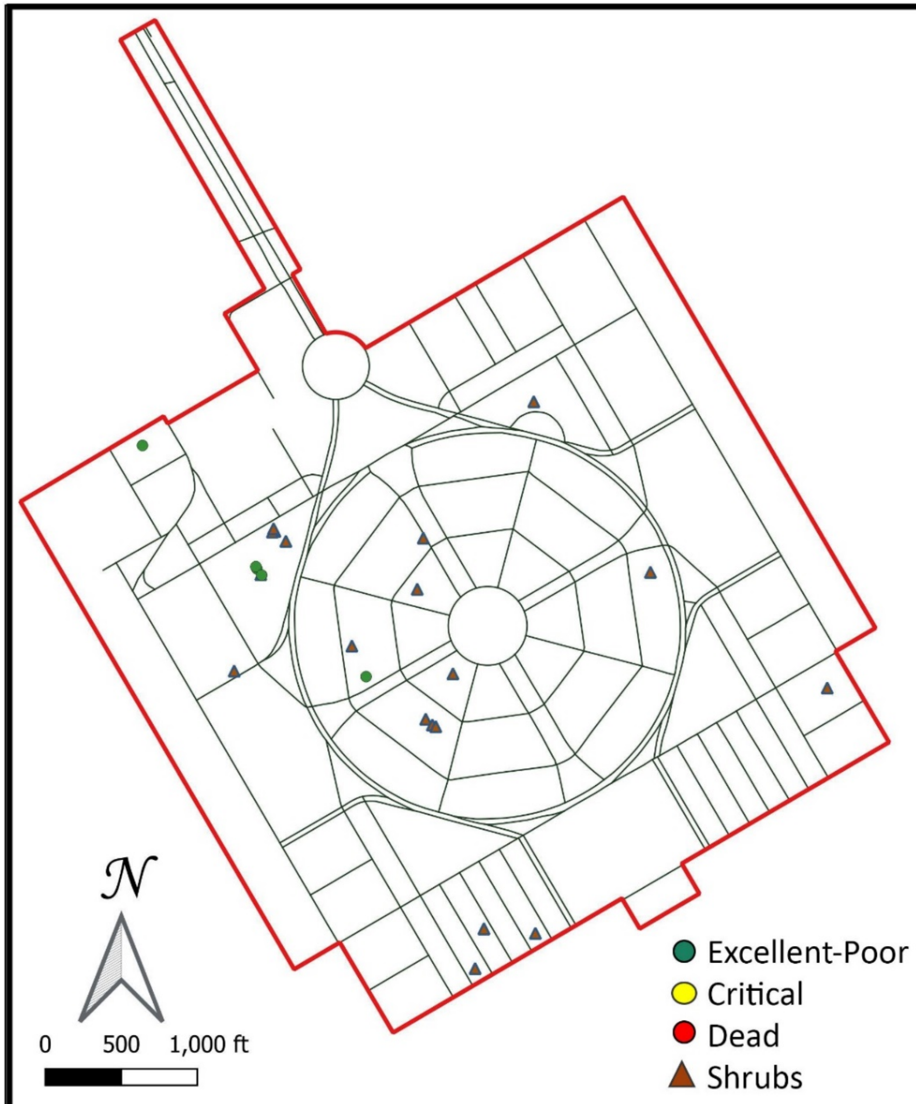
Texas Native
(central and south)

TAM NRI NHLD Inventory*

Total : 12 trees/91 shrubs
Average Height: 28 ft
Range of Heights: 19-40 ft

Condition
Excellent: 2
Good: 7
Fair: 1
Poor: 0
Critical: 2
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Mulberry

Morus alba
MOAL

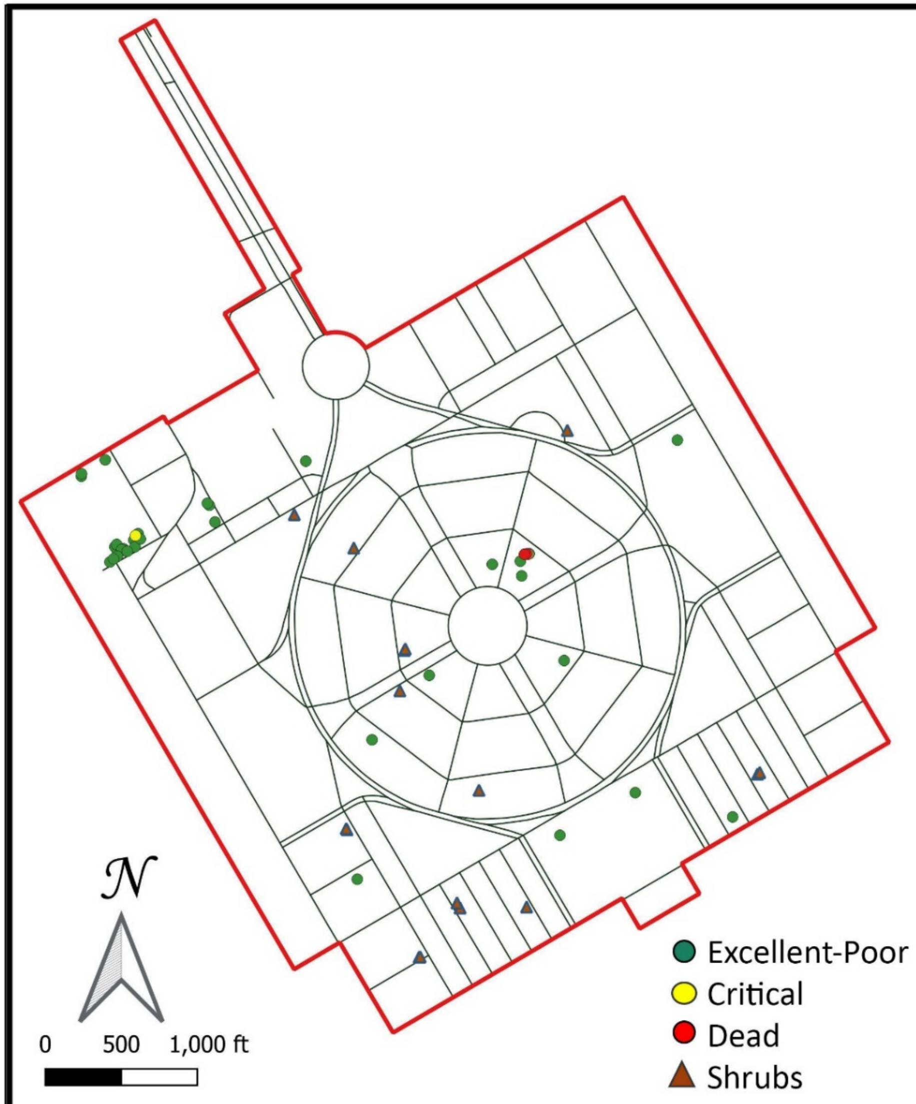
Non-native
(China and India)

TAM NRI NHLD Inventory*

Total: 5 trees/20 shrubs
Average Height: 25 ft
Range of Heights: 19-30 ft

Condition
Excellent: 1
Good: 1
Fair: 3
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Oriental Arborvitae

Thuja orientalis
THOR

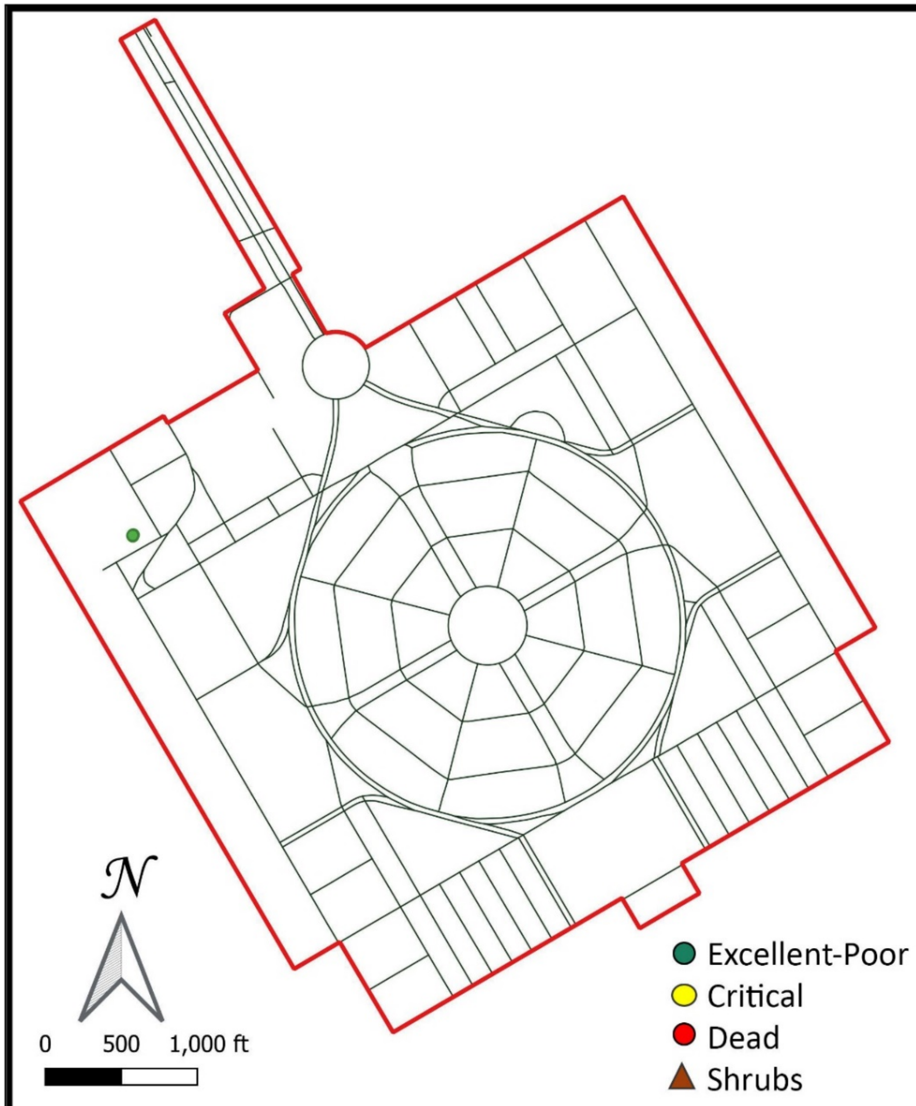
Non Native
(China and Korea)

TAM NRI NHLD Inventory*

Total: 37 trees/18 shrubs
Average Height: 25 ft
Range of Heights: 16-42 ft

Condition
Excellent: 1
Good: 3
Fair: 16
Poor: 13
Critical: 2
Dead: 2

* Colon et al., 2017, NHLD only



TREE

Osage Orange

Maclura pomifera
MAPO

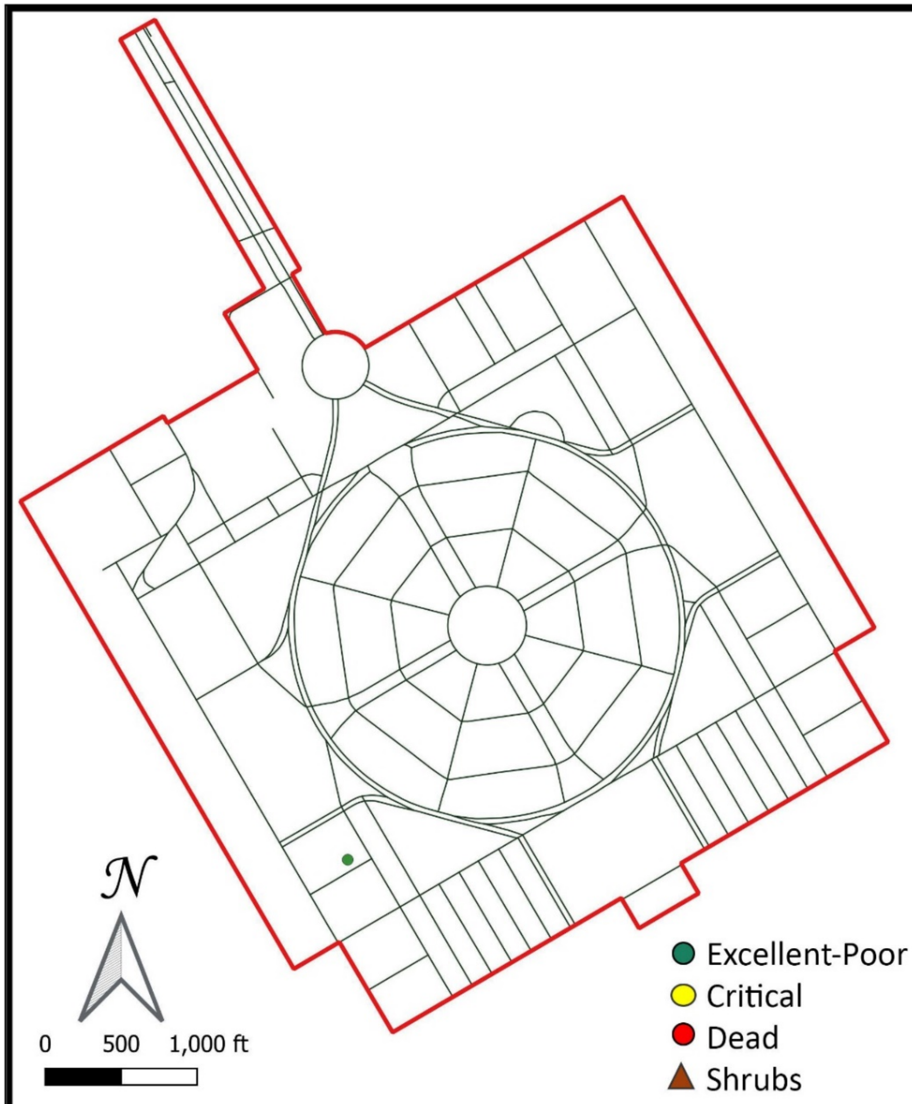
Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total: 3 trees/0 shrubs
Average Height: 39 ft
Range of Heights: 39-39 ft

Condition
Excellent: 0
Good: 0
Fair: 3
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Peach

Prunus persica

PRPE

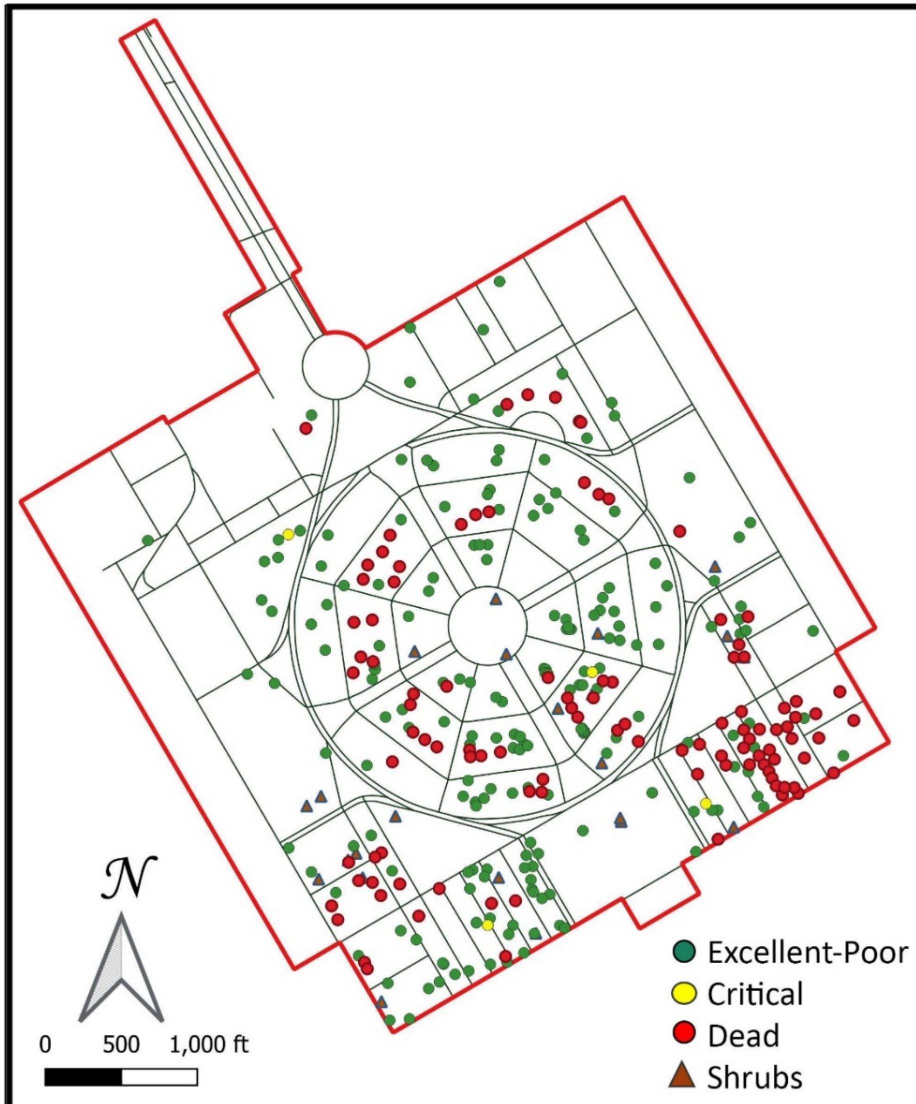
Non Native
(China)

TAM NRI NHLD Inventory*

Total: 1 tree/0 shrubs
Average Height: na
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Pecan

Carya illinoinensis
CAIL2

Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total: 307 trees/24 shrubs
Average Height: 41 ft
Range of Heights: 19-64 ft

Condition
Excellent: 12
Good: 87
Fair: 76
Poor: 22
Critical: 5
Dead: 105

* Colon et al., 2017, NHLD only

TREE

Pittosporum

Pittosporum spp.
PITTO

Non Native
(Asia, Oceania)

TAM NRI NHLD Inventory*

Total: 1 tree/103 shrubs
Average Height: 22 ft
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Post Oak

Querus stellata
QUST

Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total: 4 trees/0 shrubs
Average Height: 32 ft
Range of Heights: 31-33 ft

Condition
Excellent: 0
Good: 2
Fair: 2
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Red-tipped Photinia

Photinia fraseri
PHFR9

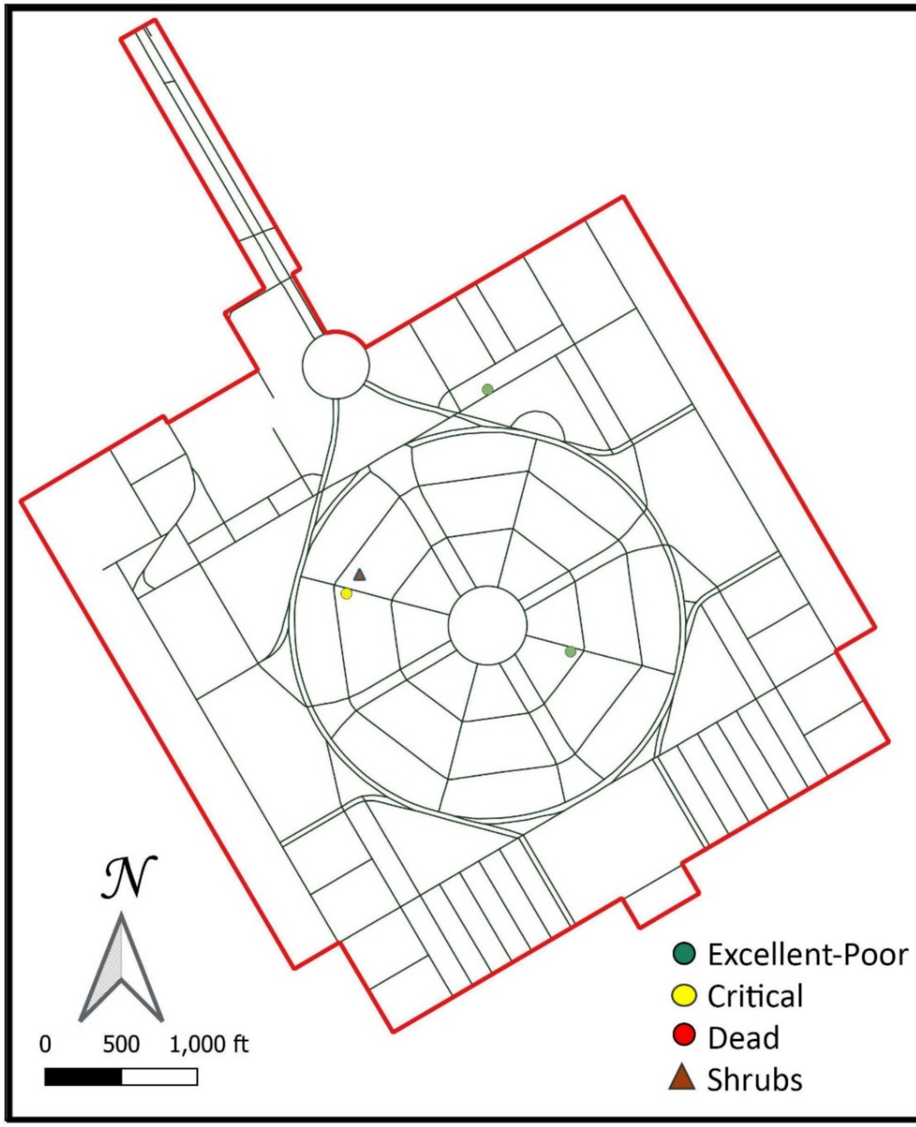
Non-native
(Asia)

TAM NRI NHLD Inventory*

Total: 1 tree/372 shrubs
Average Height: 20 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Shumard Oak

Querus schumardii
QUSH

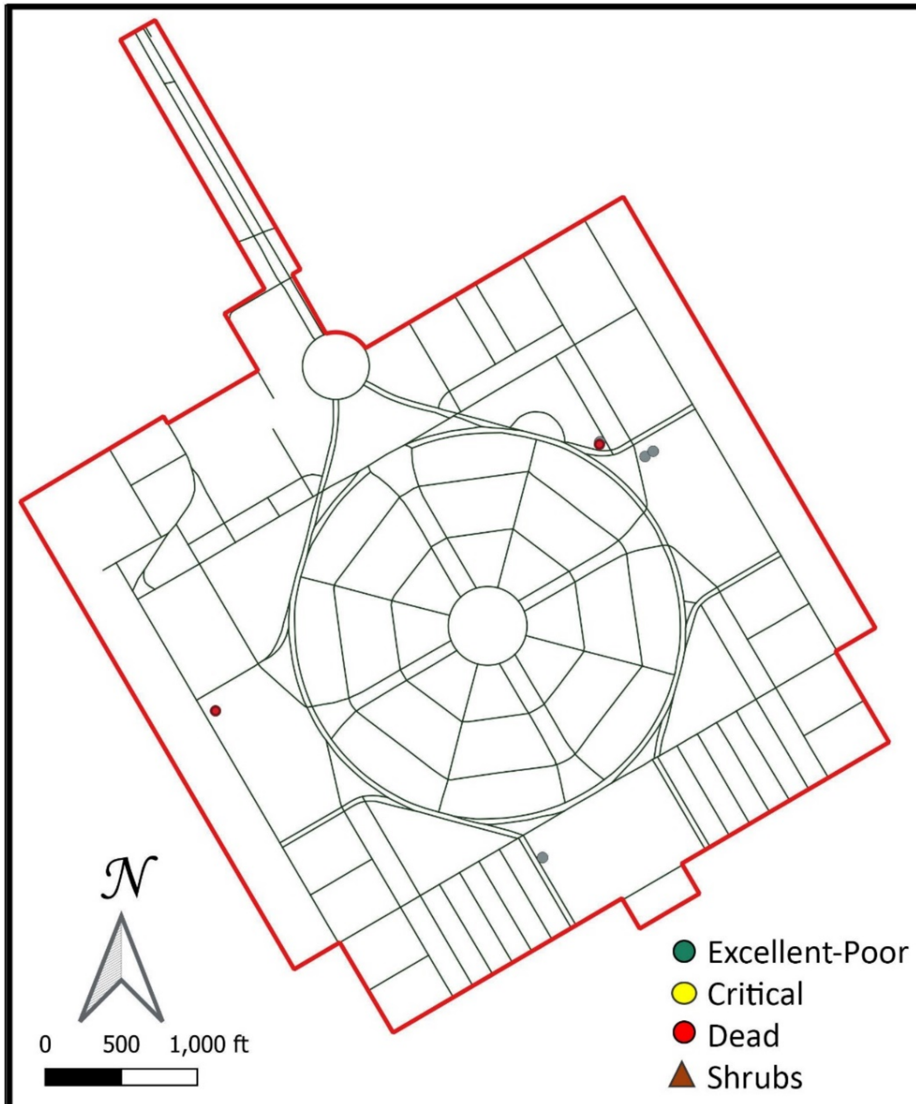
Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total: 3 trees/1 shrub
Average Height: 32 ft
Range of Heights: 29-35 ft

Condition
Excellent: 0
Good: 0
Fair: 1
Poor: 1
Critical: 1
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Slash Pine

Pinus elliottii
PIEL

Texas Native
(east)

TAM NRI NHLD Inventory*

Total: 6 trees/ 0 shrubs
Average Height: 40 ft
Range of Heights: 29-49 ft

Condition
Excellent: 0
Good: 0
Fair: 4
Poor: 0
Critical: 0
Dead: 2

* Colon et al., 2017, NHLD only

TREE

Southern Live Oak

Quercus virginiana
QUVI

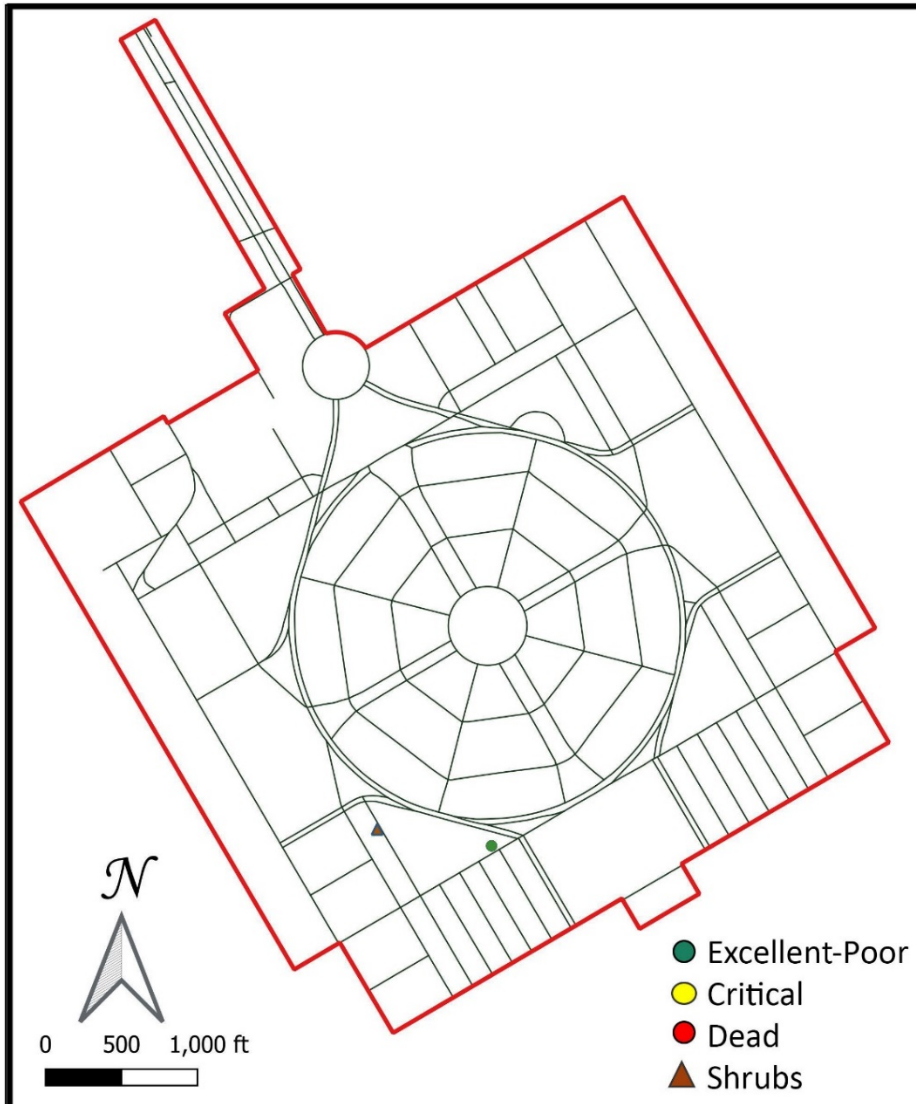
Texas Native
(southeast)

TAM NRI NHLD Inventory*

Total: 1788 trees/30 shrubs
Average Height: 35 ft
Range of Heights: 14-61 ft

Condition
Excellent: 96
Good: 776
Fair: 686
Poor: 172
Critical: 23
Dead: 35

* Colon et al., 2017, NHLD only



TREE

Southern Magnolia

Magnolia grandiflora
MAGR4

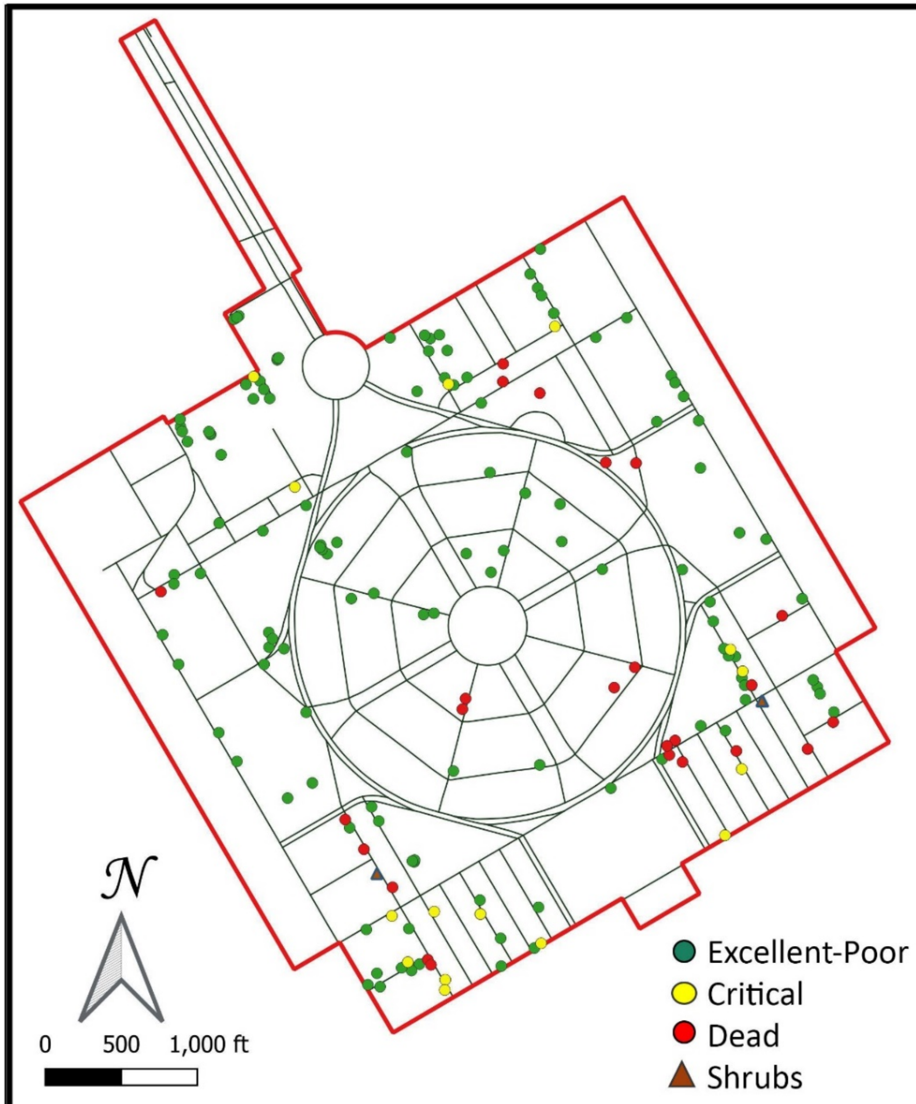
Texas Native
(southeast)

TAM NRI NHLD Inventory*

Total: 1 tree/1 shrub
Average Height: 17 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Texas Oak

Quercus buckleyi
QUBU2

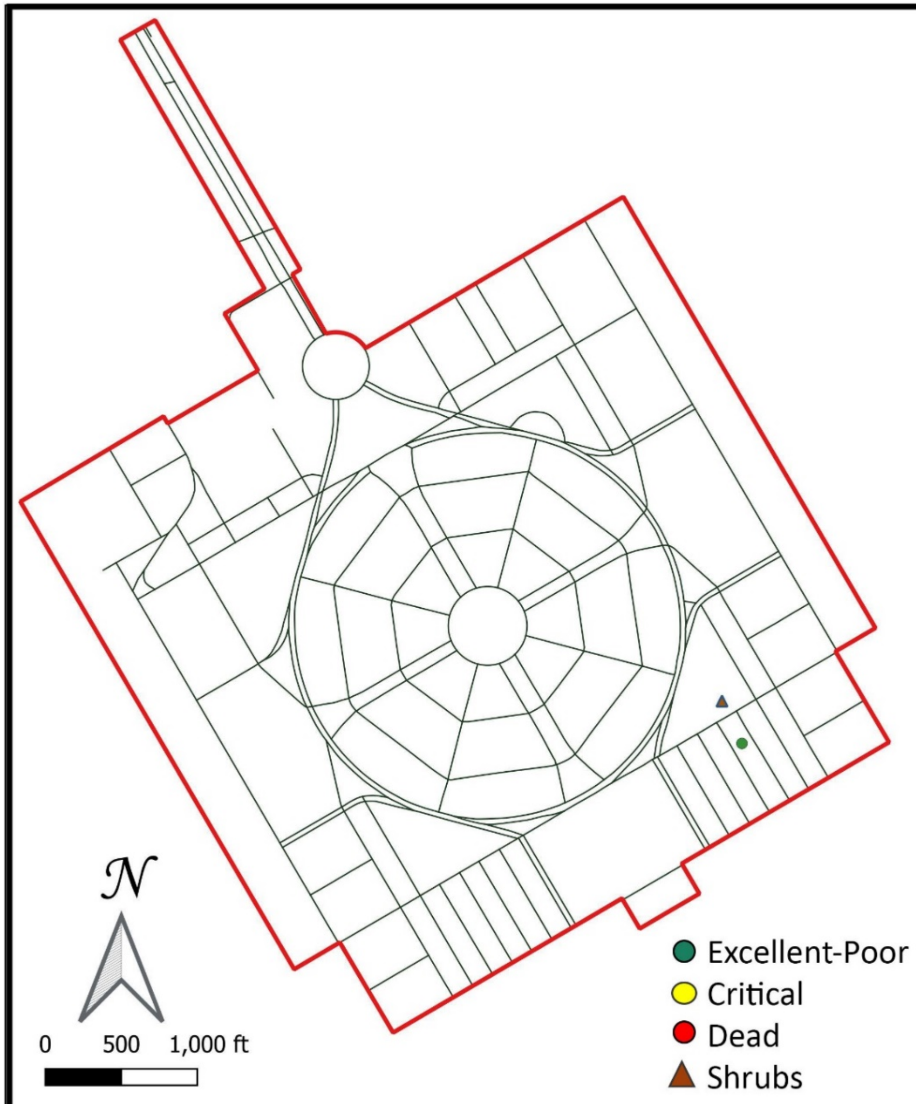
Texas Native
(central and north-central)

TAM NRI NHLD Inventory*

Total : 163 trees/3 shrubs
Average Height: 29 ft
Range of Heights: 13-48 ft

Condition
Excellent: 8
Good: 39
Fair: 49
Poor: 27
Critical: 16
Dead: 24

* Colon et al., 2017, NHLD only



TREE

Vitex

Vitex agnus-castus
VIAG

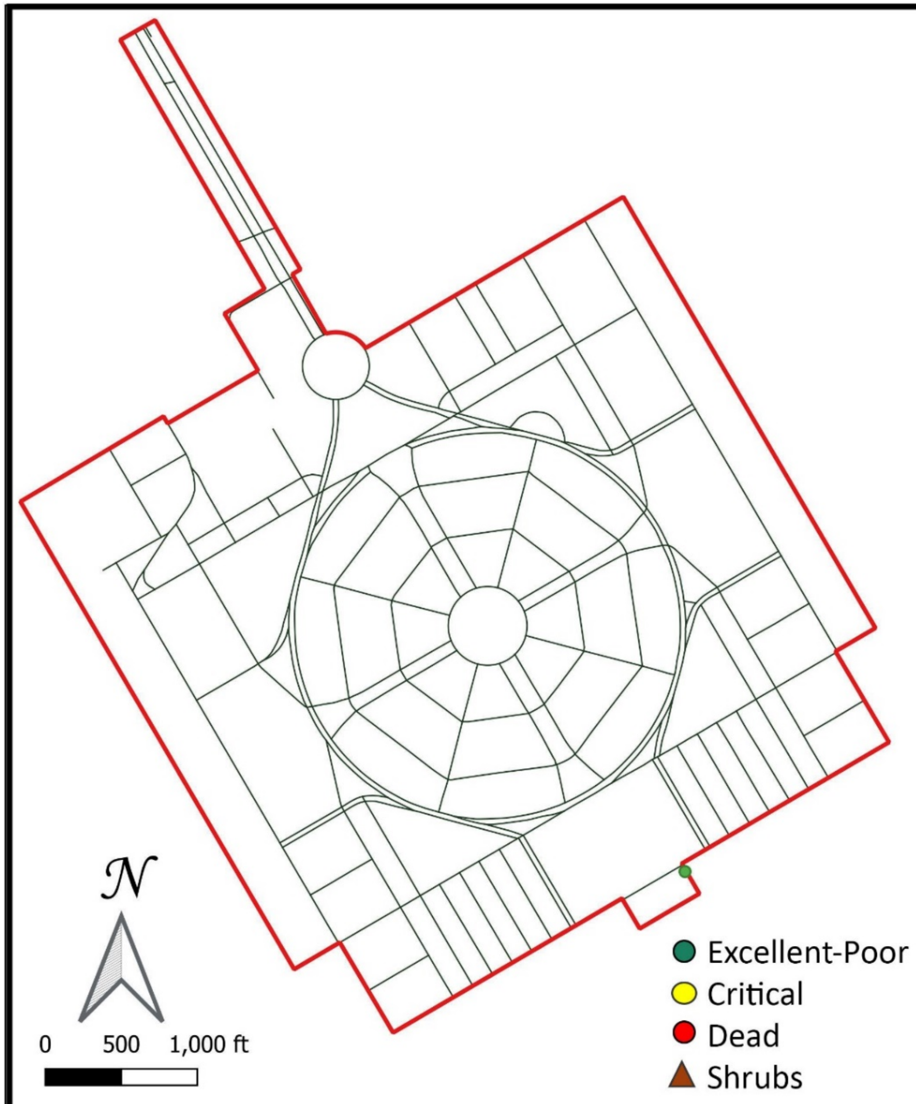
Non-native
(Eurasia)

TAM NRI NHLD Inventory*

Total: 1 tree/1 shrub
Average Height: 20 ft
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 1
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only



TREE

Water Oak

Quercus nigra
QUNI

Texas Native
(east)

TAM NRI NHLD Inventory*

Total: 1 tree/0 shrubs
Average Height: 30 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

White Ash

Fraxinus americana
FRAM2

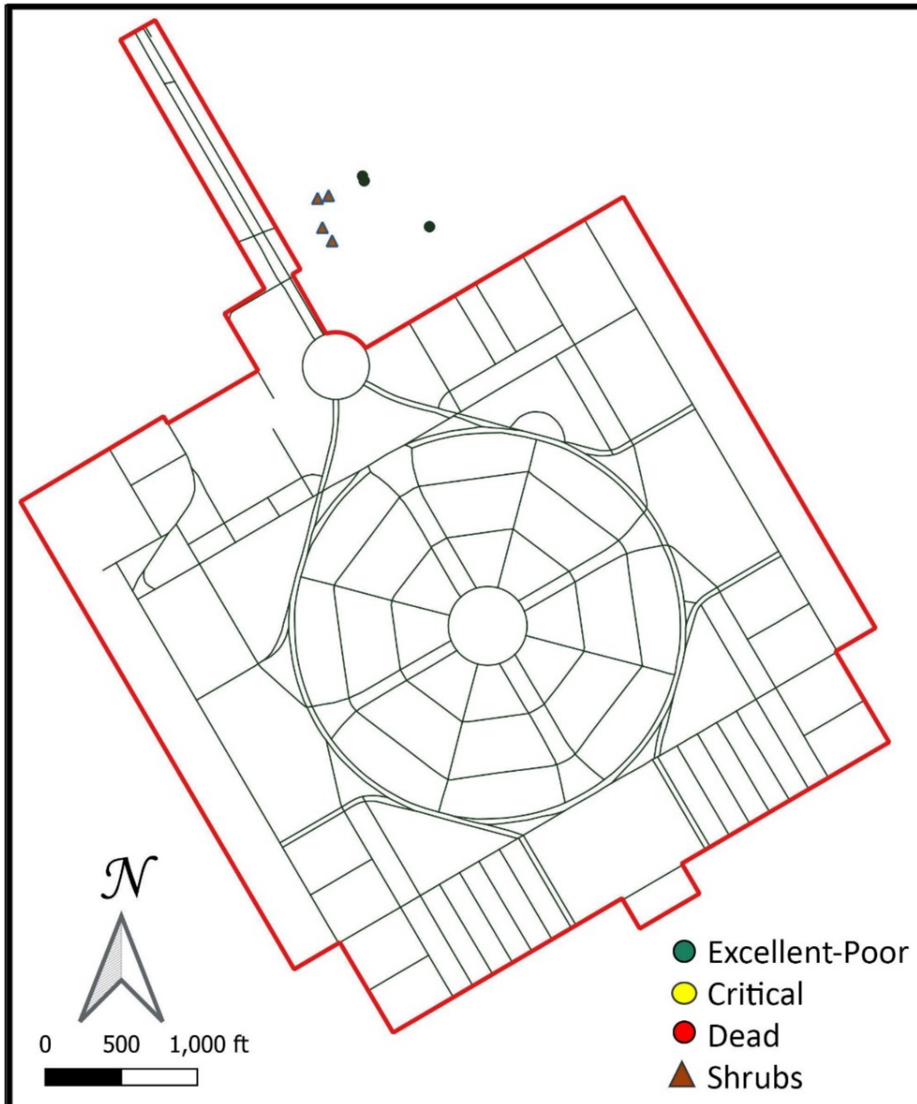
Texas Native
(east)

TAM NRI NHLD Inventory*

Total: 48 trees/3 shrubs
Average Height: 32 ft
Range of Heights: 18-53

Condition
Excellent: 0
Good: 5
Fair: 16
Poor: 11
Critical: 4
Dead: 12

* Colon et al., 2017, NHLD only



TREE

Winged Elm

Ulmus alata

ULAL

Texas Native
(east)

No Winged Elm in NHLD

TAM NRI NHLD Inventory*

Total: 0 trees/0 shrubs
Average Height: na
Range of Heights: na

Condition
Excellent: 0
Good: 0
Fair: 0
Poor: 0
Critical: 0
Dead: 0

* Colon et al., 2017, NHLD only

TREE

Yaupon Holly

Ilex vomitoria

ILVO

Texas Native
(east)

TAM NRI NHLD Inventory*

Total: 11 trees/191 shrubs
Average Height: 20 ft
Range of Heights: 13-31 ft

Condition
Excellent: 0
Good: 5
Fair: 4
Poor: 1
Critical: 1
Dead: 0

* Colon et al., 2017, NHLD only

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Appendix C

NHLD Shrub Species Maps

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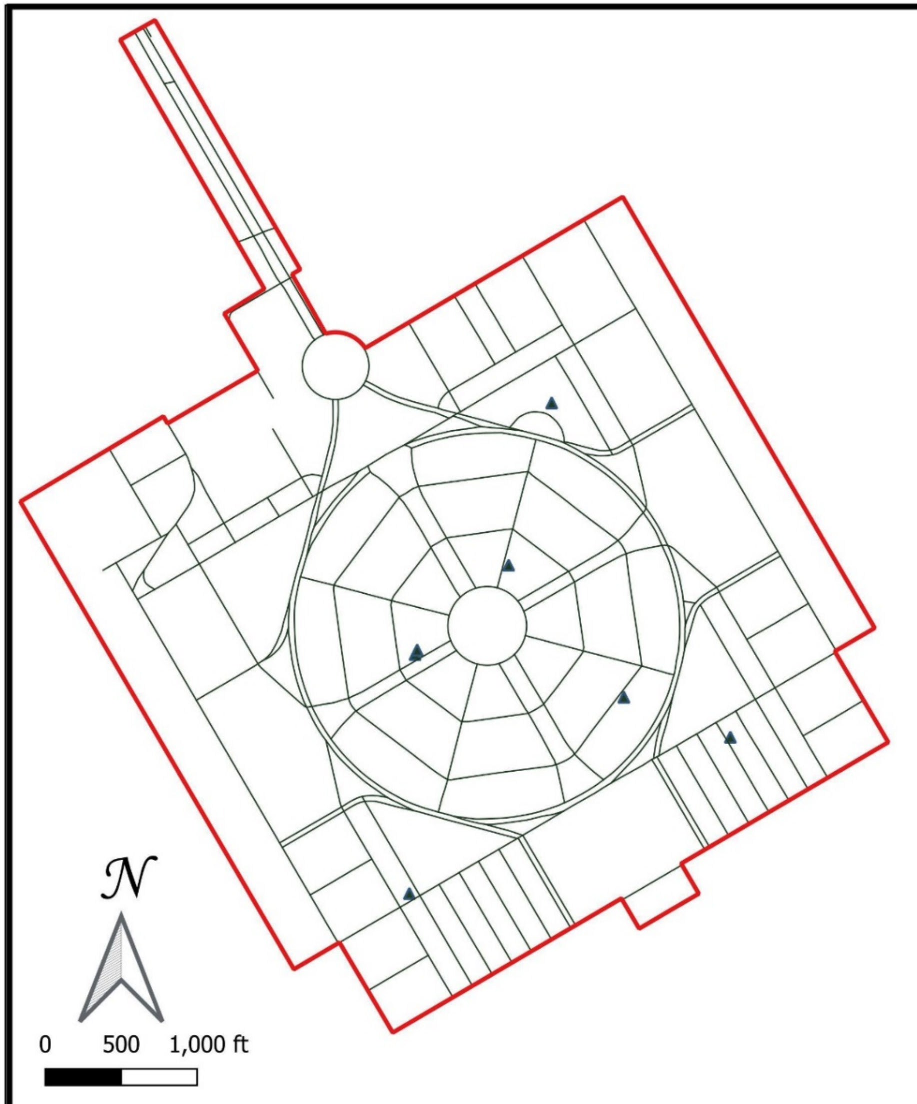


SHRUB

American Holly

Ilex opaca

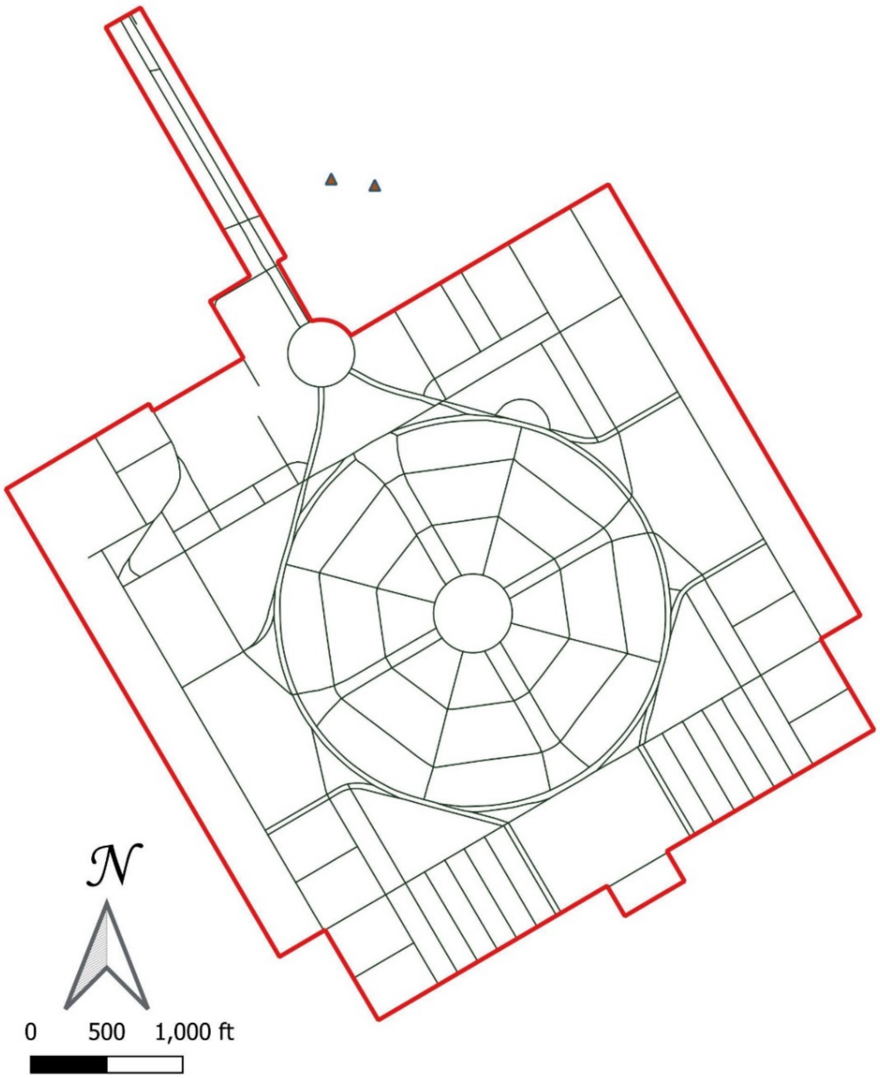
ILOP

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 7

* Colon et al., 2017, NHLD only



SHRUB

Arizona Cypress

Hesperocyparis arizonica

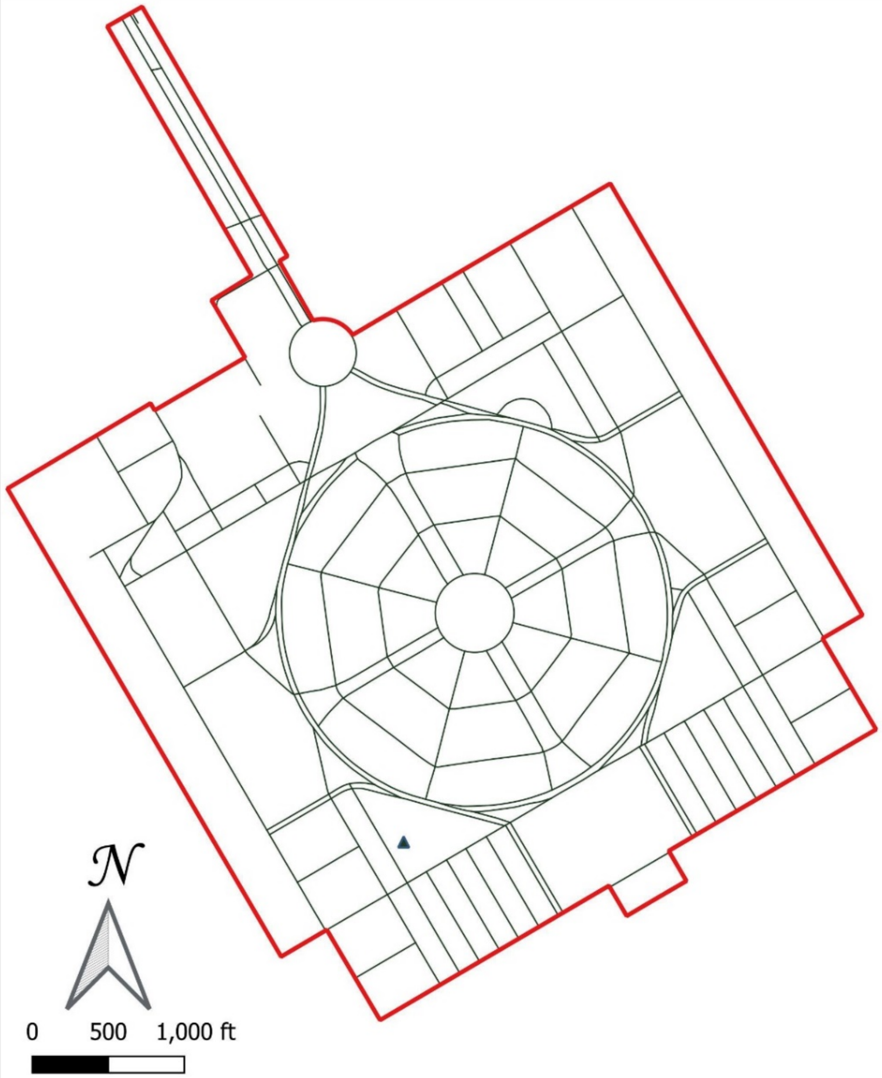
HEAR22

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

Ashe Juniper

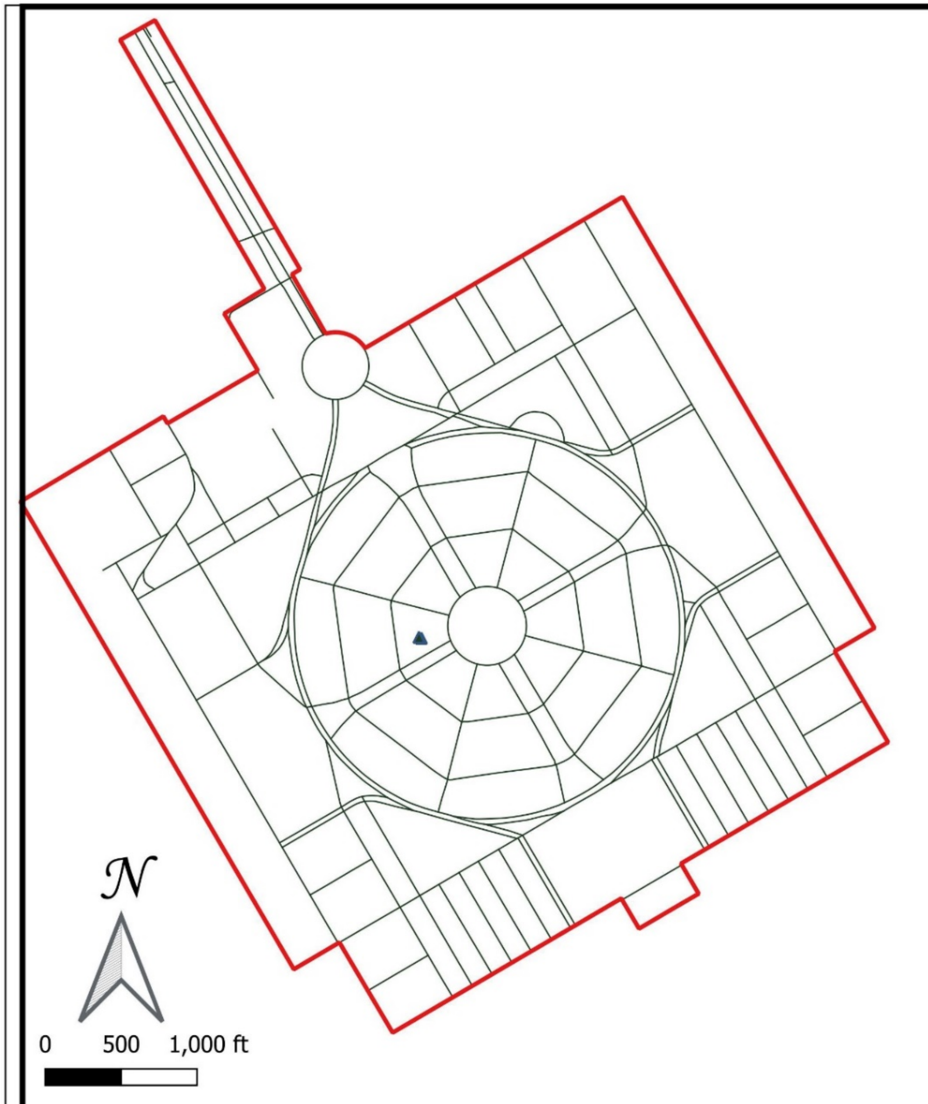
Juniperus ashei
JUAS

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only



SHRUB

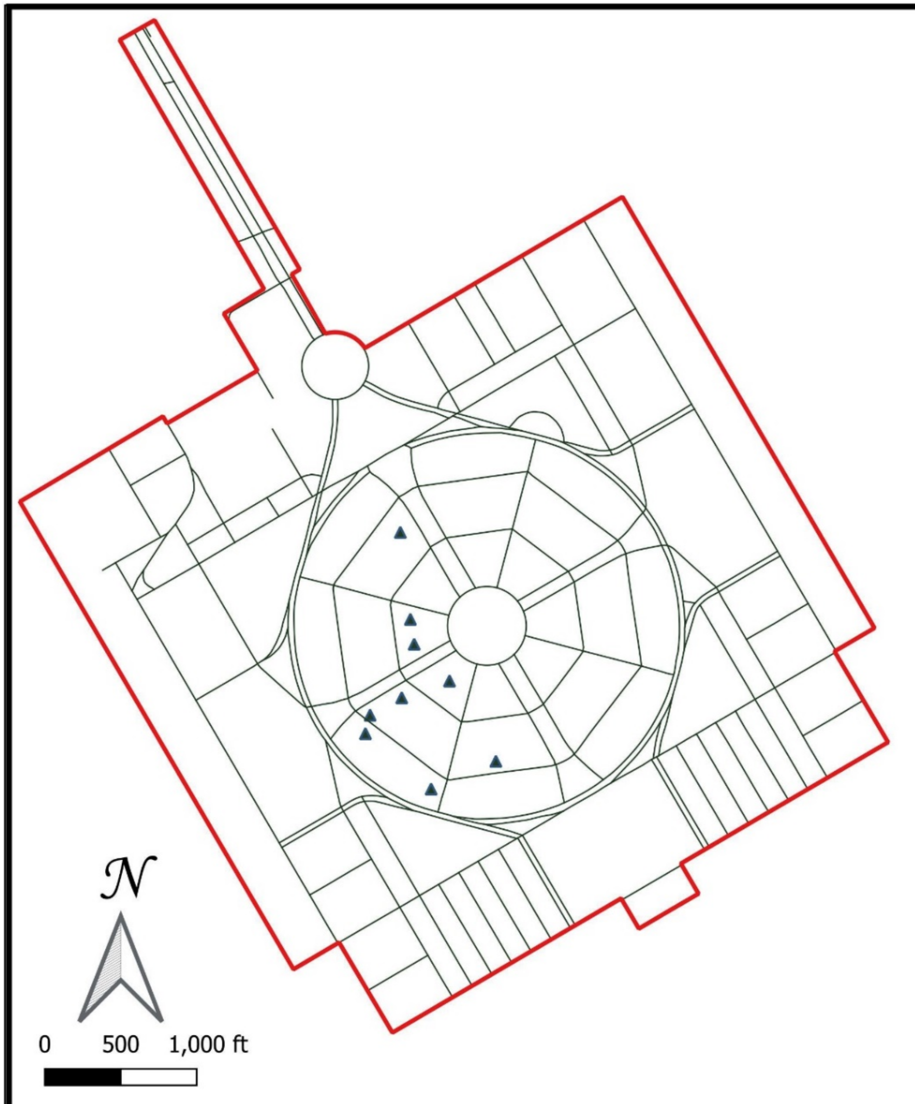
Bald Cypress
Taxodium distichum
TADI2

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 2

* Colon et al., 2017, NHLD only



SHRUB

Bamboo

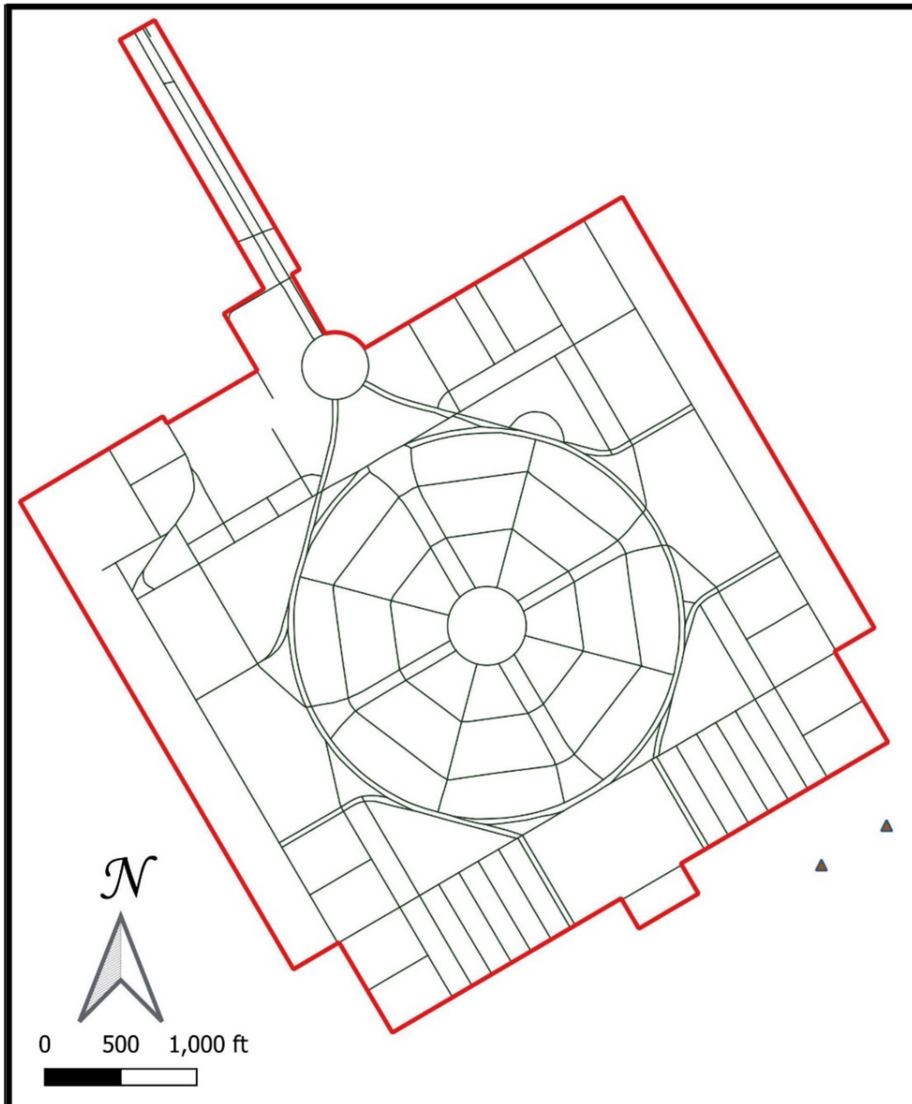
Poaceae spp.

Non-native

TAM NRI NHLD Inventory*

Shrubs: 9

* Colon et al., 2017, NHLD only



SHRUB

Bigtooth Maple

Acer grandidentatum

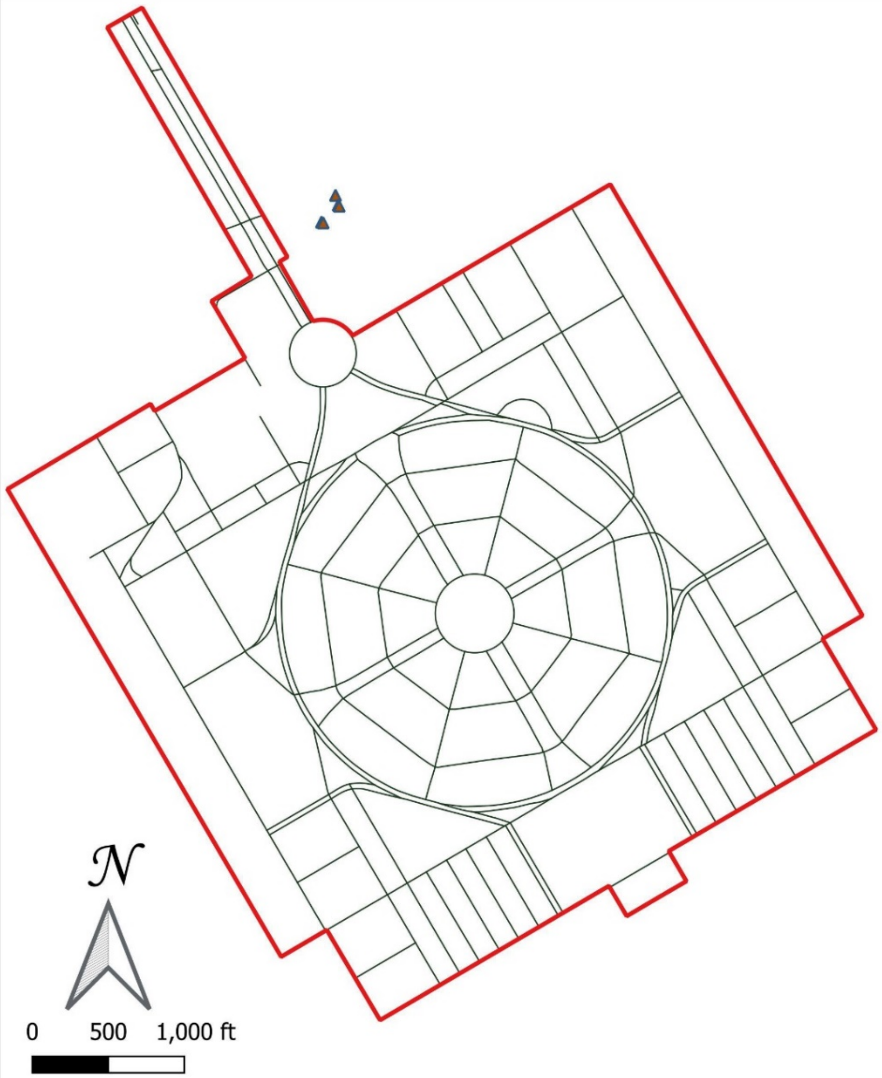
ACGR3

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

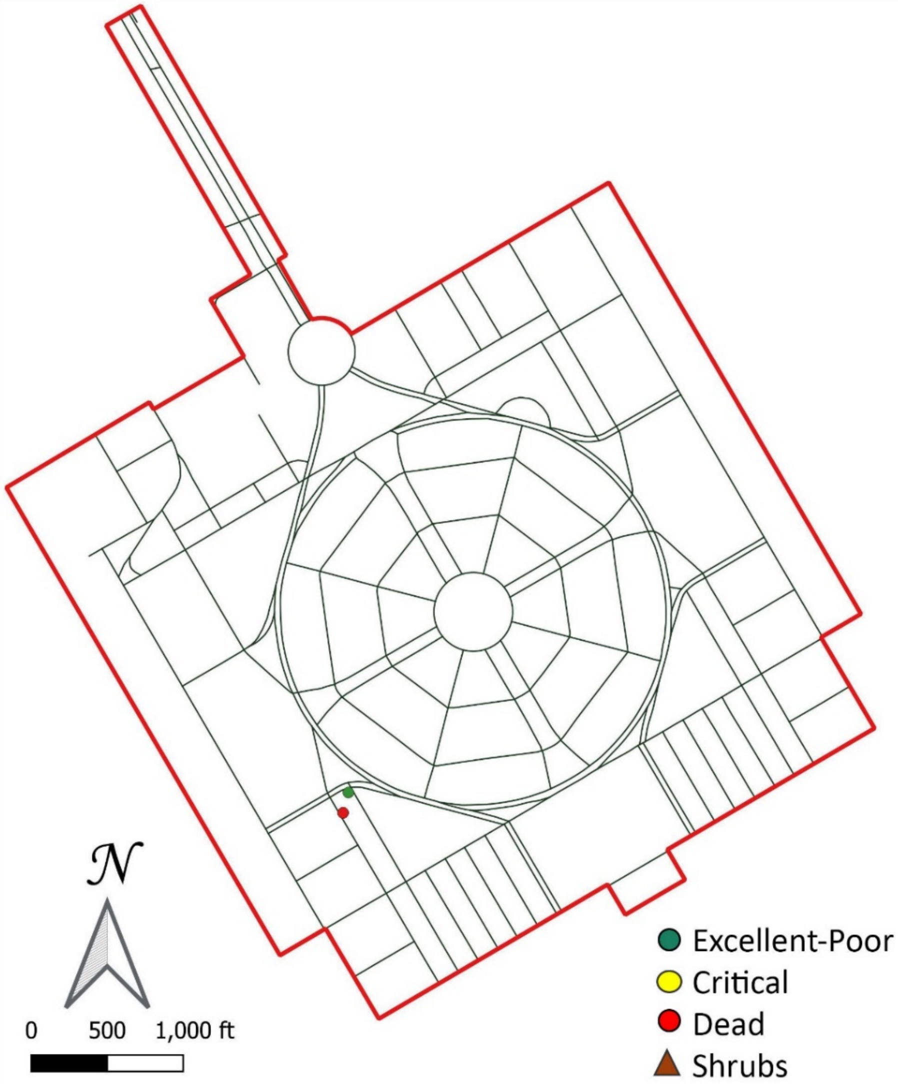
Black Locust
Robinia pseudoacacia
ROPS

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



TREE

Blackjack Oak

Quercus marilandica
QUMA3

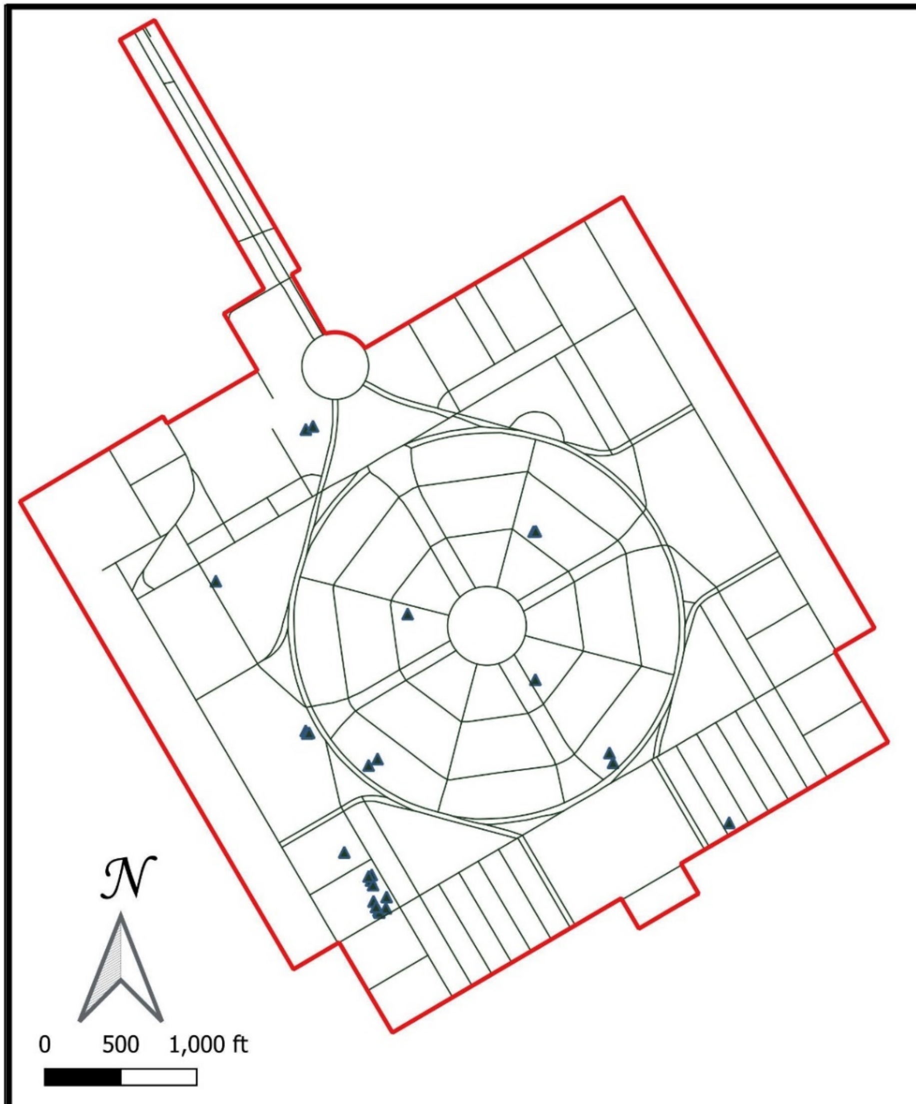
Texas Native
(east and central)

TAM NRI NHLD Inventory*

Total : 2 trees/0 shrubs
Average Height: 29 ft
Range of Heights: na

Condition
Excellent: 0
Good: 1
Fair: 0
Poor: 0
Critical: 0
Dead: 1

* Colon et al., 2017, NHLD only



SHRUB

Boxwood

Buxus spp.

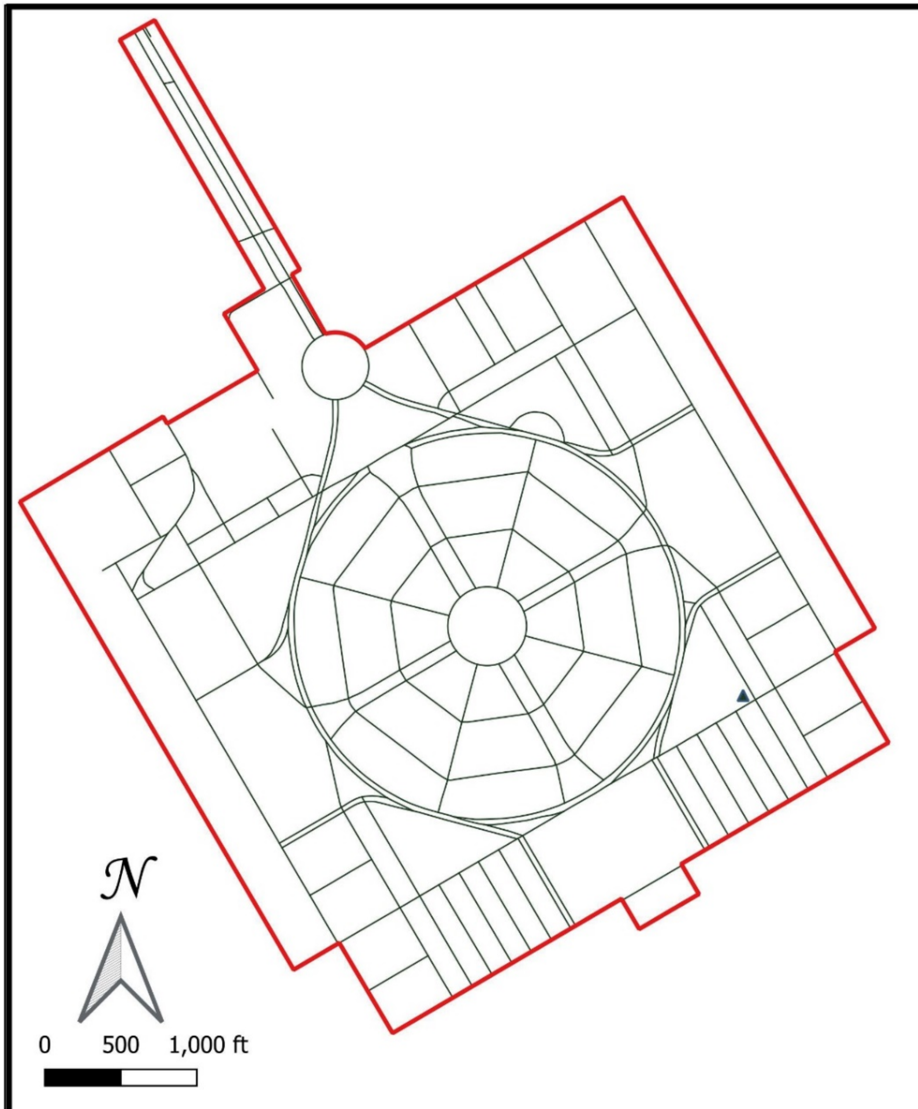
BUXUS

Non-native

TAM NRI NHLD Inventory*

Shrubs: 26

* Colon et al., 2017, NHLD only



SHRUB

Bur Oak

Quercus macrocarpa

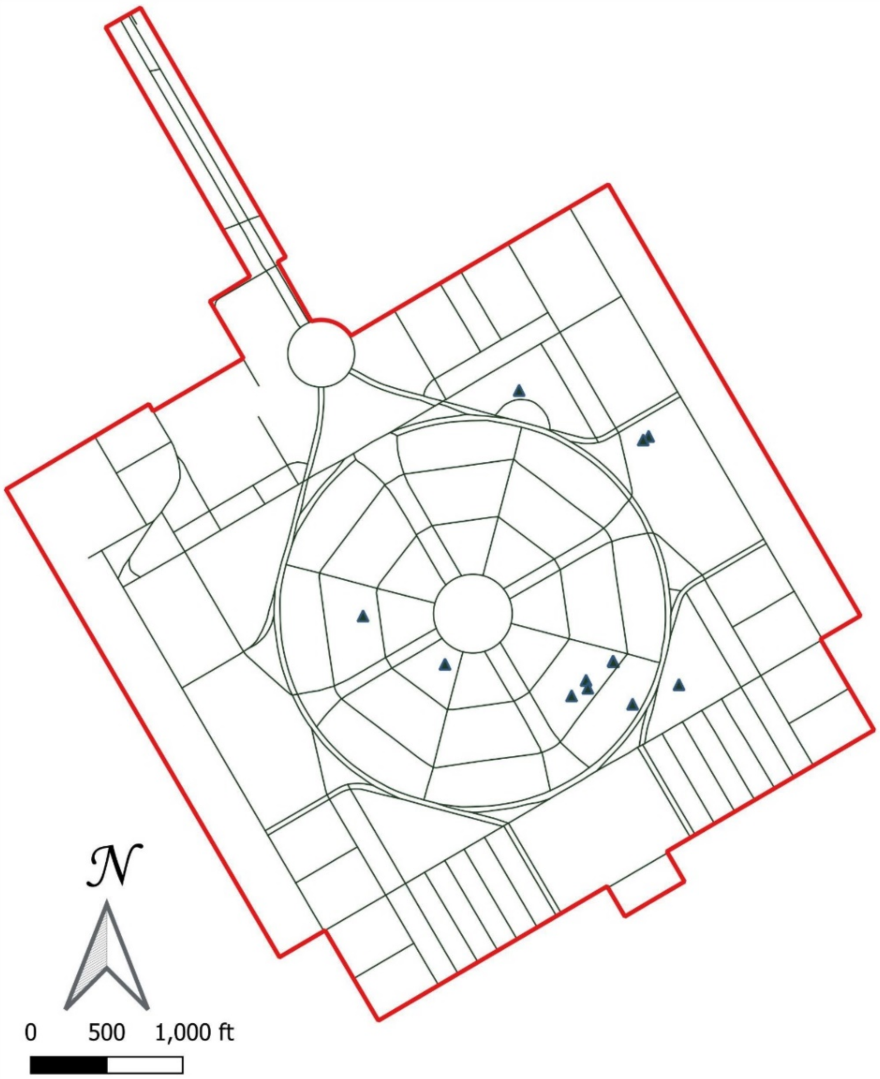
QUMA2

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only



SHRUB

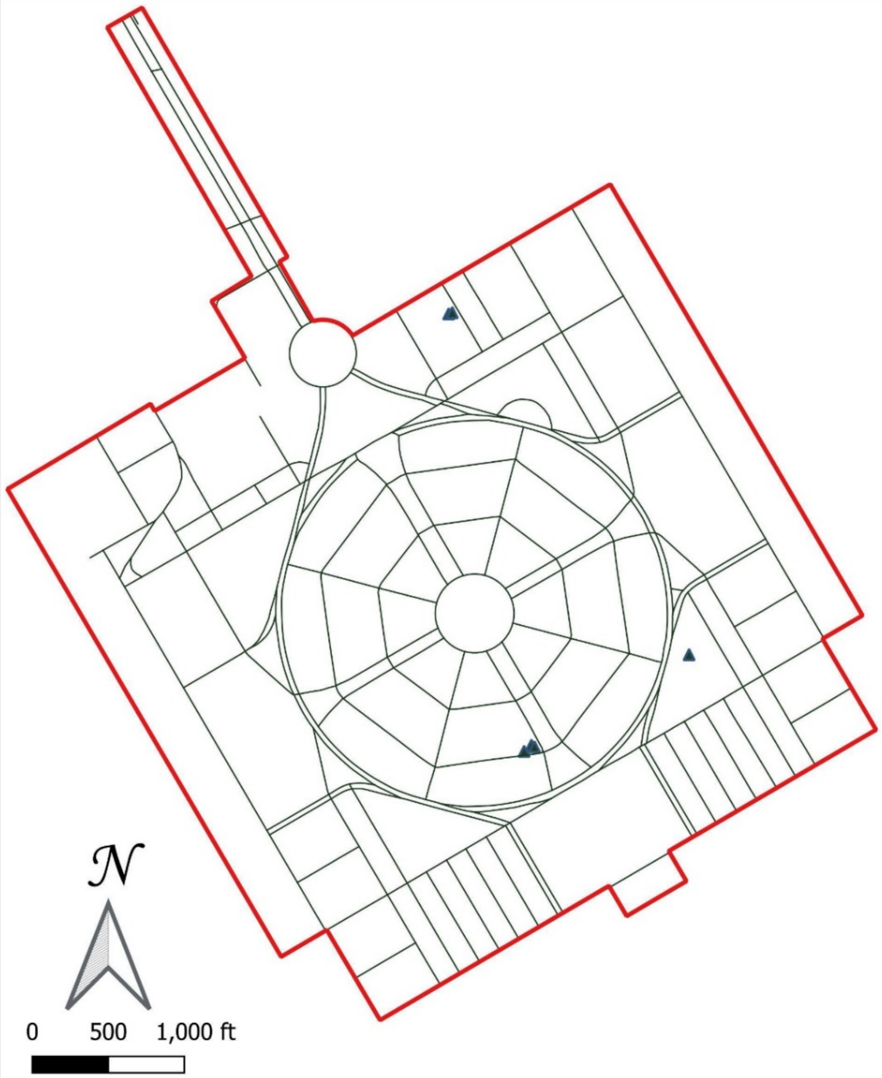
Callery Pear
Pyrus calleryana
PYCA80

Non-native

TAM NRI NHLD Inventory*

Shrubs: 12

* Colon et al., 2017, NHLD only



SHRUB

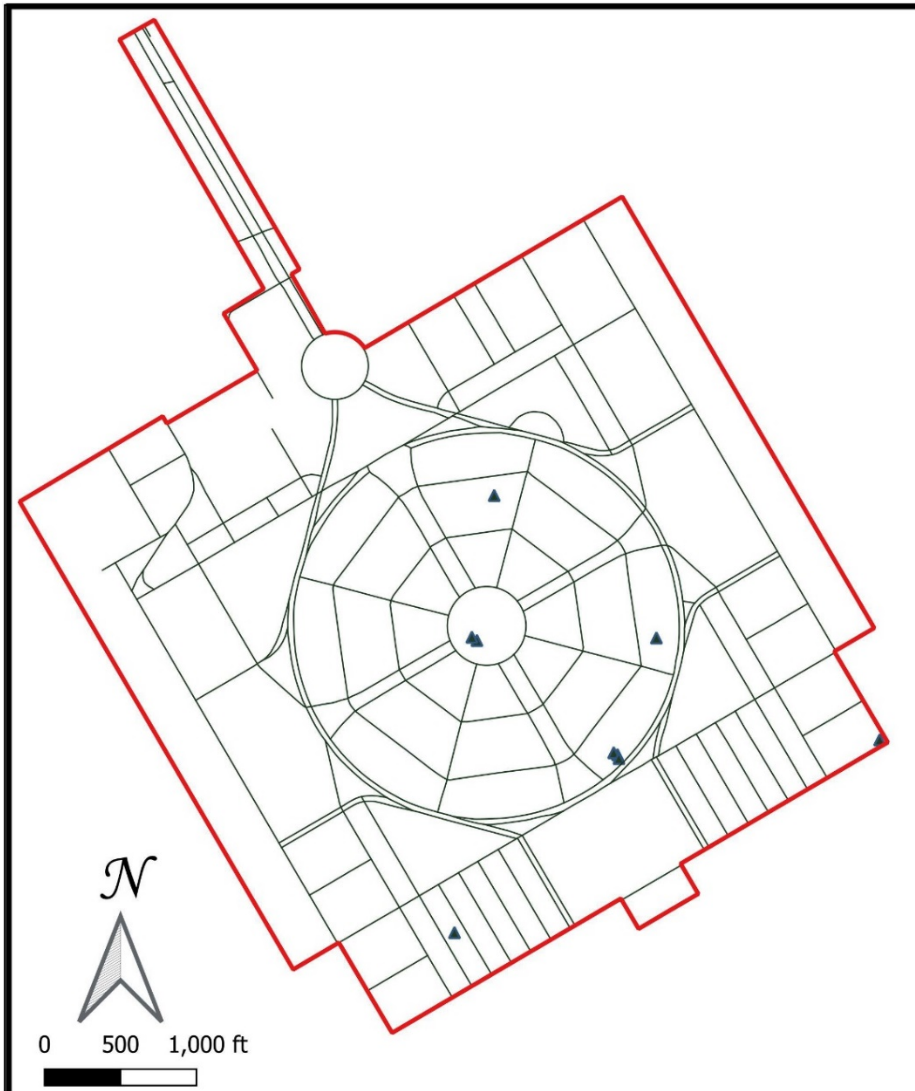
Cedar Elm
Ulmus crassifolia
ULCR

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 6

* Colon et al., 2017, NHLD only



SHRUB

Chinaberry

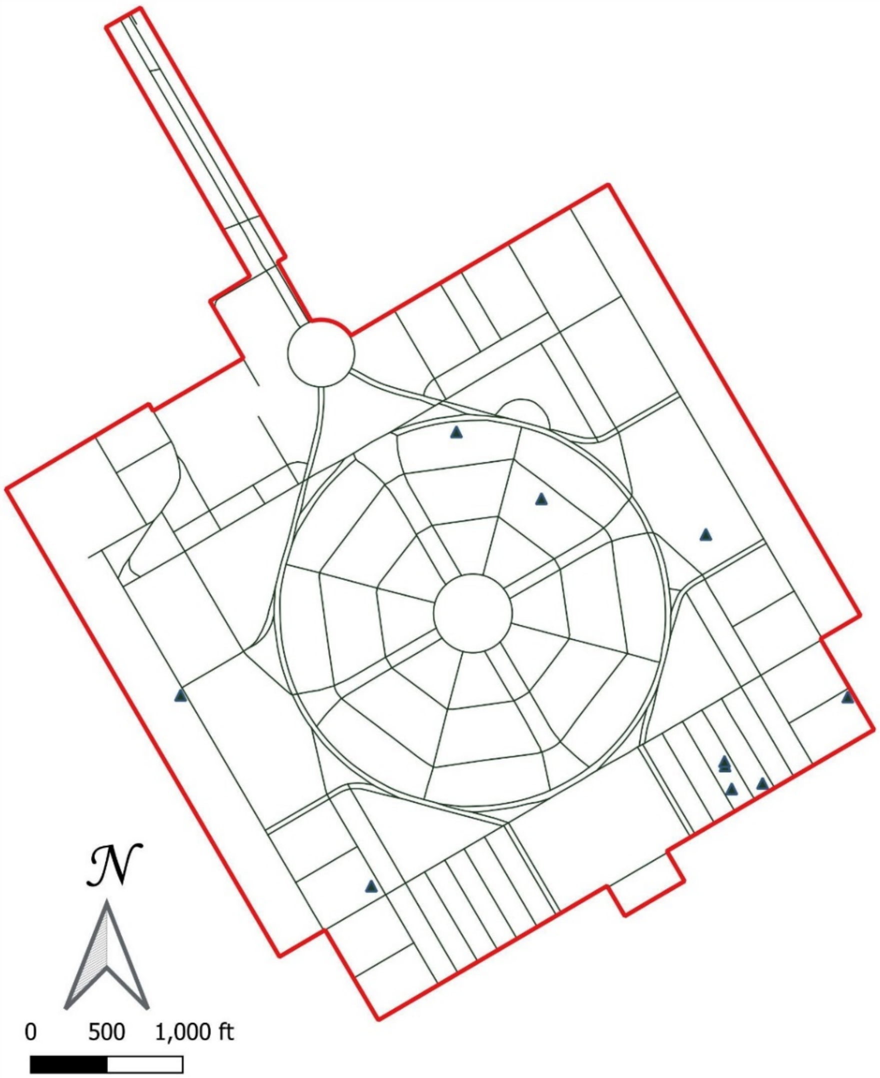
Melia azedarach
MEAZ

Non-native

TAM NRI NHLD Inventory*

Shrubs: 9

* Colon et al., 2017, NHLD only



SHRUB

Chinese Photinia

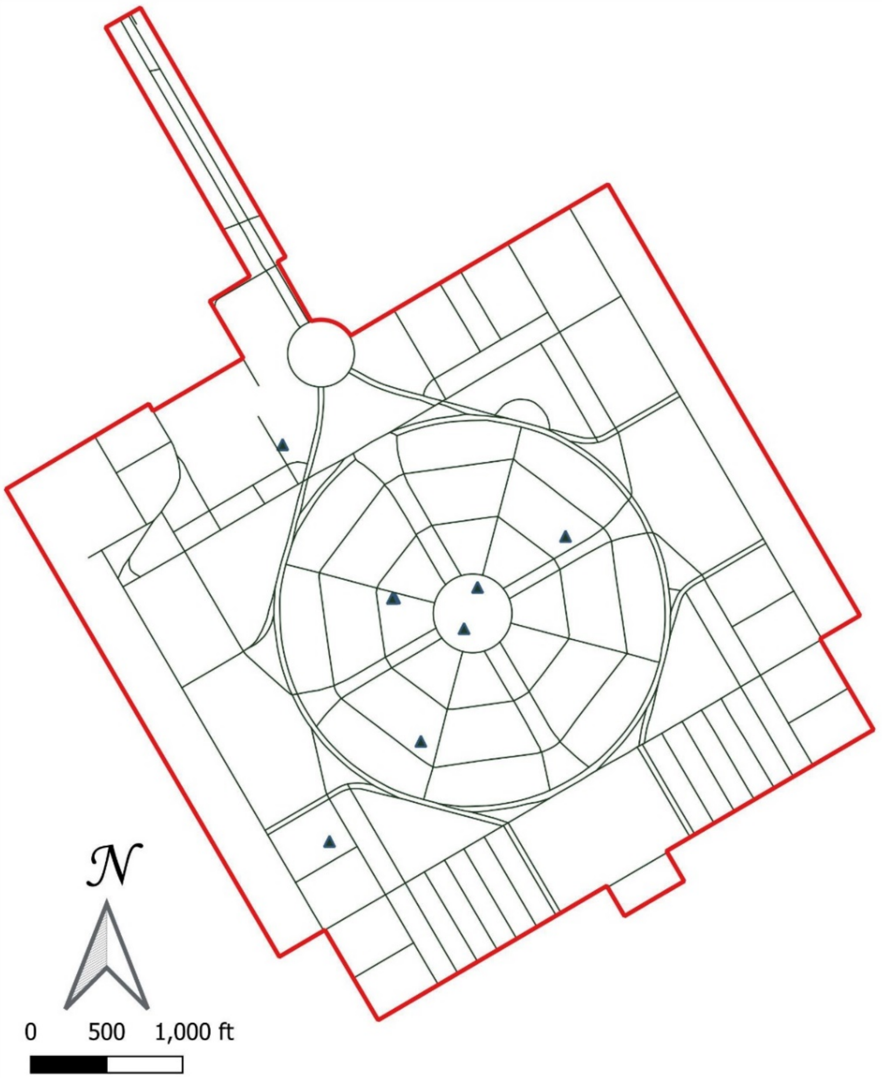
Photinia serratifolia
PHSE17

Non-native

TAM NRI NHLD Inventory*

Shrubs: 10

* Colon et al., 2017, NHLD only



SHRUB

Chinese Pistache

Pistacia chinensis

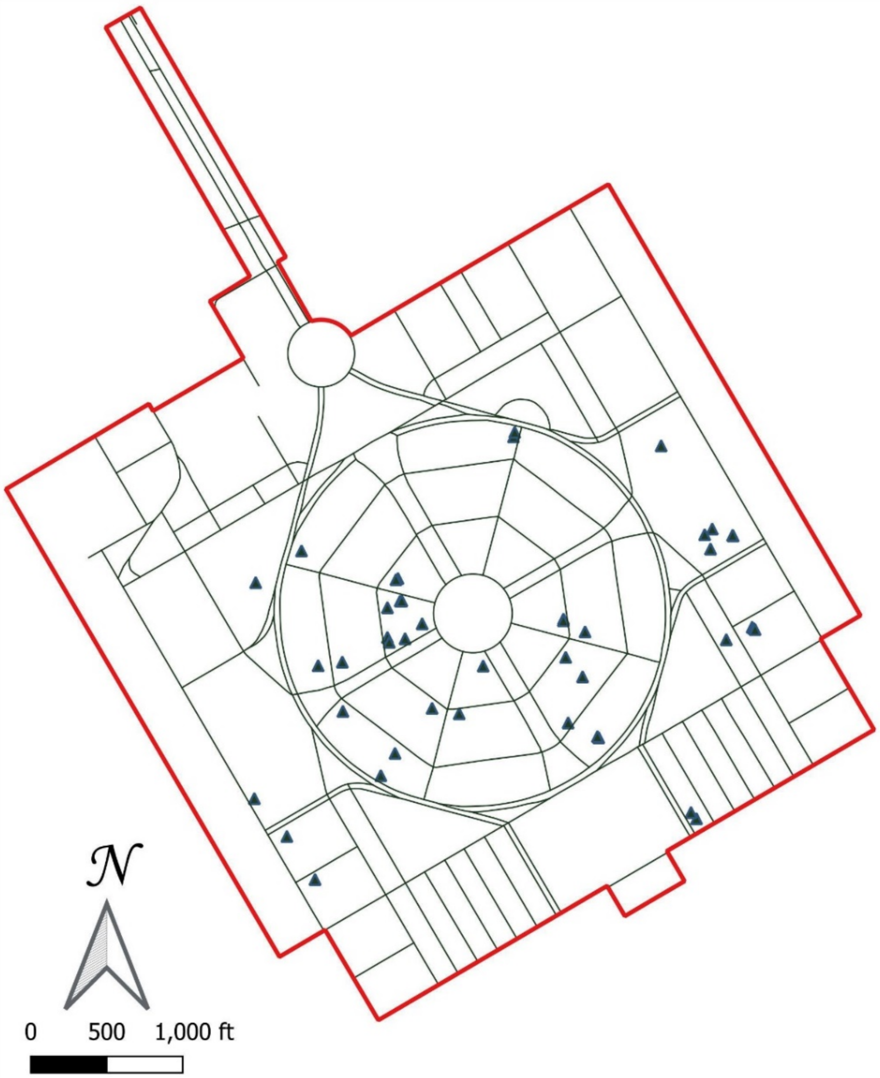
PICH4

Non-native

TAM NRI NHLD Inventory*

Shrubs: 8

* Colon et al., 2017, NHLD only



SHRUB

Chinese Privet

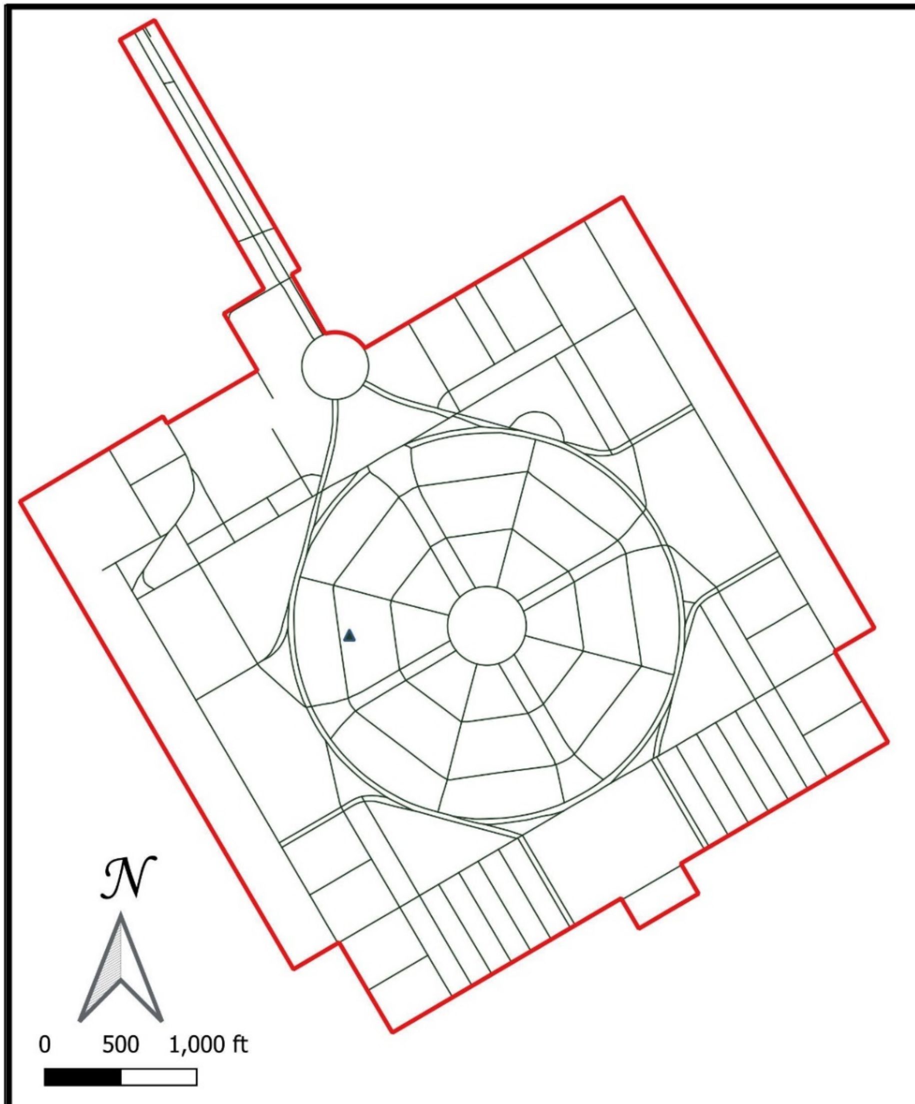
Ligustrum sinese
LISI

Non-native

TAM NRI NHLD Inventory*

Shrubs: 45

* Colon et al., 2017, NHLD only



SHRUB

Chinese Tallowtree

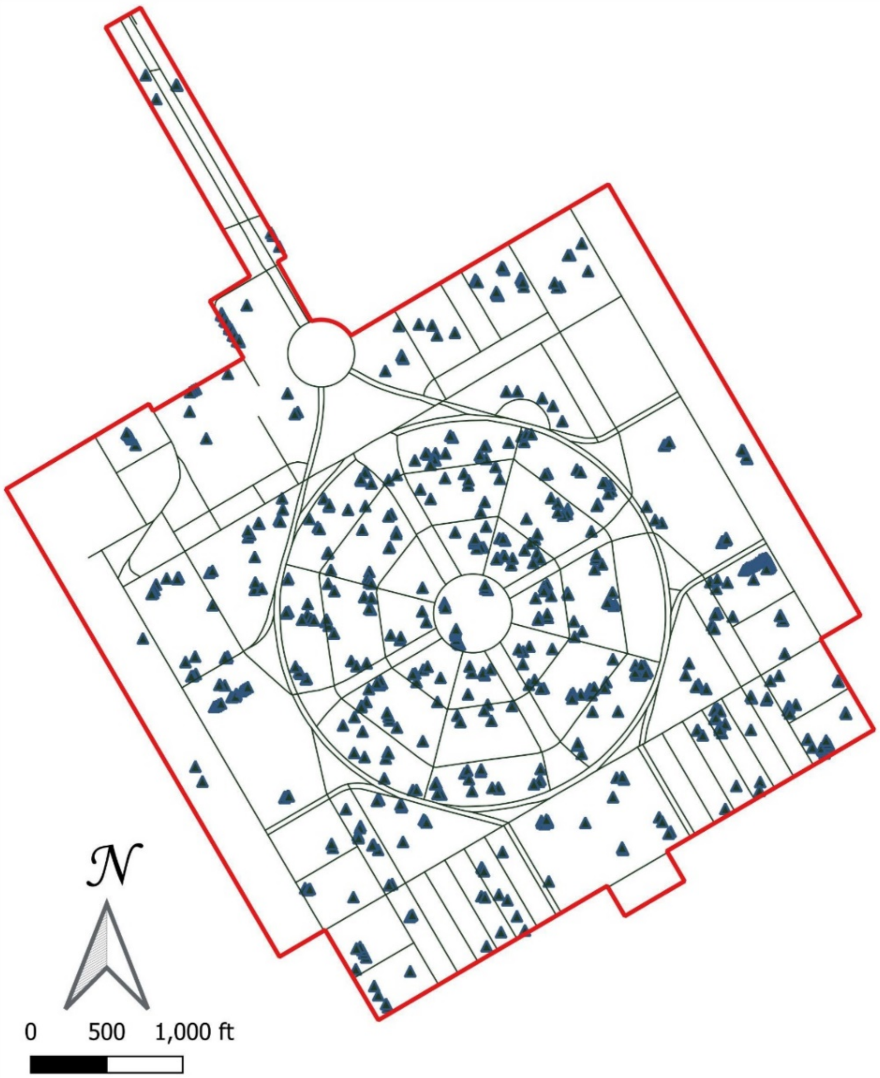
Triadica sebifera
TRSE6

Non-native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only



SHRUB

Crape Myrtle

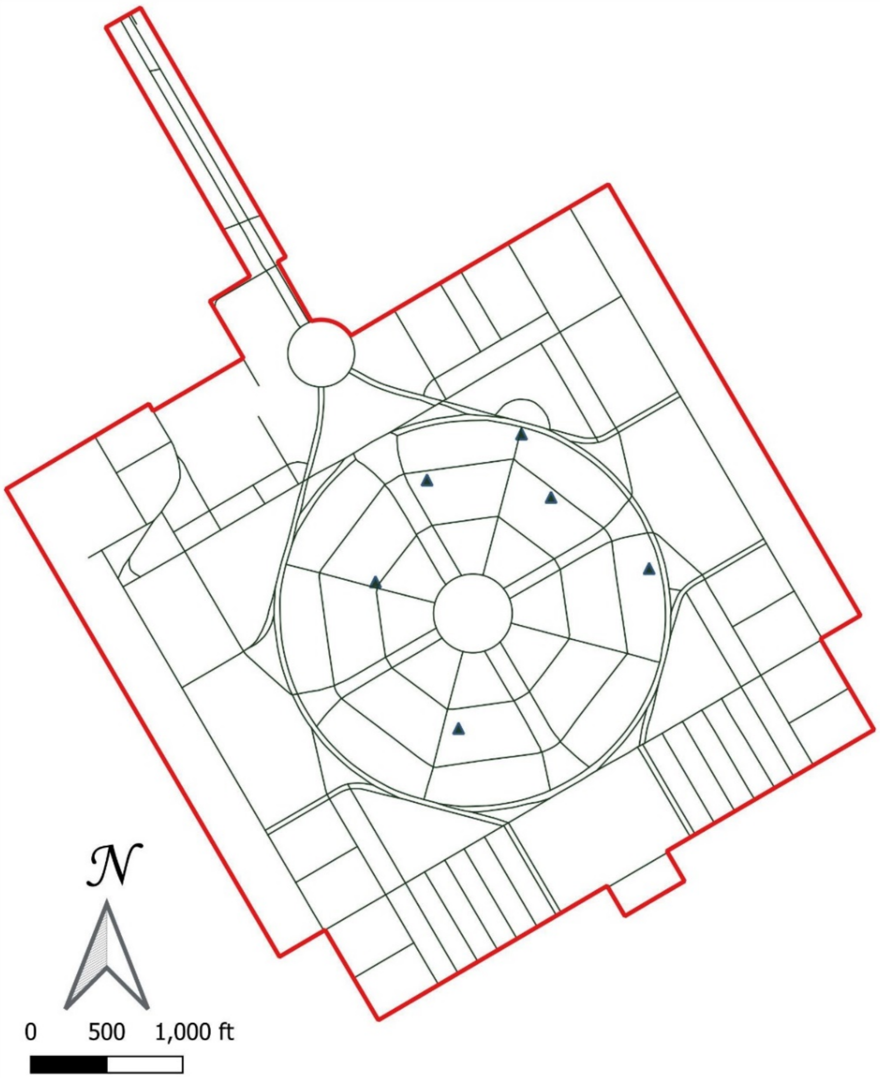
Lagerstroemia indica
LAIN

Non-native

TAM NRI NHLD Inventory*

Shrubs: 616

* Colon et al., 2017, NHLD only



SHRUB

Desert Willow

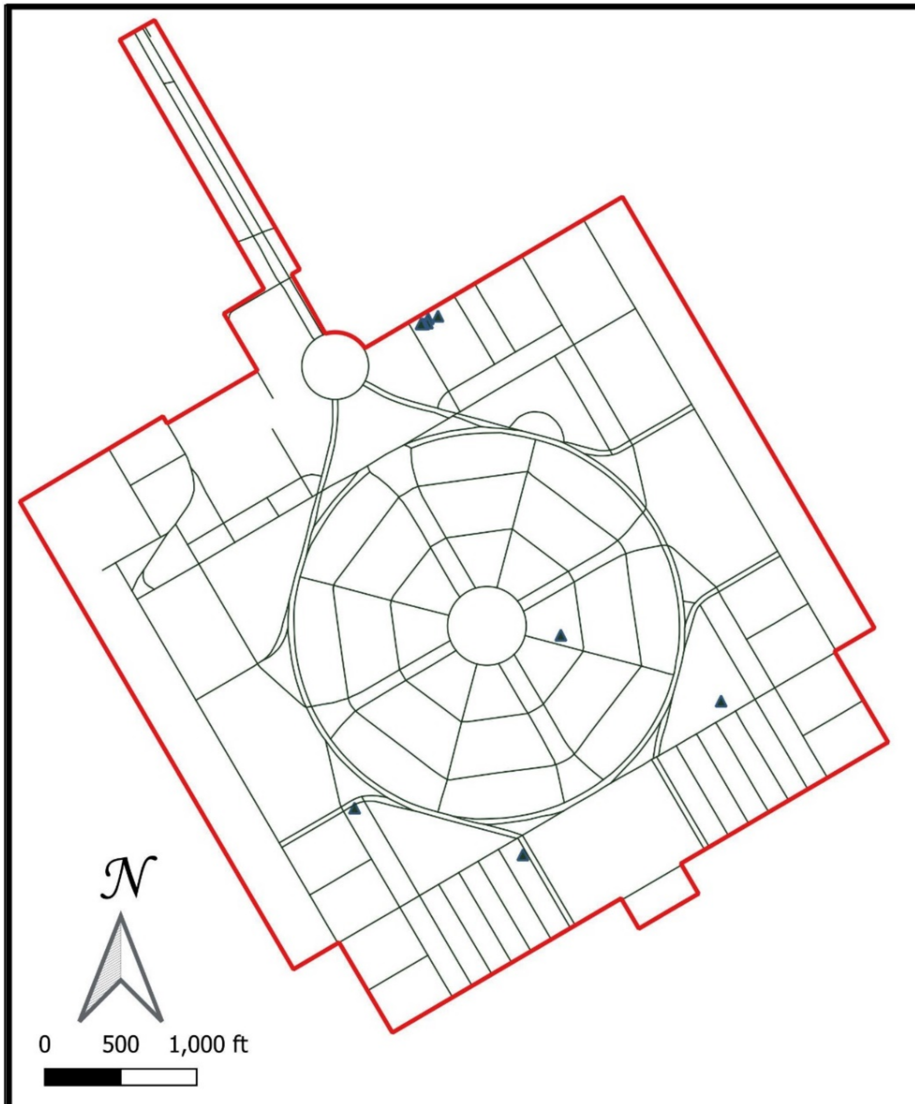
Chilopsis linearis
CHLI2

Non-native

TAM NRI NHLD Inventory*

Shrubs: 6

* Colon et al., 2017, NHLD only



SHRUB

Eastern Red Cedar

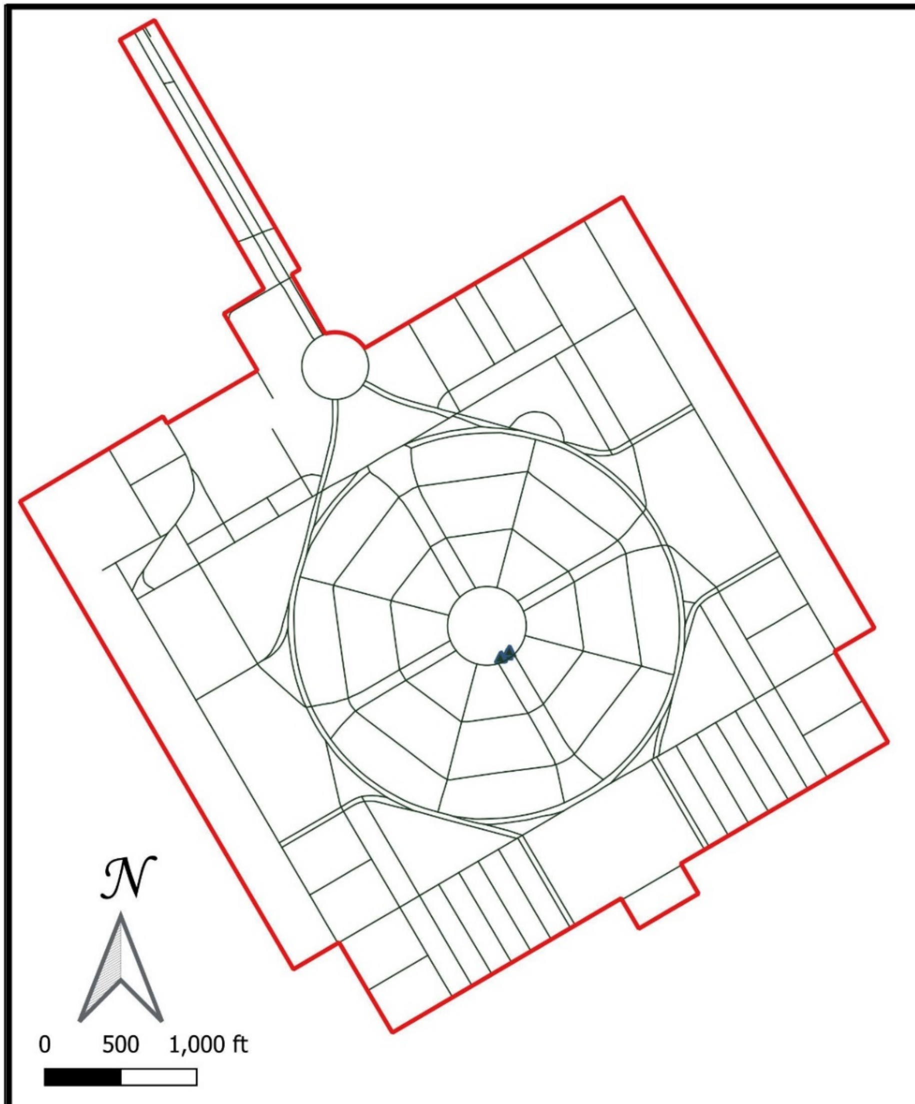
Juniperus virginiana
JUVI

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 10

* Colon et al., 2017, NHLD only



SHRUB

Eastern Redbud

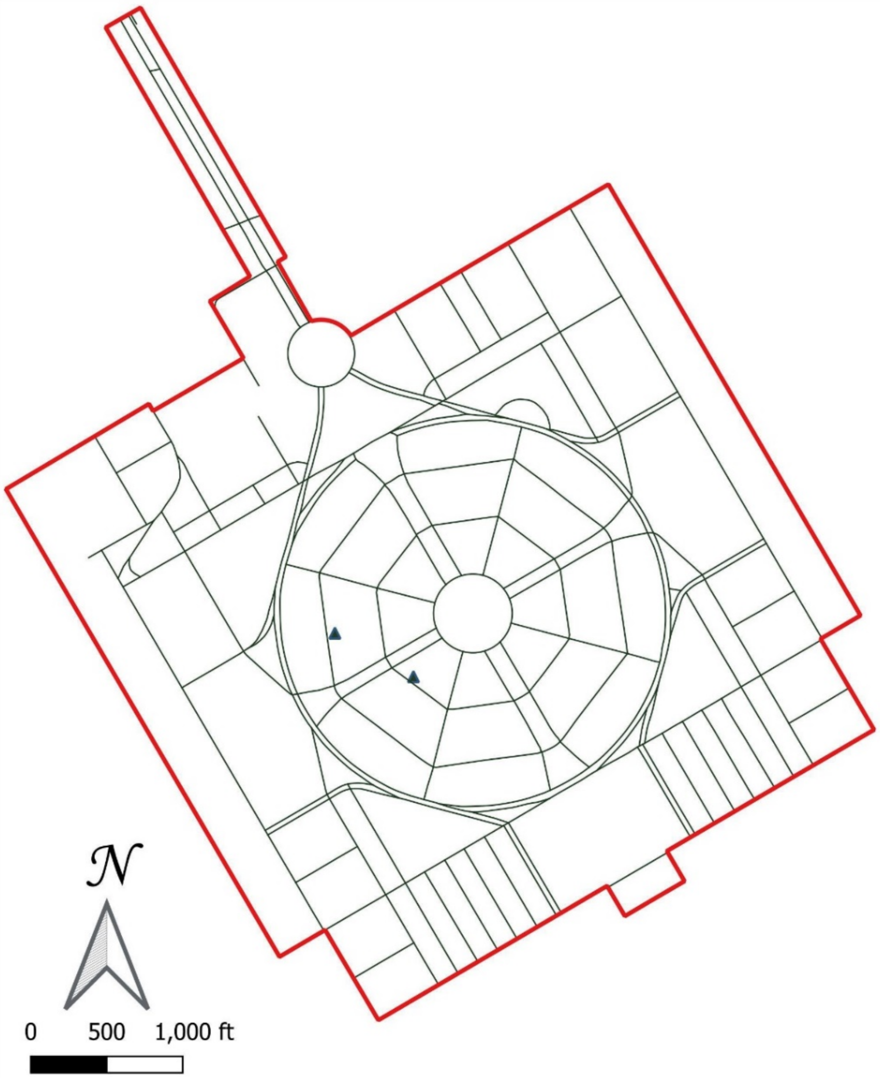
Cercis canadensis
CEAC

Teas Native

TAM NRI NHLD Inventory*

Shrubs: 5

* Colon et al., 2017, NHLD only



SHRUB

Escarpment Live Oak

Quercus fusiformis

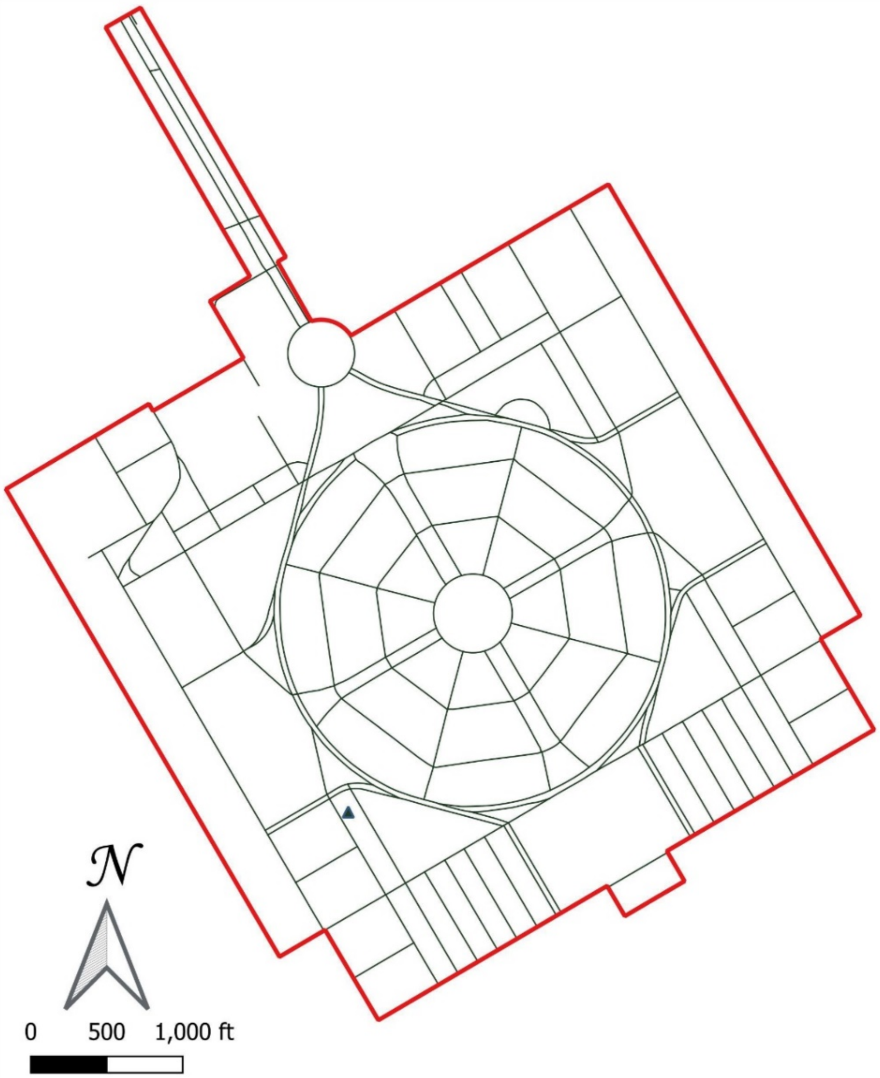
QUFU

Teas Native

TAM NRI NHLD Inventory*

Shrubs: 2

* Colon et al., 2017, NHLD only



SHRUB

Fig

Ficus carica

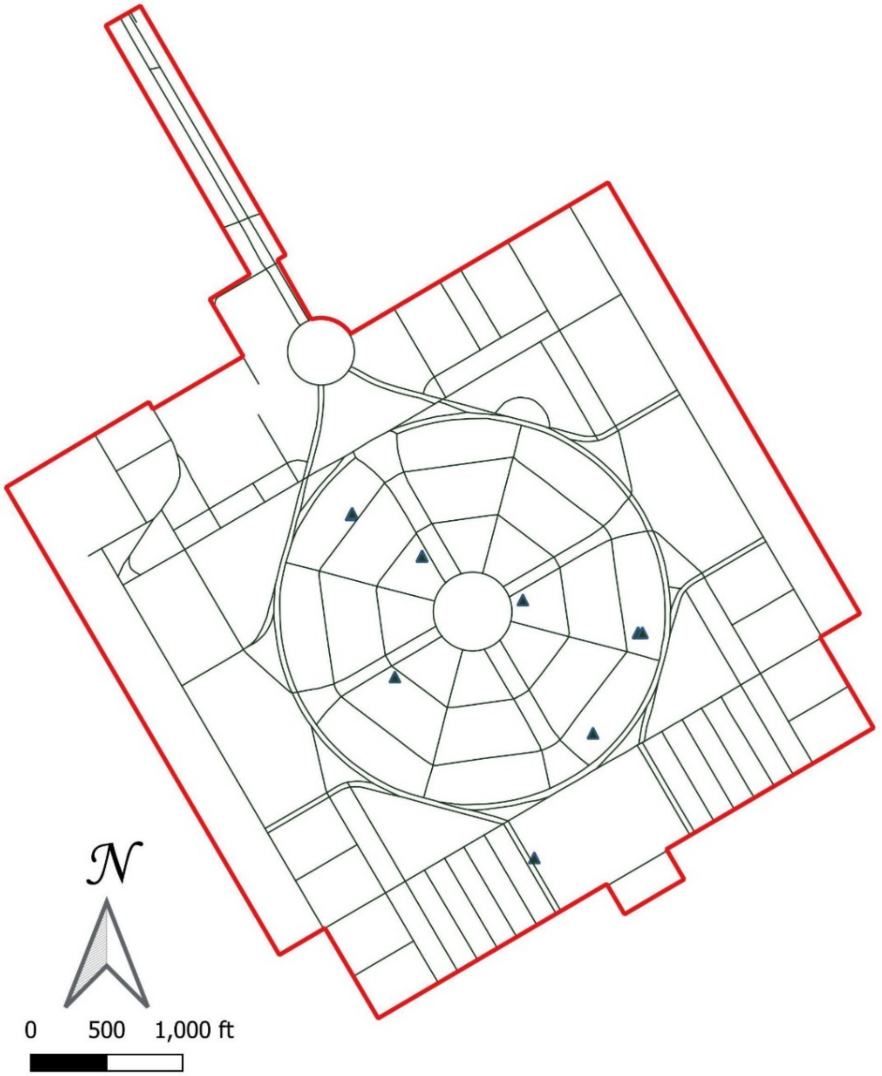
FICA

Non-native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only



SHRUB

Firethorn

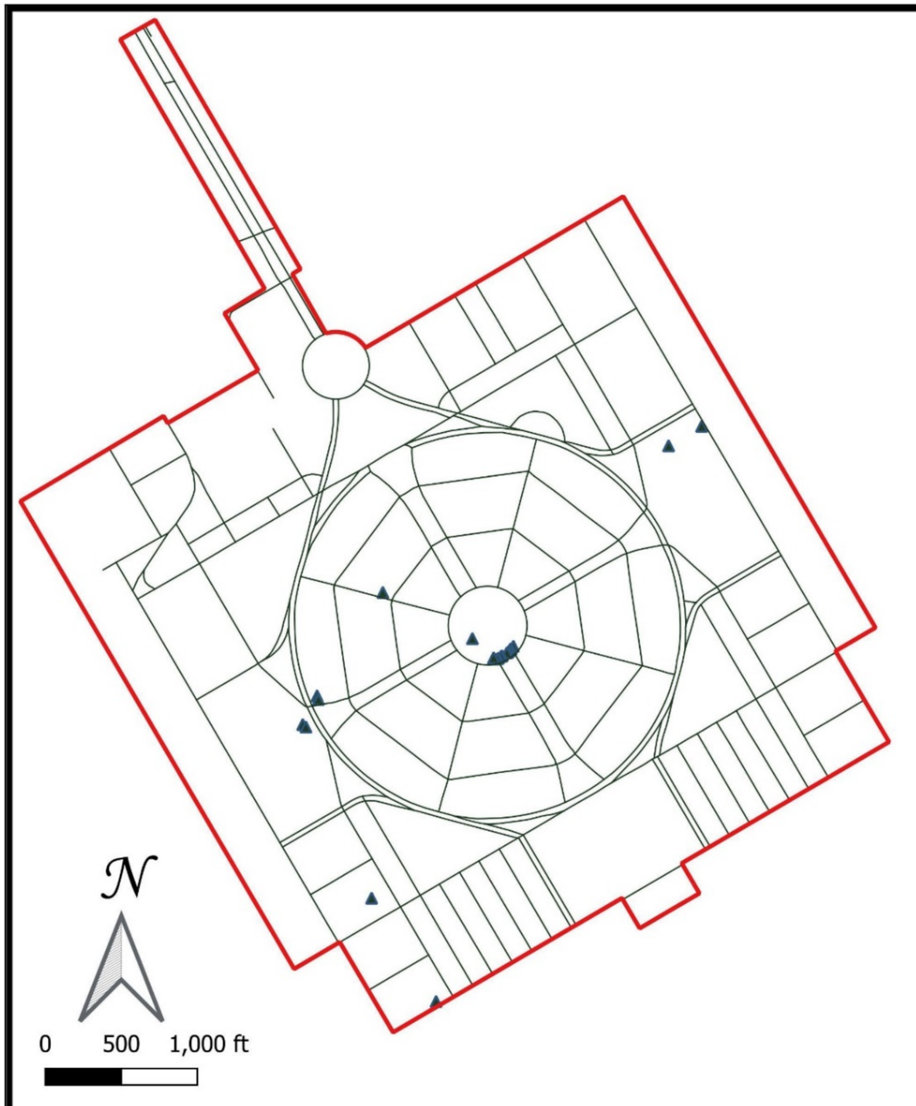
Pyracantha coccinea
PYCO2

Non-native

TAM NRI NHLD Inventory*

Shrubs: 11

* Colon et al., 2017, NHLD only



SHRUB

Glossy Abelia

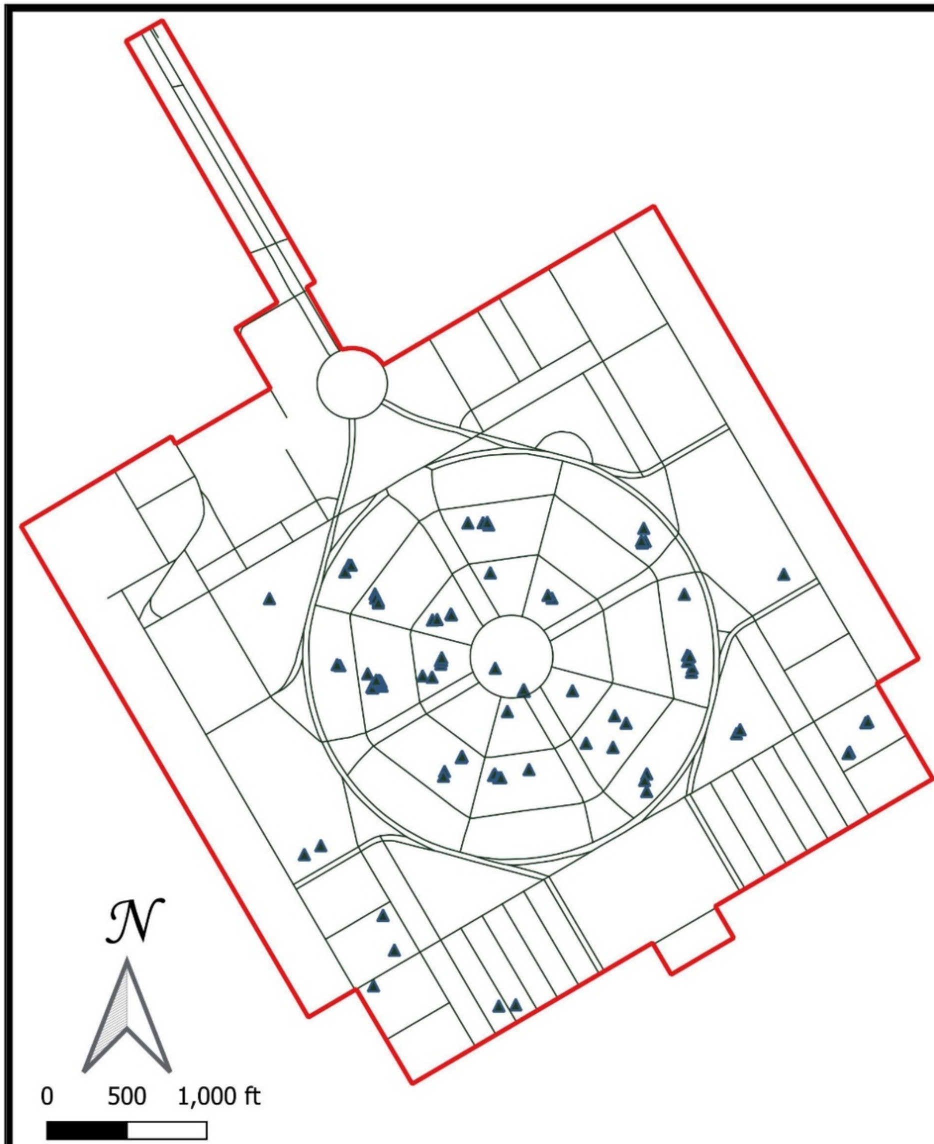
Abelia grandiflora
ABGR4

Non-native
(hybrid)

TAM NRI NHLD Inventory*

Shrubs: 23

* Colon et al., 2017, NHLD only



SHRUB

Hackberry

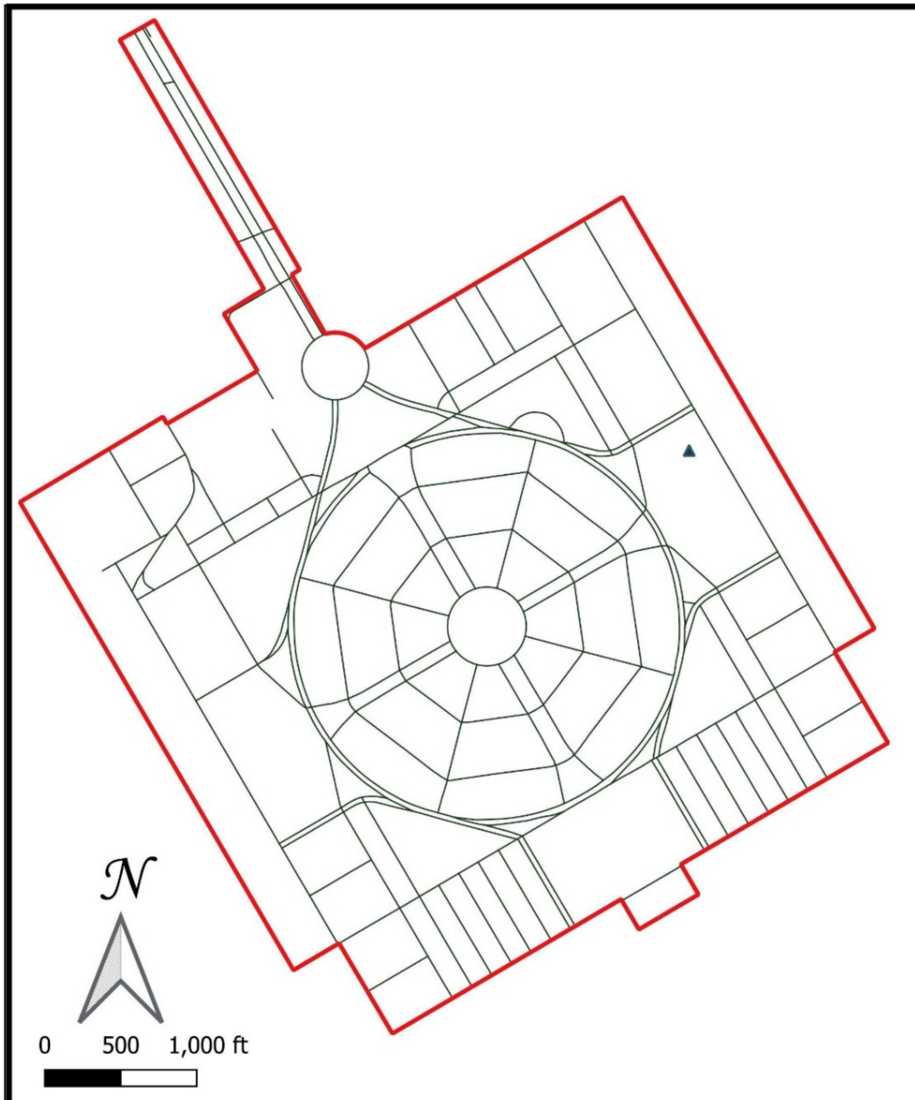
Celtis occidentalis
CEOC

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 86

* Colon et al., 2017, NHLD only



SHRUB

Hawthorn

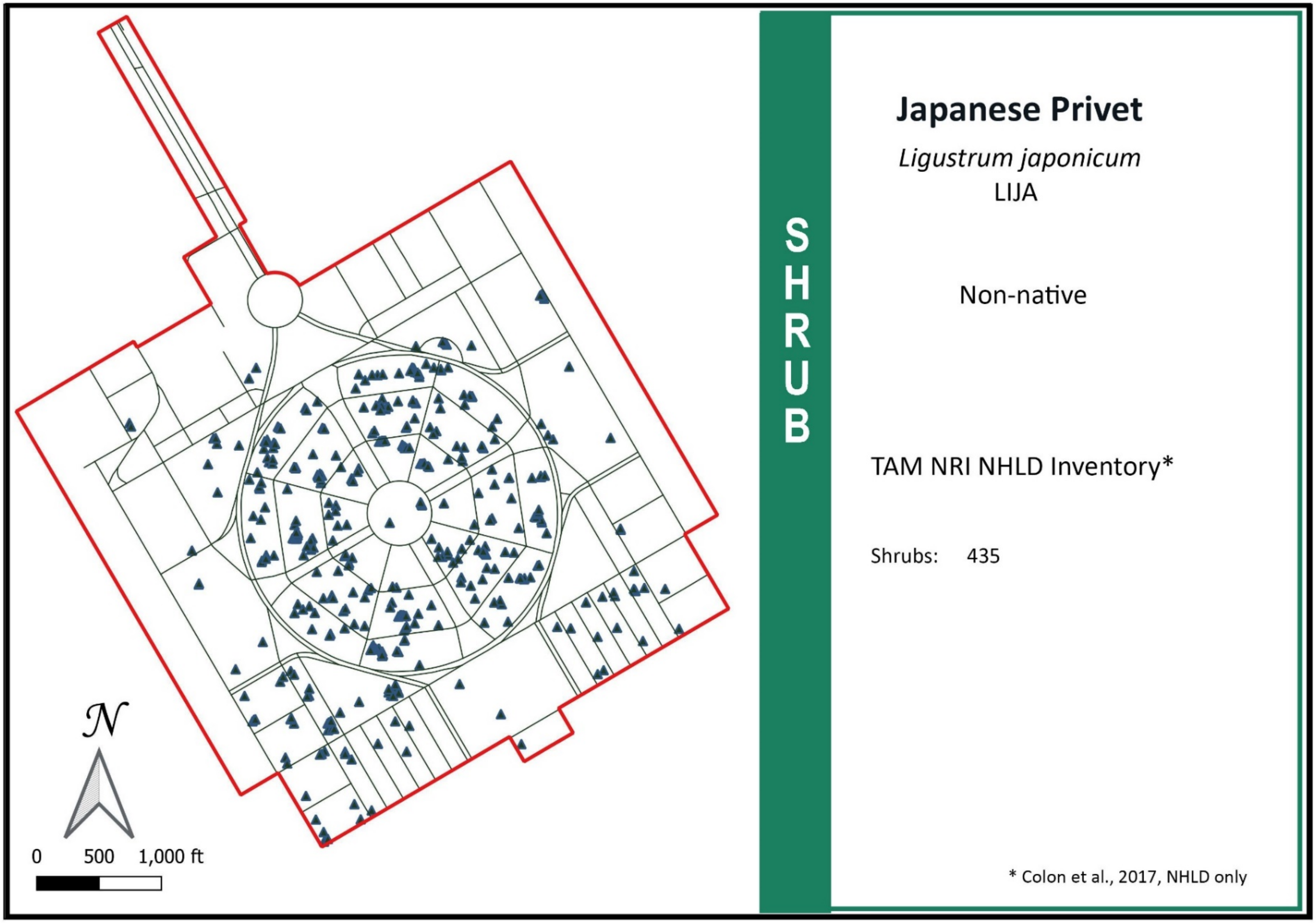
Crataegus spp.
CRATA

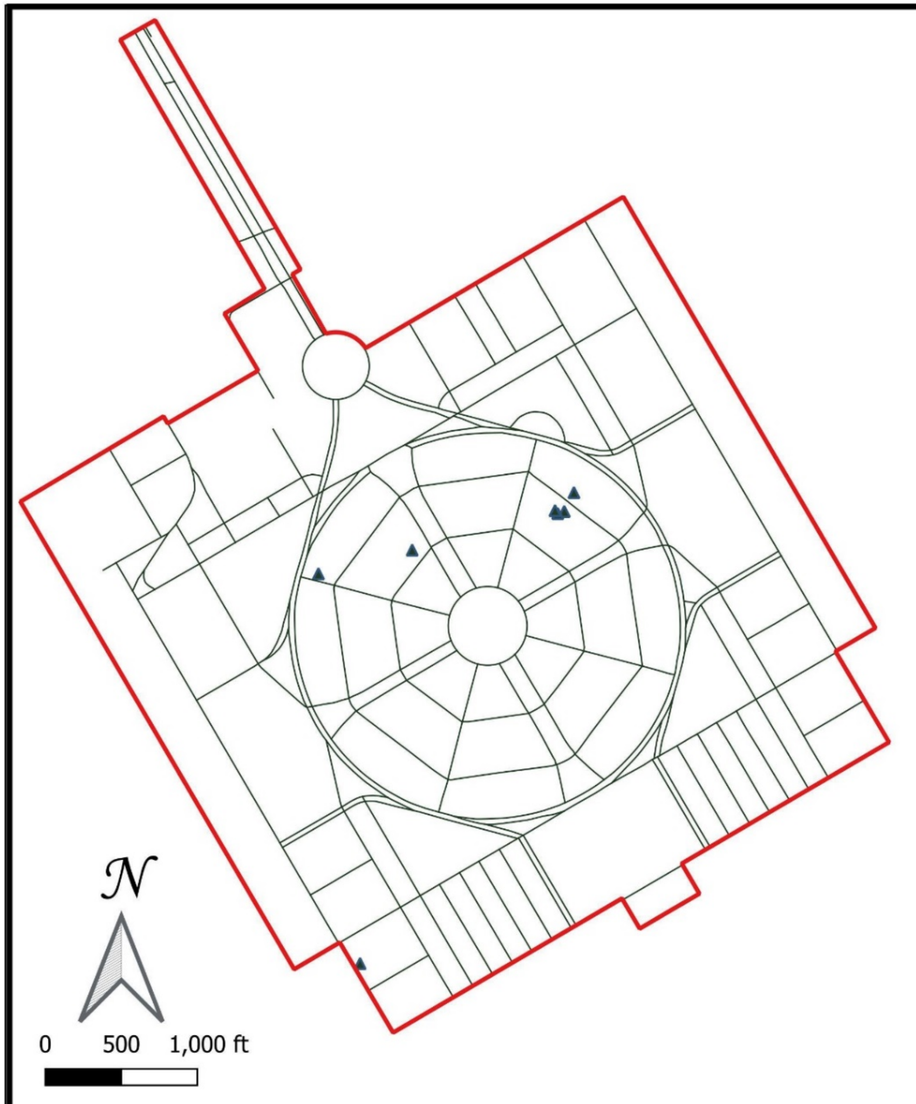
Texas Native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only


Japanese Privet
Ligustrum japonicum
LIJA
SHRUB
Non-native
TAM NRI NHLD Inventory*
Shrubs: 435
* Colon et al., 2017, NHLD only
N
0 500 1,000 ft



SHRUB

Loquot

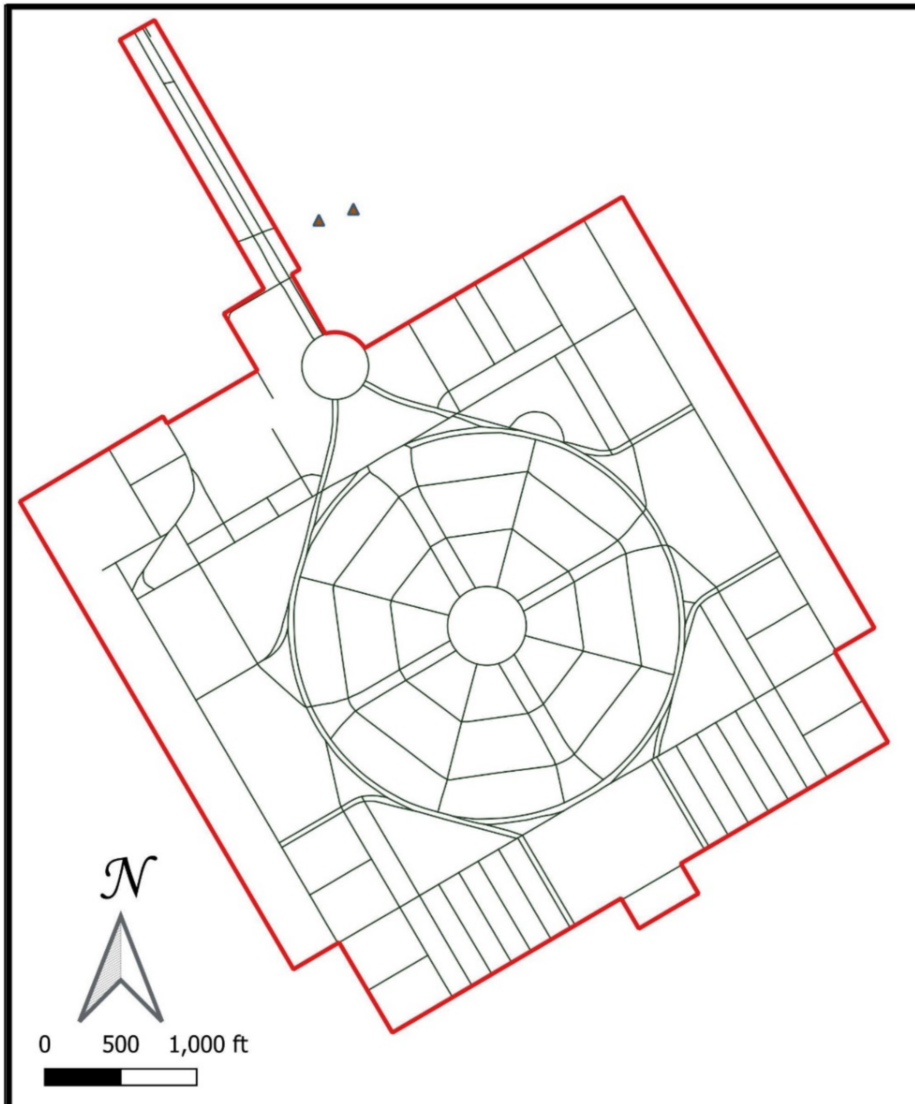
Eriobotrya japonica
ERJA3

Non-native

TAM NRI NHLD Inventory*

Shrubs: 9

* Colon et al., 2017, NHLD only



SHRUB

Maple

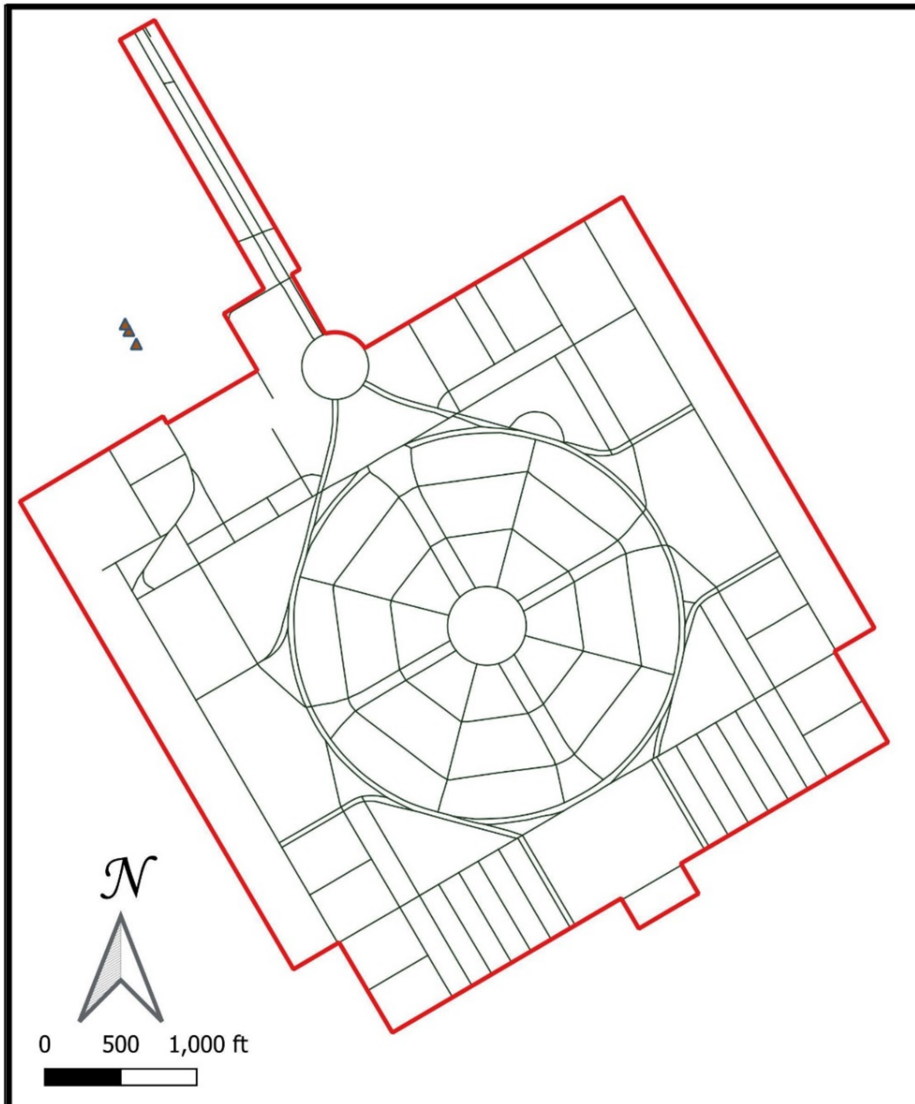
Acer spp.

Texas Native (*Acer spp.)*

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

Mexican Sycamore

Platanus mexicana

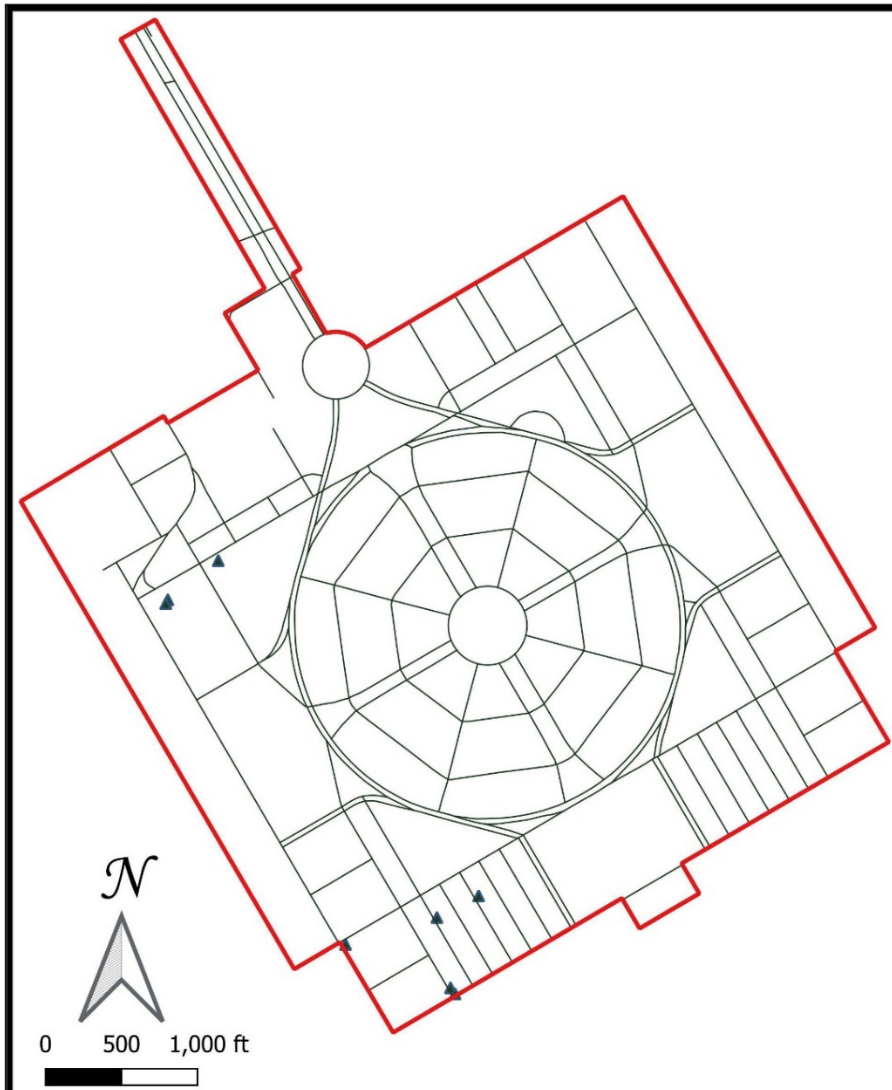
MAGR4

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

Monterrey Oak

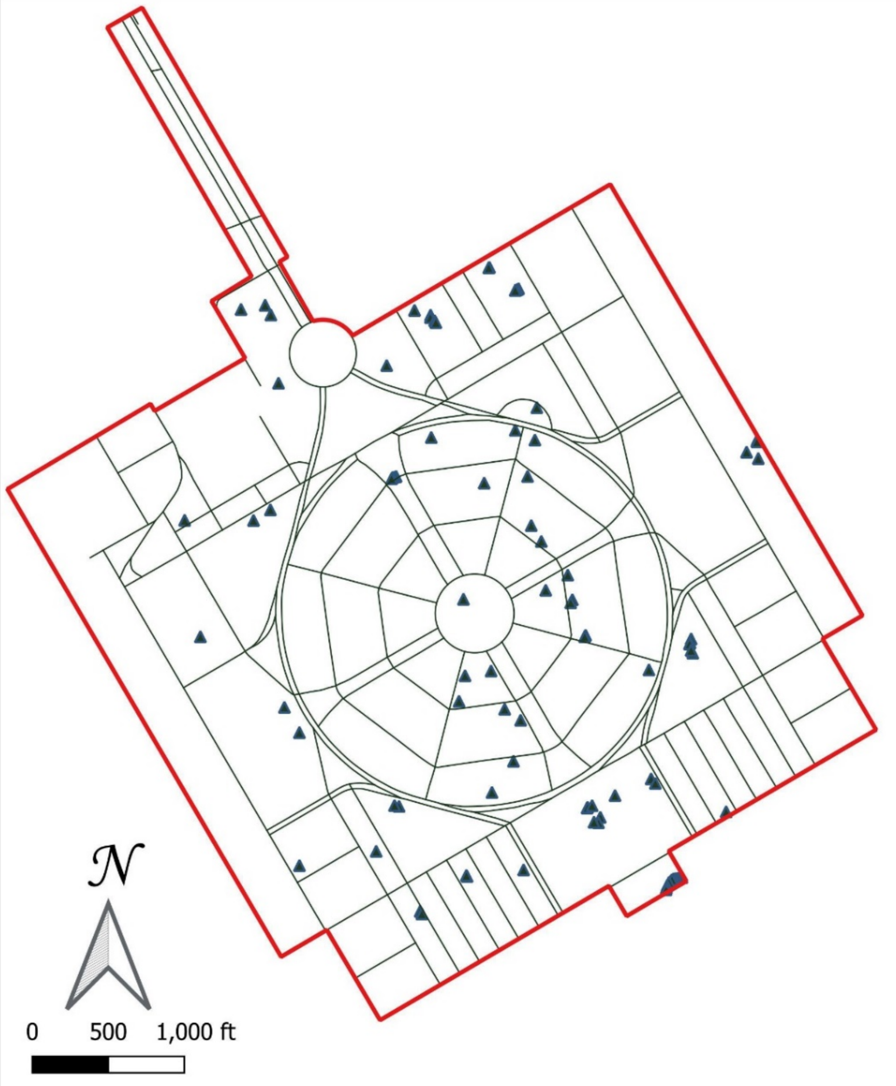
Quercus polymorpha
QUPO2

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 8

* Colon et al., 2017, NHLD only



S H R U B

Mountain Laurel

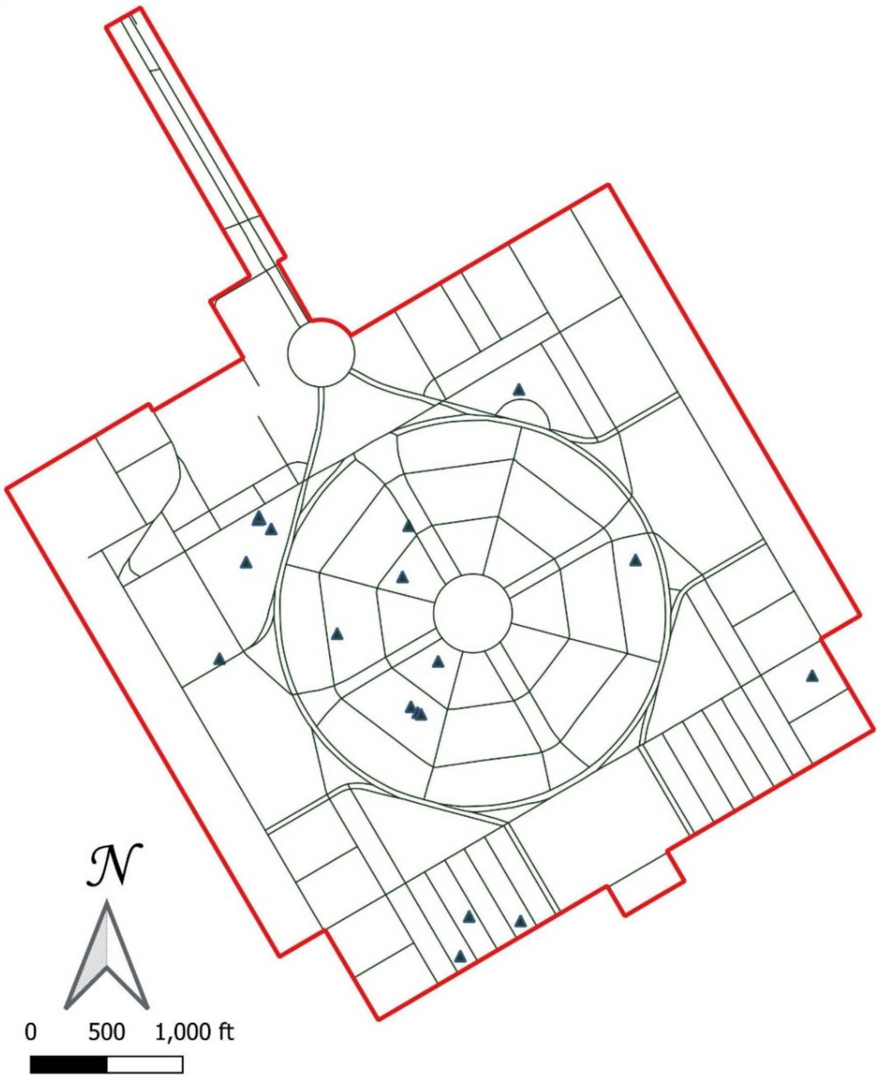
Sophora secundiflora
SOSE3

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 91

* Colon et al., 2017, NHLD only



SHRUB

Mulberry

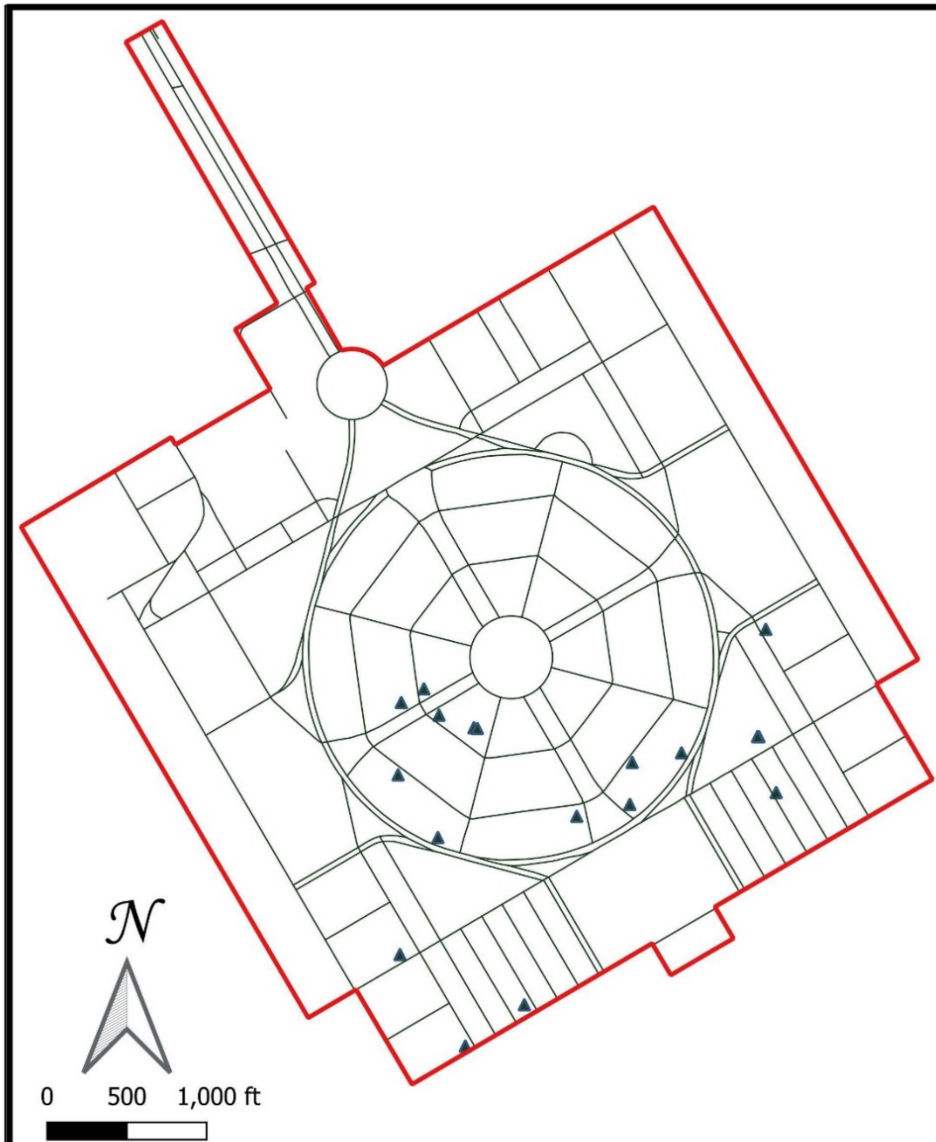
Morus alba
MOAL

Non-native

TAM NRI NHLD Inventory*

Shrubs: 20

* Colon et al., 2017, NHLD only



SHRUB

Oleander

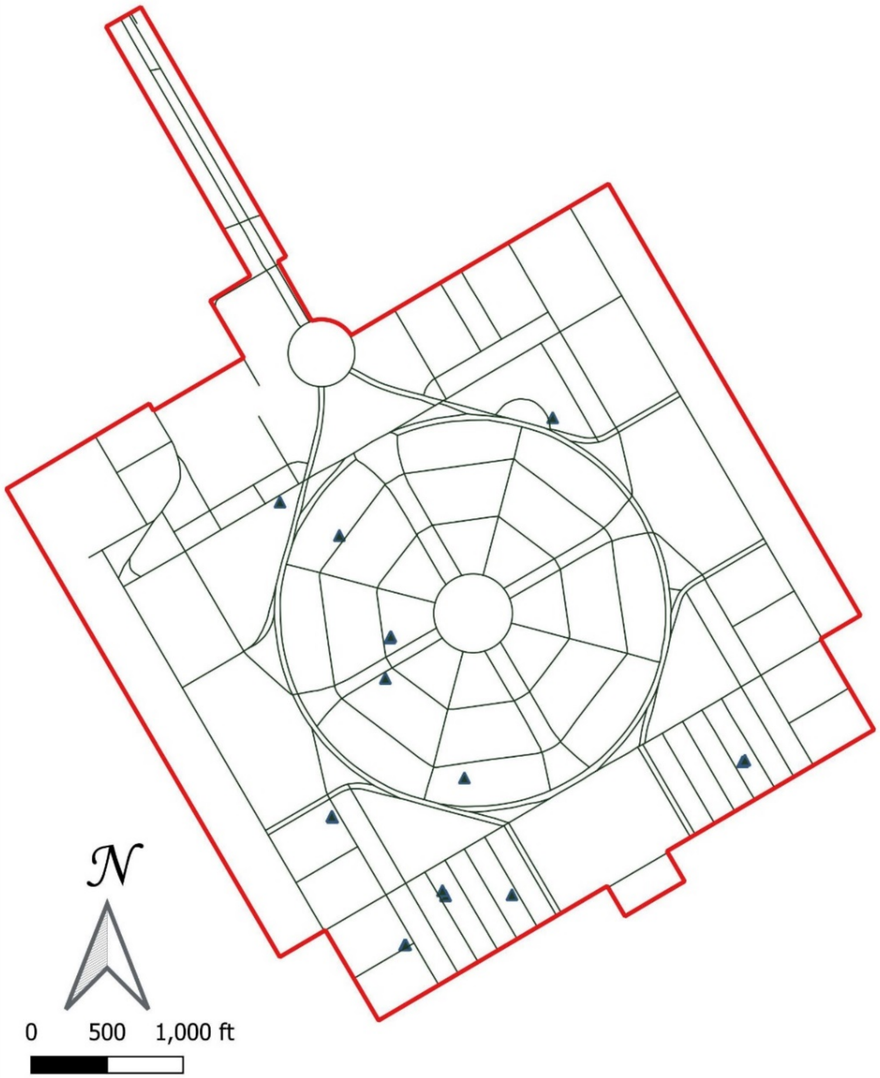
Nerium oleander
NEOL

Non-native

TAM NRI NHLD Inventory*

Shrubs: 18

* Colon et al., 2017, NHLD only



SHRUB

Oriental Arborvitae

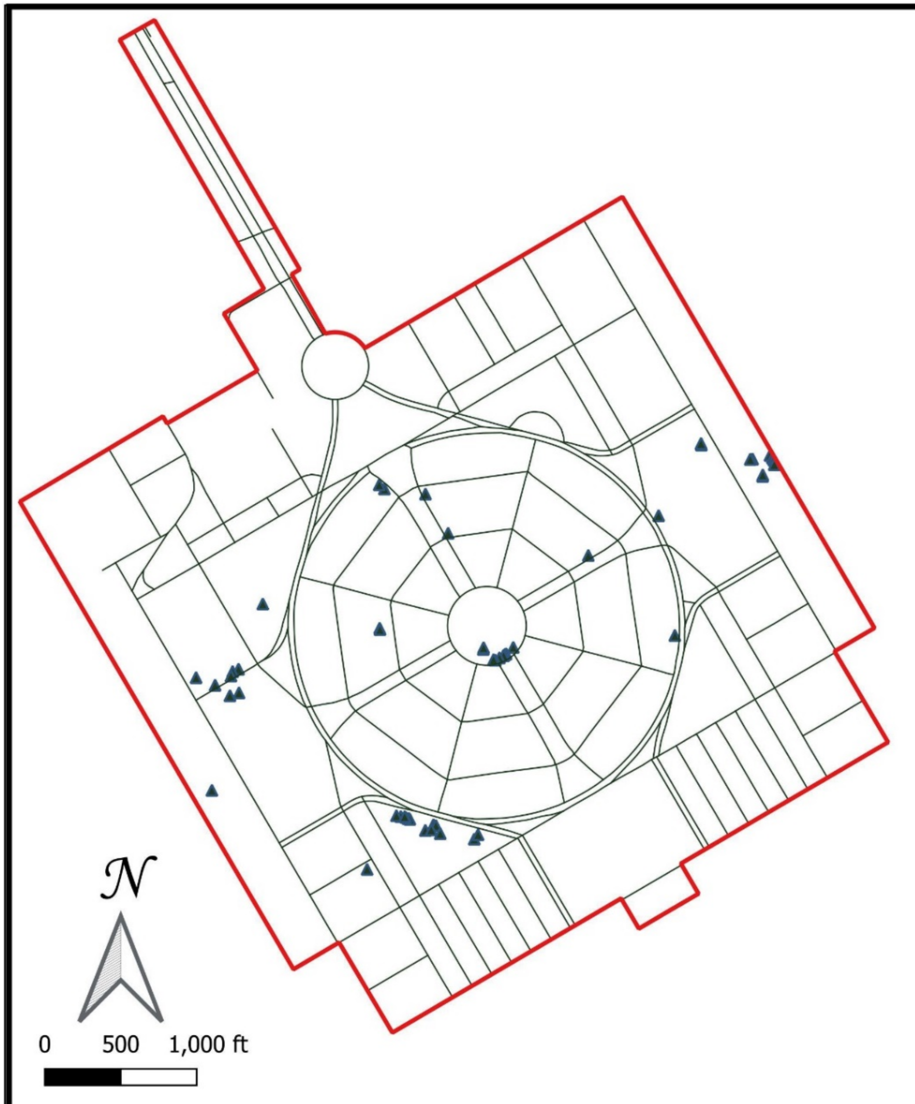
Thuja orientalis
THOR

Non-native

TAM NRI NHLD Inventory*

Shrubs: 18

* Colon et al., 2017, NHLD only



SHRUB

Palm

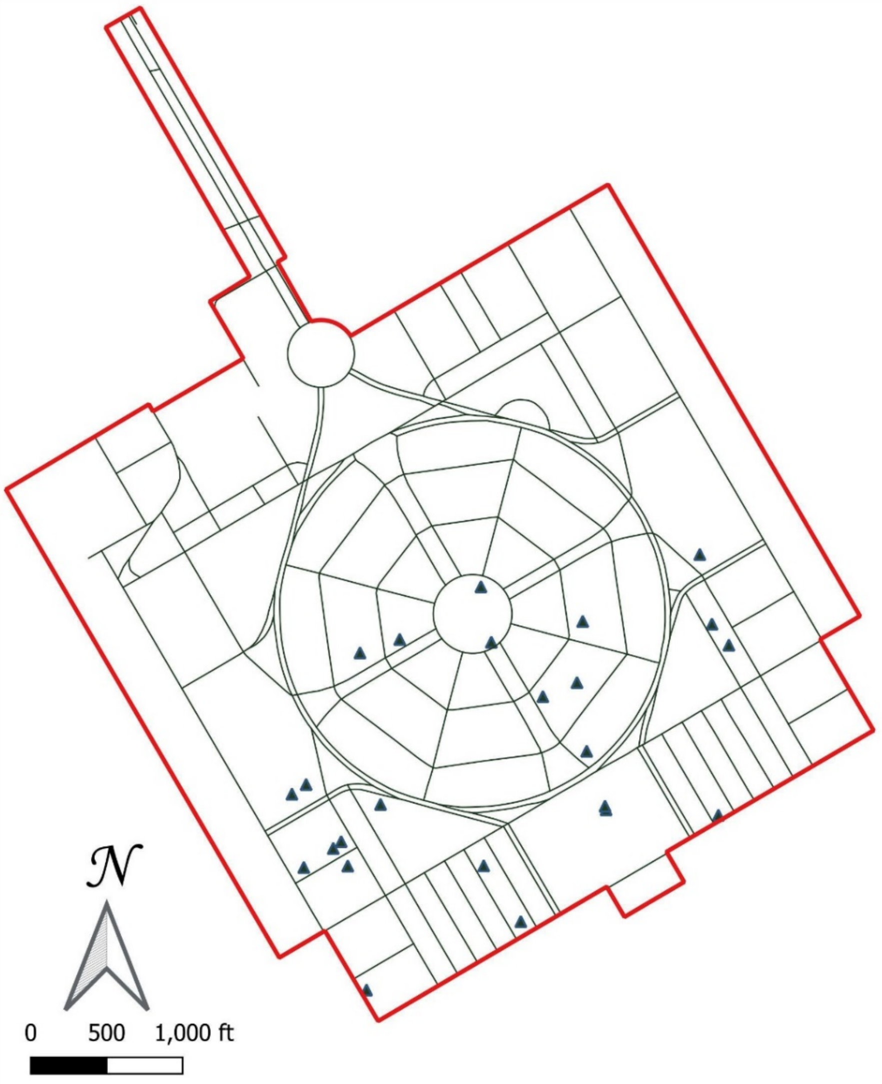
Aracacea spp.

Non-native

TAM NRI NHLD Inventory*

Shrubs: 56

* Colon et al., 2017, NHLD only



SHRUB

Pecan

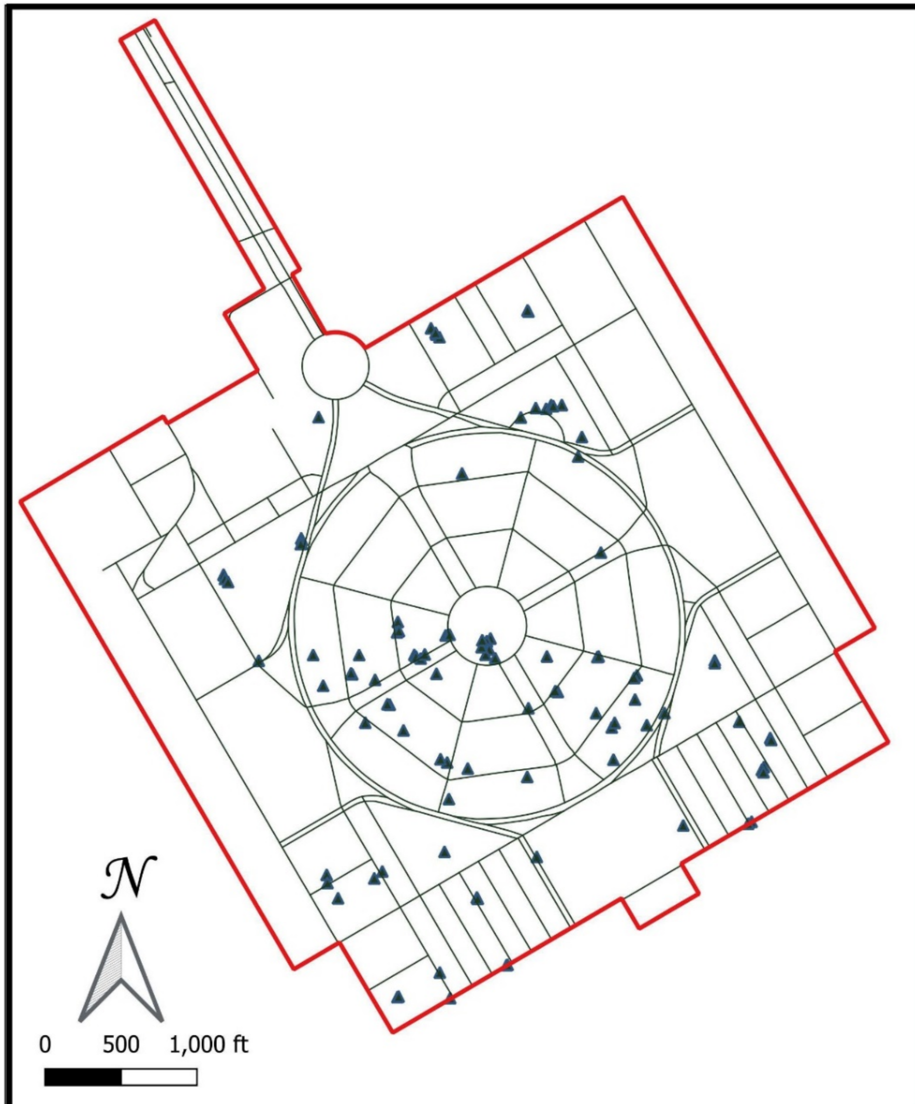
Carya illinoinensis
CAIL2

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 24

* Colon et al., 2017, NHLD only



SHRUB

Pitosporum

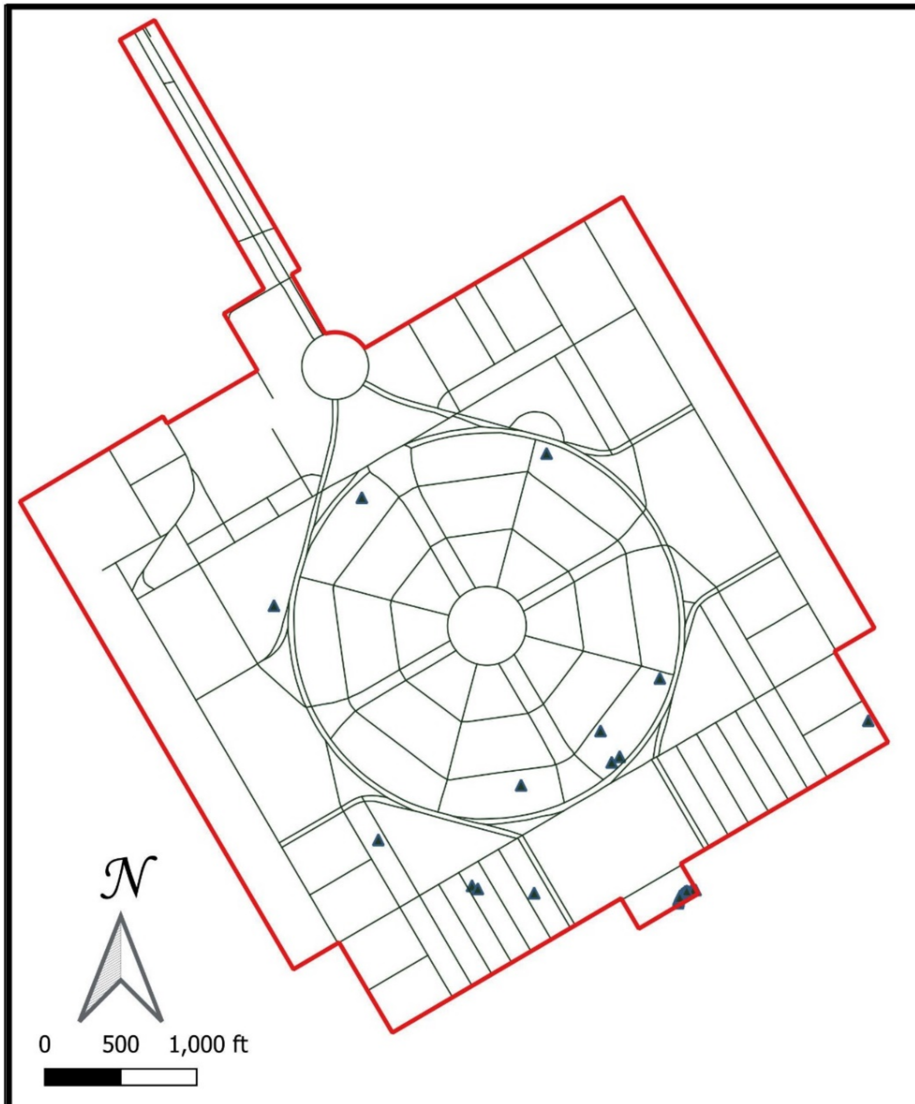
Pittosporum sp.
PITTO

Non-native

TAM NRI NHLD Inventory*

Shrubs: 103

* Colon et al., 2017, NHLD only



SHRUB

Purple Sage

Leucophyllum frutescens

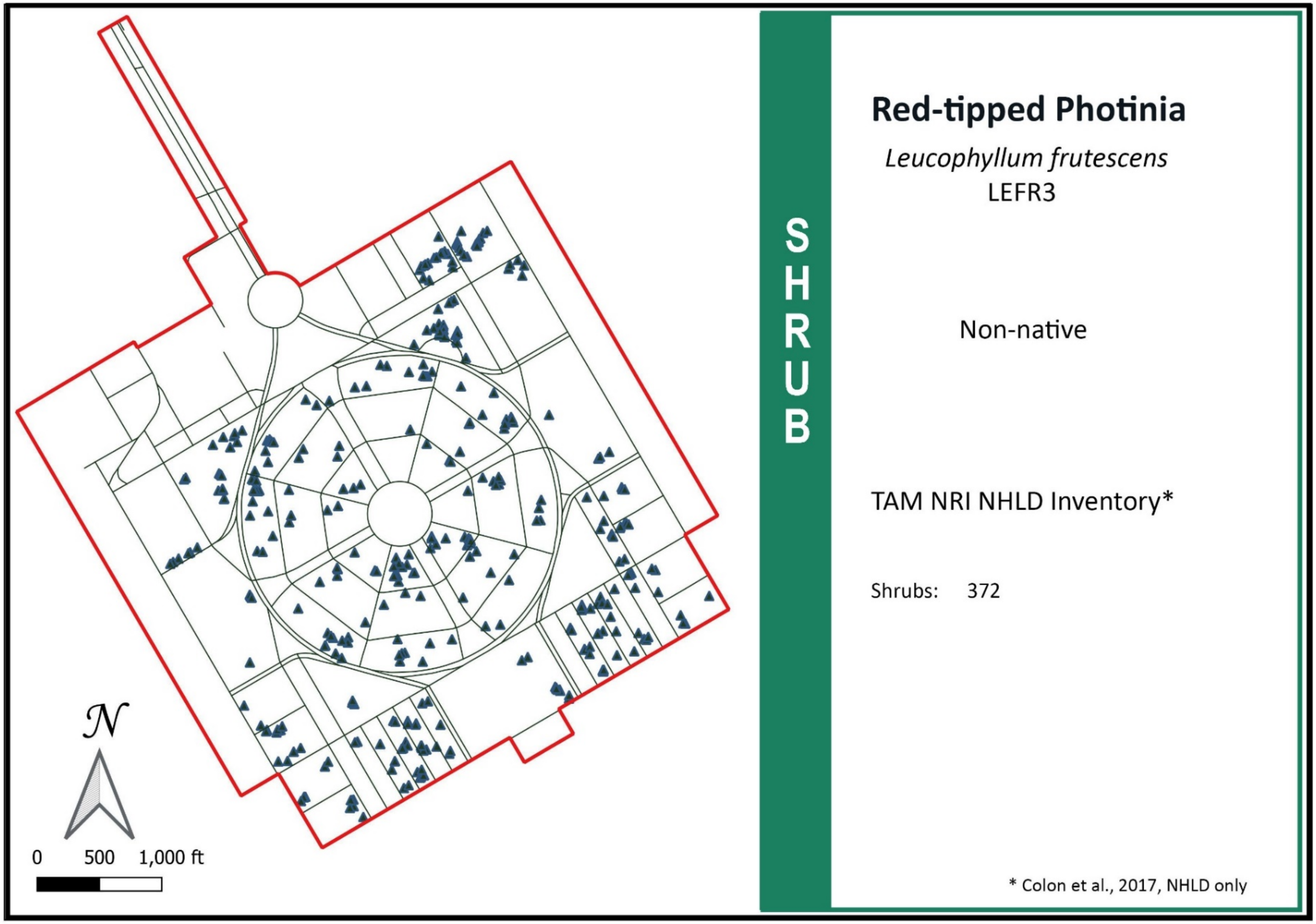
LEFR3

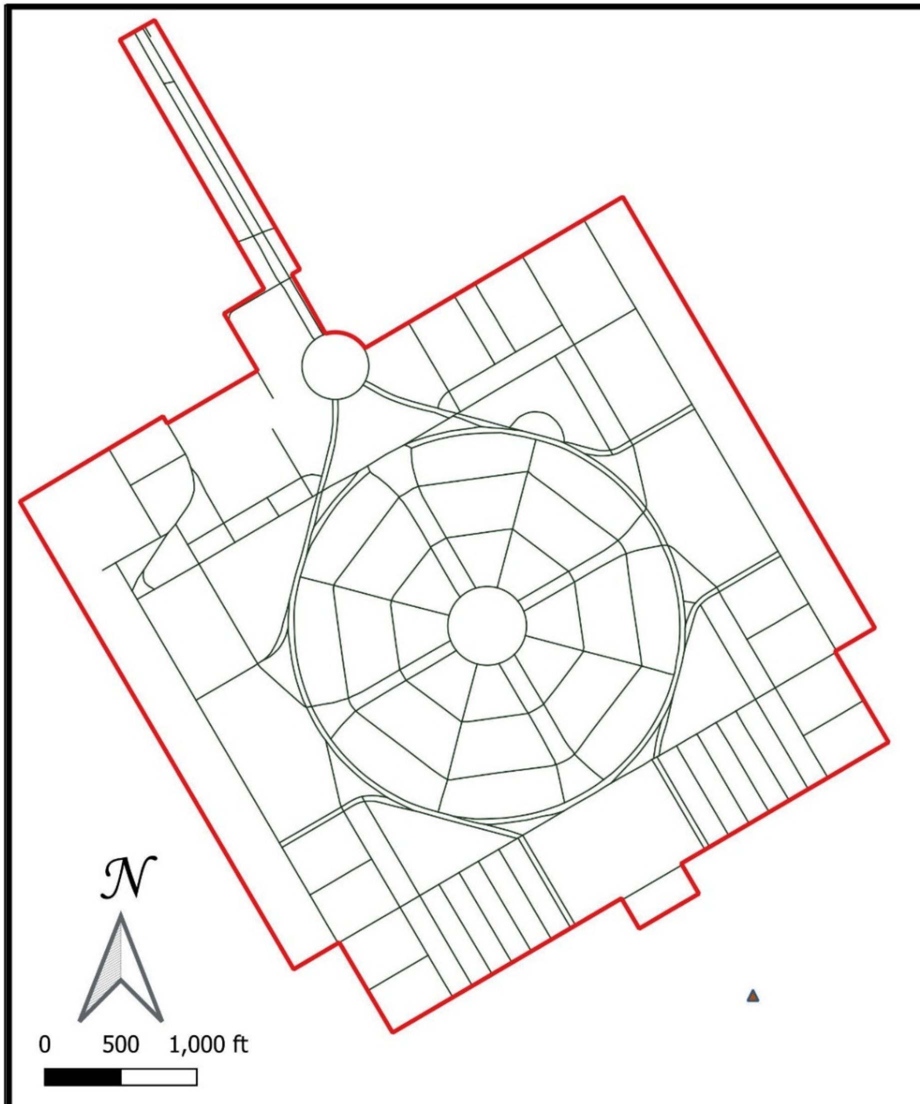
Texas Native

TAM NRI NHLD Inventory*

Shrubs: 26

* Colon et al., 2017, NHLD only


N
0
500
1,000 ft
SHRUB
Red-tipped Photinia
Leucophyllum frutescens
LEFR3
Non-native
TAM NRI NHLD Inventory*
Shrubs: 372
* Colon et al., 2017, NHLD only



Rose of Sharon

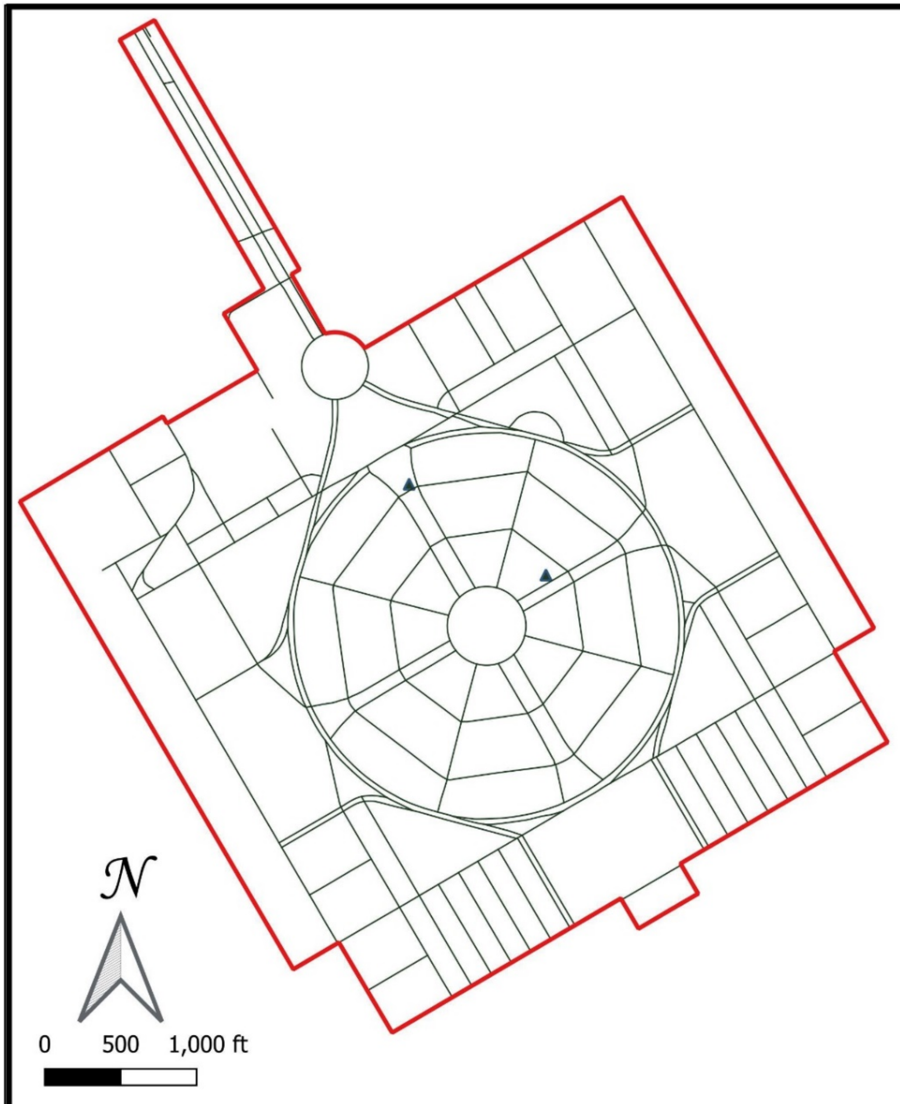
Hybiscus syriacus
HISY

Non-native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

Roughleaf Dogwood

Cornus drummondii

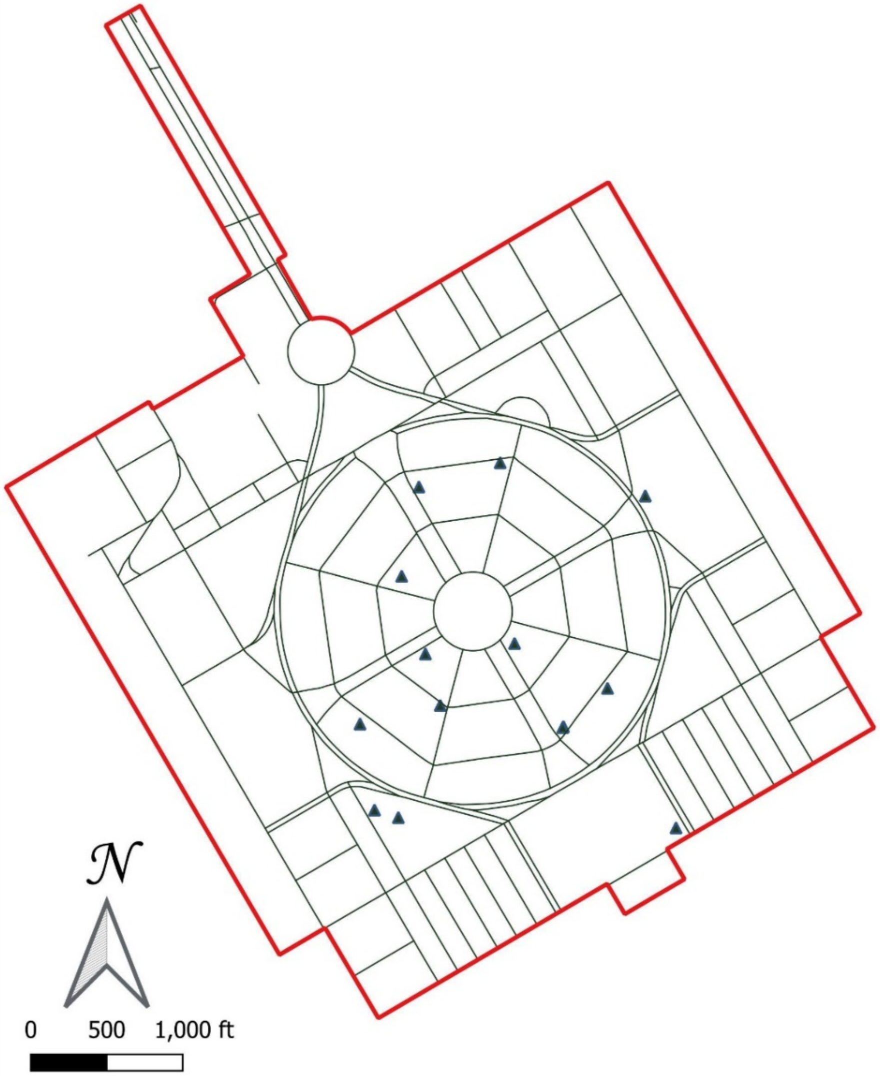
CODR

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 2

* Colon et al., 2017, NHLD only



SHRUB

Russian Olive

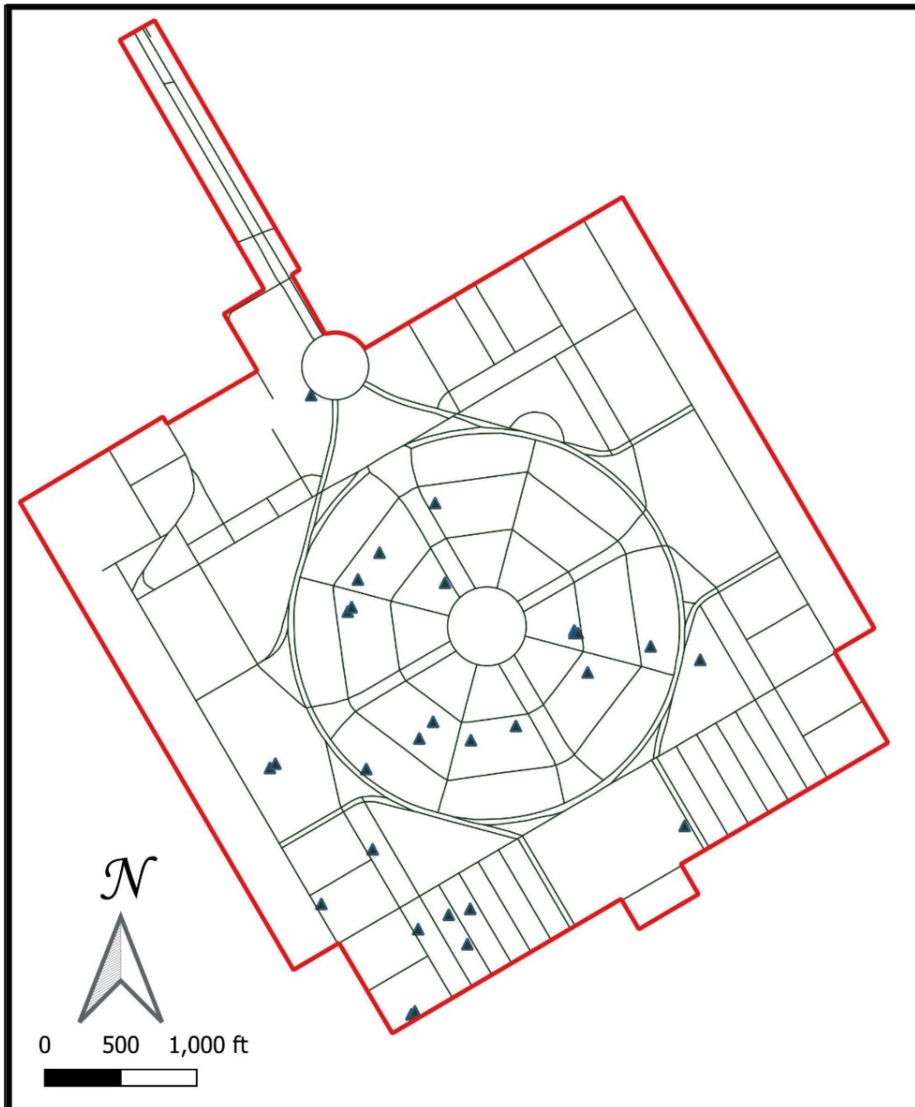
Elaeagnus angustifolia
ELAN

Non-native

TAM NRI NHLD Inventory*

Shrubs: 14

* Colon et al., 2017, NHLD only



SHRUB

Southern Live Oak

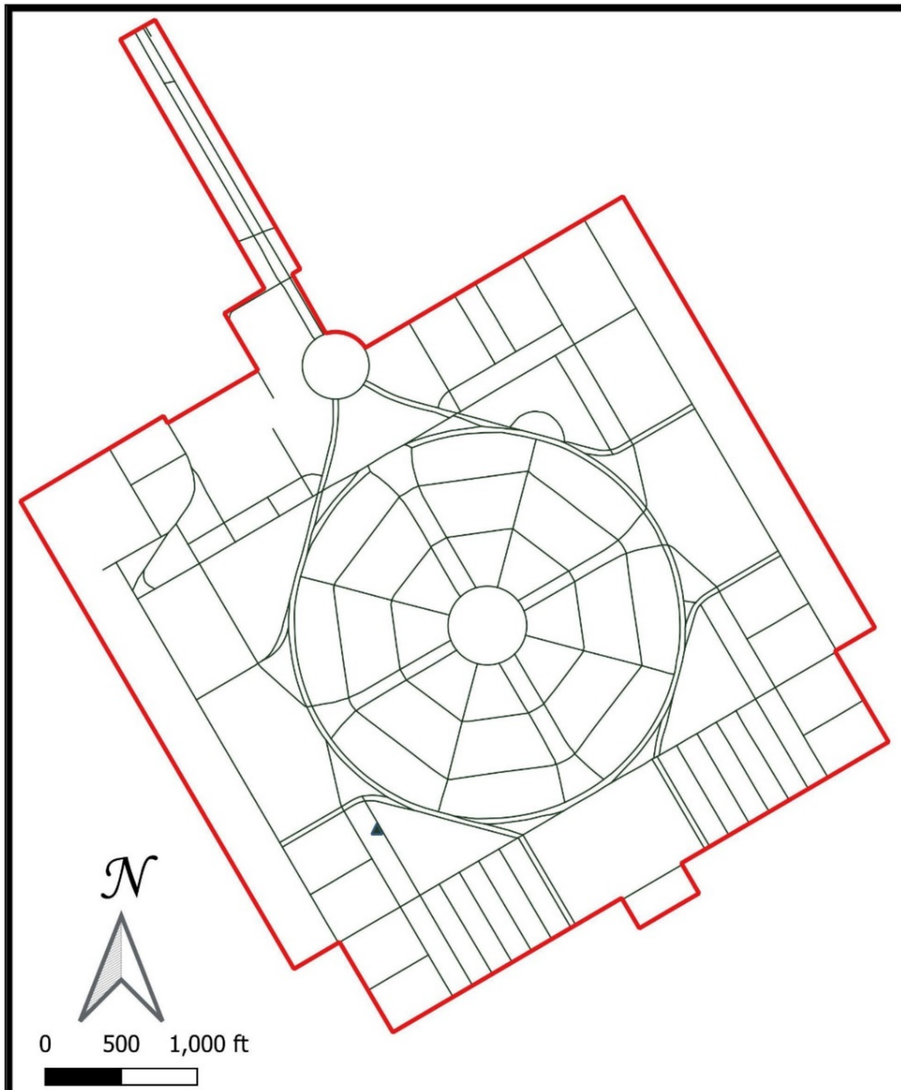
Quercus virginiana
QUVI

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 30

* Colon et al., 2017, NHLD only



SHRUB

Southern Magnolia

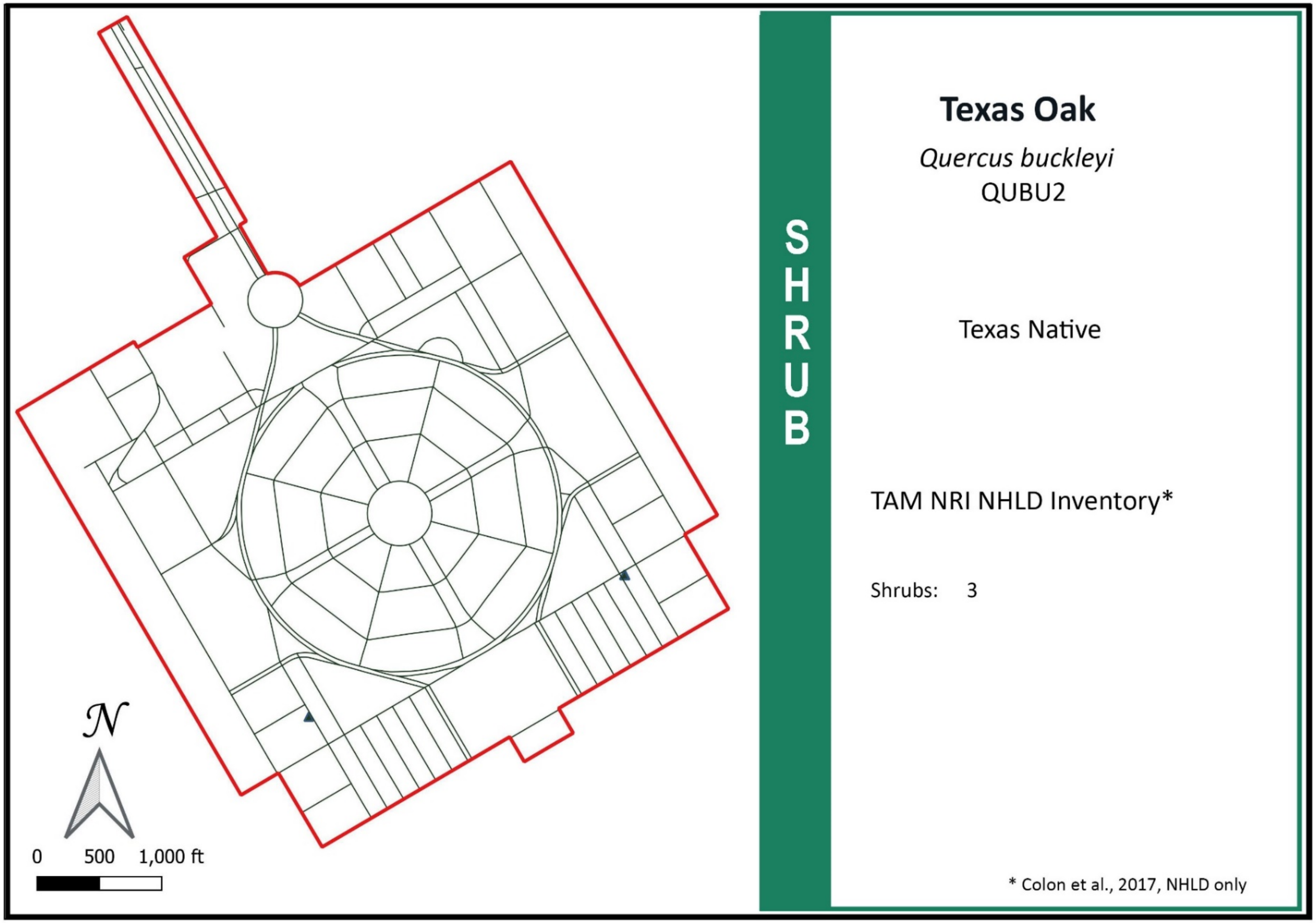
Magnolia grandiflora
MAGR4

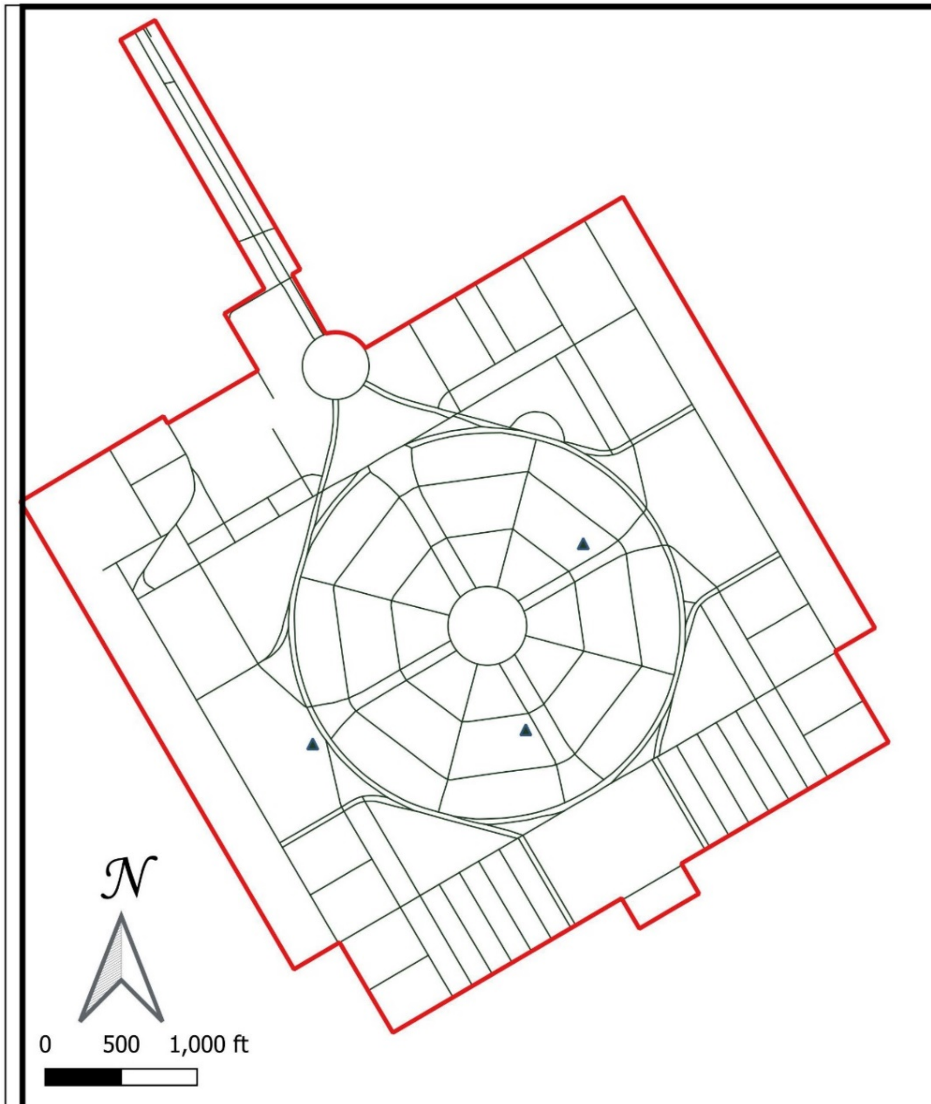
Texas Native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only


SHRUB
Texas Oak
Quercus buckleyi
QUBU2
Texas Native
TAM NRI NHLD Inventory*
Shrubs: 3
* Colon et al., 2017, NHLD only
N
0
500
1,000 ft



SHRUB

Texas Persimmon

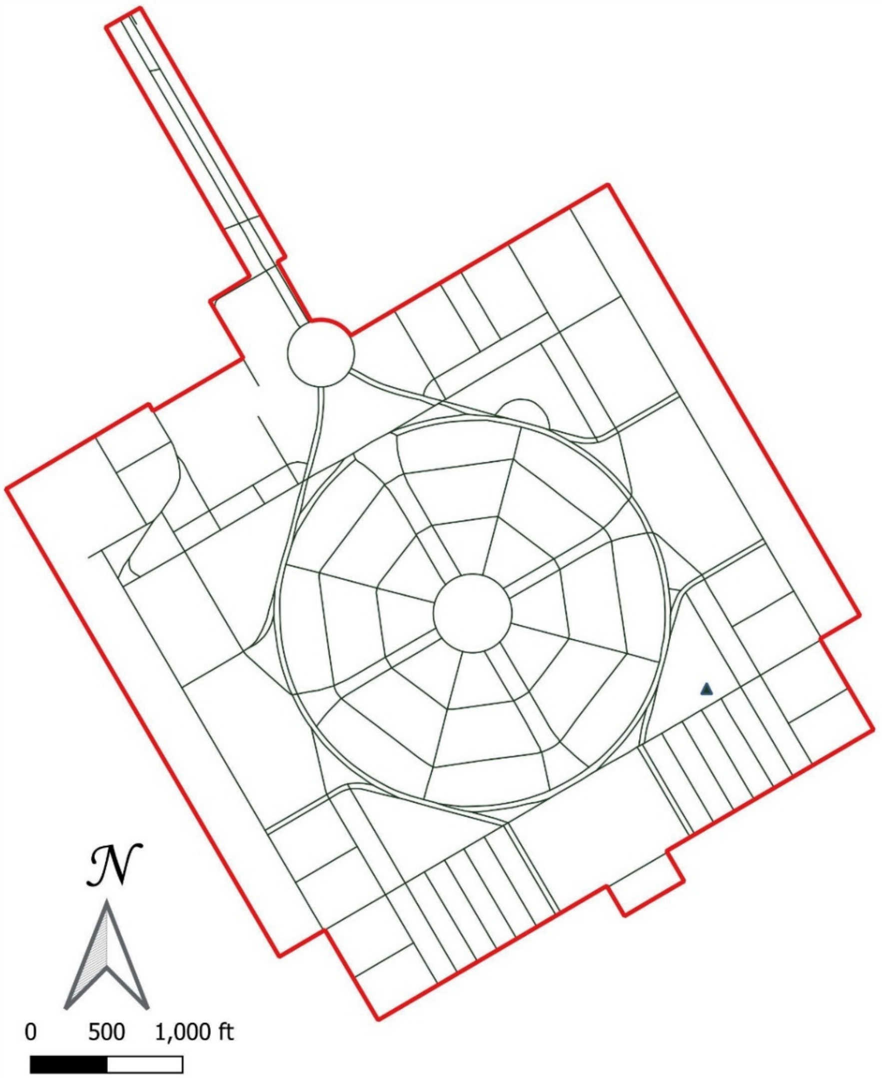
Diospyros texana
DITE3

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 3

* Colon et al., 2017, NHLD only



SHRUB

Vitex

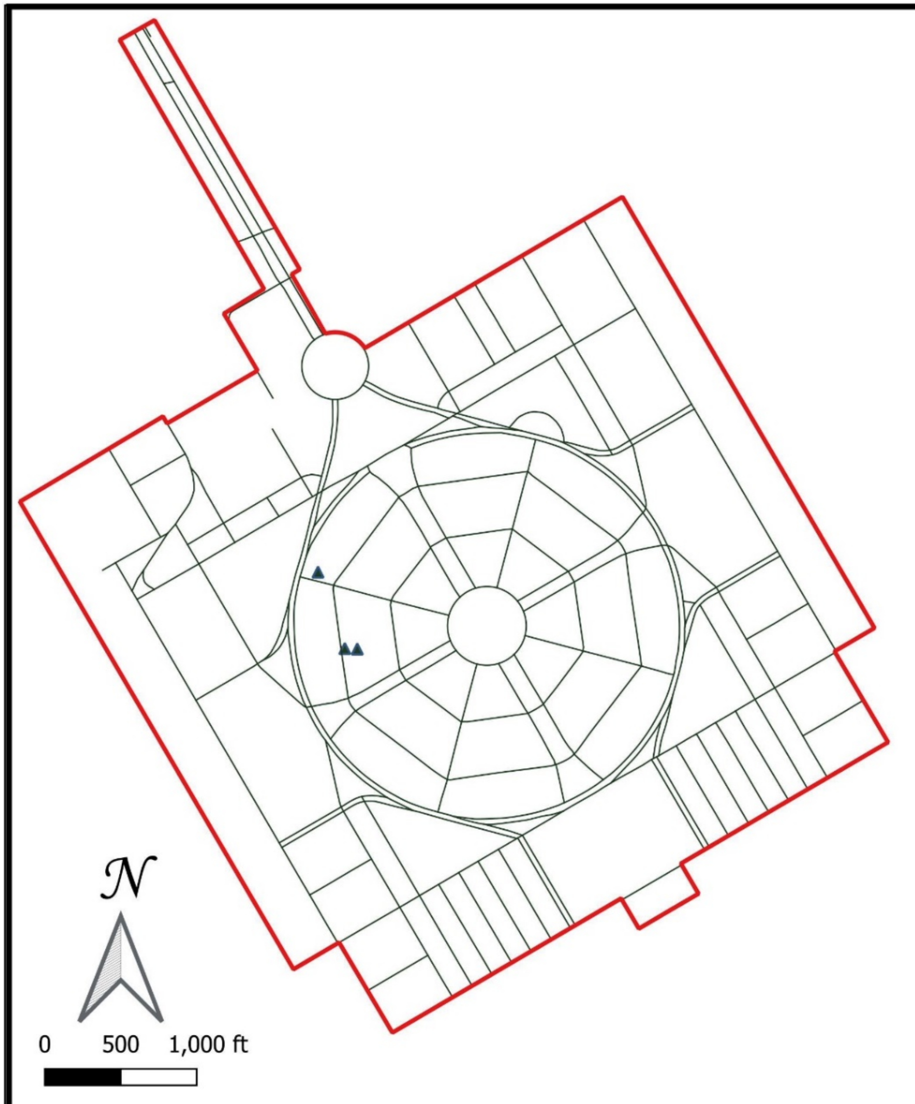
Vitex agnus-castus
VIAG

Non-native

TAM NRI NHLD Inventory*

Shrubs: 1

* Colon et al., 2017, NHLD only



SHRUB

White Ash

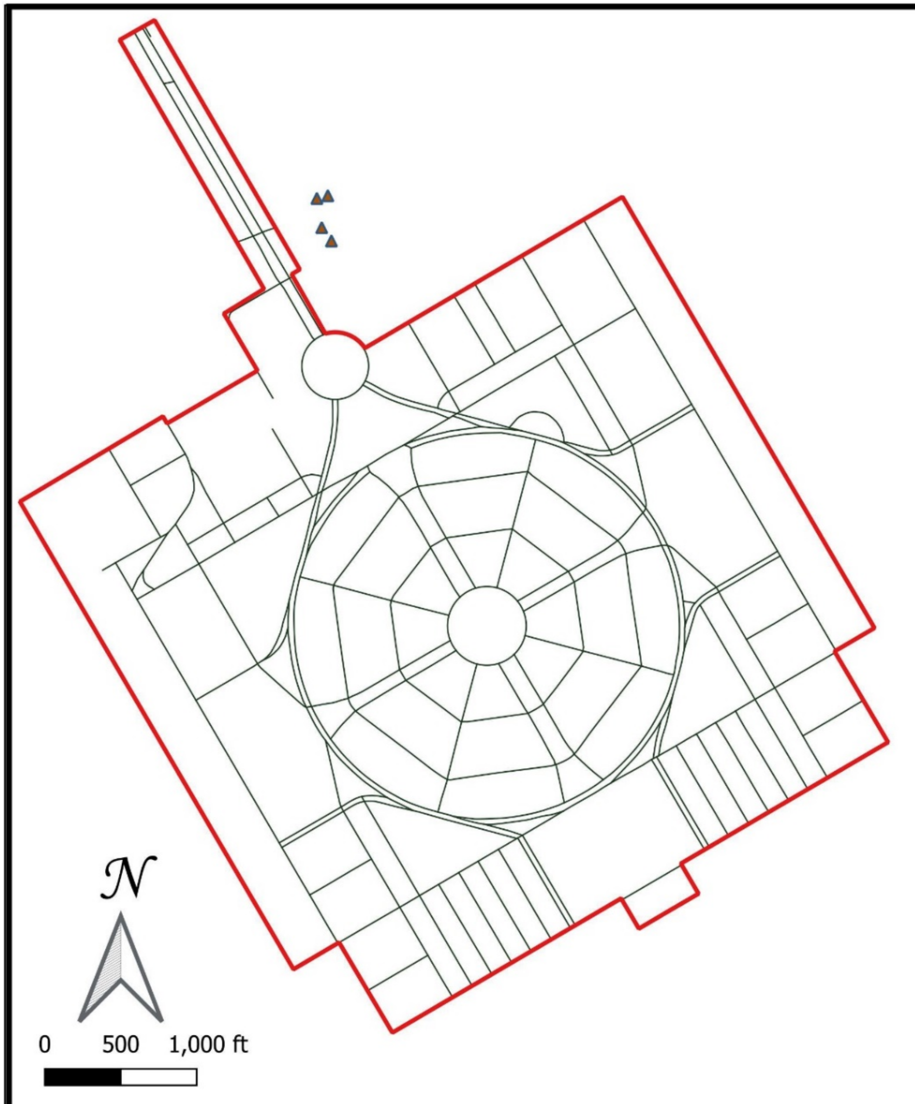
Fraxinus americana
FRAM2

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 3

* Colon et al., 2017, NHLD only



SHRUB

Winged Elm

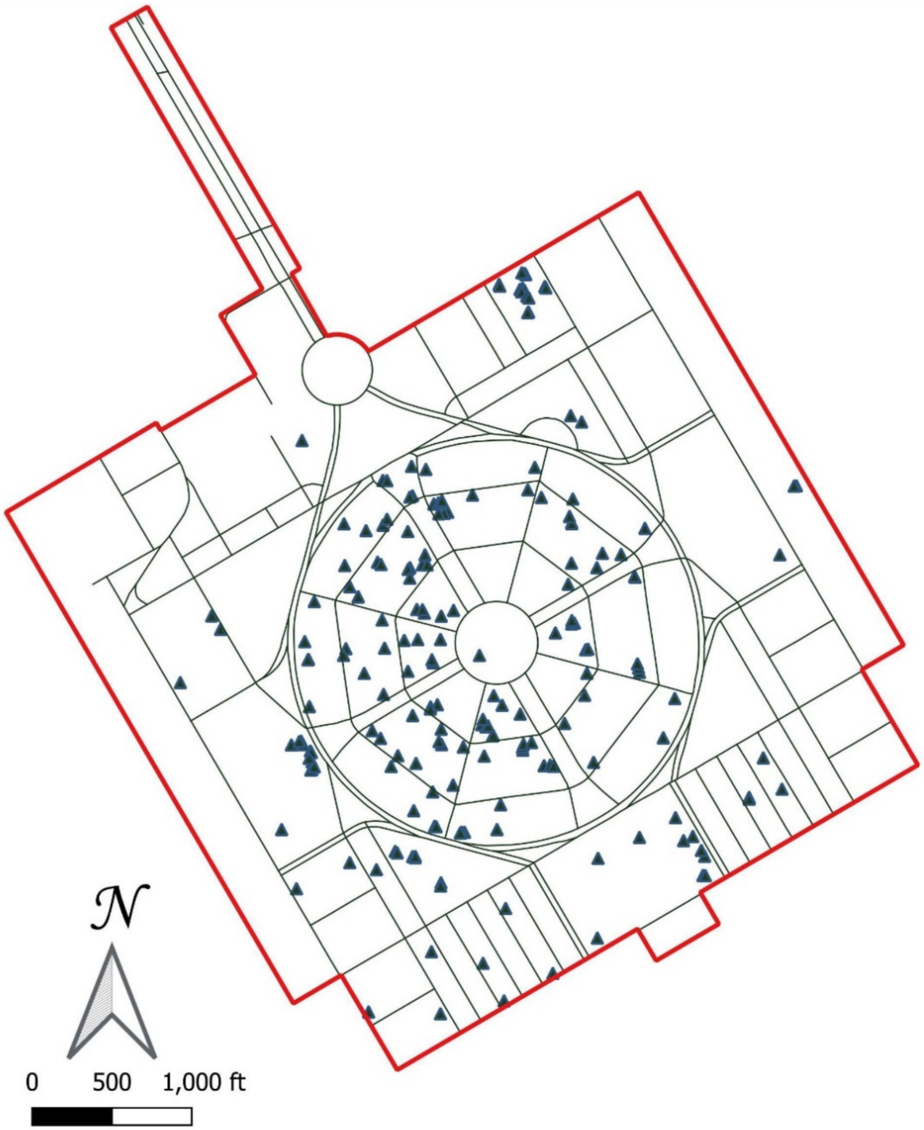
Ulmus alata
ULAL

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 0

* Colon et al., 2017, NHLD only



SHRUB

Yaupon Holly

Ilex vomitoria

ILVO

Texas Native

TAM NRI NHLD Inventory*

Shrubs: 191

* Colon et al., 2017, NHLD only

Appendix D

ISA Basic Tree Risk Assessment Form

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ISA Basic Tree Risk Assessment Form

Client ______ Date ______ Time ______
Address/Tree location ______ Tree no. ______ Sheet ____ of ____
Tree species ______ dbh ______ Height ______ Crown spread dia. ______
Assessor(s) ______ Tools used ______ **Time frame** ______

Target Assessment

Target number	Target description	Target protection	Target zone: Target within drip line	Target zone: Target within 1 x Ht.	Target zone: Target within 1.5 x Ht.	Occupancy rate 1 – rare 2 – occasional 3 – frequent 4 – constant	Practical to move target?	Restriction practical?
1								
2								
3								
4								

Site Factors

History of failures ______ **Topography** Flat☐ Slope☐ ______% **Aspect** ______
Site changes None☐ Grade change☐ Site clearing☐ Changed soil hydrology☐ Root cuts☐ Describe ______
Soil conditions Limited volume☐ Saturated☐ Shallow☐ Compacted☐ Pavement over roots☐ ______% Describe ______
Prevailing wind direction ______ **Common weather** Strong winds☐ Ice☐ Snow☐ Heavy rain☐ Describe ______

Tree Health and Species Profile

Vigor Low☐ Normal☐ High☐ **Foliage** None (seasonal)☐ None (dead)☐ Normal ____% Chlorotic ____% Necrotic ____%
Pests/Biotic ______ **Abiotic** ______
Species failure profile Branches☐ Trunk☐ Roots☐ Describe ______

Load Factors

Wind exposure Protected☐ Partial☐ Full☐ Wind funneling☐ ______ **Relative crown size** Small☐ Medium☐ Large☐
Crown density Sparse☐ Normal☐ Dense☐ **Interior branches** Few☐ Normal☐ Dense☐ **Vines/Mistletoe/Moss**☐ ______
Recent or expected change in load factors ______

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown☐ LCR ____%
Dead twigs/branches☐ ____% overall Max. dia. ______
Broken/Hangers Number ______ Max. dia. ______
Over-extended branches☐

Pruning history
Crown cleaned☐ Thinned☐ Raised☐
Reduced☐ Topped☐ Lion-tailed☐
Flush cuts☐ Other ______

Cracks☐ ______ Lightning damage☐
Codominant☐ ______ Included bark☐
Weak attachments☐ ______ Cavity/Nest hole ____% circ.
Previous branch failures☐ ______ Similar branches present☐
Dead/Missing bark☐ Cankers/Galls/Burls☐ Sapwood damage/decay☐
Conks☐ Heartwood decay☐ ______
Response growth ______

Condition(s) of concern ______

Part Size ______ Fall Distance ______
Load on defect N/A☐ Minor☐ Moderate☐ Significant☐
Likelihood of failure Improbable☐ Possible☐ Probable☐ Imminent☐

Part Size ______ Fall Distance ______
Load on defect N/A☐ Minor☐ Moderate☐ Significant☐
Likelihood of failure Improbable☐ Possible☐ Probable☐ Imminent☐

— Trunk —

Dead/Missing bark☐ Abnormal bark texture/color☐
Codominant stems☐ Included bark☐ Cracks☐
Sapwood damage/decay☐ Cankers/Galls/Burls☐ Sap ooze☐
Lightning damage☐ Heartwood decay☐ Conks/Mushrooms☐
Cavity/Nest hole ____% circ. Depth ______ Poor taper☐
Lean ____° Corrected? ______
Response growth ______
Condition(s) of concern ______
Part Size ______ Fall Distance ______
Load on defect N/A☐ Minor☐ Moderate☐ Significant☐
Likelihood of failure Improbable☐ Possible☐ Probable☐ Imminent☐

— Roots and Root Collar —

Collar buried/Not visible☐ Depth ______ Stem girdling☐
Dead☐ Decay☐ Conks/Mushrooms☐
Ooze☐ Cavity☐ ____% circ.
Cracks☐ Cut/Damaged roots☐ Distance from trunk ______
Root plate lifting☐ Soil weakness☐
Response growth ______
Condition(s) of concern ______
Part Size ______ Fall Distance ______
Load on defect N/A☐ Minor☐ Moderate☐ Significant☐
Likelihood of failure Improbable☐ Possible☐ Probable☐ Imminent☐

Page 1 of 2

Risk Categorization

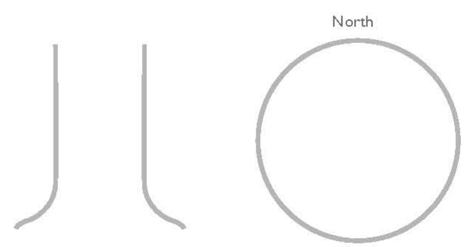
Target (*Target number or description*)	Tree part	Condition(s) of concern	Likelihood – Failure				Likelihood – Impact				Likelihood – Failure & Impact (*from Matrix 1*)				Consequences				Risk rating (*from Matrix 2*)
			Improbable	Possible	Probable	Imminent	Very low	Low	Medium	High	Unlikely	Somewhat	Likely	Very likely	Negligible	Minor	Significant	Severe	

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impact			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low



Notes, explanations, descriptions

____
____
____
____
____

Mitigation options

1. ______________________________ **Residual risk** ________
2. ______________________________ **Residual risk** ________
3. ______________________________ **Residual risk** ________
4. ______________________________ **Residual risk** ________

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐

Overall residual risk None ☐ Low ☐ Moderate ☐ High ☐ Extreme ☐ **Recommended inspection interval** ________________

Data ☐Final ☐ Preliminary **Advanced assessment needed** ☐No ☐Yes-Type/Reason ______________________________

Inspection limitations ☐None ☐Visibility ☐Access ☐Vines ☐Root collar buried Describe ______________________________

This datasheet was produced by the International Society of Arboriculture (ISA) — 2017

Page 2 of 2

Appendix C

C

i-Tree Model Results

C-1 i-Tree Canopy

C-2 i-Tree Design

C-3 i-Tree Eco

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C-1

I-TREE CANOPY

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i-Tree Canopy v7.0 Cover Assessment and Tree Benefits Report

Background

i-Tree Canopy[81] is designed to allow users to accurately estimate tree and other cover classes (e.g., grass, building, roads, etc.) within an urban area. This tool randomly lays points (number determined by the user) onto Google Earth imagery and the user then classifies what cover class each point falls upon. From this classification of points, a statistical estimate of the amount or percent cover in each cover class can be calculated along with an estimate of uncertainty of the estimate (standard error (SE). Although i-Tree Canopy also includes a tree benefits report, results only were used in this EA to assess land cover change following implementation of alternative 2 or 3. Tree benefits results were obtained using the i-Tree Eco model. The i-Tree Eco uses site specific tree inventory data, and local weather and climate data thus providing a more accurate estimate of tree benefits.

Method

i-Tree Canopy was used to estimate tree and other cover classes (e.g., grass, building, roads, etc.) within Randolph Field NHLD. This tool randomly laid points onto high resolution Google Earth Pro imagery on the NHLD. The cover class under each point was classified. 2,500 points were classified in this analysis. This large number of points within the NHLD was chosen to minimize the standard error of the estimate—the accuracy of the estimate increases as the number of points increases. Seven cover classes were used in this analysis: grass, building, road, bare ground, tree, water, and woody plant. The results include land cover percentages for each cover class. The modeled output also includes tree benefit estimates for air pollution removed annually, carbon sequestration, and hydrological estimates (avoided runoff, interception, etc.). i-Tree Canopy only was used to evaluate changes in landcover. Other i-Tree Canopy results[82] (e.g., carbon sequestration, pollutant removal, etc.) are existing conditions and serve as a rough check on results obtained from the more rigorous i-Tree Eco model.

Results

i-Tree land cover classification of 2,500 points within the NHLD using photo interpretation of Google Earth Pro imagery are in the following table. Results indicate that there would be no change in impervious cover due to implementation of either alternative 2 or 3. Building and road (includes sidewalks and parking lots) classes are impervious cover and affect stormwater runoff. The more impervious surface, the more quickly water and pollutants (e.g., oil, gasoline,

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[81] i-Tree Canopy is one of a suite of peer-reviewed software from the USDA Forest Service that provides an estimate of urban and rural forestry analysis and benefits assessments.

[82] Additional information on i-Tree Canopy air pollutant removal and monetary value model descriptions, carbon storage and sequestration rates, and carbon dioxide sequestration rates can be found at *i-Tree Methods Documentation, Model Notes, & Technical Papers*, https://www.itreetools.org/support/resources-overview/i-tree-methods-and-files, accessed 4 March 2021.

etc.) from the roads enters the stormwater sewers. Trees reduce runoff by intercepting and retaining rainwater on leaves and branches, increase infiltration and storage of rainwater in the trees' root systems, and reduce soil erosion by slowing rainfall before it strikes the soil. Although trees are more effective at controlling stormwater runoff, grasses and shrubs also slow stormwater runoff, reduce soil erosion, filter runoff, and increase infiltration. By implementing the Preferred Alternative, i.e., 40 percent trees removed and replaced by grass groundcover, there would be an increase of approximately 24 percent in grass cover class with a corresponding decrease in tree cover class. The following table compares the change in tree and grass cover before (Alternative 1, No Action) and after implementation of Alternative 2 (Preferred Alternative) or Alternative 3 (Two-Phase Implementation).

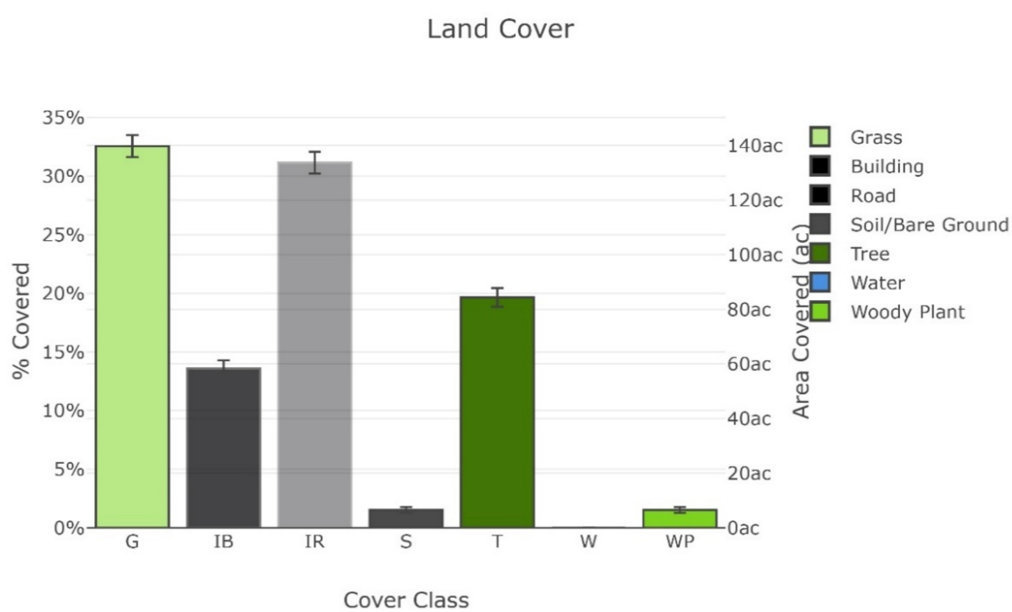
Table C1-1. Land Cover Class Change

Cover Class	% Cover			
	Alternative 1	Alternative 2	Alternative 3 Phase I	Alternative 3 Phase 2
Building	13.6	13.6	13.6	13.6
Road	31.1	31.1	31.1	31.1
Tree	19.7	15.0	17.4	15.0
Woody Plants (Shrubs)	1.5	1.5	1.5	1.5
Grass	32.6	40.4	36.5	40.4
Soil/Bare ground	1.5	1.5	1.5	1.5
Water	0.0	0.0	0.0	0.0

i-Tree Canopy v7.0

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 12/14/2020



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
G	Grass	Grass, landscape material	812	32.56 ± 0.94	139.76 ± 4.03
IB	Building	Impervious building	339	13.59 ± 0.69	58.35 ± 2.95
IR	Road	Road/Parking Lot/Sidewalk	777	31.15 ± 0.93	133.74 ± 3.98
S	Soil/Bare Ground	Soil, bare ground	38	1.52 ± 0.25	6.54 ± 1.05
T	Tree		490	19.65 ± 0.80	84.34 ± 3.42
W	Water	Pond	0	0.00 ± 0.00	0.00 ± 0.00
WP	Woody Plant	Shrubs	38	1.52 ± 0.25	6.54 ± 1.05
Total			**2494**	**100.00**	**429.27**

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE	CO_2 Equiv. (T)	±SE	Value (USD)	±SE
Sequestered annually in trees	115.13	±4.66	422.13	±17.09	$19,635	±795
Stored in trees (Note: this benefit is not an annual rate)	2,891.26	±117.08	10,601.29	±429.30	$493,106	±19,968

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Amount sequestered is based on 1.365 T of Carbon, or 5.005 T of CO_2, per ac/yr and rounded. Amount stored is based on 34.281 T of Carbon, or 125.697 T of CO_2, per ac and rounded. Value (USD) is based on $170.55/T of Carbon, or $46.51/T of CO_2 and rounded. (English units: T = tons (2,000 pounds), ac = acres)

Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	173.84	±7.04	$116	±5
NO2	Nitrogen Dioxide removed annually	955.91	±38.71	$293	±12
O3	Ozone removed annually	4,429.35	±179.37	$9,056	±367
SO2	Sulfur Dioxide removed annually	627.52	±25.41	$45	±2
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	1,103.33	±44.68	$3,458	±140
PM2.5	Particulate Matter less than 2.5 microns removed annually	196.91	±7.97	$17,055	±691
Total		**7,486.86**	**±303.18**	**$30,023**	**±1,216**

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in lb/ac/yr @ $/lb/yr and rounded:
CO 2.061 @ $0.67 | NO2 11.334 @ $0.31 | O3 52.518 @ $2.04 | SO2 7.440 @ $0.07 | PM10* 13.082 @ $3.13 | PM2.5 2.335 @ $86.61 (English units: lb = pounds, ac = acres)

Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Mgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	1.47	±0.06	$13,138	±532
E	Evaporation	5.80	±0.23	N/A	N/A
I	Interception	5.80	±0.23	N/A	N/A
T	Transpiration	16.60	±0.67	N/A	N/A
PE	Potential Evaporation	66.32	±2.69	N/A	N/A
PET	Potential Evapotranspiration	59.15	±2.40	N/A	N/A

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Mgal/ac/yr @ $/Mgal/yr and rounded:
AVRO 0.017 @ $8,936.00 | E 0.069 @ N/A | I 0.069 @ N/A | T 0.197 @ N/A | PE 0.786 @ N/A | PET 0.701 @ N/A (English units: Mgal = millions of gallons, ac = acres)

About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company)

Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

Use of this tool indicates acceptance of the EULA.

C-2

I-TREE DESIGN

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i-Tree Design v7.0

Background

i-Tree Design was used in this EA to better understand the expected changes in energy demand (cost) and lost tree benefits following implementation of the Proposed Action. The model uses the methods detailed in McPherson and Simpson[83] (1999). i-Tree Design is a forecasting model developed by the USDA to determine the effects of urban forests on atmospheric carbon dioxide reduction. The model relies on average species growth equations and other geographic parameters that are generalized from city, county, state, and climate region data to calculate tree benefits. i-Tree Design provides a gross estimate of a tree's value rather than a precise value.

Trees around buildings can reduce the demand for heating and air conditioning, thereby reducing emissions associated with production of electric power. Tree shade reduces summer air conditioning demand but can increase heating energy use by intercepting winter sunshine (Heisler 1986[84]; Simpson and McPherson 1996[85]). The amount of energy required to heat and cool buildings depends on their thermophysical properties, occupant behavior and local climate. By modifying local climate, urban forests can increase or decrease building energy use (Heisler, 1986). Lowered air temperatures and wind speeds from increased tree cover decrease both cooling and heating demand. Energy-saving benefits from trees around typical residences have been measured in the field (McPherson and Simpson 2003[86]) and estimated from computer simulations. Measured and modeled reductions caused by vegetation around individual buildings generally range from 5 to 15 percent for heating and 5 to 50 percent for cooling. For single trees, simulation studies (Heisler, 1986) suggest that energy savings from heating due to wind shielding range from 1 to 3 percent (0.15 to 5.5 million Btu[87]) for a typical energy-efficient residence. Simulations for three cities (Sacramento, Phoenix, and Lake Charles) found that three mature trees around energy-efficient homes cut annual air conditioning demand by 25 to 43 percent and peak cooling demand by 12 to 23 percent. On a per tree basis,

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[83] McPherson, E.G. and Simpson, J.R. (1999) Carbon Dioxide Reduction Through Urban Forestry, PSW-GTR-171, USDA Pacific Southwest Research Station General Publication Technical Report. A summary of i-Tree Eco methods and model description can be found on the i-Tree website, *i-Tree Methods Model Descriptions & Journal Articles*, i-Tree Eco Methods, Model Descriptions, & Journal Articles | i-Tree (itreetools.org), accessed 4 March 2021.
[84] Heisler, G.M. (1986) *Energy Savings with Trees*, Journal of Arboriculture, 12, pp. 113-125.
[85] Simpson, J.R. and McPherson, E.G. (1996) *Potential of Tree Shade for Reducing Residential Energy Use in California*, Journal of Arboriculture, 22, pp.10-18.
[86] McPherson E.G., and Simpson, J.R. (2003) *Potential Energy savings in Buildings by an Urban Tree Planting Programme*, Urban Forests & Urban Greening, 2, pp. 73-86.
[87] Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit (F°). Domestic and commercial heating and cooling systems (water heaters, air conditioners, heat pumps, etc.) in the United States generally are specified in Btu/h (Btu per hour). Btu/h measures the rate at which heating or cooling can be transferred or extracted by a system within a living or working space.

energy simulations from twelve U.S. cities found that annual energy savings for cooling from a well-placed 25-ft tall deciduous tree ranged from 100 to 400 kWh (10 to 15 percent), and peak demand savings ranged from 0.3 to 0.6 kW (8 to 10 percent) (McPherson and Rowntree 1993[88]).

I-Tree Design uses four quantities that directly influence building energy use: Heating Degree Days (HDD), Cooling Degree Days (CDD), Latent Enthalpy Hours[89] (LEH), atmospheric clearness index[90] (KT), and average windspeed. San Antonio, TX values of HDD (base 65 ºF); CDD, Cooling Degree Days (base 65 ºF); LEH, and KT, along with average annual wind speed (WND) used to model Randolph NHLD tree benefits. Detailed discussion of these parameters and how they affect cooling and heating loads can be found in Heisler (1986), Simpson and McPherson (1996) among others. In general, HDD and CDD are related to air temperature effects on heating and cooling loads. LEH is related to relative humidity and temperature.

Method

i-Tree Design was used to evaluate the expected changes to energy demand resulting from tree removal. i-Tree Design also models energy, carbon, stormwater, and air quality benefits. However, the more robust i-Tree Eco was used to model carbon, stormwater, and air quality benefits. I-Tree Eco does not model energy benefits. Unlike Design, Eco can use the entire TAM NRI's NHLD tree inventory to better estimate carbon, stormwater, and air quality impacts. i-Tree Eco also provides a more realistic estimate of annual avoided runoff as it accounts for a more detailed water balance in the tree canopy covered area[91].

Fifteen representative buildings in the NHLD, the 233 inventoried trees (Colón, Thompson, Miller, & Long, 2017b) surrounding those buildings (tree location, species, canopy condition, and dbh), along with climatological information for San Antonio, Texas were used to model the effects of implementing the Proposed Action on energy usage. The structures represent a range in size, location, and orientation within the NHLD.

Example. i-Tree Design was used to model the energy benefits of the 10 trees within the energy affects zone surrounding building 100 (Taj Mahal). Building 100 is a large administration building. The figure below depicts the zone and the modeled trees for Building 100. Results are shown in the table below. The impact each tree has on energy needed for heating and cooling is a function of the tree's species, size, canopy condition, proximity to the building, and location

[88] McPherson, E.G. and Rowntree, R.A. (1993) *Energy Conservation Potential of Urban Tree Planting*, Journal of Arboriculture, 19, 321-331.
[89] LEH is a measure of the amount of moisture that must be removed from outdoor air hourly to bring it to 77 ºF and 60 percent relative humidity
[90] KT is the ratio of the available sunshine at the earth's surface to the sunshine available on a parallel plane above the atmosphere, i.e., how much incoming solar radiation does the earth's atmosphere attenuate.
[91] Hirabiyashi, S., i-Tree Streets/Design/Eco Rainfall Interception Model Comparisons, iTree_Streets_Design_Eco_Rainfall_Interception_Model_Comparisons.pdf, accessed 5 March 2021.

(north, south, east, or west side of building). Residential and commercial energy costs in the table are current San Antonio prices. Residential (e.g., base housing) and commercial rates are included for comparison.

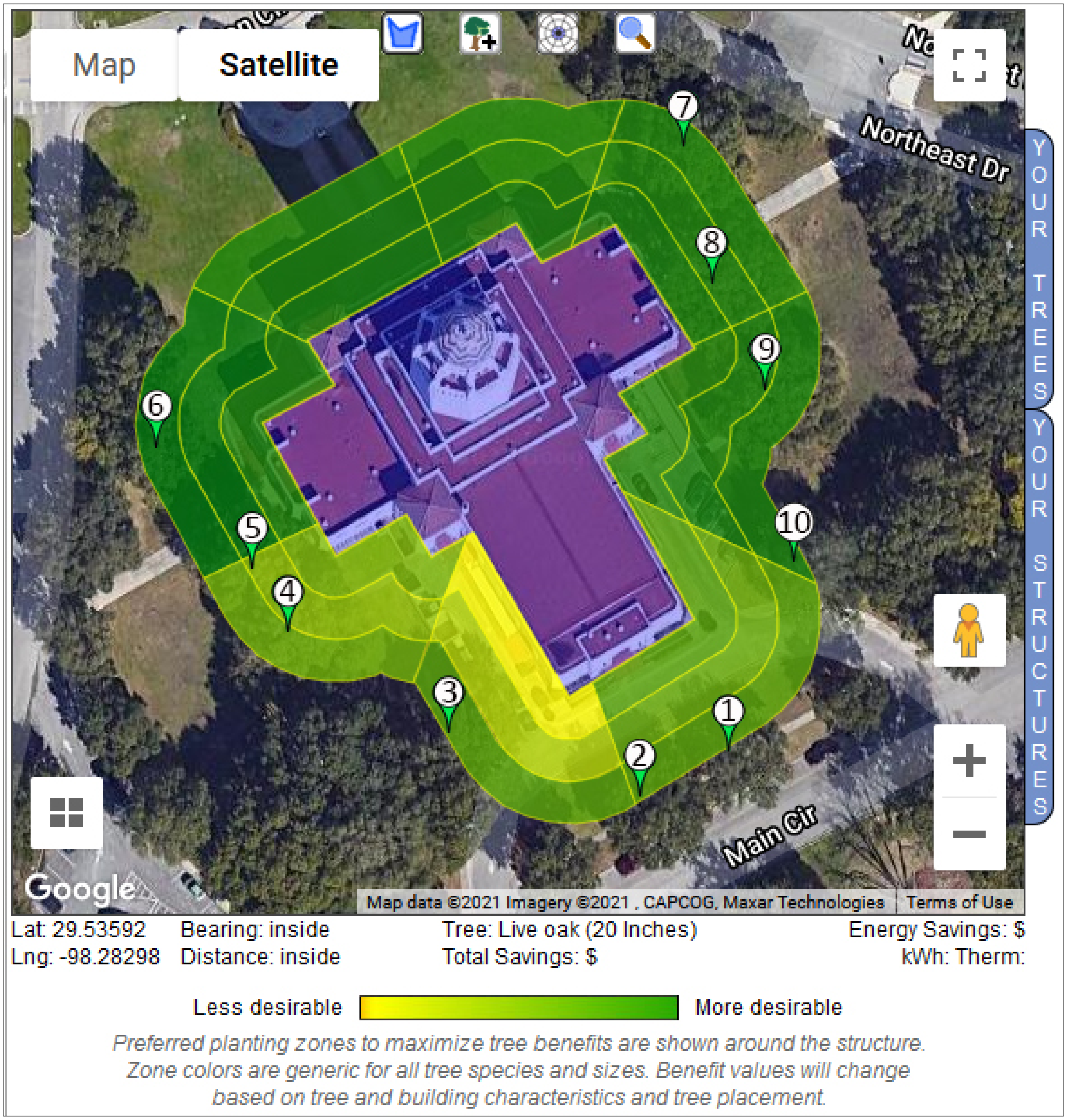

Figure C2-1. Mapped trees used by i-Tree Design to estimate tree benefits. Note the color bands representing more and less desirable (beneficial) locations for trees.

Table C2-1. Building 100 (Taj Mahal)-Annual Energy Impact

Tree No.	Tree			Cooling			Heating		
	Species	Dbh [in]	Canopy Condition	[kWh]	Residential[2] Rate [$]	Commercial[3] Rate [$]	[Therms][4]	Residential[5] Rate [$]	Commercial[6] Rate [$]
1	Live Oak	29.0	Fair	24.7	2.28	1.89	10.2	10.60	3.05
2	Live Oak	25.0	Poor	54.7	5.05	4.20	5.8	6.03	1.74
3	Live Oak	31.0	Poor	13.8	1.28	1.06	2.1	2.18	0.63
4	Live Oak	18.5	Good	0.0	0.00	0.00	(-0.10)	(0.10)	0.00
5	Live Oak	22.0	Good	16.1	1.49	1.24	0.0	0.00	0.00
6	Live Oak	26.0	Fair	14.4	1.33	1.10	(-0.01)	(0.10)	0.00
7	Live Oak	27.5	Poor	12.2	1.12	0.93	(-1.06)	(1.66)	(0.47)
8	Live Oak	23.0	Good	21.3	1.97	1.63	(-4.2)	(4.36)	(1.26)
9	Live Oak	22.0	Poor	66.5	6.14	5.10	2.3	2.39	0.69
10	Live Oak	18.5	Good	24.4	2.25	1.87	5.6	5.82	1.68
Total (all trees)				**248.0**	**22.91**	**19.02**	**20.0**	**20.8**	**6.06**

Notes: (1) See Figure C2-1 for tree locations.
(2) Average residential electricity rate in San Antonio is $0.0924/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021)
(3) Average commercial electricity rate in San Antonio is $0.0767/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021)
(4) Figures in parentheses represent a beneficial effect if tree removed.
(5) The average residential natural gas prices in San Antonio averaged approximately $1.04 per therm. ($10.41 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to approximately 99.98 cf of natural gas.
(6) The average industrial natural gas prices in San Antonio averaged approximately $0.30 per therm. ($3.00 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to approximately 99.98 cf of natural gas.

Results. Summary results for all buildings modeled using i-Tree design are given in the following table, Annual Energy Impact from Trees-NHLD Representative Buildings.

Table C2-2. Annual Energy Impact from Trees-NHLD Representative Buildings

			Cooling			Heating		
Building Number	Building Type	Number of Trees	kWh	Residential Rate[1] ($)	Commercial Rate[2] ($)	Therms	Residential Rate[3] ($)	Commercial Rate[4] ($)
B100 (Taj Mahal)	Offices	10	248.0	22.92	19.02	20.0	20.80	6.00
B120	Dormitory	21	834.9	77.14	64.04	(-13.0)	(-13.52)	(-3.90)
B323	Residential	7	251.2	23 .21	19.27	(-15.5)	(-16.12)	(-4.65)
B336	Residential	8	558.2	51.58	42.81	3.2	3.33	0.96
B414	Residential	4	350.3	32.37	26.87	(-2.9)	(-3.02)	(-0.87)
B432	Residential	4	116.3	10.75	8.92	12.4	12.90	3.72
B443	Residential	6	354.7	32.77	27.21	10.8	11.23	3.24
B523	Residential	8	330.6	30.55	25.36	11.2	11.65	3.36
B542	Residential	7	81.2	7.50	6.23	1.2	1.25	0.36
B560	Residential	11	202.7	18.73	15.55	5.1	5.3	1.53
B613	Residential	8	404.6	37.39	31.03	16.3	16.95	4.89
B642	Residential	12	207.5	19.17	15.92	18.7	19.45	5.61
B663	Offices	11	532.4	49.19	40.84	10.3	10.71	3.09
B822	Residential	8	273.5	25.27	29.98	4.5	4.68	1.35
900 (HQ AETC)	Offices	10	412.2	38.08	31.61	35.9	37.34	10.77
Office/Dormitory Buildings (Average)		**13**	**506.9**	**46.83**	**38.88**	**13.3**	**13.83**	**15.96**
Residential Buildings (Average)		**7**	**284.6**	**26.61**	**22.65**	**5.9**	**6.15**	**1.84**

Notes: (1) Average residential electricity rate in San Antonio is $0.0924/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021). (2) Average commercial electricity rate in San Antonio is $0.0767/kWh. (https://www.electricitylocal.com/states/texas/san-antonio/, accessed 4 March 2021). (3) The average residential natural gas prices in San Antonio averaged approximately $1.04 per therm. ($10.41 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to approximately 99.98 cf of natural gas. (4) The average industrial natural gas prices in San Antonio averaged approximately $0.30 per therm. ($3.00 per 1,000 cf. natural gas, https://naturalgaslocal.com/states/texas/san-antonio/, accessed 4 March 2021). One therm is equal to approximately 99.98 cf of natural gas.

Figure C2-2. Structures modeled with i-Tree Design. Building numbers in white text. Red circles residential and grey circles administrative structures.

C-3

I-TREE ECO

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i-Tree Eco v6.0

Background

I-Tree Eco ver. 6 is a peer-reviewed model developed by the USFS. i–Tree Eco was used to model structure, air quality, VOCs, biogenic VOCs, carbon sequestration, and avoided runoff characteristics of the NHLD urban forest. i-Tree Eco also provides estimates of other tree benefits not used in this EA to analyze impacts of the proposed action. The model uses field collected urban forest inventories (tree species, crown condition [health], and tree dbh), site specific hourly pollution data; validated, site-specific hourly surface weather data, and climatology. The model is web-based. Detailed information on the i-tree Eco model is available online. i-Tree Eco references on modeled parameters, e.g., biogenic emissions, air pollutant dry deposition, urban tree impact on ozone, carbon sequestration also are available online (USFS, 2020).

i-Tree Eco uses complete tree inventories such as the TAM NRI inventory (Colón et al., 2017) to provide estimates of:

1. Urban forest structure – Urban forest structure is the spatial arrangement and characteristics of vegetation in relation to other objects, e.g., buildings, within urban areas (Nowak, 1994). Model output is a report of species composition, number of trees, tree density, tree health, etc.
2. Pollution reduction – Pollution reduction (hourly dry deposition) is calculated for O_3, SO_2, NO_2, and CO, and PM_{10} deposition on tree canopies throughout the year based on tree-cover data, hourly National Climatic Data center (NCDC) weather data, and U.S. Environmental Protection Agency (EPA) pollution-concentration monitoring data. Modeled output includes pollution removal for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and $PM_{2.5.}$
3. VOCs – Volatile organic compounds (VOCs) can contribute to the formation of O_3 and CO (Brasseur & Chatfield, 1991). The amount of VOC emissions depends on tree species, leaf biomass, air temperature, and other environmental factors. Modeled output includes hourly urban forest volatile organic compound emissions and the relative impact of tree species on net ozone and carbon monoxide formation throughout the year.
4. Carbon – Atmospheric CO_2 and other greenhouse gases (e.g., methane, chlorofluorocarbons, nitrous oxide) are thought to contribute to an increase in atmospheric temperatures by the trapping of certain wavelengths of radiation in the atmosphere (US National Research Council, 1983). Through growth processes, trees remove atmospheric CO_2 and store C within their biomass. Total carbon stored and net carbon annually sequestered by the urban forest.
5. Avoided runoff - Yearly avoided runoff attributed to trees summarized by tree species or strata.

Energy effects, compensatory value of the forest, public health impacts, and potential pest impacts (region specific). Energy effects and values, were estimated using i-Tree Design which was better suited to understanding the impacts of inventoried trees (species, crown health, dbh) adjacent to NHLD buildings (see Appendix C-2).

Method

Field-surveyed NHLD urban forest information TAM NRI (Colón et al., 2017), validated surface meteorological observations from NRDC, climatological data from NRDC, and pollution data from CAMS were used as i-Tree Eco model input parameters.

NHLD urban forest information (i.e., location, species, canopy health, and dbh) collected by TAM NRI was used as model input. The inventory was prepared in 2017. The data included 2988 trees; inventoried dead trees or missing species information were not included as input parameters.

Validated surface weather observations made at Randolph AFB (WBAN 12911[92], WMO 722536[93]) for the year 2015 and made available from the NRDC were used. The weather data (precipitation, temperature, etc.) for 2015 was selected as it was the most recent "good" year of data, i.e., having less than 720 hours (30 days) missing station pressure data in the NRDC database.

Climatological data (e.g., leaf-on, leaf-off, frost-free days, etc.) for Bexar County, Texas available from NRDC was model input.

Pollution input data (best station available) for the year 2015 was used as model input.

- Ozone and SO_2: Calaveras Lake (+29.275381^{0}N, -98.311692^{0}W), San Antonio, Bexar County, TX, EPA site number 48-029-0059
- NO_2 : San Antonio IH 35, Bexar County, TX (+29.5294320N, -98.391403W), EPA site number 48-029-1069
- $PM_{2.5}$: Deer Park, Harris County, Texas (+29.670025^{0}N, -95.128508^{0}W) EPA site number 48-201-1039 (selected based upon representativeness and completeness of available meteorologic parameters)
- CO: Midlothian, Webb County, Texas (+32.4820830N, -97.0268990W) EPA site number 48-139-0016

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[92] Weather Bureau Army Navy (WBAN) is a 5-digit identifier that was the first major attempt at a coordinated station numbering scheme among several weather reporting authorities. Original participants in the WBAN number plans were the United States Weather Bureau, Air Force, Navy, and Army. The NCDC uses the WBAN identifier to identify many of its climatological datasets and continues to be important for meteorological work.
[93] The World Meteorological Organization (WMO) identifier replaces numerous incompatible formats used by national weather agencies across the world.

Results

i-Tree Eco model results*, i-Tree Ecosystem Analysis Randolph Field NHLD*, February 2021, include several composition and structure reports by species, stratum, dbh class, species distribution, species diversity indices, tree condition by species, crown health by species, leaf area, among others, benefits and cost reports by species to include carbon storage and sequestration, avoided runoff, and pollutant removal. i-Tree results also include individual tree level results, air quality and public health results, pest analysis report, and pollution reports.

Data from 2988 trees located throughout Randolph Field NHLD were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station. A summary of results follows. Results with asterisk are discussed further.

- Number of trees analyzed: 2,988
- Tree cover: 69.06 acres
- Leaf area: 268.25 acres
- Most common species of trees: live oak, Japanese privet (also shrub), pecan
- Percentage of trees less than 6" (15.2 cm) diameter: 1.5%
- Pollution removal*: 2.118 tons/year
- Carbon sequestration*: 101.25 tons/yr
- Carbon storage*: 5.065 thousand tons
- BVOC Emissions* (total): 38,980.6 lb/yr
- Avoided runoff*: 147.3 thousand cubic feet/yr

Pollutant Removal. Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter less than 2.5 microns. Particulate matter less than 10 microns (PM_{10}) is another significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns ($PM_{2.5}$) which is a subset of PM_{10}, PM_{10} has not been included in this analysis. $PM_{2.5}$ is generally more relevant in discussions concerning air pollution effects on human health. Trees remove $PM_{2.5}$ when particulate matter is deposited on leaf surfaces (Nowak et al 2013). $PM_{2.5}$ can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. I-Tree calculates $PM_{2.5}$ removal with a 50 percent resuspension rate.

An estimated 2.118 tons/year of pollutants is removed by NHLD trees and shrubs annually (Table C3-1). Monthly removal of CO was estimated to be the greatest in spring through fall with the greatest removal in April (11.2 lbs) and least in February (0.5 lbs). Monthly removal of NO_2 was greatest in the winter months with the greatest removal in January (82.1 lbs) and the least in May (30.8 lbs). Monthly removal of O_3 was greatest in spring with the greatest removal in May (390.5 lbs) and the least in January (157.2 lbs).

Table C3-1. Pollutant Removal by NHLD Trees

Pollutant	Pounds/Year	Tons Per Year
CO	89.1	0.045
NO_2	602.6	0.301
O_3	3,264.8	1.632
$PM_{2.5}$	163.6	0.082
SO_2	115.8	0.058

Annual Carbon Sequestration. Carbon storage is the amount of carbon bound up in the above-ground and below-ground tissue of woody vegetation. Gross carbon sequestration was estimated to be 101.25 tons per year or 371.29 CO_2e per year. Sequestration was greatest from live oak, Texas red oak, pecan, cedar elm, and white ash (Table C3-2).

Table C3-2 Annual Carbon Sequestration

Species	CO_2 (tons)	Sequestered Carbon (%)	CO_2e (tons)	NHLD Trees (%)
Live oak	84.58	83.5	310.14	58.8
Texas red oak	4.45	4.39	16.3	4.7
Pecan	4.00	3.95	14.66	6.8
Cedar elm	1.99	1.97	7.31	2.6
White ash	1.17	1.15	4.30	1.2
Total	96.19	94.96	352.71	74.1

Note: Sequestered Carbon (%) is percent of total amount of carbon sequestered by trees in the NHLD.

Carbon Storage. Carbon sequestration is the removal of carbon dioxide from the air by plants. Carbon storage in NHLD trees' plant tissue was estimated to be 5,065.1 tons per or 18,573.8 CO_2e per year. Sequestration was greatest from live oak, Japanese privet, pecan, Texas red oak, and *Lagerstroemia spp.* (Table C3-3).

Table C3-3 Carbon Storage

Species	Carbon Storage (tons)	Carbon Storage (%)	CO_2e (tons)	NHLD Trees (%)
Live oak	3510.1	69.3	12,871.3	58.8
Japanese privet	571.0	11.3	2,094.0	7.2
Pecan	261.9	5.2	960.6	6.8
Texas red oak	153.9	3.0	564.5	4.7
Lagerstroemia spp.	122.4	2.4	449.0	2.0
Total	4,619.3	91.2	16,939.4	74.1

Note: Carbon Storage (%) is percent of total amount of carbon stored in woody tissue of trees in the NHLD.

BVOC Emissions. Trees may also adversely affect air quality. Most trees emit biogenic volatile organic compounds (BVOCs) such as isoprenes and monoterpenes that can contribute to O_3 formation. These VOCs may be emitted as a defense against pests, predators, or to combat heat stress. Trees' emission of BVOCs and their quantity vary by species and temperature (Slowik, et al., 2010). The contribution of BVOC emissions from an urban forest to O_3 formation depends on factors that vary with temperature and atmospheric levels of NO_2. The ozone-forming potential of different tree species also varies considerably (Benjamin and Winer 1998). Generally, broad-leaved species display high isoprene emission rates while coniferous species have been found to emit high rates of monoterpenes (Xiaoxi, Xiaoxiu, Chong, & Weifang, 2020). The VOC isoprene contributes to the largest fluxes in Earth's atmosphere (Guenther, et al., 2006). Genera emitting the greatest relative amount of BVOCs are sweetgum (Liquidambar spp.), blackgum (*Nyssa spp.*), sycamore (*Platanus spp.*), poplar (*Populus spp.*), and oak (*Quercus spp.*) (Nowak 2000). i-Tree Eco estimates that the NHLD urban forest emits 38,980.6 (lbs/yr) biogenic BVOCs. NHLD trees are estimated to emit 16,521.2 lbs/yr of monotremes and 22,459.3 lbs/yr of isoprene. BVOCs emissions are believed to contribute to GHG emissions. The greatest emissions of BVOCs from the NHLD urban forest are from live oak, Japanese privet, Texas red oak, bur oak, and Monterrey oak. Ninety-five percent of BVOC emissions were from live oak and Japanese privet (Table C3-4).

Table C3-4. Annual Emissions of BVOCs

Species	Monoterpene (lbs)	Isoprene (lbs)	Total BVOCs (lbs)	NHLD Total BVOCs (%)	NHLD Trees (%)
Live oak	15,645.4	19,546.9	35,192.2	90.3	58.8
Japanese privet	0.0	0.0	1,852.6	4.8	7.2
Texas red oak	502.9	628.3	1,131.2	2.9	4.7
Bur oak	116.2	145.1	261.3	0.7	0.9
Monterrey oak	69.5	86.8	156.4	0.4	0.7
Total NHLD VOC	16,521.2	22,459.3	38,980.6	—	—

Note: NHLD Total BVOCs (%) is percent of total amount of BVOCs emitted by trees in the NHLD.

Runoff. Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, lakes, and oceans. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012). In urban areas, the large extent of impervious surfaces increases the amount of surface runoff. Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. i-Tree Eco calculated annual avoided surface runoff based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis Trees and shrubs of the Randolph Field NHLD help to reduce runoff by an estimated 147 thousand cubic feet a year. Avoided runoff is estimated based on surface weather observations made at Randolph AFB for the year 2015. During 2015, the total annual precipitation was 42.0 inches. The species having the most profound impact on runoff is the live oak (Table C3-5)

Table C3-5. Hydrologic Effects of Trees by Species

Species	Number of Trees	Leaf Area (ac)	Potential Evapotranspiration (ft^3/yr)	Evaporation (ft^3/yr)	Transpiration (ft^3/yr)	Water Intercepted (ft^3/yr)	Avoided Runoff (ft^3/yr)	NHLD Total Avoided Runoff (%)	NHLD Trees (%)
Live oak	1,758	172.77	3,769,996.1	470,436.7	1,834,763.1	471,221.3	94,877.6	64.4	58.8
Japanese privet	216	24.34	531,218.6	66,287.8	258,530.8	66,398.3	13,370.3	9.1	7.2
Pecan	202	20.31	443,120.2	55,294.5	215,655.6	55,386.7	11,153.0	7.6	6.8
Texas red oak	139	11.87	258,925.4	32,309.9	126,012.5	32,363.7	6,516.9	4.4	4.7
Cedar elm	78	6.17	134,586.2	16,794.3	65,499.8	16,822.3	3,387.4	2.3	2.6
Hackberry spp.	92	6.01	131,193.8	16,370.9	63,848.7	16,398.2	3,302.0	2.2	3.1
Eastern red cedar	51	4.26	92,851.1	11,586.4	45,188.3	11,605.7	2,337.0	1.6	1.7
White ash	36	3.97	86,670.0	10,815.1	42,180.1	10,833.1	2181.4	1.5	1.2
Bur oak	27	2.74	59,809.0	7,463.2	29,107.5	7,475.7	1505.3	1.0	<0.1
Lagerstroemia spp.	61	1.66	36,236.6	4,521.8	17,635.4	4,529.3	912.0	0.6	2.0
Total NHLD	2,988	268.25	5,853,548.0	730,431.4	2,848,775.8	731,649.7	147,328.8	94.7	~88.1

Note: NHLD Total Avoided Runoff (%) is the percent of total avoided runoff due to trees in the NHLD.

Appendix D

D

Federally Listed Bird Species on JBSA-Randolph

TCAP Bird Species of Greatest Concern in Bexar County

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Federally Listed Bird Species on JBSA-Randolph (USFWS, 2021a; TPWD, 2021)

Common Name	Scientific Name	Federal Status	Habitat (TPWD, 2021)
Golden-cheeked warbler	*Dendroica chrysoparia*	E	No critical habitat has been designated for this species by the USEPA. Ashe juniper in mixed stands with various oaks (Quercus spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.
Piping Plover	*Charadrius melodus*	T	Critical habitat has been designated by the USEPA but is not available. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.
Red Knot	*Calidris canutus rufa*	T	No critical habitat has been designated for this species by the USEPA.
Whooping Crane	*Grus americana*	E	Critical habitat has been designated by the USEPA but is not available. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.

Texas Conservation Action Plan

In 2001, the United States' Congress required each state and territory to develop a "comprehensive wildlife conservation strategy" to guide the distribution of Wildlife Conservation and Restoration Program and State Wildlife Grants funding. The USFWS identified eight elements of conservation success to guide development of state plans. The elements address species, habitats and communities, problems and issues, conservation actions, monitoring, plan reviews, coordination with conservation partners, and public involvement. As part of its plan, Texas identified a list of species of greatest conservation need (SGCN) representative of the diversity, health and importance of the wildlife in Texas. The SGCN list focuses on rare, declining, and vulnerable fish and wildlife species needing special attention for recovery, stability, and/or to prevent listings under state or federal regulation (e.g., Endangered Species Act). Texas Parks and Wildlife Department (TPWD) is the steward of the state's conservation plan, the Texas Conservation Action Plan, TCAP (TPWD, 2012a). The plan includes 11 regionally specific ecoregion handbooks. Bexar County includes the Blackland Prairie (TPWD, 2012b) and Edwards Plateau (TPWD, 2012c) ecoregions. JBSA-RND is within the Blackland Prairie ecoregion. Bird SGCN in Bexar County are listed in the table below (TPWD, 2021).

TCAP Bird Species of Greatest Concern in Bexar County

Common Name	Species	Federally Listed T&E	Habitat (TPWD, 2021)
bald eagle	*Haliaeetus leucocephalus*	MBTA	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds
black-capped vireo	*Vireo atricapilla*		Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; nesting season March-late summer
Franklin's gull	*Leucophaeus pipixcan*		Spring and fall migrant throughout Texas. It does not breed in or near Texas. During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night
golden-cheeked warbler	*Setophaga chrysoparia*	E	Ashe juniper in mixed stands with various oaks (*Quercus spp.)* edges of cedar brakes; dependent on Ashe juniper for l**on**g fine bark strips, only available from mature trees, used in nest construction; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer
interior least tern	*Sternula antillarum athalassos*	Delisted	Sand beaches, flats, bays, inlets, lagoons, islands. Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc.); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony
mountain plover	*Charadrius melodus*		Nests on high plains or shortgrass prairie, on ground in shallow depression; outside of breeding habits shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous
Piping plover	*Charadrius melodus*	T	Beaches, sandflats, and dunes along Gulf Coast and adjacent offshore islands, spoil islands, algal flats. Optimal site characteristics appear to be large in area, sparsely vegetated and with limited human disturbance
reddish egret	*Egretta rufescens*		Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear
tropical parula	*Setophaga pitiayumi*		Semi-tropical evergreen woodland along rivers and resacas; Texas ebony, anacua and other trees with epiphytic plants; dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.

western burrowing owl	*Athene cunicularia hypugaea*		Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows
white-faced ibis	*Plegadis chihi*		Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, low trees, on the ground in bulrushes or reeds, or on floating mats.
whooping crane	*Grus americana*	E	Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast
wood stork	*Mycteria americana*		Prefers to nest in large tracts of bald cypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; formerly nested in Texas, but no breeding records since 1960
zone-tailed hawk	*Buteo albonotatus*		Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions

Appendix E

E

Air Quality Summary

Record of Conformity Analysis (ROCA)

Air Emissions (Calculated - USAF's Air Emissions Guide for Air Force Mobile Sources Emission Factors)

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E-1

ROCA

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Record of Conformity Analysis

Bird/Wildlife Aircraft Strike Hazard Risk Mitigation through Habitat Management, JBSA-Randolph, TX Proposed Action

General Information: Emission factors in the *Air Emissions Guide for Air Force Mobile Sources* (2020), were used to perform an analysis to assess the potential air quality impacts associated with the Proposed Action in accordance with the Air Force Instruction 32-7040, Air Quality Compliance and Resource Management; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the analysis.

Action Location:

Base: JBSA-Randolph

State: Texas

County: Bexar

Regulatory Area: San Antonio, Texas

Action Title: Bird/Wildlife Aircraft Strike Hazard Risk Mitigation through Habitat Management, JBSA-Randolph, TX

Project Number: N/A

Project Action Start Date: 16 August 2021

Action: The Proposed Action is to reduce the BASH risk posed by the various species of birds living and roosting in the Randolph Field National Historic District between the two runways. The Proposed Action would reduce the tree, tree canopy, and shrub density in the NHLD located in central JBSA-RND and thereby decrease the habitat and thus the population of WWDO and other avian species on base.

Point of Contact:

Name: Dennis A. Sylvia

Title: Contractor

Organization: Cherokee Nation – Federal

Email: dennis.sylvia@cherokee.federal.com

Phone Number: 775.420.1688

Analysis: Total combined direct and indirect emissions associated with the action were estimated calendar year emissions were calculated on a calendar-year basis for the "worst-case" and "steady state" (net gain/loss upon action fully implemented) emissions for each pollutant of concern. Emission factors in the *Air Emissions Guide for Air Force Mobile Sources* (June 2020), Table 4-1 Criteria Pollutant Emission Factors for Non-Road Engines and Equipment were used to estimate emissions from the equipment[94] that would be used to implement the Proposed Action. General Conformity under the Clean Air Act, Section 1.76 has been evaluated for the action described above according to the requirements of 40 CFR § 93.153 (b). Therefore, the requirements of the General Conformity Rule are not applicable.

Based on the analysis, the requirements of this rule are: ______ applicable

__X__ not applicable

Conformity Analysis Summary:

Table 2. Year 1 - 2021

Pollutant	Action Emissions (tpy)	General Conformity	
		Threshold (tpy)	Exceedance (Yes/No)
San Antonio, TX			
VOC	4.1972	100	No
NOx	1.2788	100	No
CO	23.1271	—	—
SO_x	0.0023	—	—
PM_{10}	0.6295	—	—
$PM_{2.5}$	0.5815	—	—
NH_3	0.0019	—	—
CO_2e	302.210	—	—

[94] The Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide (AFCEC, 2019) requires a quantitative assessment of the annual net total direct and indirect emission of pollutants of concern to be calculated using the Air Force's Air Conformity Assessment Model (ACAM). The majority of the emission sources that would be used to implement the proposed action are from grounds maintenance equipment, i.e., off-road equipment. The ACAM has limited built-in off-road emission factors. Due to the emission sources that would be used to implement the proposed action, authorization to manually calculate emissions using emission factors listed in the Guide (AFCEC, 2020) was obtained from AFCEC (F. Castaneda, personal communication, October 5, 2020).

Table 2. Year 2 - 2022

Pollutant	Action Emissions (tpy)	General Conformity	
		Threshold (tpy)	Exceedance (Yes/No)
San Antonio, TX			
VOC	4.1972	100	No
NOx	1.2788	100	No
CO	23.1271	—	—
SO_x	0.0023	—	—
PM_{10}	0.6295	—	—
$PM_{2.5}$	0.5815	—	—
Pb		—	—
NH_3	0.0019	—	—
CO_2e	302.210	—	—

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E-2

Air Emissions

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Air Emissions

Background

Emission factors in the *Air Emissions Guide for Air Force Mobile Sources* (2020), Table 4-1 Criteria Pollutant Emission Factors for Non-Road Engines and Equipment were used to estimate emissions from the equipment[95] that would be used to implement the Proposed Action, i.e., tree limbing, felling, bucking, chipping, and stump grinding: 2-stroke chainsaw, diesel chipper, leaf blower, 4-stroke loader, and diesel stump grinder. Emission factors in Table 5-19 On-Road Vehicle Emission Factors were used to estimate vehicle emissions from light duty gasoline powered crew trucks and a small heavy duty diesel truck that also would be expected to be used to support crews and to remove vegetation debris.

Method

Assumptions – Equipment for each of three crews

- 3 Chainsaws, >6 hp, 2-stroke, 6 hrs (18 hrs total/tree) (e.g., Stihl MS 462 R C-M, gas, 6.0 hp - professional model for tree cutting services)
- 1 Shredder/Chipper, 85 hp, diesel, 6 hrs/tree (e.g., Vermeer BC1000XL)
- 1 Leaf Blower, >6Hp, 2-stroke, 4 hrs/tree (e.g., Husqvarna 965877502 2-cycle gas backpack commercial blower, 2.1 hp)
- 1 Skid Steer (small-medium) 2 hrs/tree (e.g., 2020 John Deere Model 320E 66 hp)
- 1 Stump Grinder, 74 hp, diesel, 2 hrs/tree (e.g., 2020 Carlton SP7015TRX HD Stump Grinder, Remote, 74 hp Kohler diesel engine)
- Light duty gasoline vehicle LDGV (3, one for each crew), used to transport crews to and from worksite, total 80 miles/day/vehicle.
- Heavy duty diesel vehicle HDDV, Single Axle Medium Duty Dump Truck, (e.g., 2019 International MV 607 Landscape Dump 25,999 lbs GVW), travel 20 miles one-way from Randolph dump brush/chips. assume two round-trips trips/day/crew total of 80 miles/day/3 crews.

Assumptions – Labor

- Crews work weekdays from August 16 through 28 February, excluding weekends and public holidays, i.e., 132 days/year. (Used to calculate light duty truck and heavy-duty truck (dump) used to implement Proposed Action.)
- Implementation will take two years to complete

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[95] Grounds maintenance activities, including tree removal on JBSA-RND are contracted. The JBSA-RND contractor and subcontractor performing tree maintenance and removal were contacted to obtain information on equipment and operations that would be used in tree removal operations.

Emissions from non-road engines was calculated using the horsepower/load factor method.

$$E\ (Pol) = OT\ \times\ {}^{LF}/_{100} \times hp\ \times\ {}^{1}/_{1000} \times EF\ (Pol)\ \times N$$

Where: $E\ (Pol)$ = Emissions pollutant (lbs)
OT = operating time
LF = load factor (% maximum power)
hp = horsepower rating
100 = factor to convert percent to a fraction
1000 = factor to convert from $10^3\ hp$ $({}^{hp}/_{10^3\ hp})$
$EF\ (Pol)$ = emission factor for the pollutant of concern ${}^{hp}/_{10^3\ hp}$
N = number of non-road engines

Example 1. Three (3) 2-stroke commercial chainsaws being used for 6 hours-volatile organic compound (VOC). Emissions calculation is for one tree. Answer in pounds.

Equipment type:	2-stroke chainsaw
Operating time:	6 hours
Load Factor:	70
Horsepower	6 hp
EF (VOC):	150.5760 ${}^{lb}/_{10^3\ hp-hr}$
Number of chainsaws:	3

$$E\ (VOC) = 6\ hrs\ \times {}^{70}/_{100} \times 6\ hp\ \times\ {}^{1}/_{1000} \times 150.5760\ {}^{lb}/_{10^3\ hp-hr}\ \times 3$$

$$E\ (VOC) = 11.3835 \text{ lbs}$$

Example 2. Emissions from on-road engines (vehicles) was calculated using vehicle category, pollutant emission factors, and vehicle miles travelled.

$$E\ (Pol) = VMT\ \times EF\ (Pol) \times 0.002205\ \times N$$

Problem. Three (3) light duty gasoline trucks each driven 80 miles/day. Emission calculation is for one day. Answer in pounds.

Vehicle class light duty gasoline truck (LDGT)

Vehicle miles travelled 80 miles per vehicle

EF (VOC): 0.1588 $^{\mathrm{g}}/_{\mathrm{mi}}$

Conversion g to lb 0.002205 $^{\mathrm{lb}}/_{\mathrm{g}}$

Number of vehicles 3

$$E\ (VOC) = 80\ ^{mi}/_{day} \times 0.300\ ^{g}/_{mi} \times 0.002205\ lb/g\ \times 3$$

$$E\ (VOC) = 0.1588\ lb/day$$

Results

Emissions resulting from implementation of alternatives 2 and 3 compared with the No Action Alternative are shown in Table D2-1, below.

Table D2-1. Emissions from Non-Road Equipment and Vehicles (tons)

	CO	VOC	NOx	SO_2	PM_{10}	$PM_{2.5}$	CO_{2e}	NH_3
Alternative 1 No Action								
	10.818	1.967	0.592	0.001	0.295	0.277	139.279	0.001
Alternative 2 Preferred Alternative								
Year 1	23.1271	4.1972	1.2788	0.0023	0.6295	0.5815	302.210	0.0019
Year 2	23.1271	4.1972	1.2788	0.0023	0.6295	0.5815	302.210	0.0019
Total	46.2542	8.3944	2.5576	0.0046	1.2590	1.1630	604.420	0.0038
Alternative 3 Two-Phase								
Phase I	23.1271	4.1972	1.2788	0.0023	0.6295	0.5815	302.210	0.0019
Phase II	23.1271	4.1972	1.2788	0.0023	0.6295	0.5815	302.210	0.0019
Total	46.254	8.394	2.558	0.005	1.259	1.163	604.420	0.0038